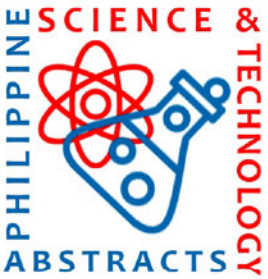
PHILIPPINE SCIENCE & TECHNOLOGY ABSTRACTS

SCIENCE AND TECHNOLOGY INFORMATION INSTITUTE
INFORMATION RESOURCES AND ANALYSIS DIVISION
Department of Science and Technology
Bicutan, Taguig City, Metro Manila
Philippines

DECEMBER 2019



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PHILIPPINE
SCIENCE AND TECHNOLOGY
ABSTRACTS

July-December 2019

Published by:

Information Resources and Analysis Division
SCIENCE AND TECHNOLOGY INFORMATION INSTITUTE
Bicutan, Taguig, Metro Manila
Philippines

AGRICULTURE

0001

Amino acid sequence of signal transducers and activators transcription proteins from broilers

Damayanti Ratna , Widjaja, Ngakan Made Rai , Hidajati, Nove , Maruf,

The purpose of this study was to determine the efficiency of STAT-1 and STAT-3 proteins that exist in hepatic tissue of broilers as a basis for making synthetic STAT protein that would promote broiler growth and is safe for humans. This study used 25 male Lohman broilers. The broilers were placed in battery cages with capacity of one broiler per cage and fed twice daily (10% less than the standard feed) at 6:00 AM and 6:00 PM. At the age of 21 days, the broilers were sacrificed by cutting the esophagus, trachea, carotid artery and jugular vein, and a sample of 5 g hepatic tissue was obtained to examine the amino acid sequence of proteins STAT-1 and STAT-3 by MALDI-TOP method. Results showed that molecular weights of STAT-1 and STAT-3 were 59.3 kDa and 59.4 kDa, respectively. Identifying the amino acid structure of the STAT protein can allow for the creation of STAT synthetic protein, which is expected to prolong the action or effect of growth hormone, thus, promoting growth of broilers. (**Author's abstract**)

Keywords: *amino acid, broiler, STAT-1, STAT - 3, synthetic protein, Agriculture*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0002

Comparative performance of sows housed with and without evaporative cooling system at temperature humidity index of 73-83

Vega, Renato S.A. , Lontoc, Carla Alilie A., Punay, Lance Christian L. , Cajano, Pauline Jo

A study was conducted to assess the effect of evaporative cooling system (ECS) on the performance of sows during summer season and to determine the temperature-humidity index (THI). Ninety one sows were used in the study, 49 sows were housed with ECS throughout gestation (T1) and 42 in conventional housing system all throughout gestation period (T2). The THI in T1 and T2 ranges from 73.31-80.47 and 75.23-82.66 respectively. Results showed that ECS significantly affects the birth weight, back fat thickness at weaning, and weaning to estrous interval of sows but did not have a significant effect on the gestation period, weaning weight, back fat thcikness at farrowing, litter size born alive, litter size at weaning, total pigs born, and number of born dead. There was also a 0.75-day difference in the weaning to estrus interval form T1 was also observed. Partial budget analysis revealed that 25,634.33 per year per house was added to the net profit of the farm due to the reduction in feed and water costs. Therefore the use of evaporative cooling system to counter the negative effects of summer heat stress on the performance of the gestating sows was economically feasible in a commercial swine production enterprise. (**Author's abstract**)

Keywords: *evaporative cooling system, swine, temperature humidity index, Agriculture*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-5
2016,
(Filipiniana Analytics)
NP

0003

Development of a model on the fate and transport of pesticide in a lowland rice area

Simon, Sam

For fast, effective and economical assessment and continuous monitoring of the level of concentration of pesticide in a lowland rice area, the development and use of a model play a very important role. The study aimed to assess the extent of pesticide contamination of water in the paddy field and drainage channel and develop a model that can be used to determine the fate and transport of pesticide in an irrigated rice area. Three-144 sqm. experimental paddy plots planted with MS 16 variety of rice and applied with Lambda cyhalothrin insecticide was used in the study. A computer based transport model was developed that will be used to simulate the concentration of pesticide residue in the ponded water and drainage channel in an irrigated rice area by mathematically tracking the total mass of chemical residues from the loading point to the drainage stream in terms of mass balance. Results of simulation of the model revealed that concentration of Lambda cyhalothrin insecticide applied in the paddy field diminished at the rate of 42.38% on the first day, 90.64% on the second day, 98.26% on the third day, 99.10% on the fourth day, and completely diminished on the fifth day. As indicated by the correlation analysis and test of significance between the observed and predicted data, the model can accurately simulate the actual pesticide concentration in the ponded and drainage water of an irrigated rice area. The study recommends the enhancement of the model by taking into consideration the advection process in the drainage stream and linking of the model to other available models by either using the input/output of the model as an input/output to the other model or vice versa. (**Author's abstract**)

Keywords: *Modeling, Fate and transport, Irrigated rice area, insecticide concentration, Agriculture*

Cabagan Journal of Research, Volume No. 21 Issue No. 1, 1-8
2012/12,
(Filipiniana Analytics)
NP

0004

Enforcement of the unified provincial fisheries law in Camarines Norte with focus on mud crab

Estanislao, Edgar A.

The article discussed the enforcement of the Unified Provincial Fisheries Law Enforcement Ordinance of Camarines Norte to widen the area coverage of fisheries management through proactive participation of the provincial government. It addressed some existing national laws that showed inconsistent implementation in the local setting, like the illegal collection and possession of mud crab species.

Keywords: *Fisheries Law, Mud crab, Camarines Norte, Agriculture*

Philippines: In the forefront of the mud crab industry development, Volume No. Issue No. , 127-128
2017,
(Filipiniana Analytics)
Fil(B) SH380.45.P6 P45 2017

0005

Performance of Muscovy ducks (*Cairina muschata*) fed with organic growth enhancers

Mamauag, Lazarine T. , Valiente, Olive

A study on growth performance of muscovy ducks (*Cairina muschata*) fed with organic growth enhancers was conducted to determine the effect of different organic enhancer on the growth performance of the muscovy ducks. A total of forty eight (48) muscovy ducks was used in the study, there were four (4) treatments used. The treatment were as follows, T1-Plain water, T2-1 part of Vermi tea + 10 parts of water, T3-1 part of Sorghum syrup + 10 parts of water, T4-Commercial feed supplement (Vitamin A & B12). The study followed the Completely Randomized Design (CRD). One day old ducklings were brooded for one week using artificial lights in cages with an area of 1 x 36 x 10 m. The ducklings were fed with starter mash in the first week, from second to fourth week they were fed with grower mash and on the fifth week finisher mash was given up to the termination of the study. The F-test analysis revealed no significant differences among the four treatments on gain in weight, feed consumption, fluid consumption, and feed conversion efficiency. However the highest economic return on gain in weight over feed consumed was obtained by Treatment 2 with 30.24 percent, followed by Treatment 3 and Treatment 4 with 15.46 percent and 13.39 percent, and the lowest is Treatment 1 with 12.35 percent. (**Author's abstract**)

Keywords: *Diet, Dilution, Muscovy duck, Sorghum syrup, Vermi tea, Agriculture*

Cabagan Journal of Research, Volume No. 21 Issue No. 1, 1-7
2012/06,
(Filipiniana Analytics)
NP

0006

Performance of nursery pigs fed diets with coated or potentiated zinc oxide

Regaspi, Anthony Francis S. , Angeles, Emily P. , Moog, Babylyn A. , Reyes, Francis Carlo C. , Raquipo, Jemimah Micah B., Cuizon, Analiza M.

A 30-d experiment was carried out to compare the effects of two zinc oxide sources on performance of nursery pigs. Four hundred sixty-one mixed-sex weanling pigs (5.34 ± 0.16 kg) were randomly allotted to two dietary treatments. Pigs were fed basal diet added with either 500 g/ton coated zinc oxide (cZnO) or 300 g/ton potentiated zinc oxide (pZnO). Each treatment was replicated three times with 76-77 pigs per replicate. Weighing was done three times at 15-d interval. Average daily gain of pigs fed diets supplemented with pZnO tend to be higher than those fed diets supplemented with cZnO at d 1-15 (0.16 vs 0.11 kg; p=0.09), d 16-30 (0.53 vs 0.41 kg; p=0.05), and at d 1-30 (0.34 vs 0.26 kg; p=0.06). There were no differences on ADFI (p=0.43) for each feeding phase and for the overall period. Feed conversion ratio (FCR) at d 1-15 did not differ between treatments (p=0.12), but pigs fed diets with pZnO improved by 22.07% at d 16-30 (1.73 vs 2.22; p=0.07) and for the overall period by 25.40% (1.88 vs 2.52; p=0.07). Furthermore, mortality was lower in pigs fed diets with pZnO (6.57 vs 15.86 %; p=0.01) than those fed with cZnO. Results indicated the advantages of pZnO over cZnO on growth and survivability of pigs. (**Author's abstract**)

Keywords: *potentiated Zinc Oxide, coated Zinc Oxide, Pigs, Agriculture*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-6
2017,
(Filipiniana Analytics)
NP

0007

Simulated transportation stress: its effect on the productivity and selected biochemical and haematological indices of laying hens

YbaÃ±ez, Adrian P. , Compendio, Jade Dhapnee Z., Espina, Dinah M

In the Philippines, ready-to-lay (RTL) hens are often sold to poultry layer farms as new stocks or replacement. These stocks are transported from the supplies farm via trucks which can last from hours to days. This study aimed to determine the effect of various transportation durations using a mechanical vibration simulator on the productivity and selected haematological and biochemical indices of laying hens. Results revealed that increasing vibration (stressor) duration exposure elevated the total white blood cell count, and heterophil-to-lymphocyte ratio (H/L) of the hens, an indicator of stress levels. Even with the shortest vibration exposure of 2 hours, H/L values were still elevated until the 2nd week. Blood glucose level was found significantly different between treatments, but with no correlation with feed intake. No significant difference was observed on plasma protein values and egg production among treatments. The stressor did not affect egg production but had an effect on the animal's feed intake. (**Authors' abstract**)

Keywords: *blood sugar, heterophils, Layer chickens, lymphocytes, stress, Agriculture*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-6
2016,
(Filipiniana Analytics)
NP

0008

Supply chain improvement for the banana (saba) industry in Cagayan Valley: an evaluation research

Bacud, Don

The study was conducted to provide an overview of the banana industry, develop the supply chain maps for saba in Region II, analyze the performance of the supply chain, identify areas for improvement in the supply chain, and recommend specific policies and programs and projects to improve the industry. The study showed that banana supply chain in Region II (Cagayan Valley) is characterized by its being heavily dependent on canvassers. Canvassers practically do not spend a single centavo and uses only their network and transactional ability; therefore they are what we call the “necessary evil” in the supply chain. Saba (banana) marketing in the region does not follow a standard quality specifications and quantity is based on manual counting of saba fingers. This marketing practice, which they coined “karate system” sometimes results in confusion and miscommunication among chain players. From the farm it takes saba two to three days to reach the end user passing through two to five intermediaries. Marketing margin ranges from 20 percent to 150 percent depending on the scope of responsibility taken by the intermediary and operating cost. Transportation problems such as poor farm to market road, increasing cost of fuel, “kotong”, traffic due to landslide and road constructions, high tax, and other fees. Foremost in banana farmer’s complain is the incidence of Banana Bunchy Top Virus (BBTV). “Bugtok” also has affected the quality of saba as revealed by a trader from Divisoria. The main reason why BBTV and “bugtok” are prevalent in the region is the poor cultural management practices of banana farmers in the region. Saba supply chain inefficiencies are caused by the prevalence of diseases and poor marketing practices. To manage these inefficiencies, the following steps should be adopted: (a) establish a standard measurement and classification system, (b) organize farmers into clusters, and (c) conduct trainings and seminars on disease eradication and prevention. (**Author's abstract**)

Keywords: *Supply chain, Supply chain analysis, Trader, Banana industry, Agriculture*

Cabagan Journal of Research, Volume No. 20 Issue No. 1, 1-19
2011/06,
(Filipiniana Analytics)
NP

0009

Sweet potato (*Ipomea batatas* L.) tuber combined with malunggay (*Moringa oleifera*) leaf meal for free range chicken

Reyes, Joel L. , Gaffud, Oli

The study was conducted to evaluate the effect of sweet potato (*Ipomea batatas* L.) tuber meal (SPTM) combined with malunggay (*Moringa oleifera*) leaf meal (MLM) as fed diets for free range chicken. Ninety (90) two-week-old chicks were distributed to three treatments replicated trice following the Completely Randomized Design. The treatments were: formulated ration alone (T1); formulated ration with 7.5% SPTM and 5% MLM (T2); formulated ration with 15% SPTM and 5% MLM (T3). Results of the study revealed significant ($P<0.05$) differences on body weight and gain in weight of broilers fed diet with SPTM combined with MLM. Adding SPTM with 5% MLM in broilers' diet positively improved weight gain. However, no significant differences were observed on feed consumption and feed efficiency. Regarding economic return, T3 had the highest return of PhP 190.53 followed by T2 with PhP 184.04 and the least was T1 with Php 178.44. The results showed that formulated ration with 15% SPTM enriched with 5% MLM improved body weight and weight gain of broilers under free-range production system and also gave higher economic return than formulated ration without SPTM and MLM. (**Author's abstract**)

Keywords: *chicken, feed efficiency, growth performance, malunggay, sweet potato, Agriculture*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-6
2017,
(Filipiniana Analytics)
NP

BIOLOGY

0010

Abundance, size and symbionts of *Catostylus* sp. medusae (Scyphozoa, Rhizostomeae) in Panguil Bay, Northern Mindanao, Philippines

Papa, Rey Donne S. , Boco, Sheldon Rey, Metillo, Ephrime B.

Monthly variations of *Catostylus* sp. medusae abundance, size and symbionts, and environmental conditions were studied in Panguil Bay, Philippines from December 2013 to July 2014. Belt transect census at six sampling stations yielded a mean abundance range of 0.1-1 m-2 with highest values recorded during the intermonsoon months of April and May. Size (bell diameter and wet weight)-frequency histograms indicated possible recruitment of medusae during late northeast monsoon months of January to March. A negative allometry was obtained for bell diameter and wet weight. Chlorophyll a showed a significant positive correlation with abundance suggesting an influence of planktonic food source. A total of 60 individuals of animal symbionts were observed including the crab *Charybdis feriata*, the carangid fish *Alepes djedaba* and the poicilostomatoid copepod *Paramacrochiron* sp. This study reported the first record of *Catostylus* sp. medusae in Panguil Bay. (**Authors' abstract**)

Keywords: *Belt transect census, zooplankton, intermonsoon, jellyfish, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-19
2014,
(Filipiniana Analytics)
NP

0011

New additions to the moss flora of Mindanao Island, Republic of the Philippines

Shevock, James R., Yorong, Aimanuelzon P

A couple of two month-long botanical expeditions conducted during 2014 and 2015 to inventory the moss flora of several mountain ranges in Mindanao, Philippines yielded 17 mosses reported new for the island, namely, *Chaetomitrium elmeri, Chaetomitrium everettii, Clastobryum indicum, Ctenidium malacobolum, Distichophyllum subcuspidatum, Distichophyllum undulatum, Ectropothecium zollingeri, Fissidens anomalus, Fissidens pellucidus, Fissidens polypodioides, Fissidens taxifolius, Hookeriopsis wishurae, Meiothecium tenellum, Rhapidostichum luzonense, Rhodobryum aubertii, Rhynchostegiella menadensis* and *Rosulabryum billarderii*. Southern range extensions for Mindanao are reported for *Acroporium sigmatodontium* and *Pelekium velatum*. (**Authors' abstract**)

Keywords: *bryophyte inventory, new records, species distribution, taxonomy, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-6
2018,
(Filipiniana Analytics)
NP

0012

Aerobic plate count, pH, and selected sensory parameters of thawed and fresh pork at a public market in Calamba, Laguna, Philippines

Baldrias, Loinda R. , Bandoy, Darwin R. , Pel, Phyll Giulia

Philippine public market sells unrefrigerated imported frozen meat products that may pose a public health concern. This study assessed the quality of thawed and fresh pork using aerobic plate count (APC), pH, and sensory parameters (color, odor and presence of slime). Fifteen samples for each type of pork were collected in a public market at Calamba, Laguna, and divided into testing schedules and minced. Serial dilution, pour plating, incubation and APC (cfu/g) were done; pH was determined; color and odor were ranked; and presence of slime was noted. Significant findings include higher APC for fresh pork, remarkably at 5h; higher increase in pH, mean color rank and mean odor rank for thawed pork; and higher peak percent slime positive for thawed pork. These findings suggest that fresh pork sold in Philippine market settings has a better keeping quality than thawed pork, and that thawed pork showed earlier signs of spoilage. (**Author's abstract**)

Keywords: *biodeterioration, discoloration, fresh products, microbial flora, pork, thawing, Biology*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 1, 1-8
2017,
(Filipiniana Analytics)
NP

0013

Amphi-Pacific tropical disjunctions in the bryophyte floras of Asia and the New World

Gradstein, R

Disjunctions between tropical America and tropical Asia, commonly called amphi-Pacific tropical disjunctions, have frequently been discussed among flowering plants but have received very little attention in bryology. A screening of the literature revealed nine species and sixteen genera or infrageneric taxa of bryophytes with amphi-Pacific tropical (or subtropical) ranges. They include *Austinia tenuinervis*, *Diphyscium chiapense*, *D. longiflorum*, *Elmerobryum*, *Fissidens* sect. *Sarawakia*, *Ganguleea angulosa*, *Hydrogonium arcuatum*, *Hymenostyliella*, *Hymenostylium aurantiacum*, *Luisierella barbula*, *Mniomalia*, *Rozea*, *Sphaerotheciella* and *Sorapilla* among the mosses and *Ceratolejeunea grandiloba*, *Drepanolejeunea* subg. *Rhaphidolejeunea*, *Lejeunea* sect. *Echinocolea*, *Lobatiriccardia*, *Myriocoleopsis* sect. *Myriocoleopsis*, *Phycolepidozia*, *Pictolejeunea*, *Rectolejeunea*, *Southbya organensis* and *Vitalianthus* among liverworts. All of them occur in tropical or subtropical Asia and the Neotropics but are not known from Africa. The causes of the amphi-Pacific tropical disjunctions in bryophytes are still unclear. In flowering plants, molecular analyses indicate that amphi-Pacific tropical ranges frequently resulted from past migration across Eurasia and the northern Atlantic Ocean, followed by local extinction. This scenario may also have operated in amphi-Pacific bryophytes but some might have reached South America via the southern Pacific migration route. The possibility of direct long-range dispersal across the Pacific Ocean cannot be ruled out and this scenario seems likely for *Southbya organensis*, which occurs on Hawaii and freely produces spores and small gemmae. The possibility that the disjunctive ranges reflect insufficient collecting and that some taxa also occur in Africa should also be taken into account. There is no strong evidence for human introduction of amphi-Pacific tropical bryophytes. The new combinations *Lejeunea* sect. *Echinocolea* (R.M.Schust.) Gradst. comb. nov. and *Myriocoleopsis* sect. Protocolea (R.M.Schust.) Gradst. comb. nov. are proposed. (**Author's abstract**)

Keywords: *Biogeography, Disjunctive range, Liverworts, Long-range dispersal, Migration, Mosses, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-11
2018,
(Filipiniana Analytics)
NP

0014

Annotated list of Odonata from Mainit Hot Spring Protected Landscape, Compostela Valley, Mindanao Island, Philippines

Jumawan, Kim M., Medina, Milton Norman D. , Villanueva, Reagan Joseph T.

Within the framework of the 'Rapid Biodiversity Survey of Mainit Hot Spring Protected Landscape' conducted by the Research and Development Centre of Assumption College of Nabunturan, an annotated list of Odonata was compiled, representing 41 species in 25 genera and 12 families from seven sites surveyed from December 2011 to February 2012. These records represent the baseline data for Mainit Hot Spring Protected Landscape and even for Compostela Valley Province. One species is potentially new to science; more than half of the records are forest dwelling endemics. (**Authors' abstract**)

Keywords: *Baseline data, endemic species, conservation, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-14
2012,
(Filipiniana Analytics)
NP

0015

Antigenic protein profile of *Anisakis* spp. (Secernentea: Ascaridia: Anisakidae) larvae isolated from mackerel tuna fish (*Euthynnus affinis*) (Actinopterygii: Scombriformes: Scombridae)

Raharjo, Hartanto Mulyo , Koesdarto, Setiawan , Mufasirin, Mufasirin , Suwanti, Lucia T , Ernawati, Rahaju , Lastuti, Nunuk D Retno , Wastomi, Zafitri N

The study aimed to explore the antigenic proteins in third-stage *Anisakis* spp. larvae from mackerel tuna. This research used 300 *Anisakis* spp. larvae from 110 mackerel tuna fish from Brondong, Lamongan, East Java, Indonesia. The research was carried out in several stages: isolation and identification of *Anisakis* spp.; isolation of soluble proteins and measurement by spectrophotometry; whole-protein characterization with SDS-PAGE; rabbit immunization for polyclonal antibody production; antibody titer measurement with indirect ELISA; and antigenic protein characterization via Western blot. Spectrophotometry results of the larvae showed homogenate protein level of 6833.3 µg/ml. Protein analysis of whole worm extract of the larvae using SDS-PAGE yielded 21 bands, with molecular weights between 12 kDa-238 kDa. Further, protein characterization via Western blot produced six antigenic protein bands: 64 kDa, 45 kDa, 38 kDa, 30 kDa, 27 kDa and 23 kDa. In conclusion, *Anisakis* spp. larvae in mackerel tuna contain six types of antigenic proteins, which might play a role in hypersensitivity or allergic reactions. (**Author's abstract**)

Keywords: *Anisakis spp., Antigenic protein, Euthynnus sp., third-stage larvae, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0016

Antigenic site of glycoprotein encoding gene in rabies virus isolate from Indonesia

Rantam Fedik A , Suwarno, Suwarno , Rahmahani

Rabies is one of the most harmful zoonotic diseases in the world, affecting both animal and human health. Each year, 55,000 people die from rabies: 56% of deaths are in Asia and 54% in Africa. In Indonesia, rabies cases (98%) are usually transmitted by dogs (domestic and wild dogs) (96.79%), cats (1.06%), and apes (0.15%). The aim of this study was to determine the homology score and predict the antigenic sites of the glycoprotein (G-protein) encoding gene from rabies virus in Indonesia using molecular analyses. G-protein gene from isolated samples was amplified using a two-step RT-PCR followed by sequencing. Results show that homology scores of Indonesian rabies virus isolates against reference virus isolates obtained from GenBank records are the following: Indonesia (93-98%), China (89-91%), Thailand (83-86%), India (82-84%), Korea (83-85%), and Pasteur strain (82-83%). Only antigenic site I of isolated sample from Sumatra changed, while antigenic sites II and VI remain unchanged. This suggests that another G-gene strain from a different region might exist in rabies virus isolated from Indonesia. (**Author's abstract**)

Keywords: *amino acid, antigenic site, dog, G-gene, Indonesia, rabies virus, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,

(Filipiniana Analytics)
NP

0017

Anuran diversity and ecology from forest fragments in Cavite Province, Luzon Island, Philippines

Mallari, Neil Aldrin D. , Diesmos, Arvin C. , Causaren, Ru

The earliest comprehensive work on Cavite Province's anurans started in 1998 in Mount Palay-Palay/Mataas-na-Gulod Protected Landscape. Annual anuran assessments have been done in this protected area since then, but not for the entire province. The anuran assemblages are also experiencing numerous anthropogenic threats that could affect their diversity. The aim of the study was to determine anuran diversity, richness, and abundance in six secondary lowland forest fragments in Cavite and further contribute to existing knowledge on Philippine anurans. Anuran surveys were conducted from February to September 2010 by employing a combination of strip transect sampling, time-constrained searches, visual encounter survey (VES), and acoustic encounter survey (AES). Utilizing EstimateS v.8.2, species diversity was represented by Shannon's Diversity Index (H'), species richness by the non-parametric Jackknife1 and sampling efficiency by MaoTau. Twenty-one (21) microhabitats were identified, and species diversity and richness were highest in riparian forests during both dry and wet seasons. A total of 17 anuran taxa, including five representing new records for Cavite, were recorded. Species diversity (H´) values slightly varied and a comparison of the MaoTau and the Jackknife1 results indicated that ca. 80-100% of the anuran species were detected from the different forest fragments. The anuran assemblage has a high degree of endemism (70.6%) with two yet-to-be described species, *Platymantis* sp. and *Kaloula* sp., also known to occur in Cavite. (**Authors' abstract**)

Keywords: *AES, amphibians, Habitats, Jackknife, MaoTau, Microhabitats, VES, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-14
2016,
(Filipiniana Analytics)
NP

0018

Aquatic heteroptera of the Lake Manguao Catchment, Palawan and New Rank of *Rhagovelia Kawakamii hoberlandti* Hungerford & Matsuda 1961

Zettel, Herbert , Freitag, H

Results of an inventory of the fauna of aquatic and semiaquatic true bugs (Insecta:Hemiptera) of small streams in a lake catchment of northern Palawan are presented. Twenty-one species were recorded. Taxonomic and ecological notes, distribution and collection sites are given for each identified taxon. *Rhagovelia hoberlandti* Hungerford & Matsuda 1961 is newly ranked as a subspecies of *R. kawakamii* (Matsumura 1913): *Rhagovelia kawakamii hoberlandti* Hungerford & Matsuda 1961, stat.n. *Cercotmetus asiaticus* Amyot & Serville 1843 is recorded for the first time from the Philippines. Endemic and few undescribed taxa are discussed. Additional environmental data of the sampled waters are discussed with comparative surveys in the country. (**Authors' abstract**)

Keywords: *Philippines, AQUA Palawana, freshwater biodiversity, taxonomy, water bugs, Hemiptera, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-27
2012,
(Filipiniana Analytics)
NP

0019

An assessment of the endo-parasites of littoral fish from Lake Taal, Batangas, Philippines

Raymundo, Jona Marie S. Gil A. Cauyan, Jonathan Carlo A. Briones , Portugal, Jacelle Andrea A. , Capuchino, Alyssa Chari

Fish parasites are ecological important because of their significant contributions to ecosystem integrity. This has gained the attention of both scientists and policy makers globally, but is not yet as evident in the Philippine setting. This is because the practical application of such knowledge requires a strong basal foundation on parasite biodiversity research, which has waned in the country in the last decades because of the retirement and passing of many prominent Filipino parasitologists. We aimed to contribute to the information on Philippine fish parasite biodiversity by surveying the parasites of various littoral fish species in Lake Taal - the third largest lake in the country. Fish were sampled in the lake from July to September 2015 through the aid of local fishermen, who employed gill nets and beach seines in the lake's littoral areas. From these, 711 specimens were gathered and necropsied for helminth endo-parasites. Parasites were retrieved from 4 of 16 fish species, with low prevalence and mean burden observed. Three parasite genera were identified, namely *Opegaster* sp. (Platyhelminthes: Opecoelidae), *Camallanus* sp. (Nematoda: Camallanidae), and *Andracantha* sp. (Acanthocephala: Polymorphidae). *Andracantha* sp. is the first report of its genera from Philippine fish, providing a contribution to the present Philippine parasite biodiversity listing, while *Opegaster* sp. represents a potential target species for biological lake monitoring because of its wide presence among gobiids throughout the country, as well as its transmission specificity. Overall, the present study provides new records for fish parasites in the country, and recommends specific targets for the conservation re-search of Lake Taal and Philippine inland waters, in general, through the exploration of potential keystone parasite biomarkers. (**Authors' abstract**)

Keywords: *Andracantha, Opegaster, Camallanus, parasite biodiversity, parasite bioindicators, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-7
2017,
(Filipiniana Analytics)
NP

0020

Bacterial and yeast food preferences of cellular slime molds (Dictyostelids) isolated from Lubang Island, Occidental Mindoro, Philippines

Dela Cruz, Thomas Edison E. , Yulo, Paul Rich

Cellular slime molds (dictyostelids) are single-celled, phagotropic micropredators in soil. Often, these organisms are grown in the laboratory with *Escherichia coli* as the food bacterium. In this study, we evaluated the feeding preferences of eight species of dictyostelids previously isolated from Lubang Island, Occidental Mindoro, Philippines. Our results showed that the isolated dictyostelids preferred gram-negative bacteria over gram-positive bacteria and yeasts. *E. coli* remained the food of choice by the most of the isolated cellular slime molds. Our study is the first attempt to evaluate the feeding preferences of locally isolated dictyostelids. (**Authors' abstract**)

Keywords: *bacteriovores, soil micropredators, food bacteria/yeasts, feeding preferences, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-8
2012,
(Filipiniana Analytics)
NP

0021

Basidiocarp production of *Pleurotus sajor-caju* (Fr.) Singer on compost supplemented with molasses

Romero, Eloi Ther

This study was conducted to determine the effects of molasses as supplement on mycelial colony growth and basidiocarp production of *Pleurotus sajor-caju* (Fr.). Five treatments with composted substrate combination of rice straw, sawdust, urea, and lime and supplemented with different concentrations of brown sugar and molasses were evaluated. Based on the results of the study, brown sugar and molasses used as supplements in the growth substrates of *Pleurotus sajor-caju* significantly enhanced the growth of mycelial colony when applied at the right concentration. Likewise, composted substrate supplemented with fifty percent of both brown sugar and molasses supported the heaviest basidiocarp production among all treatments. Two species of *Mycodrosophila* and unidentified small, shiny beetles were observed alighting on the bagged substrates and basidiocarps of *Pleurotus sajor-caju*. White insect larvae infested the base and cap of the basidiocarps. A cottony white fungus was observed contaminating the plated substrates except for the untreated bags. Contamination was not observed on the bagged substrates. Based on the cost and return analysis, the composted substrate with brown sugar and molasses supplements produced a average total yield of 873 grams and net income of Php 93.75 in five fruiting bags only. (**Author's abstract**)

Keywords: *Basidiocarp, Compost substrate, Molasses, Mushroom, Mycelial colony, Biology*

Cabagan Journal of Research, Volume No. 21 Issue No. 1, 1-11
2012/06,
(Filipiniana Analytics)
NP

0022

Beneric status of the endemic *Atalantia linearis* Merr (Rutaceae) based on *rps16* intron data (cpDNA), with a preliminary report on its phytohemical components

Alejandro, Grecebio Jonathan D. , Liwag, Leannel P. , De Castro, Luis Elijah S. , Apepe, Sinbad Alfonso A. , Adajar, Bernard Joseph L. , Gatpo, Ariam O. , Banag, Ceci

Rutaceae (or citrus family), specifically subfamily Aurantioideae, includes many economically important species due to their wide array of secondary metabolites. *Atalantia linearis* (Blanco) Merr., an imperfectly known endemic member of the Rutaceae from the Philippines, is a species of shrub found only in the province of Rizal. It was originally described as *Limonia linearis* and later transferred to the genus *Atalantia*. Subsequent study recognized *A. linearis* as a species of *Severinia* based on morphology. Comparative morphology between the two genera shows disparate features. To determine the generic status and position of *A. linearis* with more certitude, *rps16* sequences of two samples were newly generated and analyzed together with previously published related sequences. Surprisingly, parsimony analysis of the aligned 950 base pairs of the *rps16* dataset showed that the two *A. linearis* isolates did not

group to neither *Atalantia* nor *Severinia* species included in the analyses. Instead, the two *Atalantia* isolates formed a lineage of its own closely related to the subclade of *Severinia* and another species of *Atalantia* with a moderate support (BS=87). The phytochemical tests showed the presence of sugars, steroids, flavonoids, alkaloids, coumarins, tannins and phenolic compounds in the leaf and stem ethanolic extracts of *A. linearis*. Thus, the endemic species should be explored as a potential source of medicine. (**Authors' abstract**)

Keywords: *Atalantia linearis, rps16 intron, Rutaceae, phytochemical, Severinia linearis, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-11
2011,
(Filipiniana Analytics)
NP

0023

Benthic macroinvertebrates in streams contaminated by acid mine drainage: A pilot study from Thailand

Sangpradub, N

Benthic macroinvertebrates were sampled by a D-Frame Dip net (450 µm mesh size) from 3 sites of a stream contaminated with acid mine drainage from a gold mine in Loei Province, Thailand. *Sialis* larvae (Insecta: Megaloptera: Sialidae) were dominant taxa (49%) in the high Arsenic upstream site 1 followed by dipteran larvae (26%), gastropods (15%) and Coleoptera (10%). The less contaminated, downstream site 3 was dominated by Coleoptera (32%), Ephemeroptera nymphs (24%) and *Caridina* (F. Atyidae, O. Decapoda-20%). Seventeen percent of mouthpart deformity of chironomid larvae was also found in site 2. It is preliminary concluded that the extent of contamination with mining waste water has affected both, taxon composition and the proportion of chironomids with deformed mouth parts. (**Author's abstract**)

Keywords: *Gold mine, Arsenic, Stream benthos, Mouthpart deformity, Chironomids, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-7
2017,
(Filipiniana Analytics)
NP

0024

Biotype of the invasive plant species *Chromolaena odorata* (Asteraceae: Eupatoriae) in the Zamboanga Peninsula, The Philippines

Codilla, Lina T., Metillo, Ephrime B.

The gross morphology of one of the world's worst invasive plant species, *Chromolaena odorata*, now widespread in three provinces of the Zamboanga Peninsula, was examined and compared to the characteristics of Asian/West African (AWA), Southern African (SA), and Central and South American biotypes. *C. odorata* from the three provinces of Zamboanga Peninsula is very similar with the AWA and the Central and South American biotypes. Implications of this finding are discussed in the light of the species' invasion and biocontrol in South Asia, Southeast Asia and the Philippines. (**Authors' abstract**)

Keywords: *Chromolaena odorata, biotype, Asian-West African biotype, Southern African biotype, Central and South American biotype, gross morphology, invasive plants, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-15
2012,
(Filipiniana Analytics)
NP

0025

Blooms of the colonial green algae, *Botryococcus braunii* Kützing, in Paoay Lake, Luzon Island, Philippines

Saguiguit, Angelica , Cruz, May Ann , Cho, Carmela , Wu, Jiunn-Tzong , Baldia, Susana , Papa, Rey Donne, Aquino, Riyel

Blooms of the colonial green algae, *Botryococcus braunii*, have been widely known to exert toxic effects on a variety of aquatic organisms and have been noted to cause fish deaths in some environments. In this study, a monitoring of the abundance and distribution of *B. braunii* in Paoay Lake was done in 2006. Samples were taken from the surface and deep portions in the lake from 4 sampling sites. The density of *B. braunii* was found to increase with time from an average of 9,670 colonies/L in May to 24,656 colonies/L in June. The highest recorded density was 44,732 colonies/L near the area surrounding the town of Nagbacalan in July. It was also found that the abundance of some zooplankton species was lowered when the abundance of *B. braunii* was elevated in the lake. This study showed that the *B. braunii* bloom has likewise caused a decrease in dissolved oxygen and might have attributed to the toxic effects exerted by this green alga on the other organisms found in the lake. This is the first reported occurrence of a *B. braunii* bloom in Paoay Lake. (**Authors' abstract**)

Keywords: *Algal bloom, Botryococcus braunii, Paoay Lake, Biology*

Philippine Journal of Systematic Biology, Volume No. 2 Issue No. 1, 1-6
2008,
(Filipiniana Analytics)
NP

0026

Characterization and identification of high cellulase-producing bacterial strains from Philippine mangroves

Monsalud, Rosario G. , Tabao, Nik Sh

Five promising cellulase-producing bacterial strains from soils collected from various mangrove sites in the country were characterized phenotypically and identified using conventional approach and, alternatively, by rapid identification through the Analytical Profile Index (API) system. They were identified as follows: BBCS-11 as *Bacillus cereus*; BBCS-14 as *Bacillus licheniformis*; BOrMGS-2 and BOrMGS-3 as *Bacillus pumilus*; and BBoB2L2-2 as *Bacillus* sp. The results generated from this study provided data regarding species of *Bacillus* producing cellulase enzyme and impart additional knowledge regarding the bacterial diversity of mangrove forests in the Philippines. (**Authors' abstract**)

Keywords: *Bio-prospecting, Conservation, Bacterial Diversity, Mangrove Forests, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-8
2010,
(Filipiniana Analytics)
NP

0027

Characterization of marine yeasts isolated from different substrates collected in Calatagan, Batangas

Dela Cruz, Thomas Edison E. , Hernandez, Sophia Angelica S. , Sabit, Maureen B. , Ruiz, Hanah I. , Go, Connel O. , Ramirez, Carly Si

Marine yeasts can be isolated from various substrata. Their potential industrial application merits a thorough study of these microorganisms. Thus, our research study aimed to isolate and characterize marine yeasts from several substrata collected from Calatagan, Batangas. Marine yeasts were isolated using enrichment culture of seawater, marine sediments, and living and decaying seagrasses and seaweeds on Glucose-Yeast Extract-Peptone broth (GYPS) supplemented with 33 g/L marine salts. Following incubation at room temperature, a total of 13 yeast strains were isolated. Most of the marine yeasts were obtained from either living or decaying seagrasses. Growth on GYP Broth with and without salt showed that six out of the 13 isolates were able to grow in the presence or absence of marine salts. Characterization of the isolated marine yeasts was done using the conventional morphological and biochemical methods and modern molecular techniques. All marine yeasts have cream-colored, circular and convex colonies with entire margin. The cells were spherical with a size range of 2.5–12.5 μm. They utilized galactose, maltose, sucrose, trehalose, xylose, sorbitol, N-acetyl-glucosamine and 2-keto-gluconate. Only one isolate (PCL08-LG04) utilized glycerol, arabinose, cellobiose, and raffinose. Comparison of the API 20C Aux profiles with the API database indicated that the isolated marine yeasts have affinity to the genus *Candida*. Gene sequence analysis of their ITS 1 and 2 regions of nuclear rDNA identified the isolates as *Candida tropicalis* and *Pichia carribica*. (**Authors' abstract**)

Keywords: *marine yeasts, enrichment culture, polyphasic taxonomy, gene sequence analysis, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-11
2010,
(Filipiniana Analytics)
NP

0028

Characterization of newcastle disease virus lentogenic strain infected native chickens from Surabaya, Indonesia

Rahmahani, Jola , Widjaja, Nanik S , Rahardjo, Adi Prijo , Rahmawati, Indah L , Kartika, Deya , Ernawati, Rahaju , Rantam, F

This study aimed to characterize the lentogenic NDV isolate from native chickens in Surabaya, Indonesia. Thirty-seven samples of cloacal swabs from infected native chickens were collected, and pathotypes were characterized using Mean Death Time (MDT) analysis; six isolates were found to be lentogenic. Lentogenic NDV isolates were then analyzed via RT-PCR, using primers specific for cleavage site of fusion protein (F). PCR product was sequenced and analyzed using Epitope Prediction Tools (IEDB) Analysis Resource to determine the epitopes. The results showed some shifts in nucleotides, but no change was observed in amino acids. Five samples were found with similar sequence in the cleavage site, except NDV isolated from sample Ck/sby27, which had a different amino acid sequence,

"RRQKRFI." Epitope characterization specific for T-cell NDV was found in Ck/sby27 at position 42-142, with highest real score in epitopes CLDYLQLVY, SIDGRPLAA, and TAEQITAAA. These findings reinforce the assumption that the original NDV lentogenic strain is of wild origin and is still circulating in the environment. Therefore, NDV isolate Ck/ sby27 can be used in developing vaccines in the future. (**Author's abstract**)

Keywords: *Indonesia, lentogenic strain, native chicken, NCD, T-cell epitopes, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,
(Filipiniana Analytics)
NP

0029

Comparative pollen viability and pollen tube growth of two endemic Philippine *Etlingera* (Zingiberaceae, Alpinioideae)

Acma, Florfe M. , Sinamban, Evangeline B. , Porquis, Heidi C. , Mendez,

The pollen viability and pollen tube growth of *Etlingera dalican* and *Etlingera philippinensis* (Zingiberaceae) were examined from fresh samples under the light microscope (LM) and scanning electron microscope (SEM). Pollen measurements were 68-75µm for *E. dalican* and 60-65µm for *E. philippinensis*, having a spheroidal shape for hydrated pollen and an irregular shape for dry pollen for both species. *E. dalican* pollen has greenish-yellow color while that of *E. philippinensis* is greenish. Both species have inaperturate pollen but differ in their ornamentation, which is gemmate in *E. dalican* and psilate in *E. philippinensis. E. dalican* had 88.56% pollen viability while *E. philippinensis* had only 40.69%. The rate of pollen tube growth was faster in *E. dalican* (17.75 µm per day) than *E. philippinensis* (8.17 µm per day). The possible pollinators observed for the two species were butterflies of the genus *Catopsilia*, ants and flies. Additional information on the inflorescence and flower description of the two species are herein presented. (**Authors' abstract**)

Keywords: *Etlingera dalican, Etlingera philippinensis, Philippine Native Gingers, Pollen germination, Pollen morphology, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-9
2017,
(Filipiniana Analytics)
NP

0030

Comparative study of the leaf morphology of *Epipremnum* SCHOTT and *Rhaphidophora* HASSK (Araceae) in the Philippines

Medecilo, Melanie M. , Obico, Jasper John A., Bagay, Carmela Kathrina C. , Agoo, Esperanza Maribel G. , Asencion, Amelia S.

Leaves of 50 specimens under the genera *Rhaphidophora* and *Epipremnum* were measured and characterized using the Manual of Leaf Architecture. The leaf characters were compared and subjected to phenetic investigation using cluster analysis with the aid of a computer software, PC-ORD (ver 2.11). Generally, the leaves may be categorized into two groups based on lobation. The results of the cluster analysis support the transfer of *R. korthalsii* to the genus

Epipremnum. Further, the leaf morphology was able to define the interspecific relationship within *Rhaphidophora*. However, in establishing the intergeneric relationship between *Epipremnum* and *Rhaphidophora*, the leaf morphology does not offer conclusive evidence. (**Authors' abstract**)

Keywords: *Rhaphidophora, Epipremnum, R. korthalsii, leaf morphology, Biology*

Philippine Journal of Systematic Biology, Volume No. 1 Issue No. 1, 1-12
2007,
(Filipiniana Analytics)
NP

0031

A critical review of the taxonomic status of *Rafflesia philippensis* Blanco (Rafflesiaceae) from the Philippines

Madulid, Domingo A., Agoo, Esperanza Maribel G

An appraisal of the protologue of *Rafflesia philippensis* shows that it is based on collections from two places, i.e. 'Monte de Majayjay' in Mt. Banahaw and Basey, Samar made by two different individuals at different times. The protologue is brief, incomplete, vague and replete with errors that make it impossible to visualize the appearance of the species. There are no preserved specimens (holotypes) of these collections. The portion of the protologue that describes the flowers from Basey, Samar matches *R. manillana* described earlier from the same site. The flowers described from 'Monte de Majayjay' cannot be discerned because of the brief and faulty description. Being a mixture of two separate and different collections representing two distinct taxa, *R. philippensis* is thus an invalid name and an erroneously described species. The proposal to resurrect *R. philippensis* as the correct name for the species found in Kinabuhayan, Dolores, Quezon, replacing *R. banahawensis* is erroneous. *R. banahawensis* is, therefore, the correct name of the species in Mt. Banahaw. (**Author's abstract**)

Keywords: *Rafflesiaceae, Philippines, Rafflesia, R. philippensis, R. banahawensis, Fr. Manuel Blanco, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-9
2015,
(Filipiniana Analytics)
NP

0032

Current research status on the biology of pink pigmented facultative methylotrohphic (PPFM) bacteria belonging to the genus *Methylobacterium* in the Philippines

Galvez, Jeffrey B. , Carvajal, Thadd

This paper outlines the current state of knowledge on *Methylobacterium* spp. or commonly known as Pink Pigmented Facultative Methylotrophic (PPFM) bacteria in the Philippines. This review deals with its isolation and cultural properties, colonial, microscopic, biochemical, physiological and genotypic characterization, diversity and systematics, plant- and human-association, and lastly, the research thrusts and directions applicable in the Philippines. (**Authors' abstract**)

Keywords: *Anthony Lee, Pink Bacteria, Systematics, Plant-association, Bioremediation, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-17
2015,
(Filipiniana Analytics)
NP

0033

Development of an interactive database to the species of Philippine Mussaenda (Rubiaceae)

Meve, Ulrich , Alejandro, Grecebio Jonathan

An illustrated database of the 27 (including three varieties) Philippine species of Mussaenda was developed using the DELTA format and translated to an interactive key. The database, based on field observations and herbarium specimens, comprises more than 200 characters from which detailed descriptions of habit and both vegetative and reproductive parts were drawn. Full illustrations of important characters and each taxon (including field and type specimens) as well as key to the species, phenology, distribution maps, vouchers of specimen examined, discussion, and internal transcribed spacer (nrDNA) sequence are also associated with this database. The interactive identification uses 146 characters, the flower morphology and type of external indumentum score with the highest character reliabilities. The database is available at http://www.uni-bayreuth.de/ departments/planta2/wgl/delta_ru/index.html. (**Authors' abstract**)

Keywords: *Delta, Intkey, Mussaenda, Philippines, Rubiaceae, Biology*

Philippine Journal of Systematic Biology, Volume No. 2 Issue No. 1, 1-5
2008,
(Filipiniana Analytics)
NP

0034

Dicranum ignatovii sp. nova (Dicranaceae, Bryophyta) from the Far East

Fedosov, Vladimir E. , Tubanova, Dolgor Y., Dugarova, Oyuna D.

The new species *Dicranum ignatovii* Tubanova & Fedosov is described from Sakhalin, South Kurile Islands and the Khabarovsk Territory based on the approach of integrative taxonomy. The species is characterized by the unique combination of (1) short leaves with broadly acute apex, (2) slightly recurved distal leaf lamina, (3) short-rectangular to transverse rectangular distal leaf cells, (4) proximal leaf cells abruptly shortened distally and thus occupying only the basalmost leaf portion, (5) costa ending before apex, and (6) presence of flagelliform branchlets in upper leaf axils. Based on nrITS 1, 2 & 5.8 rRNA gene sequences, molecular phylogenetic analysis was carried out. As a result, three studied specimens were found in a well supported clade, nested in a weakly supported clade where *D. acutifolium, D. caesium, D. bardunovii, D. angustum, D. bonjeanii, D. scoparium* and *D. brevifolium* were also found. (**Authors' abstract**)

Keywords: *Dicranum ignatovii, D. acutifolium, D. caesium, D. bardunovii, D. angustum, D. bonjeanii, D. scoparium, D. brevifolium, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-8
2018,
(Filipiniana Analytics)

NP

0035

New dipterocarp species from the Philippines

Gutierrez, Hermes G., Rojo, Justo P. , Madulid, Domingo A.

Four new species of plants under the family Dipterocarpaceae from the Philippines are here described: *Hopea reynosoi* Gut., Rojo & Madulid; *Hopea santosiana* Gut., Rojo & Madulid, *Shorea arsorianoi* Gut., Rojo & Madulid and *Vatica mendozae* Gut., Rojo & Madulid. (**Authors' abstract**)

Keywords: *Dipterocarpaceae, Hopea, Vatica, Shorea, Philippines, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-12
2010,
(Filipiniana Analytics)
NP

0036

New distributional record and intra-specific variation of *Cerberus schneiderii* in Iyam River, Lucena City, Quezon, Philippines

Jalbuena, Glenn Lester L. , Albaño, Shairah Dianne C. , Jaluague, Julius Caesar A. , Barrera, Jr.,Wilfr

Cerberus is a genus of semi-aquatic snakes that inhabit a wide range of aquatic habitats including estuarine environments. There are two species belonging to this genus known to occur in the Philippines. However, its distributional record is still not well established since only limited areas are surveyed despite of its wide distributional range in the coastal habitats of the country. This study primarily aims to document the occurrence of *Cerberus* in Iyam River, Lucena City. The scalation patterns and metric characters were also described to determine the range of individual variability among the species. Samples were collected from different habitat types in the sampling area by systematic transect walking. By close examination, it was revealed that the samples exhibit the established morphological description of *Cerberus schneiderii*. Moreover, population exhibit high variability in scalation pattern such as anal plate, anterior chin shield, lower labials at the first chin shield, type of scale, prefrontal plate, upper labials at loreal, and ocular ring; and metric characters such as total length, tail length, snout-vent length (SVL) and Tail:SVL ratio (H' = 0.67-1.0). Statistical analysis further showed a strong significant correlation (P = <0.01) between total length and SVL, total length and weight, SVL and weight, and total length and tail length. The occurrence of different morphotypes is very important in understanding the extent of intra-specific variation within *Cerberus schneiderii* and the possible role of local adaptations and habitat use. (**Authors' abstract**)

Keywords: *Morphotype, Scalation, Dog-faced water snake, Individual variability, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-8
2017,
(Filipiniana Analytics)
NP

0037

New Distributional Records of *Utricularia striatula* Smith (Lentibulariaceae) in Mindanao, Philippines

Naive, Mark Arcebal K., Mendez, Noe P., Buenavista, Dave P

Utricularia striatula (Lentibulariaceae) is reported for the first time in the Southern Philippines and represents a new record for Mindanao Island. Full descriptions of the species, its habitat ecology, along with photographs are provided. (**Authors' abstract**)

Keywords: *Bladderwort, Bukidnon, Carnivorous plant, Lithophytic, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-4
2017,
(Filipiniana Analytics)
NP

0038

Diversity and adaptive features of corticolous lichens in the Hundred Islands, Philippines

Park, Chan-Ho , Fajardo, Weenalei T. , Lagarteja, Neil Kevin , Caliway, Mae Ann , Beniking, Roel , Amilao, Dave , Pinas, Ashley , Amoncio, Roselyn , Bawingan, Paulina A., Hur, Jae-Seou

This study is a survey of corticolous lichens in the Hundred Islands, Philippines noting their diversity and morpho-anatomical adaptive features. There were only six islands visited due to accessibility and safety reasons. There are at least thirty-two identified species of lichens; majority is crustose dominated by Graphidaceae lichens followed by pyrenolichens in terms of diversity. Morpho-anatomical features considered to be adaptive include crustose and narrow-lobed foliose growth forms, homiomerous thallus organization, thick upper cortex, and presence of pruina in the cortical or medullary layers. (**Authors' abstract**)

Keywords: *Hundred islands, epiphytic lichens, adaptive features, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-17
2014,
(Filipiniana Analytics)
NP

0039

Diversity and colonization pattern of leaf litter arthropods during early stages of decomposition in Mt. Makiling, Los Baños, Laguna

Barrion-Dupo, Aimee Lynn A. , Perez, Juveneil Eis

Litter arthropod presence is considered important because their feeding activities facilitate nutrient cycling. However, studies to document the leaf litter arthropod community in the Philippines remains wanting. This pioneering study aimed to: 1) identify arthropod orders and families associated with leaf-litter during the early stages of decomposition; 2) measure abundance and diversity of these leaf-litter arthropods, and; 3) observe the pattern of colonization of these arthropods on decomposing leaf-litter. Two (2) 100g mixed leaf litter samples were collected every other week for 10

weeks (December 2010-February 2011). Arthropods extracted from leaf litter samples were sorted and identified. A total of 1650 individuals were classified to belong to 13 orders, namely: Acarina, Araneida, Blattodea, Collembola Dermaptera, Hemiptera, Hymenoptera, Isopoda, Lepidoptera, Psocoptera, Trichoptera, Coleoptera and Diptera. The last two orders mentioned were the most family-rich. Cluster analysis for family composition and diversity showed four discernible clusters hypothesized to have been influenced by moisture content and rainfall. This however, remains as speculation until a follow-up study is done. Also, no distinct pattern of colonization was observed. However, initial and consistent leaf litter arthropod colonizers were recognized. These were Araneida, Blattodea, Coleoptera, Collembola, Diptera, Hemiptera, Hymenoptera and Trichoptera. Consistent colonizers were namely: Coleoptera, Diptera and Hemiptera. (**Authors' abstract**)

Keywords: *abundance, Berlese-Tullgren funnel, secondary growth forest, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-14
2013,
(Filipiniana Analytics)
NP

0040

Diversity, exploitation and conservation status of commercially important sea cucumber (Class Holothuria) species in Southeast Asia

Lopez, Mark Louie , Velasco, Rainier Ulrich, Devanadera, Mark

Recent trends in sea cucumber fisheries show a marked increase in landings due to a strong increase in demand. The risk of overexploitation at present is high since the case of sea cucumber fisheries in Southeast Asia (SEA) shows a very complex system of interactions, where economic and social factors play important roles. Results showed that most of the countries in SEA Region, particularly Philippines and Indonesia, have the highest number of species harvested every year and placed in highest exporting countries of dried sea cucumber therefore placing them in over-exploited category. Lack of data on basic biological parameters of most species and cultural and sociological non-acceptance of aquaculture as an alternative fishing method for sea cucumber are also to blame for the decline in sea cucumber population in the wild. It is suggested that countries in SEA should implement two important steps to manage existing and future holothurian fisheries. First, the increasing rate of new fisheries had best be reduced to a level where management has time to react to early warning signs of resource depletion. Second, lacking changes in regulation, the catch trajectory and patterns of serial spatial, species and size expansion or depletion are largely predictable. Knowledge of the impending sequence of events can therefore be pre-emptively incorporated into the management of new and existing high-value marine fisheries. Overall, the study highlights the urgent need for better monitoring and reporting of catch, abundance data and proper scientific stock, and ecosystem impact assessment to ensure more sustainable harvesting of sea cucumbers. (**Authors' abstract**)

Keywords: *biodiversity loss, trepang, marine invertebrates, conservation management, tropical fisheries, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-13
2015,
(Filipiniana Analytics)
NP

0041

Earthworm distribution in selected islands of the Visayan (Central Philippine) archipelago

Flores, Dante G

Nine (9) genera were identified from sixty-seven (67) collection sites within ten selected islands of central Philippines distributed over thirty municipalities. Among these nine genera, seven (*Pheretima, Pleionogaster, Pithemera, Amynthas, Polypheretima, Metaphire, Archipheretima*), belong to family Megascolecidae and two were highly invasive exotics (*Pontoscolex, Eudrilus*). Genus *Pheretima* showed the most diversity and is widely distributed, followed by the *Pleionogaster* group. *Pithemera* and *Polypheretima* could have native and exotic representatives as suggested by the vegetation type from which they were collected, while *Amynthas* and *Metaphire* could be native species. (**Author's abstract**)

Keywords: *Central Philippine Earthworms, Pheretima, Pleionogaster, Pithemera, Amynthas, Polypheretima, Metaphire, Archiperetima, Megascolecidae, Biology*

Philippine Journal of Systematic Biology, Volume No. 1 Issue No. 1, 1-5
2007,
(Filipiniana Analytics)
NP

0042

Effect of alkaloid of *Achyrantes aspera* Linn. (Caryophyllales: Amaranthaceae) on increasing caspase 9, caspase 3 and apoptosis in mice with breast cancer

Suwasanti, Niluh , Basori, Achmad , Putri, Desak Ketut Sekar Cempaka , Zakaria, Sunarni , Safitri, Erma , Mustofa, Imam , Meles, Dewa Ketut , Wurlina, W

It has been proven that *Achyranthes aspera* Linn. alkaloid can improve apoptosome (cytochrome C and APAF-1) formation in the mitochondria of cancer cells. However, it is yet to be seen whether chromosome fragmentation by caspase 9 and caspase 3 can induce apoptosis in breast cancer cells in mice. Fifty-two-month old adult female mice were used in this study and were equally divided into five groups. Healthy mice (C-) were given orally with 0.5 ml of carboxy methyl cellulose (CMC) solvent, while mice with breast cancer (C+) were given 0.5 ml of 15 mg/kg body weight methotrexate. To test for the effect of alkaloid on breast cancer cells, T0 group, mice with breast cancer, was only administered with 0.5 ml of CMC solvent. T1, T2 and T3 each received 0.5 ml of *A. aspera* alkaloid, at a dose of 75, 100 and 125 mg/kg body weight. respectively. All groups received the same treatment daily for eight weeks. Rate of apoptosis in mice breast cancer cells and expression of caspase 9 and caspase 3 were measured. This study suggests that *Achyranthes aspera* alkaloid can increase number of apoptotic cells and enzymes caspase 9 and caspase 3. (**Author's abstract**)

Keywords: *Achyrantes aspera, alkaloid, apoptotic cell, breast cancer, caspase 3, caspase 9, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,
(Filipiniana Analytics)
NP

0043

Effect of aluminum silicate on the spermatozoa, plasma membrane and seminiferous tubules of mice exposed to *Fusarium graminearum* (Sordariomycetes: Hypocreales: Nectriaceae)

Safitri, Erma , Mulyati, Sri , Hernawati, Tatik , Samik,

This study was conducted to determine the effect of aluminum silicate on the quality of sperm, plasma membrane and seminiferous tubules of mice exposed to the fungus *Fusarium graminearum*. Twenty-five healthy, 8-10 week old, 20-25 g, BALB/c adult male mice were used. They were divided equally into five groups: negative control (C-) was not given *F. graminearum* and aluminum silicate; positive control (C+) received 0.5 ml *F. graminearum* suspension (228 × 108 spores/ml) but without aluminum silicate. Treatments 1, 2, 3 were each given the same amount of fungus and aluminum silicate with doses 0.5 mg (T1), 1 mg (T2), and 2 mg (T3) for 21 days. Testes and spermatozoa were obtained from the epididymal duct to examine for the said parameters. Motility (%) was highest in C-, but not significantly different from T3 (P>0.05). Viability (%) was highest in C-, which was significantly different with all treatments (P0.05). Meanwhile, abnormalities (%) were highest in C+, and significantly different from all treatments. Plasma membrane integrity was highest in C-, but not significantly different from T3. Likewise, seminiferous tubule quality was highest in C- but lowest in C+. All parameters, except the latter, were lowest in C-. Results of the study suggest that using aluminum silicate can maintain the quality of sperm in mice exposed to *F. graminearum*. (**Author's abstract**)

Keywords: *aluminum silicate, Fusarium graminearum, seminiferous tubule, sperm, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,
(Filipiniana Analytics)
NP

0044

An enumeration of the woody plants of Cantipla forest fragments, Cebu Island, Philippines

Buot, Jr., Inocencio E. , Cadiz, Ge

Woody plants in Cantipla forest fragments, Barangay Tabunan, Cebu Island, Philippines, were inventoried from three 200 m^2 plots. A total of 45 species were recorded representing 37 genera of 26 families. The most represented families were Euphorbiaceae (5 species) followed by Moraceae (4 species) and Rubiaceae (4 species) while the most represented genus was *Ficus* (4 species). The fragmented forest is also a habitat of the critically endangered *Cinnamomum cebuense* Kost. (Lauraceae), locally known as *kalingag*. The flora of the Cantipla forest fragments is typical of a lowland rainforest vegetation. There is an urgent need to examine and analyze the dynamics of this important ecological heritage and biodiversity corridor so that appropriate forest and environmental management strategies by the local government and the community will be identified and implemented. (**Authors' abstract**)

Keywords: *floristic composition, tropical mountain, lowland forest, Cebu watershed, Cantipla forest, Cinnamomum cebuense, Biology*

Philippine Journal of Systematic Biology, Volume No. 3 Issue No. 1, 1-7
2009,
(Filipiniana Analytics)
NP

0045

Ethnobiology and alternative medicine of the Ybanag minority in Northern Isabela, Cagayan Valley, Philippines

Cabauatan, J

Research interest and activities in the areas of Ethnobiology and Ethnomedicine have increased tremendously in the last decade. The basic approach of this study combined both the elements of social and biological methodologies. Findings revealed that Ybanag minority has better acceptance on the utilization of plants and animals (ethnobiology) to support their basic needs in their socio-economic activities while their cultural heritage are kept protected and respected. Regardless of their differences in socio-economic status, age, cultural and experiential background, their individual attitude is consistently favorable to their practice. Considering this group to occupy the largest areas in Region 02, the utilization of about 673 different indigenous plants and animals for rituals, beliefs, medicine, food, burial customs and other miscellaneous uses was extensively practiced with the highest fidelity index of between 76-100 percent. The continuous utilization of these biological resources is the only way they can conserve and protect their whole entity of ancestral domain, from birth to death. Their accessibility to the wild made them survive and depend mostly for their subsistence and other major and miscellaneous activities, and even considered them the protector of the wild. Hence, the attention to participate in any project or measures that could help them in their sustenance, in a manner that they too could help in the restoration of the natural environment is necessary. With these results, an appropriate system of management for biological resources necessitates these accumulated data for long term management and sustainability, a better principle to reconnect the people to the natural world. (**Author's abstract**)

Keywords: *Ethnobiology , Ethnomedicine, Miscellaneous uses, Fidelity index, Biology*

Cabagan Journal of Research, Volume No. 22 Issue No. 1, 1-9
2013/06,
(Filipiniana Analytics)
NP

0046

Faunistic survey of Philippine freshwater microcrustacean zooplankton: New locality records and updated species accounts

Zamora, Cyd Vincent L. , Manuel II., Apollo L. , Villalon, Janna Vernice R. , Tan, Christopher Allan F. , Fernandez, Ann Tonette B. , De Leon, Gabrielle O. , Dela Paz, Erica Silk P., Papa, Rey Donne S.

This paper updates the taxonomy and distribution of microcrustacean zooplankton belonging to Cladocera and Copepoda from selected freshwater bodies of Luzon Island, Panay Island and South Cotabato, Mindanao Island in the Philippines whose zooplankton fauna have remained undocumented to date. A total of 31 sampling sites were visited including 11 ponds, 5 lakes, 12 rivers, 1 man-made dam, and 2 streams. Zooplankton samples were collected using 80mesh size plankton nets, and processed and identified in the laboratory. Morphological characteristics were examined under light compound, dissecting, and phase-contrast microscopes for taxonomic identification. Results showed that 13 species were present from the different sampling sites with 7 cladocerana and 6 copepods. Further analyses revealed new locality records for *Mesocyclops ogunnus* in Lake Taal and *Arctodiaptomus dorsalis* in Lake Lahit. All species from Lake Holon are new locality records. Results from this study contributed much needed information to make a thorough analysis on the distribution of microcrustacean zooplankton taxa in the Philippines as well as provide the first accounts of microcrustacean zooplankton from Panay Island. (**Authors' abstract**)

Keywords: *Arctodiaptomus dorsalis, Cladocera, Copepoda, Lake Holon, Lake Lahit, Lake Taal, Philippines, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-13
2016,

(Filipiniana Analytics)
NP

0047

Floral diversity assessment of the buffer zones and vicinity of the Mt. Hamiguitan Range Wildlife Sanctuary (MHRWS), Davao Oriental: basis for inclusion to protected area zone

Lagunday, Noel E. , Colong, Ruel D. , Salolog, Mary Cor S. , Gorme, Felipe S. , Coritico, Fulgent P. , Acma, Florfe M. , Amoroso, Vic

In 2016, municipal ordinances to expand the protected area of the MHRWS were issued with the aim of protecting and preserving the remaining biodiversity of the buffer zones and to strengthen the core zone. The municipal ordinances however, have limitations and do not guarantee legal promulgation. Hence, this study is on the gathering of complete and concrete floral data so that these expansion sites will become part of the protected area and encompassed in legal promulgations. Botanical fieldworks conducted from Oct to Dec 2017 were carried out in five study sites of the MHRWS expansion sites using 40 20 x 20 m sampling plot with a distance of 20 m between plots and opportunistic transect walk techniques. The study disclosed 228 taxa of plants, of these, 74 species were ferns and lycophytes, 6 species of gymnosperms, 30 species of herbs and vines and 118 species were trees and shrubs. There were three new records of ferns and lycophytes increasing the number of species to 155. There are 13 (5.7%) threatened species, 22 (9.6%) and endemic species. Findings suggest that species in each site are unique and maybe attributed to the vegetation present, elevation variations of the different sampling sites and anthropogenic activities. The proposed expansion sites harbor diverse threatened and plants deserving protection and conservation efforts. Results of this study support the contention that the expansion sites, which are included in the municipal ordinances, be part of the official protected area. (**Authors' abstract**)

Keywords: *biodiversity, Mt. Hamiguitan Range Wildlife Sanctuary expansion sites, Mindanao, Philippines, buffer zone, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 2, 1-16
2018,
(Filipiniana Analytics)
NP

0048

Floristic composition of the remaining forests in Upland Cavite, Luzon Island, Philippines

Medecilo, Maria Melanie P., Lagat, Myra N

Cavite Province lies in the western monsoon forest zone of the Philippines and is considered as a tropical lowland rainforest making it a haven for diverse flora and fauna. The existing total land forest area is 8,624.956 hectares, but the only proclaimed national park is Mts. Palay-palay/Mataas na Gulod Protected Landscape. Unfortunately, the remaining forests are not spared from biodiversity loss because of its accessibility to Metro Manila, which eventually leads to unsustainable use of natural resources. This study was conducted to characterize the floristic composition, analyze the vegetation structure, and provide an inventory of plants in the provinces' remaining forests. Data collection was done from June 2014 to March 2016. Forty-six plots (20m x 20m) were used for tree species composition. The plot size for shrub and non-woody plants was 5m x 5m quadrats while for herbaceous plants it was 1m x 1m quadrat. Plant diversity and environmental parameters in each plot were measured and recorded. Canonical Correspondence Analysis (CCA) was employed to analyze the relationships between vegetation and environmental variables. The study documented 501 species belonging to 336 genera and 113 families. Three vegetation types, secondary forest,

agricultural ecosystem, and semi-secondary (mixed forest) were documented in the remaining forests in Upland Cavite and the Protected Area (PA) part is characterized as lowland evergreen dipterocarp rainforest dominated by *Shorea guiso, Ficus chrysolepis, Diospyros pyrrhocarpa, Buchanania arborescens* and *Strombosia philippinensis*. The forest floor is dominated by *Anaxagorea luzonensis, Aglaonema commutatum* and *Bolbitis rhizophylla*. (**Authors' abstract**)

Keywords: *Plant diversity, Vegetation, Lowland dipterocarp forest, Mts. Palay-palay/Mataas Na Gulod Protected Landscape, Conservation, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-21
2017,
(Filipiniana Analytics)
NP

0049

Foliar fungal endophytes of selected medicinal plants from the Province of Albay, Philippines

Guerrero, Jonathan Jaime G., General, Mheljor A. , Imperial, Jazzlyn T

Fungal endophytes were isolated from the leaves of the 10 most frequently used medicinal plants in the province of Albay, Philippines at three different locations: upland, lowland, and coastal areas. Their occurrence, frequency, and isolation rates were compared. A total of 120 isolates belonging to 17 species were identified. *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk and *Colletotrichum gloeosporioides* M.B. Dickman were the most frequent fungi occurring in 10 and nine plants, respectively. No significant difference in the total number of isolates, as well as the total number of unique species from among sampling sites, was detected. *Blumea balsamifera* (L.) DC harbored the most endophytes with 16 isolates, while banana leaves yielded the least with eight isolates. There were species of fungi that cut across all sampling sites, while a few occurred only in one site. The collection of additional samples from other sites within the province and the testing of the biological properties of the isolates are recommended. (**Author's abstract**)

Keywords: *Albay, endophytes, Glomerella cingulata, medicinal plants, upland, Biology*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 31 Issue No. 1, 1-17
2019/06,
(Filipiniana Analytics)
NP

0050

Genetic characterization of Newcastle Disease Virus from broiler flocks in selected areas in Central Luzon, Philippines

Umali, Dennis V., Beguas, Rizi Ma

Newcastle Disease (ND) is a serious and highly contagious disease of poultry. To infer on the molecular epidemiological characteristics of ND virus involved in recent ND outbreaks in the Philippines, five clinical cases of ND in broiler flocks in Central Luzon were analyzed. Records of management and farm history were obtained to characterize the clinical profile of the disease. All affected broilers were vaccinated against ND using different brands

of commercial vaccines at different schedules. Affected flocks showed varying clinical signs and mortality rates. Nucleotide sequencing and phylogenetic analysis were performed using the fusion (F) gene. All field ND virus strains (NDVs) were velogenic with a proteolytic cleavage site of ^{112}RRQKR*F^{117}. Phylogenetic analysis of the five field NDVs showed that all strains belong to subgenotype VIIi and were 99% similar with the novel subgroup of virulent NDVs currently emerging from Indonesia, Pakistan and Israel. All strains were epidemiologically related, and successful elucidation of the progenitor virus may aid in the prevention and control of ND outbreak in broilers. (**Author's abstract**)

Keywords: *broilers, genotype VIIi, Newcastle disease virus, Philippines, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-10
2018,
(Filipiniana Analytics)
NP

0051

Genetic variation, advertisement call, and morphometry of *Microhyla nilphamariensis* from Bangladesh

Sumida, Masayuki , Kuramoto, Mitsuru , Kurabayashi, Atsushi , Sarker, Mohammad Abdur Razzaque , Hasan, Ma

The rich biodiversity of frogs and toads in Bangladesh is unexpected considering the rather simple topographic features of the country. Indeed, a new species, *Microhyla nilphamariensis*, has recently been described from Nilphamari District (northern region), Bangladesh. However, additional genetic, acoustic, and morphometric data are necessary to precisely delineate the newly described species as well as to measure conservation management. In this study we performed genetic, acoustic, and morphometric analyses. Our analyses showed that *M. nilphamariensis* was genetically divergent from its near congener *M. ornata* at 3.2% and 10.6% for the 16S rRNA and Cytb genes, respectively. Mean call duration of *M. nilphamariensis* was 0.42 ± 0.01 s (n = 8) and the call was composed of about 15.13 ± 0.35 rapidly repeating pulses with a pulse rate of 37.9 ± 0.4/s. Dominant frequency bands of *M. nilphamariensis* were much higher than those of *M. ornata* and *M. fissipes*. Principal component analyses showed that *M. nilphamariensis* differed from its near congeners in having shorter first and second fingers, shorter first toe, and longer inner and outer metatarsal tubercles relative to the snout-vent length. (**Authors' abstract**)

Keywords: *Mitochondrial DNA, Advertisement call, Morphometry, Microhyla, Bangladesh, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-18
2015,
(Filipiniana Analytics)
NP

0052

Genotypic and allelic frequency analysis of *Mx* gene in Philippine native and commercial chicken (*Gallus gallus domesticus*)

Tenorio, Sofia Jean A. , Salces, Agapita J. , Valdez, Joshua Da

The study was conducted to analyze the genotypic and allelic frequencies of *Myxovirus* (*Mx*)-resistance gene in Philippine native chickens. DNA was extracted from blood and 101 bp of the *Mx* gene exon 13 was amplified and digested using PCR-RFLP. Digested products were visualized through polyacrylamide gel electrophoresis to determine the genotype of each chicken. Genotyping results showed that Philippine native chickens had higher frequencies of the favorable AA genotype and A allele than GG genotype and G allele, respectively. Similarly, commercial layer, but not broiler chickens, had higher frequencies of AA genotype and A allele. Moreover, the present study confirms the association of *Mx* genotype with genetic group, plumage color, and geographical location. Frequencies were not significantly different between sexes. Patani, Joloanon, and Labuyo genetic groups, black plumage color and native chickens from Mindanao were associated with AA genotype. Commercial broiler was more likely to be associated with GG genotype than AA and AG genotype. (**Author's abstract**)

Keywords: *disease resistance, genotyping, Mx gene, hilippine native chicken, PCR-RFLP, Biology*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-10
2017,
(Filipiniana Analytics)
NP

0053

Gordonia terrae USTCMS 1066: Its taxonomy, antimicrobials and imidazolium susceptibility and evaluation as an initial screening agent for anti-TB compounds and natural products

Quinto, Edward A. , Macabeo, Allan Patrick G. , Abrantes, Jose Francis V. , Lioanag, Lorna , Garcia, Car

The taxonomic classification and unique characteristics of an air-borne actinomycete exhibiting a dark orange pigmentation were determined by polyphasic analysis. The colony appeared as a contaminant in an agar plate culture of the marine luminous bacterium: *Vibrio fischeri* USTCMS 1026. Subsequent investigation identified the actinomycete contaminant as MP 1066 for *Mycobacterium phlei* USTCMS 1066 but was later found to have morphological, physiological, biochemical and genotypic characteristics compatible with member species of the genus *Gordonia*. BLAST comparison of MP 1066 yielded 100% 16S rDNA sequence alignment with *Gordonia terrae* so the strain was renamed as *Gordonia terrae* USTCMS 1066. Its antimicrobial susceptibility profile is similar to that of the pathogenic mycobacteria yielding small MICs and large inhibition zones against the antibiotics: ampicillin (AMP), azithromycin (AZT), amoxicillin-clavulanic acid (AUC), ciprofloxacin (CIP), ethambutol (ETHAM), isoniazid (INH), rifampicin (RIF), tetracycline (TET), sulfamethoxazole-trimethoprim (SXT), and streptomycin (STREP). In addition, the crude ethanolic extracts of *Acanthella carteri, Alstonia scholaris Lunasia amara* Blanco, *Momordica charantia, Wrightia antidysenterica, Zingiber officinale* and the pure synthetic imidazole: 1,3-bis(4-methylphenyl) imidazolium chloride likewise inhibited strongly the growth of *Gordonia terrae* USTCMS 1066. Substances that strongly inhibited *Gordonia terrae* USTCMS 1066 were also observed to be strongly inhibitory to *Mycobacterium tuberculosis* indicative of its suitability as an initial assay organism for the screening of anti-TB natural products and synthetic compounds most specially for laboratories that are not equipped with Biosafety Level III facilities. (**Authors' abstract**)

Keywords: *Gordonia, Mycobacterium, anti-TB, antibiotics, plant extracts, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-19
2014,
(Filipiniana Analytics)
NP

0054

Growth rate, melachite green biodegradation and carotenoid production of *Gordonia terrae* USTCMS 1066

Abrantes, Jose Francis V. , Menguito, Corazon A. , Barcelon, Eufemio G. , Valdez, Michael C. , Quinto, Edward

The *Gordonia* bacteria are known for their exceptional ability to biodegrade a plethora of organic compounds and to produce various carotenoid pigments. *Gordonia terrae* USTCMS 1066, an orange hyperpigmented actinomycete isolated from a contaminated agar plate culture of *Vibrio fischeri* USTCMS 1026, grew rapidly in tryptic soy broth (Merck) supplemented with 0.5% yeast extract and yielded carotenoid content of 207 μg/g dry weight. It exhibited a growth rate of 0.0026 min^{-1} (38 min. doubling time) at 30°C with 200 rpm orbital shaking. This strain also grew in nutrient broth (Merck) containing a high concentration of 0.05% (500 mg/L) malachite green and significantly biodegraded the initially bluish triphenylamine dye by 99.8% to colorless after 3 days of incubation at room temperature without shaking. (**Authors' abstract**)

Keywords: *Gordonia, Gordonia terrae, Vibrio fischeri, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-13
2015,
(Filipiniana Analytics)
NP

0055

Histochemical expression of transforming growth factor beta and tumor necrosis factor alpha in rabbits (*Oryctolagus cuniculus*) (Mammalia: Lagomorpha: Leporidae) infected with *Sarcoptes scabiei* (Arachnida: Acari: Sarcoptidae)

Lastuti, Nunuk D Retno , Suwanti, Lucia T , Rizki,

Sarcoptes scabiei infection causes type I and IV hypersensitivity reactions induced by cytokines TGF-β and TNF-α. This study was conducted to analyze the TGF-β and TNF-α expression in rabbits with severe scabies. Five mixed-bred rabbits (3 males and 2 females), with age 12-18 months, were obtained from farms in East Java. Rabbit ear skin samples that showed clinical symptoms of severe scabies (without medical therapy), such as crusts, pus, excessive hyperkeratosis on nose, muzzle, around the eyes, ears and legs were collected. Skin scraping was done to detect the presence of *S. scabiei* mites, and skin samples were stained with hematoxylin eosin (HE) and subjected to immunohistochemistry. Strong staining of TGF-β and moderate staining of TNF-α were evident in all samples. TGF-β was expressed on stratum granulosum to stratum basalis of epidermis layer, half of the dermis, sebaceous gland, and hair follicle, while TNF-α was expressed on half of the epidermis layer, stratum spinosum to stratum basalis, and half of the dermis. This study illustrates that severe scabies infection triggered increased expression of TGF-β and TNF-α in rabbit ear skin, where TGF-β expression was more pronounced than TNF-α. (**Author's abstract**)

Keywords: *cytokine, immunohistochemistry, Sarcoptes scabiei, scabies, TGF-B, TNF-a, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,
(Filipiniana Analytics)
NP

0056

Historical trends among cestode research of vertebrates in the Philippines

Briones, Jonathan Carlo A. , Martinez, Vane

The study of cestodology has provided an increased understanding of global parasite epidemiology and has contributed to the decrease of human health risks caused by parasite infections. Research trends over past decades have proven that more species have yet to be discovered. An analysis of the trend of cestode studies among vertebrates in the Philippines is hereby presented in aspects of (1) peer-reviewed readership, (2) host taxa studied, (3) geographical distribution, and (3) target parasite species of interest. A survey of 182 publications in primary scientific and grey literature from 1904 to 2017 revealed that most studies were published locally. Likewise, a number of papers favored mammals, particularly humans, as the preferred vertebrate host of study. Looking into geographical distribution, a great number of publications focused on Luzon Island and was concentrated in Manila. Cestode species reported so far in the country belong to order Cyclophyllidea, with *Taenia solium* and *T. saginata* as the preferred species to be investigated. Looking into these, we suggest that a shift into the application of molecular systematics and biotechnology would further develop Philippine cestode research, given that the historical trend has focused on parasite discovery, identity, and classification. May this paper be a call to further fill the gaps in what is known about cestodes and other parasites in the Philippines, given the country's potential for further discoveries. (**Authors' abstract**)

Keywords: *Cyclophyllidea, parasite, Platyhelminthes, Taenia, tapeworm, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 2, 1-12
2018,
(Filipiniana Analytics)
NP

0057

The history of freshwater research in the Philippines with notes on its origins in the University of Santo Tomas and present-day contributions

Briones, Jonathan Carlo A. , Papa, Rey Donne

The study of freshwater ecosystems in the country has long had the reputation of being fragmentary and inconsistent, especially when compared to its marine counterparts. Other scientists have in fact noted that many studies that have been conducted on Philippine freshwaters have not gone beyond the "age of exploration", which resulted to it being poorly represented in the scientific literature. This scenario has been consistent for both lotic and lentic habitats, even for those considered as major river and lake ecosystems, including those found in key biodiversity or known protected areas. This has gone on for decades in spite of the obvious need for invigorated and scientifically-driven approaches to study and manage freshwater ecosystems throughout the country, especially since freshwater ecosystems, including its flora and fauna, are under increasing threat from both natural and man-made environmental stressors, including intensive aquaculture, leading to eutrophication, the introduction of non-native species, as well as climate change. This is further aggravated by the low number of experts in various fields of basic and applied freshwater biology including taxonomists, limnologists, restoration ecologists etc. to deal with various problems and challenges in the Philippine setting. This paper presents the background, history and origins of freshwater biology research in the Philippines and the contributions of the University of Santo Tomas from 2002 to present. (**Authors' abstract**)

Keywords: *Wallacea Expedition, Tropical Lakes, History of Science, Freshwater Zooplankton, Invasive species, Limnology, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-13
2017,
(Filipiniana Analytics)
NP

0058

Identification of archaeological charred wood from Ille site, El Nido, Palawan, Philippines

Paz, Victor J. , Escobin, Ramiro P., Conda, Jennifer , Ramos, Mario D.R. , Lewis, Helen , Carlos, J

Seven charred wood fragments from the archaeological site of Ille in El Nido, Palawan were identified as an undetermined monocot and representatives of the families Caesalpiniaceae, Dipterocarpaceae, and Araucariaceae/Podocarpaceae. Though very few pieces were determined, the results gave a glimpse of the types of woody plants most likely present in the vicinity of Ille, 14,000 to around 4,000 years ago. This report also aims to provide taxonomic identification based on the available literature to serve as baseline information for future use. (**Authors' abstract**)

Keywords: *anthracology, archaeobotany, hardwood, softwood, monocotyledon, Biology*

Philippine Journal of Systematic Biology, Volume No. 18 Issue No. 2, 1-8
2018,
(Filipiniana Analytics)
NP

0059

Identification of shiga toxin-producing *Escherichia coli* in raw milk samples from dairy cows in Surabaya, Indonesia

Hastutiek, Poedji , Yanestria, Sheila Marty , Harijani, Nenny , Effendi, Mustofa

The purpose of this research was to identify the presence of shiga toxin-producing *Escherichia coli* (STEC) in raw milk samples in Surabaya dairy cows using Multiplex Polymerase Chain Reaction (MPCR) assay. Approximately 10 ml milk samples from 75 apparently healthy Holstein Friesian cows from Surabaya, Indonesia were analyzed. Milk samples were inoculated with brilliant green bile broth (BGBB), subcultured in eosin methylene blue agar (EMBA) and were confirmed biochemically using Indol test. Multiplex PCR using primer *flic*H7 and primer *stx2* (gene coding shiga toxin) were then performed. Results showed that 26 out of 75 samples were *E. coli* in bacterial isolation and MPCR. Moreover, two samples (7.7%) were positive for *stx2* gene. The MPCR assay described in the present study can be employed to identify and screen for *E. coli* harboring *stx2* gene in raw milk from dairy cows in Indonesia. (**Author's abstract**)

Keywords: *Escherichia coli, multiplex PCR, shiga toxin, stx2 gene, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0060

In vitro pH tolerance, bile salt resistance and antimicrobial activity of *Lactobacillus plantarum* isolated from crossbred cattle

Hariyati, Irma , Pribadi, Teguh Bagus , Afikasari, Dian , Yulianto, Berny , Soepranianondo, Koesnoto , Maslachah, Lilik , Sahidu, Adriana Monica , Lokapirnasari, Widya Pa

This research was done to evaluate the characteristics and probiotic potential of lactic acid bacteria (LAB) isolated from the small intestine of ten three-year-old male Ongole crossbred cattle. Ten-centimeter samples were obtained from each small intestine, wastes were removed then samples were placed in sterile sample bottles, and immediately taken to the laboratory for bacterial isolation. The LAB isolates were subjected to low pH tolerance (pH 2 and 4), bile salt resistance, and antimicrobial activity against enteric pathogens *Staphylococcus aureus* and *Eschericia coli*. Biochemical assay indicated that isolate was gram positive, rodshaped, catalase negative, and capable of fermenting glucose, mannitol, xylose, rhamnose, sucrose, lactose, arabinose, raffinose and sorbitol. Biochemical and morphological identification suggests that the isolate was *Lactobacillus plantarum* WPL 117 (strain number of control indicator organisms was *Lactobacillus plantarum* ATCC 14917). This isolate was able to survive at low pH (2 and 4), tolerated 0.3% bile salts, and capable of inhibiting *S. aureus* and *E. coli*. Thus, this isolate can be considered a probiotic candidate for further study. (**Author's abstract**)

Keywords: *antimicrobial activity, bile salt, lactic acid bacteria, pH tolerance, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0061

Isolation and characterization of pink pigmented, facultative methylotrophic (PPFM) bacteria from leaves of neem, *Azadirachta indica* A. Juss

Lee, Anthony C. , Kumar,

A total of twenty isolates of pink-pigmented, facultative methylotrophic bacteria were obtained from the leaves of neem. All isolates exhibited pink to orange-pink pigmentation, entire margin, round colonies with a smooth glistening surface, and convex elevation. Most of the colonies were opaque with butyrous consistency. Staining revealed rod to coccobacilli shaped, Gram negative cells, containing poly-β-hydroxybutyrate granules. Biochemical analyses showed that all were catalase positive; majority of them were positive for citrate utilization, urease and oxidase activities but were negative for amylase activity. They can be cultivated on ammonium mineral salt (AMS) agar with methanol, glycerol peptone agar (GPA) and tryptic soy agar (TSA) with variations in colonial morphology. Based on the observed characteristics, the isolates obtained belong to the genus *Methylobacterium*. (**Authors' abstract**)

Keywords: *leaf bacteria, PPFM bacteria, Methylobacterium, Biology*

Philippine Journal of Systematic Biology, Volume No. 3 Issue No. 1, 1-9
2009,
(Filipiniana Analytics)
NP

0062

Isolation and characterization of purple nonsulfur bacteria (PNSB) from a rice paddy soil in Bulacan, Philippines

Pastor, Allen Brian I. , Dela Cruz, Thomas Edison E. , Jarabelo, Romel E. , Chan, Jackson S. , Montano, Gera

Purple nonsulfur bacteria (PNSB) are phenotypically diverse group of microorganisms and are known for their biological nitrogen fixation in flooded rice paddies. Our research study, then, aimed to isolate and characterize PNSB and determine their population count. Rice paddy soil samples were collected from San Jose del Monte, Bulacan, and were inoculated into completely filled culture vials pre-filled with different enrichment media, e.g. Larsen's medium, Van Niel's medium, and Acetate Yeast Extract (AYE) medium. Following incubation for 4 weeks under an incandescent bulb, only the AYE medium resulted to bright "red bloom" indicating growth of PNSB. Morphological and cultural characterization of the isolated PNSB showed pinpoint, red colonies and Gram negative, non-spore forming, thin, elongated (0.5 x 2.0 μm) rods. *In vivo* absorption spectrum using spectrophotometer showed the presence of bacteriochlorophyll a and carotenoids. The isolated PNSB utilized pyruvate, malate, glucose, lactate, citrate and soluble starch as its carbon sources, and ammonium sulfate, peptone and yeast extract as nitrogen sources. Preliminary identification identified the PNSB isolates as *Rhodopseudomonas* sp. MPN estimated low number of PNSB (2 cells per ml) in the collected rice paddy soil. (**Authors' abstract**)

Keywords: *purple nonsulfur bacteria, Rhodopseudomonas sp., enrichment culture, Most Probable Number (MPN), bacterial identification, rice paddy soil, Biology*

Philippine Journal of Systematic Biology, Volume No. 3 Issue No. 1, 1-11
2009,
(Filipiniana Analytics)
NP

0063

Isolation and identification of lactic acid bacteria from the digestive tract of Kampung chicken (*Gallus gallus domesticus*)

Lokapirnasari, Widya Paramita , Yulianto,

The aim of this study was to isolate and identify lactic acid bacteria (LAB) derived from the digestive tract of Kampung chicken or Indonesian native chicken (*Gallus gallus domesticus*). This study used ten 20-week old male native chicken with an average body weight of 1 kg, slaughtered and processed in accordance with Halal methods. Ten-centimeter sections of the esophagus, crop, proventriculus and ventriculus were obtained, stored in sterile bottles and placed in an icebox. LAB were isolated from the chickens' gastrointestinal tract. LAB identification was done through microscopic morphology, gram staining, catalase test and biochemical tests. Isolates were gram positive, negative on catalase test, non-motile and rodshaped. Isolates YL 117, YL 217, and YL 317 can ferment glucose, sucrose and lactose; isolate YL 117 can ferment xylose, sorbitol, arabinose and raffinose; and isolate YL 317 can ferment malonate, arabinose and raffinose. This study suggests the presence of three LAB isolates from the gastrointestinal tract of *Gallus gallus domesticus: Lactobacillus plantarum, L. acidophilus* and *L. casei*. (**Author's abstract**)

Keywords: *Gallus gallus domesticus, Kampung chicken, lactic acid bacteria, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0064

Leaf architecture of selected species of Malvaceae *sensu* APG and its taxonomic significance

Buot, Jr., Inocencio E., Laraño, Allen Anth

The leaf architecture of Malvaceae *sensu* APG was examined and characterized to determine if it can be used in classification of the family and the identification of its species. Forty species were observed, measured and described. A dichotomous key was constructed based solely on leaf architecture characters.

The dichotomous key indicated that leaf architecture characters can be used in distinguishing some species of Malvaceae *sensu* APG. Some basic leaf architectural characters can also be used in describing certain clades within the family.

It is recommended that specimens are collected personally instead on relying on available specimens in the herbarium. Preparation of leaf skeletons through clearing method can also be done in future studies. Increase of sample size is also recommended. (**Authors' abstract**)

Keywords: *leaf architecture, APG, classification, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-34
2010,
(Filipiniana Analytics)
NP

0065

Methylobacterium zatmanii, a pink pigmented facultative methylotrophic (PPFM) bacterium isolated from the human oral cavity

Carvajal, Thaddeus M., Lee, Anthony C. , Tan, Ronabelle L

A pink pigmented facultative methylotrophic (PPFM) bacterial isolate (P1UM) was obtained from the oral cavity of a male patient diagnosed with periodontitis and dental caries. The bacterial isolate exhibited glistening, smooth, circular, pink colored colonies in minimal medium supplemented with 0.5% methanol. Microscopic morphological examination showed that the isolate is a Gram-negative rod-shaped bacterium with polyß-hydroxybutyrate (PHB) granules. Phylogenetic analysis using its16S rDNA sequence revealed that the isolate is closely related to *Methylobacterium zatmanii*. (**Authors' abstract**)

Keywords: *Methylobacterium zatmanii, polyß-hydroxybutyrate (PHB) granules, pink pigmented facultative methylotrophic (PPFM) bacterium, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-9
2011,
(Filipiniana Analytics)
NP

0066

Microsatellite-based genetic diversity and relationship analyses of three genetic groups of domesticated mallard ducks (*Anas platyrhynchos domesticus* L.)

Capitan, Severino S. , Mendioro, Merlyn S., Vega, Renato SA. , Lambio, Angel L., Agatep, Robert C., Yebron, Medino Gedeun N

The genetic diversity and relationship among the Philippine Mallard, Khaki Campbell and Pekin ducks were analyzed by employing 28 microsatellite primers which were amplified from the genome of 30 animals representing each genetic group. Twenty-one of the 28 microsatellite primers employed are polymorphic. The average observed and effective number of allele ranges from 2.238 to 2.714 and 1.565 to 1.934, respectively, while the average observed and expected heterozygosity ranges from 0.297 to 0.432 and 0.308 to 0.422, respectively. The within population inbreeding estimate among the three genetic groups of mallard ducks is -0.0020 while the total inbreeding estimate is 0.1292 suggesting that random genetic drift could be happening in the duck populations considered. On the other hand, the measurement of population differentiation has a value of 0.1309. Relationship analyses reveal that the Philippine Mallard is genetically closer to the Khaki Campbell (0.0944) than with the Pekin (0.1523). The genetic distance between the Khaki Campbell and the Pekin is 0.1386. (**Authors' abstract**)

Keywords: *genetic diversity, genetic relationship, microsatellite, Philippine mallard duck, Biology*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-6
2016,
(Filipiniana Analytics)
NP

0067

A modified sieve dish for easier preparation of microscope slide mounts for taxonomic studies of armored scale insects (Hemiptera:Diaspididae)

Lit, Jr., Ireneo L. , Barbecho, Norma

A modified dish that serves as a sieve for specimens that undergo series of chemical treatments during the preparation of specimens for microscope slide mounts is described and illustrated. The dish serves as a filter for draining fluids. It is assembled using simple materials, namely: the cap of a 15 ml centrifuge tube with the closed end perforated, a glass cloning cylinder, and a piece of fine-mesh fabric (i.e., synthetic satin ribbon) that is slightly larger than the diameter of the cloning cylinder. The use of the modified dish facilitates slide-mounting of more specimens, including crawlers or their exuviae, per batch within a shorter period of time. (**Authors' abstract**)

Keywords: *armored scales, Coccoidea, Coccomorpha, Diaspididae, microtechnique, scale insect taxonomy, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-6
2015,
(Filipiniana Analytics)
NP

0068

Molecular confirmation on the phylogenetic position of the genus *Clemensiella* Schltr. in Marsdenieae (Apocynaceae-Asclepiadoideae)

Lemana, Bismark Oliver C. , Alejandro, Grecebio Jonathan D. , Buera, Arleen L., Laurente, Ophelia S.

The Philippine Marsdenieae (Apocynaceae-Asclepiadoideae) comprises a total of seven genera including the imperfectly known *Clemensiella* Schltr. Due to its unique morphology, the position of the small genus in the tribe Marsdenieae of Asclepiadoideae was previously in question. In this first molecular study of *Clemensiella*, the internal transcribed spacer (ITS, nrDNA) region of three isolates were newly generated and analyzed together with previous published sequences. The present aims to assess the phylogenetic positon, monophyly and closely-related genera of *Clemensiella*. The three *Clemensiella* isolates yielded a total of 630 to 642 base pairs (bp) and the average GC content ranged from 63.21% to 63.86%. Based on the strict consensus tree, the monophyly of *Clemensiella* is highly supported with BS=100% and nested within the tribe Marsdenieae with BS=61%. This study confirms the phylogenetic position of *Clemensiella* in Marsdenieae and its close relation to *Dischidia* and *Hoya*. Although the three Marsdenieae are distinct in their seed structures, they share common features in habit, inflorescence and corolla aestivation. (**Authors' abstract**)

Keywords: *Clemensiella, ITS, Marsdenieae, Apocynaceae, Asclepiadoideae, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-12
2010,
(Filipiniana Analytics)
NP

0069

Morphological and molecular identification of a novel species of *Uvaria* (Annonaceae) with potential medicinal properties

Alejandro, G.J.D. , Lemana, B.O.C. , Macabeo, A.P.G. , Salas, S.R. , Padilla, D.K.M. , Lim, V.I.M. , Exconde, B.S. , Cabuang,

The imperfectly known genus *Uvaria* (Annonaceae) comprises ca. 20 species of shrubs to small trees in the Philippines. During recent fieldwork at Valderrama, Antique, a suspected new species of *Uvaria* was collected. Based on morphology, this *Uvaria* species can be distinguished from other Philippine congeners by its large obovate-lanceolate leaves and pubescent carpels. Additional molecular characters inferred from two plastid DNA regions (*mat*K and *trn*L-F) were sequenced from this *Uvaria* species and *U. grandiflora* to gain more certitude on the identity of this *Uvaria* species. Phylogenetic analysis using Maximum Parsimony was carried out including 48 foreign *Uvaria* species and other Annonaceae genera derived from GenBank. Results showed that the divergent *Uvaria* species and *U. grandiflora* were nested among the SE Asian *Uvaria* subclade, with a strong support (BS=91%). Therefore, we propose a new species, *Uvaria valderramensis* sp. nov. The first phytochemical assays on the leaf extracts of *U. valderramensis* showed the presence of triterpenes, sterols, tannins, flavonoids, phenols and alkaloids. (**Authors' abstract**)

Keywords: *Uvaria, Annonaceae, matK, trnL-F, phytochemical assays, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-13
2012,
(Filipiniana Analytics)
NP

0070

Morphotaxonomy and diversity of terrestrial microalgae and cyanobacteria in biological crusts of soil from paddy fields of Los Baños, Laguna (Philippines)

Monsalud, Rosario G. , Arguelles, Eldri

Floristic and taxonomic study on the basis of morphological and cytological characteristics of terrestrial algae found in biological crusts of soil from paddy fields of Los Baños, Laguna showed the occurrence of 14 taxa (3 unicellular, 2 colonial, 7 non-heterocytous filamentous and 2 heterocytous filamentous) belonging to the class Cyanophyceae, Chlorophyceae, Klebsormidiophyceae and Trebouxiophyceae. The collection reported in this study represents 9 orders, 10 families, 13 genera and 14 species based on recent combined taxonomical approach. Of these taxa, the occurrence of a rare green alga *Chlorolobion braunii* (Nägeli) Komárek is reported for the first time in the Philippines. Three species are also reported here based on current taxonomic nomenclature and these are *Planktothrix agardhii* (Gomont) Anagnostidis & Komárek, *Kamptonema chlorinum* (Kützing ex Gomont) Strunecký, Komárek & J.Smarda and *Tetradesmus dimorphus* (Turpin) M.J. Wynne. These taxonomic records are considered important information in enriching the knowledge about the diversity and habitat distribution of cyanobacteria and microalgae in the Philippines. (**Authors' abstract**)

Keywords: *algae, diversity, new record, taxonomy, rice fields, soil habitat, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-12
2017,
(Filipiniana Analytics)
NP

0071

The Negros Ark: a hypothesis the systematics and biogeography of Rhopalocera (Lepidoptera) in the Philippines

Badon, Jade As

Current distributional data on Philippine butterflies suggests that colonization and exchange of species between Luzon and Mindanao are hypothesized to have occurred during the Miocene Epoch (23-5.3 million years ago). Species from the families Pieridae, Hesperiidae, and Zygaenidae were set as an example to explain some disjunction of distribution of some species in the archipelago. The hypothesis will definitely become an interest in the field of biogeographical and phylogenetic studies in the country. (**Author's abstract**)

Keywords: *butterfly, colonization, biogeography, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 2, 1-10
2018,
(Filipiniana Analytics)
NP

0072

Nematode infestation in the Indonesian shortfin eel (*Anguilla bicolor*) (Actinopterygii: Anguilliformes: Anguillidae) harvested from Aceh Waters, Indonesia

Sidqi, Mufakkir , Affan, Muzailin , Dewiyanti, Irma , Batubara, Agung Setia , Muchlisin, Zainal A., Lubis, Bahtia

The study was conducted to determine the nature of infestation of nematodes on Indonesian shortfin eel (*Anguilla bicolor*) harvested from Aceh Province waters, Indonesia. The sampling was conducted in Aceh Singkil, Aceh Jaya and Aceh Besar Districts from August to September 2016 and January 2017. Twenty-two samples from Aceh Singkil, one sample from Aceh Jaya, and 23 samples from Aceh Besar were analyzed for gastrointestinal worms. Two species of worms were found in the gastrointestinal tract of fish samples, namely, *Anisakis* sp. and *Procamallanus* sp. *Anisakis* sp. was found in the stomach of the eel sample from Aceh Singkil, while *Procamallanus* sp. was found in the intestine of the eel samples from Aceh Jaya. No fish samples from Aceh Besar were infested with nematode. (**Author's abstract**)

Keywords: *Anisakis, Indonesia, Procamallanus, shortfin eel, Biology*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018,
(Filipiniana Analytics)
NP

0073

Nepenthes alfredoi (Caryophyllales, Nepenthaceae), A New Species of Pitcher Plant from Mindanao, Philippines

Lagunday, Noel E. , Colong, Ruel D. , Coritico, Fulgent P., Amoroso, Vic

The Philippines having the highest rates of endemism of this family is considered a center of diversity of the genus *Nepenthes* along with Sumatra and Borneo. Recent explorations in Mindanao and Luzon has raised the Philippine number of *Nepenthes* species to 52. This study reports the discovery of a new *Nepenthes* species from Mt. Hamiguitan. It is distinguished in having ground and upper pitchers with fringed wings on the tendril. The new species described herein was only observed at Gov. Generoso and has not been recorded elsewhere in the Philippines. Known only from the type locality and it faces severe threat from habitat destruction. (**Authors' abstract**)

Keywords: *Carnivorous pitcher plants, Nepenthes, Mt. Haminguitan Wildlfe, Sanctuary, Mindanao, Philippines, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-6
(Filipiniana Analytics)
NP

0074

A new cave-dwelling mygalomorph spider of the genus *Phlogiellus* Pocock, 1897 (Araneae: Theraphosidae: Selenocosmiinae) from Burdeos, Polillo Island, Quezon Province, Philippines

Barrion, Alberto T. , Rasalan, Joseph B. , Barrion-Dupo, Aimee L

A new tarantula species of the genus *Phlogiellus* Pocock, 1897, *P. kwebaburdeos* n. sp. is described and illustrated based on a series of specimens collected inside the Puting Bato Cave 3-4 in Burdeos, Polilio Island, Quezon Province, Philippines. *P. kwebaburdeos* Barrion-Dupo, Barrion and Rasalan n. sp., a cave-dwelling mygalomorph spider represents the fifth and sixteenth species of *Phlogiellus* reported in the Philippines and in Southand Southeast Asia, respectively. (**Authors' abstract**)

Keywords: *Araneae, cave-dwelling mygalomorph, Polillo Island, tarantula, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-15
2014,
(Filipiniana Analytics)
NP

0075

A new record of *Pyrostria* (Vanguerieae-Rubiaceae) from the Philippines inferred from molecular and morphological data

Arriola, Axel H. , Arenas, Elizabeth H. , Cremen, Ma. Chiela M., Alejandro, Grecebio Jonat

Recent studies on *Canthium* revealed that the genus is polyphyletic. Subsequently, *Canthium sensu stricto* (s.s.) was re-delimited to species having paired supra-axillary spines, which led to the reinstatement of various genera in the Vanguerieae such as *Keetia, Psydrax* and *Pyrostria*. This raised questions on the generic affiliations of Philippine *Canthium* species as most of its members lacked spines. In an effort to revise the Philippine *Canthium*, the endemic spineless *Canthium subsessilifolium* was collected to ascertain its generic affiliation within the tribe using plastid (*trnL-F* region) and nuclear (ITS region) markers. The majority-rule consensus tree of combined data sets showed a well-supported clade of the whole Vanguerieae (PP=1.00). Interestingly, *C. subsessilifolium* was nested within the robustly supported *Pyrostria* clade (PP=1.00). Morphological similarities of *C. subsessilifolium* with *Pyrostria* further supported our molecular results. Therefore, a new combination is here provided: *Pyrostria subsessilifolia* (Merr.) Arriola & Alejandro. This study establishes for the first time the existence of *Pyrostria* in the Philippines. (**Authors' abstract**)

Keywords: *Canthium, ITS, Pyrostria, Rubiaceae, trnL-F, Vanguerieae, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-12
2013,
(Filipiniana Analytics)
NP

0076

A new species of *Diplycosia*: D. benitotanii Argent (Ericaceae) from Mt. Halcon in the Philippines is described in honour of the late Dr. Benito Tan

Argent,

A new species *Diplycosia benitotanii* (Ericaceae) is described from Mt. Halcon, Mindoro, Philippines in honour of the late Dr. Benito C. Tan. Comments are made on the morphological similarities with other Philippine species in this genus. (**Author's abstract**)

Keywords: *New species, Diplycosia, Ericaceae, Mt. Halcon, Mindoro, Philippines, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-4
2018,
(Filipiniana Analytics)
NP

0077

A new species of mayfly (Ephemeroptera: Trichorythidae) from Mindanao Island, Philippines and association of life stages using DNA barcode

Lin, Chung-Ping , Villanueva, Reagan Joseph T. , Batucan Jr., Leocris S., Nuñeza, Olga M.

A new mayfly species, *Sparsorythus buntawensis* sp. nov. (Tricorythidae) from Layawan River of Mt. Malindang in Mindanao Island, the Philippines is described based on nymphal and adult morphologies. *Sparsorythus buntawensis* sp. nov. differ from all known members of the genus primarily in the deeper cleft of the hypopharynx and wider distance between compound eyes. Conspecific specimens of various life stages and sexes of this new mayfly were associated using DNA barcode. (**Authors' abstract**)

Keywords: *Mt. Malindang, Macroinvertebrate, Sparsorythus, Freshwater, Layawan River, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-8
2016,
(Filipiniana Analytics)
NP

0078

Notes on *Distichophyllum armatum* (Daltoniaceae, Bryophyta) in Thailand

Chantanaorrapint, Sahut, Juengprayoon, Wanwisa, Suwanmala, Or

Distichophyllum armatum (E.B. Bartram) B.C. Ho & L. Pokorny, is newly discovered in lower montane forest in southern Thailand. A description and line drawing are provided, and its diagnostic characters and geographical distribution are briefly discussed. (**Authors' abstract**)

Keywords: *bryophyte, diversity, moss, Thai-Malay Peninsula, taxonomy, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-4
2018,
(Filipiniana Analytics)
NP

0079

Notes on the natural history of some lizards in the remaining forest patches of Cavite, Luzon Island, Philippines

Lagat, Rona

Twenty-nine species of lizards, belonging to four families, were recorded in the remaining forest patches of Cavite Province, Luzon Island, Philippines. The family Agamidae is represented by 4 species, Gekkonidae by 9 species, Scincidae by 14 species, and Varanidae by 2 species. Fifty-five percent of the species in the area are endemic to the Philippines, indicating the region of Luzon is dominated by forest-obligate species. Fifteen species are diurnal and 13 species are nocturnal including *Brachymeles bonitae* Duméril & Bibron, 1839, *Brachymeles boulengeri boulengeri* Taylor, 1922, and *Brachymeles kadwa* Siler & Brown, 2010. Three major habitats (forest, stream, and human habitation) were occupied by the observed species, with some species appearing to be habitat generalists. Observation accounts include notes on lizard behavior during social interaction, predator avoidance and capture. (**Author's abstract**)

Keywords: *Cavite, Endemicity, Lizard natural history, Species richness, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-23
2011,
(Filipiniana Analytics)
NP

0080

Occurrence of cellular slime molds (Dictyostelids) in Subic Bay Natural Forest Reserve, Zambales, Philippines

Yulo, Paul Richard J. , Ching, Maricar , Yap, Jennifer , Dagamac, Nikki Heherson A. , Torres, Jeremy Martin O., Dela Cruz, Thomas Edison E., Ramirez, Carly Simon P. , Santiago, Krystle Angelique A.

Cellular slime molds or dictyostelids are unicellular, amoeboid organisms that feed on bacteria. They are commonly found in forest soils where they play an important role in maintaining balance among soil microbial flora. However, in the Philippines, in spite of their important ecological roles, very few studies have looked at these organisms. Thus, this present investigation was designed to look at the occurrence of cellular slime molds in two forest trails within Subic Bay Natural Forest Reserve, Zambales, Philippines. Forest and mossy soils were collected from these areas and used for the isolation of dictyostelids. Our results showed clonal population counts of 821 to 3,150 clones/g soil. Identification of the isolated dictyostelids showed two species: *Dictyostelium laterosorum* and *Polysphondylium pallidum*. This is the first report of cellular slime molds in Subic Bay Forest Reserve, Zambales. (**Authors' abstract**)

Keywords: *clonal population count, Dictyostelium, diversity, forest soil, Polysphondylium, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-6
2011,
(Filipiniana Analytics)
NP

0081

Octoblepharum benitotanii (Octoblepharaceae) a new species from the Old World Tropics

Chantanaorrapint, Sahut , Allen, Noris S

Octoblepharum benitotanii Salazar Allen & Chantanaorr., a new species of *Octoblepharum* from the Old World tropics, is described and illustrated based on specimens from Thailand and Timor. Taxonomic affinities and information on habitat and distribution are discussed. This is the fourth species of *Octoblepharum* described for Asia besides *O. albidum, O. arthrocormoides*, and *O. pocsii* and, not counting *O. depressum*, whose type specimen has not been found and thus its status is doubtful. *Octoblepharum benitotanii* is distinguished by its narrow, elongate, tumid, long acuminate leaves and peristome with eight foveolate-reticulate teeth. (**Authors' abstract**)

Keywords: *Bryophyta, Octoblepharum albidum, species-complex, Southeast Asia, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-9
2018,
(Filipiniana Analytics)
NP

0082

Pee value: storing urine for subsequent DNA analysis

De Ungria, Maria Corazon A., Calacal, Gayvelline C. , Honrado, Maria Lourdes D. , Soliven, Nelvie Fatima J

Drug abuse is a prevalent problem in the Philippines. With the increased drive to apprehend individuals who partake in the use of illegal drugs, there is a need to re-examine the handling and storage procedures for urine samples, which may be tested to prove or disprove allegations of drug use. With the availability of forensic DNA technology as the most powerful tool for human identification, the inclusion of DNA testing in decision trees used by law enforcers and government laboratories during drug investigations is expected to improve the process of determining actual drug users while promptly addressing allegations of misconduct. Because DNA testing is a relatively novel procedure previously not considered in drug investigations in the Philippines, there is a need to test whether storage procedures for urine that showed positive results allow for subsequent DNA testing. Samples that test positive for drugs are routinely stored at -20°C for up to one year prior to disposal. In this study, urine DNA samples were extracted from 20 male individuals. The samples were subsequently stored at room temperature, 4°C, and -20°C for 2 months and 9 months. This was followed by DNA profiling using the PowerPlex® 21 System. Overall, DNA extracted from urine samples stored at cool temperatures (4°C and -20°C) were found to provide more consistent DNA profile results compared to samples that were stored at room temperature. We propose here a decision tree for drug testing from start to end that should serve as a decision support tool for Philippine government agencies engaged in drug investigations. (**Author's abstract**)

Keywords: *DNA prof iling, short tandem repeats, storage duration, storage temperature, urine DNA extraction, Biology*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 31 Issue No. 1, 1-15
2019/06,
(Filipiniana Analytics)
NP

0083

Phenetic analysis of eighteen species of Philippine *Medinilla* Gaudich. (Melastomataceae) based on morphological characteristics and phenolic profile

Cardenas, Lourdes B. , Hadsall, Annalee S. , Rodriguez, Evelyn B. , Gruezo, William Sm. , Rayos Jr., Anto

The genus *Medinilla* Gaudich., having about eighty Philippine species, is widely distributed in the archipelago. This study used morphological and chemical data to explain taxonomic relationship among eighteen species belonging to the genus. For chemical data, two-dimensional paper chromatography was employed to survey different phenolic compounds present in each species considered in this study. A total of seventy-seven different phenolic compounds were found to be present among the eighteen species of *Medinilla*. A phenogram was constructed by PAST version 1.42 (with Ward's method as algorithm) using only morphological characters, another using chemical characters obtained by paper chromatography, and another using both morphological and chemical characters. In the first phenogram, two distinct clusters were formed while in the second phenogram, three distinct clusters were formed with *M. clementis* and *M. dolichophylla* separating from the rest of the species studied. In third phenogram, three major clusters were observed. In all three phenograms generated, *M. ternifolia* and *M. venosa* consistently clustered closely together. The same case was observed with *M. ramiflora* and *M. myrtiformis*. The phenograms reflect taxonomic affinities among the species used in this study. For further studies, inclusion of more species and molecular sequencing of samples are recommended. (**Authors' abstract**)

Keywords: *Medinilla, Paper Chromatography, Phenetics, Phenolic Compounds, Cluster Analysis, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-11
2016,
(Filipiniana Analytics)
NP

0084

Phenotypic characterization of pink pigmented facultative methylotrophic bacteria from soil exposed to vehicular soot

Lee, Anthony C. , Jang, Seun

Twenty-three (23) pink pigmented facultative methylotrophic bacterial isolates were obtained from soil collected along the island pavement of Taft Avenue fronting De La Salle University-Manila campus. They were described in terms of morphological and biochemical properties, as well as, responses to selected antimicrobials. All isolates were gram-negative rod shaped cells with sudanophilic cysts. Colonial morphologies of the isolates were described after growing them in both minimal and enriched media. All bacterial isolates showed circular, entire, opaque, raised to convex colonies regardless of the media used. Differences however, in terms of intensity of pink pigmentation and consistency were observed when the isolates were grown in different media. In terms of biochemical characteristics, all isolates exhibited urease, catalase, amylase and oxidase activities. Variations in terms of their ability to oxidize different sugars and citrate as carbon and energy sources were observed among the isolates. All isolates yielded negative to blood hemolysis test, indole production methyl red and Voges Proskauer tests. The temperature for the optimum growth of the bacterial isolates was at 30°C. Some strains however, were observed to grow at 37°C and 4°C. All isolates were susceptible to imipinem, β-lactams and β-lactam-β-lacatamase inhibitor formulations, tetracycline but resistant to meropenem. Based on the phenotypic characteristics observed, the isolates are assigned to the genus *Methylobacterium*. (**Authors' abstract**)

Keywords: *PPFM bacteria, Methylobacterium, soil bacteria, air pollution, Biology*

Philippine Journal of Systematic Biology, Volume No. 2 Issue No. 1, 1-4
2008,
(Filipiniana Analytics)

NP

0085

Phenotypic trend and estimates of genetic parameters for growth traits of Philippine swamp buffaloes in a nucleus herd, Cagayan Province, Philippines

Flores Es

The Philippine Carabao Center (PCC) at Piat, Cagayan, Philippines established a breeding program to improve growth rates of Philippine swamp buffaloes. A total of 1,322 growth records from 220 animals taken at birth, 6, 9, 12 and 18 mos from 2002 to 2014 were analyzed in multi-trait genetic animal models that included additive direct effects only or both additive direct and maternal effects using ASReml 3.0 program to estimate variance components. Growth rates improved across the years but the response was most evident at 12 and 18 months as breeder bulls were selected based on weight at these two age categories. Improvement at weaning and pre-weaning weights (<12 mos.) did not follow the same trend as weights at 12 and 18 mos. This may be due to the fact that while direct heritability was moderate for weight at 18 mos. At 0.19, it was low for pre-weaning and weaning weights. Maternal heritability was higher for these traits at 0.21 for weight at 9 mos thus, selection for replacement breeders should include weights at 9 and 6 mos. especially for the heifers. When the data set has increased, animals should be ranked and selected based on direct and maternal breeding values for growth traits. (**Author's abstract**)

Keywords: *Biology*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-6
2017,
(Filipiniana Analytics)
NP

0086

Philippine Porphyra species: Their economic potentials

Cordero, Jr., Pacie

A description of the Philippine species of Porphyra and their economic potential is presented. (**Author's abstract**)

Keywords: *Porphyra, economic algae, Eucheuma, Kappaphycus, Biology*

Philippine Journal of Systematic Biology, Volume No. 2 Issue No. 1, 1-5
2008,
(Filipiniana Analytics)
NP

0087

Physico-chemical analysis of fish pond water in Candaba, Pampanga, Philippines

Sandoval, Khristine L., Cada, Kristel Joy S., Labana, Ryan V., Dungca, Julieta Z.

The study of physico-chemical parameters in fish ponds in Candaba, Pampanga was conducted to determine the quality of water for fish pond from July to August, 2014. Water samples were tested in-situ using probe meter: Thermo Orion Model A920. The results showed variation in the observed parameters at the different sampling stations and two sampling dates. Temperature ranged from 29 ± 16.74 to 35.23 ± 1.01ËšC. pH values were 8.70 ± 5.02 to 9.57 ± 1.11. Dissolved oxygen values were 5.20 ± 3 to 7.57 ± 0.77mg/L. Electrical conductivity ranged from 220 ± 0.01 to 489 ±0.57 µS/cm. The values for temperature and DO were higher than accepted values for fish culture while those of other parameters favored for good fish production. The observations in this study suggest that fish production in some fish ponds of Candaba, Pampanga could be practiced without adverse effects posed by the quality of water. (**Authors' abstract**)

Keywords: *Physico-chemical parameters, Fish pond, Freshwater, Desirable limit, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-4
2017,
(Filipiniana Analytics)
NP

0088

Pink pigmented facultative methylotrophic (PPFM) bacteria isolated from the hair scalp and nasal cavity

Ho, Howell T., Lee, Anthony C. , Carvajal, Thaddeus M. , Castro, Christian Zachariah R. , Uy, Jamela, Uy, Miko

A total of 10 PPFM bacteria isolates from the hair scalp and nasal cavity of subject volunteers was described in terms of morphological and biochemical characteristics. Isolates generate pink, small-sized, round, raised, entire and opaque colonies when cultivated in minimal salt medium with 0.5% methanol. Microscopic morphology revealed that the isolates were Gram-negative bacilli. All isolates yielded positive in urease, catalase and oxidase tests. Phenotypic characteristics conform to the features of genus *Methylobacterium*. Phylogenetic analysis using its 16S rDNA sequence revealed that three isolates are identified as *Methylobacterium rhodesianum* while seven are identified to be only *Methylobacterium sp.* Some PPFM bacteria isolates obtained in the study may be potential novel sequences. The presence of these bacteria in the human scalp and nasal cavity may imply that they are part of the resident or transient microbiota. More samples are needed to ascertain their association with the human scalp and nasal cavity. (**Authors' abstract**)

Keywords: *Methylobacterium, PPFM, nasal cavity, human hair scalp, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-9
2013,
(Filipiniana Analytics)
N P

0089

Plasma glucose level and insulin-like growth factor-I (IGF-I) mRNA expression in chronically stressed Nile tilapia (*Oreochromis Niloticus* L.) reared under sub-optimal stocking densities

Vera Cruz, Emmanuel M., Guzman, L

The study evaluated the growth and stress response of Nile tilapia (*Oreochromis niloticus* L.) to suboptimal rearing densities. A stock of juvenile all male tilapia weighing 65 grams was used in the study. The experimental fish were conditioned for one week at stocking density of 3 m^{-3} in 300 m^2 net enclosure; then reared in 1m x 1m cages installed in pond for three months at stocking densities of 75 m^{-3} and 150 m^{-3}. The results revealed that 75 m^{-3} was significantly higher ($P<0.05$) than 150 m^{-3} with respect to the specific growth rate (SGR). Also, blood plasma glucose (GLU) was significantly higher ($P<0.05$) in the stocking density of 150 m^{-3} than that of 75 m^{-3}. On the contrary, Insulin-like growth factor (IGF-I) mRNA expression was comparable between the two density classes. With respect to their temporal trend, the growth and GLU increased consistently with time while IGF-I increased only from month 1 to month 2; and partly declined on the third month. A significantly positive relationship also exists between the two variables in which GLU increased logarithmically with IGF-I. Their functional relationship is written as $Y=27.21\ln(x) + 66.134$. In like manner, a positive linear relationship; that is, $Y= 0.0169(x) + 0.54490$, was also observed between SGR and IGF-I. Conclusively, the stocking density of 150 m^{-3} has been shown to be more chronically stressful than 75 m^{-3} as evident by the relatively lower SGR and higher GLU observed in the former. Although the expression of IGF-I mRNA was not directly influenced by the stocking density, its declining expression with increasing GLU at the end of the culture period is attributed more on GH mediation and its positive linear relationship with SGR proved its utility as indicator of growth in this species. The result demonstrated in the present study also proved the potential utility of GLU as stress biomarker and that its mechanism of secretion is directly influenced by the expression of the IGF-I mRNA via paracrine route and indirectly via negative feedback mechanisms of GH/IGF-I axis. (**Author's abstract**)

Keywords: *Glucose, IGF-I mRNA, Suboptimal stocking density, Specific growth rate, Stress, Biology*

Cabagan Journal of Research, Volume No. 21 Issue No. 1, 1-14
2012/06,
(Filipiniana Analytics)
NP

0090

A preliminary assessment of herpetofaunal diversity in the Taal Volcano Protected Landscape (TVPL) Luzon Island, Philippines

Diesmos, Mae Lowe L. , Escobar, Maria Isabella J. , Yabut, Angelica May O. , Marasigan, Marie Joie D. , Endozo, Maria Crisse

The Taal Volcano Protected Landscape (TVPL) encompasses a prehistoric volcano caldera harboring numerous endemic species. Although regarded as a unique area with a diverse ecological community, biodiversity research in TVPL is still found to be wanting. In light of the numerous undocumented terrestrial faunal species in TVPL, the present study was conducted to provide baseline information and increase research interests on the herpetofaunal diversity. Twelve sites within the municipalities of Tanauan, Mataas na kahoy, and Balete were surveyed between May and November 2015. A combination of transect and opportunistic sampling techniques were utilized, with morphometric data and sexual maturity recorded for each specimen collected. This preliminary survey documented 24 newly documented species of amphibians and reptiles occurring within TVPL. A total 10 frog species (Bufonidae, Ceratobatrachidae, Microhylidae, Dicroglossidae, Ranidae, and Rhacophoridae) and 14 reptile species (Agamidae, Gekkonidae, Scincidae, Varanidae, Acrochordidae, Colubridae, Elapidae, and Trionychidae) were documented. Of the 14 reptiles recorded, three are endemic species and widespread throughout the Philippines: *Gekko mindorensis*, *Hydrosaurus pustulatus*, and *Draco spilopterus*. Also recorded were the Philippine endemic frogs *Kaloula picta* and *Limnonectes woodworthi* along with the Luzon endemic *Platymantis mimulus* and *Varanus marmoratus*. The species-effort curve of amphibians showed a distinct plateau whereas the species-effort curve of reptiles showed an increasing trend, suggesting that additional sampling efforts will most likely detect several more undocumented species. (**Authors' abstract**)

Keywords: *Amphibians, Biodiversity, Reptiles, Batangas, Lake Taal, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-6
2017,
(Filipiniana Analytics)
NP

0091

Preliminary checklist of marine gastropods and bivalves in the Kalayaan Island Group Palawan, Western Philippines

Dolorosa, Roger G. , Balisco, Rodulf Anthony T. , Baguinbin, Darna M. , Gonzalez, Jeric B. , Hombre, Shema

The Kalayaan Island Group (KIG) in the West Philippine Sea is a threatened rich fishing ground endowed with diverse flora and fauna. However, studies about gastropods and bivalves in KIG are lacking. This preliminary listing of shelled gastropods and bivalves of KIG is based on collections in 2014 and 2016. Seventy eight species of shelled gastropod and bivalves belonging to 28 families were documented. The list includes some threatened species of giant clams and large reef gastropods. Extensive sampling especially in deep areas is expected to enrich the current list. Species inventory of other taxa is also suggested to understand the extent of biological diversity in this wide eco-region. (**Authors' abstract**)

Keywords: *Bivalves, Gastropods, Kalayaan Island Group, Palawan, West Philippine Sea, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-10
2016,
(Filipiniana Analytics)
NP

0092

Preliminary report on the anurans of Mts. Palay-Palay Mataas-na-Gulod protected landscape, Luzon Island, Philippines

Causaren, Rubie M

I provide information on the anurans of Mts. Palay-Palay Mataas-na- Gulod Protected Landscape (MPPMNGPL) and its immediate vicinities based on field surveys conducted on accessible localities in 1998, 2006, and 2009. A total of 14 species representing four anuran families in 10 genera were recorded from the area. Baseline data on species richness, habitat and altitudinal distribution, and natural history of anurans are presented. The anuran assemblage exhibited high levels of endemicity (57%). Anurans were recorded in elevations from as low as 40 masl to more than 600 masl with the non-endemic species generally distributed in the lowlands while most of the endemics were restricted to higher elevations. Majority of the non-endemic species were usually associated with human-modified habitats while most of the endemic species were restricted to forest habitats. Eight microhabitat types were identified and a large proportion of anurans occurred in bodies of water and forest floor litter. (**Author's abstract**)

Keywords: *Mts. Palay-Palay Mataas-na-Gulod Protected Landscape, Cavite province, Luzon Island, amphibian fauna, herpetofauna, distribution patterns, species richness, anuran assemblage, Biology*

Philippine Journal of Systematic Biology, Volume No. 3 Issue No. 1, 1-14
2009,
(Filipiniana Analytics)
NP

0093

Pteridophyte and gymnosperm diversity in Musuan, Bukidnon

Amoroso, Victor

Inventory of pteridophytes and gymnosperms in Musuan, Bukidnon revealed 102 species, 52 genera and 24 families of pteridophyes and 8 species and 6 genera of gymnosperms. Of these, 10 species of pteridophytes are endemic, 8 species rare, 8 are depleted, 4 species are new records in terms of locality and 59 are economically important species. Likewise, the gymnosperms have 8 economically important species, 2 rare, and 7 introduced species. Three species of pteridophytes are locally threatened in the wild. (**Author's abstract**)

Keywords: *inventory, species richness, non-flowering, vascular plants, Mindanao, Biology*

Philippine Journal of Systematic Biology, Volume No. 1 Issue No. 1, 1-14
2007,
(Filipiniana Analytics)
NP

0094

The pteridophytes of Adams, Northern Luzon, Philippines and their ecosystem services

Austria, Celia M. , Magtoto, Lie

The Philippines has approximately 1,100 species of lycophytes and ferns, and this represents approximately 9% of the worldwide fern flora. Botanical explorations and local documentations continue to expand the list. Local documentations increase our knowledge on species distribution and conservation status, which are essential in biodiversity conservation. This paper reports on a survey of the pteridophytes of Adams, Ilocos Norte, one of the remaining floristic sites in Luzon Island, Philippines. A series of floristic surveys conducted at selected sites in Adams recorded and vouchered 47 species, 34 genera and 21 families of pteridophytes. Among all these pteridophytes, six are threatened Philippine plant species. These are *Platycerium coronarium, Ceratopteris thalictroides, Tectaria psomiocarpa, Psilotum nudum, Blechnum egregium,* and *Angiopteris evecta*. This study contributes to the baseline data on Philippine pteridophytes especially on their distribution, and can serve as reference for biodiversity conservation and restoration efforts as ferns may help in the stabilization of degraded lands and facilitation in plant communities. (**Authors' abstract**)

Keywords: *Pteridology, Ferns, Biodiversity and conservation, Checklist, Ilocos Norte, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-9
2017,
(Filipiniana Analytics)
NP

0095

Rafflesia camarinensis (Rafflesiaceae), a new species from Mt. Asog, Camarines Sur, Luzon Island, Philippines

Valenzuela, Flordeliz B., Jaucian-Adan, Gertrudes Girlie , Agoo, Esperanza Maribel G. , Madulid, Domingo A.

Rafflesia camarinensis, a new species of *Rafflesia*, is described from Mt. Asog, Camarines Sur in southeastern Luzon, Philippines. The species is remarkable in being one of the smallest *Rafflesia* in the Philippines with flower diameter measuring just 11-13 cm across. It is distinguished from *R. baletei* from the adjoining Mt. Isarog by various characters more notably its smaller size, dome-shaped perigone lobes, thicker and almost woody texture, less dense warts which are more or less homogeneous and raised, fewer, shorter and randomly distributed processes, and a diaphragm concolorous with the perigone lobes and with continuous thick white warts on its surface. It has a very narrow distribution, is critically endangered and needs immediate conservation actions. (**Authors' abstract**)

Keywords: *Rafflesiaceae, Rafflesia camarinensis, Mt. Asog Philippines, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-5
2016,
(Filipiniana Analytics)
NP

0096

A rapid assessment of spider diversity in Kabigan Falls, Pagudpud, Ilocos Norte, Philippines

Uba, Marigold O. , Chua, Jenny Lyn C., Carvajal, Thaddeus M

A rapid assessment of spider diversity in Kabigan Falls, Pagudpud, Ilocos Norte. Spiders are the most permeating predators in both agricultural and natural ecosystems. In ecological studies, they serve as indicators of environmental quality and as biological control agents in agricultural ecosystems. A total of 38 individuals collected from Kabigan Falls were comprised of 13 species. These species are from the family Araneidae, Sparassidae, Pholcidae, Salticidae, and Tetragnathidae. Most of the specimens collected from the site were under families Tetragnathidae and Araneidae. The most species-rich family is Araneidae (5). These include the following: *Araneus inustus, Cyclosa insulana, Cyclosa mulmeinensis, Cyclosa spirifera* and *Larinia* sp. Newly-recorded spiders include are *Tetragnatha plena* Chamberlin, 1924, a new Philippine record; and new locality distributed spiders are *Chalcotropis luceroi* Barrion & Litsinger, 1995 and *Pholcus arayat* Huber, 2011. (**Authors' abstract**)

Keywords: *spiders, Kabigan Falls, spider diversity, taxonomy, Araneae, Tetragnathidae, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-11
2014,
(Filipiniana Analytics)
NP

0097

Rapid assessment of Taal Volcano Protected Landscape (TVPL) terrestrial biodiversity

Banag, Cecilia I. , Papa, Rey Donne S. , Diesmos, Arvin C. , Ordas, Jorge Anton D., Soliven, Gerald Thomas A.

With the exponential rise of human activities in the past decades, majority of studies conducted in Taal Volcano Protected Landscape (TVPL) are geared towards the conservation and preservation of Lake Taal's remaining biodiversity. However, the current structure and assemblage of its terrestrial biotic communities remain relatively unstudied. In this study, we conducted biodiversity censuses in the four sites in TVPL to provide baseline information regarding the community structure of the selected study sites. Comparison of the plant diversity in Taal Volcano Crater Island and Romandan Falls within the forested areas of Mataas na Kahoy, Batangas reveal that both sites support remarkably different vegetation, with the former supporting a smaller floral diversity. The fairly small number of animal samples present difficulty in providing conclusive findings to the wildlife structure of the two study sites. However, the presence of 11 animal species exhibit valuable results in determining the ecological status of TVPL. It is deduced that several ecological barriers exist between the sites, which is attributed to their unique terrestrial biota. (**Authors' abstract**)

Keywords: *Philippines, Ecology, Biogeography, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-10
2017,
(Filipiniana Analytics)
NP

0098

New record of *Phyllodiaptomus (Ctenodiaptomus) praedictus sulawensis* Alekseev & Vaillant, 2013 (Hexanauplia, Copepoda, Calanoida, Diaptomidae) in the Philippines (Luzon Island)

Papa, Rey Donne S. , Han, Bo-Ping , Dumont, Henri J. , Rizo, Eric Zeus C. , Cuballes, John Kenneth V. , Igancio, Aezrile A. , Lacaba, Justine Val Jade B. , Guinto, Shea Kathleen

A study originally intended to update the taxonomy and distribution of calanoid copepods in selected freshwater ecosystems of Central Luzon has led to the discovery of a new record of *Phyllodiaptomus* Kiefer, 1936 in Candaba Swamp, Pampanga. Since 1979, the only calanoid copepods recorded from this area included *Filipinodiaptomus insulanus* (Wright S., 1928) and *Tropodiaptomus australis* Kiefer, 1936. Later studies on calanoid copepods in the region have since been non-existent. Analyses of pertinent key morphological characters revealed that the specimens at hand belonged to *Phyllodiaptomus (Ctenodiaptomus) praedictus sulawensis* Alekseev & Vaillant, 2013, a freshwater diaptomid calanoid copepod subspecies discovered and known to be endemic only in Indonesia. Provided in this paper are baseline information on the morphological characters of the Philippine members of the subspecies accompanied by line drawings as well as a comparison between the recorded morphological data presented by Alekseev, Haffner, Vaillant & Yusoff (2013) and the current dataset to support the identification of the specimen. The discovery of *P. (C.) praedictus sulawensis* in the Philippines, which was thought to be endemic in Indonesia, presents a new record of this species in the country and the first such record outside of its country of origin. (**Authors' abstract**)

Keywords: *Candaba Swamp, Copepod, Indonesia, Thailand, Inland Waters, Limnology, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 2, 1-11
2018,
(Filipiniana Analytics)
NP

0099

First record of the anchovy *Stolephorus teguhi* (Engraulidae) from the Philippines

Motomura, Hiroyuki , Hata, Ha

A single Philippines specimen (59.7 mm standard length) of *Stolephorus teguhi* Kimura, Hori & Allen, 2009 (Engraulidae), previously recorded only from North Sulawesi, Indonesia, was recently discovered in the fish collection of the National Museum of Natural History, Smithsonian Institution, USA. A full description is given of the specimen, which constitutes the first record of the species from the Philippines and supports the view that *S. teguhi* is widely distributed in the Celebes Sea to the eastern part of the South China Sea. (**Authors' abstract**)

Keywords: *Distribution, Fish fauna, New record, Taxonomy, Morphology, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-5
2017,
(Filipiniana Analytics)
NP

0100

First record of the gillspot cardinalfish, *Neamia notula* (Apogonidae) from the Philippines

Motomura, Hiroyuki , Yoshida, To

A single Philippines specimen (28.3 mm standard length) of *Neamia notula* Fraser & Allen, 2001 (Apogonidae), previously recorded from Mauritius, Indonesia, and Japan, was recently discovered in the Smithsonian Museum (USA) collection. The specimen, described herein, constitutes the first record of the species from the Philippines and supports the view that *N. notula* is widely distributed in the Indo-West Pacific. (**Authors' abstract**)

Keywords: *distribution, fish fauna, New record, Taxonomy, morphology, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-4
2017,
(Filipiniana Analytics)
NP

0101

Redefining the role of natural history collections and museums in an era of global climate change

Liao, Lawre

Natural history collections (NHCs) have accumulated billions of specimens as permanent records of the diversity of the world's natural heritage. For centuries, biological museums have typically supported the goals of taxonomy, systematics, biogeography and public education. In this time of rapid environmental change, herbarium specimens in NHCs have been employed to provide phenological and distributional data that are indicative of rising temperatures and for tracking alien plant introductions. Historical herbarium materials can also provide long-term proxy datasets useful for reconstructing past ecological conditions and which may also be useful for projecting future trends. Changing times require NHCs to re-define their goals so as to remain relevant and sustainable. (**Author's abstract**)

Keywords: *biogeography, climate change, global change biology, herbaria, taxonomy, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-10
2013,
(Filipiniana Analytics)
NP

0102

Rediscovery and lectotypification of the Philippine endemic *Hornstedtia microcheila* Ridl. (Zingiberaceae) including an amendment to its description

Naive, Mark Arcebal

Hornstedtia microcheila Ridl. (Zingiberaceae; Alpinioidieae; Alpinieae) is a poorly known endemic species in the Philippines. It has not been collected again since its description in 1909. In 2017, however, the species was rediscovered in the Mt. Mandalagan Range, Patag, Silay City, Negros Occidental, after a lapse of over a century. A new, amended and extended description of *H. microcheila* based on this new collection is presented herein. Typification, colour photographs, distribution data, ecological details as well as a taxonomic key to the different *Hornstedtia* species in the Philippines are also provided. (**Author's abstract**)

Keywords: *Alpinieae, Hornstedtia, lectotype, Negros Occidental, Philippines, rediscovery, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-6
2017,
(Filipiniana Analytics)
NP

0103

The regenerating forest of Magbukún Aeta in Morong, Bataan, Philippines: a biological hotspot for protection and conservation

Cuevas Virginia C. , Galias, Ca

This research focused on the study of a tropical semi-evergreen rain forest community structure within the ancestral domain of the Aetas in Morong, Bataan. Point-Centered Quarter Method (PCQM) was used where five 200 m transects were laid across a 28-ha study site. Trees with ≥1 cm diameter at 1.3 m from the ground (diameter at breast height [DBH]) were sampled. Trees encountered were categorized into four groups: seedlings, saplings, pole trees and standard trees based on girth classes. A total of 76 tree species belonging to 61 genera and 35 families were recorded. The most represented family was Moraceae, followed by Dipterocarpaceae, Sapindaceae and Lauraceae. The species with highest importance percentage (IP) were *Shorea contorta* Vidal (Dipterocarpaceae) (IP=9.731), *Macaranga tanarius* (L.) Muell.-Arg. (Euphorbiaceae) (IP= 5.659) and *Canarium europhyllum* G. Perkins (Burseraceae) (IP= 4.538). Very high values of species diversity were calculated (H'= 3.817; D'= 0.968). The area was previously a dipterocarp forest and can now be classified as a young regenerating forest, composed primarily of seedlings many of which are dipterocarps. There were 17 threatened species, including two critically endangered and two endangered species (listed in The IUCN Red List of Threatened Species (2017-3) and DAO (2017-11) as well as twelve endemic species identified as present in the area. This forest is a biological hotspot that needs utmost protection and conservation. (**Authors' abstract**)

Keywords: *Ancestral domain, Endemic, PCQM, Threatened species, Tree diversity, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-26
2019,
(Filipiniana Analytics)
NP

0104

Screening and optimization of cellulase production of Bacillus strains isolated from Philippine mangroves

Monsalud, Rosario G., Tabao, Nik Sh

Two-hundred and twenty-five mangrove bacterial strains previously isolated from several mangrove areas in the Philippines were qualitatively screened for cellulase production and 154 were found to be capable of cellulase production. Among them, ten strains showed very strong positive cellulase activities, which were then quantified. Five with the statistically highest activities, specifically, BBCS-11, BBCS-14, BBoB2L2-2, BOrMGS-2, and BOrMGS-3, including *Cellulomonas* sp. BIOTECH 1240 (control), were further subjected to partial optimization studies. The effects of substrate, pH, incubation temperature and incubation time on cellulase productoin were determined. The cellulase activities (U mL^{-1}) of the strains under optimized conditions were: 54.80 (Control); 56.60 (BBCS-11); 66.50 (BBCS-14); 50.33 (BBoB2L2-2); 51.04 (BOrMGS-2); and 48.70 (BOrMGS-3). The promising cellulase producers were previously identified: BBCS-11 as *Bacillus cereus*; BBCS-14 as *Bacillus licheniformis*; BOrMGS-2 and BOrMGS-3 as *Bacillus pumilus*; and BBoB2L2-2 as *Bacillus* sp. (**Authors' abstract**)

Keywords: *Bio-prospecting, Conservation, Bacterial Diversity, Bacterial Enzymes, Mangrove Forests, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-9
2010,
(Filipiniana Analytics)
NP

0105

Searching for the relatives of the Philippine endemic *Gloeocarpus* Radlk. (Sapindaceae): Evidence from molecular sequence data

Arriola, Axel H., Alejandro, Grecebio Jonathan D.

Gloeocarpus is a monotypic genus and is endemic to the Philippines. There are no available molecular data for *Gloeocarpus*, and its generic status as well as its position within the Sapindaceae has never been challenged, hence, it was not included in any molecular phylogenetic study within the family. Therefore, to determine its phylogenetic position and to evaluate its monophyly, the ITS (nrDNA) regions were sequenced and analyzed together with the previously published sequences of closely related genera. The aligned ITS dataset contained a total of 694 positions, 239 of which are parsimony informative. The strict consensus tree confirmed the phylogenetic position of *Gloeocarpus* within the tribe Cupanieae with strong support (BS=100) and the monophyly of the genus is highly supported (BS=100). Molecular results support morphological evidences characterizing the genus by having the sinuous branchlets and hairy petals with folded margin. (**Authors' abstract**)

Keywords: *Gloeocarpus, Sapindaceae, nrDNA, Cupanieae, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-14
2011,
(Filipiniana Analytics)
NP

0106

Species composition of freshwater zooplankton fauna from selected groundwater-dependent ecosystems in Bulacan Province (Philippines) with taxonomic notes of new locality record of harpacticoid species in the Philippines

Koh, Moses Isaiah L. , Papa, Rey Donne S. , Juan, Jannah B. , Cavite, Ysabel Grace C., Lopez, Mark Louie D.

In the Philippines, the taxonomy of freshwater zooplankton fauna from ground waters remain poorly understood, yet knowledge on this group is important to know patterns in groundwater biodiversity to develop sound conservation policies. In this study, zooplankton were studied by collecting samples from selected groundwater-dependent ecosystems in Bulacan Province. Results indicate the presence of 13 species belonging to 10 families from Rotifera, Cladocera, and Copepoda. Large portion of the samples included the copepods *Mesocyclops* and *Thermocyclops* spp. together with cladocerans *Ceriodaphnia cornuta* and *Moinodaphnia macleayi*. Observation of these taxa in groundwater-dependent ecosystems suggests high surface and sub-surface hydrological connectivity in the Province. Lastly, new locality record of *Elaphoidella bidens* in the Philippines was established. (**Authors' abstract**)

Keywords: *Caves, Cladocera, Copepoda, Groundwater pumps, Springs, Wells, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 1, 1-7
2017,
(Filipiniana Analytics)
NP

0107

Species diversity, abundance and habitat distribution of anurans in Mts. Palay-Palay Mataas-na-Gulod Protected Landscape, Luzon Island, Philippines

Causaren, Rubie M

Mt. Palay-Palay is Cavite's only protected landscape and yet very few herpetological studies have been done in this area. Thus, the study aims to provide robust ecological data on different anuran species so that an effective conservation and management plan could be formulated. Five habitats were sampled using a combination of cruising transect, stratified random strip transect sampling, time-constrained searches, visual encounter survey (VES) and acoustic encounter survey (AES). A total of 1528 individuals belonging to 12 species was recorded from the study area. In addition to previous works, 2 *Platymantis* spp. were new records bringing the total species richness to 16. Of the 16 species, 10 (62.5%) are endemic to the Philippines. Among the species, *Platymantis mimulus* was the most abundant and also had the highest density of 174 frogs ha^{-1}. Among the habitats riparian forests had highest species diversity, Mau Tao and Jackknife1 values which showed dependence of anurans on water. Of the 17 microhabitats, forest floor litter was the most occupied by anurans. (**Author's abstract**)

Keywords: *Diversity, Species Richness, Density, Microhabitats, Mao Tau, Jackknife1, AES, VES, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-11
2016,
(Filipiniana Analytics)
NP

0108

New species of *Sphagnum* from the Philippines with remarkable morphological characters

Tan, Benito C., Nosratinia, Sonia , Ignatov, Michael S. , Ignatova, Elena A. , Mishler, Brent D.

Sphagnum apopenneysii B.C. Tan, Ignatov, Ignatova, & B. Mishler is described as a species new to science. It was found submerged in a high mountain lake, at 2385 m elev. on Mt. Apo on Mindanao island in the Philippines. The new species is peculiar in its poor expression of leaf cell dimorphism. Cells in the upper half of the branch leaves are all identical, linear-vermicular, and all have chloroplasts and nuclei. In the mid-leaf, a moderate differentiation in shape appears with larger cells, approaching in shape to hyalocysts, yet still containing chlorophyll. Only near the base of the branch leaves is a pattern common to most *Sphagnum* species observed, including inflated hyalocysts with fibrils, albeit without any pores. Collections from deeper water have long lanceolate leaves, while plants from shallower water have stem leaves that are ovate-triangular, similar to those in many species of *Sphagnum* in section *Cuspidata*. Both nuclear and plastid DNA sequence data support the placement of this new moss in section *Cuspidata*. (**Authors' abstract**)

Keywords: *Sphagnum apopenneysii, Sphagnum sect, Cuspidata, chlorocyst, hyalocyst, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-13
2018,
(Filipiniana Analytics)
NP

0109

Spikemoss flora (*Selaginella*) in Mindanao Island, the Philippines: species composition and phenetic analysis of morphological variations

Coritico, Fulgent P., Acma, Florfe M. , Amoroso, Victor B. , Bautista, Maje

The genus *Selaginella*, commonly referred to as spikemosses, is an important component of the Philippines' lycophytes diversity. Mountain ecosystems in Mindanao island hold diverse species of lycophytes, however the morpho-taxonomy diversity of this group is poorly documented there. The study aimed to determine *Selaginella* species richness, distribution and phenetic relationships based on morphological characteristics in Mindanao island. Specimens of *Selaginella* were collected in Mt. Apo, Kidapawan City; Mt. Hamiguitan, Davao Oriental; Mt. Kiamo, Mt. Kitanglad, Mt. Musuan and Mt. Limbawon in Bukidnon; Mt. Timpoong, Camiguin; and Mt. Malindang, Misamis Occidental. The 24 *Selaginella* species were collected and subjected to numerical phenetic analysis using the PC-ORD program. A total of 11 morphological characters and 44 character states were used in the analyses. Of the 24 species, seven are Philippine endemics, four are potential new species and two species are widely distributed in the areas studied. Results of the phenetic analysis showed four major clusters. (**Authors' abstract**)

Keywords: *endemic species, lycopods, Philippines, Selaginellaceae, taxonomy, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-9
2018,

(Filipiniana Analytics)
NP

0110

Status of the Myxomycete collection at the UPLB-Museum of Natural History (UPLB-MNH) Mycologocal Herbarium

Quimio, Tricita H. , Parra, Christian M. , Javier, Anton Oliver M. , Dela Cruz, Thomas Edison E., Kuhn, Rudolf V.

The Philippines is considered one of the world's megahotspots of biodiversity. Among the country's fungal species, about 4,698 species belonging to 1,031 genera are currently known or described, of which only a small number of myxomycetes were included. At the UPLB-MNH Mycological Herbarium, one of the country's premier depository institutions of fungal collections, only about 446 myxomycete specimens were recorded. In this review paper, progress made in myxomycete diversity in the Philippines is reported. The conservation status of the myxomycetes specimens deposited at the UPLB-MNH Mycological Herbarium is also assessed. Furthermore, hindrances to the discovery of new myxomycete species and challenges encountered by local researchers are also discussed. (**Authors' abstract**)

Keywords: *myxomycetes, slime molds, biodiversity, conservation, Biology*

Philippine Journal of Systematic Biology, Volume No. 3 Issue No. 1, 1-15
2009,
(Filipiniana Analytics)
NP

0111

Survival and growth of re-attached storm-generated coral fragments post super-typhoon Haiyan (a.k.a. Yolanda)

Tan, Barron Cedric A., Anticamara, Jonathan

Coral reefs in Eastern Samar, Philippines were badly damaged by super typhoon Haiyan, which left many reefs in a fragmented state–with many branching corals and other coral forms scattered in loose pieces. As part of the efforts to address this problem, we tested the re-attachment of 43 species of coral fragments to sturdy natural substrates in three reef sites in Eastern Samar (Can-usod and Monbon in Lawaan, and Panaloytoyon in Quinapondan). The results revealed that 88% of re-attached coral fragments survived (45% showed positive growth, and 43% survived with partial tissue mortality). Those that showed positive growth exhibited high growth rates. We also found that fragments of some coral species are more fast-growing (e.g. *Cyphastrea decadia*, *Echinopora pacificus*, and *Millepora tenella*) than others (e.g. *Porites lobata* or *Pectinia paeonia*). Overall, our results suggest that if Local Government Units (LGUs) invest in the re-attachment of fragmented corals (e.g. reefs damaged by super typhoons or by various human activities such as fishing), then coral reef degradation in the Philippines would have a better chance of recovering. (**Author's abstract**)

Keywords: *Coastal management, conservation, Leyte Gulf, reef restoration, super typhoon, Biology*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 30 Issue No. 2, 1-27
2018,
(Filipiniana Analytics)
NP

0112

Tagaloblatta kasaysayan Gen. et Sp. Nov. (Blattodea: Ectobiidae: Pseudophyllodromiinae), a new minute cockroach from Mt. Makiling, Los Baños, Laguna

Lucañas, Crist

A new ectobiid cockroach, *Tagaloblatta kasaysayan* gen. et sp. nov. from Mt. Makiling, Los Baños, Laguna is described. The new genus externally resembles the Neotropical genera Isoldaia Gurney & Roth 1966 and *Agmoblatta* Gurney & Roth 1966 but genital morphology shows possible close relation with *Sundablatta* Hebard 1929, *Pseudophyllodromia* Brunner 1865, and *Allacta* Saussure & Zehntner 1895. The genus can be distinguished from the other genera by the minute, non-overlapping tegmina, absence of hind wings and specialized abdominal glands, simple, posteriorly symmetrical subgenital plate and similarly-sized style. (**Author's abstract**)

Keywords: *Biodiversity, Cockroach fauna, New genus, New species, Philippines, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-4
2016,
(Filipiniana Analytics)
NP

0113

A taxonomic account of lizards along established trails in Mts. Palay-Palay Mataas-na-Gulod protected landscape, Luzon Island, Philippines

Lagat, Rona

Twenty-three species of lizards were recorded in Mts. Palay-Palay Mataas-Na-Gulod Protected Landscape. Belonging to four families; Agamidae is represented by three species, Gekkonidae with seven species, Scincidae with twelve species and Varanidae with one species. Fifty-two percent of the species in Mts. Palay-Palay Mataas-Na-Gulod Protected Landscape is endemic which is dominated by forest species. Lizard diversity decreases with increase in elevation. Three major habitats (forest, stream and human habitation) were observed to be occupied by the species and habitat overlaps were observed as some species can occupy all habitat types. **(Author's abstract)**

Keywords: *lizards, phylogenetics, biogeography, Biology*

Philippine Journal of Systematic Biology, Volume No. 3 Issue No. 1, 1-12
2009,
(Filipiniana Analytics)
NP

0114

Taxonomic survey of nickel hyperaccumulating plants in a mining site on Luzon Island, Philippines

Obico, Jasper John A. , Ragragio, Elena M. , Salvador, Shamaine Anne SJ. , Bayas, Quinn Eri

Plants that accumulate large amounts of heavy metals can be useful for environmental phytoremediation. These hyperaccumulators are capable of tolerating high concentrations of metals which are otherwise toxic to non-hyperaccumulators. This study aimed to account and categorize hyperaccumulating plant species in the Lagonoy ophiolite complex located in Camarines Sur province on Luzon Island. Plants were collected from several sampling sites within the mining area, identified, and their nickel content was measured using AAS. A total of 44 species from 30 families were collected and classified into non-accumulators, hemiaccumulators, hyperaccumulators and hypernickelophores based on the nickel level ranges defined in the work of Fernando *et al*. (2013). Six species were classified as non-nickel accumulators, in which the nickel content was <100 ppm (1 ppm=1 µg Ni/g dry matter). Twenty-one species were classified as hemiaccumulators, having 100-999 µg/g Ni levels. There were 11 species of hyperaccumulators with nickel content of >1000 µg/g Ni in dry matter and six hypernickelophores with nickel content of >10000 µg/g Ni in dry matter. The plant with the highest nickel content was *Lygodium circinnatum* (Burm.f.) Swartz. The potential of this fern as a phytoremediation plant is discussed. (**Authors' abstract**)

Keywords: *heavy metals, mining, nickel hyperaccumulators, ophiolite complex, pollution, Biology*

Philippine Journal of Systematic Biology, Volume No. 12 Issue No. 1, 1-6
2018,
(Filipiniana Analytics)
NP

0115

Taxonomy of Philippine sardines revealed by biometrics data

Alvia, K.M. , Canlas, R.A. , Sonico, M.G.L , Samonte, I.E., Pagulayan, R.C.

The Philippine sardines (Genus *Sardinella*, Family Clupeidae) are interesting organisms due to their great morpho-anatomical similarities. They usually thrive in marine environment with the exception of lhe freshwater sardine *S. tawilis* endemic to Lake Taal. To elucidate the relationship of the Philippine *Sardinella* spp. 35 biometric variables were determined and then subjected to descriptive (mean. standard deviation, and statistical range} and inferential (Factor Analysis (FA). Discriminant Function Analysis (DFA), and Hierarchical Cluster Analysis (HCA)) tests. Thirty variables correlated to the four-factor data reduction in FA that explains 96.9% of the total variance among the six sardines In DFA, only 29 variables were found useful in differentiating the sardines. The same 29 features were able to properly predict the identity of 99.58% of the sardines. The close relationship of *S. albella* to the Lake Taal sardine was demonstrated by all three dendrograms drawn from all 35 variables. Only from the 30 FA informative variables, and from the 29 discriminating variables, respectively. The dendrograms also show that the two populations of *S. tawilis* form two distinct clusters consistent with evidence from molecular data. Among the marine sardines, *S. lemuru* can be regarded as the farthest relative of the freshwater sardine *S. tawilis*. (**Authors' abstract**)

Keywords: *Sardinella, Clupeidae, Morphometrics, Meristics, descriptive, multivariate tests, Biology*

Philippine Journal of Systematic Biology, Volume No. 1 Issue No. 1, 1-14
2007,
(Filipiniana Analytics)
NP

0116

Tree elements along the western slope of Mt. Lobo: Species composition from 700 to 1,007m altitudes

Caringal, Anacl

Mt. Lobo, the highest peak in the coastal province of Batangas, Luzon Island was sampled for its dendrological elements. The forest community along the western slope proved to be diverse in terms of representative tree species. Families and genera of medium altitude (700-800masl) such as Anacardiaceae (*Buchanania, Dracontamelon*), Combretaceae (*Terminalia*), Dipterocarpaceae (*Parashorea, Shorea*), Euphorbiaceae (*Drypetes, Glochidion, Mallotus, Neotrewia*), Meliaceae (*Aglaia, Amoora, Dysoxylum*), Moraceae (*Ficus, Artocarpus*), Sapotaceae (*Palaquium, Pouteria*) were gradually replaced by the characteristics montane families like Clethraceae (*Clethra*), Fagaceae (*Lithocarpus*), Lauraceae (*Cinnamomum, Litsea, Phoebe*), Melastomataceae (*Astronia, Astrocalyx, Medinilla, Memecylon*), Myrtaceae (*Leptospermum*), Podocarpaceae (*Podocarpus*), Rutaceae (*Melicope*) and Theaceae (*Eurya*). Ascending to 1,007m altitude, Mt. Lobo's mossy forest community appeared simple which was composed of relatively fewer families, genera and species typical of temperate distribution or the "microtherms" (cold-adapted) like conifers (*Podocarpus*), oak (*Fagaceae*), Clethra (*Clethraceae*), *Astronia* and *Medinilla* (Melastomataceae), and *Leptospermum* (Myrtaceae). Such speciation is typical of the oak-laurel type of forest in the montane tropics.

The endemic *Tectona philippinensis* (Verbenaceae) interestingly was not found in Mt. Lobo as the species is exclusively distributed on low-lying hills (200-300masl) characterized by Karst formation and honey-comb edaphic features where tree elements become typically deciduous during summer. (**Author's abstract**)

Keywords: *dipterocarp, Mt. Lobo, Philippine teak, microtherms, mossy forest, Biology*

, Volume No. 2 Issue No. 1, 1-4
2008,
(Filipiniana Analytics)
NP

0117

Tree species diversity of the remaining forest fragments in Cavite, Luzon Island, Philippines

Causaren, Rubie M., Lagat, Ronaldo D. , Agoo, Esperanza Maribel G

Cavite has remaining secondary lowland forest fragments that are believed to be either remnant from commercial logging activities ca. 25-45 years ago or as a direct result of land conversions for agriculture or human settlements. There have been no vegetation studies among these forest fragments except in Mt. Palay-Palay in 2004. The aim of the research was to describe these remaining forest fragments (in addition to Mt. Palay-Palay), their tree species diversity, composition, ecological assessment and current anthropogenic threats affecting these areas. Vegetation analysis was performed using the Point-Centered Quarter Method (PCQM) in 72 100-m transects in forest fragments with different habitats. Species diversity was computed using Shannon's diversity index (H′). A total of 2,853 tree individuals belonging to 50 families, 127 genera, and 174 species was encountered. Species diversity indices (H′) in all forest fragments were high and their importance value indices (IVIs) fall within the range of IVIs of tropical forest inventories. Assessment of ecological status revealed that of the 174 species, 44 (25.3%) are endemic, 114 (65.5%) are native/indigenous, and 16 (9.2%) are exotic/introduced. Thirty-nine angiosperms are threatened representing 8.9% of all threatened angiosperms in the Philippines. Overall, Cavite's remaining forest fragments are diverse in terms of

tree species and all experience anthropogenic threats and it is highly recommended that they be protected and conserved including the diverse fauna and flora associated with these areas. (**Authors' abstract**)

Keywords: *Anthropogenic pressures, Diversity index, PCQM, Secondary lowland forest, Threatened, Vegetation analysis, Biology*

Philippine Journal of Systematic Biology, Volume No. 11 Issue No. 2, 1-18
2017,
(Filipiniana Analytics)
NP

0118

Validation of two extraction methods for human DNA from cigarette butts

De Ungria, Maria Corazon A. , Salvador, Jazelyn M. , Calacal, Gayvelline C. , Ferrer, Dorothy Emma C. , Sales, Paul R

Cigarette butts found in crime scenes may be used to identify persons and link them to a crime through DNA prof iling of epithelial cells from saliva stains on these materials. Downstream analysis of cigarette butts poses some challenges because these are often exposed to chemical contaminants and environmental conditions which lead to DNA degradation. In this study, several factors were tested to compare the amount and quality of DNA obtained from cigarette butts extracted using an organic procedure and the QIAamp® DNA Micro Kit (QIAGEN). Results show that exposure to an outside environment had a significant effect on DNA yield and amplifiability for both extraction procedures. Prolonged storage of cigarette butts of up to six months affected the amount of DNA that can be extracted using the QIAamp® DNA Micro Kit. However, complete DNA profiles can be generated from cigarette butts stored for six months provided that these samples are stored indoors under controlled temperature conditions and with minimal exposure to contaminants. (**Author's abstract**)

Keywords: *Cigarette butts, DNA typing, DNA yield, forensic science, Biology*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 31 Issue No. 1, 1-12
2019/06,
(Filipiniana Analytics)
NP

0119

A vegetation inventory of a traditional secondary forest (*Muyong*) in Kinakin, Banaue, Ifugao, Northern Luzon, Philippines

Espaldon, Ma. Victoria O., Macandog, Damasa M. , Rabena, Mark Anthony F., Cuevas, Virginia C.

Traditional forest (*muyong*) has been recognized as a beneficial component of the rice terraces landscape of Banaue, Ifugao. It supplies irrigation water for the rice paddies (*payoh*); it provides firewood, timber, medicine and food for the locals; and it shelters various kinds of wildlife species. Threats have been reported to some *muyong* mainly due to anthropogenic activities and natural causes. Hence, protection of its biodiversity is important to sustain its ecological function and even its socio-cultural value. This study provides a botanical checklist of a *muyong* patch in Brgy. Kinakin, Banaue, Ifugao. A total of 52 woody species (> 3 cm DBH; > 2 m height) representing 40 genera and 31 families were recorded from the ten 10 m x 10 m quadrats. The most represented families were Euphorbiaceae, Fabaceae, Myrtaceae and Phyllanthaceae while the most represented genera were *Macaranga*, *Ficus*, *Syzygium*, and

Desmodium. There were eight species categorized as endemic to the Philippines and one species [*Alnus japonica* (Thunb.) Steud.] considered as introduced to the *muyong*. Also, there is one species (*Macaranga caudatifolia* Elmer) listed as threatened species in the Philippines. The dominant woody species in the *muyongs* were *Clethra tometella* Rolfe ex Dunn. (*umog*), *Weinmannia luzoniensis* Vidal (*tabangawen*), *Calophyllum soulattri* Burm. f. (*bitaor*), *Lithocarpus submonticolus* (Elmer) Rehder (*palayon*) and *Macaranga caudatifolia* Elmer. (*bayyakot*). In general, the observed floral composition of the *muyong* showed a close resemblance to the tropical lower montane forest formations of the Philippines. (**Authors' abstract**)

Keywords: *Secondary montane forest, Banaue, muyong, vegetation composition, dominant species, Biology*

Philippine Journal of Systematic Biology, Volume No. Issue No. , 1-23
2015,
(Filipiniana Analytics)
NP

CHEMISTRY

0120

Correlatios between zinc and heavy metal concentrations in commercially available zinc oxide sources

Magpantay, Veneranda A. , Angeles, Emily P. , Regaspi, Anthony Francis S. , Belen, Gean Camille C. , Dimaiwat, Medallaine I., Sulabo,Rommel C

The study was conducted to determine the correlation between zinc and heavy metal concentrations (lead, cadmium, arsenic) in different ZnO sources. Seven ZnO samples submitted to Laboratory 1 were analyzed for Zn and heavy metal concentrations using atomic absorption spectrophotometry (AAS). Another ten samples submitted to Laboratory 2 were analyzed for Zn using AAS and for heavy metals using inductively coupled plasma–atomic emission spectrometry. Correlations were determined for the data gathered. Concentrations of Zn, Pb, Cd and As ranged from 3.6 to 79.2%, 0 to 1341.2 ppm, 0 to 178.3 ppm, and 0.4 to 12.9 ppm, respectively. Zinc content in different ZnO sources was not correlated with heavy metal concentrations. For Laboratory 1, Pb concentration detected in ZnO was positively correlated ($P<0.001$) with Cd, whereas in Laboratory 2, Pb was negatively correlated ($P<0.001$) with Cd. Arsenic concentration found in ZnO tended ($P<0.07$) to positively correlate with Pb ($r=0.72$) and Cd ($r=0.75$) for Laboratory 1. The present study shows wide variability of Zn and heavy metal concentrations in commercially available ZnO sources. It is recommended that heavy metal concentration in ZnO should be checked regardless of the Zn content. (**Author's abstract**)

Keywords: *Arsenic, Cadmium, Heavy metal, Lead, Zinc oxide, Chemistry*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-7
2017,
(Filipiniana Analytics)
NP

0121

Enhanced colloidal stability of Al_2O_3-water nanofluids using a lauryl sulfate-based surface-active ionic liquid as dispersant

Postradob, Glaiza T. , Arcoc, Susan D. , de Leon, Rizalinda L. , Dolientea, Step

Originally intended as alternative thermal fluids, nanofluids or nanosolid-liquid composites now have other emerging industrial applications. However, nanofluids' long-term colloidal stability must be further developed. In this original research, a halogen-free, low cost alkyl sulfate-based surface-active ionic liquid, 1-hexyl-3-methylimidazolium lauryl sulfate ([HMIM]LS) was proposed as a dispersant for Al_2O_3-water nanofluids to enhance its colloidal stability. Colloidal stability of Al_2O_3 nanoparticles dispersed in [HMIM]LS aqueous solution was monitored for one week using UV-vis spectroscopy, zeta potential measurement and particle size distribution. From UV-vis spectroscopy, absorbance of the nanofluid with [HMIM]LS was consistently higher than the controls even until day 7 by a factor of 38. The zeta potential of the nanofluid with [HMIM]LS became more negatively charged from -19.2 mV to -36.7 mV on day 0 and day 7. In spite of these modest values attributed to the adsorbed IL layer on the nanoparticle surface, these results supported the double layer micellar stabilization mechanism. Particle size distribution also corroborated with the absorbance and zeta potential results by showing that larger-sized particles settle slower in the nanofluid with [HMIM]LS compared to the controls. These results showed that [HMIM]LS was an effective dispersant for Al_2O_3-water nanofluids. (**Author's abstract**)

Keywords: *Colloidal stability, Nanofluids, Ionic Liquid, Chemistry*

Philippine Engineering Journal, Volume No. 39 Issue No. 2, 1-16
2018,
(Filipiniana Analytics)
NP

COMPUTER SCIENCE

0122

A design for task-role based access control for personal health record systems

Zuniga, Rose Ann S., Festin, Susan P

We present our design for a Task-Role Based Access control system for Personal Health Records (PHR). Current access control models deployed for PHR systems are, at best, based on role-based models. This neither allow for flexibility nor fine-grained restrictions on access to records. The ideal situation is to have a dynamic, task-based access control model on top of the role-based restrictions. Multiple constrains were also added to provide a more fine-grained access. Furthermore, specific policies for PHR systems were also defined. From our survey of existing PHR systems none provide these combination of dynamic access control coupled with constraints and roles. We implemented a prototype, a hybrid PHR-EMR (Electronic Medical Record) system, of our design where we applied the security model we are proposing. We also conducted a usability testing and our evaluation shows that our design can be used and implemented in an actual PHR. (**Author's abstract**)

Keywords: *Access Control, TRBAC, Task Role Based Access Control, PHR, Personal Health Record System, Computer science*

Philippine Engineering Journal, Volume No. 38 Issue No. 1, 1-12
2017,
(Filipiniana Analytics)
NP

ECOLOGY

0123

Benthic macroinvertebrates of the University of the Philippines Diliman campus waterways and their variation across land use in an urban, academic landscape

Hernandez, Maria Brenda M. , Deborde, Danielle Dominique D. , Salluta, John Claude Renan B. , Magbanua, Fran

Urban development impacts stream ecosystems primarily via changes in hydrological regime, geomorphology, and in water quality. These changes in turn have biological effects. The University of the Philippines Diliman campus, located at the heart of the highly urbanized Quezon City, has gone through numerous developments in terms of landscape and infrastructure. Unlike the terrestrial environment, the extent to which these developments have impacted the campus waterways is unknown. Hence, our research aims to assess the overall condition of the waterways in the campus based on the benthic macroinvertebrate assemblages. A total of 19 stream reaches were sampled in November 2015 and 2016 in the following land use categories: academic/academic support units (six sites), campus core (eight sites), and parks and open spaces (five sites). One-way analysis of variance (ANOVA) detected significant spatial difference in several macroinvertebratebased metrics, stream physicochemistry, and in-stream habitat condition elements. Our study reveals that all sampled stream reaches, regardless of their land use categories, are under poor to severe pollution conditions. All macroinvertebrate-based metrics and indices indicate degraded water quality and stream health. Our results are consistent with urban stream studies elsewhere, which suggest that land-based activities can be stressful for some aquatic organisms, and at times, result in reduced abundance and even reduction in species composition. (**Author's abstract**)

Keywords: *Biomonitoring, biotic indices, stream habitat assessment, urban land use, water quality, Ecology*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 31 Issue No. 1, 1-20
2019/06,
(Filipiniana Analytics)
NP

0124

Morphometrics and ecology of Order Chiroptera in selected caves of the Northern Sierra Madre Natural Park, Luzon, Philippines

Cabauatan, Jane G. , Vinarao, Grace

This study was conducted to identify the bat species inhabiting in selected caves of the Northern Sierra Madre Natural Park (NSMNP), Luzon, Philippines through their morphometric characteristics, determine the current conservation status of bat species in the study sites, and recommend possible conservation, protection and maintenance of these species in the selected caves. A total of 24 bat species were identified from the selected sites. These species belong to six families namely: Pteropodidae (2), Emballonuridae (2), Molossidae (1), Vespertilionidae (5), Hipposideridae (5), and (9). Furthermore, the conservation of identified species of bats was categorized based on the IUCN Red list (2010). Majority of the species were categorized as least concern. Three out of the 24 species were near threatened. Two species were categorized as data deficient. Only one species is unknown. In line with the possible threat to bats, it was found out that the major factors that greatly affect their way of living and their population were destruction of their habitat and the rampant hunting of people for them. Result of the study could be subject to in depth molecular assessment. Rigid execution and implementation of the laws and policies concerning the protection of species in the

wild should be done by the Government and other concerned agencies to help prevent their extinction. (**Author's abstract**)

Keywords: *Morphometrics, Biodiversity, Chiroptera, Conservation status, Extinction, Ecology*

Cabagan Journal of Research, Volume No. 20 Issue No. 1, 1-10
2011/06,
(Filipiniana Analytics)
NP

0125

Penetration of lahar aggregates by Philippine subterranean termites (Isoptera: Termitidae)

Ong, Heherson B. , Acda, Menan

Lahar aggregates from Mt. Pinatubo consisting of uniform or mixed particles were tested as physical barriers to prevent tunneling and penetration of *Nasutitermes luzonicus*, *Macrotermes gilvus*, and *Microcerotermes losbanosensis*. Uniform particle diameter in the range of 1.18-1.40 mm to 2.0-2.36 mm prevented *N. luzonicus* and *M. losbanosensis* or 1.70-2.00 mm to 2.00-2.36 mm for *M. gilvus* from penetrating the lahar barrier. When several particle sizes in the diameter range 1.18-2.36 mm or 1.70-2.36 mm were uniformly mixed, the resultant barrier prevented penetration of *N. luzonicus* or *M. losbanosensis* and *M. gilvus*, respectively. Repellency tests showed that lahar particles were neither repellent nor toxic to *N. luzonicus*, *M. gilvus*, and *M. losbanosensis*. Field evaluations using mixed particle sizes 1.18-2.36 mm and 1.70-2.36 mm performed very well in preventing tunneling of field colonies of *M. losbanosensis* and *M. gilvus*, respectively. (**Author's abstract**)

Keywords: *Physical barrier, Termitidae, Lahar, Subterranean termites, Ecology*

Cabagan Journal of Research, Volume No. 21 Issue No. 1, 1-12
2012/06,
(Filipiniana Analytics)
NP

0126

Predicting soil loss and surface run-off from rainfed uplands on Northern Luzon: assessing the impact of rainfall regimes and crop management practices using simulation model

Alejandro, Lanie , Balderama, Orlando , Bareng, Jeoffrey Ll

The impact of rainfall regimes and crop management practices in the rainfed uplands of the Cagayan Valley region, Northern Philippines was examined. The primary goal of the study is to evaluate the performance and adaptability of the Water Erosion Prediction Project (WEPP) model in estimating the rate of soil erosion and runoff under upland rice cultivation. The research involves establishment of automatic weather station and erosion plots with three conservation management as treatments. Analysis was undertaken to characterize rainfall events in terms of amount, intensity, duration and frequency in relation to erosion data. Comparison of actual and simulated data and sensitivity analysis of scenarios for different types of rainfall, slope, and conservation practices were made. The validation results demonstrated the statistical acceptability of the WEPP model. The actual and simulated data indicated that 50 percent soil loss is reduced when contour planting with hedgerow is practiced. The rate of soil loss is linearly affected by increasing slopes and length, such that, the rate of soil removal ranges 1.2-48.46 t ha-1 across treatments at 10-50 percent slope and 10-40 m slope length. The model can be used to develop decision support tools for conservation,

optimization and utilization of farm resources in agricultural watershed units for improved productivity of upland areas in sustainable way. (**Author's abstract**)

Keywords: *Agricultural watershed, Runoff, Soil erosion, Upland agriculture, WEPP model, Ecology*

Cabagan Journal of Research, Volume No. 22 Issue No. 1, 1-12
2013/06,
(Filipiniana Analytics)
NP

ENGINEERING

0127

Analytical modelling of Melchor Hall using non-destructive tests

Estanislao, Dan Mari D.V. , Antonio, Jr., Oscar Vic

This study aims to generate a digital and analytical model of Melchor Hall using the program SAP2000 together with the details obtained from the Melchor Hall as-built plans, 1949 Palma Hall plans which substituted for the original 1949 Melchor Hall plans, and the results obtained from the three non-destructive tests–Rebar Scanning Tests, Schmidt Rebound Hammer Test and Ultrasonic Pulse Velocity Test. These non-destructive tests were conducted to determine the material and section properties primarily targeting the current concrete compressive strength and rebar configuration of the structural members such as beams and columns. The said model was subjected to Nonlinear Static Pushover Analysis while applying dead and live loads prescribed by the National Structural Code of the Philippines 2010 and lateral earthquake loads based on the Uniform Building Code 97. The said analysis monitored 12 joints on the topmost portions of the model along its length to obtain the pushover curves that determined if the structure's capacity meets its demand. The research showed that analytical models can still be created for old reinforced concrete structures with the help of non-destructive tests. Material properties of old reinforced concrete members were also evaluated using research and non-destructive testing. It was proven through non-destructive testing that the structural elements of both Melchor Hall and Palma Hall are similar. Analysis of the generated analytical model showed that the structure can withstand earthquake loads defined using the UBC 97. However, retrofitting measures are still needed by the structure in order to prevent the formation of plastic hinges that can put the lives of the people occupying the structure at high risk. (**Author's abstract**)

Keywords: *non-destrucive testing, ultrasonic pulse velocity, nonlinear static pushover analysis, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-16
2017,
(Filipiniana Analytics)
NP

0128

Comparative assessment of water column correction techniques for seagrass mapping using Worldview-2 image

Tamondong, Ayin M., Blanco, Ariel C. , Fortes, Miguel D

Benthic cover mapping has always been challenging, primarily due to the compounding effects of the overlying water column. While a number of algorithms have been developed to address these, research on the application and performance assessment of such methods to seagrass mapping using high-resolution satellite images is limited. This research dealt with seagrass mapping using WorldView-2 images with an emphasis on the evaluation of the relative performance of different water column correction methods and on the band combinations. A geometric correction was conducted using DGPS survey coordinates. Atmospheric correction was performed using the Fast Line-of-Sight Atmospheric Analysis (FLAASH) model as this produced image-derived spectra similar to field spectra. Three water column correction models were applied and compared, namely, Lyzenga's Optical Model (LOM), Stumpf's Ratio Model (SRM), and Simple Radiative Transfer Model (SRTM). Maximum Likelihood Classification (MLC) was used to classify the image corrected for glint and water column effects. Using LOM and SRTM, overall classification accuracies obtained were 75.50% and 87.84%, respectively. STRM yielded the highest overall accuracy at 88.30% with ML applied on Worldview-2's coastal, green, yellow and red bands. However, the use of the coastal blue band, instead of the blue band, marginally increased the accuracy of the classification using SRTM. (**Author's abstract**)

Keywords: *seagrass, benthic habitat, mapping, WorldView-2, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-20
2017,
(Filipiniana Analytics)
NP

0129

Development of models and methodology for the reliability evaluation of two interconnected power systems

Dulce, Elvin D., del Mundo, Rowaldo D

This study developed analytical and probabilistic models and methodology that simultaneously take into account the intermittency of wind power, the seasonal variation in hydropower, and the load forecast uncertainty, in evaluating the reliability of two interconnected power systems. The intermittency of wind power was incorporated by using a sliding window approach with a 7-hour period while the seasonal variation in hydropower was incorporated by considering the hourly generation. A seven-step approximation of the normal distribution was used for the load forecast uncertainty considerations. The Loss-of-Load Expectation (LOLE) in the Luzon Grid in 2014, when assisted by the Visayas Grid, increased from 53 hours/year to 95 hours/year when the intermittency of wind power, the seasonal variation in hydropower, and the load forecast uncertainty were considered. On the other hand, when the Luzon Grid is the assisting system, the LOLE in the Visayas Grid increased from 12 hours/year to 32 hours/year. A significant improvement was observed in the accuracy of the calculated LOLE in the two interconnected power systems when the intermittency and the seasonal variation in the generation, and the load forecast uncertainty were simultaneously considered. (**Author's abstract**)

Keywords: *Loss-of-Load Expectation, Intermittency, Seasonal Variation, Load Forecast Uncertainty, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 2, 1-24
2018,
(Filipiniana Analytics)
NP

0130

Development of wind vulnerability curves of low-rise wooden frame structures in the Greater Metro Manila Area, Philippines

Suiza, Ran

Wood frame structures comprise a substantial part of the building population in the Philippines and most of these serve as residential buildings. With the advent of risk management, researchers tend to study the susceptibility of various structures against different disasters. This study focuses on the determination of the susceptibility or the vulnerability of low-rise wood frame structures in the Greater Metro Manila Area to severe wind. The methodology includes developing a model database that identifies typical wood constructions in the area; which is followed by an interaction analysis to determine the wind pressures developed in the building envelope. Damage analysis then follows which leads to the derivation of wind fragility curves, curves that give the probability that the structures exceed a particular damage state. The last part of this study derives the vulnerability curve which expresses the ratio of the cost of repairing to the cost of replacing the structures. It was found out that for the same set of structures, the cost of repairing is half of that of replacing the structures at a wind speed of 177 kph. (**Author's abstract**)

Keywords: *wind vulnerability, low-rise wooden frame structures, typhoon Haiyan, computational fluid dynamics (CFD) analysis, vulnerability analysis, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 1, 1-12
2017,
(Filipiniana Analytics)
NP

0131

Estimating Typhoon Haiyan's wind speeds using windicators

Agar, Joshua C., Mata, William L. , Hernandez , Jr., Jaime Y

Typhoon Haiyan of 2013, by the time it struck the Philippines, has been regarded as one of the strongest tropical cyclones. Yet there are discrepancies between the estimated maximum wind speeds reported by the weather agencies worldwide, causing widespread confusion. In the absence of credible in situ wind speed measurements that will provide the storm's true strength, "Windicators" are analyzed. Windicator, coined from the terms wind and indicator, are existing simple structures of interest through failure analysis would directly provide an estimate of the wind speeds that brought the bending or even toppling of the structure. The study includes an expansive field survey on affected areas, excluding inundated areas, in Region VIII, where the storm made landfall at peak intensity. Computational Fluid Dynamics (CFD) was used to determine the wind speeds that initiated the failure, either yielding or localized buckling. The direction of failure/deformation is taken into account in order to establish an estimated time of failure, which in turn directly reflects on the proximity of the storm at the time of the arrival of the winds that caused the structural failure. Using digital image correlation of the satellite images or the gradient wind equation from the approximation of pressure profile of the storm, the radial profile of the storm, before and during landfall are established. This can then be used to estimate the winds on the cyclone's eyewall from the computed wind speed experienced by the windicator. The study determined through analysis of five windicators, that Typhoon Haiyan has 1-minute sustained winds of 351 kph, 10-minute sustained winds of 290 kph, both estimated intensities before landfall at Leyte, and a minimum central pressure of 872.2 mbar, using Holland's approximation and from the recorded pressure of 910 mbar from Guiuan Weather Station of PAGASA. (**Author's abstract**)

Keywords: *Windicators, Typhoon Haiyan, Forensic Structural Analysis, Computational Fluid Dynamics, Wind Engineering, Geophysical Fluid Dynamics, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 1, 1-14
2018,

0132

Evaluating the effectiveness of the rapid test kit used in the field monitoring of iodine content of salt in the Philippine market

Palma, Alexander Michael G. , Llaguno, Erick

With its ease of use and the minimal training required, the Rapid Test Kit (RTK) has been found to be suitable for field monitoring of compliance to government programs promoting salt iodization in the Philippines and in other countries. The test consists of adding two drops of the test solution on the surface of the salt and comparing the resulting color with the color chart included in the kit.

It has been shown that the colors in the accompanying chart simply do not match with those observed when test solutions are applied on the samples. The tests resulted to colors representing different shades of purple while the existing color chart in RTK presents shades of gray. A scoring system based on different shades of purple was used to quantify the results and allow the conduct of statistical analysis.

To further evaluate the effectiveness of the RTK to distinguish the different levels of iodization in the salt i.e. non-iodized (5ppm and below), inadequately iodized (10, 15, 20, and 25 ppm) and adequately iodized (30, 35, and 44ppm), experimental design and measurement system capability (Attribute Gage Repeatability and Reproducibility or Gage R&R) analyses were undertaken.

Results from the experimental design show that the type of salt used–whether Local Solar, Imported Solar, Pure Dried Vacuum (PDV) or Cooked Salt–do not affect the resulting color (score) when the test solution is applied. There is no 'type of salt effect' and only the amount of iodine in the salt contributes to the variation in the shades of purple observed.

Further, the tests showed that inspectors had difficulty assessing samples within the inadequately iodized range. Iodine concentration levels at the lower rung of this range tend to be misclassified as 'poorly iodized' while those at the upper end of the range tend to be judged as 'adequately iodized'.

From the results of the experiments, three Reference Charts (5 ppm, 30 ppm and chart containing both colors for 5 ppm and 30 ppm) were proposed to replace the existing ineffective chart. These charts were evaluated in their ability to discriminate between the different levels of salt iodization.

Of the 3 proposed Reference Charts tested, the one involving one color only for 5 ppm is the most effective i.e. high percentage of agreement between inspectors on their judgements and that their judgements match the actual iodine concentration levels.

If the government will continue to use the RTK measurement system, the reference chart for one color for 5 ppm is the preferred replacement for the existing chart. However, its limitation should be recognized in that it can only confidently state that a salt sample is either 'poorly iodized' or at the very least, inadequately iodized. (**Authors' abstract**)

Keywords: *Rapid Test Kit, Measurement System Capability, Salt Iodization, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 1, 1-16
2017,

0133

Experimental investigation of jalousie type window frames subjected to static wind pressure

Carandang, Alvin Junor , Acosta, Timoth

Glazing components of a building envelope refer to windows, doors, or any portions made of glass that permit light and provide an outside view of a building. However, in the presence of severe winds, glazing components are prone to failure. This study experimentally investigated the capacity of typical jalousie type window frames against simulated static wind pressures. The static wind pressures were simulated inside an air chamber to create a pressure difference across samples. In this study, five large-scale tests were performed where four of which experienced pull-through failures of the standard aluminum casing and one of which experienced breakage of glass blades. A four-point bending test was also done to measure the capacity of the glass subjected to uniform pressure. It was observed that the governing mode of failure for the window system was the pull-through failure at a mean pressure capacity of 4.218 kPa with a coefficient of variance of 0.23. The capacity of the glass was observed to fail at a higher mean pressure of 6.508 kPa with a coefficient of variance of 0.25. The threshold capacity obtained from this study will be useful for developing fragility curves of buildings in future studies. (**Author's abstract**)

Keywords: *Jalousie, Window frame, Static Wind Pressure, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 2, 1-14
2018,
(Filipiniana Analytics)
NP

0134

Feasibility based design of hybrid electric vehicles for public transportation in the Philippines

Denoga, Gerald

The research is about the feasibility of adopting a novel parallel-series hybrid drive train for public transportation in the Philippines. The drive train will initially be designed to meet the performance requirements of existing public utility jeepneys. The design will then be evaluated against both a technical and an economic feasibility criterion. The technical criterion includes simulating the performance of the hybrid vehicle in the context of local PUV drive cycles, to arrive at estimates of fuel economy, battery requirements and refinements in gearing, motor and engine sizing. The economic feasibility will then be analyzed based on potential fuel savings checked against current fuel prices, prevailing interest rates, operating routes and schedules, maintenance costs and the market prices of the power train components. Discussion of the feasibility of the hybrid PUV will include possible changes in the design, acquisition, and operation of the drive train. Mentioned also are the implications on individual driver income, national economy, environment, and local industries. (**Author's abstract**)

Keywords: *parallel series hybrid, public transportation, feasibility, total cost of ownership, life cycle analysis, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-14
2017,
(Filipiniana Analytics)
NP

0135

Inventory control heuristic for a perishable item under stochastic demand and restricted batch size

Ani, Angelo C., Martinez, Iris Ann G. , Arriola, III, Claro A

This paper considers a type of inventory problem that deals with perishable item. The problem, which the authors believe has its main application in quick-service systems, such as fast food restaurants and similar systems, assumes that the item has a fixed lifetime and fixed lead time. The production of the item uses limited-capacity equipment that prepares the item in batches. Inventory review is done periodically. Demand for the item exhibits seasonal fluctuations throughout the planning horizon, and shortage results in lost sales. Unsold items exceeding allowed shelf life are set aside for disposal. Two heuristics were developed in order to identify the number of batches to be prepared at the start of each period. Cost considerations include setup costs, shortage cost, and excess cost. As part of the research, the heuristics were tested using real instances from an actual system. The approach is found to be successful in finding satisfactory solutions for the realistic target cases and specified metrics. (**Author's abstract**)

Keywords: *perishable items, heuristics, stochastic inventory model, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-16
2017,
(Filipiniana Analytics)
NP

0136

A method of determination of the start and end of combustion in a direct injection diesel engine using the net heat release rate

Reyes, Joseph Gerard T., Quiros Edwin N

Biodiesels have been reported to produce higher amounts of NOx and other regulated emissions as opposed to neat diesel. The use of biofuels in the Philippines is mandated by Republic Act 9467. Concurrently, RA 8749 regulates, among other sources, emissions of compression ignition engines. This necessitates further analysis on the use of biodiesel blends in conventional diesel engines in order to check conformance with both laws. With the country recently acquiring a sophisticated engine test facility, users need to be given procedures in order to facilitate their investigations. Studies suggest that the amount of biodiesel emissions are related to ignition delay and combustion duration of diesel engines due to engine system response to the properties of biodiesels. Ignition delay is the duration in crank angle from the start of injection (SOI) of fuel into the engine cylinder until the start of combustion (SOC) of the fuel-air mixture. The combustion duration is the duration in crank angle bounded SOC and end of combustion (EOC). For compression-ignition engines, such as diesel engines, several approaches were developed and utilized in order to pinpoint the crank angle for the SOI, SOC and EOC. Some of these approaches required the use of specialized and dedicated equipment that would be found only in facilities that could afford to acquire them. Other methods estimated SOC using maximum of the 2nd or 3rd order derivatives of recorded in-cylinder pressures. These pressure data may also be utilized together with the corresponding cylinder volumes to generate the net heat release rate (NHRR), which shows the trend of heat transfer to the gases enclosed in the engine cylinder. The start of combustion is then determined at the point where the value of the NHRR is minimum and followed by a rapid increase in value, whereas the EOC is at the crank angle where the NHRR becomes zero prior to the exhaust stroke of the engine. In this study, a method of determining SOI, SOC and EOC was developed using injection line and in-cylinder pressures data recorded from tests of a common rail direct injection diesel engine. This proposed method was then matched against two distinct test criteria for SOC to test its feasibility and results have shown conformance to the two criteria. (**Author's abstract**)

Keywords: *common rail direct injection (CRDI) compression-ignition engines, start of injection, start of combustion, ignition delay, end of combustion, net heat release rate, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-13
2017,
(Filipiniana Analytics)
NP

0137

Multivariate logistic regression approach for landslide susceptibility assessment of Antipolo, Rizal

Zarco, Mark Albert H. , Victor, Jaime Ang

Slope instability associated with heavy rainfall or earthquake is a familiar geotechnical problem in the Philippines. This study aims to perform a detailed landslide susceptibility assessment of Antipolo City using a statistical approach. In this study, morphologic and non-morphologic factors contributing to landslide occurrence and their corresponding spatial relationships were considered. The multivariate logistic regression was performed in randomly selected datasets based on the landslide inventory. These were divided into training and test data sets based on K-cross fold validation scheme resulting to different models. The model selected for the final implementation has an overall accuracy of 91.66%, AUROC of 0.908, standard error of 0.002 and RMSE of 0.2478. Cross validation with deterministic approach using physically based slope stability models were performed, where there was no significant difference between the two approaches in identifying areas of highly and very highly susceptible to landslide occurrence. The study also shows that almost 40% of Antipolo City has been assessed to be potentially dangerous areas in terms of landslide occurrence. (**Author's abstract**)

Keywords: *Landslide Susceptibility Assessment, Logistic Regression, Slope Stability, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 2, 1-14
2018,
(Filipiniana Analytics)
NP

0138

Nondestructive evaluation of masonry materials used in historic Philippine structures: case study of structural performance of Manila Cathedral

Antonio, Jr., Oscar Victor M. , Piedad, Melmar B. , Peralta, Mathew Har

Due to numerous tectonic activities in the Philippines, many old heritage structures are susceptible to damage. These structures are mostly made of adobe, clay, bricks, and the like, which are inhomogeneous and contain cracks of variable sizes. As a step towards preservation, this research aimed to develop correlations between mechanical properties of materials such as Young's modulus of elasticity and uniaxial compressive strength which are usually determined using destructive tests, and nondestructive parameters, such as ultrasonic pulse velocity and wave attenuation. Ultrasonic testing was conducted to determine wave characteristics of different masonry materials used in old Philippine structures. The correlations obtained between these properties and the material properties obtained from destructive testing gave high values of coefficient of determination, resulting in a viable basis for modeling. To demonstrate the usefulness of this method, data from in situ nondestructive tests were used as parameters in the

correlations for the material comprising the Manila Metropolitan Cathedral-Basilica. Using the mechanical properties obtained, a structural model was created through the commercial program SAP2000. Both strength-based and time-history analyses were employed to determine the displacement and stress distribution on the structure when subjected to different load combinations. Results of the analyses confirmed that unreinforced masonry structures may fail due to excessive tensile stresses on certain parts of the structure. (**Author's abstract**)

Keywords: *ultrasonic pulse velocity, nondestrucive testing, masonry materials, Youngs modulus of elasticity, uniaxial compressive strength, strength based analysis, nonlinear modal time-history analysis Nomenclatur, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 1, 1-14
2017,
(Filipiniana Analytics)
NP

0139

Operational cost comparison of alternative fuel vehicles for public transportation

Mercado, Jose Gabriel E., Quiros, Edwin N

This paper presents the operational cost analysis of different alternative fuel vehicles used for Public Utility Jeepneys (PUJ's) in Metro Manila. Four models were generated using data from the UP-SM North Jeepney route. Model A used actual data gathered from the on-road tests conducted. Model B did not consider the downtime days to normalize the daily net income. Model C kept the costs not related to fuel and maintenance, jeepney fare, and data influence by the preference of the driver, constant. Model D assumed only jeepney type varied, without accounting for any preference for any preference mentioned in Model C. For all models, in terms of Fuel Cost (PhP) per Passenger-km, the Electric Jeepney is 35-49% more economical and has 1%-36% higher net income vs Diesel Jeepney. However, the LPG jeepney is less economical by 8%-18% vs Diesel Jeepney in Models A-C but more economical by 4% in Model D due to higher cost of Diesel fuel. In terms of Net Income (PhP) per Passenger-km, LPG Jeepney has 10% lower income vs Diesel Jeepney in Models A&B but has 5% higher income in Models C&D as considered days are the same, thereby minimizing differences in the number of passengers that affects both parameters. (**Author's abstract**)

Keywords: *jeepney, alternative fuels, operational cost analysis, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 1, 1-12
2018,
(Filipiniana Analytics)
NP

0140

A programmable testbed for spectrum survey in the Philippines: measurements and analyses

Abrenica, Carl Anthony M. , Marciano, Jr. Joel Joseph S. , Salvatus, Janette G. , Guillen, Neil Daniel B. , Lopez, Aristotle D. , Pintor, Annie L

This study investigates white spaces in the frequency range 410 MHz to 960 MHz using a programmable measurement testbed. Radio spectrum scanning was performed for a total of 144 hours (6 days at 24 hours/day) with the main objective of identifying and quantifying the white space contained in the said bandwidth as a preliminary phase in

developing a repository for spectrum utilization in future work. Channel occupancy based on NTC's 2016 channel plan was evaluated herewith. Results show underutilization of the observed bandwidth, with highest average channel occupancy to be 45.12% which is utilized by Cellular Mobile Telephone System in the frequency band, 925 to 960 MHz. Occupancy results show that the observed frequency band contains a large amount of white space. This could be used for different applications, whether for connectivity improvement, government's social services or simply public awareness of the spectrum utilization. This study serves as a foundation for future studies that may include a real-time spectrum observatory and similar applications. (**Author's abstract**)

Keywords: *white space, channel occupancy, channel plan, average power levels, power spectrum, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 1, 1-16
2018,
(Filipiniana Analytics)
NP

0141

A proposal of a demand shifting function to address the demand-capacity imbalance of capacity-constrained systems that shift demand by discount setting

Lorenzo, Lowell , Martinez, Iris Ann , Boydon, Christia

This paper addresses the problem of low profit of service establishments because of the imbalance between capacity and demand. The hypothesis of this paper is that profit can be maximized by shifting demand from high demand periods to low demand periods. The proposal of this research is to shift the demand through discount setting that is structured and optimized, which is the demand shifting function to be applied to maximize profit. This paper states general framework and the specific method to arrive at the recommended demand shifting function. Furthermore, it is applied to a real test case of a spa service facility. Results show that for the test case, profit is increased and the variability of demand among time periods is decreased. (**Author's abstract**)

Keywords: *demand-capacity imbalance, demand shifting function, service facility, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 2, 1-10
2018,
(Filipiniana Analytics)
NP

0142

A simple hinge model for displacement-based nonlinear analysis of reinforced concrete columns

Tingatinga, Eric Augustus J. , Garcia, Patrick Aylswo

During strong earthquakes, reinforced concrete (RC) structures experience cyclic lateral loads that result to degradation in load-carrying capacity, and failure of columns in shear and/or flexure. This study presents a simple hysteretic hinge model that may be used in displacement-based analysis of RC columns, classified as flexure critical, shear critical, and shear-flexure critical, subjected to cyclic loads. The proposed hinge model made up of zero-length nonlinear springs can simulate the hysteretic behavior of reinforced concrete material in axial, shear, and flexure. The nonlinear parameters of the springs were derived from geometric and material properties of the column and estimated

using Response-2000 software. Pushover analysis and response to cyclic loading were performed using the Open System for Earthquake Engineering Simulation (OpenSees) program and validated by comparing the force-displacement response of select forty-three RC columns available in the PEER Structural Performance Database. Results show that for the six rectangular columns, the numerical experiments using the proposed hinge model and the actual force-displacement curves gave R-squared values greater than 0.80 signifying good agreement of results. Therefore, it was concluded that the model can reasonably replicate nonlinear behavior of shear-, shear-flexure, and flexure-critical columns subjected to cyclic loading and, therefore, may be used to assess performance of actual RC columns. (**Author's abstract**)

Keywords: *hinge model, reinforced concrete, performance assessment, OpenSees, column, Engineering*

Philippine Engineering Journal, Volume No. 39 Issue No. 2, 1-10
2018,
(Filipiniana Analytics)
NP

0143

Statistical analysis of the effect of CME-diesel blends on the performance of a light duty common rail direct injection engine

Mercado, Jose Gabriel E. , Balbarona, Juvy A. , Denoga, Gerald

This paper presents the effect of coconut methyl ester (CME) biodiesel blends in the performance of a light duty automotive common rail direct injection engine. Total of six fuel blends – B0 (Neat Diesel), B2 (2% CME, 98% B0), B5 (5% CME, 95% B0), B10 (10% CME, 90% B0), B15 (15% CME, 85% B0) and B20 (20% CME, 80% B0) were tested for performance at 100% load with varying speeds from 800 RPM to 2400 RPM at an interval of 400 RPM. At this typical engine speed range, no significant differences for biodiesel blends versus neat diesel were observed for torque. (**Author's abstract**)

Keywords: *CME blend, biodiesel, engine torque, Engineering*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-12
2017,
(Filipiniana Analytics)
NP

ENVIRONMENTAL SCIENCE

0144

Local adaptation to climate change: strategies of farmers, employees, and local businessmen

Bernardo, Eil

This study was aimed at determining some local adaptation strategies to climate change by various socioeconomic groups in the municipality of Cabagan. These groups include farmers, employees, and local businessmen. Data were gathered from fifteen farmer respondents, thirteen employees from government and private agencies and twelve local entrepreneurs. The study showed that the respondents were aware of climate change. The respondents said they felt

the impacts of climate change such as the following: low agricultural production, increase in prices of commodities, and decrease in sales. The respondents performed activities to minimize the effects of climate change. Some of these practices are as follows: adjusting the plant calendar by the farmers, the employees and local businessmen practice water harvesting, selling recyclable materials, and using public transportation, to name a few. They did simple practices, yet these were actually good adaptation strategies to climate change. (**Author's abstract**)

Keywords: *Climate change, Adaptation strategies, Climate change impacts, El Nino, La Nina, Environmental science*

Cabagan Journal of Research, Volume No. 19 Issue No. 2, 1-8
2010/12,
(Filipiniana Analytics)
NP

GEOLOGY

0145

Process water use and water quality in selected small scale gold processing sites in the Philippines

Soriano, Virginia J. , Soriano, Robe

Small-scale gold production contributes significantly to the total value of gold mined in the country. While the economic benefits from small scale gold production are promising, certain concerns such as water management and heavy metal pollution have been raised. This study provides actual documentation at nine observation sites across the Philippines to quantify the use of process water and the changes in water quality indicators in small-scale gold production. The results show a wide variability in the amount of water use due to the choice of method employed in the recovery of gold. Process water was measured to range from 1,424 to 38,512 liters per ton of ore with a mean of 17,723 liters per ton of ore. On the average, the process water usage associated with sluicing, milling, cyanidation, and panning accounted for 79%, 16%, 4%, and 1% of the total process water, respectively. The laboratory analysis of the process water also showed that heavy metal content for arsenic, cadmium, mercury, and lead above the effluent standards for gold ore mining were detected in some stages during the gold extraction process. The results can be used to identify potential stages in improving the efficiency of water use in the gold extraction stage for small scale facilities and in adopting water saving alternatives. Furthermore, the results can be useful for identifying the potential impacts and proper management of the effluents from the processes. Recommendations to improve management of water resource and water quality are discussed and presented. (**Author's abstract**)

Keywords: *Sustainability, Small scale gold production, Water use, Water quality, Geology*

Philippine Engineering Journal, Volume No. 38 Issue No. 2, 1-20
2017,
(Filipiniana Analytics)
NP

INDUSTRY

0146

21 Biomass Projects Selected among The Hundred New Energy Developments

The share of so-called new energy in Japan in FY2006 remained at only 2.2% (excluding hydro-as well as geothermal power) among the total primary energy supply of the country. The total amount of new energy of the year as crude oil equivalent was 12.62 million KL in which solar-power was 0.418 (3% of new energy), wind-power 0.617 (5%), waste and biomass power generation 2.905 (23%), biomass heating 1.56 (12%), other heating in total amounted to 7.12 million KL (57%) respectively. Japan aims at raising the new energy's share up to 3% by FY 2010.

On 22 April 2009, NEDO (New Energy and Industrial Technology Development Organization) presented "The Hundred New Energy Developments". NEDO intends to make the nation informed of excellent utilization of new energy, for this purpose NEDO has selected one hundred outstanding new energy developments, out of numerous efforts undertaken in many parts of Japan utilizing wind power, solar power, biomass power and so on.

Twenty-one biomass-related developments have been selected, showing the largest share among the hundred. Unused woody biomass in mountainous region is utilizes as fuel, and woody biomass utilization brings out the vigor of the regional economy. (**Author's abstract**)

Keywords: *new energy, Japan, biofuel, woody biomass utilization, solar power, wind power, waste and biomass power generation, biomass heating, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/05,
(Filipiniana Analytics)

0147

40 yen/liter of bioethanol is the goal!

Japanese Government attaches importance to biofuels as one of the countermeasures for global warming. The government plans to increase domestic biofuel production that is to be used in the transport industry, to an amount equivalent to a half million ton of crude oil, by 2010.

In order to achieve this goal, "Innovative Bioethanol Technology Research Union" was founded in late February 2009, jointly by Nippon Oil Corporation(ENEOS), Mitsubishi Heavy Industries, Ltd.(MHI), Toyota Motor Corporation, Kajima Corporation, Sapporo Engineering Ltd., and Toray Industries, Inc. The Union aims to realize a steady supply of low-price bioethanol supported by domestic capitals, and by uniting various technology components that are peculiar to and strong point of each one of these companies.

The Union's present goal is, by 2015, to establish production technology for supplying 40 yen/liter bioethanol, which is competitive with crude oil price today. This price setting was decided by looking at US price setting of 36 yen/liter equivalent by 2012. US government has set a goal of 28.4 million kl (75 billion gallon) bioethanol consumption in 2012.

Through R&D effort, the union strives for establishing an epoch-making innovative integrated production technology for cellulose-origin bioethanol that would not compete nor interfere with existing agricultural food production. At this moment their goal is a production plant of 200,000 kl per year. This R&D project is conducted in association with the University of Tokyo, the National Agriculture and Food Research Organization (NARO), and the Forestry and Forest Products Research Institute (FFPRI). The estimated research budget reportedly amounts to some tens of billion yen during five years from FY 2009 to FY 2013. (**Author's abstract**)

Keywords: *Japan, biofuel, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0148

The 9th EAS (East Asia Summit) energy cooperation task force meeting

The 9th EAS (East Asia Summit) Energy Cooperation Task Force Meeting was held at Kuala Lumpur in Malaysia on 24th March 2009. The participating countries were 14 countries (ASEAN + 6 countries) such as Singapore, Brunei, Thailand, Indonesia, Malaysia, Philippines, Cambodia, Myanmar, Vietnam, Japan, Korea, India, Australia, and New Zealand (Laos and China were not present). The bureau of ASEAN and Staffs of ASEAN Energy Center attended this meeting and energy cooperation of each country was reported and discussed.

Asia Biomass Energy Cooperation Promote Office of NEF (New Enegy Foundation) presented Asia Biomass Energy Researchers Invitation Program at this meeting. This Invitation program was highly appreciated in effective program to strengthen the cooperation ties between ASEAN + 6 countries more firmly. (**Author's abstract**)

Keywords: *ASEAN, East Asia Summit, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0149

Acceleration of domestic production/use of bioethanol

The Japanese Government has designated a set of target values for promoting the use of domestic bioethanol, a gasoline substitute, as 50,000 KL in FY 2010, 1,000,000 KL in FY 2020, and 3,800, 000 KL in FY2030. In this consequence, a rapid expansion of the use of domestic bioethanol is taking place in many districts in Japan.

A proof project for E3 (gasoline containing 3% of bioethanol) utilization has been started in Tokyo metropolitan area. Under the contract to the Ministry of Environment, The Japan-Brazil Ethanol Co. is supplying E3 to a gas station for government cars located in the Shinjuku Gyoen Park since April 2009. The bioethanol mixed in this E3 is the product of the Bioethanol Japan Kansai Co. based in Sakai city. This proof project in the metropolis that is the greatest gasoline-consuming area would be the most important step for popular use of E3 all over the country.

JA (the Japan Agricultural Cooperatives) in Niigata prefecture has been operating a throughput business including cultivation of rice crop (of non-food kind; raw material for bioethanol), production of bioethanol, and sales of E3 (gasoline with 3% of bioethanol). “Green Gasoline” is the brand name of this E3 that has been on sale in Niigata prefecture since July 2009. This throughput business of E3 has been given a favor from local gasoline consumers who think that rice fields of the district is well utilized, and that use of ecologically harmless fuel is welcome and will be popularized.

Recently, Okayama prefecture office has been promoting the introduction of bioethanol, and the office has started a proof running experiment of automobiles using E10 (gasoline containing 10% of bioethanol) in the end of August 2009, jointly with the Mitsubishi Motors Co. The bioethanol is supplied from a test plant operated by the Mitsui Zosen Co. in Maniwa City in Okayama. The test plant produces bioethanol using waste wood discharged from local lumber mills. The test car is one of "Pajero" cars made by Mitsubishi Motors Co. Detailed investigation will be made on exhaust gas properties and endurance capability of mechanical parts in the fuel system, by running the car more than 30,000 km distance. (**Author's abstract**)

Keywords: *bioethanol, Japan, E3-gasoline, rice crop, green gasoline, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0150

Achieving artificial photosynthesis energy conversion more efficiently than plants

Toyota Central R&D Labs, Inc. announced that in February 2016 they achieved the world's highest energy conversion efficiency rate of 4.6% with artificial photosynthesis, using water and carbon dioxide as raw materials and sunlight as energy to produce useful materials. In 2011, Toyota Central had managed an energy conversion efficiency rate of just 0.04%, but by developing a semiconductor substrates using iridium and ruthenium catalyst, they succeeded in increasing the efficiency rate a hundred-fold.

In September 2014, Panasonic Corporation managed to achieve a conversion efficiency rate of 0.3%, becoming the first to exceed the rate of 0.2% for regular plants, and in November of that same year, Toshiba reached 1.5%, which was then followed by 2.0% achieved by the Japan Technological Research Association of Artificial Photosynthetic Chemical Process (ARPChem) in February 2015. Now an even greater conversion efficiency has been achieved, highlighting Japan's remarkable accomplishments in this field. The goal of artificial photosynthesis is to manufacture fuels such as hydrogen, methane and alcohol and chemical raw materials such as ethylene and propylene from the carbon dioxide produced by facilities such as thermal power plants, and ARPChem aims to achieve a conversion efficiency of 10% in 2021. (**Author's abstract**)

Keywords: *artificial photosynthesis, energy conservation, semiconductor substrates, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/03,
(Filipiniana Analytics)

0151

Achieving substantial energy saving effects for bioethanol production

On February 2, 2012, the University of Tokyo and Nippon Steel Engineering Co., Ltd. announced that they had developed a technology that reduces energy by 85% in the distillation process for bioethanol production. The theory of "self-heat recuperation" advocated by Professor Tsutsumi Atsushi from the Institute of Industrial Science at the

University of Tokyo was applied to the distillation process for bioethanol production. Verification and testing equipment located at Nippon Steel Engineering Co., Ltd.'s Kitakyushu Environmental Technology Center was used to confirm its energy saving effects. This was the world's first demonstration of self-heat recuperation theory.

With self-heat recuperation the steam generated during the production process is compressed to increase it to a high temperature so that it can once again be used as a heat source. As such, absolutely no heat needs to be added. Reusing the thermal energy obviates the need for additional fuel and makes it possible to achieve substantial energy saving effects.

The energy consumed in the distillation process accounts for more than 50% of the total used during the production of bioethanol, and so saving energy here constituted a significant challenge. But with self-heat recuperation technology, manufacturers can get by with using less than 50% of the conventional amount of energy consumed in the production of ethanol, owing to which substantial reductions in its production costs can be expected.

Self-heat recuperation can be applied to distillation, concentration, evaporation, drying, and other processes, and so the Institute of Industrial Science at the University of Tokyo will continue to work on disseminating and promoting this technology in other fields as well. Based upon these results, Nippon Steel Engineering Co., Ltd. plans to strengthen its biomass business both in Japan and overseas. (**Authors' abstract**)

Keywords: *bioethanol production, substantial energy, self-heat recuperation, biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/03,
(Filipiniana Analytics)

0152

Activities for spreading the use of biomass to Southeast Asia

Asian biomass resource is estimated to share around 40% of that of the whole world. Abundant biomass exists in Asia, especially in southeast Asia. By Using advanced biomass conversion technology of Japan on one hand, and by bringing abundant Asian biomass resources and native production technology on the other hand, it seems very advantageous to produce biomaterials as well as to generate energy from biomass. In this cooperation Japan and these Asian countries would gain big profit, and at the same time it would contribute to the conservation of global environment. For realizing this goal, various joint ventures and research projects are being eagerly undertaken or on the plan among these countries.

On February 12 and 13, 2009, a Japan-Thailand Joint Workshop was held at the Tsukuba Center of the National Institute of Advanced Industrial Science and Technology (AIST), where more than seventy Thai researchers and engineers attended.

This workshop covered a very broad area of modern practical science and technology, such as bioethanol, biodiesel fuel, biomaterial, life cycle assessment (LCA), photocatalyst, ceramic materials, information technology, medical technology for human welfare, biosensors and so on. Vivid presentations and hot discussions were made among the attendees in some existing cooperative research areas as well as in the other areas where future cooperative relations are being mutually sought.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) invited, from February 23 to March 2, 2009, a number of government officials from Thailand (four) and Vietnam (three), who are much interested to visit biomass towns in Japan. The visitors made a survey tour on some biomass utilization facilities. In Japan, utilization of biomass in local areas has been much advanced recently. The visitors are eager to bring back Japan's technology and know-how to

their homeland so that their nation may develop biomass-towns there. In farming villages of southeast Asia, it seems possible to utilize rice straw, rice husks and livestock excreta as biomass resources. (**Author's abstract**)

Keywords: *Japan, asian biomass resource, bioethanol, biodiesel fuel, life cycle assessment, photocatalyst, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0153

Adopting Japanese-made turbines for geothermal power in Indonesia

Indonesia is first in the world in terms of its geothermal resources, but third in the world in terms of its installed capacity, as is indicated in Fig. 1. The Indonesian government has been promoting the adoption of geothermal power with the objective of adopting approximately 4,000 MW in total by FY 2014 under its second crash program (2010 Presidential Decree). What is more, under Vision 25/25 by the Ministry of Energy and Mineral Resources the country has set the target of adopting a total of 12,000 MW by the year 2025.

The three Japanese companies of Toshiba Corporation, Mitsubishi Heavy Industries, Ltd., and Fuji Electric Co., Ltd. have captured more than 70% of the global share for steam turbines for geothermal power. After it received an order from Patuha Geothermal Power Plant in 2011, Toshiba Corporation received an order for three sets of 60 MW geothermal power turbines and generators from Sarulla Geothermal Power Plant in July 2014.

Sarulla Geothermal Power Plant has a structure whereby Sarulla Operations Ltd. serves as its developer, with this company funded through a joint investment by Itochu Corporation, Kyushu Electric Power Co., Inc., and Medco Power Indonesia (a total energy company from Indonesia), as well as Omat International, Inc. from the United States (a US company that manufactures, constructs, and operates geothermal equipment). In addition, Hyundai Engineering & Construction Co., Ltd. in South Korea is carrying out the engineering, procurement, and construction of the plant. After construction began on the 180 MW Sarulla Geothermal Power Plant in 2014, a plan to expand it into a 330 MW geothermal power plant, thereby making it one of the largest in the world, was worked out, and so the further involvement of Japanese companies is expected. (**Author's abstract**)

Keywords: *Indonesia, geothermal power, Japanese-made turbine, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/08,
(Filipiniana Analytics)

0154

Adoption and examination status for renewable energies in Brunei Darussalam

Brunei Darussalam is moving forward with examinations based around its adoption target figure of 10% for renewable energies by the year 2035, which the Energy Department announced in 2011. But according to statistics from 2012

(see Fig. 1), there was still virtually no renewable energies accounting for its primary energy, as these provide 2 GWh of electrical energy compared with the 3,930 GWh from thermal power generation.

In the Energy White Paper it released in 2014, the country indicated a target of increasing its electricity generated from renewable energies to 954 GWh by 2035 (see Fig. 2).

In order to promote the adoption of renewable energies in the future, in November 2014 the Brunei Institute of Technology announced research results related to the possibility of using agricultural waste for pyrolysis and gasification. According to this, Brunei Darussalam can use the coconut shells and fibers, corn fibers, rice husks, and sawdust generated from sawing shown in Table 1 as raw materials for pyrolysis and gasification. Out of all of these, sawdust is considered to be the most promising given its low moisture content and calorific value.

What is more, the roadmap formulated by the Energy Department and others in 2011 also incorporated items like connecting power generated from renewable energies to the power grid starting from 2020 and introducing a feed-in tariff (FIT). The hope is that the introduction of renewable energy will gain momentum in the future. (**Author's abstract**)

Keywords: *Brunei Darussalam, renewable energy, examination status, adoption status, agricultural waste, pyrolysis, gasification, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/01,
(Filipiniana Analytics)

0155

Adoption of bio jet fuel for the 2020 Olympic and Paralympic Games in Tokyo

As symbolized by the rapid proliferation of low-cost carriers (LCCs), the amount of energy consumed by the air transportation sector is on the rise worldwide, amounting to about 2% of net emissions of CO_2 globally. In response to this, the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) have been spearheading efforts to improve fuel efficiency and for the practical use of renewable jet fuels in the aim of reducing the amount of greenhouse gases (GHGs) emitted by aviation-related agencies around the world. The IATA has set the ambitious environmental target of reducing the aviation industry's CO_2 emissions by 50% by the year 2050 relative to their 2005 levels.

When it comes to Japanese airline companies, in 2009 Japan Airlines Co., Ltd. (JAL) began test flights using bio jet fuel, with All Nippon Airways Co., Ltd. (ANA) and Nippon Cargo Airlines, Limited (NCA) doing the same in 2012 (Table 1). However, jet fuel is strictly standardized, and so as things currently stand they are limited to mixing this in with petroleum-based jet fuel, with the development of fuels with better suited ingredients underway.

Given such developments, the Ministry of Land, Infrastructure, Transport and Tourism established the Committee for the Study of a Process Leading to Introduction of Bio Jet Fuel for the 2020 Summer Olympic Games and Paralympic Games in Tokyo, which held its first meeting on July 7, 2015. The three items below are the major subjects it considered.

Plan for flights using bio jet fuel for the 2020 Summer Olympic Games and Paralympic Games in Tokyo; setting in place an environment for supplying bio jet fuel; and reassessing domestic bio jet fuel production.

The process study committee has set up the Supply Chain Working Group to scrutinize issues like supply chains for the Olympics, and the Fuel Production Working Group to scrutinize the quantities of such fuel that can be provided. These groups will move forward with specific considerations. (**Author's abstract**)

Keywords: *Japan, bio jet fuel, olympic games, paralympic games, renewable energy, fuel efficiency, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,
(Filipiniana Analytics)

0156

Adoption status of biodiesel fuel (BDF) in Indonesia

Indonesia is promoting the adoption of biodiesel fuel (BDF) in order to reduce its imports of petroleum and foster the palm oil industry. The Ministry of Energy and Mineral Resources (MEMR) of Indonesia enacted mandatory targets for the ratio of BDF to be intermixed in fuel in 2008, which are shown in Fig. 1. The targets call for ratios of 5-10% by 2015, and as the adoption results for 2013 for the transportation sector shown in Fig. 2 indicate, this came to 5.57% for this sector, thereby largely achieving the target values. Yet on the other hand, the adoption of BDF has not made progress in the industry and electricity sectors.

In order to promote the adoption of BDF across all sectors, including industry and electricity, in 2013 the MEMR raised the target ratios for the intermixing of BDF by 2015 for each sector shown in Fig. 3 from the 5-10% in Fig. 1 to 10-25%. What is more, as can be seen from Fig. 1 and Fig. 3, the MEMR has decided to ultimately set the target values for each sector at 25-30%, as opposed to 20%, for 2025.

Indonesia has high target values internationally for the adoption of BDF, and research is moving forward on the impact that the large-scale adoption of BDF would have on machinery. For example, preparations for the full-scale adoption of BDF are being promoted through research on: (1) The impact from whether public power companies in Indonesia use filtration treatment on fuel for their power plants, and (2) the impact this will have on the durability of diesel engines being done by the Bandung Institute of Technology, a representative research institute within Indonesia. (**Author's abstract**)

Keywords: *Indonesia, biodiesel fuel, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/12,
(Filipiniana Analytics)

0157

Advances in concentrating solar power (CSP) in China

In China's Twelfth Five-Year Plan (2011-2015), targets for the adoption of concentrating solar power (CSP) have been set at 1 GW by 2015 and 3 GW by 2020. In response to this plan, two commercial CSP plans are currently underway in Delingha City in Qinghai Province (see Fig. 1).

One is a project by SUPCON Solar Technology Co., Ltd., which completed a 10 MW plant and began producing electricity in July 2013, with this slated to ultimately be expanded to 50 MW. The second is a 50 MW CSP project by China Guangdong Nuclear Solar Energy Development Co., Ltd. (CGNSED), of which construction began in July 2014.

In August 2014, the central government (National Development and Reform Commission) approved a feed-in tariff (FIT) of 1.2 yuan per kWh for the CSP project by SUPCON Solar Technology Co., Ltd. This is the first time a FIT has been approved for a CSP project. China does not yet have a uniform price for FITs for CSP projects, but rather is at the stage where these are considered individually for separate projects. But since it has demonstrated the potential for FITs to be adopted, this has raised the hopes of related companies. A close watch will be kept on future developments geared towards achieving these adoption targets. (**Author's abstract**)

Keywords: *China, concentrating solar power, solar energy, solar project, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/01,
(Filipiniana Analytics)

0158

Advances in Manufacturing Bioethanol from Marine Algae

While research on the production of bio oil is actively being carried out for microalgae, there has been a lack of progress with the use of biomass energy from marine algae. The reasons for this are because producing bioethanol from the polysaccharides contained in terrestrial crops is comparatively easier, and because ethanol fermentation is difficult because the polysaccharides in marine algae differ from the cellulose and starch found in terrestrial plants.

Large marine algae are broken down into green algae, brown algae, and red algae, as shown in Table 1. Of these, there is a large volume of brown algae resources, which include kelp, *Undaria pinnatifida*, *Sargassum fulvellum*, and more. However, brown algae differ from green algae, which contains a great deal of cellulose and starch, in that it also contains complex components aside from cellulose like mannitol, laminarin, and alginic acid. These other non-cellulose parts are left behind as reside without undergoing ethanol fermentation.

Under such circumstances, in October 2015 Kyoto University reported a technology for converting alginic acid, which previously could not be broken down, into ethanol by using a genetically modified enzyme on *Ecklonia kurome*, which is a type of brown algae. What is more, in November 2015 Mie University reported that it had discovered a new type of bacterium that breaks down the cellulose, hemicellulose, alginic acid, and mannitol in brown algae species in the alimentary canal of abalone, for which marine algae is their preferred food source. This bacterium can also be used in the production of bioethanol from corn, sugarcane, and more.

This second case is a result of a project in the Japan Science and Technology Agency's (JST) Strategic Basic Research Programs (CREST), with the expectation that it will be implemented and scaled-up in the future. (**Author's abstract**)

Keywords: *marine algae, Undaria pinnatifida, Sargassum fulvellum, Ecklonia kurome, bioethanol, polysaccharides, cellulose, alginic acid, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/12,
(Filipiniana Analytics)

0159

Advances in perovskite solar cells from Japan

A new solar cell that was developed by Japanese researchers has been garnering international attention. In 2009, a group led by Professor Tsutomu Miyasaka from Toin University of Yokohama identified the ability of compound thin films with a crystalline structure known as perovskite to function as solar cells, and verified that its generating efficiency was 3.9%. Later, in 2012, as a result of advances made through joint research between Toin University of Yokohama and the University of Oxford, a maximum generating efficiency of 10.9% was achieved, which has been earning attention from around the world. The National Renewable Energy Laboratory (NREL) in the United States investigates and publicly announces the efficiency of solar cells from around the world. It announced that as of June 2015, a perovskite solar cell developed by the Korea Research Institute of Chemical Technology had demonstrated a maximum efficiency of 20.1%.

A mere six years since they were first announced, perovskite solar cells have achieved a generating efficiency that surpasses not only that of crystalline silicon solar cells, but also amorphous silicon solar cells, organic thin-film solar cells, and dye sensitized solar cells (see Fig. 1).

Perovskite is a type of crystalline structure, and shares the same name with another type of crystalline structure. Those that are currently being studied as solar cells can be expressed by the chemical formulas $CH_3NH_3PbBr_3$ and $CH_3NH_3PbI_3$ (see Fig. 2). The solar cells can be formed simply by applying a solution that serves as the raw materials over a porous membrane of titanium oxide. As a result, not only do the solar cells have a high generating efficiency, but it is also expected that they will be low-cost as well. (**Author's abstract**)

Keywords: *Japan, perovskite, solar power, renewable energy, solar cells, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/07,
(Filipiniana Analytics)

0160

Advances in Power Generation from Unused Wood Biomass

Advances are being made in the introduction of biomass power generation that were instigated by the feed-in tariff (FIT) scheme for renewable energy that was adopted in 2012. The number of facilities that have newly received FIT authorization as of the end of April 2015 comes to 284, with a generating capacity of 2,084 MW. There have also been 106 facilities that were newly installed, with their generating capacity coming to 269 MW. Of these, the number of authorized facilities for power generated from methane fermentation gas comes to 111, with the number of authorized wood biomass power generation facilities almost identical at 105. But when this is viewed in terms of their installed capacities, power generated from wood biomass is 50-times greater than that for power generated from methane fermentation gas (Table 1). Furthermore, within wood biomass, unused wood has accounted for the majority of the installed capacity adopted after the FIT scheme, while general wood accounts for most of the authorized capacity, including for facilities to be installed hereafter, with the expectation that this will grow in the future.

At the meeting of the Procurement Price Calculation Committee, which revises the fixed purchase price for FIT, that was held in February 2015, it was decided that the purchase price for power generated from unused wood biomass of less than 2,000 kW would be raised starting in FY 2015, as shown in Table 2.

The following advantages have been raised as reasons for this: 1. Biomass power generation is a stable renewable energy with minimal fluctuation in output. 2. As the introduction of small-scale power generation from unused wood biomass progresses, new demand for forest timber offcuts, such as thinned wood that until now had been abandoned, will be created. At the same time, this will also contribute greatly to revitalizing local regions in conjunction with forestry policies, through things like making efficient use of resources and increasing employment in local regions. 3.

The procurement prices thus far have been based on the assumption of a large project scale, and the regions in which resources commensurate with this scale can be gathered are limited. In order to promote the use of unused wood biomass in the future, it will be necessary to promote small-scale power generation from unused wood biomass, which is estimated to be profitable even in regions with poor conditions.

Table 3 shows examples of unused wood biomass power plants that are less than 2,000 kW. The revised fixed purchase price will be applied to power plants of less than 2,000kW that have already been authorized as an exception. The hope is that this series of new policies for unused wood biomass will promote the introduction of small-scale unused wood biofuel. (**Author's abstract**)

Keywords: *power generation, unused woody biomass, methane fermentation gas, biomass, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/12,
(Filipiniana Analytics)

0161

Airplane biofuel from Australian-grown mallee

At the Innovating with Asia 2014 Conference held on May 21, 2014, the Future Farm Industries Cooperative Research Centre in Australia reported that biofuel derived from mallee meets the standards of the Roundtable for Sustainable Biomaterials (RSB), which is an international initiative from Switzerland, and therefore it can be used in airplanes.

Companies taking part in this project on mallee-derived biofuel include the French airplane manufacturer Airbus SAS, the airline company Virgin Australia Airlines, the Australia bio-oil manufacturer Renewable Oils Corporation Pty. Ltd., the Canadian bio-oil manufacturer Dynamotive Energy Systems Corporation, and the French research institute IFP Energies Nouvelles (IFPEN). The conventional technique of fast pyrolysis is used to manufacture mallee jet fuel, together with a process known as Catalytic Low Hydrogen Upgrading of Bio-oil (CLHUB Process). The CLHUB Process is a method for achieving high purity that employs a catalyst that was developed by Dynamotive Energy Systems Corporation and IFPEN.

The Future Farm Industries Cooperative Research Centre mentioned above also reported on the CO_2 reductions from mallee jet fuel. The report stated that on a flight between Perth and Sydney, this jet fuel could reduce CO_2 emissions by 40% compared with the use of Jet-A fuel derived from fossil fuels.

Mallee can be grown on poor soil and so it does not compete with plants used for food. As such, it is a biofuel that is suitable for Australia. When it comes to biofuel manufacturing processes and ways of cultivating mallee, the plan is to continue research by using the Great Southern region in southwest Australia near Perth as a model. (**Author's abstract**)

Keywords: *renewable energy, Australian-grown Mallee, airplane biofuel, fast pyrolysis, Catalytic Low Hydrogen Upgrading of Bio-oil process, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/07,
(Filipiniana Analytics)

0162

Algae biodiesel fuel production through the use of the CO_2 discharged from thermal power plants (Australia)

The Australian government is promoting the Gen 2 Grant Program; Second Generation Biofuels Research and Development Program, in which it is investing AUD15 million (1.24 billion yen) with a view toward reducing emissions of CO_2. The development of algae biofuel in particular represents a true second generation biofuel that is not in competition with foodstuffs the way that palm oil or soybeans are.

MBD Energy Limited of Australia, which is developing algae biofuel production, is working on the "CO_2 to Energy" project. This will use CO_2 emitted from the three locations of the Tarong Energy, Loy Yang A, and Eraring Energy coal-fired thermal power stations within the country in order to cultivate algae, and will then manufacture oil and animal feed from the algae grown this way. In 2011 MBD Energy Limited ordered Origin Oil Inc. from the United States a large-scale system unit for concentrating algae in order to extract oil from it (with a processing capacity of 1,100 liters/minute). This unit will be installed at the Tarong Power Station.

MBD Energy Limited's technology for producing algae biofuel will also be applied at the coal-fired Ratchaburi Power Plant in Thailand. Loxley PLC of Thailand will invest 60 million baht (150 million yen) into the construction of a plant for producing biodiesel fuel from algae (announced in June 2012). (**Authors' abstract**)

Keywords: *Australia, biodiesel production, carbon dioxide emission, algae, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/08,
(Filipiniana Analytics)

0163

Algae production for biofuel at a sewage treatment plant (New Zealand)

Algae are known to propagate remarkably if they are supplied with organic effluent of a moderate concentration (household and industrial effluent, etc.). This is because the nitrogen and phosphorous content contained within organic effluent plays a role as fertilizer. Using this effluent for the propagation of algae and converting it into biofuel is revolutionary in the sense that it can purify the organic effluent at a low cost while simultaneously being able to produce biofuel with great efficiency.

One of the world's largest facilities for manufacturing biofuel from algae using sewage is in operation in New Zealand. After having undergone primary treatment, sewage that is generated in Christchurch, New Zealand is conducted to a High Rate Algal Pond (HRAP), where the algae is propagated and the harvested algae is turned into biofuel via a Super Critical Water Reactor (SCWR).

Currently, it is propagating algae in a five-hectare algal pond by pumping 2,000 m^3 of primary wastewater into the pond per day. The biogas produced from the sewage sludge is burned to obtain electricity, while conversely the CO_2 contained in the exhaust gas is used for the propagation of the algae. The harvested algae is treated in high temperature (300°C or higher), high pressure (20 MPa) critical water, and can produce 70,000 liters of biofuel that resembles the components of crude oil per year. This SCWR was completed in 2005 and is known as the Mark1 SCWR (MK1).

Construction of the MK2 plant, which has a biofuel production capacity (84,000 liters per year) that is 12-times that of MK1, was initiated in 2008. MK2 can produce two barrels of biofuel from 1,000 kg of algae per day. Despite the fact that the waterways for the algal pond were damaged from the earthquake in February 2011, MK2 is currently

operating at full capacity. What is more, the construction of an MK3 plant, which would have a biofuel production capacity (1,600,000 liters per year) that is 20-times that of MK2, is being considered. Christchurch has a 220-hectare sewage treatment pond, and if all of this sewage were to be utilized then it could produce 90 barrels of biofuel per day. (**Authors' abstract**)

Keywords: *algae, organic effluent, biogas, super critical water creator, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/09,
(Filipiniana Analytics)

0164

Announcement of preliminary generating cost for renewable energies

The Energy and Environment Council established by the Japanese government announced its preliminary power generation cost calculations for each type of power source-including nuclear power, coal power, renewable energies, and others for the period of 2010 to 2030 through its Cost Estimation and Review Committee in December 2011. Following the accident at the nuclear power plant, solar power, biomass, and other renewable energies have been growing in importance and have been vested with high expectations. What is more, in July 2012 a system will get underway whereby power companies will purchase the total volume of all renewable energies at a fixed price, which is expected to add additional momentum to their popularization.

Of the generating costs announced by the Cost Estimation and Review Committee, those for solar power are expensive at more than 30 yen per kWh in 2010. But by 2030 this may potentially fall to half or one-third of its present levels on account of the efficiency from being mass produced and other factors. For the generating costs from woody biomass, unutilized wood thinned from forests is used as the raw material. While it is expensive at 17.4-32.2 yen per kWh with mono-fuel combustion generation, it drops to 9.4-9.7 yen per kWh with coal co-combustion.

The generating costs for fossil fuels in 2010 came to 9.5-9.7 yen per kWh for coal power and 10.7-11.1 yen per kWh for LNG power, meaning that the generating costs for renewable energies are higher. In order to popularize renewable energies it will be important to reduce their generating costs and promote the local production and consumption of electricity, whereby electricity is generated from the renewable energies that are most suited to the local region and then consumed in said region. (**Authors' abstract**)

Keywords: *renewable energy, power generation, woody biomass, generating cost, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/02,
(Filipiniana Analytics)

0165

Annually 700 million ton of biomass resources available in China

China has become a huge consumer of energy today, and in fact, recent annual increase rate of energy consumption has been staying more than 9%. In 2009 Chinese energy consumption reached 2,252 million ton COE (crude oil equivalent), and exceeded America's energy consumption with 2,170 million ton COE. At last, China became the world's greatest energy consumption country. The United States, which has held the top spot for around 100 years, ceded top position to China.

The Chinese primary energy depends on coal greatly. The primary energy supply in 2007 amounted to 1,981.62 million ton COE, of which 65% came from coal. Biomass energy's share was 9.8%. Chinese government plans to greatly expand the use of renewable energy as much as possible so that it may save conventional energy, and it plans to increase the proportion of biomass energy up to 15% by 2020. As regard the domestic consumption of fuels, the share of biofuels was as small as only 2%, but the government intends to raise the share up to 15% by 2020.

China has been an agricultural country endowed with abundant biomass resources. Some 700 million ton of waste agricultural products are being generated every year. The traditional use of waste biomass has been direct burning for heating purpose. But today, China is adopting much advanced methods that employ gasification and liquefaction technique, and the waste biomass is changed to more environment-conscious products. In order to promote production/utilization of biofuels, Chinese government is paying a subsidy of 0.4 USD (34 yen) for producing one liter of biofuel.

China's introduction scheme for biofuels dictates that annual production capability for bioethanol to be raised to 10 million ton, and that of biodiesel to be 2 million ton by 2020. As regard the raw materials for the biofuels, corn and cassava are used for producing bioethanol, and waste food oil is used for biodiesel. But in future non-food plants such as cellulose and jatropha will be used in place of the food crops. Stable supply of staple foods is by far the largest concern of Chinese government that is responsible for maintaining the welfare of 1.3 billion people. (**Authors' abstract**)

Keywords: *China, biomass resources, coal, gasification, liquefaction, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/09,
(Filipiniana Analytics)

0166

ANRE promotes power generation by mixed-burning of coal and woody-biomass

Coal-burning thermal power stations are being encouraged to adopt the mixed-burning of coal and woody-biomass by the Agency for Natural Resources and Energy (ANRE) of Japan, for expanding the use of new energy resource and achievement of legal duty amount assigned by the RPS (Renewable Portfolio Standard) Act: a special regulation for promoting the use of new energy by electric power industries. The Chugoku Electric Power Co., the Chubu Electric Power Co., the Hokuriku Electric Power Co., and Electric Power Development Co. (J-Power) are

conducting proof experiments at model plants and or planning full-scale implementation.

ANRE has made an estimate regarding the effect of mitigating CO_2 emission by the introduction of mixed burning of coal and woody biomass into electric power generation plant. The estimate shows that in the case of a 400,000 kW class coal power plant, a reduction of CO_2 would amount to about 110,000 ton, where 5% of woody biomass (110,000 ton in weight) was burnt with coal. Up to the present the maximum mixing ratio of woody biomass has been 3%, but

ANRE plans to raise the ratio up to 5% and to spread the mixed-burning method countrywide in the future, thereby reducing both coal consumption and CO_2 emission.

Japan has been the biggest coal-importing country in the world. More than 99 % of coal needed for thermal power generation and steel production is imported from abroad today. In FY 2007, Japan imported 186.13 million ton of coal, of which 100.73 million ton were used for electric power generation. If 5% reduction of coal consumption could be achieved, coal import would be reduced by 5 million ton. Therefore, the reduction in both coal consumption and CO_2 emission must be very large. (**Author's abstract**)

Keywords: *Japan, coal-burning thermal power station, Renewable Portfoilio Standard Act, carbon dioxide, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0167

The application of a bilateral offset credit mechanism for biomass with Vietnam is under examination

Vietnam announced the Vietnam Power Development Plan for the 2011-2020 Period in July 2011. As indicated in Figs. 1 and 2, its targets for introducing renewable energies are 4,200 MW (5.6%) by 2020 and 13,799 MW (9.4%) by 2030. As part of these, its targets for biomass power are 500MW (0.6%) by 2020 and 2,000MW (1.1%) by 2030.

As part of Japan's cooperation concerning technology for the use of biomass to Vietnam, the application of a new Bilateral Offset Credit Mechanism (BOCM) for the country is being examined. This new mechanism will be examined by the COP19 in order to allow it to be implemented more effectively and efficiently by harnessing the experiences and reflections of the Clean Development Mechanism (CDM) and Joint Initiative (JI) prescribed by the Kyoto Protocol.

The projects indicated in Table 1 are being carried out to serve as feasibility studies for creating this Bilateral Offset Credit Mechanism. The initiatives for beer plants, starch processing plants, and other food processing plants carried out by Osaka Prefecture, Tepia Corporation Japan Co., Ltd., Yanmar Co., Ltd., and Osaka Sangyo University are projects that are being performed through an industry-government-academia partnership and through the Vietnam Academy of Science and Technology (VAST), which is a research institution that is representative of Vietnam. (**Author's abstract**)

Keywords: *Vietnam, biomass power, renewable energy, bilateral offset credit mechanism, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/01,
(Filipiniana Analytics)

0168

Approval probable for airplane biofuel standard

Roughly 70 billion gallons (256 million ka) of jet fuel is being consumed every year by all commercial airline company in the world today, and CO_2 emission from jet liners is estimated to be as much as 677 million ton a year, which accounts for 2% of total CO_2 emission from all over the world. Regular jet fuels in use today, including Jet-A and Jet-A1, are mainly composed of kerosene extracted from crude oil. The ASTM (American Society for Testing and Material) Standard dictates the properties of regular jet fuels.

In late years, in view of reducing CO_2 emission from airplanes, major airlines companies in the world have conducted various full-scale flight experiments (see Table 1), using biofuel-blended jet fuel with various blend ratio (20-50%). The standardization of bio-jet-fuels is one of the goals of these extensive experiments. Bio SPK (Bio Synthetic Paraffin Kerosene) is the general term for these biofuels for aircraft. They are produced by adding hydrogen atoms to plant oils that are extracted from jatropha, camelina and some kind of algae. The plant oils are consisted of paraffin molecules that have nine to fifteen carbon atoms, and free from sulfur content. Hence, the Bio SPK is regarded as a kind of "Drop-in Fuel" that does not require any modification of jet engines.

Commercial use of Bio SPK requires an official approval of the ASTM. For the time being, "an approval process on the use of jet fuels containing Bio SPK at 50%" is going on, and reportedly, the approval in the earlier half of FY2011 would be quite probable. Getting the approval for the use of Bio SPK, biofuel use in airlines industry will increase a lot and consequently will result in reduction of CO_2 emission.

From now on, other flight experiments using various kinds of biofuels will be carried out by airlines companies such as TAM in Brazil. Besides, Boeing Company. in cooperation with China International Airlines Company. is planning to conduct flight experiments in 2011, using China-made jet fuel resulted from jatropha oil. Every country in the world has its own biomass resources, therefore bio-jet-fuel peculiar to each country may be produced and supplied for the aircrafts in near future. (**Authors' abstract**)

Keywords: *airplane biofuel, carbon dioxide emission, Jatropha, Camelina, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/12,
(Filipiniana Analytics)

0169

Asia renewable energy workshop (AREW 2015) held in Malaysia

The Asia Renewable Energy Workshop (AREW 2015) was held over the two days of February 3 and 4, 2015 at Universiti Putra Malaysia (UPM) in the suburbs of Kuala Lumpur, Malaysia. The workshop was held through the joint sponsorship of six agencies from both Japan and Malaysia, including the Agency for Natural Resources and Energy (ANRE) in Ministry of Economy, Trade and Industry (METI), the New Energy Foundation (NEF), and the National Institute of Advanced Industrial, Science and Technology (AIST) for Japan, and the Ministry of Energy,Green Technology and Water (MEGTW), the Universiti Putra Malaysia (UPM), and the Malaysia Super Satellite Campus,Kyushu Institute of Technology (Kyutech MSSC) for Malaysia.

It is projected that the Southeast Asian Region, principally centered around the ASEAN countries, will see substantial growth in its demand for energy in the future. Developing and popularizing renewable energies in this region is an extremely important point when it comes to resolving the energy problems that affect the development of each country, as well as combating climate change. To date, Japan has been involved in wide-ranging projects for joint research and human resource development together with ASEAN and other countries over renewable energy.

AREW 2015, which was the first meeting of this workshop, was attended by 122 people from nine countries, including ASEAN countries and Japan, representing governments, research institutes, universities, and companies. Presentations were given and a lively exchange of opinions was held regarding the state of renewable energy in each country, their challenges, and the course of international cooperation. Experts from the participating countries debated shared

challenges and future international cooperation for the individual sectors of biomass, solar, and wind energy, and came to a shared understanding with respect to future courses of action. (**Author's abstract**)

Keywords: *Malaysia, workshop, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/03,
(Filipiniana Analytics)

0170

Australia cleared its target for biofuel use in transport

Hitherto the Australian Government designated a target value for biofuel use as 350,000 KL/year by FY 2010. In FY 2009, however, the government's target will be cleared earlier, because consumption of biofuel is now expected to reach 355,000 KL.

Annual production of bioethanol in Australia has been steadily increasing so far, namely, 40,300 KL in FY 2005, 83,600 KL in FY2006, 180,000 KL in FY 2007. On the other hand, the production of biodiesel fuel seems to have come to a standstill, namely, 21,200 KL in FY 2005, 76,300 KL in FY 2006, and 75,000 KL in FY 2007, even though the production capacity of biodiesel fuel has now reached as much as 672,000 KL/year.

Owing to worldwide financial crisis of 2008, many biofuel-related projects were forced to withdraw or to be frozen. But meantime, Australian Government has given a tax exemption (AUSD 0.381 /L) as well as a subsidy on biofuels, in addition, Australian automobile industry has eagerly promoted the use of biofuels. Obviously, these measures have resulted in the achievement of the aforementioned target. The CO2 emission from automobiles has steadily decreasing, namely, 230.3g-CO_2/km (2006), 226.2g-CO_2/km (2007), 222.4g-CO_2/km (2008). As regard the reduction of CO_2 emission by automobiles, the target value of 222g-CO_2/km has been set for FY 2010 which is 12% less than FY 2002-record (252g-CO_2/km). Therefore, this target will surely be cleared in time. (**Author's abstract**)

Keywords: *biofuel, Australia, bioethanol, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0171

Australia expands production of biofuels – 2.4 times in 5 years

Australia's primary energy supply in 2007 amounted to 133 million ton COE (crude oil equivalent), of which figure 60 million ton (45%) was shared by coal and 5.37 million ton (4%) was shared by biomass and waste.

The total amount of CO_2 emitted from all nations in the world amounted to 30.8 billion ton in 2009, in which 0.43 billion ton (1.4%) was emitted from Australia. Among today's advanced countries, Australia appeared to be the No. 1 in the world in 2009 in terms of CO_2 emission per capita, surpassing USA. The figures were 20.5 ton per capita for an Australian and 19.7 ton for an American, respectively. Recognizing this fact, Australian government has made up

a decisive policy in order to cope with suspending global warming and environmental issues, and promoting the utilization of renewable energy.

In Australia today, biofuels are attracting most keen attention among various kind of renewable energy. Reportedly, production of bioethanol and biodiesel in 2010 will be 350,000 ka and 286,000 ka, respectively; total production is 636,000 ka. Now Australia plans to produce 910,000 ka of bioethanol as well as 609,000 ka of biodiesel in 2015; total production would be 1,519,000 ka. Therefore, Australia's biofuel production would be increased 2.4 times in five year.

Sugarcane and wheat are mainly used for producing bioethanol, and rapeseed, sunflower seed and soybean are used for biodiesel. Looking at the expansion plan for the biofuels use in the country, business firms are showing movement in order to procure raw materials for the biofuels in domestic market. National Biodiesel Ltd. announced that it would invest 220 million US dollars to cultivate soybeans at Port Kembla for producing biodiesel. (**Authors' abstract**)

Keywords: *Australia, biofuel production, carbon dioxide emission, bioethanol, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/11,
(Filipiniana Analytics)

0172

Australia to double biofuels by 2015

In July 2011 the Australian Government announced that it plans to introduce a carbon pricing system from July 2012 as part of its countermeasures to global warming. This carbon pricing system is a system whereby companies that are major emitters of CO_2 will be charged AUD 23 (roughly 2,000 yen) per ton. The expectation is that introducing this system will enable reductions of CO_2 emissions of 160 million tons per year, while at the same time serving as a tailwind for creating new business for the biomass energy industry.

Australia's consumption of petroleum and diesel fuel in 2009 both came to 19 billion liters, of which it imports 22% or more of its petroleum and 48% or more of its diesel fuel. The government is promoting the introduction of biofuels in the sense that this will secure its national energy supplies by cutting down on imports of petroleum fuel, while also contributing to substantial reductions in CO_2 emissions.

The main raw material for bioethanol fuels is sugarcane. Since more than 90% of its domestic sugar production is concentrated in the subtropical zone of Queensland State, Queensland is the most proactive about producing bioethanol fuels. Because the price of sugar fluctuates widely as the price of petroleum rises, the state government is trying to uncover ways to develop the sugar industry by expanding the production of biofuels in order to stabilize the incomes of sugarcane farmers.

APAC, an Australian biofuel consultants company, estimates that the production capacity for biofuels in 2015 will be double that compared to in 2010. Bioethanol fuels will grow from 350 million liters in 2010 to 910 million liters in 2015, while biodiesel fuels will grow from 286 million liters in 2010 to 690 million liters in 2015. Microalgae has the best future potential as a raw material for biodiesel fuels. With microalgae, 100,000 liters of fuel can be obtained from 1 ha (hectare), as opposed to 5,000 liters with palm oil. Research is currently moving forward, with production on a commercial basis being anticipated. (**Authors' abstract**)

Keywords: *Australia, biofuel, carbon pricing system, bioethanol, sugarcane, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/08,

(Filipiniana Analytics)

0173

Australian CO_2 emission right due to eucalyptus plantation sold at 6.6 million dollars

On 20 November 2009, CO_2 Australia Co. announced that the company sold to ACTEW Co. its right for CO_2 emission due to eucalyptus plantation at the price of some 6.6 million dollars. ACTEW Co. is an Australian government-owned company in charge of holding national infrastructure facilities including water treatment, sewage treatment, power generation, gas distribution and telecommunications, and also in charge of their financial management. (Cf.: 30 years of CO_2 emission from the plantation x unit price = 337, 000 ton/y x 30 year x 0.65 USD/ton-CO_2 = 6,570,000 USD)

CO_2 Australia Co. has developed more than 12,500 ha of eucalyptus plantation in the states of New South Wales, Victoria and West Australia. Eucalyptus is a kind of tall trees that dominate in semi-arid climate region with annual precipitation of 10 mm.

In addition to the fact that eucalyptus efficiently binds CO_2, it seems very probable that oil extracted from eucalyptus leaves could be used as biofuel. In fact, eucalyptus is regarded as one of the second generation biofuel resources (including micro algae, sugarcane and eucalyptus) of Australia, and Australian government is promoting a development project for the resources, investing 14 million dollars. Incidentally, those kinds of eucalyptus leaves that are eaten by koala bears have little oil content. (**Authors' abstract**)

Keywords: *carbon dioxide emission, eucalyptus, Australia, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/02,
(Filipiniana Analytics)

0174

Two big biomass power projects in Philippines

At the turn of 2009 to 2010, public announcements were made as regard to two big project plans as regard to biomass power generation. They are named as Quezon Project and Global Green Project, respectively. In the projects, 36 biomass power plants, having capacity of 660 MW in total, will be constructed investing 1.894 billion dollars.

Quezon Project is a by-far enlarged version of initial project plan (released in January 2007) of a 10 MW class biomass power generation station to be constructed on Bondock Peninsula, which has been promoted by the Quezon Electric Cooperative. The scale of Quezon plan has finally come up to 240 MW in total. On the other hand, Global Green project was 87.5 MW at the time of November 2008 (5 power stations, investing 200 million dollars), but now it has been enlarged to 420 MW which is five times as large as the initial plan. (**Authors' abstract**)

Keywords: *biomass power project, Philippines, power station, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/03,
(Filipiniana Analytics)

0175

Biggest biomass power station in Japan starts at Kawasaki City

Around 1960 Japan could fulfill 85% of domestic lumber demand by using its own forestry resource, but production cost of domestic lumber was very high. In 1964, Japan therefore decided to import much cheaper lumber from abroad by completely liberalizing lumber import. The lumber import rapidly increased, and domestic supply went down. After 1990, share of domestic lumber supply stayed at nearly 20%, scored bottom figure of 18.2% in FY2000, then gradually rose to 24% in FY2008.Today Japan has vast forest areas that cover 67% of its land. Steep mountainous geography of Japan, however, hinders the exploitation of domestic lumber at competitive cost. Thus Japanese forestry industries have been slumping for long time.

In December 2009, with a slogan “From Concrete Society to Woody Society”, The Ministry of Agriculture, Forestry and Fisheries (MAFF) issued a new plan for revitalizing forestry and lumber industries in Japan, aiming at raising the share of domestic lumber supply as high as 50% by 2020. Expanding the use of domestic forestry resource is considered to contribute to counter the suspending global warming problems, and at the same time it would revitalize and foster domestic forestry and lumber industries. To promote use of domestic lumber in public sector, Japanese government enforced “The Law for Promotion of Use of Domestic Lumber for Public Buildings” in October 2010.

Meanwhile a new trend for expanding the use of domestic woody biomass is appearing. As a purely-biomass-burning-type power plant, Kawasaki biomass power station that is biggest of this kind in Japan has just started commercial operation in February 2011. This power station was jointly established and operated by three enterprises, SUMITOMO FORESTRY Co., LTD. SUMITOMO JOINT ELECTRIC POWER Co., LTD. and FULUHASHI EPO CORPORATION. The power plant can supply 33 MW of electricity, consuming 180,000 ton/year of woody chips collected from Kanto area. Possible reduction of CO_2 emission by this power station was estimated to amount to 120,000 ton/year, which corresponds to annual CO_2 emission from 22,000 households. (**Authors' abstract**)

Keywords: *Japan, biomass power station, lumber, forestry resoures, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/03,
(Filipiniana Analytics)

0176

Biodiesel fuel is becoming popular in local areas of Japan (Kyoto)

Japanese people are more and more becoming aware of the importance of using biofuels for stopping “global warming”. Today in Japan, more than fifty different municipalities are promoting utilization of biodiesel fuel, among which Kyoto City is the forerunner which started as early as in FY 1997.

Used tempura-oil and other cooking oil are processed to become a biodiesel fuel which runs as many cars as 267 including garbage-collecting trucks, city commuter buses. This Kyoto-system is the largest in Japan. The total annual production of biodiesel fuel in Japan today amounts to about 5000 kl, in which Kyoto’s share comes up to 30%. (Ministry of Agriculture, Forestry and Fisheries Statistics FY 2007). (**Author's abstract**)

Keywords: *biofuel, global warming, tempura-oil, cooking oil, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,

(Filipiniana Analytics)

0177

Biodiesel in Thailand

Thailand has a population of 63 million, it draws 49% of national annual consumption of energy from overseas countries. Especially, Thailand imports 85% of crude oil that is consumed in the country every year. To get out of import-dependent situation of energy, Thai government has designated a 15-years plan from FY 2008 to FY 2022 so as to cover 20% of total national energy demand by reproducible energy.

Among various reproducible energy resources, domestically produced, palm-derived bio-diesel fuel is critically important for energy policy of the nation. 5,182,000 ton of palm oil was produced in FY 2004, whereas 6,390.000 ton in FY 2007. So, production capacity increased 1.23 times in four years. From 1 ton of crude palm oil, approximately 0.88ton of biodiesel oil can be produced.

Presently, commercial-scale production plants for biodiesel fuel are operating at 12 sites of Thailand. These plants utilize waste cooking oil and palm oil. Their nominal total production capacity is approximately 3,900 ton a day. Actually, however, as of November 2008, their total output remains only 1,000 ton a day. Therefore, Thai government decided to apply a tax exemption to lower market price of biodiesel so that this fuel may be more and more popular nationwide. (**Author's abstract**)

Keywords: *Thailand, crude oil, palm-derived biodiesel, biodiesel fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0178

Bio-ETBE production using domestic bioethanol

Reportedly, the Petroleum Association of Japan (PAJ) plans to start full-scale sales of “Bio-ETBE” in 2010, where PAJ sets a target supply capacity of 840,000 kl for the domestic ETBE in FY 2010. ETBE (Ethyl Tertiary-Butyl Ether) is chemically synthesized from bioethanol and isobutane. Biogasoline containing 7% of Bio-ETBE are presently on sale, as a trial, at 100 gas stations in Japan. To produce 840,000 kl of Bio-ETBE, 300,000 kl of bioethanol is required.

A business agreement has been made on February 26, 2009, between Japan Biofuels Supply LLP (JBSL) and Hokkaido Bioethanol Co. (HBC), where JBSL is to buy bioethanol from HBC. JBSL was jointly formed and funded by nine oil wholesales suppliers in order to produce bio-ETBE. This project aims at raising Japan’s energy self-reliance level by increasing production of bio-ETBE utilizing domestic bioethanol as feedstock.

The manufacturer Hokkaido Bioethanol Co. has been established at Shimizu-Cho, Tokachi-district of Hokkaido. HBC is jointly funded by the JA (Japan Agricultural Cooperatives) Hokkaido Chuoukai and its associate. HBC plans to produce 15,000 kl of bioethanol from FY 2010, using beet and non-standardized wheat of the area as feedstock. In FY 2008 JBSL imported bio-ETBE, at the price of around 100 yen/liter, from Brazil, European and North American countries. (**Author's abstract**)

Keywords: *Japan, Bio-ETBE, Ethyl Tertiary-Butyl Ether, biogasoline, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0179

Bioethanol from squeezed lees of Mandarin oranges

Mandarin oranges are typical produce of Ehime prefecture. Squeezed lees of mandarin oranges that are exhausted from orange juice factories every year amount to 22,000 ton. Some portion of the lees is used as cattle foods or for making compost, but the rest is simply deposited as waste at the cost of 15 to 20 yen/ kg. To make good use of the lees, Ehime prefecture has started, from FY 2009, a model project of bioethanol production from squeezed lees of oranges, as a proof experiment project granted by the Japanese government.

The model project is of three years term. Ehime municipal office plans to develop a continuous production system of bioethanol from so-far-wasted squeezed lees of oranges. Bioethanol produced by this test plant will be used for running cars, agricultural machines and for warming up greenhouses. A local closed recycling system: produce bioethanol in Ehime from Ehime's agricultural produce, and use the bioethanol in Ehime, is the goal. (**Author's abstract**)

Keywords: *mandarin oranges, bioethanol, Ehime, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0180

Bioethanol is appearing in Vietnam market

Surrounded by the South China Sea, and endowed with a number of rich fishing spots off and along the coastline stretching 3,260 km long, Vietnam boasts of its surface fishing catch that is ranking No.17 in the world. The long coastline gives Vietnam the blessing of marine products, and also it is exposed to strong wind prevailing most of time and therefore suited for wind power generation. Electricity of Vietnam (EVN) plans construction of the large-sized wind-power plant with 30MW.

In 2007, the annual supply of primary energy in Vietnam scored 53.97 million ton of COE (crude oil equivalent), out of which 25.54 million ton COE, 45.5% of the total, was biomass energy. Vietnam's oil refinery facility has not enough capacity, and therefore most of crude oil exploited in the country has to go abroad once, and then Vietnam imports refined oil products such as gasoline. Of the biomass energy, 59.6% is consumed in household sector, and rice straw and firewood are used for cooking.

Vietnam government has been keenly promoting production and use of bioethanol that can replace fossil oil and oil products. The government plans to establish five factories for bioethanol production in the country, which can supply 365,000 ton of bioethanol a year. Sugarcane and cassava will be used as raw materials. In this consequence, the country will be able to supply 7.3 million ton of E5 gasoline (with 5% of bioethanol content) to domestic market. In August 2010, the first product was delivered from the bioethanol production factory, the first one in Vietnam, constructed by Dong Hanh Co. in Quang Nam Province in central Vietnam.

Meantime, PetroVietnum one of national oil/gas business group, started sales of E5 gasoline at their twenty gas stations located in five major cities of Vietnam, from August 2010. The price was presently set to 15,450 Dohng (approximately 70 yen) per liter that is slightly lower than that of A92 gasoline (15,990 Dohng; 72 yen per liter) that has an octane value of 92. (**Authors' abstract**)

Keywords: *Vietnam, bioethanol, sugarcane, cassava, E5, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/09,
(Filipiniana Analytics)

0181

Bioethanol production and environment policy of Thailand

Thai government established “The National Bio-Fuel Development and Promotion Committee” (NBDPC) in order to develop and promote use of bio-fuels. The committee is commissioned for establishing national policy and regulation as well as for promoting bio-fuel related technology.

Thai government has been promoting the sales of 10 % ethanol-contained gasoline (gasohol), and sales of E20 (20% ethanol-contained gasoline) has started on 1 January 2009. Ethanol production in Thailand in FY 2008 was 1.57 million liter per day on average.

In Thailand, a new biogas production business by utilizing exhausted water from bioethanol production plant has been started. "Advance Agro Ethanol Co. Ltd.", a subsidiary company to “Advance Agro Public Co. Ltd.”, one of major paper manufacturer in Thailand, has orderd a exhausted-water treatment facility to Siemens AG in Germany at a price of 10 million dollars. AAE would be able to save more than 5.5 million dollars a year by obtaining biogas from the exhausted water by adopting anaerobic fermentation technique.

Seeing as much as 2,500 liter of water was needed for producing one liter of biofuel so far, people have been very anxious about if the biofuel production process became popular, many rivers in southeastern Asia would be badly contaminated. This new technology of anaerobic fermentation seems promising and would help promote popular use of bioethanol. (**Authors' abstract**)

Keywords: *biofuel, gasohol, anaerobic fermentation technique, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/07,
(Filipiniana Analytics)

0182

Bioethanol production from cassava residue in Thailand

As indicated in Fig. 1, the cultivation of cassava is thriving in countries in the tropics, and in Southeast Asia Indonesia came in second place and Thailand in fourth place in terms of their production output in 2012. Fig. 2 shows the trends in production output for the major cassava producing countries in Asia. At the same time though, Thailand is first in the world (as of 2011) for exports of cassava starch (tapioca) at 1.86 million tons. In Thailand, disposing of the strained lees that form the residue given off when cassava starch is produced has become a problem, and examinations have been given to how to use this effectively.

Research and development on manufacturing bioethanol to serve as fuel from the non-food biomass of cassava residue has been carried out between Japan and Thailand, as is indicated in Table 1. Joint research on yeast that ferments at high temperatures at a university have progressed to the stage of becoming a demonstration project carried out by a company. Manufacturing ethanol from cassava starch is possible with existing technologies, but manufacturing ethanol from cassava residue is a new experiment.

Proving plants by Idemitsu Kosan Co., Ltd. and others that went into operation in October 2013 and proving plants by Sapporo Breweries Limited and others that went into operation in April 2014 have all been built within factories for manufacturing cassava starch in Thailand. The expectation is that the results of these proving tests will reduce cassava residue in Thailand and be conducive to handling its energy demand. Moreover, in the future the goal is for this to not just be limited to within Thailand, but to disseminate plants to other countries in the tropics such as those in Southeast Asia where cassava is cultivated as a raw material for tapioca. (**Author's abstract**)

Keywords: *Thailand, bioethanol production, cassava residue, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/06,
(Filipiniana Analytics)

0183

Biofuel and unused fossil fuel to be essential for automobile fuels by 2020

Crude oil production is expected to peak in 2009, and decrease by 20% by 2020, and by 40% by 2030. On the other hand, the number of motor vehicles in Asia is expected to increase, notably in China and India, from 150,000,000 in 2000 to 350,000,000 by 2020.

The use of new fuels is essential to accommodate this forecast growth in vehicle numbers. New fuels are sought which are able to satisfy requirements for production in low price, large volume, high energy density, safety, and clean combustion. The use of ethanol and biodiesel fuels manufactured from biomass naturally springs to mind, however this will be insufficient and a comprehensive fuels policy also including unused fossil fuels is required. (**Author's abstract**)

Keywords: *biofuel, fossil fuel, automobile fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. , 1-2
2009/01,
(Filipiniana Analytics)

0184

Biofuel from algae

Japan Airlines Co. made a successful flight experiment using biofuel on January 30, 2009. In this case, JAL used a biofuel that was a mixture of refined oil from camelina plant, jatropha, and a kind of alga.

Biofuels of the first generation are those produced from food as raw materials, whereas the second generation biofuels are those produced from inedible woody biomass such as grasses, waste woods and some kinds of algae. Generation-1 biofuels were strongly criticized that they caused a significant increase of food prices. Consequently, research and development races for Generation-2 biofuels is more and more accelerated.

Recently, algae are attracting largest expectation as raw material for Generation-2 biofuel. There are many kinds of algae that can efficiently produce oil and other hydrocarbons. Therefore, after "the Oil Crisis" in late 1970s, algae have been investigated as candidate raw materials for producing biomass energy. Relatively, algae plantation can yield much oil in a small area. Biofuel production of algae per one hectare-year can reach as much as 98,500 liter, exceeding many times that of soybeans (1,900 liter), and of palm (5,950 liter). If algae were grown in an area of 49,000,000 ha, today's biofuel demand of the world would be completely met. Although today's production scale remains small, there seems to be a big possibility that large amount of biofuels derived from algae will be used in near future, where the scale of production would have been by far enlarged. (**Author's abstract**)

Keywords: *Japan, biofuel, Camelina, Jatropha, algae, generation-1 biofuel, generation-2 biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0185

Biofuel from waste food: challenge for technology development and industrialization in Japan

The total amount of waste food generated in Japan amounted to 19.4 million ton during FY2004. It contained 3.39 million ton from food production industry (classified as industrial waste), 5.32 million ton from food supply and food catering industries (general waste from business), and 10.7 million ton from general households. Of the waste from households, only 3% has been recycled.

Nippon Steel Engineering Co., LTD has made a study on reutilization of waste food from general households that scored lowest recycle ratio. NSCE has conducted a chain of proof experiments for a project "Technology Development and Industrialization for the Production of Bioethanol using Waste Food" since 2005 at Kitakyushu City. The proof project has been contracted from NEDO (New Energy and Industrial Technology Development Organization) and designed to produce bioethanol using house garbage collected in Kitakyushu City.

General waste annually emitted from Kitakyushu City area amounted to some 168,000 ton, of which 59,000 ton was house garbage, sharing 35% of the total. Except for garbage, the waste consisted of scrap paper, grass and woody materials, used textile materials and plastics that can be incinerated. So far, all of the general waste including house garbage, has been incinerated at waste treatment facilities of the city. But since house garbage contains water as much as 71% in average, and therefore a lot of fuel is needed for burning, which has been thought to be problematic.

The newly developed technology has a merit that makes it possible to turn moist house garbage into useful biofuels instead of merely burning it. Here is the key process of the technology: 1. Separate house garbage from other general waste materials; 2. Produce ethanol from the garbage, and in addition, produce heavy oil from recovered oil content, which can be used as substitute of A-class heavy oil; and 3. Incinerate solid residue emitted from the process at a town garbage treatment facility (gasification melting furnace) together with other combustible materials contained in general waste.

Disposing 10 ton of garbage a day, the proof experiment facility could produce 379 kg of bioethanol together with 660 kg of recovered oil. Applying this proportion, it would be possible to produce 2,242 ton of bioethanol from 59,000 ton of garbage that are emitted from Kitakyushu City every year. The new technology proved that it has made it possible, on one hand, to cut down fuel consumption at town garbage treatment facilities, and on another hand it can produce useful biofuels. Thus, recycling of waste materials emitted from food businesses and households has made one step forward to industrialization. (**Authors' abstract**)

Keywords: *Japan, bioethanol, house garbage, biofuel, industrial waste, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/12,
(Filipiniana Analytics)

0186

Biofuel utilization in New Zealand

New Zealand is an island country comprising two main landmasses (the North Island and the South Island), and numerous smaller islands. Land area of 275,000 km^2 is three-fourths that of Japan, and the population are 4,330,000 (2009). New Zealand an agriculture and agricultural products export country mainly with stock-raising and dairying. As for 5,800,000 number of milk cows, the number of sheep are 32,400,000: these number is more than New Zealand's population.

In 2008, total primary energy supply was 766.04 PJ:Peta Joule (18.30 million ton of crude oil equivalent), the most common energy source was oil and second most is renewable energy with high rate of 31.5%. New Zealand has the third highest percentage of renewable primary energy supply, behind only Iceland (70%) and Norway (50%). Renewable energy is mainly geothermal and hydro-energy; woody biomass is important primary energy with 16.8%. Wood pellets prepared by woody biomass are used as heat source. Table shows primary energy supply in New Zealand.

The New Zealand puts emphasis on expansion of biofuel utilization. In 2008, Biofuel Act was enacted. This bill is to oblige the oil company to sale of the biofuel: light oil with mixed 5% biodiesel, gasoline with mixed 3-10% bioethanol. Table summarizes biofuel production/utilization in New Zealand.

From July 1, 2009, government carried out grant of max 42.5 cents (30 yen)/liter biodiesel production to support domestic biodiesel production. The total budget is 36 million dollars for three years (2.5 billion yen). (**Authors' abstract**)

Keywords: *New Zealand, biofuel utilization, Biofuel Act, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/05,
(Filipiniana Analytics)

0187

Biofuel utilization in Philippines

The primary energy supply in FY2008 was 39.3 million ton (crude oil equivalent) in which domestic energy supply was 21.91 million ton; 55.8% self-sufficiency of energy supply in Philippine. Biomass energy such as wood waste and bagasse was 5.54 million ton (14.1% of total primary energy) which is important energy resource. Also, 40,000 ton of CME (Coconut oil Methyl Ester), which is succeeded in extraction and practical use, was supplied in FY 2008. Table shows primary energy supply in Philippine (FY2008).

In order to heighten the self-sufficiency of energy supply to 60% in 2010, that is higher oversea's energy dependence, Philippine government promotes. Alternative Fuels Program. From February 2009, light oil to 2% mixture of biodiesel was obliged to use according to Biofuel Act (2007; taken effect). Furthermore, gasoline to mixture 5% of bioethanol was oblige in 2009; and in 2011 mixture would increase 10%.

Gasoline consumption is about 4 million ka/year in Philippine, therefore 200,000 ka bioethanol is necessary by 5% mixture. But only 33,000 ka bioethanol is produced by 2 companies of LAC (Leyte Agri Corp) and SCBI (San Carlos Bioenergy Inc). Table shows domestic bioethanol production in Philippine. The shortage is imported from Brazil.

On 12 April, JGC Corp. and Itochu Corp. announced that "GFII (Green Future Innovations Inc) was founded in cooperation with Philippine business partner to produce bioethanol with largest scale and to generate electricity". Bioethanol production corresponds to mixture increase 10% in 2011. 54,000 ka bioethanol will be produced by GFII from February 2012; and 13.5% of required amount of bioethanol (4 million ka x 0.1=400,000 ka) can be supplied by this domestic bioethanol. Imported bioethanol could be reduced. (**Authors' abstract**)

Keywords: *Philippines, crude oil equivlent, biomass energy, coconut oil methyl ester, gasoline consumption, Biofuel Act, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/05,
(Filipiniana Analytics)

0188

Biofuels from bamboo forests

Many country villages of Japan are suffering from problems of "neglected bamboo forests". Uncared bamboo trees tend to proliferate wildly and invade into surrounding cultivated fields and woods. An estimate shows 93 million ton of bamboo trees are growing in Japan. Many municipalities have begun cutting down the bamboo trees, but growing speed of bamboo is so rapid that the bamboo problems seem to remain forever.

A group lead by Prof. Kiyohiko Nakasaki, the Department of Engineering of Shizuoka University has been conducting a research for producing ethanol from neglected bamboo trees since FY 2007. By using a special disk saw developed by an expert cutlery shop (Marudai Ironworks Co.) in Hamamatsu, bamboo trees were made into fine powder of 0.05μm. This powdering makes it possible to dissolve the bamboo cellulose into saccharide with astonishingly high efficiency of 75%, which formerly was only 2% with existing technique. It was possible to produce 110 milliliter of ethanol from 1kg of bamboo. The research team aims at producing one liter of ethanol at a cost of 100 yen. Prof. Nakasaki estimated annual production of 220,000 kl bioethanol would be possible if 3.3 million ton of bamboo trees were cut down and supplied as raw material, without harming the echo-system of the surrounding nature. (**Author's abstract**)

Keywords: *Japan, bamboo, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0189

Biofuels supplied from oil industry

In order to reduce CO_2 emission from transport sector, Japanese government has designated a plan to replace, by FY 2010, 500,000 ton of conventional fossil fuels consumed in transport industry with biofuels. The government also requests that oil industry should supply 210,000 ton of biofuels by itself, out of the said 500,000 ton. The oil industry intends to achieve the government-assigned goal by supplying a kind of biogasoline that contains some bio-ETBE (Ethyl Tertiary-Butyl Ether). Recently the oil industry is taking a range of measures to accelerate R&D efforts so as to realize cost down and steady supply of this biogasoline.

Today, major oil dealers in Japan are jointly importing bioethanol and bio-ETBE from overseas. Meanwhile Cosmo Oil Co. Ltd. decided, from strategic viewpoint of responding to popular use of biofuels, that the company should consistently produce biogasoline in Japan, in order to cut down production cost and strengthen the company's market competitiveness.

Cosmo Oil plans to produce 10,000 KL of bioethanol in FY 2011, from the "black liquor" that is discharged from pulp production process at Nippon Paper Chemicals Co. Ltd. The black liquor contains a lot of saccharides (sugars) that can be converted to ethanol. Therefore the utilization of black liquor in this way seems very practical. As for production of Bio-ETBE, Cosmo intends to adapt an existing system at Sakai factory to this purpose. Cosmo plans to start regular production of bioethanol and bio-ETBE, with consistent process and domestic raw material, in the beginning of FY 2011. (**Author's abstract**)

Keywords: *Japan, biofuel, Bio-ETBE, Ethyl Tertiary-Butyl Ether, biogasoline, black liquor, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0190

Biogas from sewage sludge: injection into city gas pipe gets started

The Advanced Energy Supply Structure Law that was put into force in September 2009 made it compulsory for energy suppliers to use some portion of non-fossil energy resources on one hand, and for gas suppliers to use some portion of biogas on another hand. City-gas suppliers have so far been making effort to expand the use of biogas produced from sewage sludge and waste food, and in FY2010 they intend to introduce biogas that is equivalent to 220,000 ka of crude oil.

The number of users of modern sewage treatment system in Japan is more than 90 million in Japan today. Consequently, enormous amount of sewage sludge is being continuously generated in Japan, for instance, in FY2007, the total weight of dried sludge scored 2,250,000 ton. The recycling rate of sewage sludge has become quite high (77%) today. Of the sludge, 1,340,000 ton is being recycled for producing construction materials such as cement, and 390,000 ton is used for producing chemical fertilizer. The rest, 520,000 ton, is being directly dumped at landfill sites. Recently a new technical challenge is being taken in order to utilize the sewage sludge as an energy resource instead of recycling as construction material or fertilizer.

Kobe City, Osaka Gas Co.,LTD. and Kobelco Eco-Solution Co.,LTD announced together in October 2010 that they have just commenced a new service business to distribute biogas produced from sewage sludge by directly injecting the gas (with methane content more than 97%) in to existing city gas pipe. Annual amount of biogas to be injected into city gas pipe will be 800,000 m^3 that is equal to the consumption of 2,000 families, and the reduction of CO_2 emission due to the new service is estimated to be 1,200 ton annually.

Regarding civil use of biogas generated from sewage sludge, Nagaoka City in Niigata prefecture became the forerunner in Japan in1999, followed by Kanazawa City in Ishikawa prefecture in 2005. Volume of biogas generated annually in these cities is 600,000 m^3 in Nagaoka and 280,000 m^3 in Kanazawa, respectively. In both cases, biogas is first transferred from sewage plant to existing city-gas factories as a “raw material”.

In the abovementioned case of Kobe City, however, it is the first case in Japan where the biogas is directly put into the city-gas pipe. The new service makes it possible to make full use of biogas generated at sewage treatment sites since the biogas is directly put into the city gas pipe, and it also eliminates gas transfer from sewage plants to city-gas factories. (**Authors' abstract**)

Keywords: *biogas, sewage sludge, non-fossil energy, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/11,
(Filipiniana Analytics)

0191

Biomass energy in Korea today

The supply of primary energy in Korea during 2008 was 240.75 million ton COE (crude oil equivalent). Of which 232.2 million ton COE (96.4%) was imported. The components of the imported energy resources were coal (27.1%), crude oil (41.6%), LNG (14.3%), and nuclear (13.5%). Korea heavily depends on imported oil, especially oil from Middle East (82%).

Domestic primary energy was 8.55 million ton COE that accounted for only 3.6% of the total. Renewable energy resources were mostly waste materials, and amounted in total 5.2 million ton COE.

The sum of hydro energy and waste material energy was 6.40 million ton COE, sharing only 2.7% in the total primary energy of Korea. Korean government has designated a plan to raise the share of renewable energy, except for that of hydro energy, to 5% by 2011, to 11% by 2030. The contents of the 11% are wastes (3.7%), biomass (3.4%), wind power (1.4%) and others (2.5%).

Regarding biofuels in Korea, biodiesel fuels are currently in use. The raw materials for the biodiesel are mainly soybeans (80%), and remaining 20% is shared by imported palm oil and domestic waste food oil. Some twenty companies are producing biodiesel and their total production capacity today amounts to 667,000 ka per year. Consumption of biodiesel in Korea has been steadily increasing every year: 90,000 ka in 2007, 180,000 ka in 2008, almost doubled during a single year. And it is estimated to be 270,000 ka in 2009. The mixing ratio of biodiesel to

regular diesel oil is set at 1% at present, and the ratio will be raised to 3% in 2012. Consequently, consumption of biodiesel in Korea is expected to increase further in future. (**Authors' abstract**)

Keywords: *Korea, biomass energy, coal, crude oil, LNG, nuclear, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/07,
(Filipiniana Analytics)

0192

Biomass energy occupies 28% in Indian energy structure

During FY 2006, energy consumed in India as a whole scored 565.7 million ton of crude oil equivalent (COE). Coal energy was the largest and scored 222.8 million ton of COE (39.4%), next came traditional sort of biomass energy including agricultural waste, firewood and charcoal, and excrement of livestock altogether, scoring 159.9 million ton of COE which occupied 28.3% of total energy consumed in India.

These traditional kinds of biomass energy are called “non-commercial energy”, because they are not traded in the market. In farmer’s houses of the local districts, electricity, gas and/or kerosene are not in use as yet, most people are still depending on traditional biomass energy and leading energy–self-sufficient lives. Of the total amount of non-commercial energy consumed in India, a big share of 78.2% is taken by household sector.

Agricultural waste, and excrement of livestock are regarded as low quality energy resources, and if burnt in the house, the fume may pollute the air and give rise to respiratory diseases.

Indian Government has set up a policy to reduce the use of traditional biomass energy from now on, and instead, to increase/expand the use of domestic biomass resources in other directions such as biomass power generation as well as production of biodiesel fuels from them and so on. (**Author's abstract**)

Keywords: *biomass energy, India, crude oil equivlent, non-commercial energy, biodiesel fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0193

Biomass energy trend in Japan

Primary energy supply for fiscal year 2008 in Japan was 599.66 million kilo liter [kL] (crude oil equivalent), and non-fossil energy was atomic-energy (10.4%), hydro-energy (3.1%) and new-energy (geothermal-energy et al.) (3.1%); total of these non-fossil energy was 16.6%.

The new energy is renewable energy (such as solar, wind, biomass, geothermal and small hydro energy), of which needs assistance for spread because of it's high-cost. In this "new energy", the energy supply of biomass was 5.11 million kL (crude oil equivalent) accounted for 0.85% (Fig. 1).

In Japan, annual biomass production is 322 million tons. Although recycling rate of biomass is 76%, the other 24% of biomass is not recycled. The amount of un-used biomass is 76.44 million tons a year; in particularly, the top un-used biomass are sewage sludge, waste paper, food waste, non-edible agricultural product and forest residue (Table 1, Fig. 2).

Among un-used biomass, recycling rate of forest residue is only 1%. Forests cover about 70% of Japan's total area, and Japan is one of the largest forested countries in the world. However, 80% of all woods has to be imported. Japanese forest industry and farming village can stimulate activity by reducing import of wood and using domestic wood. To achieve this, it is necessary that forest changes worn-out into valuable by reusing forest residue abandoned in the forest. It is strongly expected that forest residue is recycled even more. (**Authors' abstract**)

Keywords: *Japan, renewable energy, biomass production, forest industry, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/05,
(Filipiniana Analytics)

0194

Biomass energy use in Laos

Still to this day the housing sector and small-scale factories in Laos are dependent on traditional fuels for their energy use. As shown in Fig. 1, firewood and charcoal account for 68% of its primary energy supplies. Laos is an agricultural country that produces an enormous volume of waste every year from agriculture and forestry. It also has excellent potential to cultivate energy crops, which are the raw materials for biofuels. For these reasons, the country holds promise when it comes to using biomass energy.

The locations of biomass power generation sites that use bagasse from the strained lees of the sugarcane from sugar plants, as well as power plants that use biogas from corn (ears), are shown in Fig. 2. As of the end of 2014, the installed capacity for biogas power generation at the three sites shown in the figure totaled 39.74MW. In the example of the corn plant in this figure, 80% of the 5,000 tons of corn husks that are generated every year are used as fuel for drying the corn ears, with the remains then used as organic fertilizer.

Every year in Laos, sawdust is given off from the 365,000 tons of timber produced, as are rice husks from the 2.53 million tons of rice and corn husks from the 67,500 tons of corn it produces. The biomass energy potential from these sources is shown in Table 1. Cases in which energy from corn husks, rice husks, and sawdust is utilized are still rare in Laos, and this requires further research and development in the future. (**Author's abstract**)

Keywords: *Laos, biomass energy use, renewable energy, biomass power generation, biogas, biomass energy potential, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/02,
(Filipiniana Analytics)

0195

Biomass plantation becoming active in Southeast Asia

In southeastern Asia biomass plantation is becoming active in order to produce biofuels. This is because EU agreed in 2007 that the mixing ratio of Biofuel for fuel was 10% by 2020. EU countries are now promoting to produce biofuel in own countries, and this trend will be seemed to accelerate recently. It is thought that southeastern Asia biomass plantation is the business for supply of the raw material(biomass) of biofuel. The production of bioethanol in EU increased remarkably from 528,000 ton (2004) to 2,816,000 ton (2008). The world's bioethanol production will be expected 150 million kL, which is three times than present production, in the near future.

1. Thailand, Indonesia, Philippine: Plantation of sugarcane, cassava - In Thailand, Indonesia and Philippine, in total 20,000 km2 of sugarcane fields and 33,000 km^2 of cassava fields will be newly cultivated by 2010. In June 2009, Ms Ratneswary Balasingam from Indonesia, (Frost & Sullivan's Asia Pacific Research Analyst of Chemicals, Material & Food Practice), commented that it seemed certainly obvious that these countries would continue to promote expansion of plantation for the purpose of producing biofuels and at the same time as a means for vitalizing economy of remote areas.

2. Malaysia: Cassava plantation in northeast of Kalimantan - In September 2009, MLABS System Co., NEXT Gen Biosciences Co. and Grand Inizio Co. jointly announced that they agreed on a project to develop cassava plantations on a land of 100 km2 wide, in Sabah state (northeast of Kalimantan) of Malaysia. NEXT Gen would take charge of the construction of bio-ethanol production plant, and Grand Inizio would take charge of the engineering of the entire system.

3. Indonesia: Palm Plantation - Reportedly in February 2009, 20,000 km^2 of peatlands in Indonesia would be converted into palm plantations.

4. Supply Quantity of Biofuel from New Biomass Plantation - As shown in the Fig., newly developed plantation area will be as wide as 73,000 km^2. Therefore, by the new plantation, roughly 36.5 million ton of biofuel will be annually supplied in future (biofuel will be obtained 500 ton/km2). 73,000km^2× 500 ton/km^2=36,500,000 ton/year

In addition, in July 2009, ZTE Agribusiness Co. Ltd. of China disclosed that ZTE had made a proposal to Congo government for developing palm plantations of 10,000 km2, which formerly was 2,000 km2 in September 2008. Plantation of biomass is now spreading not only in Southeast Asia but also in African countries. (**Authors' abstract**)

Keywords: *southeastern asia, biofuel, sugarcane, cassava, palm, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0196

Biomass power generation by Japanese companies in Asia

Economic development and the growth of cities have been remarkable throughout the various countries of Asia. This in turn has been accompanied by enormous demand for infrastructure improvements, and it is expected that the region will have need for infrastructure improvements worth approximately USD 8 trillion by the year 2020. On the other hand, given the shrinking of Japan's domestic markets due to its declining birthrate and the aging of its population, in order to grow Japan will have to engage for the future in business in Asia associated with growth in the region. As

such, the Japanese government is proactively supporting Japanese companies that are making inroads into Asian markets.

In the wake of the population increases in Asia's newly emerging countries, shortages of electricity have come to pose a particularly serious problem, and so there are strong demands for infrastructure improvements in the supply of electricity. Biomass power generation offers one of the most effective ways of resolving this problem. Asia contains plentiful biomass resources in its agricultural waste, forest resources, and the raw garbage generated by cities, with most of this currently going unused. By using these resources to generate energy, these countries can resolve their electricity shortages while at the same time creating societies that are oriented towards the recycling of biomass resources.

Biomass power generation projects that use Japanese technology are being developed in countries throughout Asia. These biomass power generation projects developed in Asian countries by Japanese companies have been compiled below. (**Authors' abstract**)

Keywords: *biomass resources, power generation, renewable energy, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/09,
(Filipiniana Analytics)

0197

Biomass power generation from shochu lees in Japan

The production of potato shochu from sweet potatoes thrives in the Kyushu Region. The shochu lees that are generated as a result of shochu production consist of the residue that is left over after the fermented shochu mash has been distilled, with this weighing roughly twice that of the shochu produced (in the case of potato shochu). Alcohol lees contain highly concentrated organic matter and can be effectively used as biomass resources. A number of shochu manufacturers are shown in Table 1. These manufacturers use the biomass generated from things like the shochu lees and potato scraps to produce biomass heat in the form of boiler fuel in their shochu factories.

Chief among these is Kirishima Shuzo Co., Ltd., which was the first in Japan to begin a power generation project from sweet potatoes that uses shochu lees and potato scraps as raw materials in September 2014. In 2006, the company installed equipment that causes the shochu lees to undergo methane fermentation, and uses the biomass generated from this as a heat source to provide heat in its shochu production processes. For this accomplishment it was awarded the New Energy Foundation Chairman's Award, which is the New Energy Grand Prize of the New Energy Foundation, in 2007. For the power generation that it recently began, it will add power generation equipment for these heat using facilities and then sell the full amount of power generated to Kyushu Electric Power Company, taking advantage of the feed-in tariff scheme for renewable energies that began in 2012.

As can be seen from this example, this not only demonstrates possibilities for using shochu lees as heat within factories, but also for power generation projects as well. As such, the expectation is that shochu manufacturers will make further progress when it comes to effectively utilizing biomass. (**Author's abstract**)

Keywords: *Japan, biomass power generation, Shochu Lees, shochu production, methane fermentation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/10,
(Filipiniana Analytics)

0198

Biomass power generation grown up to 1,600 MW in Philippines

In November 2008, Global Green Power Co., an affiliate of Aboitiz Power Co., presented a two hundred million dollars plan to construct five 17.5 MW class biomass power stations and totally 87.5 MW capacity power generation facilities would be installed. Of the five, two plans were disclosed in June 2009, namely; 1. Mina, IIoilo (construction cost: 1.951 billion pesos); 2. San Leonardo, Nueva Ecija (construction cost: 2.002 billion pesos) (1 peso = 1.98 yen).

Each power plant will consume everyday 400-500 ton of biomass materials such as rice chaff, rice straw, corn straw, empty shells of palm, strained lees of corn. These two power plants will be put into regular service in January 2011, operated by 140 employees.

In addition, Sure Eco Energy Philippines Co. has presented a plan to construct power stations, with capital sharing from a Japanese business, to be operated on agricultural by-products at four locations as shown below: 3. San-Pedro, Laguna: 250 MW; 4. San Jose, Lipa city: 250 MW; 5. Natividad, Nueva Ecija: 60 MW; and 6. San Vicente, Sumilao Bukidnon: 950 MW.

Consequently, Philippine's biomass power generation capacity has grown up to 1,595.5 MW, excluding small-scale power stations, and the amount of agricultural by-products to be burnt in the power plants will be 13 million ton annually. (**Author's abstract**)

Keywords: *biomass power generation, Philippines, power station, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0199

Biomass power generation in Thailand

Agriculture has been the top key industry of Thailand. Hence (waste) biomass has been the major energy resource of the country, and the total energy obtained from the biomass is estimated to be as much as 65 x 1015 J that accounts for 20-30% of primary energy demand of Thailand. Major biomass resources of Thailand are lees of sugarcane, rice-chaff, empty fruit bunches (EFB) of palm, and scrapped rubber trees.

According to recent statistics, Thailand produced 64.97 million ton of sugarcane in 2004 (world No.4), 30.47 million ton of rice in 2008 (No.7), 1.3 million ton of palm oil in 2009 (No.3), and 3.14 million ton of natural rubber in 2006 (No.1). Especially, the share of rubber production in the world has been around one third.

To strengthen the country's electric power supply capacity, Thailand intends to utilize its rich biomass resources. The following table summarizes recent major projects for biomass power generation. (**Authors' abstract**)

Keywords: *Thailand, agriculture, biomass power generation, biomass resource, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/03,
(Filipiniana Analytics)

0200

Biomass projects by Japanese firms are flourishing in Asia

Biomass projects by Japanese firms are flourishing in Asia one after another. The basic objectives of the projects may be summarized as follows: 1. to transfer biomass technology developed in Japan to Asian countries; 2. to develop a market for biomass energy utilization in these countries; and 3. to reduce CO_2 emission in these countries.

Besides, adoption of CDM (Clean Development Mechanism) in these projects is strongly encouraged by Japanese firms. Some of the latest, notable projects are presented here: Biomass Power Generation: 1. Nishinippon Environmental Energy Company (NEECO), a subsidiary company of Kyushu Electric Power CO.,INC made an announcement on 11 August 2010, stating that the company would start a biomass power generation business in India, by burning poultry excrement and woody chips as fuel. India today is facing a serious shortage of electricity owing to rapid economic development. Therefore NEECO intends to develop a market in this country for biomass power generation and supply. 2.EJ Business Partners Co.,Ltd, a company specialized in environmental issues, announced that the company would take part in a biomass power generation project in Philippine, by using chaff and woody scraps as fuel. On 28 May 2010, the kick-off ceremony for this biomass power generation project took place at Rosario in Philippine. Bioethanol: 1. Itochu Corporation. and JGC Corporation (Nikki) jointly made announcement on 8 April 2010 that they would, jointly with Philippine business partners, take part in a bioethanol production project (biggest in Philippine) that uses sugarcane as raw material, at the same time, take part in an electric power supply business that uses bagasse as fuel. Meanwhile, a business consortium formed by Itochu Corporation. and other three Japanese companies started construction of a bioethanol production factory in Vietnam in late March 2010, which uses cassava as raw material. 2. On 19 August 2010, Tsukishima Kikai Co., Ltd (TSK) and JFE Engineering Corporation jointly announced that they were entrusted with a proof project from NEDO (New Energy and Industrial Technology Development Organization) to conduct a pilot-scale bioethanol production in Thailand. The companies intends to develop a commercial bioethanol production system in Thailand, which uses squeezed lee of sugarcane as raw material, and therefore they have chosen to start with a pilot-experiment at a factory of a sugar maker in Thailand. (**Authors' abstract**)

Keywords: *Japan, biomass project, biomass power generation, bioethanol, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/09,
(Filipiniana Analytics)

0201

Biomass stoves are becoming popular in Nepal

More than eighty percent of domestic energy of Nepal comes from biomass such as wood, cattle manure and agricultural waste. Most households burn wood for fuel, and more than eighty percent of domestic energy is consumed in people’s homes. In this consequence, the country has been suffering from two big problems.

1. Harm to Health - Smoke and flue gas of wood burnt for cooking at homes fill up the houses and cause respiratory

diseases. For this reason, the death rate is quite high due to suffering from child hood asthma and bronchitis. Nepal's census of 2001 proved that number of deaths due to asthma and bronchitis was 7,170 (6.71%) annually, among which the deaths of infants had a share of 23%. The death rate of infants is nearly twice that of the grownups, because infants occupy 12.1% of the Nepal's population. PM10 (density, in the air, of particles smaller than 10 micron meter in diameter) measured at Nepal homes was 2,418 μg/m3, which was about three times denser than the case when LNG was burnt.

2. Decrease of Forest Area - Nepal's forest area has been rapidly decreasing, because people tend to consume more wood than former period. Nepal census 2004/2005 made it clear that the nation had 16.8 million ton/year of demand for wood, on the other hand, the limiting logging quantity at which Nepal forests could be sustainable was 6.478 million tons, which could fulfill only 39% of the demand. Especially at Terai district, which is a grass-land in the south of Nepal alongside the border to India, only 19% of demand can be fulfilled. In this consequence, and in fact, about 10 million ton of wood (biomass) in excess of the said limit has been logged down every year, causing a rapid decrease of forest area.

As a solution to the above big problems, biomass stoves have been developed and becoming popular. The fuel of this biomass stoves is woody pellets which burn more efficiently, and combustion gas is exhausted to outdoor. The biomass stoves have a much better thermal efficiency than traditional kitchen ranges and do not pollute the air in the house. The National Agriculture and Environment Forum (NAEF) has estimated the number of biomass stoves in the country might have already been beyond 30,000 by March 2009. (**Authors' abstract**)

Keywords: *Nepal, biomass, biomass stoves, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0202

Biomass-coal co-firing power generation becoming popular in Japan

Co-firing of biomass with coal, using wood pellets and wood chips, are becoming popular in some places over Japan. Coal power generation emits relatively large amount of CO_2 for producing 1 kWh of electricity. In terms of cost of power generation, however, coal power is the cheapest. Coal is very cheap and exists in abundance on earth, and it will last more than 100 years from now at today's consumption rate. This is the strong point of coal.

Woody biomass/coal co-firing will make it possible to reduce coal consumption, and reduce CO_2 emission. At the same time it will also make so-far-unused woody biomass into useful energy. It is known that Japan has been the biggest importer and consumer of coal in the world. Japan depends 99% of coal from abroad. Only for power-generation purpose, Japan's annual import of coal amounts to 100 million ton, and for steel making another 80 million ton of coal is required annually. Co-firing of unused domestic woody biomass would possibly reduce consumption of coal by a few million ton.

Here are a few instances of woody biomass utilization for power generation in Japan: 1. Nippon Steel Corporation: (NSC) started an experimental biomass/coal co-firing by making use of forestry residue in November 2010. The proportion of woody biomass to coal is 2%. NSC estimated annually 5,000 ton of woody biomass would be consumed, and 7,000 ton of CO_2 emission would be cut down; 2. Hitachi Kyodo Karyoku Co.,LTD: (HKK Co.Ltd) announced that it would begin coal/biomass co-firing power generation at Nakoso power station in Iwaki city from March 2011. The power station, reportedly, would consume annually 90,000 ton of woody pellets, at 3% of co-firing ratio. Also it would reduce 150,000 ton of CO_2 emission annually. The introduction of commercial co-firing power generation is the first case in Tohoku region; 3. Hokkaido Electric Power Co.,Inc: (HEPCO Inc) announced last year that it would

begin a range of proof co-firing experiment at Sunakawa power station from December 2010. Wood chips produced in Hokkaido would be burnt with coal at a mixing ratio of 1-3%; and 4. Ube Industries LTD.: Last year Ube announced that it would start full-fledged co-firing experiments from December 2010, where imported palm kernel shells to be burnt together with coal. Reportedly, Ube plans to foster a business system for biomass fuel supply and expects annually one million ton of biomass fuel to be supplied by the business in 2013. (**Authors' abstract**)

Keywords: *Japan, coal, wood pellet, wood chips, co-firing, woody biomass utilization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/02,
(Filipiniana Analytics)

0203

Biotech Park (Bioxcell) will be constructed in Malaysia

The Malaysian government emphasizes the research & development of bio-diesel, bio-ethanol, bio-hydrogen and bio-gas, and recognizes that the agricultural biotechnology and industrial biotechnology will greatly contribute to the growth of Malaysia.

On May 22, 2009, UEM Land Bhd (a subsidiary of UEM Group Bhd), a biotechnology company in Malaysia and Malaysian Biotechnology Corp Bhd (BiotechCorp) clarified a plan to jointly construct a biotech park of 80.8ha in the Nusajaya development area (9,600ha) of Malaysia. The construction will start at the end of 2009, and Biotech Corp will lure enterprises there.

They plan to invite 20 to 30 companies different in scale from large to venture enterprises, and about half of the site will be occupied by manufacturing companies. It is expected to develop significantly taking advantage of its good location that is near Malaysian Engineering College and the high-tech bio-industry in Singapore.

Its large scale can be well understood if you consider that Virginia Biotechnology Research Park, a strong base of biotechnology in the Unites States, consists of 14 ha (about 3,000 researchers) and Biotech Park Berlin Buch, a strong base of biotechnology in Germany, consists of 32 ha (about 2,200 researchers). (**Author's abstract**)

Keywords: *Malaysia, biotechnology industry, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,
(Filipiniana Analytics)

0204

Brunei Darussalam seeks for economic diversification

Brunei Darussalam is located in the northern part of Kalimantan Island (Borneo Island) and has a population of 406,000 (2009) and its territory is 5,765 km^2, endowed with abundant fossil fuel resources such as crude oil and natural

gas. By exporting the rich energy resources, Brunei economy is prosperous at present, since nearly half of Brunei's GDP is supported by the export.

Primary energy supply of Brunei at present consists of crude oil and natural gas that are produced entirely in the country. The domestic supply of energy produced from biomass and waste materials have shared nearly 9% of Brunei's total primary energy consumption until 1971, but then gradually decreased to zero in 1993 and thereafter.

Nevertheless, an estimate has shown that Brunei's crude oil and natural gas will be depleted by 2025 and 2039, respectively. Therefore Brunei government is keenly promoting the production and use of renewable energy that would replace the energy from crude oil and natural gas.

The one of the renewable energy is solar energy. Brunei Darussalam is located in a tropical region where solar energy is abundant and available throughout the year. Efforts in exploiting solar energy have conducted for a solar demonstration project (1.2 MW solar power plant, which is the largest in the ASEAN) between Brunei government and Japanese Company-Mitsubishi Corporation. In accordance with promoting the use of renewable energy, Brunei joined the IREA (International Renewable Energy Agency) on 23 June 2009.

In order to reform existing industrial structure that is completely dependent on fossil fuels, Brunei government is promoting diversification of the country's economics. For an example, Brunei is fostering methanol production industry as a downstream industry of oil industry, using crude oil and natural gas as raw materials. Mitsubishi Gas Chemical Company, INC, ITOCHU Corporation. and Brunei National Petroleum Company. jointly established a company named BMC (Brunei Methanol Company) which company started production and sales of methanol since May 2010. BMC produce methanol 850,000 ton a year that is to be used as raw material for producing formalin and ascetic acid as well as biodiesel. The methanol is mainly exported to Asian countries that are enjoining rapid economic growth. (**Authors' abstract**)

Keywords: *Brunei Darussalam, fossil fuel, crude oil, natural gas, solar energy, methanol production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/11,
(Filipiniana Analytics)

0205

The challenge to diversify raw materials for biofuel: utilization of powered bamboo

On December 18th a research group comprising from Shizuoka University, Ishikawa Prefectural University, Graduate School for the Creation of New Photonics Industries, and Marudai Ironworks Co. Ltd. announced its success in the conversion of 75% of the cellulose in powdered bamboo (50 micrometers maximum particle size) to gluecose using enzyme-based hydrolysis. The work of the research group is aimed at establishing technology for the manufacture of ethanol at the government target cost of 100 yen per liter. Bamboo is another non-food material. (**Author's abstract**)

Keywords: *bamboo, cellulose, enzyme-based hydrolysis, ethanol, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/01,
(Filipiniana Analytics)

0206

Challenges for expanding production and use of domestic biodiesel fuels

In 2008, the total amount of biodiesel fuels produced in the world measured 12 million ka (kiloliter), while Japanese production in total was only 7,000 ka. Currently in Japan, biodiesel fuels are being produced by small local factories, and mainly from used food oils collected from restaurants as well as general households in small amount. This is the main reason why biodiesel fuels cannot be mass produced, nor become popular in Japan. There are 66 domestic biodiesel makers; among the 66 makers, only 13 have capability to produce more than 100 ka per year, and the rest are medium and small.

As for used food oil in Japan, 300,000-350,000 ton comes from food businesses, and 100,000 ton comes from general households, every year. Total amount of used food oil are 400,000-450,000 ton per year. It is expected possible to produce 490,000 ka of biodiesel fuel from 450,000 ton of used food oil. Annual consumption of light oil in Japan today stays around 40,000,000 ka. According to biodiesel mixture ratio 5% of light oil established in Japan, 2,000,000 ka of biodiesel would be necessary, which is expected to reduce CO_2 emission by 5,000,000 ton a year. In order to supply 2,000,000 ka of biodiesel, Japan should employ other kind of biomass for producing biodiesel, apart from the above-mentioned waste food oil.

In this circumstance, various efforts are being made to expand the domestic production and use of biodiesel. For instance, use of raw materials other than food oil, development of simpler and easier production methods, and expansion of utilization methods in addition. The following table summarizes various challenges being made in Japan in this regard. (**Authors' abstract**)

Keywords: *biodiesel fuel, Japan, used food oil, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/08,
(Filipiniana Analytics)

0207

China is first place worldwide in hydropower generation facilities

Worldwide installed capacity for hydropower generation in 2011 was 970 GW, of which China's 212 GW accounted for 22%, placing it first worldwide in hydropower generation facilities. What is more, China newly installed 12.3 GW, which is 50% of the new installed capacity in 2011 (of 25 GW), placing it first in the world in this respect as well.

The Chinese government has set out the goal of installing 300 GW of hydropower generation by 2015 in its 12th Five-Year Plan. Furthermore, in July 2012 the last power generation unit (0.75 GW) of the 32 large-scale power generation units at the Three Gorges Power Plant went into operation, thus completing a hydropower plant with a net output of 22.5 GW, which is the largest in the world. It was a major project that took roughly ten years to complete.

At the same time, the approximately 5 million people who live within remote regions in China are still unable to access the electric power system. To fix this, the introduction of economical pico hydropower (less than 5 kW) and mini hydropower (up to 4 MW) that use local rivers is being considered instead of other generation methods or the laying of new power lines. With pico hydropower in particular, the generation costs are lower than with conventional thermal power generation (which is mainly from coal), in addition they are also cheaper than those for wind power, solar, and diesel in China. (**Authors' abstract**)

Keywords: *China, hydropower, pico hydropower, electric power system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/08,
(Filipiniana Analytics)

0208

China is number one in the world at solar power production

China installed 2,200 MW of the 29,665 MW of solar power that was newly installed in 2011, placing it third worldwide after Italy and Germany. Yet conversely, when viewed in terms of its production output from solar cells, China's approximately 15,000 MW accounted for 47% of the worldwide production of 32,099 MW in 2011, making it the number one producer globally. Nine of the world's 15 top solar cell manufacturing companies are Chinese companies.

Armed with their low prices, Chinese companies exported about 95% of their production output to Europe and the United States in 2010, but in 2011 its export rate decreased to 83.3%. This was due to the following reasons: In August 2011 a FIT system was initiated throughout all of China, and so the installation of facilities increased; and the introduction of solar power slowed down in Europe following revisions to European FIT systems.

The Chinese government is forcefully promoting the introduction of renewable energies, and so, in the future, China has the potential to surpass Italy and Germany to become the world's largest market for solar cells installed annually. (**Authors' abstract**)

Keywords: *China, solar power, power production, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/07,
(Filipiniana Analytics)

0209

China promotes to produce bioethanol from non-crops

The global production output for bioethanol in 2011 amounted to 86.1 billion liters, which was down slightly compared to 2010 (86.5 billion liters). Bioethanol production increased from 2000 to 2010, but the down was for the first time in 2011. The reason of down was the Bioethanol production in Brazil (in 2011 compared with the previous year 7 billion liters of decrease) by financial crisis, while the United States and Brazil accounted for nearly 90% of total world bioethanol production output. China was the largest producer in Asia, producing 2.1 billion liters.

Ten provinces in China have mandated the use of E10 fuel, which is a mixture of 10% bioethanol with gasoline. It has five bioethanol production plants, which use corn (73.3%), rice and wheat (18.3%), and cassava (8.3%) as their raw materials. The amount of bioethanol manufactured in China in 2010 did not increase relative to the amount from 2009. This was caused by the fact that the government would not approve the construction of new manufacturing plants on account of the rapid rise in the cost of food, as well as the decline in production subsidies (they were 20 cents/liter in 2008 but 17 cents/liter in 2011).

In 2005, the government established “Renewable Energy Promotion Law”, and has set a target for bioethanol production of 2 million tons (2.1 billion liters) by 2010, 10 million tons (12.5 billion liters) by 2020. Automobile sales in China have made this market the largest in the world, and so fuel consumption is sure to expand. The government plans to promote the following initiatives for using bioethanol as a fuel for automobiles: Using cassava and sweet sorghum as raw materials, as they do not contend with foodstuffs; and partnering with overseas research institutions in striving to perform research and development on second-generation bioethanol that uses inputs like bagasse (strained sugar cane lees), rice straw, and wheat straw. (**Authors' abstract**)

Keywords: *China, bioethanol, E10 fuel, Renewable Energy Promotion Law, plant resources, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/06,
(Filipiniana Analytics)

0210

China ranked third in the world for bioethanol production

China is ranked third in the world behind the United States and Brazil for the production of bioethanol, producing 2.1 billion liters (1.66 million tons) in 2009. In 2006 China enacted its Renewable Energy Law, in which it laid out its production targets for bioethanol of 2.53 billion liters (two million tons) by 2010 and 12.66 billion liters (ten million tons) by 2020.

With the remarkable economic growth in China, its energy consumption continues to rise. Emissions of CO_2 in 2008 came to 6.52 billion tons, which accounts for 22.1% of the world’s total emissions of 29.5 billions tons and makes China the number one CO_2 emitting country in the world. For this reason, the government is expanding the use of renewable energies and working to reduce emissions of CO_2.

The major raw material for bioethanol is corn. China’s corn production in 2006 came to 145.49 million tons, and it is the second largest producer in the world. This corn is consumed within China mainly as animal feed (73%) and food (27%), making China the world’s second largest consumer. Corn is one of China’s major grains.

The price of corn rose in 2006, which precipitated a rise in the cost of animal products as a result. What is more, the fact that its stockpiles have decreased has given rise to concerns over food security, and so in 2007 restrictions were placed on using corn as a raw material for bioethanol.

China is aiming to switch over to potatoes like cassava and sweet potatoes and woody biomass as alternative raw materials to corn. Its production output of cassava is 8.76 million tons, which is just a mere 6% that of corn. Stably supplying potatoes will be a challenge for the production of bioethanol in the future. (**Authors' abstract**)

Keywords: *China, bioethanol, carbon dioxide emission, corn, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/06,
(Filipiniana Analytics)

0211

China to ramp up biomass power generation to 13 million kW by 2015, and to 30 million kW by 2020

In November 2011 the China Securities Journal reported that the configuration for the renewable energy industry's 12th Five-Year Plan had taken shape and that it would be officially announced by the Chinese government within the year. According to the report, the Five-Year Plan (2011-2015) for biomass energy out of the renewable energies would raise the installed capacity for biomass power generation from the 5.5 million kW at the end of 2010 to 13 million kW (2.4-fold) by 2015. In addition, they also speak of a plan to expand this to 30 million kW (5.5-fold) by 2020.

A breakdown of the installed capacity for biomass power generation in 2015 shows that 8 million kW will come from woody biomass, 2 million kW will come from power generation that uses methane gas as fuel, and 3 million kW will come from power generation from waste incineration. The plan calls for 300 biomass power plants to be built all over China by 2015. China's biomass-related industrial quarters have performed trial calculations which show that an additional 500 to 700 sites over and above this will be needed to produce 13 million kW of power.

If the construction of biomass power plants proceeds according to plan, then this will advance the industrialization of biomass usage, while also leading to the significant development of biomass-related companies. (**Authors' abstract**)

Keywords: *biomass power generation, renewable energy, methane gas, industrialization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/12,
(Filipiniana Analytics)

0212

China was once again number one in the world for wind power installed in 2013

In 2012 the United States was first in the world in new installed capacity for wind power by a narrow margin, with China coming in second place. But by 2013 China was once again ranked first in the world (refer to Fig. 1). Compared to the United States' new installed capacity of 13,124 MW in 2012, this dropped to 1,084 MW in 2013, for a decrease of 92%. The reason for this is because the Federal Production Tax Credit of 2012 was applied in 2013 as well, but since there was a delay prior to its being clearly defined progress wasn't made on new construction work.

In China new installations rose from 12,960 MW in 2012 to 16,088MW, thereby capturing the number one spot globally in terms of its new installed capacity. As shown in Fig. 2, China is also ranked first in terms of its cumulative installed capacity. Its rate of increase was 121%, or the same as for the previous year, with this shown in Fig. 3.

As indicated in Fig. 4, in 2013 the adoption of wind power proceeded in sites that are suitable for wind power such as Xinjiang Uyghur Autonomous Region in the northwest and the Inner Mongolia Autonomous Region in the northeast. In particular, it is pinning its hopes on a plan by the State Grid Corporation of China to lay 8GW of high voltage DC power lines from Xinjiang Uyghur Autonomous Region to Henan Province, which is a region with a large population and high energy demand. As such, the forecast for the next two to three years is that the installation of wind power will continue.

What is more, at the end of 2012 the National Energy Administration (NEA) changed the premiums (surcharges) from the feed-in tariff scheme for renewable energies that had been paid to the electricity providing companies from a lump-sum at the end of the year to a quarterly payment. This measure is designed to improve the cash flow of the energy supplying companies and encourage investment. In addition to this, it also instituted proactive policies in the end of 2013 to encourage the introduction of power, such as by raising the feed-in tariff price to 0.25 US cents per kWh, which is roughly twice what it was before. (**Author's abstract**)

Keywords: *China, wind power, installation capacity, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/06,
(Filipiniana Analytics)

0213

China was ranked first for newly installed capacity for solar power in 2014, with Japan in second place

In terms of newly installed capacity for solar power around the world in 2014, as shown in Fig. 1 China was ranked first and Japan was ranked second with 10.6 GW and 9.7 GW, respectively. As the total amount installed worldwide that year came to 40 GW, these two countries accounted for half of the global total. China adopted a feed-in tariff (FIT) scheme in 2011, with Japan doing the same in 2012, due to which solar power has increased dramatically in these countries. Yet conversely, Germany, Italy, and Spain, which experienced rapid increases in solar power from adopting FIT schemes, have seen enthusiasm for adopting solar power taper off as a result of the reduced purchase prices. But when viewed globally, cumulative installed capacity continues to rise, showing growth of 27% year-on-year in 2014, as indicated in Fig. 2. The largest cumulative installed capacity as of the end of 2014 was to be found in Germany, China, then Japan, in descending order (Fig. 3).

Europe has been leading the way in the adoption of solar power, followed by China, Japan, and the United States, which all have their own domestic solar cell industries. But given the falling price of solar cells, the expectation is that this will continue to spread to regions fortunate to have excellent solar radiation conditions, such as Southeast Asia, South America, the Near and Middle East, and Africa. (**Author's abstract**)

Keywords: *China, Japan, renewable energy, solar power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/09,
(Filipiniana Analytics)

0214

China will use 12 million tons of biofuel as aircraft fuel by 2020

In August 2012 the National Energy Administration of China announced its 12th Five-Year (2011-2015) Plan for the Development of Renewable Energies. Its annual consumption target for renewable energies for 2015 is 478 million tons (carbon equipment) of which the amount of biomass energy that will be uses is will be 50 million tons. When it comes to biofuels, it has set up usage targets of 3.5 million tons for bioethanol and 1.5 million tons for biodiesel fuel.

With regard to the use of biofuels for aircraft, in May 2012 the Civil Aviation Administration of China (CAAC) announced that the consumption of jet fuel for aircraft in China is currently 20 million tons, with this to reach 40 million tons by 2020, and that it plans to use biofuels for 12 million tons (30%) of this. The CAAC has stated that only biofuels can offer solutions to both this substantial increase in jet fuel consumption and its environmental measures.

A test flight using biofuel carried out in October 2011 on an Air China Boeing 747 has proven its viability. The Chinese oil company PetroChina supplied Air China with 15 tons of biofuel made from jatropha oil for the test flight. What is more, PetroChina also has plans to build a plant to manufacture 60,000 tons of biofuel each year (jet fuel made from jatropha) by 2014.

Developments are also proceeding apace for using waste cooking oil and seaweed as raw materials for biofuels.

Airbus, which is an aircraft manufacturer with its headquarters located in Toulouse, France, has partnered with Tsinghua University in China to jointly perform a Sustainability Assessment on aviation biofuel made from waste cooking oil in order to promote the commercial production of biofuel (announced in August 2012).

The Boeing Company, which is the world's largest aircraft manufacturer, jointly established a research laboratory for making biofuel from waste cooking oil in Beijing together with the Commercial Aircraft Corporation of China (COMAC) in August 2012.

Biofuels made from waste cooking oil can be produced sustainably, with 29 million tons of cooking oil consumed within China each year. There are high hopes for aviation biofuel made from cooking oil from the standpoint of reusing waste. (**Authors' abstract**)

Keywords: *China, renewable energy, carbon equipment, biofuel, jatropha oil, waste cooking oil, seaweed, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/10,
(Filipiniana Analytics)

0215

China's solar thermal heating industry is first in the world

The introduction of solar thermal heating systems (water heaters), which use solar energy directly as heat, is making progress in China, Europe, and other areas. Solar water heaters make hot water from solar heat and are used to supply hot water to homes. China's installed capacity (cumulative total) as of the end of 2010 in particular accounted for approximately 70% of the world's, with a difference of more than ten-times the capacity compared to the second-place Turkey.

The following reasons could be given for why the use of solar heat is making progress in China: The government is proactively promoting its use as part of its environmental measures; China's economy is developing and its living standards are on the rise; and China's proprietary technology is advancing and it is supplying markets with high quality products.

China's solar water heater industry in particular got its start in the latter half of the 1970s, and is comprised of an integrated industrial chain that extends all the way from processing the raw materials to the manufacturing, sales, and servicing of water heater products.

Within China there are said to be some 1,000 companies that are manufacturers of these solar thermal systems, with 25 companies that have received "Golden Sun" product certification. Most of the products are installed domestically within China, but they are also exported to newly emerging countries in Africa and Central and South America, and have even begun to be exported to Europe as well. Some imports are even entering Japan. (**Authors' abstract**)

Keywords: *China, solar energy, water heater, solar thermal system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/09,
(Filipiniana Analytics)

0216

Commencement of commercial operations for Japan's third largest wood chip fired power plant

In 2009 the domestic production output for wood chips in Japan came to 5.13 million tons, with the amount imported coming to 10.48 million tons. Since the amount of wood chips supplied in the country came to 15.61 million tons, 67% of this was covered by imports from overseas. In 2008 there were 5.8 million tons of domestically produced chips and 14.72 million tons of imported chips for a total of 20.52 million tons, which means that the consumption of wood chips decreased by 24% in 2009 compared to the previous year. This was caused by the decline in the production output for paper and paper board due to the economic downturn, as well as the drop in the amount of lumber produced and the decline in the number of residences that were demolished.

The raw materials for the wood chips produced within Japan were 2.4 million tons of unsawn timber (raw wood) and 110,000 tons of timber offcuts from forest land. Conversely, industrial timber offcuts discarded after being used as materials from raw wood accounted for 1.69 million tons with wood from building demolitions and scrap wood accounting for 930,000 tons. As such, approximately 50% of the discarded lumber is being reused in the form of chips. Use in manufacturing paper and pulp accounts for 80% of the uses of domestically produced wood chips, with 5% being used for power generation, 2% being used as a heat source for drying facilities, and use for energy coming in at around 10%.

In September 2011, ORIX Corporation announced that it commenced commercial operations at a woody biomass power plant in Agatsuma that is fired by wood chips. The power generation capacity is 13,600kW, with the annual amount of power supplied coming in at 85 million kWh. When this is converted into standard household terms, it corresponds to the annual electricity consumption of roughly 24,000 households. About 130,000 tons of wood chips for use as fuel will be purchased from wood chip suppliers within Gunma Prefecture or from neighboring prefectures each year.

The Kawasaki Biomass Power Plant, which is a wood chip fired power plant with an output of 33,000kW, making it the largest in Japan, went into operation in February 2011. The second largest is the Gonoike Biomass Power Plant (Kamisu City, Ibaraki Prefecture, output of 21,000kW), with the Agatsuma Biomass Power Plant now the third largest in Japan. Large-scale power generation from wood biomass has shifted into high gear in Japan. (**Authors' abstract**)

Keywords: *petroleum, biofuel, renewable energy, Bio-ETBE, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/11,
(Filipiniana Analytics)

0217

Commercial biohydrogen production project in 2013

On 24 March 2009, Sapporo Breweries Ltd. announced that the company would start proof production experiments of biohydrogen using squeezed lees of agricultural produce like sugarcane, as a joint project with a Brazilian oil company Petrobras (Rio de Janeiro) and Ergostech Co. (San Paulo) specialized in research and consulting on renewable energy.

This proof experiment to produce hydrogen from cellulose-type biomass is the first venture in the world. In fact, Sapporo Breweries Ltd. has formerly succeeded in developing a pilot plant for the production of hydrogen-methane in two-stage fermentation process utilizing waste-bread as raw material. This achievement is based on the company's original technology and know-how as regards fermentation as well as processing plant design, which have been gained and accumulated in brewing beer.

They plan to install and operate a pilot plant with 1 cubic-meter capacity at the experimental laboratory of Ergostech by the middle of September 2009. And in 2010, they intend to conduct a continuous fermentation experiment, utilizing waste of vegetables and crops. Further, they plan to install a pre-commercial production plant so as to make proof production experiment in 2013 and later. They intend to spend 2.5 million dollars for the project in order to realize, within ten years, a production cost of 40 yen/m^3 that may be equal to and competitive with the cost of crude oil and natural gas.

Hydrogen is regarded as a most clean energy resource and getting high evaluation worldwide. Hydrogen is a most promising energy in the future to be used for home-type fuel cells and for running automobiles. An estimate shows that the Japan's hydrogen market will expand mainly with demand from home-use fuel cells, and hydrogen market size will swell up to 15 thousand billion yen by 2020. Existing hydrogen production method is using crude oil as main resource material and is discharging CO_2 in production process. The aforementioned biological process for producing "biohydrogen" utilizing agricultural waste, will be able to drastically reduce the use of fossil fuels in our society, and at the same time reduce the CO_2 discharged from hydrogen production. (**Author's abstract**)

Keywords: *biohydrogen, agricultural produce, cellulose-type biomass, hydrogen, Japan, carbon dioxide, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/05,
(Filipiniana Analytics)

0218

Completion of a plant that produces bioethanol from bagasse in Thailand

In order to reduce the amount of gasoline consumed in Thailand, the government has taken the lead in promoting the use of "gasohol," which adds bioethanol produced from the abundant supply of sugarcane found in the country to gasoline. Thailand is the world's fourth largest producer of sugarcane, and the fifth largest producer of bioethanol (Fig. 1 and Fig. 2).

Strained lees from sugarcane (bagasse) is left over as the residue from when sugar is extracted from sugarcane. To date, bagasse has been used as fuel for boilers at sugar manufacturing plants, with the bagasse that couldn't be used up that way being disposed of. In 2012, Japan's NEDO began working together with the Office of the Cane and Sugar Board (OCSB), Ministry of Industry, Kingdom of Thailand in advancing the construction of a demonstration plant to extract bioethanol from waste bagasse. This was completed and went into operation at the end of August 2015. This

bioethanol production plant was built by Tsukishima Kikai Co., Ltd. and JFE Engineering Corporation acting on consignment from NEDO on the premises of Thai Roong Ruang Energy Co., Ltd., which is the energy management company of a sugar manufacturing group in Saraburi Province, Thailand (Fig. 3). Its processing capacity for bagasse is 1,300 tons per year, for which it will produce 100 kL of bioethanol per year.

This plant employs a technique that Tsukishima Kikai Co., Ltd. has spent a long time developing. This technique uses the cellulase separated from enzyme producing microorganisms to saccharify cellulose, then ferments the sugar produced using yeast to produce ethanol. Normally, saccharification and fermentation are carried out in separate reaction vessels, as shown in Fig. 4, but this plant is characterized by the fact that a simultaneous saccharification and fermentation technique is used to carry this out in the same reaction vessel. Moreover, the production of cellulase is carried out within the plant, and it has also adopted an on-site production technique for enzymes. Using these techniques, it will be able to produce ethanol from the 20-40% of waste bagasse that previously had not been used up as fuel at the sugar manufacturing plant. (**Author's abstract**)

Keywords: *Thailand, bioethanol, bagasse, gasohol, fermentation, saccharification, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/10,
(Filipiniana Analytics)

0219

Completion of a tidal power generation demonstration test in the Kanmon Straits

Tidal power generation is a method of generating power by using the energy of the tides that flow in a systematic manner according to the ebb and flow that is produced from the gravitational pull of the moon and sun. The current speed is affected by geological formations, with the current speed getting faster at sites where the flow channels are narrow, such as at straights or water channels. The maximum tidal speed in the Kanmon Straights is about 4.8 meters per second, making it one of the foremost straights for swift currents in Japan.

As shown in Table 1, in Kitakyushu City a survey on tidal resources and their usable amount was initiated in FY 2009, and a power generating system was installed in March 2012. Afterwards, a demonstration test was conducted over approximately one year and seven months, and the collection of data related to maintenance and the power generation output was completed in October 2013. As for the water turbines used to generate power, miniature Darrieus water turbines (vertical axis water turbines) with a maximum output of 1.4 kW that were developed by the Kyushu Institute of Technology were used, thereby allowing them to obtain a power generating efficiency of more than 20% even with the relatively slow current speeds found in the vicinity of the pier where they were installed.

What is more, as shown in Table 2, tidal power generation has also been taken up through a research and development project on ocean energy technology by the New Energy and Industrial Technology Development Organization (NEDO), which is moving forward with research and development. (**Author's abstract**)

Keywords: *tidal power generation, demonstration test, Japan, vertical axis water turbine, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/02,
(Filipiniana Analytics)

0220

Completion of one of Japan's largest bioethanol production plants

Japan's paper manufacturing industry uses recovered paper and wood (pulp) as its raw materials, with 60% coming from recovered paper and 40% coming from wood. Its wood consumption in 2010 came to 16.724 million tons. A breakdown of this reveals that 4.955 million tons came from domestic wood and 11.769 million tons came from imported wood, meaning that 70% of the total was covered by imports.

The paper manufacturing company Oji Paper Co., Ltd. has 190,000 ha of company-owned forests in Japan and 300,000 ha overseas to ensure its supply of wood. The company promotes the planting of tree species that grow quickly (fast-growing trees) such as eucalyptus, acacia, willow, and poplar. The pulp (vegetable fiber) used as the raw material for paper is manufactured by first removing the bark from the trunks of these fast-growing trees and then processing these trunks mechanically and chemically. The pulp yield from fast-growing trees is around 65%, as leaves, branches, bark, and the like are wood offcuts not effectively utilized.

Oji Paper Co., Ltd. has completed an experimental pilot plant inside its Kure Mill to produce bioethanol from woody biomass that is the largest of its kind in Japan, with which it will initiate a demonstration experiment. Using unutilized branches and leaves, offcuts that cannot be used as raw materials for manufacturing paper, and fast-growing trees that are felled after a short time as its raw materials, this plant will be able to process 1 ton of these materials per day to produce 250-300 liters of bioethanol. Oji Paper Co., Ltd. also possesses the technology for rendering massive quantities of pulp, which serves as the preprocessing for manufacturing bioethanol. By effectively using unutilized biomass and harnessing its preprocessing technology, the company will expand its new business.

This demonstration experiment consists of research and development that has been commissioned by the New Energy and Industrial Technology Development Organization (NEDO) to Oji Paper Co., Ltd., Nippon Steel Engineering Co., Ltd., and the National Institute of Advanced Industrial Science and Technology (AIST). The demonstration experiment will begin in April 2012. It has set its sights on commercialization between 2015 and 2020, and has laid out the target of keeping production costs down to 80 yen per liter. (**Authors' abstract**)

Keywords: *bioethanol, paper, vegetable fiber, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/02,
(Filipiniana Analytics)

0221

Concentration of industries in the renewable energy sector in Fukushima Prefecture

With the aim of recovering from the earthquake, in August 2011 Fukushima Prefecture worked out the Vision for Revitalization in Fukushima Prefecture and formulated the Plan for Revitalization in Fukushima Prefecture, which set forth measures for this. It has positioned the Renewable Energy Promotion Project as a major pillar within this.

The prefecture established the Research Council for the Promotion of Renewable Energy-related Industries in 2012 on the thinking that it is important to work to create networks that aim for the new entry of companies and other entities. Roughly 500 companies, organizations, and other entities are taking part from within the prefecture and outside of it.

What is more, on March 25, 2014 Fukushima Prefecture concluded an agreement with the National Institute of Advanced Industrial Science and Technology (hereafter "AIST") related to collaboration and cooperation between the two parties. The goals of this agreement included industrial promotion in the sustainable energy sectors in Japan and

Fukushima Prefecture. In April 2014 the Fukushima Renewable Energy Institute, AIST was opened in Koriyama City, thereby setting in place a structure for promoting research and development for the renewable energy sector, technical assistance for local companies, and the development of human resources. The Fukushima Renewable Energy Institute, AIST carries out the research and development shown in Table 1, and provides support to renewable energy-related companies located in the three prefectures struck by the Great East Japan Earthquake (Fukushima, Miyagi, and Iwate) through the Program to Support Corporate Seeds in the Afflicted Region, as shown in Table 2. (**Author's abstract**)

Keywords: *Japan, renewable energy, industrial promotion, research and development, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/07,
(Filipiniana Analytics)

0222

Conference of Asian biomass energy promotion activity in 2009 held

On March 10, 2010, a conference was held with regard to "Asian Biomass Energy Promotion Activity in 2009" at Otemachi Sankei Plaza (Tokyo). The conference was accompanied with an information exchange party, and the participant surpassed 90 people.

Anterior half of conference, presentation and discussions were made as regards biomass energy in Asia-related "policy","model project", "study cooperation", "personnel training project" and "an information dispatch". The main reporters in this session were Agency for Natural Resources and Energy, New Energy and Industrial Technology Development Organization (NEDO), The Institute of Energy Economics Japan (IEE Japan), New Energy Foundation (NEF) and National Institute of Advanced Industrial Science and Technology (AIST).

In the latter half, three presentations were made by foreign invited researchers from Vietnam, Indonesia and Thailand who conducted joint research in accordance with “Asia Biomass Energy Researchers Invitation Program” operated NEF. Finally, presentation and discussions were made as regards “Overview of energy situations in Indonesia”, “Government Policy on Biofuel” and “Expectation/Activities/Acknowledgement for Asia Energy Researchers Invitation Program by NEF" by Dr. Ir. Soni Solistia Wirawan, who is the head of Institute for Engineering and Technology System Design at Agency for Assessment and Application of Technology (BPPT) Indonesia.

In information exchange party, certificate ceremony of “Asia Biomass Energy Researchers Invitation Program” was held. Completion certificate was handed each five invited researchers from Vietnam, Indonesia and Thailand by Mr. Kondo who is Chairman of New Energy Foundation. Completion certificate will be sent later to nineteen invited researchers who already went back to own country. (**Authors' abstract**)

Keywords: *conference, asian biomas energy promotion, policy, model project, information dispatch, study cooperation, personnel training project, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/03,
(Filipiniana Analytics)

0223

Conference of Asian Biomass Energy Promotion Activity in 2010 held

On March 2, 2011, a conference was held with regard to “Asian Biomass Energy Promotion Activity in 2010” at Otemachi Sankei Plaza (Tokyo). The conference was accompanied with an information exchange party, and the participant surpassed 80 people. This time, there were many participants from the private company with 40 people.

Presentations were made as regards biomass energy in Asia-related “policy”, “model project”, “study cooperation”, “personnel training project” and “activity for transmission of information” in the morning. The main reporters in this session were Agency for Natural Resources and Energy (Ministry of Economy Trade and Industry), New Energy and Industrial Technology Development Organization (NEDO), The Institute of Energy Economics Japan (IEE Japan), National Institute of Advanced Industrial Science and Technology (AIST), and New Energy Foundation (NEF).

In the afternoon, the activity result of “The Asia Biomass Researchers Invitation Program. FY 2010” was presented by NEF; and the policy of “Japanese government aims to put the activity results into practical use in the coming years” was also presented. Then, Asia Biomass Energy Researchers of Invitation Program operated by NEF from Indonesia, Thailand, Vietnam, India and Malaysia presented. In these presentations, they focused on “How do we put into practical use?”.

Finally, research activities of biomass were introduced by National Institute of Advanced Industrial Science and Technology (AIST) and Seikei University which were the Japanese acceptance organization of the invitation researcher.

In information exchange party, certificate ceremony of “Asia Biomass Energy Researchers Invitation Program” was held. Completion certificate was handed each seven invited researchers by Mr. Kondo who is Chairman of New Energy Foundation. Completion certificate will be sent later to fourteen invited researchers who already went back to own country. (**Authors' abstract**)

Keywords: *conference, policy, model project, study cooperation, personnel training project, information dispatch, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/03,
(Filipiniana Analytics)

0224

Conference of Asian Biomass Energy Promotion Activity in 2011 held

On March 1, 2012, a conference was held with regard to “Asian Biomass Energy Promotion Activity in 2011” at Otemachi SUNSKY ROOM (Tokyo). The conference was accompanied with an information exchange party, and the participant of domestic and Southeastern Asian research organization, university and he biomass energy-related company surpassed 100 people. In particular, 14 participants from 6 foreign countries, Malaysia, Indonesia, Vietnam, Thailand, Cambodia, Philippines attended this Conference.

Presentations were made as regards biomass energy in Asia-related “International collaboration”, “International operation”, “Biomass research and development and Asian network” and “activity for transmission of information” in the morning. The main reporters in this session were Agency for Natural Resources and Energy (Ministry of Economy Trade and Industry), New Energy and Industrial Technology Development Organization (NEDO), The Institute of Energy Economics Japan (IEE Japan), National Institute of Advanced Industrial Science and Technology (AIST) and New Energy Foundation (NEF).

In the afternoon, “The activity results of the Asia Biomass Invitation Program and their practical use” of Invitation Program organized by NEF were presented. This time, the invited researchers presented the seeds technology of research results and private company (Yamamoto fine coal Industry, JFE engineering, Kansai Electric Power) presented the efforts for practical use of these seeds technology

Then, invited researchers of Asia Biomass Invitation Program operated by NEF from Indonesia and Vietnam presented the activity results, and the focuses on “How do we put into practical use?” were introduced by National Institute of Advanced Industrial Science and Technology (AIST) and Seikei University which were the Japanese acceptance organization of the invitation researcher.

Consecutively, “the information exchange party for matching” was performed for the matching of biomass- research seeds/needs by industry-government-academia. And certificate ceremony of “Asia Biomass Energy Researchers Invitation Program” was held. Completion certificate was handed each invited researchers by Mr. Kondo who is Chairman of New Energy Foundation. Completion certificate will be sent later to invited researchers who already went back to own country. (**Authors' abstract**)

Keywords: *conference, asian biomas energy promotion, international collaboration, international operation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/03,
(Filipiniana Analytics)

0225

Conference on asia biomass energy held

On March 11, 2009, a conference was held with regard to the progress of the Asia Biomass Energy Cooperation Promotion Project in FY 2008, at Tsukuba City. The conference was accompanied with a site tour and an information exchange party, inviting 90 persons from public in general.

In the morning, a site tour was made visiting biomass utilization facilities of the National Institute of Advanced Industrial Science and Technology (AIST), located at the Japan Automobile Research Institute (JARI), and Tsukuba-East and Tsukuba-West Branches of the AIST. Technical presentations were made as regards the R&D conducted on the reduction of environmental pollution from diesel-driven cars, technology to improve quality of new fuels such as biodiesel fuel and their application.

In the afternoon, presentations and discussions were made as regards the present state of biomass energy utilization among Asian countries and in Japan, and also as regards the scope and planning for future cooperation. The main reporters in the session were the Agency for Natural Resources and Energy, the New Energy and Industrial Technology Development Organization (NEDO), the Institute of Energy Economics Japan (IEEJ), the New Energy Foundation (NEF), and AIST.

Next, four presentations were made by foreign invited researchers from Indonesia and Thailand who conducted joint research at AIST in accordance with “Asia Biomass Energy Researchers Invitation Program” operated by NEF. They talked about the status of biomass energy utilization in their countries as well as results of the said joint research in Japan. Their presentations indicated that the Invitation Program has been very effective for promoting biomass energy utilization as well as developing the technology in their countries. (**Author's abstract**)

Keywords: *biomass utilization facilities, reduction of environmental pollution, conference, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0226

Construction of 33,000 kW-class woody biomass power generation plant

Shifting from fossil fuels, utilization of woody biomass is steadily growing. Especially in wood industry, paper industry and furniture industry, woody-biomass-burning (WBB) boilers are more and more coming into use. The number of WBB boilers and that of WBB power plants were 174 and 12 respectively. The numbers increased to 531 and 108 in FY 2007, 615 and 144 in FY 2008, respectively. Here, increase of power plants is especially notable. Among these, the number of large scale WBB boilers installed capacity more than 10,000 kW are 12. The rest WBB are almost small scale boilers installed capacity less than 1,000 kW.

Construction of large-scale WBB power plants is going-on in the Kawasaki factory of ENEOS Co. in Kawasaki city. Kawasaki Biomass Power Co. has started construction of a large-scale biomass power station. The plant is to be constructed in the Kawasaki factory of ENEOS Co. in Kawasaki city, and it will be put into performance trial in October 2010. The output will be 33,000 kW. The cost of construction is 108.5 billion yen, one third of which is granted by NEDO.Waste wood from construction sites and waste woody pellets are collected from Kawasaki city, Yokohama city and southern part of Tokyo (23 ward district) and these waste wood will be made into woody chips. In this project, a chip-making factory capable of 197 ton/day is also to be constructed in addition.

The company estimated that the power plant would consume 180,000 ton of woody chips annually, and this would result in the reduction of CO_2 emission as much as 120,000 a year. (**Author's abstract**)

Keywords: *woody biomass, Japan, wood-biomas-burning, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0227

Construction of biomass power stations in China: outstanding in Jiangsu

Chinese Government made an announcement in September 2007 that China would construct biomass power stations having total capacity of 30,000 MW by 2020. To achieve this goal, construction of biomass power stations began in many places of China, most of which are in accordance with CDM (Clean Development Mechanism). Among them, project of Jiangsu province looks outstanding in terms of total capacity of the power plants including those on the plan.

Looking at the construction cost of biomass power stations, it is noted that the power station in Baotou, Neimenggu, the construction plan of which was released in April 2009, seems quite expensive. Because the Baotou plant is designed to have a capacity 25 MW, while the investment is amounting 147 million USD, that is to say, 5.88 million USD per 1 MW. In general sense, a reasonable construction cost would be as much as 247 million USD per 1 MW,

which was recorded in the case of Wangkui power station in Heilonjiang province. (Capacity 30 MW; Investment 74.17 million USD; Put into operation in November 2007).

Incidentally, it was not so early when China began adopting biomass power generation. The first plant was constructed in Shandong province and started operation in December 2006. The plant has a capacity of 25 MW, consuming 150,000-200,000 ton of biomass annually, and its construction cost was 35.7 million USD.

Looking at southern China, Wuhan Kaidi Electric Power Engineering Company is constructing fifty biomass power stations in the seven provinces of Hubei, Hunan, Shanxi, Fujian, Jiangsu, Jiangxi and Anhui. Each power station would have a capacity of 12 MW, and supply 7.2 billion kWh per year to 70,000 households. WKEPE Co. also presented a plan stating that Electric transmission and distribution system for the districts was ordered to General Electric Co. in June 2008, in addition, reforestation projects covering 4,000 km^2 of area would be carried out by 2013, spending 3 billion Chinese yuan (39 billion yen). (**Authors' abstract**)

Keywords: *China, biomass power, Baotou plant, biomass power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0228

Construction of hydrogen stations via renewable energies

Fuel cell vehicles are automobiles that are extremely environmentally friendly because they use hydrogen for fuel and only give off water instead of emitting CO_2. In December 2014, Toyota Motor Corporation put the MIRAI, a fuel cell vehicle, up for sale, while Honda Motor Co., Ltd. plans to begin selling its own FCV by the end of FY 2015.

One piece of infrastructure that is crucial when it comes to popularizing these fuel cell vehicles is the hydrogen stations that supply hydrogen, which is their fuel. The Strategic Road Map for Hydrogen and Fuel Cells (2014) formulated by the Ministry of Economy, Trade and Industry states that, “The goal is to secure about 100 hydrogen supply stations primarily in four major metropolitan areas within FY 2015.”

As things currently stand, the vast majority of hydrogen stations consist of stations that supply hydrogen produced from fossil fuels. However, progress is also being made on developing stations that use hydrogen produced from renewable energies. Honda Motor Co., Ltd. and Iwatani Corporation, which is a major supplier of hydrogen gas, have developed Japan’s first package hydrogen stations through the use of electrolysis, with the first of these constructed at Saitama City Eastern Area Environment Center in September 2014. This was followed by one built at the Kitakyushu Eco Town Center in December 2014 (see Table 1).

In March 2015, Mitsubishi Kakoki Kaisha, Ltsd, Fukuoka City, Kyushu University, and Toyota Tsusho Corporation completed a station that supplies hydrogen using methane produced via methane fermentation from sewage sludge as its raw material at the Fukuoka City Chubu Water Treatment Center, as shown in Fig. 1. These are the world’s first demonstration-level facilities, and were carried out as part of the Breakthrough by Dynamic Approach in Sewage High Technology Project (B-DASH) by the Ministry of Land, Infrastructure, Transport and Tourism. (**Author's abstract**)

Keywords: *renewable energy, hydrogen station, fuel cell vehicles, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/05,
(Filipiniana Analytics)

0229

Construction of Malaysia's first rice husk power plant

Malaysia began accepting applications for a feed-in tariff (FIT) scheme in December 2011, and its installed generating capacity from renewable energies has reached a cumulative total of 243.3 MW as of 2014. A breakdown of this reveals there is 11.7 MW from biogas power, 55.9 MW from biomass power, 15.7 MW from small hydropower, and 160 MW from solar power (see Fig. 1).

As shown in Fig. 2, biomass from oil palms accounts for the majority of its reserves of biomass energy at approximately 84%. But aside from this, it also has regions where the rice husks generated from rice cultivation can be used. In January 2015, construction work began on Malaysia's first rice husk power plant which will have an output of 9.95 MW. This is being built in the state of Kedah (Fig. 3) in northern Malaysia, where vast quantities of rice husks are produced. The plan for this rice husk power plant is to have Majunaka Eco Energy Sdn Bhd generate power and sell 7 MW to the power company Tenaga Nasional Berhad (TNB), with the remaining power to be consumed internally.

While Malaysia has an abundance of oil palms, the expectation is that in the future it will promote the use of other types of biomass suited to local regions. (**Author's abstract**)

Keywords: *Malaysia, rice husk, power plant, renewable energy, biomass energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/03,
(Filipiniana Analytics)

0230

Construction of proof production plant for BTL

On March 4, 2009, Yonden Engineering Co. Ltd. (YONE) announced that it would construct, at Nakamachi, Tokushima prefecture, by the end of 2009, a proof plant for the production of BTL (Biomass to Liquid), a liquid type biofuel to be produced from abundant thinned wood and waste wood in the region.

Woody biomass is converted into gases (CO and H_2) by pyrolysis, and these gases are converted into liquid fuel (BTL) through Fischer-Tropsch-Reaction. The BTL can be used as substitute for diesel fuel, kerosene or heavy oil. Since BTL is not fossil-derived substance, use of BTL means just a recycling of carbon on the earth, so it does not increase CO_2. Incidentally, this construction of BTL proof plant is the first case of the kind in Japan.

This project was granted to YONE by the Ministry of Economy, Trade and Industry (METI) as a model case of "A Proof Experiment Project : Excavation of Technology Seeds for Realization of Low-carbon Society and Industrial System". The plant is so designed that it can continuously operate for thirty days and produce 15,000 liter of BTL a month. A sum of 130 million yen was allotted for the project during FY 2009. (**Author's abstract**)

Keywords: *Japan, biomass to liquid, biofuel, woody biomass, Fischer-Tropsch-Reaction, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0231

Construction of RITE-Honda process test plant for bioethanol production

The Research Institute of Innovative Technology for the Earth (RITE) and Honda R&D Co. jointly plans to construct, at Kazusa Akademia Park in Chiba Prefecture, a research laboratory for developing practical bio-ethanol production technology. They aim at establishment of practical technology for mass production of bioethanol from cellulose materials such as inedible plant stalks and leaves. The research laboratory will be founded in April 2009 and be operated in November 2009. The Laboratory is to be constructed on a land of 5,000 m^2, and to have one experiment building with floor space of 1,052 m^2 in total.

RITE and Honda has conducted research on the production method of bioethanol based on RITE-Honda process as well as its proof experiment, using a model test plant installed at Honda's Fundamental Technology Research Center since April 2007. The process was developed by fusing together "RITE strain", a microorganism developed by RITE with Honda's engineering technology. The process made it possible to drastically reduce harmful effect on ethanol fermentation, which resulted in much efficient production of bioethanol.

Honda is planning to make trial run of its FFV (Flexible Fuel Vehicle) using bioethanol produced by this test plant. (**Author's abstract**)

Keywords: *bioethanol production technology, Japan, cellulose biomass, RITE strain, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0232

Construction of the largest solar park in Asia is underway in India

India formulated the Jawaharlal Nehru National Solar Mission (JNNSM) in 2009 as a policy for solar power, and is currently promoting its adoption. The adoption of solar power is concentrated mainly in the western states of Gujarat and Rajasthan, which are situated in the sun belt region that is world-famous for its abundance of sunlight. Gujarat is also home to the Charanka Solar Park, which boasts the largest scale in Asia (and is in second place globally). Construction on the solar park began in 2010, and it began operating at 214MW in 2012. The plan is to ultimately expand it to a size of 500MW by the end of 2014. Moreover, 100MW of wind power turbines will also be jointly established together with it, making it the world's largest hybrid park for solar and wind power. There are 17 domestic Indian companies taking part in the project, along with three international companies, including SunEdison LLC. Its total budget is 74 billion yen, and it has received financing of roughly 13.3 billion yen from the Asian Development Bank.

Table 1 shows the rankings of large-scale solar parks in the Asian region. The Nanatsujima Mega Solar Power Plant

on Kagoshima, Japan that went into operation in 2013 is ranked fifth. Fig. 1 shows the locations where large-scale solar parks have been installed. (**Author's abstract**)

Keywords: *India, solar park, wind power turbine, solar power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/03,
(Filipiniana Analytics)

0233

Construction of the world's largest floating mega solar system

Following the start of the feed-in tariff (FIT) scheme for renewable energies, rapid progress has been made with the installation of solar power within Japan, and as such land that can be used to install mega solar plants has been decreasing. When it comes to installation sites that can be used next after land, rooftop lending programs for solar power have been initiated with the roofs of buildings like factories and warehouses serving as candidate sites for this. Initiatives have also begun to install (floating) facilities atop water on ponds used for agricultural water.

West Holdings Corporation, which has head offices in Hiroshima and Tokyo, has actually installed a floating mega solar facility on a pond in Okegawa City, Saitama Prefecture in July 2013. Together with Kyoraku Co., Ltd., which deals in plastic products, it has been developing a floating platform in order to keep costs down.

In August 2014, Kyocera TCL Solar LLC, which is a company founded through joint investment by Kyocera Corporation, a major player when it comes to solar panels, and Century Tokyo Leasing Corporation, announced that it had been supplied with floating platforms from the French platform manufacturer Ciel & Terre and would enter the market for mega solar facilities installed atop water. As its first such project, it started construction on floating mega solar facilities on Nishihira Pond and Higashihira Pond in Kato City, Hyogo Prefecture in September 2014. The floating mega solar facility on Nishihira Pond in particular will be approximately 1.7 MW in size, which will give it the world's largest installed capacity when it comes to floating solar power.

West Holdings Corporation is aiming to install 30 MW a year, while Kyocera TCL Solar LLC is aiming to install 60 MW in FY 2014, with the expectation being that progress will continue to be made with the installation of floating mega solar facilities in the future. (**Author's abstract**)

Keywords: *floating mega solar system, renewable energy, Japan, facility installation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/11,
(Filipiniana Analytics)

0234

Construction of woody-pellet production plants in Thailand and Indonesia

Southeastern Asian countries are endowed with rich forestry resources. Their natural settings are ideally suited for woody biomass production owing to their vast land areas and abundant sunshine. Table shows their forest areas and reserve of forestry resources. In recent years demands for biofuel has been rising worldwide, and bioenergy businesses are becoming more and more interested in southeastern Asian countries that are rich in forestry biomass.

As an example of utilization of biomass resources, Vega Promotional Systems Inc., 100 subsidiary to Natural Fuels Industries Inc., of Thailand announced in March 2009, that the company plans to produce woody pellets of 8 mm size, by utilizing existing production plant at MAPTaPHUT Port after some conversion. Chaffs, corncobs and waste of eucalyptus will be the raw materials for the pellets. Vega plans to produce 500,000 ton annually, the plant will be in full operation in autumn 2009. Of the product, 20% will be consumed in Thailand, and 80 % will be exported to Europe and America.

Meanwhile, in March 2009, a project agreement has been signed between Korean and Indonesian governments. The agreement states a woody-pellet production plant will be constructed and operated in 2010 in Kalimantan, Indonesia. The size of the production is now under negotiation, however, they plan to construct a woody pellet production plant designed to utilize biomass fed from the 200,000 ha of forest. The product will be exported to Korea. Some Japanese electric power companies have already started so-called bio-power generation by burning woody tips imported from southeastern Asia. Many other countries are looking at southeastern Asian countries as rich biomass reserve areas, and therefore more bio-businesses and bio-projects of this sort will likely be developed in near future. (**Author's abstract**)

Keywords: *southeastern asia, biofuel, bioenergy, bio-power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/05,
(Filipiniana Analytics)

0235

Construction started for the first commercial hydrogen production plant using woody biomass

Japan's forestry reserve in FY2005 was 4,340 million m^3, composed of planted forests (2,554 million m^3) that are cultured by human hands for producing lumber, and natural forests (1,786 million m^3) that are grown by the Nature.

The forestry reserve has been increasing steadily at a pace of 80 million m^3 a year, of which planted forests have larger proportion. This is on one hand because the trees planted just after the World War II, by national encouragement policy, have now grown up and waiting for cutting down, and on another hand because comparatively low-priced imported lumber increased and consequently use of domestic wood became very little.

A huge amount of woody biomass, as waste, is generated every year in Japan's forest reserve. It is composed of forestry residue (8.6 million m^3), waste from lumber mills (10.8 million m^3), and waste from construction (11.8 million m^3). Regarding use of the woody biomass, 8.6 million m^3 (28%) is used for energy generation, 9.8 million m^3 (31%) is used for production of various materials, and so far, Japan could not find a proper way to reuse the rest 12.8 million m^3 (41%).

Suppose that all of the unused woody biomass as much as 12.8 million m^3 to be palletized and used for energy generation, the total energy will be equal to that of 2.4 million kl of crude oil, and in addition it will result in the reduction of CO_2 emission by 5 million ton. Considering of the unused biomass as well as the abovementioned natural increase of forest reserve as much as 80 million m^3 per year, Japan has indeed a very abundant, unused woody biomass resources. If it is possible to use them properly as energy resources, Japan could cut down CO_2 emission drastically.

As for a new way of woody biomass use, on 2 June 2010, IDEX Co,LTD made an announcement that it would start construction of a hydrogen gas production plant that gasifies woody biomass. The plant, reportedly, would use various waste woody biomasses discharged from lumber mills and construction sites in Fukuoka prefecture, and it can produce 7,200m^3 of high purity hydrogen gas per day from 15 ton of waste woody biomasses. IDEX Co,LTD plans to make test run of the plant during FY 2011 before starting full commercial operation. A commercial type gasification plant of this scale (15 ton/day) is the first in the world. The hydrogen produced here will be used for fuel-cells. (**Authors' abstract**)

Keywords: *Japan, commercial hydrogen production plant, woody biomass, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/07,
(Filipiniana Analytics)

0236

Contract price agreed on RDF from RDF manufacturing plant in Shiraoi-cho, Hokkaido

The Japan's first RDF power station was commissioned in 1989, and currently more than 16 stations are in operation, of which three stations are in Hokkaido. Seven RDF manufacturing plants (excluding RPF manufacturing plants) have been constructed to satisfy demand.

The RDF plant under construction at Nippon Paper Industries' Shiraoi-cho site in Hokkaido will produce 37.6 tonnes of RDF daily, for which a contract price of 5,775 yen per tonne has been agreed. Total processing costs will therefore increase to 200,963,000 yen, however Shiraoi-cho will bear 170,000,000 yen of this annually, so that costs are expected to drop to 109,188,000 yen. (**Author's abstract**)

Keywords: *power station, Japan, manufacturing plants, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/01,
(Filipiniana Analytics)

0237

Cooperation between Japan and India in the Renewable Energy and Energy Conservation Sectors

India is the world's third largest emitter of greenhouse gases. In October 2015, the country submitted its target to cut its amount of greenhouse gases per unit of gross domestic product (GDP) by 33-35% (to 2005 levels) by the year 2030. This was done with a view towards the 21st session of the Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC) to be held in December 2015. As part of this, it will proactively adopt renewable energies, with this to include raising power generating capacity to 175 million kW through solar power (100 million kW), wind power (60 million kW), biogas (10 million kW), and hydropower (5 million kW). It is also planning to rapidly expand demand for infrastructure in the renewable energies sector in the future, such as by promoting energy conservation and afforestation.

At the Japan-India Summit Meeting held in September 2014, agreement was reached over the goals of doubling direct investment to India and the number of Japanese companies entering the market there over the next five years. The Ministry of Economy, Trade and Industry of Japan partnered with the Ministry of New and Renewable Energy and the Ministry of Power of the Republic of India to hold the Renewable Energy Working Group and Energy Conservation Working Group at the end of August 2015 in New Delhi. These were designed to strengthen cooperation in the renewable energy sector and the energy conservation sector. The two working groups confirmed the progress of joint projects between the two countries, such as demonstration projects for energy conservation and the energy conservation sector through the New Energy and Industrial Technology Development Organization (NEDO), and also held discussions related to new areas of cooperation.

At the Renewable Energy Working Group, discussions were held on the energy storage, solar energy, and biomass energy sectors as new areas of cooperation in India through NEDO. Here it was affirmed that storage batteries by Japanese companies are effective, especially for the energy storage sector (Fig. 1).

NEDO sponsored the India-Japan Energy Forum 2015 "Exhibition," an exhibition for the renewable energy sector in India that will last for three days starting from September 23, 2015. At the event, a large number of outstanding energy technologies possessed by 24 Japanese companies and organizations was put on display and introduced. (**Author's abstract**)

Keywords: *India, energy conservation, renewable energy, solar power, wind power, biogas, hydropower, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/11,
(Filipiniana Analytics)

0238

Current state of and challenges for solar power in India

India is a tropical country that receives strong sunlight over an extended period of time each day, making solar power a promising form of energy for it. The Indian Government laid out the Jawaharlal Nehru National Solar Mission (JNNSM) in 2009 as its policy for solar power.

As part of this it laid out the goal of generating 22 GW of solar power by FY2022 while keeping the generation costs inexpensive at a level equivalent to the existing generation costs. In 2010, power generation installed capacity in India was 168,945MW, of which renewable energy occupied 11% (18,655MW); wind power (13,066MW), small hydropower (2,939MW), bio power (2,632MW), solar power (18MW). At present the cumulative total for India's solar power is 18 MW, with its target value of 22 GW representing an ambitious figure that is on par with the 24.8 GW produced in Germany, which is the world's largest generator of solar power.

In order to encourage the generation of solar power, India has introduced a feed-in tariff system for electricity. To foster domestic companies, during the bidding for electricity generation projects that would like to purchase electricity it is requested that both the solar panel cells and modules be manufactured within India. Due to the impact from the global drop in the price of solar battery modules, the price for the recently conducted second term bid fell from the

12.15 Rupees/kWh (17 yen/kWh) from the first term to 10 Rupees/kWh (14 yen/kWh). Doubts have been raised over whether this price is viable in a business-sense at this level, and reducing the generating costs via market expansion and technical innovations could be brought up as a challenge for the future. (**Authors' abstract**)

Keywords: *India, solar power, power generation, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/06,
(Filipiniana Analytics)

0239

Current state of geothermal power in the Philippines

The Philippines is the country that is in fourth place after Indonesia, the United States, and Japan in terms of its geothermal resources, and as indicated in Fig. 1 it is in second place worldwide in terms of its cumulative installed capacity for geothermal power. The introduction of geothermal power had been stagnant in the Philippines since 2000, but the enactment of a bill on renewable energies in 2009 has set things in motion once again through the adoption of preferential legal and economic measures for the introduction of renewable energies (including geothermal power). In its roadmap of the National Renewable Energy Plan (2010-2030) it planned to adopt 15,236 MW of geothermal power by the year 2030. Its current capacity of 1,843 MW from 2013 has fallen off from its 1,904 MW from back in 2010 on account of the aging of facilities and the fact that they are under construction to rehabilitate them from said aging.

Fig. 2 shows the locations of existing and planned geothermal power plants. If the plans indicated here are achieved then its capacity will rise by roughly 290 MW.

Of these, Yokogawa Electric Corporation has received an order for a project to build a geothermal power plant in Maibarara. This is the first project to which the country's Renewable Energies Act enacted in 2008 applies. Trial operations began in August 2013, with plans to begin commercial operation in the fourth quarter of 2013. What is more, Sumitomo Corporation has received an order from EDC for a project to relocate the major facilities from North Negros to Nasulo due to the aging of the geothermal power plant at the former site, with this slated to be completed in 2014. (**Authors' abstract**)

Keywords: *Philippines, geothermal power, status, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/11,
(Filipiniana Analytics)

0240

Current state of renewable energies in Brunei Darussalam

Brunei Darussalam is a 5,765 square meter (roughly the same as Mie Prefecture in Japan) country with oil and natural gas resources that is located on the island of Borneo adjacent to Malaysia. It covers its own energy use through oil and natural gas, as shown in Table 1 and Fig. 1. For this reason, it had minimal interest in the use of renewable energies, but due to mounting worldwide interest in this and in order to diversify its energy sources and bolster its energy

security it set out a goal of adopting 10% electricity from renewable energies in 2035 in the Energy White Paper presented by its Energy Department in 2011.

One example to date where this has been introduced is the Tenaga Suria Solar Power Plant being carried out jointly between the Brunei government and Mitsubishi Corporation. This is a power plant with a 1.2 MW installed capacity that uses six types of solar cells. The partners gathered data for three years from 2010 to 2012 and evaluated the regional characteristics of the solar cells and the commercial viability for generating power with the aim of promulgating solar power generating projects thereafter. Aside from this, demonstration projects with regional characteristics are being carried out like those for the installation of solar power on offshore platforms for oil and gas and floating structures. In addition, evaluations are also being performed on the commercial viability of introducing waste power generation (20 MW) and offshore wind turbines (16-20 MW). (**Author's abstract**)

Keywords: *Brunei Darussalam, renewable energy, natural gas, oil resource, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/11,
(Filipiniana Analytics)

0241

Current state of solar thermal power in Australia

In Australia, there is little in the way of solar dispersion and the country has intense solar radiation, making it one of the world's best-suited regions in the world for solar thermal power (Fig. 1). The Australian government established the goal of covering 20% of its electricity through renewable energy by 2020, and has been vigorously adopting solar thermal power as one type of renewable energy. Plants are currently in operation in two locations in Australia, with another two locations under construction (see Table 1 and Fig. 2).

The plant at Lake Carelligo, which has been operating since 2011, consists of eight solar towers made up of graphite solar storage receivers (SSRs). It uses graphite heat storage developed by Graphite Energy of Australia, and employs a special method of continuously generating 3 MW using steam turbines by switching over pipes to concentrating towers that produce steam.

The Liddell Plant that went into operation in 2012 uses a hybrid power generating system in which solar heat is used to produce steam, which is sent to an adjoining coal-fired power plant to reduce the amount of coal used. This method is also being adopted for the Kogan Creek Plant, which is scheduled to begin operating in 2016. The Jemalong Plant contains heat storage tanks via liquid sodium, which enable it to produce power even at nighttime when there is poor solar radiation.

The techniques used in these plants do not consist of the simple structures seen in other countries with advanced solar power technology. Rather, solar power projects with various different configurations, such as graphite heat storage systems, or supplying steam to coal-fired power plants in a hybrid manner, are lined up and assessed next to each other, thereby assuming the aspect of a solar thermal power assessment test. The expectation is that this will reduce initial investments and also reduce fuel expenses, particularly in cases where these are added on as additions to established thermal power plants. (**Author's abstract**)

Keywords: *Australia, solar thermal power, renewable energy, hybrid power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/10,
(Filipiniana Analytics)

0242

Current state of solar thermal power in India

The Indian government initiated the Jawaharlal Nehru National Solar Mission (JNNSM) in 2009 as its policy for solar power. The mission aims to introduce 20 GW of solar power generation by the year 2022, with this including both solar power and solar thermal power.

In June 2013, India's first commercial concentrating solar power (CSP) plant with an output of 50 MW began operating in Rajasthan. The power plant operator is Godawari Green Energy Limited (GGEL), and the plant utilizes a parabolic trough configuration. This was followed in November 2014 by the world's largest linear Fresnel CSP (100 MW) by Reliance Power Limited in Rajasthan, then by a parabolic trough CSP (50 MW) by Megha Engineering and Infrastructure Ltd. (MEIL) in Andhra Pradesh (see Tables 1 and 2). All of these plants have received certification from JNNSM. Aside from these, construction is moving ahead with a CSP plant of more than 270 MW that has also been certified. (**Author's abstract**)

Keywords: *India, solar thermal power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/03,
(Filipiniana Analytics)

0243

Current status of wind power in Myanmar

As indicated in Fig. 1, hydropower accounts for roughly 66% of the power generating equipment in Myanmar, with natural gas-fired thermal power accounting for about 29%. With hydropower, which accounts for the bulk of this, the amount of power generated declines in the dry season compared with the rainy season. As a result, the country must develop renewable energies aside from hydropower in order to meet the demand for power that will come about as a result of its future economic growth.

In 1997, Japan's NEDO carried out a survey on Myanmar's potential for wind power. The results showed that the available supply is 365.1 TWh/year, and indicated that the Bay of Bengal and the 2,832 km long coastal region running along the Andaman Sea is suitable for wind power. In 2003, a 40 kW wind power system developed by Fuji Heavy Industries Ltd. of Japan was installed in the village of Chaung Thar, which faces the east coast of Myanmar. This was accomplished through a NEDO program, and has the distinction of being the first instance of hybrid power generation in Myanmar.

In 2014, the Ministry of Energy of Myanmar concluded an MOU concerning a large-scale wind power project with Gunkul Engineering Public Co., Ltd. of Thailand and China Three Gorges Corporation of China. Following this, Feasibility Studies of 18 sites were initiated, as shown in Fig. 2. Moreover, in June 2015 Zeya & Associates Co., Ltd., a power developer from Myanmar, and Vestas Wind Systems A/S, a manufacturer of wind power generation equipment from Denmark, agreed to build a 30 MW wind power plant in Mon State. The World Bank is preparing to provide USD 4 million for Myanmar's plans to augment its power supplies, and there is gathering momentum to begin building large-scale power generating facilities in Myanmar. (**Author's abstract**)

Keywords: *Myanmar, wind power, renewable energy, hybrid power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/09,
(Filipiniana Analytics)

0244

Decision reached to build a large-scale geothermal power plant in a Quasi-National Park in Japan

The Wasabizawa Geothermal Power Plant, which is slated to be built in Kurikoma Quasi-National Park in Akita Prefecture, was adopted as a project eligible for a loan guarantee by Japan Oil, Gas and Metals National Corporation (JOGMEC), with construction work slated to begin in April 2015. This geothermal power plant will employ a double-flash system with an output of 42 MW. As a large-scale geothermal power plant within Japan, this plant comes 19 years after the Takigami Geothermal Power Plant (Oita Prefecture) went into operation in 1996. It will also be the first large-scale geothermal power plant since the 1999 enactment of the Environmental Impact Assessment Law aimed at geothermal power plants larger than 10 MW. With respect to the environmental impact assessment, the assessment was finished in its entirety in October 2014, which was three years after the environmental impact assessment scoping document was initially filed.

This is scheduled to begin operating in May 2019. Its implementing body is Yuzawa Geothermal Power Corporation, which is being financed by J-Power, Mitsubishi Materials Corporation, and Mitsubishi Gas Chemical Company.

Table 1 shows the rankings of geothermal power plants in Japan larger than 10 MW by permitted output. Once Wasabizawa Geothermal Power Plant is completed it will have the third highest output in Japan.

What is more, of all the renewable energies, geothermal power is one power source that is not governed by the weather and which can stably supply power year-round. As such, it has a high equipment capacity factor of approximately 70%. This value is enormous compared to the roughly 20% for wind power and the roughly 12% for solar power, and so there are expectations that geothermal will continue to spread in the future. (**Author's abstract**)

Keywords: *Japan, geothermal power plant, renewable energy, double-flash system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/03,
(Filipiniana Analytics)

0245

Demand for gasoline in India will grow by 8.5% in the future

India’s population of 1.21 billion people (as of March 1, 2011) ranks it second place in the world behind China’s population of 1.417 billion people. If things continue on their current course, then it will surpass China to become the most populous country in the world in 2025, and is expected to reach 1.6138 billion people by 2050. The country’s rising energy consumption is commensurate with its economic development and increase in population. The amount of oil consumed by India in 2010 came to 155.5 million tons, which ranks it fourth in the world behind the United

States, China, and Japan. This rise in oil consumption has been brought about by the fact that gasoline consumption is increasing due to the rapidly advancing motorization of India's middle-income class.

In May 2011 the Danish company Novozymes announced the following study results concerning India's biofuels market: "By 2020 India will be able to cover 59% of its demand for gasoline through biofuels from the agricultural waste from rice, wheat, and corn." With regard to expanding the dissemination of biofuels, the Indian Government announced in its National Policy on Biofuels that it will, "Replace 20% of the fuel used for transport with biofuels by the year 2017."

Currently, bioethanol in India is manufactured from molasses, which is a byproduct from the process of manufacturing sugar from sugarcane. The amount of sugar produced in India in FY2008 was 15.8 million tons. The amount of molasses produced was 6.5 million tons, and the amount of ethanol produced from this came to 1.3 billion liters (1.02 million tons). As part of the production of ethanol, 150 million liters (120,000 tons) were consumed as fuel, accounting for about 1% of the annual amount of gasoline consumed in India (17.3 billion liters).

For the future, the demand for gasoline is forecasted to grow 8.5% a year, and in 2017 more than 30 billion liters of gasoline will be needed. It cannot achieve its goal from the National Policy on Biofuels with ethanol from molasses alone. But in India there are rising expectations for the abundant production of bioethanol from agricultural waste, which serves as the raw material. (**Authors' abstract**)

Keywords: *India, gasoline, bioethanol, sugarcane, molasses, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/07,
(Filipiniana Analytics)

0246

Demand for wood pellets in South Korea will reach 5 million tons in 2020

The South Korean Government has laid out a vision of "low carbon, green growth," which aims for sustainable economic growth by minimizing energy and resource consumption while simultaneously minimizing CO_2 emissions. In order to promote this vision, the government settled on a basic plan of developing and popularizing the use of domestic new and renewable energy technology. This has been backed by the fact that South Korea is dependent on imports for 97% of the energy it consumes.

The "new and renewable energy" classification refers to energy from wind power, sunlight, solar heat, small hydroelectric power, geothermal heat, biomass, and waste. The targets for the amount of primary energy comprised of "new and renewable energy" are 2.4% (2007), 6.1% (2020), and 11.5% (2030). In 2007 biomass accounted for 6.0% of new and renewable energy, but the country plans to try to expand the use of biomass by raising this to 30.8% for 2030.

Due to the fact that South Korea's land is 63% forests, the use of forest biomass will be effective in terms of both creating employment and protecting the environment. The government decided in 2010 that it would build eight new plants for manufacturing wood pellets. The use of pellets as an energy source for generating electricity and for boilers (that use heat) will expand hereafter, with it conjectured that there will be demand for 5 million tons in 2020. It cannot supply this with domestic production alone, and so 75% of this will be covered by imports. In 2009 it imported pellets from nine countries, including China, Canada, and Vietnam.

Meiken Lamwood Corporation, Ltd. (Maniwa City, Okayama Prefecture), which is a major manufacturer of laminated wood in Japan, began exporting several dozen tons worth of pellets to South Korea in October 2010. It plans to expand this to as much as 200 tons each month for the future, and is aiming to expand sales to 17,000 tons a year at full operation by securing stable sales channels. (**Authors' abstract**)

Keywords: *South Korea, wood pellets, carbon dioxide emission, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/07,
(Filipiniana Analytics)

0247

Demonstration experiment of power generation by cofiring started in Nobeoka City

Demonstration experiment of power generation by co-firing biomass with coal is now advancing in collective work with Nobeoka City, Nobeoka forestry association and Asahi KASEI Corp. in Gokase River watershed area. The Gokase River runs through the northern side of Miyazaki Prefecture and has the river mouth in Nobeoka city.

The biomass is chip which is made from forest biomass in Gokase River watershed area where is rich in forest resources. The use of the forest resource creates employment of forestry worker, and the reason for use of forest resource is to reproduce forest, and to return to the old forest.

The goal of demonstration experiment is to make the system that wood chip can be used with the cost that is near to coal. The wood collection, transportation system that can become profitable will be built by making transportation test of thinning wood with high-performance forestry machine and by calculating the collection/transportation cost and amounts of woody biomass such as construction material.

Power generation by co-firing will start in July 2012; co-firing 40% of coal and 60% of woody chip is planned. The wood chip is used 100,000 tons a year and CO_2 emission reduction is expected 170,000 tons a year.

The cost of import coal is 10,000 yen/ton in March 2011. It seems that coal price rises in future. It is necessary for wood chip that the cost of chip is cheaper than coal, because calorific value of chip is 60% of coal.

The use of woody biomass takes important roles to create job and to make reforestation in addition to reduce CO_2 emission. Feed in Tariff (FIT) system is now considered. This system is that electric company purchases electricity by renewable energy at fixed price. In conjunction with FIT system, this demonstration experiment, which makes system of chip derived from forest available-utilization, in Nobeoka city attracts rising attention. (**Authors' abstract**)

Keywords: *power generation, Nobeoka City, coal, forest biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/05,
(Filipiniana Analytics)

0248

Demonstration experiment on wave power generation started

A demonstration experiment on wave power generation began in April 2015 in the Port of Sakata in Yamagata Prefecture (see Fig. 1). This experiment is being carried out as part of NEDO's Research and Development of Ocean Energy Technology, and it aims to get the costs of generating power down under 40 yen/kWh for when this is commercialized.

This demonstration experiment employs a wave power generation system that uses an oscillating water column air turbine. With this system, the upwards and downwards movement of the water level caused by the power of the waves is converted into airflow within an air chamber, with this air used to power a turbine to rotate a generator, thereby providing electrical energy. The direction the air flows is constantly alternating as a result of the upwards and downwards movement of the water level, but this uses a special turbine with which the rotating direction remains the same. It has an installed capacity of up to about 15 kW.

This demonstration experiment in the Port of Sakata follows after an experiment that started about 30 years ago, making this the second such experiment here (Table 1). The first demonstration experiment took place between 1987-1999 on wave power generation using an oscillating water column. It was carried out as joint research between 20 private companies that was mainly led by the former First District Port Construction Bureau of the Ministry of Transport and the Coastal Development Institute of Technology. As indicated in Table 1, this current experiment is being carried out under the primary leadership of NEDO with the participation of Mitsubishi Heavy Industries Bridge & Steel Structures Engineering Co. Ltd., TOA Corporation, and other institutes and companies.

This experiment added a mechanism for boosting the conversion efficiency of air energy for a broad range of wave frequencies. It also switched the type of oscillating water column air turbine over from the Wells turbine used in the first experiment to a newly developed impulse turbine in the aim of improving the generating efficiency.

A mechanism that can be attached to existing breakwaters has also been adopted in the hopes that it can reduce construction and installation costs. (**Author's abstract**)

Keywords: *wave power generation, Japan, renewable energy, oscillating water column air turbine, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/06,
(Filipiniana Analytics)

0249

Demonstration test units for floating offshore wind turbines are going into operation in quick succession

On October 28, 2013, a 2 MW floating wind turbine (Ministry of the Environment) went into operation off the coast of Kabashima Island, Goto City, Nagasaki Prefecture. In addition, on November 11 a floating offshore wind turbine (Ministry of Economy, Trade and Industry) went into operation off the shore of Fukushima Prefecture. For the one off the coast of Fukushima Prefecture, at first a 2 MW turbine was installed and two 7 MW turbines are slated to be added to this by the year 2015.

Japan is a maritime nation with the world's sixth largest exclusive economic zone, and can utilize a vast expanse of ocean. However, the coastline around Japan has many places where the land suddenly plunges downwards, and so it has to install wind turbines in relatively deep waters, as opposed to the shallow ocean regions like those found in Europe. Furthermore, these demonstration tests must take into consideration not only the impact from the wind and waves, but also the impact to marine organisms. According to the survey by the Ministry of the Environment shown in Table 2, installing floating wind turbines demonstrates the potential to obtain an installed capacity that is roughly 4.5-times that from on land.

The only actual track record with floating offshore wind turbines globally comes from the Hywind Project (2.3 MW) in Norway and the Principle Power Project (2 MW) in Portugal, giving Japan the top share worldwide in the floating offshore wind turbine sector. As for Japan's wind turbine companies, Mitsubishi Heavy Industries Co., Ltd. established an offshore wind turbine joint venture with Vestas (ranked second in global share in 2012) from Denmark in

September 2013, and is setting in place a structure with aspirations of reaching the top class globally. (**Author's abstract**)

Keywords: *demonstration test, wind turbine, renewable energy, Japan, floating offshore, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/12,
(Filipiniana Analytics)

0250

Demonstration tests for the use of biomass in Cambodia

Roughly 70% of the working population in Cambodia is employed in agriculture, with the cultivation of rice in paddy fields thriving on 90% of its farmland. Conversely, while village electrification plans are making progress as indicated in Fig. 1, the overall electrification rate in Cambodia is 24%, with the electrification rate being even lower in agricultural districts. For this reason, the country considers the installation of transmission networks along with decentralized power generation through renewable energies to be countermeasures for this. Consequently, it is considering generating power from the rice husks, rubber trees, bagasse, and cashew nut hulls from Table 1, which are the remnants left over from agricultural production that are produced in abundance in agricultural regions.

NEDO installed a rice husk gasification power facility within a rice mill in Takéo Province, which is located to the south of Phnom Penh, where it is conducting demonstration tests since 2011. What is more, the Ministry of Industry, Mines and Energy of Cambodia announced in February 2013 that it will be carrying out a project with a budget of USD 5.6 million over a span of four years to develop technologies for generating renewable energies from biomass fuel. This will target the five sectors of food processing and clothing factories, brick furnaces, rubber factories, and rice mills, and will receive technical and economic support from the United Nations Industrial Development Organization (UNIDO) and Global Environment Fund (GEF).

Moreover, by way of initiatives by Japanese companies the Chugoku Electric Power Company, Inc. and others have partnered with the Institute of Technology of Cambodia to carry out a demonstration test on power generation from the co-combustion of biomass obtained from gasifying a mixture of the jatropha residue and rice husks and other remnants left over from agricultural production, to which jatropha oil has been added. (**Author's abstract**)

Keywords: *Cambodia, renewable energy, biomass fuel, decentralized power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/12,
(Filipiniana Analytics)

0251

Determining demonstration ocean areas for ocean energy in Japan

Japan possesses some of the world’s foremost expansive ocean areas, and has enormous potential for ocean energy. However, demonstration trials on developing ocean energy power generation have not proceeded as expected due to

concerns over factors like the impact on marine organisms and fishing rights. In order to overcome this current state of affairs, the Headquarters for Ocean Policy of the Cabinet Secretariat took the lead in selecting demonstration ocean areas in the six locations shown in Fig. 1 in July 2014. In these areas improvements have been made to legal structures for using the water areas and multiple support measures have been enacted (New Energy and Industrial Technology Development (NEDO) and the Ministry of the Environment) by local municipalities in coordination with companies on the development side and residents. Within the water areas that were recently selected, the construction of an IHI plant and demonstration trials for ocean thermal energy conversion by Xenesys Inc. and others were begun in FY 2013 in Okinawa Prefecture. What is more, the world's first hybrid tidal and wind power generation by MODEC Inc. is currently underway off the coast of Kabeshima Island, Karatsu City, Saga Prefecture with a view towards a demonstration trial being held there sometime in 2014.

On the other hand, in Europe, which is more advanced than Japan in terms of the development of ocean energy, various countries have been conducting demonstration trials at the European Marine Energy Center (EMEC) on the Orkney Islands in northern Scotland. The expectation is that now that a structure for performing demonstration trials has at last been set in place in Japan as well, this will accelerate the development of ocean energy in the country. (**Author's abstract**)

Keywords: *Japan, ocean energy, wave power generation, renewable energy, ocean thermal energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/08,
(Filipiniana Analytics)

0252

Development of a superconductive flywheel as a countermeasure against the output fluctuations from renewable energies

Fluctuations in the power output generated by solar and wind power are unavoidable due to changes in sunlight and wind speed. As the amount of such renewable energies that fluctuate due to the weather introduced increases, it could potentially affect the stability of the electrical grid. There are a number of different methods to ensure the stability of the electrical grid. Large-scale storage battery systems (see Table 1) that use lithium ion batteries or the like have been developed as one such method, and demonstration experiments are being carried out on them.

As for other methods other than storage batteries, a group led by the Railway Technical Research Institute and Furukawa Electric Co., Ltd. began a demonstration experiment in April 2015 that uses a superconductive flywheel storage device. With this device, when there is surplus electricity a motor is used to turn a flywheel to store this as rotational energy. Conversely, when there is a shortage of electricity the flywheel is used to operate a motor that acts as a generator, thereby generating electricity. Since this flywheel rotates by floating without making contact as a result of high-temperature superconduction technology, it is capable of minimizing energy loss due to friction. The device is one of the largest superconductive flywheels in the world, and its specifications are shown in Table 2.

After the experiment concludes, this superconductive flywheel device is slated to be relocated to the 1 MW Komekurayama Solar Power Plant run by Yamanashi Prefecture, where it will be connected to the grid in the summer of 2015 to collect basic data. (**Author's abstract**)

Keywords: *superconductive flywheel, output fluctuation, renewable energy, solar power, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/06,

(Filipiniana Analytics)

0253

Development of a yeast that reduces bioethanol production costs

Japan's CO2 emissions for FY2009 came to 1.075 billion tons, of which emissions from the transportation sector (automobiles, ships) accounted for roughly 21% at 230 million tons. The transportation sector's CO_2 emissions have been declining steadily from their peak of 267 million tons in FY2001. But seeing as how CO_2 emitted from automobiles accounts for as much as 90% of the transportation sector's emissions, countermeasures to reduce CO_2 are extremely important to the auto industry.

The Japan Automobile Manufacturers Association, Inc. is working on further reducing CO_2 emissions from automobiles. As part of this, the dissemination and expansion of biofuels that are suited to local conditions is considered to be an extremely effective way of reducing CO_2 emissions. As such, the plan is to strive to promote the commercialization of cellulosic ethanol and biomass to liquid (BTL), which do not have an impact on food, and increase the amount introduced.

Bioethanol currently accounts for the main source of biofuels for automobiles. The automobile manufacturer Toyota Motor Corporation is proactively working to develop cellulosic bioethanol. It opened its Biotechnology and Afforestation Laboratory (Miyoshi City, Aichi Prefecture) as a research institute for producing cellulosic bioethanol in October 2011.

This laboratory succeeded in developing a yeast that boosts the production efficiency of bioethanol by using genetic recombination technology. Through this method they obtained an ethanol fermentation concentration that ranks among the best in the world (approximately 47g/L), with the expectation being that this will substantially reduce production costs. Toyota has decided that it will move ahead with development with the goal of making practical use of cellulosic ethanol in 2020. (**Authors' abstract**)

Keywords: *yeast, cellulosic ethanol, bioethanol, genetic recombination technology, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/01,
(Filipiniana Analytics)

0254

Development of biomass energy use in Southeast Asia

Southeast Asian nations are rapidly becoming aware of the importance of biomass energy and they are looking forward to introducing development aids and/or CDM projects from Japanese enterprises. (CDM=Clean Development Mechanism)

Chubu Electric Power Co., Inc. announced that it would begin commercial operation of their two electric power stations, the goal of the company's electric power supply project using palm-biomass, at eastern Saba-State of Borneo island in Malaysia in January or February 2009. So far, most of empty shells of coconut (=palm-fruit) were regarded as waste and brought to dump heaps after extracting the content that yielded palm oil. The power stations are expected to supply 10,000 kW of electricity commercially, and Chubu Electric Power will gain two million tons of "CO_2-Credit" by the end of 2012.

Itochu Corporation is planning to initiate the production and sales of a biofuel as substitute for gasoline, jointly with local enterprises in Thailand. The biofuel is produced from molasses which is the remain of sugar-beet after sugar extraction. (**Author's abstract**)

Keywords: *biomass energy, clean development mechanism, electric power station, coconut, molasses, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,
(Filipiniana Analytics)

0255

New development of high efficiency lignin elimination technique

Innovative Bioethanol Technology Research Union (IBTRU) plans to establish bioethanol production technology by FY 2015. Their new production plant would be capable of supplying 200,000 kl of bioethanol which would be sold on market at 40 yen/liter. A member of the Union, Nippon Oil Corporation (ENEOS) released that they had succeeded in developing a novel advanced pre-processing technique for the production of bioethanol from cellulose biomass.

It is a novel eliminating technique of lignin what ENEOS has developed. In the production process of bioethanol, lignin must, at first, be eliminated from cellulose biomass, since lignin interferes with fermentation. Woody biomass is first fragmented into small particles of 0.2 to 2 mm diameter, then mixed and heated in a pre-processing tank where the mixture is exposed to a special gas that efficiently takes away the lignin. With this pre-processing, it was proved that the new process, in a best condition, could produce saccharide six to seven times more than the case without pre-processing. In addition, this pre-processing could efficiently eliminate lignin under a relatively low temperature and also it is harmless to environment. (**Author's abstract**)

Keywords: *bioethanol, cellulose biomass, bioethanol production technology, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0256

Development of ocean energy in Australia

According to a survey carried out by Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO) in 2012, ocean energy is a renewable energy with enormous potential that is in its initial stages of development, which it posits could supply 11% or more of Australia’s electricity in 2050.

Since the powerful waves that surge towards its southern coastal areas throughout the year are particularly ideal for wave power generation, they represent its greatest source of ocean energy (see Fig 1). As shown in Fig. 2, places like the Derby Coast and Banks Strait offer candidate sites for tidal power generation.

There are several companies that are developing ocean energy power in Australia, as indicated in Table 1, and while it will be sometime in the future before any of these go into operation they are currently moving forward with demonstration projects. In terms of recent developments, in 2012 the Tropical Tidal Testing Centre was established by Tenax Energy and Charles Darwin University, and in July 2013 the Derby Tidal Power Project was approved by the state government and was started with a view towards its completion two years later. (**Author's abstract**)

Keywords: *Australia, ocean energy, renewable energy, wave power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/01,
(Filipiniana Analytics)

0257

Development of ocean energy in Taiwan

Since 2014, Taiwan has been promoting the National Energy Program, Phase II (NEPII), which is a five-year plan that runs until the end of 2018. As part of this, it has been promoting the development of ocean energy led primarily by the Offshore Wind Power and Marine Energy Focus Center. This focuses on developing wave power generation and tidal power generation, using the energy of the Kuroshio Current that runs along the east side of Taiwan. The latter is referred to as Kuroshio power. Universities, research institutes, and companies are also taking part in the development being carried out under the leadership of the center, with small-scale experiments being performed in actual ocean waters (see Table 1).

Wan Chi Steel Industrial Co., Ltd. has a system for harnessing Kuroshio power, and there is also a system that was independently developed by National Taiwan Ocean University and one that was jointly developed by National Taiwan University and National Taiwan Ocean University. The proposals for both of these have been for systems that are anchored in place and which consist of a set of two rotors.

The plan for the ocean energy development roadmap in NEP II is to complete the technology to commercialize wave power by the end of 2016, and to finish prototype experiments on commercial equipment by the end of 2018. What is more, when it comes to this Kuroshio power, the schedule calls for completing the roadmap by the end of 2016 and performing experiments and improvements in ocean waters by the end of 2018. The major goals of the NEP II are to introduce renewable energy in Taiwan and foster this industry, which it will move forward on by cooperating with other countries. (**Author's abstract**)

Keywords: *Taiwan, ocean energy, wave power generation, tidal power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/03,
(Filipiniana Analytics)

0258

Development of production process of bioethanol in Japanese way

For expanding the use of bioethanol in the society, it is essential to establish a chemical process and technique to produce ethanol by using pruned wood branches or plants. Research and development of wood-based bioethanol production process in Japan is underway by taking account of regional vegetation conditions.

At Bohzawa in Kita-Akita City, a verification plant for bioethanol production from pruned wood branches of Akita-cedar trees is expected to be put into operation in next April. The plant is designed to produce 20,000 liter of ethanol annually from 90tons of wood. The Forestry and Forest Products Research Institute is in charge of its design and operation. For the first time in Japan, alkaline pulping technique adopted from paper manufacturing process is introduced to the plant to efficiently eliminate lignin which is one of the major components of wood.

An agency-industry-university consortium formed by 8 institutions based in Okayama prefecture and surrounding areas developed a method by making use of a gene recombination technique, and succeeded to produce bioethanol from wheat bran. This is the outcome of three years effort started in 2006. A kind of yeast that issues cellulose-dissolving enzyme was propagated by five times and thus raised the ability to dissolve cellulose. This technique is adoptable to other cellulose matters such as rice bran and chaff. (**Author's abstract**)

Keywords: *bioethanol, Japan, Akita-cedar trees, wheat bran, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,
(Filipiniana Analytics)

0259

Development of world-class organic solar cells in Japan

Research and development is being carried out on organic solar cells that use organic compounds instead of silicon or inorganic compounds to serve as next-generation solar cells. These include organic thin-film solar cells that use organic thin-film semiconductors, as well as dye-sensitized solar cells that utilize organic dyes. However, these are still roughly half as efficient at generating electricity as crystal silicon solar cells, and at their current stage they are still insufficiently durable. Yet on the other hand, the following factors could be listed as advantages of organic solar cells: Simple production process, low cost, low environmental impact, possibility of creating flexible, film-shaped solar cells, and possibility of creating colorful solar cells with exceptional design characteristics.

In the global race to increase generating efficiency, world-class generating efficiency has been achieved by the National Institute for Materials Science (NIMS) in Japan at 11.4%, Mitsubishi Chemical Corporation at 11.0%, and Sumitomo Chemical Co., Ltd./University of California, Los Angeles (UCLA) at 10.6%.

The development of organic solar cells is being promoted through Japanese projects like the Project for the Development of Organic Solar Cells Conducive to the Low-Carbon Society, which is part of the Cabinet Office's Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST), as well as NEDO's Guidance and Technical Development Project for the Practical Application of Organic Solar Cells. (**Authors' abstract**)

Keywords: *Japan, organic solar cells, crystal silicon, dye-sensitized, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/08,
(Filipiniana Analytics)

0260

Developments in the introduction of geothermal power in the Philippines

The Philippines is the country ranked fourth in the world in terms of geothermal resources after the United States, Indonesia, and Japan, but the adoption of geothermal power in the country has been stalled since 2000. The government has been promoting the adoption of renewable energy through the Renewable Energy Act enacted in 2009, and it has been promoting the adoption of geothermal power by establishing adoption targets for this by region and for each year, which are shown in Table 1. As Phase 1 of this, it completed and began operating the Maibarara Geothermal Power Plant, which has an installed capacity of 20 MW, in February 2014.

The vitalization of the geothermal power business has been accompanied by increased participation by overseas operators. Marubeni Corporation and Enel Green Power (EGP), an Italian renewable energy power developer, have established a joint venture that includes a local company in the Philippines. They plan to build a power plant that will exceed 100 MW, with 2020 as the target for this.

In addition, Mitsubishi Hitachi Power Systems, Ltd. (MHPS) received an order from Green Core Geothermal Inc. (GCGI) in the Philippines for construction work to renovate the Tongonan Geothermal Power Plant. This consisted of upgrading three steam turbines supplied by MHPS in 1981 to the latest, state-of-the-art turbines.

In the Philippines, the Open and Competitive Selection Process (OCSP) is a system for adopting renewable energy by deciding on the operators for proposed sites via competitive bidding. The Department of Energy of the Philippines has decided that it will use the OCSP to decide on the operators for four new proposed geothermal power sites (see Fig. 1) in September 2015. This will be the second time such bidding has taken place since 2009, with the aim being to have the government decide on the operator in order to get the projects completed without interruption. The aforementioned Maibarara Geothermal Power Plant was a result of the OCSP from 2009, with the expectation being that steady progress will be made with the construction of geothermal power plants in the future. (**Author's abstract**)

Keywords: *Philippines, geothermal energy, geothermal power, renewable energy, power plant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,
(Filipiniana Analytics)

0261

New developments with algae biofuel

Biofuel that is produced from the raw material of algae has been garnering attention. A characteristic trait of algae biofuel is its high production efficiency. When grains and other plants are used as the raw materials, then the annual fuel production output for every one hectare (ha) (area yield) is 0.2 tons for corn and 6.1 tons for palm oil. Compared to these, the microalgae *Botryococcus* has a high output of 118 tons.

Aurantiochytrium, which is an algae with a production capacity that is more than ten times that of *Botryococcus*, was presented by the University of Tsukuba (Professor Makoto Watanabe) at an international conference (held in Tsukuba) in December 2010. *Aurantiochytrium* has one-third the oil content compared to *Botryococcus*, but its breeding speed is 36 times faster and its production efficiency is 12 times greater. Research and development and demonstration tests are slated to be carried out in the aim of commercializing it within ten years.

In addition, in April 2011 Kyoto University Graduate School (Professor Kousaku Murata) announced that they were the first in the world to establish the technology for producing bioethanol from seaweed (alginic acid). Brown algae accounts for 95% of the seaweed harvested in Japan, with the alginic acid contained in abundance in this brown algae serving as the raw material for bioethanol.

They claim to be able to produce 13 grams of ethanol for every one liter of culture water by using a special bacterium. They calculate that they will be able to produce about 250 grams of ethanol from one kilogram of alginic acid. Surrounded by seas on all four sides, Japan is ranked sixth place in the world for combined territorial waters and exclusive economic zones. By using this enormous ocean surface it will be able to cultivate seaweed and turn it into biofuel.

This biofuel will improve Japan's energy self-sufficiency ratio and will contribute enormously to the issue of global warming. What is more, it will also enable Japan to draw the world's attention to its high level of technology for algae biomass. (**Authors' abstract**)

Keywords: *biofuel, Botryococcus, Aurantiochytrium, brown algae, bioethanol, alginic acid, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/06,
(Filipiniana Analytics)

0262

Diversification in biofuel: produced from sunflower seeds

On December 20th, Nishi-Nippon Railroad Co. Ltd. held trial rides of a bus powered by biodiesel fuel (BDF) derived from sunflower seeds as part of celebrations associated with the 100th anniversary of the establishment of the company. The sunflower seed oil was imported from Thailand and Tanzania and the fuel manufactured on a trial basis, however the ability to manufacture biodiesel fuel from locally produced sunflower seeds has been confirmed. This represents a new stage in progress in manufacture of biodiesel fuel from non-food oils. (**Author's abstract**)

Keywords: *biodiesel, sunflower seeds, biodiesel fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/01,
(Filipiniana Analytics)

0263

The economic effect of renewable energy in the world in 2030 is 1.3 trillion dollars (about 152 trillion yen)

In January 2016, the International Renewable Energy Agency (IRENA) released preliminary estimates indicating that a global economic effect (GDP) of 1.3 trillion dollars (about 152 trillion yen) will be generated in the year 2030 and that economic growth will be raised by a maximum of 1.1% when the proportion of renewable energy such as wind power and solar power etc., is doubled.

This calculation is based on the following three scenarios regarding the amount of renewable energy implementation from 2010 to 2030. (1) When based on the previous forecast of each country (Referenceï¼š2014 IEA estimates), (2) When the proportion of global energy consumption occupied by renewable energy is doubled compared to the case in (1) (REmap), (3) When electrification of air conditioning devices and electric cars etc. using power from renewable energy is promoted in addition to the case in (2) (REmapE).

The estimation of economic effects incorporates the influences from installation of facilities related to renewable energy, expansion of renewable energy power generation business, and reduction of coal and oil imports. Being an importer of oil, both scenarios have a positive effect in Japan when the results are seen by country. As shown in Fig. 1, in Case (2) where the proportion of renewable energy is doubled by 2030, it is estimated that GDP growth in Japan will be raised to 2.3%, becoming the highest in the world. In Case (3), GDP growth in Japan will also be raised to 3.6%, becoming the second highest in the world after Ukraine. The market size reaches 18 trillion yen when the real GDP of 524.7 trillion yen (FY 2014) in Japan is multiplied by a growth rate of 3.6%. (**Author's abstract**)

Keywords: *renewable energy, economic effect, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/03,
(Filipiniana Analytics)

0264

An economic study result of power generation using woody biomass-coal co-combustion

An economic study, conducted by the woody biomass-coal co-combustion study group of Shimane Prefecture, on power generation using woody biomass-coal co-combustion on the Misumi coal-burning power station (one million KW capacity) of the The Chugoku Electric Power Co.INC has been concluded. Shimane Prefecture has vast forest areas covering 79% of the land and therefore it has woody biomass in abundance. Adoption of biomass-coal co-combustion method will consume a large quantity of woody biomass of the Shimane Prefecture.

The study concluded: 1. The total woody resources collectable, within 50 km circle range of the Misumi power station, including forest residue, woody waste issued from construction sites and saw mills, are estimated to be about 40,000 ton a year. 2. If the waste wood from construction sites and saw mills were made into chips to be burnt at the power stations, the supply cost would be the lowest, ranging from 3,576 to 15,576 yen/ton. Since Misumi power station sets a buying price of 6,782 yen/ton for the woody chips, the proposed method would be economically feasible.

Shimane Prefecture continues to have consultation with the The Chugoku Electric Power Co.,INC in order to realize the biomass-coal co-combustion at Misumi power station. The Prefecture look forward to utilizing its abundant woody biomass for steady energy supply, reducing CO_2 emission, and revitalizing the local society and industries as well as creating new employment chances.

Incidentally, the record and future plan of woody biomass-coal co-combustion power generation in Japan are shown in the table and graph . It is shown that Japan's woody biomass consumption has been 625,000 ton per year at maximum so far. Japanese electric businesses now regard biomass-coal co-combustion power generation method as a quick and effective measure for reducing CO_2 emission, and they are in fact setting a policy to increase adoption of co-combustion method in their power stations. (**Author's abstract**)

Keywords: *woody biomass-coal co-combustion, Japan, power station, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0265

EFB power generation is becoming popular in Asia

A large amount of remnant is being deposited from palm oil production process. While all of palm fruit fiber and a part of coconut shells are burnt for heating purpose in the palm oil processing, the rest has been just left over. Every year, EFB (Empty Fruit Bunches) is generated 3.46 million ton in Indonesia and 4.71 million ton in Malaysia. So, electric power generation by burning EFB is now eagerly anticipated.

As depicted in Fig., palm oil price has been falling so far, but it is now rising again and consequently promotion for EFB power generation seems to be gaining a thrust again. (**Author's abstract**)

Keywords: *palm oil production process, empty fruit bunches, EFB power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/05,
(Filipiniana Analytics)

0266

Effective utilization of forestry resources is becoming active

For conservation of natural environment, different eco-businesses are flourishing for the utilization of woody biomass resources. Japan's forestry resources are abundant, and domestic lumber production of Japan in FY 2008 scored 17.71 million cubic-meter, in fact. Dividing among prefectures, Hokkaido shared 20 %, followed by Miyazaki (8%), Iwate (7%), Kumamoto (5%), Akita (5%), Oita (4%). With regard to cedar lumber, total production amounted 8.76 million cubic-meter, in which Miyazaki had the biggest share of 14% and followed by Oita 8%.

Different ways of utilization of woody biomass in aforementioned districts are summarized in the following table. It is noted that the utilization of woody biomass is becoming busy, in different areas respectively. (**Author's abstract**)

Keywords: *forestry resources, woody biomass, Japan, biomass energy utilization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0267

An efficient bioethanol production from seaweeds/algae

The national land area of Japan is 380, 000 km^2, ranking No. 60 in the world. However, the total sum of Japan's territorial sea and EEZ (Exclusive Economic Zone) amounts to 4,470,000 km^2, which is No.6 in the world. In order to take advantage of this vast oceanic area, development of new technology for culturing ocean biomass (sea algae and seaweeds) is rising rapidly. This is considered to be vital for Japan to produce biofuels from these oceanic resources.

On 14 July 2010, Tohoku University announced that they have successfully developed a high efficiency production technology for bioethanol from marine plants, jointly with Tohoku Electric Power Co., Inc. In this technology, seaweeds such as kelps and gulfweeds etc. are first made into liquid by a special enzyme, and next the liquid is to be fermented by yeast and bacteria for nearly two weeks. According to the report, about 200 ml of bioethanol was obtained from 1 kg of seaweeds by this process.

The Sendai Power Station of Tohoku Electric Power Co., Inc. reported that some 300 ton of seaweeds are sucked into the cooling water intake and are discharged as waste every year. Applying the above-mentioned new technology, the waste seaweeds could be utilized as a marine biomass resource, and the bioethanol thus obtained could be burnt as fuel at the power station.

The reason why seaweeds are attracting attention now is because sea algae and seaweeds can yield biofuels at quite higher rate than conventional plant bio-resources. Soybeans can yield 1,900 a (liter), and palm oil can 5,950 a of biofuel per year on one hectare of land. Algae, however, can yield 98,500 a that is many times as much! In addition, some algae can absorb nearly ten times as much CO_2 as any land-born plants can.

On 29 July 2010, NEDO (New Energy and Industrial Technology Development Organization) presented a list of contractors for "Next Generation Biofuels Technology Development Projects", looking forward to the introduction of new technology by 2030. Four out of eight research themes are included in "Technology Development for Biofuels Production from Micro Algae". It seems that seaweeds and algae may solve today's world energy problems as well as global warming issues in future, with a big possibility. (**Authors' abstract**)

Keywords: *Japan, bioethanol production, seaweeds, algae, ocean biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/09,
(Filipiniana Analytics)

0268

Electric power business using grass: first in Japan

First electric power generation using wild grass "Susuki" is underway in the wide-spread meadow of Mt. Aso in Kumamoto prefecture. This R & D project (FY 2005-2009) is granted by NEDO. Susuki, Japanese pampas grass is grown by human hands in England or The Netherlands as an energy resource. But, a lot of wild susuki grows here over the skirt of Mt. Aso.

Wild grasses and woody tips are gasified and the gas is burnt to operate a gas-engine-powered electricity generator. In addition, exhausted heat is recovered. A NPO called Kyusyu Biomass Forum and its associates initiated and manages this project. The generated electricity and recovered heat are used as energy resource for the swimming pool of a public recreation facility "Azalea 21". (**Author's abstract**)

Keywords: *Susuki, wild grass, Japan, woody tip, gas-engine-powered electricity generator, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,
(Filipiniana Analytics)

0269

Electricity system reforms are gaining momentum

With a view towards the across-the-board liberalization of retail sales of electricity, a reform bill for the Electricity Business Act, which mandates that power transmission divisions be spun off of major power companies, was enacted in the National Diet on June 17, 2015. These electricity system reforms are being promoted in three-stages, since they will entail major transformations in business structures.

In the first stage, the Organization for Cross-regional Coordination of Transmission Operators, which was established in April 2015, will coordinate power supply and demand, including power supply cutting across different regions. Even in cases where it will be difficult to absorb the fluctuations in wind power with just the electric power system in Hokkaido alone, this arrangement will make it possible to get by without having to curb wind power output in Hokkaido by connecting its system up with the electric power system in Honshu. Next, in the second stage the across-the-board liberalization of retail sales of electricity that is slated for 2016 will make it possible for consumers to choose power companies that generate solar and wind power. In the third stage, the separation of electric power generation and transmission will be carried out, in which power companies' power generation and power transmission divisions will be separated from one another in April 2020. This will enhance the independence of power transmission companies, and will encourage new operators that generate power from renewable energies to newly enter the market by making it easier for them to connect to the grid. Ultimately, the aim is to lower electric fees through competition, with the goal being to deregulate electric fees from 2020 onward. As shown in Table 1, a process has been established for extending the electric power system reforms that began with liberalizing new market entry, enabling cross-regional electricity supplies, and removing fee regulations for large-scale power consumers in 2000 to ordinary households. (**Author's abstract**)

Keywords: *Japan, electricity system reform, power supply, power source, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,

0270

New energy power by the RPS law increased 1.83 times in 5 years

Japan depends on imports for fossil fuel including petroleum, coal, and natural gas, with its energy self-sufficiency ratio of barely 4%. Additionally, the CO_2 emission by using the fossil fuel is promoting the global warming. As measures against this "energy problem" and "global warming problem", "new energy" is effective; thus the Japanese government is promoting the spread of the "new energy."

The "new energy" is defined by law* as energy that needs to be the most widespread of the "renewable energies" such as biomass, solar energy, wind power, geothermal power, and hydraulic power. As regulatory measures for electric power suppliers to promote the introduction of the "new energy", the RPS law (Renewable Portfolio Standard law: special measures law related to utilization of new energy, etc. by electric power suppliers) is available. (*Special measures law related to promotion of new energy utilization, etc.)

The RPS law established in June, 2002 and enforced in March, 2003 is a law to obligate electric power suppliers to derive a certain ratio or more of the electric energy from the new energy. While the supply of electricity such as new energy based on the RPS law was 4.06 billion kWh in fiscal 2003, it was 7.43 billion kWh in fiscal 2007, a 1.83-fold increase in 5 years. Of them, the growth of wind power generation is remarkable, but the power generation by means of the biomass is largest as electric energy generated, accounting for nearly 50% of the whole.

The certified power generation facility capacity by power generation type based on the RPS law is 5,616,438 kW (August, 2008), and biomass, wind power, and solar light are large in proportion. The target of gross generation under the RPS law is 12.2 billion kWh in fiscal 2010 and 16 billion kWh in fiscal 2014. (**Author's abstract**)

Keywords: *Japan, fossil fuel, natural gas, carbon dioxide emission, new energy, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,
(Filipiniana Analytics)

0271

New energy PR activities for children based on hands-on learning in the Minamisoma Solar Agri Park

The Minamisoma Solar Agri Park in Fukushima Prefecture where a solar power plant (500 kW) and a plant factory have been established on grounds damaged by the tsunami is being used a center for hands-on learning using new energy as a theme. Using the Minamisoma Solar Agri Park as a stage, the Fukushima Solar and Agriculture Experience Association continues to promote PR activities on new energy e.g. by conduction hands-on learning in conjunction with elementary and junior high schools. In the 2.5 years since it was opened in April 2013, more than 2100 out of 3500 children from elementary and junior high schools in Minamisoma City have attend the hands-on lessons. In addition, weekend classes, summer classes and winter classes are also held to promote PR activities on new energy, and more than 600 elementary and junior high school students have attended the classes in 2.5 years.

The merit of these PR activities lie in allowing children to have fun and feel a sense of achievement in learning more about new energy e.g. “Inspection tours” of an actual solar power plant. In addition, efforts are being expended to come up with fun ways for children to learn about new energy e.g. through “hands-on power generation research” using original systems in which the positions and angles of solar panels can be changed freely, “smart use of new energy” by storing the solar power generated in the battery of an electric car to operate household appliances”, and so on. In addition, “Hydro Power Courses” that let participants compare the power of water and their own power to get a sense of how great hydropower is, and “New Energy Power Plant Tours” that let people walk on a map of Fukushima Prefecture, etc., are also available.

The Fukushima Solar and Agriculture Experience Association collaborates with self-governing bodies and universities as well to implement an extensive range of PR and other activities for residents in general. Its model to promote the expansion and sustainability of new energy is highly rated and has won the FY 2015 New Energy Award (Director-General Prize of Agency of Natural Resources and Energy) implemented by the New Energy Foundation. (**Author's abstract**)

Keywords: *PR activities, inspection tours, solar power plant, new energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/03,
(Filipiniana Analytics)

0272

Enhancing power lines from areas suited to generating renewable energy to demand regions

Regions that are suited for wind power in which there are vast stretches of land with favorable wind conditions are predominantly found in areas like Hokkaido and Tohoku, but there are limitations on the grid-connected capacity and demand there. As such, the introduction of wind power has not proceeded as anticipated. For this reason, regions with particularly favorable wind conditions but little in the way of electricity demand were designated as “special concentrated wind farm development areas,” and a system for installing and augmenting power lines was initiated in 2013. This scheme consists of an arrangement in which the national government provides support for special purpose companies (SPCs) that aim to recover investments via usage fees for power lines from wind power business operators that are expanding their wind power projects. The aim is to expand wind power projects by enhancing power lines in Tohoku and Hokkaido. As a result of public appeals, in 2013 the SPCs Japan Power Transmission Co., Ltd. and Hokkaido Northern Wind Power Transmission Co., Ltd. were adopted for a power transmission network development project (see Table 1). The completion of a route on the Sea of Japan side and a transmission network between central Hokkaido and Okhotsk (as shown in Fig. 1) will make it possible to install up to 2,000 MW of wind power.

There is also the Project to Develop Power Lines between Hokkaido and Honshu, which will augment power lines between the regions in order to link Hokkaido and Honshu. Construction work for this to increase the current capacity of 600,000 kW by 1.5-times to 900,000 kW by April 2019 was begun by Hokkaido Electric Power Company in April 2014 (see Table 2). Whereas existing routes pass through the Shimokita Peninsula, the newly established route will make use of the Seikan Tunnel. Doing so will make it easier to maintain, and this is also being done out of consideration for disaster response measures by making it a separate route.

This will make it possible to transmit electricity from wind power to demand regions, while also making it possible to coordinate demand over a broader area. This in turn is setting in place the conditions for promoting the adoption of renewable energies. (**Author's abstract**)

Keywords: *Japan, power lines, renewable energy, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/07,
(Filipiniana Analytics)

0273

Establishing the technology for the highly efficient manufacturing of bioethanol from rice straw

Research is being promoted on breaking down polysaccharides such as the cellulose contained in rice straw and other plant-derived resources and using these as raw materials. In May 2014 Taisei Corporation announced that it had developed a new technique that was capable of reducing the manufacturing cost of bioethanol to approximately 70 yen/liter by means of manufacturing ethanol from the cellulose and starch contained in rice straw at the same time.

Taisei Corporation carried out the Project for Developing Soft Cellulosic Resources Utilization Technology together with Sapporo Breweries Ltd. as a project subsidized by the Ministry of Agriculture, Forestry and Fisheries for five years starting from July 2008. By only using cellulose as the raw material for ethanol, they were able to achieve a manufacturing cost of 85.2 yen/liter and a 45% reduction in CO_2 emissions. Through its own independent research from later on, Taisei Corporation discovered that the “alkali treatment” developed as a pretreatment for cellulose shown in Fig. 1 could similarly be effectively used for the starch contained in rice straw. As such, by developing a highly efficient technique for manufacturing ethanol from cellulose and starch at the same time it was able to achieve a manufacturing cost of 70.7 yen/liter and a 52% reduction in CO_2 emissions, as shown in Fig. 2. With these figures it has reached a level that is below the manufacturing cost of 100 yen/liter for bioethanol that would allow it to replace petroleum, and above a 50% reduction in CO_2 emissions.

With the Project for Developing Soft Cellulosic Resources Utilization Technology mentioned above, three groups including Kawasaki Heavy Industries, Limited, the Kashiwanoha Bio-ethanol Limited Liability Partnership, and Mitsubishi Heavy Industries, Ltd. have concluded the research and development. The hope is that bioethanol derived from rice straw, which is a form of non-food biomass that is produced domestically, will contribute to the reduction of use of fossil fuels. (**Author's abstract**)

Keywords: *bioethanol, alkali treatment, enzymic saccharification, fermentation, rice straw, carbon dioxide emission reduction, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/07,
(Filipiniana Analytics)

0274

Establishment of a technology that can manufacture biofuel from rice straw for less than 90 yen per liter

Mitsubishi Heavy Industries, Ltd. announced in April 2011 that it had established a technology that can domestically manufacture biofuel from rice straw and other materials for the low cost of less than 90 yen per liter. The Hyogo Prefecture Soft Cellulose Utilization Project is a technical verification project that will manufacture bioethanol, which

is a biofuel, from rice straw that has received aid from the Ministry of Agriculture, Forestry and Fisheries. It uses barley straw and rice straw harvested from Inami Town, Kago County, Hyogo Prefecture as its raw materials.

The goal of the Soft Cellulose Utilization Project is to establish a technology for manufacturing biofuel by using nonfood raw materials such as rice straw. It has been implementing verification projects since FY2008 at Hyogo Prefecture, as well as Hokkaido, Akita Prefecture, and Kashiwanoha (Chiba Prefecture) as model districts. The model districts are verifying manufacturing processes that are suited to their respective climatic conditions and regional characteristics. This project is characterized by the fact that it is providing verification on everything from the collection, transportation, and storage of the raw materials through to the manufacturing of the biofuel and even the effective use of the residue in an integrated manner. Of the four model districts, the Hyogo Prefecture model district wrapped up in March 2011, while the other three model districts are currently working on their verification projects.

When it comes to the processes for manufacturing bioethanol from rice straw and barley straw, Mitsubishi Heavy Industries, Ltd. was in charge of the pretreatment and saccharification process, while Hakutsuru Sake Brewing Co., Ltd. oversaw the fermentation process and Kansai Chemical Engineering Co., Ltd. oversaw the distillation and dehydration process. The verification projects thus far have manufactured ethanol with a concentration of greater than 99.5%, and have established the rough estimate that they will be able to manufacture this at the low cost of less than 90 yen per liter.

The establishment of technology for producing biofuels domestically using nonfood raw materials has enormous significance for Japan, which has a low food self-sufficiency rate of 39%, and is therefore expected to offer benefits hereafter. (**Authors' abstract**)

Keywords: *rice straw, bioethanol, barley straw, fermentation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/12,
(Filipiniana Analytics)

0275

Establishment of an Algae Research Institute in the Biomass Industry City of Saga

Saga City, which was selected as a Biomass Industry City in 2014, has set forth a plan to evolve biomass resources into more futuristic forms and produce new energy from them. It plans to join forces with Saga University and University of Tsukuba so that the three of them can establish a research and development institute for the cultivation of algae in FY 2016. The University of Tsukuba has a research center on cultivating algae that works on advanced research and industry-academia-public partnerships. It has also set up a cooperative structure in which the local Faculty of Agriculture of Saga University also takes part.

Algae has been garnering attention in both the food and energy sectors, and Saga City has been researching the technique for cultivating algae shown below and its business potential. It has announced a plan to commercialize this through a corporate partnership. Moving forward, the expectation is that Saga City will engage in mutual cooperation together with the algae research institute. (See Fig. 1.)

Algae cultivation by using the carbon dioxide generated through the sewage treatment process at the Saga City Sewage Treatment Center is being carried out through a joint research structure consisting of Saga City, euglena Co., Ltd, Toshiba Corporation, Nihon Suido Consultants Co., Ltd., Nikkan Tokushu Co., Ltd., and Japan Sewage Works Agency (as of March 31, 2016). This is being done as part of the FY 2015 Breakthrough by Dynamic Approach in Sewage High Technology (B-DASH) Project demonstration research by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

The plan is to have ALVITA Corporation operate a facility that cultivates algae using carbon dioxide generated from the Saga City Disposal Plant starting from April 2016, and produce, sell, and perform research and development on useful components using algae. (**Author's abstract**)

Keywords: *Japan, algae, biomass resource, algae cultivation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/02,
(Filipiniana Analytics)

0276

Establishment of the study team for biomass commercialization strategies

The Committee for the Promotion of Biomass Use, which is comprised of seven governmental ministries, has established the Study Team for Biomass Commercialization Strategies to consider strategies for commercializing biomass. The study team is composed of 18 people from academia, private companies, and local municipalities who have expert knowledge related to commercializing the use of biomass. Its first meeting was held within the Ministry of Agriculture, Forestry and Fisheries on February 10, 2012.

The study team will consider the following issues and then submit the results to the Committee for the Promotion of Biomass Use: 1. Cross-sectional analyses of the level reached by the related technologies, and the selection and concentration of technologies for research and development, verification, and commercialization, 2. The creation of consistent structures that encompass everything from the procurement of raw materials through to their conversion and sale with a view toward commercialization, and 3. Strategies for creating business models for Japan’s pattern of biomass use.

There have been growing expectations for safe and reliable renewable energies following in the wake of the Great East Japan Earthquake that occurred in March 2011. The private research company Fuji-Keizai has announced its predictions that the market scale of the biomass industry in Japan will grow by 2.1-fold to 257.9 billion yen by FY2015 relative to 2010. It is believed that the enactment of the Feed-in Tariff Scheme for Renewable Energies that will begin in July 2012 will provide a push to expand the biomass use market. (**Authors' abstract**)

Keywords: *biomass, commercialization, technology, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/03,
(Filipiniana Analytics)

0277

Ethanol production by means of termites getting momentum

Use of biofuels is regarded as one of powerful trump cards to cope with suspending global warming issue, and therefore getting more and more interest today. Bioethanol is a representative biofuel and produced by means of fermentation using various kinds of biomass resources that are classified into three groups: sugars contained in juice

of sugar cane, beat etc.; starchy crops such as corn, sweet potato, tapioca; and waste of woody biomass such as forest residue, thinned wood, woody construction waste, rice straw and chaff etc.

Currently, the most economical way to produce ethanol is fermentation of glucose that is contained in juice of sugar cane and its kind, and this method needs only a simple system. There is another process that uses starchy crops as raw materials, where saccharifying enzyme turns starch into glucose. The glucose is subsequently put into fermentation process and turned into bioethanol. Both two methods have been widely adopted in practical use.

A new process for bioethanol production is under development, which utilize waste woody biomass that would not compete with production of edible food crops. Wood and grass materials are made of cellulose, hemi-cellulose and lignin that are strongly bonding together. Consequently, pretreatment technology to dissolve this bonding is required. At present, however, any of pretreatment technology so far developed has proved to be quite costly and far from being used in practice.

A noteworthy report has been published recently as regard to biological decomposition of woody material using microbes such as fungi, which is one of pretreatment methods under research. Termites are thought to be voracious insects that eat houses made of wood. On the other hand, it has been known that termites have special digestive capability in their bowels to dissolve cellulose into glucose.

A national research institute RIKEN has been conducting research on termites since long time ago. January 2010, RIKEN made an announcement that it has obtained a comprehensive set of cellulose-decomposing enzymes (cellulases) from various microbes living in the guts of termites. And that after investigating the genome of the microbes, it has succeeded in clarifying the high-efficiency saccharification system working in termites' guts. RIKEN also stated that some termite's genes for producing enzymes has 5-10 times more strong activity than that of hitherto known enzymes.

Termites are generally regarded as nuisance to human society, but they are in fact beneficial for the nature since termites decompose dead trees, and some 20% of plant biomass in the nature is decomposed by termites. The clarification of cellulose-decomposition process in termite guts will undoubtedly open the way to establish a new production technology for bioethanol, since this new technology can make it possible to dispense with traditional pre-treatment of cellulose, and hence it will be much more energy-efficient and of low cost. (**Authors' abstract**)

Keywords: *ethanol production, termites, fermentation, cellulase, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/03,
(Filipiniana Analytics)

0278

To expand domestic biofuel production in Japan

Japanese Government has set a goal of 50,000 ka (ethanol equivalent) domestic biofuel-production by 2011 and 6.00million ka by 2030. The biofuel is an gasoline alternative fuel. 6.00 million ka is 10% of current gasoline consumption; Japanese government shows that "It is possible to produce 6.00 million ka biofuel in Japan". The raw materials of biofuel assume wood/grass (rice straw, wheat straw), energy crops on abandoned farmland (rice, beet) and ligneous biomass (woody construction waste, forest residue) because thisbiomass would not interfere with agriculture foods and feeds. Raw materials of domestic biofuel are shown in Table.

At present Self-Energy ratio "18% self-sufficiency of energy supply (included nuclear power generation) + 20% resources interests in foreign countries that Japanese Government and Japanese company hold" is 38% in Japan. On 28 April, 2010, Ministry of Economy, Trade and Industry showed a target to raise this ratio to 70% by 2030.

By expand domestic biofuel production, “Self-Sufficiency of Energy Supply” could be raised. For this aim, university / private company / institute promote to develop domestic biofuel production powerfully. Research and development results of domestic biofuel production by companies and institute in Japan were announced in succession recently. Recent topics of domestic biofuel research and development are shown in Table. (**Authors' abstract**)

Keywords: *biofuel production, Japan, woody biomass, forest residue, ethanol equivalent, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/05,
(Filipiniana Analytics)

0279

Expanding the use of renewable energies on Hachijojima Island

In 1999 3,300 kW of geothermal power was introduced on Hachijojima Island, while in 2000 500 kW of wind power were introduced there. As of 2009 approximately 25% of the island’s energy needs were being covered by renewable energies. Given such circumstances, in 2012 Hachijo Town compiled the Hachijojima Clean Island Plan. This plan incorporates a number of different goals and aspirations, such as aiming to derive 100% of the town’s power from natural energies in the future while retaining its current internal combustion power plant as an emergency power source, as well as serving as a base for supplying energy and accepting refugees in the event that a disaster occurs that would deal severe damage to the Tokyo region. Fig. 1 shows its targets for introducing natural energies for power by the year 2022. It has reduced its supplies of energy to 70% of 2009 levels through the use of energy conservation, 58% (=40.8/70) of which it plans to cover by supplying natural energies.

In January 2013 the Tokyo Metropolitan Government partnered with Hachijo Town to consider implementing a model project in order to substantially expand the use of renewable energies such as geothermal power on Hachijojima Island, and has examined this through the Investigative Commission to Expand the Use of Renewable Energies on Hachijojima Island. The third meeting of the commission was held in January 2014, at which a mid-term adjustment was compiled on the possibility of expanding the use of renewable energies.

Through this mid-term adjustment, analytical results were obtained that indicated that geothermal resources exist there that have the potential to generate 14,000-24,000 kW of power over a 30-year span in the vicinity around the existing geothermal power plant. Therefore, if two 3,000 kW power facilities are introduced the island can cover 72% of its total energy with geothermal power, while using diesel power generation for the remaining 28% (Fig. 2). Moreover, in order to handle the surplus power at nighttime and the frequency adjustments that will result from the enlargement of installed capacity, instead of the pumped storage that had initially been planned the commission is now considering adopting a storage battery system along with countermeasures against the bad odors from the geothermal steam. (**Author's abstract**)

Keywords: *Japan, renewable energy, geothermal power, wind power, natural energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/05,
(Filipiniana Analytics)

0280

For expanding use of biofuels in Japan

The Japanese government designates a target value for domestic biofuel production as 50,000 kl by 2011, up to 6,000,000 kl by 2030, the latter figure equals to 10% of annual consumption of gasoline in Japan. To achieve this goal, various measures are being taken or on the plan by the government and related industrial bodies.

To expand the use of biofuels in transport sector, the Council for Promotion of Biofuel Utilization under the Ministry of Environment, has, in last January, elaborated a range of measures including "Promotion and lateral expansion of Bioethanol", "Utilization of Locally-suited and Collectable Materials", "Acceleration of Introduction of E10 (10% ethanol added gasoline)", "Promotion of Adaptation of Fuel Stations and Storages to E3 (3% ethanol added gasoline)".

In addition to the above, from coming April, oil Industries will start to supply "Biogasoline" = gasoline containing Bio-ETBE (Ethyl Tertiary-Butyl Ether), with all-out efforts. The "Bio-ETBE" is synthesized from bioethanol derived from sugar cane, and iso-buten. They estimated the total sales of the "Biogasoline", gasoline with 7% of ETBE, would amount to about 140,000 kl, during FY 2008, at one hundred gas-stations in the country. Further, the oil industries plan to raise the sales amount up to 200,000 kl in FY 2009, and up to 840,000 kl in FY2010, where changing to unreserved sales. This biogasoline clears the octane rating of 89.0 of regular gasoline, and therefore it is expected to become popular. (Petroleum Association of Japan). (**Author's abstract**)

Keywords: *Japan, biofuel, biogasoline, Ethyl Tertiary-Butyl Ether, ethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,
(Filipiniana Analytics)

0281

Expansion of biogas utilization by using methane fermentation technique

Energy recovery in the form of biogas using methane fermentation technique seems to be suited for utilizing such sloppy kind of biomass that contains a lot of water and various organic substances. Examples are high-concentration organic wastewater such as lees of shochu liquor and soybean broth, as well as waste food, surplus sludge, cattle manure, and sewage sludge. Various sorts /forms of waste biomass are generated depending on conditions of specific local areas. Therefore any system for energy recovery from biomass has been designed in accordance with the particular conditions of the area.

Awamori-shochu (spirit) is a speciality of Okinawa prefecture. Forty-seven manufacturers in Okinawa produce 20,000 KL of Awamori-shochu every year. Consequently, about 30,000 ton of shochu-lees are being generated every year. In November 2009, Tarakawa Co., one of the shochu manufacturers, started installation of a biogas production facility that ferments shochu lees into biogas. The plant will be completed in September 2010. Total cost for the project is estimated to be 300 million yen, of which 143 million yen to be subsidized by the Ministry of Agriculture, Forestry and Fisheries. By methane fermentation technique, the plant produces biogas that is to be burnt in a boiler. The company estimated that it would be possible to save 35 ton of A-class heavy oil and reduce CO_2 emission by 64 ton annually, by using the biogas.

A new trend is appearing in the utilization of biogas produced by methane fermentation. Japanese government has issued a regulation for advancing national energy supply structure in July 2009. The regulation contains an article to make it obligatory for gas industry to utilize biogas. Consequently, in October 2009, Tokyo Gas Co. and Osaka Gas Co. made announcements that they would begin utilization of biogas. Using methane fermentation technique, waste food and sewage sludge are turned into methane gas. And the gas is purified so that its contents would be similar to that of regular city gas, and this purified gas will be directly injected into city gas distribution pipes.

So far, use was made of biogas as a fuel at the same place where the gas was generated. But now, a drastic change of this philosophy is appearing in Tokyo and Osaka. Biogas will be distributed to a wider area through existing city gas pipelines to general households and factories. A widespread distribution system of biogas, like the aforementioned cases, would certainly promote expanded use of biogas in near future. (**Author's abstract**)

Keywords: *methane fermentation technique, biogas utilization, shochu liquor, soybean broth, waste food, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0282

Exports of biomass fuel from Malaysia

Agensi Inovasi Malaysia (AIM; Malaysia Innovation and Technical Promotion Agency), an organ of the Malaysian government, has explained that the "National Biomass Strategy 2020 (NBS 2020) places primary emphasis on biomass from palm trees." The production output for the palm oil industry in Malaysia came to 83 million tons in 2012, but within this strategy it is predicted that this will grow to approximately 100 million tons by 2020.

The biomass fuel of palm kernel shells (PKS) generated as a result of the extraction of oil from palms is already being exported to places like Japan, China, Thailand, and Europe for use as fuel in generating power (see Fig. 1). The outlook is that PKS will also increase as a result of the increased production of palm oil in the future, which will in turn lead to an increase in excess PKS for exports. Fig. 2. shows the prospects for the production output from the five types of biomass generated by palm trees (the increased increment in the figure also includes the five types of biomass in the same proportions as the sections listed numerically).

In Japan a feed-in tariff (FIT) scheme for renewable energies was adopted in July 2012, which improved the profitability of biomass power generating businesses. What is more, it has also given rise to business operators who are considering importing biomass fuels from overseas in order to cover fluctuations in the amount of biomass generated within Japan and to preserve its scale of power generation. In response to such domestic needs within Japan, as one example in the fall of 2013 JFE Shoji Trade Corporation decided to go into the biomass fuel business, and established a local subsidiary in the form of JS Biomass Resources Sdn. Bhd. in Sabah, Malaysia to sell PKS for biomass fuel. This company is currently securing the amount sold from 43 factories in Bintulu, Sarawak through a subcontracting company (Human & Eco Energy Resources Development), which has allowed it to sell approximately 176,000 tons each year.

Furthermore, New Energy Development Co., Ltd. of Japan established a subsidiary (New Energy Development Dumai) in Indonesia in 2013 in the aim of beginning to export to Japan starting from June 2014. (**Author's abstract**)

Keywords: *Malaysia, biomass fuel, renewable energy, palm kernel shell, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/02,
(Filipiniana Analytics)

0283

Falling transportation costs for biomass raw materials

Biomass accounts for more than 10% of primary energy supplies throughout the world, with the installed capacity for generating power from biomass roughly doubling between 2004 and 2012 (Fig. 1), while the installed capacity for modern biomass heat use that excludes the use of firewood and the like has risen by 1.3 times (Fig. 2).

Biomass differs from renewable energies such as sunlight and wind power in that it requires the use of fuel, with it claimed that for biomass power generation, 40 to 60% of the costs of generating power come from the fuel costs. There have been preliminary calculation results reported claiming that this is approximately 70% when you include the various costs, particularly for cases where unutilized wood in Japan is used (Fig. 3).

In order to reduce the fuel costs, the New Energy and Industrial Technology Development Organization (NEDO) from Japan and the Technical Research Centre (VTT) from Finland have been advancing research and development to improve transportation efficiency, such as by increasing bulk density and making the unloading speed faster (Table 1). (**Author's abstract**)

Keywords: *biomass raw materials, transportation cost, biomass power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/03,
(Filipiniana Analytics)

0284

Family-use biogas plants getting popular in India

The primary energy supply of India in 2007 scored about 600 million ton COE (crude oil equivalent). The sum of energy obtained from biomass and waste was 160 million ton COE, sharing 26.9% in the total primary energy. The biomass and waste is mainly composed of forest resource (wood), agricultural waste and cattle excrement.

The total consumption energy was about 390 million ton in India and 340 million ton in Japan respectively, of which 160 million ton (41.4%) was used for residential purpose in India and 50 million ton (14.3%) in Japan. India had much higher ratio used in house; and that 130 million ton of biomass and waste were used for house, so biomass and waste were precious energy resources for house in India.

Traditional fuels of India have been wood and “cow-dung-fuel” that is a dry cake made of cow dung and straw. These fuels, however, have low burning efficiency and in addition tend to be harmful to health due to its dense fume and smoke. Furthermore, among 200 million households in India, 44% houses do not use electricity, and 75 million households in rural areas still use kerosene for illumination.

In order to solve this problem, Indian government has been promoting the use of “family-use biogas plant”. This is a simple fermentation tank to be installed in a pit. It is quite simple and of low cost. Cattle excrement and house garbage are thrown into the tank to be fermented to yield “biogas”, which can be burnt for cooking as well as for illumination instead of kerosene purchased. The biogas contains methane at a proportion of 55%-75%, and it has become an important energy resource especially in farming villages.

Only in one year (from March 2008 to March 2009), about 100,000 units of the “family-use biogas plant” were installed in India. At the end of March 2009, accumulated number of the installed units became 4.13 million. In addition an estimate has shown that potential demand for the biogas plant would be as many as 12.34 million units within India. Indian government has been subsidizing 60% of installation cost (nearly 100 USD/unit). Reportedly, the

investment for the installation would be recovered in two years. It seems that installation of the biogas plants would be continuously increased in number. (**Authors' abstract**)

Keywords: *India, biomass, cow-dung-fuel, family-use biogas plant, biogas, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/10,
(Filipiniana Analytics)

0285

Felda, Malaysia's largest palm oil company, building second biomass power plant

Malaysia is the second largest producer of palm oil in the world, with its production output for palm oil in 2010 coming to 18 million tons (estimated value). The palm oil production output for the entire world is 48 million tons, with Malaysia accounting for 37.5% of this. Each year 70 million tons of biomass are discharged in Malaysia, 85.5% of which is discharged by the palm oil industry. The biomass from the palm oil industry includes empty fruit bunches (EFB), palm kernel cake (PKC), and palm oil mill effluent (POME).

Felda Holdings, which is the largest palm oil production company in Malaysia, produces about 8% of global palm oil output and discharges 3 million tons of EFB each year. Felda Holdings announced in March 2011 that it would build a biomass power plant that uses only EFB. The plant will use 350,000 tons of EFB each year as fuel for generating electricity. It will start generating electricity in December 2012 and will have a generating capacity of 12.5 MW.

In 2004 Felda Holdings became the first company in Malaysia to generate electricity (7.5 MW) by using EFB as the raw material, and this power plant will be its second. What is more, it has plans to reuse all of the EFB that it discharges by the year 2013.

Joint research between Japan and Malaysia was carried our for three years beginning in 2004. Through this joint research by the three companies of Japan's Kyushu Institute of Technology (Professor Shirai), University Putra Malaysia, and Felda Holdings, facilities for demonstration tests on methane fermentation using palm oil mill effluent as the raw material were built in 2005. They claim to be able to generate 500 kW of electricity from the methane that is produced. (**Authors' abstract**)

Keywords: *Malaysia, palm oil, biomass power plant, palm oil production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/06,
(Filipiniana Analytics)

0286

First floating offshore wind turbine generation system has started in Japan

Due to its wind conditions, geography, residential environment, and the impact on its ecosystems it will be difficult for Japan to install wind turbine generation on land. Instead it is focusing on offshore wind turbine that has enormous potential and which is expected to serve as a replacement for onshore wind turbine.

On February 23, 2012 the Japan Wind Power Association announced that the potential for generating wind power at sea (600 GW) is four times that of generating it on land (140 GW). What is more, it pointed out that from 2030 onward the pace would fall off for installing onshore wind turbine and that offshore wind turbine would increase, in particular floating wind power generators.

Against this background, on June 11, 2012 a group that included Kyoto University succeeded in the offshore installation of Japan's first floating wind turbine (100 kW) in the waters around Kabashima Island, Goto City, Nagasaki Prefecture as an experimental project for the Ministry of the Environment. What is more, there are plans to install 2 MW worth of floating wind turbines in FY2013. In addition, an experimental study project on large-scale offshore floating wind turbine farm (2MW+7MW+7MW; three turbines installed for a total of 16 MW) off the coast of Fukushima will be carried out from FY2012 until FY2016 by Ministry of Economy, Trade and Industry (METI). Installed capacity 7MW/unit of wind turbine generation system is the world's largest-scale offshore floating wind power. (**Authors' abstract**)

Keywords: *Japan, wind turbine, wind power, generation system, onshore wind turbine, offshore wind turbine, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/06,
(Filipiniana Analytics)

0287

Food waste being used at Japan's largest biomass fired power plant

Kawasaki Biomass Electric Power Co., Ltd. (Kawasaki-ku, Kawasaki City, Kanagawa Prefecture), which has Japan's largest biomass fired power plant with an output of 33,000 kW, began operating in February 2011 by using woody biomass fuels such as construction scrap wood. This power plant uses 180,000 tons of wood chips a year as raw materials to achieve an annual CO_2 emission reduction of 120,000 tons.

In June 2011 Ajinomoto Co., Inc., the largest seasoning company in Japan, announced that it had begun supplying the power plant with the residue generated from when liquid seasoning is manufactured to serve as a new biomass raw material. This residue is "humus", and it is generated by the process of manufacturing liquid seasonings in Ajinomoto's Kawasaki Plant, which is its main factory for seasonings. It consists of the strained lees from when the vegetable protein in soybeans is broken down and amino acids are extracted from the degradation product. Since March 2011 this has been sent to the Kawasaki Biomass Power Plant, which is likewise situated in Kawasaki-ku, where it has been reused as fuel for generating power.

Ajinomoto Co., Inc. had previously disposed of the vast majority of this humus as organic waste, while reusing some of it as fertilizer or the like. Because this humus is carbon neutral, it is capable of contributing to cutting emissions of CO2 if it is used as a fuel for generating power. But it had been difficult to use this as fuel because it contains large amounts of salt and moisture. Yet recent advancements in filtration and cleaning technology for when liquid seasonings are manufactured have achieved reductions in the salt concentration and moisture content of humus which have made it possible to use this as a biomass fuel for generating electricity. For the future 4,000 tons of this is slated to be supplied each year. (**Authors' abstract**)

Keywords: *Japan, biomass fired power plant, wood chips, humus, seasonings, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/08,
(Filipiniana Analytics)

0288

As for energy consumed in Vietnam, the biomass energy accounts for 46%

The total energy demand in fiscal 2006 in Vietnam was equivalent to 30 million tons of petroleum. By energy types, 46% was for biomass, 23% for petroleum, 17% for coal, 10% for natural gas, and 4% for hydraulic power, indicating the high degree of dependence on biomass energy. Main resources for the biomass energy (the quantity: 50 million tons per year) are rice husks, wood, droppings of animals, and agricultural waste.

The final actual energy consumption by divisions was 59% for home, 21% for industry, 15% for transportation, 4% for commerce, and 1% for agriculture. In Vietnam, 70% of population lives in rural areas where firewood, straw, and wood are used as the energy source for cooking at homes. Most of the biomass energy is utilized in rural areas as home energy. In Vietnam, they are exactly practicing a “low-carbon society." (**Author's abstract**)

Keywords: *total energy demand, Vietnam, biomass energy, low-carbon society, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,
(Filipiniana Analytics)

0289

Forest resources in ASEAN countries

The Association of South-East Asian Nations (ASEAN) is a regional cooperation organization composed of ten countries from the South-East Asian region, which have been experiencing rapid economic development. The region is situated in a tropical zone, and has the capacity to produce large quantities of biomass all year round. Woody biomass from forests constitutes a particularly valuable source of energy in the form of domestic fuel for local residents.

The forest area, percentage of land area accounted for by forests, and growing stock in forests (volume of trees comprising forests) have been indicated in the tables and figures for the ASEAN countries of Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand, Vietnam, Brunei Darussalam, Singapore and Japan.

The percentage of forests making up the national territory of Japan is high at 69%, and the country is well-endowed with forest resources; Out of the ASEAN countries Indonesia has the most extensive forest area, as well as abundant growing stock in forests; But it is also the country with the largest decline in its forest area. Large swaths of forest continue to be felled, and over the past 20 years the forests have decreased by about 24,113 (thousand ha), which is comparable to the forest area of Japan; and Forests continue to decline in countries other than the Philippines and Vietnam.

These forest resources are used as materials in the form of lumber products such as furniture, plywood, and paper and pulp, or are used for energy in the form of wood fuel. Due to rapidly expanding demand, these countries are now faced with the problem of depleting their natural forest resources. In the future it will be necessary to strike a suitable balance between material use and energy use, while also increasing natural forest resources. (**Authors' abstract**)

Keywords: *forest resources, tropical zone, domestic fuel, wood fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/11,
(Filipiniana Analytics)

0290

Future supply targets of bioethanol and biodiesel in Southeast Asia

The government of Japan as well as those of Southeast Asian countries are eager to expand the use of biofuels (bioethanol, biodiesel). This is not only because they want to cut down CO_2 emission by the use of biofuels that are renewable, but also because they intend to reduce import of fossil fuels by making use of their own biomass resources for producing fuels and, at the same time, consume the fuels in their own country.

The following table shows the target values for popularization of biofuels in each country. Although some difference can be noted with regard to extent and speed of popularization, it might be safely said that in several countries biofuels could replace 10-20% of conventional fossil fuels by FY 2020, and that by FY 2030 most countries may be able to achieve 20% of substitution (of fossil fuels) by biofuels. (**Authors' abstract**)

Keywords: *bioethanol, biodiesel, carbon dioxide emission, southeast asia, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/01,
(Filipiniana Analytics)

0291

FY 2014 Energy White Paper

On July 14, 2015, the Ministry of Economy, Trade and Industry released the FY 2014 Annual Report on Energy (Energy White Paper). This year's Energy White Paper used a quantitative evaluation index (see Table 1) for energy security to compare the latest figures with those from the 2000s (2010 Energy White Paper) regarding the global energy security environment, which is undergoing enormous changes due to the shale gas revolution in the United States. By doing so, it was able to analyze the ways in which energy security is changing in various countries.

The underlined sections for each item have been scored based on a comparative evaluation and a comparison has been performed on the quantitative evaluation with each country (Fig. 1).

This has revealed that: 1. The United Kingdom had the highest scores for both its figures for the 2000s and its most recent figures, but as a result of its increase in primary energy self-sufficiency because of the shale gas revolution the United States has the most-improved score; 2. Japan was rated the lowest, and had the lowest score among the assessed countries.

In the White Paper, a supplementary budget of 360.1 billion yen was posted for FY 2014 for measures to promote renewable energies such as enhancing energy conservation measures, fuel countermeasures, and local production for local consumption. Moreover, characteristic initiatives to promote the adoption of renewable energies included the creation of regional recycling systems that use forest trimmings as wood biomass fuel and supplying the hot water left over after generating power with geothermal power to communities. Local production for local consumption-style

measures that are conducive to community-building were also introduced, with these including agricultural production projects and snow melting projects for roads. (**Author's abstract**)

Keywords: *energy white paper, renewable energy, energy security, energy consumption, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,
(Filipiniana Analytics)

0292

Gasification of woody biomass for power generation and production of liquid fuel

Recently, “woody biomass gasification system” has been getting popular. The system can produce combustible gas directly from woody biomass by a thermal process called “pyrolysis”, and then generate electric power and heat by burning the gas. Generally speaking, most of biomass exist thin and widespread form over the earth surface, and therefore collection of biomass from a wide area tends to be costly. This pyrolysis system can be made compact and has a high efficiency of electric power generation and can operate on rather small quantity of biomass available in a local area. By using pyrolysis, it is possible to cut down size and cost of power plant compared with those of conventional system that burns biomass directly and generate electric power by steam turbines.

Commercial projects and proof projects that use the above-mentioned “woody biomass gasification system” for providing electric power and liquid fuel have been increasing in number. Tsukishima Kikai Co., Ltd established its own woody biomass gasification system at Senhoku city in Akita prefecture in August 2010. This plant gasifies waste woody chips and woody scraps that amount to 3,000 ton a year, and it can provide 300 kW of electricity by burning the gas in a gas engine-generator. At the same time the exhausted heat of the plant is recovered and used for other purposes.

Kawasaki Plant Systems Co., Ltd accomplished a range of proof experiment of a woody biomass gasification system and power generation plant, in August 2010 at Niyodogawa-Cho, Kochi prefecture. The proof experiment has been conducted for three years since April 2007, under contract from NEDO (New Energy and Industrial Technology Development Organization). Forestry residue was gasified and burnt in a gas turbine to generate electric power. The experiment has proven that the plant can provide 150 kW of electricity by consuming 2,700 ton of forestry residue a year. The exhausted heat is recovered and used for drying the woody biomass.

At Naka-Cho, Tokushima prefecture, the first Japanese test plant was installed that can gasify woody biomass and then turns the gas into liquid fuel. A full-fledged proof experiment of the plant is presently under way. This project has been jointly conducted by Micro Energy Co. which developed plant system, and Yonden Engineering Co.,Inc which operate plant. The plant is a kind of BTL (Biomass to Liquid) production system that can produce 20 liter of liquid fuel from 100 kg of woody biomass per hour. The liquid fuel is to be consumed by boilers, municipal cars and forestry machineries. (**Authors' abstract**)

Keywords: *gasification, woody biomass, liquid fuel, power generation, pyrolysis, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/10,
(Filipiniana Analytics)

0293

Gathering momentum regarding the introduction of geothermal power generation in Japan

Despite being the third ranked country in the world in terms of geothermal resources, Japan has not made any progress in introducing new plants ever since the Hachijojima Geothermal Power Plant in 1999. The reason for this is that most of the proposed sites fall within national parks or hot spring areas, and there are apprehensions over the negative impact on the natural environment and hot spring sources from the development of geothermal power, such that the government has regulated its development.

Yet following the accident at the Fukushima Nuclear Power Plant the government has laid out measures to introduce and expand renewable energies. As part of this, emphasis has come to be placed on geothermal power generation for the following reasons: Japan has substantial geothermal resources; the output is stable, and is not affected by the climate; and Japan's technology for geothermal power generation is the best in the world (Japanese companies have 70% of the global share for geothermal turbines). What is more, Japan has instituted a feed-in tariff system as one of its measures, and has set the purchase price for geothermal power at 27.3-42 yen/kWh.

The government has set out a policy of easing regulations on development that is aimed at the introduction of geothermal power. It has also decided that it will provide approval for small-scale geothermal power generation even in national parks upon conditions such as local consent being obtained. In response to this the Japan Hot Springs Association, which is concerned about the impact of geothermal usage on hot springs, issued a statement saying that it is opposed to the rampant development of geothermal power, and that consensus with the local region is indispensable for its development. Given such circumstances, the first case of geothermal power development within a national park with the consent of local hot springs operators began in Tsuchiyuonsenmachi, Fukushima City in January 2012. This project is being jointly developed by the Tsuchiyu Onsen Partnership, Howa Plant Manufacturing Inc., and JFE Engineering Corporation, with the aim being to enter it into operations in 2014.

What is more, the Japan Geothermal Developers' Council is carrying out studies on promising sites for geothermal development in the six prefectures of the Tohoku Region and releasing the results of this. On the basis of the amount of heat present, the potential output came to 2,732-5,464 MW. These recent onsite surveys have revealed that the developable output is between 655 and 740 MW, of which 170 MW is outside of national parks and 485-570 MW is within said parks. (**Authors' abstract**)

Keywords: *Japan, geothermal resources, renewable energy, tariff system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/09,
(Filipiniana Analytics)

0294

A geothermal heat pump began operating at Tokyo Sky Tree

Geothermal heat pumps are systems that make it possible to boost the efficiency of air conditioning and supplying hot water through the use of cooling water in the summer and water as a heat source in the winter. This can be done due to the fact that the underground temperature is lower than the ambient temperature in summer and higher than it in the winter. These pumps are especially effective in urban areas at keeping the heat island phenomenon in check since they eliminate the heat radiated out into the atmosphere from outside air conditioning units.

They have gained considerable traction in the United States, where 12,000 MW of capacity has already been introduced at present. The reason for this is that the US Department of Energy is actively promoting the installation of geothermal heat pumps in order to cut down on emissions of CO_2 and to create new employment, and it is aiming

to install 1 million units per year up through the year 2017. What is more, the government is also offering financial assistance (tax credits, subsidies) for their installation.

In Japan the dissemination of geothermal heat pumps is lagging considerably far behind compared to the West because of the high costs of laying the heat exchange pipes underground and the fact that the technology is not widely known. But for the first time in Japan a district heating and cooling system that uses geothermal heat was adopted on the Tokyo Sky Tree, which opened for business in May 2012. This system uses geothermal heat to cover district heating and cooling, thereby allowing the annual energy consumption to be reduced by approximately 43%. The expectation is that installing a geothermal heat pump on the Tokyo Sky Tree will raise their visibility.

The Ministry of the Environment compiled the Geothermal Usage Guidelines in March 2012 to serve as measures for the dissemination and adoption of the technology. Moreover, the Ministry of Economy, Trade and Industry is supporting the adoption of geothermal heat pumps through its Project on Measures to Support the Accelerated Use of Heat from Renewable Energy. (**Authors' abstract**)

Keywords: *Japan, geothermal heat pumps, carbon dioxide emission, renewable energy, heat island phenomenon, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/10,
(Filipiniana Analytics)

0295

Green power getting popular by woody biomass power generation

Green Power is electric power that is generated by means of renewable energy such as biomass, wind and solar power etc., which do not contribute to increase CO_2 in the atmosphere. Among them, power generation by means of woody biomass has been gathering attention from eco-businesses, because it has a great advantage that it can provide steady supply of electricity free from changeable weather conditions. Today, two different business models are working in Japan for expanding the woody biomass power generation.

The first business model is based on “Locally-produce and Locally-consume Policy” for electricity, in other words, to supply electricity by means of locally obtainable biomass resources. Yamagata prefecture has rich woody biomass resources. Especially, Murayama City and its surrounding areas are famous for cherry fruits and cherry trees. In this circumstance, waste woody biomass resources such as thinned wood and cut-down aged trees have been generated as much as 130,000 ton annually. In order to utilize the waste woody biomass for supplying electricity to the district, Yamagata Green Power Co. installed a gasification-type power generation plant that has a capacity of 2,000kW and supplies 15 million kWh per year in 2006.

For making use of the power, Murayama city and Yamagata GP concluded a trade contract in February 2010. The city intends to use this electricity at city offices, community center, gymnasium, seven elementary and middle schools of the city. This green power can fulfill 70 to 80% of power demand of the city area. Murayama city’s “Locally-produce and Locally-consume” of electricity is the first venture of this sort in Japan, and the city expects that it may be possible to reduce CO_2 emission by 1,280 ton per year.

The second model is a scheme based on the Tradable Green Certificate System, where businesses and private persons who want to use green-power bear the cost for power generation, and consign the power generation to professional power businesses. This system makes it possible for green power users to use green power even if the user’s location is distant from the power generation sites. Besides the Green Certificate can verify the business’s contribution to cutting down CO_2 emission.

SONY Co. has become the largest contractor of the Tradable Green Certificate in Japan. The amount of domestic TGC of SONY has been increasing every year, scoring 20.4 million kWh (=GWh) in FY2006, 36.4 GWh in FY2007, 55.45 GWh in October 2008, and 70.94 GWh in July 2009. About 49% of the green power used by SONY is supplied from woody biomass power generation plants. Owing to the domestic TGC system, it is now possible to use at SONY's Tokyo Office, the green power generated at Tsubetsu town, a remote forestry industry town of Abashiri-gun in Hokkaido. (**Authors' abstract**)

Keywords: *green power, power generation, tradable green certificate system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/03,
(Filipiniana Analytics)

0296

Handling fluctuations in output from the generation of renewable energies

The output from power generated by renewable energies like solar and wind power fluctuates according to the intensity of the solar radiation or wind. There are fears that if such facilities are installed in certain locations in a concentrated manner in the future then these fluctuations will have an impact on the voltage and frequency of the power supplied by power companies. Storage batteries are being considered as a countermeasure to this, and cases in which they have been installed have been on the rise. By way of example, in response to these precipitous fluctuations in wind power, countermeasures to short-term fluctuations in which energy is stored in a battery during peak times that are over and above the output targets and discharged from the battery during the valley part of the output cycle in order to smooth it out are conceivable. So too are countermeasures to long-period fluctuations in which power generated at nighttime when there is little demand for electricity charges the battery, which then discharges during the daytime to provide a certain level of output. But these latter measures require large-capacity batteries.

Hokkaido Electric Power Company announced in July 2013 that it would install redox flow batteries, which are one type of storage battery, in order to expand its adoption of renewable energies. They have an output of 15,000 kW and a capacity of 60,000 kWh, with this serving as the first case of a power company installing large-scale storage batteries.

Pumped storage power generation had previously been used to store power from the excess electricity at nighttime, but it is claimed that it is more effective to handle this via battery storage in order to improve the ability to follow short-term fluctuations. The different types of storage batteries for renewable energies shown in Table 1 are being developed. Table 2 shows examples of various different batteries that have been applied to the generation of wind power. The requested price for their adoption is on par with that of pumped storage power generation at 20,000 yen/kWh, but at this point in time there are still complaints with them. It is hoped that their performance will be improved and their cost will come down in the future. (**Authors' abstract**)

Keywords: *Japan, renewable energy, output fluctuation, solar power, wind power, pumped storage power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/11,
(Filipiniana Analytics)

0297

Handling fluctuations in renewable energy output via electricity storage using compressed air

Since the power output from solar and wind power fluctuates as a result of changes in the climate, if these were to be adopted in large scale then measures would be needed to ensure the stability of power grids. Large-scale storage battery systems that use lithium ion batteries or the like have been developed as one such method, and demonstration experiments are being carried out on them.

As a different approach from that of storage batteries, on June 19, 2015 Kobe Steel, Ltd., Advanced Collaborative Research Organization for Smart Society of Waseda University, and the Institute of Applied Energy announced that they would develop an adiabatic compressed air energy storage system. This system uses a compressor that runs on electricity generated from renewable energies to store energy in the form of compressed air and heat. Then, when electricity is needed, the pressure and heat from the stored compressed air is used to generate power via a screw generator. This system consists of a screw compressor, screw turbine generator, heat storage tank, and air storage tank. An MW-class demonstration test will begin in FY 2016, with plans to continue the demonstration test and commercialize the technology from FY 2017 onwards. An attempt to store energy via compressed air was carried out in Japan using a compressed air energy storage gas turbine (CAES-G/T) at a facility in Sunagawa Town, Hokkaido Prefecture from 1998 to 2001. This was commissioned by the Agency for Natural Resources and Energy, with the New Energy Foundation (NEF) carrying out the construction and trial operation together with Hokkaido Electric Power Company, Electric Power Development Co., Ltd., and IHI Corporation. With this system, electricity is used at nighttime to blow the stored compressed air through a gas turbine to drive the turbine directly for power recovery, and this is also used as air for combustion to turn a generator to generate power.

Tables 1 and 2 show a comparison of these systems. Control software will have to be developed for the new system, but since the system is combined with general-purpose machinery it does not require fuel. Following in the wake of the adoption of renewable energies, energy storage technologies that had previously been examined are now being reappraised, and there are moves for their practical implementation using current technologies. (**Author's abstract**)

Keywords: *renewable energy, energy storage system, compressed air, power output, power fluctuations, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,
(Filipiniana Analytics)

0298

Handy husk power system in Bihar Province, India

80 million people live in Bihar province situated in the northeast of India. About 85% of the inhabitants, however, live in districts remote from modern network of electricity supply. In Bihar province, people use woody biomass such as woody waste and excrement of animals as their major fuel for living. Various kinds of husks are generated in this province as much as 1.8 million ton a year. A set of “Husk Power System” that uses husks as fuel has been in operation since 2007 in order to utilize this valuable biomass resource.

The power generator is a small unit that can provide 40kW of electricity. The cost to install this type is only 1USD per watt of power generation capacity. Until the system was installed, husks were piled up and left alone in the field, and these husk-heaps often caused methane gas problems, which the system now eliminates completely. The number of “Husk Power System” unit gradually increased: three in December 2008, 19 in December 2009, 50 in August 2010,

and 60 at present. The small-and-dispersed power system can supply electricity to nearly 25,000 households living in 250 villages.

One unit of the system can supply electricity to 400 households, which in turn save 42,000 liter of kerosene and 18,000 liter of diesel fuel. So far these fossil fuels were consumed for power generation, but husk power system reduced electricity price down to half as much as in former days.

Bihar province plans to introduce more and more husk power system in the districts: the total number to be 500 units by December 2012, 2014 units in December 2014. In this consequence, the province will have another 10,000 jobs (employment), cut down CO_2 emission as much as 72,000 ton a year, and electric lights will shine in one million households. (**Authors' abstract**)

Keywords: *India, woody biomass, husk power system, power generator, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/02,
(Filipiniana Analytics)

0299

Holding of 8th Biomass-Asia Workshop in Hanoi

8th Biomass-Asia Workshop and Asia Biomass Office Conference were held through the joint sponsorship of VAST (Vietnam Academy of Science and Technology), AIST (the National Institute of Advanced Industrial Science and Technology), and NEF (the New Energy Foundation) from November 29 to December 1, 2011 in Hanoi, Vietnam.

This was a large scale international conference in which more than 180 people and 15 countries participated. In the seminar there were 37 speeches and research presentations, and on the final day the participants toured a bio-related facility on the outskirts of Hanoi. There were four presentations for the industrialization, the practical use of the bioenergy and was the workshop to promote the industrialization and practical use of biomass.

The speeches and research presentations were on the following subjects: 1. Biotechnology in Sustainable Biomass Development; 2. Sustainable Biomass Utilization; 3. Sustainability Assessment and Environmental technology of Biomass Utilization; 4. Standardization and Industrialization of Biofuel; and 5. Utilization and an Industrialization of Biomass Energy Researches.

The Biomass Office of NEF (the New Energy Foundation) presented the report /proposal of NEF invitation program and the international collaborative research, and an active discussion for the future was performed. The invitation researchers from Southeast Asia were 79 people, 11 countries in these four years from 2008. In order to industrialize the results provided by invitation program jointly between Japan and Southeastern Asian countries, Japanese private company will accept NER invitation researcher from 2011. (**Authors' abstract**)

Keywords: *biotechnology, biomass utilization, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/03,
(Filipiniana Analytics)

0300

Holding of overseas seminars and overseas workshop on Asia Biomass in Indonesia

Overseas Seminars and an Overseas Workshop pertaining to Asia biomass were held from November 29 to December 1, 2010 in Indonesia's capital city of Jakarta.

Overseas Seminars (November 29 to December 1, 2010): The Seventh Biomass-Asia Workshop and Asia Biomass Office Conference was held through the joint sponsorship of Indonesia's Badan Pengkajian dan Penerapan Teknologi (BPPT; Agency for the Assessment and Application of Technology), the National Institute of Advanced Industrial Science and Technology (AIST), and the New Energy Foundation (NEF). This was a large scale international conference in which roughly 280 people and 13 countries participated. In the seminar there were 36 speeches and research presentations, and on the final day the participants toured a bio-related facility on the outskirts of Jakarta. The speeches and research presentations were on the following subjects. 1. Activities for evaluating sustainability in relation to biomass energy; 2. Reports and proposals regarding the invitation projects and international joint research conducted by Japan.

Overseas Workshop (November 29, 2010): The Third Asia Biomass Energy Workshop was held under the joint sponsorship of the Department of Energy (DOE) of the Philippines, which is the lead country in creating the Biofuels Database in East Asia, and Asia Biomass Office (NEF). Fourteen people from the following eight countries took part as participants: (1) Cambodia: Ministry of Industry, Mines and Energy; (2) Laos: Ministry of Energy and Mines; (3) Malaysia: Malaysian Palm Oil Board; (4) Myanmar: Ministry of Energy; (5) Thailand: Ministry of Energy; (6) Indonesia: Agency for the Assessment and Application of Technology; (7) Philippines: Department of Energy; and (8) Japan: New Energy Foundation (NEF).

The participating countries offered reports and consultations concerning the current state of the biofuel database in each of their countries, and consultations were also held regarding new content for the database. (**Authors' abstract**)

Keywords: *overseas seminars, overseas workshop, biomass energy, biofuels database, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/06,
(Filipiniana Analytics)

0301

Husk power generation soon starts in Cambodia

Agriculture has developed as major industry of Cambodia, sharing 34% of GDP, and employed 60% of total labor force of the country in 2008. During the period from 1995 to 2007, production of rice, corn, cassava and green vegetables increased dramatically in association with their cultivation acreage. Especially rice production doubled and rice fields increased by 24%. Rice production in 2010 is expected to amount to 7 million ton.

At present some 2 million ton of surplus rice is produced in Cambodia, and exported to Vietnam and Thailand without husking. This is because Cambodia has not enough rice cleaning facilities. Cambodian government announced in August 2010 that the country would further increase rice production as well as rice export in years ahead, and by 2015 it would make it possible to export cleaned rice more than 1 million ton a year.

Rice husks (chaff) share is about 20% of un-husked rice in weight. In 2010, 1.4 million ton of rice husks were generated in Cambodia. Suppose all the husks were burnt to generate electric power, Cambodia would obtain 1,120 GWh of electricity. The total electricity supply of Cambodia in 2004 scored 642 GWh. Therefore it looks quite possible that husk power generation may fulfill all electricity demand of the country.

The largest rice-cleaning factory in Cambodia is owned by Angkor Kasekam Roongroeung Co., Ltd.(AKR). The company has contracted with 30,000 local rice farmers, and operates a rice-cleaning factory with a capacity of 60,000 ton per year, in Kandal province 25 km away from Phnom Penh the Capital. On 15 December 2010, AKR announced publicly that the company would invest 6 million USD for a husk power system wit 2.5 MW capacity that would start commercial operation soon. And that AKR would supply electricity at a price of 900 Riel/kWh, while at present, the farmers pay 1,100 Riel/kWh. Electrification of Cambodia is only 26%, which is the lowest in southeast Asia. Price of electricity is the highest. The Cambodian farmers are keenly looking forward to having lower price of electricity and higher rate of electrification, by introducing husk power system. (**Authors' abstract**)

Keywords: *Cambodia, husk power generation, rice husk, chaff, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/02,
(Filipiniana Analytics)

0302

Import of EFB (empty fruit bunch) of palm is swelling

Production of all kind of vegetable oil worldwide in FY2008 scored about 138 million ton. Where palm oil, extracted from palm fruits, had the largest share of 32.2% (44.48 million tons). The palm oil production has increased by 32.2% in recent five years compared to that in FY 2004, which was 33.65 million tons.

Palm oil production is expected to increase further in near future. Among the major palm oil producing countries, Indonesia comes to No.1, producing 20.25 million tons, and next comes Malaysia, producing 17.76 million tons. The two countries' production put together comes up to 38.01 million tons, accounting for 85 % of worldwide production of palm oil.

In the process of palm oil production, a large amount of residue is generated. Especially empty fruit bunches (EFB) of palm have scarcely been in use and have been just cast away. For producing 1 ton of palm oil, 1.07 tons of EFB is generated. Therefore the amount of EFB just thrown away every year in Indonesia comes up to 22 million tons, and that in Malaysia 19 million tons, respectively.

The EFB is a kind of woody biomass having a calorific value of 4,400 kcla/kg-dry, and is regarded a safe and promising biofuel resource because it has very low chlorine content. Some Japanese trading firms have been focusing on EFB that is constanty and abundantly generated in Indonesia and Malaysia, and they have begun to introduce EFB to Japan so as to be used by Japanese industrial companies, in the field of power generation, chemical products, paper as well as cement production.

These EFB users have been expanding the use of various biofuels, as substitutes for crude oil and coal, in order to cope with the global warming problems. Japanese companies such as Tokuyama Co., ORIX Co., Itochu Co., one after another, have been importing EFB from southeastern Asian countries, and expanding the use of them in Japan. (**Authors' abstract**)

Keywords: *vegetable oil, palm oil production, empty fruit bunch, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/01,
(Filipiniana Analytics)

0303

Import quantity of woody pellets

Japan's production capacity of woody pellets has increased rapidly in recent five years. Annual production of woody pellets in FY 2003 was 2,400 ton, and it escalated every year: 3,700 ton in FY 2004, 8,700 ton in FY 2005, 8,700 ton in FY 2005, 22,500 ton in FY 2006, 32,600 ton in FY 2007, and came up to 60, 000 ton in FY 2008, nearly 25 times as much as that of FY2004. Meanwhile, the number of pellet factories was 10 in FY 2003, 13 in FY 2004, 18 in FY 2005, 38 in FY 2006, 47 in FY 2007, and increased to 55 in FY 2008, more than five times as many as that of FY 2003.

Looking at the distribution of pellet factories all over Japan, eight exist in Hokkaido, four in Iwate, three in each of Miyagi, Nagano and Kochi prefectures, respectively. Woody pellets are mainly burnt as fuel in small boilers and stoves at present.

On the other hand, Japan imports woody pellets from overseas and the amount has been increasing rapidly. Annual import of woody pellets stayed around 10,000 ton per year during the period from FY 1998 to FY 2006, but increased to 14,000 ton in FY 2007, 41,900 ton in FY 2008, and now in FY 2009, it has already scored 49,000 ton during the period from January to October.

There are reasons why the import of woody pellets is rapidly increasing: 1. Use of woody pellets as fuel for power generation plants has become popular and this requires steady and abundant supply of the pellets; 2. The price of imported woody pellets has been comparatively lower than that of domestic products.

The average price (CIF: Cost, Insurance and Freight) of imported pellets was some forty yen per kg during FY 2007. Thereafter, pellet price steadily decreased to 27.6 yen/kg in FY 2008, and 21.8 yen/kg in FY 2009.

Meanwhile, the price of domestic woody pellets at the factory gate has been around 25-30 yen/kg in general. Consequently, big pellet-consumers like power stations tend to call for imported pellets. (**Authors' abstract**)

Keywords: *wood pellets, Japan, power generation plant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/02,
(Filipiniana Analytics)

0304

Improvement of biomass energy utilization in Bangladesh homes

Biomass Energy consumed in the people's republic of Bangladesh has a 60% share in the total primary energy consumed in this country. A 250 kW - class biomass electric power station, fueled by chaffs, the first case in the country, began operation in FY2008. On the other hand, large scale development of natural gas is going on, since the country has a great potential of 329 Gm^3–2,500 billion ton–of natural gas reserve. Besides, Barapukuria coal mine was discovered in 1985. Assisted by Chinese Government, 2 million ton/year of coal is being excavated and a 250MW class coal-burning power station has started regular operation.

Consequently, the ratio of biomass energy to the total energy of the country is expected to become smaller in future. Whereas in most households, people are still mainly dependent on traditional biomass fuels (wood and dried plants etc.). More than 92 % of housewives are cooking meals using solid biomass fuels that cause serious air pollution in their houserooms. Owing to fume-contaminated air, a great number of people suffer from acute diseases like pneumonia and 46,000 people dies of them, of which children's share is almost 70%.

According to the report of the World Bank, concentration of floating particles (PM10: minute particles smaller than 10 micron meter in diameter) in their room air was found to be 30-35 times as dense as WHO standard. To cope with this bad condition, improved cooking stoves (ICS) have been developed and are becoming popular. The market size of ICS is estimated to be as large as 2 million units. One of the stores sold 2,000 ICS units in six months. Reportedly, the cost required to lessen 1 ton of CO_2 emission by using ICS is estimated to be 8 dollar/t-CO_2-effective. Therefore ICS can not only be effective for reducing the air pollution but also effective for improving heating efficiency.

Besides, the Bangladesh government promotes use of in-house biogas systems (IBS) that can process excrements of livestock and poultry into biogas. In four years from FY 2006 to FY 2009, the government plans to popularize IBS as many as 60,000 units all over the country. (**Author's abstract**)

Keywords: *biomass energy, Bangladesh, woody biomass, in-house biogas system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0305

Improving the efficiency of bio-oil extraction from microalgae

Research is being carried out on efficiency improvements to reduce the energy used during the drying process and the extraction process through the use of solvents that are required in order to produce fuel from microalgae.

Tokyo Gas Co., Ltd. and the University of Tokyo announced that they had succeeded in improving energy efficiency by performing methane fermentation on low temperature heat treatment and the extracted residue in September 2014.

With the conventional bio-oil process shown in Fig. 1A, 8.1 MJ/kg-dry energy is needed to heat it to dry it out and to evaporate the solvent. But with the process that was recently developed in Fig. 1B, the process can be performed at a low temperature of around 90°C, so that even when this is combined with evaporating the solvent the quantity of heat is 4.1 MJ/kg-dry, thereby roughly halving the energy needed. Methane fermentation is also performed on the waste liquid that contains sugar from the drying, as well as the residue from the solvent extraction, and if this methane were to be used to generate power then electricity, heat for primarily low temperature thermal use, and CO_2 to cultivate the microalgae could be obtained. The energy balance expresses the proportion of energy from the bio-oil obtained versus the energy put in to obtaining it. This process achieved an energy balance of 5.3 versus that from the conventional process of 1.7, thus achieving the target value for practical implementation. This made it possible to harness the outstanding characteristics of the microalgae used in the experiment. The expectation is that research on scaling this up in the future will be carried out. (**Author's abstract**)

Keywords: *bio-oil extraction, microalgae, methane fermentation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/12,
(Filipiniana Analytics)

0306

Improving the hydrogen conversion efficiency from solar energy

Research and development on producing hydrogen from renewable energy and using it as an energy carrier to store and transport energy is being promoted by the Strategic Innovation Promotion Program (SIP) of the Council for Science, Technology and Innovation (CSTI) in the Cabinet Office.

A research team from RIKEN and the University of Tokyo announced in April 2015 that they had achieved an energy conversion efficiency of 15.3% for producing hydrogen from solar power. As shown in Fig. 1, a concentrating solar cell that uses a concentrating lens (Fresnel lens) was used for the solar cell, and for the water electrolysis conductive polymers were used instead of an aqueous solution for the electrolytes. As a result, it exhibited an energy conversion efficiency that surpassed that of hydrogen generation from sunlight using conventional photo-catalysts (10% or less).

This was followed by the announcement on August 20, 2015 that Monash University in Australia had achieved a conversion efficiency of 22.4%. Next, a research team from the University of Tokyo and the University of Miyazaki announced on September 17 that it had achieved a conversion efficiency of 24.4%, thus setting a new world record.

The system showing the greatest efficiency featured a concentrating solar cell made by Sumitomo Electric Industries, Ltd. with an improved optical design mounted on a high precision solar tracking stand made by THK Co., Ltd. An experiment using this was performed outdoors at the University of Miyazaki. The system uses conductive polymers for the water electrolysis. The conversion efficiency for concentrating solar cells currently stands at 31%, with it estimated that if this were to further improve to 35% in the future then the energy conversion efficiency from solar power to hydrogen would reach 28%.

The materials used in concentrating solar cells are expensive. However, this will make it possible to produce hydrogen at a large scale in foreign countries with excellent solar radiation conditions and turn it into liquid hydrogen so that it can be imported from overseas by tankers as an energy source, much the same way that petroleum is. There are high hopes in hydrogen conversion technology that uses highly efficient concentrating solar cells as a new energy carrier for linking continents. (**Author's abstract**)

Keywords: *Japan, solar energy, hydrogen conversion efficiency, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/10,
(Filipiniana Analytics)

0307

Indian biomass businesses going abroad

India has many world famous biomass businesses that have excellent technology. A plantmaker The Praj Industries is outstanding among them, having established more than 200 factories for bioethanol production all over the world. The company guarantees that their technology have an ability to produce more than 260 liter of bioethanol from one ton of molasses, and in fact, some factories have made records of more than 280 liters.

On 7 December 2009, Praj announced that the company concluded a contract with Eco-Energy Co. in Ethiopia, in which the Praj would give a technical assistance to Eco-Energy so that the latter could develop a large plantation system of 25,000 ha size for producing biofuels (jatropha oil and castor oil).

Next, Alfa Laval Co. has a full-fledged line-up of production facilities for producing bioethanol as well as biodiesel, which are adopted all over the world. On 2 November 2009 Alfa Laval India Co. announced that the company recieved an order from the Petro-Vietnam Groupe of Vietnam to construct a bioethanol production facility capable of producing 330 KL/day, at the cost of 14 million USD. The facility, reportedly, is a system of the BIOSTIL Process developed by Alfa-Laval, which will be put into operation in 2011.

Thirdly, Natural Bioenergy Co. is the first Indian company to produce biodiesel, founded in 2005. The company has been operating a production system capable of producing 100,000 tons per year. Most of raw materials are being imported from Indonesia. The import quantity of jatropha has been increasing lately. In FY 2008, the company has exported to European countries 10,000 ton of biodiesel. (**Authors' abstract**)

Keywords: *biodiesel, bioethanol, India, molasses, Jatropha, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/01,
(Filipiniana Analytics)

0308

India's efforts to obtain biofuel from *Jatropha*

Biofuel from jatropha plants has been gathering attention because the plants grow well on wasteland and such fuel is not in conflict with food. Given the fact that it has a great deal of wasteland, India was the first to begin working on planting jatropha and using it for fuel. For rural farmers, using the oil from jatropha plants obviates the need to purchase diesel fuel. So it serves a role as a countermeasure to poverty while also having the added advantage of converting wasteland over to agricultural land.

As for the cultivation of jatropha, the plant grows even in regions with a considerably low annual precipitation of 200-1,500mm of water, does not require much fertilizer, and can survive on land at altitudes between 500 and 1,000m. However, to grow well it requires temperatures of 20°C or higher. Approximately 30% oil can be extracted from jatropha seeds as a percentage of its weight, which can be used as fuel in diesel engines even in its crude, unrefined state.

The Advanced Biofuel Centre of the Centre for Jatropha Promotion (CJP) is an organization that has been promoting the use of biofuels from jatropha in India and which has designated 200 districts of jatropha cultivation areas in the country. These regions are found in almost every state in India, and were determined via the following criteria: Amount of wasteland, high poverty rate among farmers, under the poverty line, and climatic conditions suitable for jatropha.

In each of these regions jatropha will be cultivated on blocks of 15,000ha that will be managed by farmers from those districts. This will make it possible to convert 3 million ha of wasteland into jatropha agricultural land over the next three years. (**Authors' abstract**)

Keywords: *biofuel, jatropha, wasteland, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/02,
(Filipiniana Analytics)

0309

India’s potential installed capacity for wind power is 3,000 GW

As of the end of 2011, the installed capacity for wind power worldwide (cumulative total) was 238 GW. Of this, India’s installed capacity (16.1 GW) placed it fifth in the world and second in Asia after China. Moreover, as of the end of March 2012 it had reached 17.352 GW and has been steadily increasing. The reason for this lies in the fact that taxes on the installation of such facilities have been reduced by the state governments, along with the setting of a feed-in tariff system that is more advantageous than those for other renewable energies. In terms of the installed capacity for wind power in each state, the state of Tamil Nadu accounts for a good deal of this with approximately 40% of the total, and is followed next by the states of Gujarat and Maharashtra.

The Centre for Wind Energy Technology (C-WET) has calculated that the potential installed capacity for wind power across all of India is 48.561 GW. However, this number comes from wind conditions 50 m above the ground and a scenario in which wind power facilities were set up on 1% of the area in each state, making it a conservative figure. States that have a high potential capacity for power generation include Karnataka (11.531 GW) and Gujarat (10.645 MW). The actual potential installed capacity is expected to be roughly 100GW on account of the increasing sophistication of wind power generation equipment in recent years.

However, in April 2012 an expert in wind energy from India announced that given the increasing size of wind power turbine equipment and the appearance of offshore wind turbines, the country has a latent potential of 2,000 GW. In addition, an analysis by the U.S. Lawrence Berkeley National Laboratory (LBNL) released results saying this is 3,000 GW, which pushes up the current estimate by some ten times or so. (**Authors' abstract**)

Keywords: *India, wind power, feed-in tariff system, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/09,
(Filipiniana Analytics)

0310

Indonesia is aiming to be a leader in biodiesel

Oil accounts for 52% of the primary energy in Indonesia, which is heavily dependent on oil. The government has adopted policies to lower this dependence on oil and to expand coal and renewable energies. Indonesia has worked out the Target Energy Mix, which calls for decreasing oil to 20%, increasing coal to 33%, and increasing renewable energies to 17% by 2025 (Fig. 1). From among these renewable energies it has set a target of 5% for biofuels.

The full-scale manufacture of the biofuels of bioethanol and biodiesel began in 2006. In 2010, 1 million liters of bioethanol and 400 million liters of biodiesel were produced for a combined total of 401 million liters, with the overwhelming majority of this being biodiesel manufacturing. This is because the raw material for biodiesel is palm oil, which is found in abundance in Indonesia. Indonesia is the world's largest producer of palm oil, and manufactures 20 million tons of palm oil each year from its 7 million hectares of palm plantations. 80% of this is exported, making the production of palm oil an important industry for acquiring foreign currencies.

There are 20 biodiesel factories within Indonesia, with an annual manufacturing capacity of 4.277 billion liters in 2010. But since the amount actually manufactured is 400 million liters, this means that the facility operation rate is a mere 9.4%. The reason for this is that the raw material of palm oil accounts for 85% of the cost of producing biodiesel, and as such it lacks a competitive edge versus diesel oil and thus has not become widespread. The global price for palm oil has skyrocketed from USD 369 per ton (2005) and USD 440 per ton (2008) to USD 1,171 per ton (2010).

When viewed globally, the demand for biodiesel is forecasted to grow on into the future. The Indonesian Government is aiming to become a global leader in biodiesel on the back of its abundant palm oil and manufacturing capacity. In 2010 the country exported 325 million liters of biodiesel to the European Union (EU). For the future it is moving forward with the manufacture and development of biodiesels from jatropha and pongamia, which do not contend with food, as well as from waste cooking oils which had previously been thrown out. In terms of cost, waste cooking oils could be obtained in April 2011 for 22 cents (18 yen) per liter versus USD 1 (80 yen) for palm oil, making them cost competitive. (**Authors' abstract**)

Keywords: *Indonesia, biodiesel, oil, renewable energy, bioethanol, jatropha, pongamia, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/05,
(Filipiniana Analytics)

0311

Indonesia is developing sewage treatment by biomass

Indonesia produces various kinds of fruits, such as banana, mango, citrus, mangosteen, dorian, papaya, sarakku (snake fruit). While dorian is called the king of fruits, mangosteen is called the queen of fruits because of its tender pulp and delicate sweetness. The total production of mangosteen in the world is 150,000 ton, of which 70,000 ton is produced in Indonesia, outstanding in this regard.

Lately in Indonesia, a national plan has been developed in order to introduce and maintain public health infrastructure such as sewage treatment facilities. Especially a keen demand exists for an efficient and low-cost sewage treatment system that could be used at home industries as well as small-scale manufacture industries. Because of economic reasons, serious research efforts have been made to find a way to utilize the country's rich and cheap biomass resource as absorbent in sewage treatment process. It has been proven that the shell of mangosteen could absorb ions of heavy metals.

Since ten years ago a research has been conducted to utilize mangorian shells to purify sewage water. Experiments have shown that mangorian shells have high efficiency in absorbing lead, cadmium, zinc and cobalt. Now, use of mangorian shells for sewage purification is thought to be a very promising, because it is very cheap and efficient. (**Authors' abstract**)

Keywords: *Indonesia, mangosteen, dorian, mangorian shells, sewage treatment, sewage purification, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/03,
(Filipiniana Analytics)

0312

Indonesia Is doubling the purchase price of electricity from geothermal power generation to accelerate its adoption

One of the reasons why the introduction of geothermal power generation has not made progress in Indonesia, which has the world's greatest geothermal resources, is that the purchase price of electricity by the state-owned power company PLN has been low. In June 2012 the Indonesian government announced that it plans to install an additional 4,000-5,000 MW to its current 1,200 MW of geothermal output by 2015.

In conjunction with this, the government will substantially raise the purchase price of electricity from geothermal power generation from its current 9.7 cents/kWh to 10-17 cents/kWh, thereby nearly doubling it. What is more, the government has laid out promotion measures such as making the resource exploration period a tax-free period, and setting up a geothermal power generation fund of USD 145 million (approximately 11.6 billion yen) through its Government Investment Unit (PT PIP).

At the same time, in March 2012 Sumitomo Corporation (Japan), PT Supreme Energy (Indonesia), and GDF SUEZ (France) jointly concluded an agreement to construct power plants of 220 MW, which would be among the largest in the world, at two geothermal mining spots (220 MW x 2 spots) on Sumatra Island and sell the electricity from these to PLN as a project for geothermal power generation in Indonesia. (**Authors' abstract**)

Keywords: *Indonesia, geothermal power, power generation, electricity, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/08,
(Filipiniana Analytics)

0313

Indonesia is going to double subsidy for expanding biofuel use

On 3 January 2010, the government of Indonesia announced that it would enforce the mixing of biofuel by more than 1% to regular automobile fuels. In this consequence, Indonesian people expect that the government will double the subsidy for biofuel which at present is 1,000 Rupiah (10 yen) per one liter of biofuel.

The production of biofuels in Indonesia in FY 2009 proved to be barely 104,000 kL, which showed 96% reduction from the record of the FY 2008 that scored 2,560,000 kL. Last year, among eleven Indonesian biofuel makers, six companies stopped production and of the rest, utilization of their factories was less than 5%. The sharp drop of biofuel production from palm oil was caused by the following market conditions: 1. A sharp rise of demand for palm oil worldwide: price of palm oil, which stayed low for some time lately, showed a big rise as much as 50% compared to that at the end of 2008 (512 USD/ton); 2. Shortage of soybeans supply, due to drought in South-America during early half of 2009, has turned the use of palm oil from fuel to food.

Indonesian government made a decision in the middle of 2009 to subsidize biofuel, giving 1,000 Rupiah/liter, only to make little effect. This year, therefore, people are expecting that the subsidy will be doubled to 2,000 Rupiah.

In addition to the aforementioned enforcement of mixing 1% of biofuel to regular automobile fuels, fuels for industrial use were made obligatory to include 2.5% of biofuel, and also national electric power stations were made to use biofuel at least 0.25%. (**Authors' abstract**)

Keywords: *biofuel, Indonesia, biofuel production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/02,
(Filipiniana Analytics)

0314

Indonesia is no.1 in the world in palm oil production

Indonesia has been one of oil-producing countries in the world, and in fact produces 1.2% of crude oil in the total volume of oil production in the world. The export of crude oil, however, is lessening today. After 2004 Indonesia became an oil-importing country. In 2006 Indonesia consumed 60 million ka of crude oil, 50 % of which was used in the transport sector.

Besides Indonesia is known to be No.1 in palm oil production, sharing 44.5% in the world. In 2008, 20.25 million ton of palm oil was produced from 7 million hectare of palm plantation, and 80% of which was exported. Palm oil stands as one of important export items of Indonesia.

Lately Indonesia started to produce biodiesel from palm oil, by establishing 22 factories that produced 1,000 ton of biodiesel in 2006, expanding rapidly to 360,000 ton by 2007. In April 2010, Indonesian Government fixed the subsidy for biofuel (diesel oil containing 2.5% of biodiesel) to be 2,000 Rupiah (20 yen) per liter. The subsidy will be allocated to 777,075 ka of biodiesel.

In order to reduce import of crude oil, the government is making effort to promote development and use of various kinds of renewable energy represented by biofuels. Especially, it is fostering biodiesel industry taking advantage of the country's status as No. 1 in the world of palm oil production.

Indonesia designated "National Plan on Biofuel" in 2006. The plan dictates that, by 2025, the production of biodiesel to be raised up to 10.22 million ka that would be mixed with diesel oil at 20% ratio, and that, likewise, production bioethanol to be raised up to 6.28 million kâ„" that would be mixed with premium gasoline at 15% ratio. (**Authors' abstract**)

Keywords: *palm oil production, biofuel, Indonesia, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/06,
(Filipiniana Analytics)

0315

Indonesia possesses plentiful biomass resources

Indonesia is a country that extends out horizontally with the equator running through it, giving most of the country a tropical climate and making it well suited for growing grains like rice and corn. Its agricultural production output in 2010 came to 19.76 million tons of palm oil (first in the world), 3.27 million tons of coconuts (first in the world), 2.59 million tons of natural rubber (second in the world), 66.41 million tons of rice (third in the world), 18.33 million tons of corn (eighth in the world), and 2.69 tons of sugar (17th in the world), making agriculture an important industry for Indonesia.

The production of these agricultural products involves enormous amounts of agricultural waste (biomass) being given off each year. This agricultural waste has an energy potential of 614.7 million GJ per year. Furthermore, the woody biomass from its forests and lumber mills comes to 15.77 million tons per year, which constitutes an energy potential of 141.5 million GJ per year. The total biomass from both its agriculture and forests comes to as much as 756.1 million GJ per year, which is comparable to 24GW of installed power plant capacity. Indonesia's net installed power plant capacity is 30.32GW (as of the end of 2009), and so the country could cover 80% of its power through biomass power generation.

While it possesses enormous amounts of biomass resources, it is only using a mere 3.25% of these. Indonesia has instituted favorable treatment in terms of its tax system and other areas for its renewable energies businesses, which include biogas, solar power, and hydropower. For the future, the government plans to put its efforts into developing renewable energies in order to cut its emissions of CO_2, and will boost its usage rate for biomass in particular out of consideration for sustainability.

In addition to these types of solid biomass, Indonesia also has 18 million tons of raw garbage and other waste given off by its municipalities each year, as well as 82.6 million tons of livestock excrement from cattle and pigs each year. When it comes to electricity from garbage, though it has not applied a feed-in tariff system, going forward the government plans to set a price of Rp 600/kWh (5 yen/kWh); (from a July 2012 report in The Jakarta Post). (**Authors' abstract**)

Keywords: *Indonesia, biomass, palm oil, coconut, natural rubber, rice, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/09,
(Filipiniana Analytics)

0316

The Indonesian government doubled the dissemination subsidy for bio-fuel in fiscal 2010

In Indonesia, the use ratio of bio-fuel in automobiles in fiscal 2008 is 1% and that in other industries is 2.5% and in fiscal 2010, the use ratio of the bio-fuel will be raised to 3% and 5%, respectively.

At the end of May, 2009, the Indonesian government submitted to the House of Representatives a bill to double the bio-fuel subsidy for the next fiscal year to 1.5 trillion Rp[rupiah] (about 125 million dollars). The government judged that it would be difficult to achieve the target of fiscal 2010 unless the subsidy is doubled. The subsidy is expected to be 1,450 Rp/L for bio-ethanol and 1,660 Rp/L for bio-diesel oil. (Note: 1 Rp = about 0.01 yen).

Meanwhile, PT Pertamina, an Indonesian state-owned oil company, raised the price of high-octane value gasoline, which is not subject to the subsidy, by 200 to 300 Rp/L on June 1, 2009. The price of Pertamax Plus gasoline was raised from 6,300 to 6,500 Rp/L and that of Bio Pertamax gasoline from 5,600 Rp/L to 5,900 Rp/L.

The Indonesian government has a policy of promoting the spread of the bio-fuel on two fronts: one to raise the price of gasoline not subject to the subsidy and the other to double the subsidy for the bio-fuel. (**Author's abstract**)

Keywords: *biofuel, Indonesia, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,
(Filipiniana Analytics)

0317

Indonesian national plan for biomass energy supply

In FY 2006, the total consumption of primary energy of Indonesia scored 8.37 billion barrel of crude oil equivalent. This figure was consisted of crude oil (47%), natural gas (22%), coal (24%), hydraulic power (2%), geothermal (5%), showing quite high dependence on crude oil. A presidential decree for promoting the use of biofuel was issued in January 2006 designating the future energy policy of Indonesia. The decree designates a goal to be attained by 2025, where the share of crude oil to be lessened as low as 20%, that of coal to be raised to 33%, in addition that of biofuels (bioethanol, biodiesel fuel, and other kinds of biomass-derived oil) to be 5%.

Table shows the national supply plan of biomass energy for FY 2010. As regards production of biodiesel fuel at present, BPPT (Badan Pengkajian Dan Penerapan Teknologi) has installed a test plant that can produce 1 ton per day of biodiesel oil using jatropha oil as raw material, at its Energy Technology Development Center and has been running a range of experiments. Besides, BPPT possesses a full-scale proof plant with 5,000 ton/year capacity. The biodiesel fuel produced by these plants will be blended with light oil so as to be used for transportation vehicles. The blending ratio will be 10% by FY 2010, and to be raised to 20% by FY 2025. (**Author's abstract**)

Keywords: *Indonesia, biofuel, crude oil, biomass energy, biodiesel fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/05,
(Filipiniana Analytics)

0318

Initiatives for Euglena Jet Fuel

Euglena Co., Ltd. is a venture company that originated out of the University of Tokyo. The company focuses on the outstanding fat production capacity of Euglena, which are the microalgae for which the company is named, which it uses to develop bio jet fuel.

An experiment to establish techniques for cultivating Euglena outdoors was conducted on Ishigaki Island, Okinawa. In April 2015, research began on the cultivation of bio jet fuel using “Super Euglena” that use genetically modified Euglena, as did the acquisition of new cultivation data for the outdoor cultivation of Euglena and the verification of candidate cultivation sites, at the University of California, San Diego (UC San Diego) in the United States. Concurrent with this, in May 2015 Euglena Co., Ltd. and Chevron Lummus Global LLC (CLG) concluded a licensing agreement concerning biofuel isoconversion process technologies, as well as a basic design agreement for the facilities for this. Isoconversion process technologies refer to proprietary biofuel refining and manufacturing technologies jointly developed by CLG and Applied Research Associates, Inc. (ARA), a research, development, and engineering company from the United States. A fuel refining facility that uses these technologies will be built close to Haneda Airport in Tokyo, and is slated to begin a demonstration experiment using airplanes in 2018.

Thus far, Euglena Co., Ltd. has promoted research and development in cooperation with JX Nippon Oil & Energy, Hitachi, Ltd., Keio University, Shimane University, and others, and it is aiming to further speed up the commercialization of this technology by partnering with foreign universities and companies. (**Author's abstract**)

Keywords: *Japan, Euglena, jet fuel, isoconversion process technologies, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/12,
(Filipiniana Analytics)

0319

Initiatives for local energy production for local energy consumption throughout Japan

There has been rising interest in renewable energies as a result of the Great East Japan Earthquake and the accident at the Fukushima Dai-Ichi Nuclear Power Plant. In local areas it is crucial that regional, small-scale, decentralized energy systems be constructed that supply electricity by distributing small-scale power generating facilities close to energy consumers.

Initiatives for Local Energy Production for Local Energy Consumption will produce energy from biomass within local regions throughout Japan that will be consumed within those regions. Such initiatives will make these energy systems possible, and will also contribute greatly to creating sustainable communities and revitalizing industries within these regions. The following initiatives have been compiled as recent (2012) initiatives for Local Energy Production for Local Energy Consumption throughout Japan.

Kawasaki City is partnering with the Kawasaki Biomass Power Plant in order to expand its use of biomass. In addition to the construction scrap wood that it has been using thus far, it will also use scrap pallets, product packaging, and wood that has been thinned from pear gardens that are generated within the city.

Gunma Prefecture has formulated its Plan to Promote the Use of Biomass. This will boost its biomass usage rate by 10% compared to 2010 levels to 81% by FY2021.

Nara Prefecture compiled its Basic Philosophy on the Use of Renewable Energies from of solar power, small to medium hydropower, and biomass. The prefecture will promote the use of woody biomass in particular, seeing as how mountain forests make up 80% of the land in Nara Prefecture.

Kumamoto Prefecture has formulated its Plan to Promote the Use of Biomass. As one of the foremost agricultural prefectures throughout Japan, Kumamoto Prefecture has a large production output in areas like agriculture and stockbreeding, and as such it contains a wealth of unused biomass from agricultural waste. (**Authors' abstract**)

Keywords: *Japan, energy production, energy consumption, renewable energy, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/07,
(Filipiniana Analytics)

0320

Initiatives for solar thermal usage in Kochi Prefecture

With its copious amounts of sunlight, Kochi Prefecture is promoting the adoption of solar power and carrying out initiatives for new solar hot water supply systems. Conventional solar hot water supply systems mainly consisted of flat plate types that were installed on the rooftops of residences, but with the new systems a type known as Parabolic trough systems are being used. As indicated in Table 1, Parabolic trough devices had previously been developed for use in solar thermal power. They are shaped like a rain gutter, with the interior covered in mirrors that reflect the sunlight and concentrate it on a pipe in the center, thereby heating the liquid flowing inside the pipe. They are also equipped with a tracking function that changes the angle according to the position of the sun.

A Parabolic trough solar hot water supply system from Sopogy Inc. in the United States went into operation starting from February 2014 as a replacement for the conventional flat plate type solar hot water supply system that had grown obsolete at Healthy Care Hanari, a nursing and health care facility for the elderly in Nahari Town, Kochi Prefecture. What is more, through the FY 2012 Project to Support the Dissemination of the Smart Community Concept by the Ministry of Economy, Trade and Industry, a model for building disaster-resistant towns was set up that consists of Parabolic trough solar hot water supply systems, electric car sharing, solar power for residential use, and energy farms being led by Arakawa Denko Co., Ltd., an electrical equipment company in Kochi City. This FS project by the Ministry of Economy, Trade and Industry was taken over by the Kochi Smart Community Research Council, which is comprised of 15 companies within Kochi City in industries such as electrical equipment and construction. What is more, Arakawa Denko Co., Ltd. has been carrying out demonstration tests on Parabolic trough solar hot water supply systems since April 2013. There are high hopes for a new solar energy usage configuration developed in Kochi that combines Parabolic trough solar hot water supply systems with solar power. (**Author's abstract**)

Keywords: *Japan, solar thermal usage, solar power, solar hot water supply system, Parabolic trough, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/09,
(Filipiniana Analytics)

0321

Initiatives for the large-scale outdoor cultivation of microalgae

Given microalgae's property of containing an enormous amount of oil, it has been gaining attention as a next-generation biofuel. A group comprised of IHI Corporation, Kobe University, and Neo-Morgan Laboratory Incorporated announced that they will complete and begin operating experiment equipment for the large-scale outdoor cultivation of microalgae in Kagoshima Prefecture by April 2015 (see Photo 1). In 2013 this group led a successful experiment with a 100 m^2 cultivation pond at IHI's Yokohama Works, and this time the experiment will be over an area of 1,500 m^2.

The above example consisted of an open system that used an outdoor cultivation pond. However, closed systems that use transparent containers that light can pass through are also conceivable for the large-scale cultivation of microalgae. But since the construction costs are expensive with this approach, it has the drawback that the production costs for the algae are too expensive. Conversely, while there are hopes that open systems will reduce production costs, demonstration tests must be performed to verify the potential for these to give rise to a fight for survival arising between various different types of plankton due to the incursion of zooplankton and phytoplankton clinging to things like pollen, insects, and bird feces.

Others aside from the group comprised of IHI Corporation, Kobe University, Neo-Morgan Laboratory Incorporated, are carrying out demonstration tests for the large-scale cultivation of different types of microalgae in cultivation ponds, as indicated in Table 1. This is currently moving from basic research in the laboratory to the demonstration test phase. They are currently moving from basic research in the laboratory to the demonstration test phase. In addition, cultivating ponds come in a square pool shape, as well as another type that is circular with an agitator in it. A raceway configuration with a mechanism that creates a current is also used. (**Author's abstract**)

Keywords: *outdoor cultivation, microalgae, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/05,
(Filipiniana Analytics)

0322

Initiatives in Akita Prefecture for the realization of a hydrogen society

The use of hydrogen for purposes other than its conventional use as a raw material for chemicals is projected to increase through its use on Ene-Farm (residential fuel cell power generation and hot-water supply systems) and as a fuel for fuel cell vehicles (FCV). However, at present most hydrogen is produced from fossil fuels, and so CO_2 is generated during its production. Conversely, when hydrogen is produced by using power obtained from wind power and other renewable energies to perform electrolysis on water, hydrogen can be obtained without giving off CO_2.

In the future, we must be able to produce hydrogen that is not accompanied by CO_2 through the use of renewable energies. As a first step towards achieving this, Akita Prefecture and Chiyoda Corporation concluded the Partnership Agreement on Initiatives to Realize a Hydrogen Society (Table 1) in August 2014. Chiyoda Corporation is developing a technique (the organic metal halide method) to produce methylcyclohexane (MCH) by reacting hydrogen with toluene in order to store and transport hydrogen. MCH does not have to be kept at extremely low temperatures or high pressure the way that liquid hydrogen or compressed hydrogen do, and so it can be treated in the same fashion as gasoline. This partnership agreement is a move that is suited to accelerating the realization of a hydrogen society through the start of the full-scale introduction of FCVs in 2015 (which is being promoted by 13 car manufacturers and the like) as well as the Strategic Road Map for Hydrogen and Fuel Cells that was revised by the Ministry of Economy, Trade and Industry in June 2014.

Akita Prefecture has an abundance of natural energy, including wind, solar, geothermal, and biomass. The prefecture has experience with implementing a direct current (DC) smart grid that combined various different renewable energies with storage batteries in Ogata Village, as shown in Table 2, from 2009 to 2011, and in 2011 it formulated the Akita Prefectural Strategy for New Energy Industries. This includes a demonstration project that combines renewable energies and a hydrogen plant, as shown in Fig. 1. (**Author's abstract**)

Keywords: *Japan, hydrogen society, carbon dioxide emission, renewable energy, methylcyclohexane, fuel cell vehicles, residential fuel cell power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/10,
(Filipiniana Analytics)

0323

Initiatives to Create a Hydrogen Society Derived from Renewable Energy in Hokkaido

Hokkaido has numerous areas that are suitable for generating power from renewable energies, such as wind power, but it has little in the way of capacity that can be transmitted. As a result, since 2013 it has been moving forward with the installation of a power grid that will connect such areas to the capital of Tokyo, where there is enormous demand.

Conversely, the Hokkaido Council for the Promotion of Hydrogen Innovation, which is sponsored by the Hokkaido Government, has been considering an idea to send renewable energies to regions with demand for such energy in the form of hydrogen. It announced the results of this in December 2015 in the form of the Vision to Achieve a Hydrogen Society in Hokkaido (draft), which lays out a plan for between 2016 and about 2040.

Table 1 shows two initiatives to convert renewable energies into hydrogen for transportation in Hokkaido, both of which were adopted through the Ministry of the Environment's Demonstration Project for Low-Carbon Hydrogen Technology in Regional Partnership. The project being carried out in Shikaoi-cho is designed to serve as a demonstration for power generation and thermal cogeneration via fuel cells in the local region, which it will do by adding hydrogen production equipment to a biogas plant and building a hydrogen station and hydrogen transportation system. It has the capacity to supply 430,000 Nm^3 of hydrogen each year. In addition, the project carried out in Shiranuka-cho will demonstrate power generation and thermal cogeneration via fuel cells by producing 1,000 Nm^3 of hydrogen per day via electrolysis from small hydro power of 220 kW.

In addition to these sorts of demonstration projects in local regions, the Hokkaido Council for the Promotion of Hydrogen Innovation is also advancing research on a separate method for transporting hydrogen from Hokkaido to Tokyo via liquid hydrogen tankers. (**Author's abstract**)

Keywords: *Japan, renewable energy, hydrogen society, power generation, thermal cogeneration, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/02,
(Filipiniana Analytics)

0324

Initiatives to promote renewable energy in Fukushima Prefecture

Fukushima Prefecture, which is the third largest prefecture in Japan by area, has an abundance of mountain forests, hot springs, and similar resources. It is also endowed with renewable energy sources, and it has held up dramatically promoting renewable energy as a major pillar of its reconstruction. When it comes to the large-scale adoption of renewable energy and the nurturing and concentration of related industries, the prefecture has set forth the ambitious vision of generating 100% or more of the energy demand within the prefecture from renewable energy, with 2040 set as the rough goal for this. As such, Fukushima Prefecture aspires to be a leading region when it comes to renewable energy. With this vision, the assumption is that the prefecture will increase the share of energy supplies from renewable energy within the prefecture to about 40% by 2020, then generate 100% or more of the energy demand within the prefecture from renewable energy by around 2040. As such, it is working to concentrate and nurture related industries by setting in place core centers (Fig. 1).

The Renewable Energy Promotion Association of Fukushima Prefecture, which will use the revenue from selling this electricity to support reconstruction, was launched on July 31 through an agreement between 18 organizations, including Fukushima Prefecture, the Ministry of Economy, Trade and Industry, Tokyo Electric Power Co.,Inc., Tohoku Electric Power Co.,Inc., and the National Institute of Advanced Industrial Science and Technology (AIST).

The prefecture is providing subsidies for companies' power generating equipment, transmission equipment, and so forth. In exchange for using the power companies' power grids, the companies will donate their share from the project's revenue to projects supporting reconstruction (1 million yen annually per 1 MW). The aim is to expand the adoption of renewable energy through the activities of the association, thereby providing backing to reconstruction and restoration in the afflicted regions and across the prefecture as a whole. (**Author's abstract**)

Keywords: *Japan, renewable energy, promotion initiative, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/09,
(Filipiniana Analytics)

0325

Inroads into overseas markets by the biomass businesses of Japanese companies

The Japanese environmental industrial companies are making inroads in overseas markets and export for future growth. This has been backed by the following factors: Japanese plant manufacturers possess exceptional technology in environmental, energy conservation, and waste recycling fields and have a competitive edge when viewed from a global perspective. Even as markets in Japan have been shrinking sales channels have been expanding overseas; and by utilizing their overseas networks, trading firms have been positioning biofuels as a source of energy and selling biofuels produced overseas.

The global warming countermeasure and the efforts of the natural environment-preservation are spreading on worldwide, in particular introduction of the biomass energy is pushed forward worldwide as measures to global warming. Recent inroads made into overseas markets by the biomass businesses of Japanese companies have been compiled into the following table. (**Authors' abstract**)

Keywords: *biomass, inroads, global warming, waste recycling, energy conservation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/06,
(Filipiniana Analytics)

0326

Installation of typhoon-resistant wind power turbines in Okinawa and the Kingdom of Tonga

Okinawa, which has an abundance of wind resources, is an island region that runs from the subtropics to the tropics. But at the same time, this region is also assailed by typhoons, cyclones, hurricanes, and other tropical depressions. Protecting wind power generation equipment from typhoons and the like in such regions is a necessary condition for the adoption of wind power there.

On Agunijima Island, Okinawa Electric Power Company has installed folding windmills, whose turbine braces can fold down during strong winds to avoid them and began operating them in June 2014. These turbines were systematized by Progressive Energy Corporation of Okinawa, which incorporated folding towers onto turbines by the

French company Vergnet. Most of the current wind power equipment utilizes a three-blade system, but since these turbines only use a two-blade system they can be stowed away compactly by laying them down against the ground. Therefore, the turbines are structured so that they can be laid down close to the ground's surface, to avoid the strong winds in the upper air when storms are predicted to hit.

To date, Okinawa Electric Power Company has installed folding turbines on Haterumajima Island and Minamidaitojima Island in Okinawa, with the ones on Agunijima Island marking the fifth such installation. It also announced in October 2014 that it will introduce these on Taramajima Island as well. What is more, a decision was reached to install these in the Kingdom of Tonga as a project by the Japan International Cooperation Agency (JICA). The hope is that the adoption of folding wind power generation will proceed by using these remote islands that are assailed by typhoons and other storms as its power sources. (**Author's abstract**)

Keywords: *Tonga, typhoon-resistant, wind power turbines, two-blade system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/12,
(Filipiniana Analytics)

0327

Installation status for ground source heat pumps

The Ministry of the Environment announced the installation status for ground source heat pump systems in January 2015. For this, it compiled the results up through the end of 2013, with the cumulative number installed of 1,513, representing a roughly 1.5-fold increase from the 990 there were from the last survey at the end of 2011. Since 2011 the number that has been installed in each single fiscal year has exceeded 200, with the record for new installations being beaten every year (see Fig. 1).

When viewed by prefecture, in terms of the cumulative number of installations Hokkaido is ranked in first place with 426, which is four-times the cumulative number installed in second-place Tokyo. As indicated in Fig. 2, which shows the top ten prefectures as of the end of 2013, five of the prefectures are in the Tohoku Region and three are in the Kanto Region. Niigata had the largest rate of increase between 2011 and 2013, followed by Akita and then Yamagata.

In the summer the earth temperature is lower than the ambient temperature, while in the winter it is higher than the ambient temperature, and so ground source heat pumps release heat underground in the summer and pump it up from underground in the winter. As such, these systems achieve energy savings compared with air conditioning and hot water supply units that use the hot ambient air in summer and cold ambient air in winter as their heat sources. The operating principle behind ground source heat pumps is explained in Fig. 3, using its operation for air conditioning as an example. (1) First, compressed, high temperature refrigerant gas exchanges heat with antifreeze in an outdoor unit, thereby cooling it and turning it into a liquid. (2) Then, it is passed through an expansion valve to turn it into a low temperature gas. (3) This low temperature gas is used to cool the air, and cold air is blown out of an indoor unit. Then once the refrigerant gas has warmed up it is cycled by being returned to a compressor. (4) Conversely, the antifreeze which has grown warm in the outdoor unit is cooled underground (to about 15°C) and cycled. Cooling the refrigerant gas using antifreeze that is around 15°C allows for more efficient air conditioning operation than using the atmospheric air, which is about 30°C in the summer. For heating, warm air is obtained indoors by going through the refrigerant cycle in Fig. 3 in the opposite direction.

The national and local governments have been offering support by providing subsidies in order to promote the adoption of ground source heat pumps. The expectation is that as the number of such pumps installed in the future increases, the cost of the systems will fall, thus further spurring their adoption. (**Author's abstract**)

Keywords: *pump system, heat pumps, ground source, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/03,
(Filipiniana Analytics)

0328

Instituting preferential treatment measures for the adoption of biomass power in Vietnam

The Vietnam Power Development Plan for 2011-2020 Period is being implemented with the goal of boosting the country's share of renewable energies in order to reduce the economic burden from using fossil fuels in response to Vietnam's energy demand, which will only increase in the future.

Of the different renewable energies, biomass power is considered a viable option in Vietnam on par with wind power. Therefore, preferential treatment measures for biomass energy projects (Decree No. 24/2014/ND-CP) were enacted in May 2014. The details are listed below.

1. The decree imposes on power companies the obligation to purchase the full amount of power produced by biomass power generators, and says they must conclude sales contracts within six months after the power generator's application. The valid period for this contract will last 20 years, but this can be extended; 2. Biomass power generating projects are eligible to receive preferential treatment for investment financing, investment guarantees, and export guarantees, as well as import duty exemptions for materials and products. They can also be exempted from land use fees and the costs for connecting to the power grid; and 3. The power purchase price is 5.8 US cents per kWh (not including tax).

As an agrarian nation Vietnam has an abundance of biomass that can be used for biomass power generation.

As things currently stand edible types of biomass such as corn and cassava are being used, with the amounts of non-edible types of biomass generated which are expected to be used in the future shown in Fig. 1. What is more, Fig. 2 shows the biomass energy potential for a hypothetical scenario in which the total amount generated is applied to generating power. Rice straw is generated in large quantities, and also looms large from an energy perspective. This is followed by firewood, corn residue, and rice husks. Over the long-term, it will be important to continue to effectively use these non-edible types of biomass with their enormous potential. (**Author's abstract**)

Keywords: *Vietnam, biomass power generation, renewable energy, wind power, preferential treatment measures, rice straw, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/08,
(Filipiniana Analytics)

0329

Intermediate-temperature solid-oxide fuel cells that use biogas for fuel

Toyota Motor Corporation has been grabbing attention with its December 2014 release of a production model fuel cell vehicle (FCV). With fuel cells, it is common to see phosphate fuel cells put to use as stationary power systems. What is more, Japan is a world-leader in the practical application of home fuel cell systems (Ene-Farms), which is a

technology for supplying both power and hot water. As shown in Table 1, fuel cells come in a variety of different types, including polymer electrolyte fuel cells (PEFCs), phosphoric acid fuel cells (PAFCs), and solid oxide fuel cells (SOFCs). These have begun to be put into practical use, as stated above.

Most fuel cells reformulate high purity hydrogen and city gas for use as fuel. In December 2014, Okayama University and the Livestock Research Lab of the Okayama Prefectural Technology Center for Agriculture, Forestry and Fisheries announced a system comprised of an SOFC that uses biogas derived from pig excrement for fuel. Since SOFCs have a high operating temperature, they have the advantage of offering high efficiency without the use of a platinum catalyst. But they have problems in the sense that it is time-consuming to start and stop operating them, and the materials used in the equipment are limited. This system utilizes catalysts that can curb the separation of carbon from the biogas. They also use an SOFC that is operable at intermediate temperatures, which reduces the operating temperature from 800°C for traditional ones to 600°C. This enables them to concurrently offer efficient power generation and thermal use, and thus hold promise for efficiently using biomass. (**Author's abstract**)

Keywords: *biogas, Japan, solid oxide fuel cells, fuel cell vehicles, polymer electrolyte fuel cells, phosphoric acid fuel cells, molten carbonate fuel cells, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/02,
(Filipiniana Analytics)

0330

International palm oil life cycle assessment conference held in Malaysia

At the International Palm Oil Life Cycle Assessment Conference held in Kuala Lumpur, Malaysia during 18-2 October 2009, Prof. Lee Keat Teong of the University of Malaysia made it clear that biodiesel oil developed from palm oil would be the most symbiotic to global environment.

His comparative study made on palm oil against jatropha oil and rapeseed oil concluded that biodiesel made from palm oil had the highest ratio of [obtained energy/invested energy], using the least land area for cultivation, and in addition, palm trees had relatively large reserve of CO_2.

On the other hand, J.H. Schmidt and his associates presented the result of their calculation on the average CO_2 emission due to palm cultivation in Malaysia, which yielded a value of 3.18 ton-CO_2e/ton of palm oil. They also reported that cultivation of palm trees on peat-land triggers a large volume of CO_2 emission from the peat. And they also mentioned that stopping the palm cultivation on peat land would inhibit CO_2 emission from the soil. (**Authors' abstract**)

Keywords: *palm oil, carbon dioxide emission, Malaysia, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/02,
(Filipiniana Analytics)

0331

Introducing wooden biomass fuel facility of the largest scale for co-firing generation of coal and wooden biomass

The generated energy of fiscal 2007 in Japan is 1,023.9 billion kWh, and by source, 25.3% is for coal, 27.4% for natural gas, 13.1% for petroleum, 25.6% for nuclear power, 6.6% for ordinary hydraulic power, 1.0% for pumped hydraulic generation, and 0.7% for new energy. Japan, poor in energy resources, stopped to depend on one energy source after the oil shock and has generated electric power through a balanced combination of coal, natural gas, petroleum, and nuclear power.

Among fossil fuels, coal is rich in reserves. Its minable duration is 171 years while it is 40 years for petroleum and 65 years for natural gas. Coal is an important resource widely distributed in the world and considered to ensure a stable supply for the longest period.

However, the coal fired power generation has a drawback because its CO_2 emission factor (CO_2 emission per 1kWh generated) is 975 g-CO_2/kWh, which is larger than 742 g-CO_2/kWh for oil fired generation and 608 g-CO_2/kWh for LNG fired generation. To cope with this, power companies in Japan are promoting “utilization of biomass for coal fired generation” as one of CO_2 emission reduction technologies.

In Okinawa Prefecture, the power generation of co-combustion of coal and wooden biomass is getting into full swing. On May 25, 2009, JP Steel Plantech Company announced that it had concluded a contract to deliver its wooden biomass fuel facility, largest in scale in Japan, to Biomass Recycling Center in Uruma-shi, Okinawa Prefecture. The construction is scheduled to be completed at the end of September, 2009.

In Okinawa Prefecture, more than 40,000 tons of waste wood including construction and demolition waste and furniture are produced and most of them are incinerated and not utilized. The wooden biomass fuel facility introduced this time will enable to process 20,000 tons of waste wood per year and produce cylindrical pellets of about 3 cm in length. About 50% of the waste wood produced in Okinawa Prefecture is recycled, resulting in resources worth 6,500 yen/ton. These pellets will be combusted by 3% of mixing ratio with coal at Gushikawa Coal Fired Power Plant of The Okinawa Electric Power Co., Inc. from fiscal 2010. By utilizing these wooden pellets, Okinawa Electric Power Company can achieve CO_2 emission reduction of about 40,000 tons per year because due to the reduced coal consumption. (**Author's abstract**)

Keywords: *Japan, wooden biomass, coal, carbon dioxide, power plant, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,
(Filipiniana Analytics)

0332

Introduction of a feed in tariff (FIT) for renewable energies by Japan

On August 26, 2011 the Bill on Special Measures Concerning Procurement of Renewable Energy Sourced Electricity by Electric Utilities was adopted and established at a plenary session of the Japanese House of Councillors. The bill mandates that electric utilities purchase the electricity generated from renewable energies such as solar power, wind power, and biomass during the fixed-period contract with fixed price. It is slated to be entered into force on July 1, 2012.

Japan’s rate of energy self-sufficiency is at the low level of 4%, and so it is hastening to expand the diffusion of renewable energies in order to boost its rate of self-sufficiency. To date, the government has implemented a variety of different measures designed to expand its diffusion. These are the: “Renewables Portfolio Standards (RPS Program)”:

Where electric utilities use minimum amounts of electricity generated from renewable energy sources; “Excess Electricity Purchasing Scheme for Photovoltaic Electricity”: Where electric utilities purchase the surplus portion from solar power generation.

The current Feed in Tariff (FIT) program is one where electric utilities purchase the electricity generated from renewable energies at a fixed price. There are high hopes that this will enable the maximum amount of such energies to be purchased, and serve as a trump card for the diffusion of renewable energies.

A FIT program for renewable energies was initiated in the United States in 1978, and at present such programs have been adopted in more than 70 countries, states, and regions worldwide. When Germany enacted its EEG Law (Erneuerbare-Energien-Gesetz, German Renewable Energy Act) in 2000, it achieved enormous growth in that biomass generation increased 8.5-fold from 579 MW (2000) to 4,910 MW (2010), while wind power generation increased 4.5-fold from 6,097 MW (2000) to 27,204 MW (2010).

Provisional calculations for the current costs of power generation from renewable energies (yen/kWh) show that at 37-46 for solar, 12-41 for biomass, and 12-24 for geothermal, these are relatively high compared to thermal power generation at 7.5. The setting of appropriate purchase prices suited to the power sources has become important for the sake of making these respective renewable energies commercially viable. In the future these will be calculated by third party agencies and then determined by the government. (**Authors' abstract**)

Keywords: *renewable energy, tariff, feed, photovoltaic electricity, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/10,
(Filipiniana Analytics)

0333

The Introduction of wind power is making progress in Pakistan

Pakistan has established the goal of switching 5% of its energy supplies over to alternative and renewable energies by the year 2030, and is making progress in introducing wind power as part of this. According to the results of a study by the National Renewable Energy Laboratory (NREL) in the United States, Pakistan has the potential to introduce 132,000 MW of wind power (Fig. 1).

The installation of wind power in modern-day Pakistan is concentrated in the Sind Province to the south, where the wind is strong. This has shown rapid development, as approximately 250 MW had been installed by March 2015, compared with the 6 MW from 2009, with this shown in Table 1. Foreign direct investment is being accepted for wind power projects, with the China Three Gorges Corporation, which is a hydropower development company from China, and Zorlu Energy, a Turkish manufacturer of power plants, serving as the operators.

There are currently nine wind power projects that are underway in Pakistan backed by its tremendous desire to install wind power, with the country slated to achieve a cumulative installed capacity of 730 MW by 2016. The various preferential treatment measures by the government have proven effective at accelerating the introduction of wind power in the country. Such measures include the adoption of lucrative power purchase prices linked with price increases and foreign exchange, tax exemptions for imported equipment, income tax exemptions, and consumption tax deferments. (**Author's abstract**)

Keywords: *Pakistan, renewable energy, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/09,

(Filipiniana Analytics)

0334

Introduction status for biofuel in Thailand

As indicated in Fig. 1, oil accounts for a large percentage of the primary energy consumption in Thailand, with roughly 9% of its GDP spent on importing oil from overseas. In order to reduce imports of oil, the Thai government has been implementing the Renewable and Alternative Energy Development Plan (AEDP 2012-2021) since 2012. When it comes to annual bioethanol use and consumption (production), through this it has been promoting its introduction with the goals of using 3.285 billion liters of bioethanol and 2.628 billion liters of biodiesel by 2021. What is more, biodiesel fuel derived from algae and jatropha has been positioned as an advanced biofuel, and the goal has been set to use 1.095 billion liters of this each year.

Bioethanol is intermixed in with gasoline and sold in E10 (the number indicates the percentage of ethanol mixed in), E20, and E85 versions. Its price has been set as being comparatively less expensive than gasoline that does not contain ethanol in order to popularize and promote it, as shown in Table 1. Furthermore, it was mandated that B7 diesel fuel (the number indicates the percentage of biodiesel mixed in) be sold starting from January 2014. As indicated in Figs. 2 and 3, the amounts of bioethanol and biodiesel fuels used have increased since 2012, when the targets were set, compared to before this.

In Thailand, bioethanol is produced from sugarcane molasses and cassava, while biodiesel fuel is produced from the oil palm. However, in Thailand areas that are suited to the cultivation of oil palms are limited to the southern and eastern parts of the country, and so research and development is being promoted to produce biodiesel fuel from algae and jatropha. (**Author's abstract**)

Keywords: *Thailand, renewable energy, biofuel, bioethanol, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/05,
(Filipiniana Analytics)

0335

Introduction status for renewable energies on Sulawesi, Indonesia

Indonesia has the world’s fourth largest population in the world at approximately 230 million people, and it is an island nation that consists of about 1,300 islands that are located to the south of the Indochina Peninsula. The island of Sulawesi that is introduced here accounts for the third largest area in Indonesia (at approximately 10%) after the islands of Kalimantan and Sumatra, while it is third in terms of population after Java and Sumatra. But due to the complicated shape of the island it has limitations in terms of setting in place a power grid, so its electrification rate is lower in a relative sense than those in Java or Sumatra, as shown in Fig. 1.

Indonesia’s state-run electricity company of PLN has been promoting plans to set in place power plants and power lines on Sulawesi as indicated in Fig. 2. This electricity will tend to be used for industrial purposes, and will not cover the electrification of rural villages. As such, the government has been promoting the Energy Self-Sufficiency Village Program (ESSV) since 2007, which promotes the electrification of rural villages through the introduction of renewable energy.

The provincial government of South Sulawesi announced in January 2014 that it will use ESSV’s budget as a resource

to introduce 50kW small hydroelectric power plants in Pinrang and Luwu for 4.5 billion Indonesian rupiah (about 40 million yen), thereby newly supplying electricity to 200 households.

In addition, the International Finance Corporation (IFC) that is affiliated with the World Bank Group decided in May 2014 that it will invest in a wind farm to be built in Janeponto in the province of South Sulawesi. This is the first case of the IFC investing in wind power in the East Asian region. Moreover, the major renewable energy that Indonesia possesses is geothermal power, with only the one location of Lahendong being developed out of the 65 proposed sites on Sulawesi. It is hoped that the introduction of geothermal power will proceed on Sulawesi by harnessing the opportunity provided by the aforementioned investment into Sulawesi made by the IFC. (**Author's abstract**)

Keywords: *Indonesia, renewable energy, rural electrification, geothermal power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/06,
(Filipiniana Analytics)

0336

Introduction status for solar power in Malaysia

Malaysia enacted its Renewable Energy Act in April 2011, which introduced a feed-in tariff scheme (FIT scheme) for renewable energies and set the goal of adopting 985 MW of renewable energy by 2015. The amount introduced as of 2014 came to 286.0 MW (Fig. 1). As part of this, solar power, for which the FIT purchase price had been set at a high level, showed a particularly high rate of growth. Compared in terms of the purchase price for roughly 1 MW of installed capacity for renewable energy, the FIT for solar power is 0.5472 Malaysian ringgit/kWh, whereas other renewable energies were set at low prices of around 0.2400-0.4500 Malaysian ringgit/kWh (Tables 1 and 2).

Considering the favorable conditions for solar power, the construction of mega-solar plants is being advanced. The Eastasia Group from Japan and Vsolar from Malaysia plan to begin joint construction of a large-scale solar power plant with a net output of 100 MW starting in summer 2015. For this project, Vsolar will serve as the business proprietor, with Eastasia Group handling the engineering, procurement, and construction (EPC). For the construction work, they have said that they plan to use a robot that installs solar panels that was developed by Alion Energy from the United States. One of these robots along with five workers has the capacity to install 500 kW per day, which makes it possible to dramatically reduce the construction time. (**Author's abstract**)

Keywords: *Malaysia, solar power, renewable energy, feed-in tariff system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/07,
(Filipiniana Analytics)

0337

Introduction status for solar power in Pakistan

Pakistan is situated in the Sun Belt Region, which has some of the best sunlight hours and sunlight intensity of anywhere in the world. It has anywhere from 185 to 290 days with clear skies each year, with its solar radiation on a flat surface between 5.5 and 6.5 kWh/m^2/day, as shown in Fig. 1.

In May 2015 a 100 MW mega-solar plant in the outskirts of Bahawalpur in Punjab Province has begun supplying electricity to the grid by capitalizing on such advantageous conditions. This is part of the 1 GW Quaid-e Azam Solar Park, in which the government of Punjab Province serves as the operator. What is more, in February Phono Solar Technology Co., Ltd. from China and the local Green Volt Technologies Private Limited established a 1.25 MW mega-solar plant in Punjab Province. This was followed in April by the decision to install 1MW of solar panels from China's Yingli Solar on the roof of Pakistan's Parliament House Building in the capital of Islamabad, with China bearing the full cost for this.

In 2014 Pakistan initiated a feed-in tariff scheme (see Table 1) for solar power, which caused the adoption of equipment to flourish. It is scheduled to install 709.6 MW of solar power through 31 projects by 2018. (**Author's abstract**)

Keywords: *Pakistan, solar power, renewable energy, feed-in tariff system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/07,
(Filipiniana Analytics)

0338

Introduction Status for Wind Power in Japan in 2015

In January 2016, the Japan Wind Power Association reported the results for implementation of wind power in 2015. According to this report, as shown in Fig. 1, the cumulative amount installed by the end of December 2015 came to 3,038 MW from 2,077 generators at 434 power plants, while the amount installed in 2015 alone came to 244 MW from 109 generators at 22 power plants. After implementation of the feed-in tariff scheme (FIT) in July 2012, the fall in installations gradually recovered, and in 2015 it returned to the pre-2011 level.

Also, in July 2015 the Japanese government decided on the plan for Japan's energy mix (power supply composition) in 2030, in which the installed capacity planned for wind power facilities is 10,000 MW (for land and offshore facilities combined). In response to this, there has been rapid progress in new development project proposals by wind-power-generating companies, and by the end of 2015 the number of installation proposals undergoing the necessary environmental assessment procedures prior to construction amounted to approximately 7,640 MW, predominantly in Hokkaido and the Tohoku (North-Eastern) region. If these are all completed smoothly, then it is predicted that the energy level of 10,000 MW from wind power installation, which was indicated in the intended energy mix planned for 2030, should be reached ahead of schedule, sometime in the 2020s.

Wind power facilities that commenced operation in 2015 (Table 1) include Hitachi Ltd's first 5 MW downwind power generation system installed in the Kashimako Fukashiba Wind Power Plant. This is a huge wind power system with a hub height of 90 m and a rotor diameter of 126 m to support the large-scale systems that will be required in future offshore wind power generation. (**Author's abstract**)

Keywords: *Japan, wind power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/03,
(Filipiniana Analytics)

0339

Introduction status for wind power in Vietnam

Vietnam is currently implementing its Vietnam Power Development Plan 2011-2020-2030. As part of this, it has set its targets for the adoption of renewable energies at 3,192 MW by 2020 and at 9,892 MW by 2030. Vietnam has an abundance of wind power potential in particular, and its target values for this were set at 1,000 MW by 2020 and 6,200 MW by 2030. This is a comparatively high level of relative importance compared with other renewable energies.

Currently, 77 wind power projects and commercialization plans are underway, with the total amount from the 18 provinces with plans coming to 7,234 MW. Conversely, wind power projects at Binh-thuan, Phu-Quy, and Bac-Liew are currently in operation, as indicated in Table 1 and Fig. 1. The largest of these is the Bac-Liew coastal wind power project. In May 2015 the US Trade and Development Agency (USTDA) announced that it would contribute subsidies for a feasibility study for 300 MW in its third stage. A number of issues will be considered as part of this survey, including the wind conditions, power output, permission and land management, grid connections, infrastructure design, installation and construction costs, and the financing plan. (**Author's abstract**)

Keywords: *Vietnam, wind power, renewable energy, commercialization plan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/07,
(Filipiniana Analytics)

0340

Introduction status of wind power in Australia

Australia generates 15.3% of its total energy from renewable energies (FY 2014; Fig. 1). Hydropower accounts for the majority of this at 7.5% (19 TWh), followed next by wind power at 6.3% (16 TWh). In the Australian Energy Projections to FY 2050, which were released by the federal government in November 2014, it indicated that 20% of the commonwealth's total energy would consist of electricity from renewable energies by FY 2034. In terms of the amount of power generated by each source by FY 2034 shown in Fig. 2, power from renewable energies will account for 20%. Whereas wind power will increase to 10.2% (32 TWh) compared to FY 2014 in Fig. 1, hydropower will remain at 19TWh, thereby declining to a proportion of 6%. The plan is to introduce 4 TWh of geothermal power for a 1.3% share. Australia will promote the adoption of power from renewable energies with its primary focus being on wind power.

Favorable progress has been made in the adoption of wind power since 2007 (Fig. 3). South Australia down south and Victoria and West Australia in particular have an abundance of wind energy sources, and lead the rest of Australia in the adoption of wind power (Figs. 4 and 5). (**Author's abstract**)

Keywords: *Australia, wind power, renewable energy, hydropower, solar power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/05,
(Filipiniana Analytics)

0341

Involvement of Japanese firms in biomass projects of Southeastern Asia

Southeast Asian countries are endowed with rich biomass resources that are being supplied cheep and steady. A number of Japanese firms are keenly interested in developing the use of the biomass, by way of investment and direct commitment in the experiments as well as creation of biomass business between Japan and these countries. This article introduces three representative cases: 1. In Malaysia: In December 2010, Mitsui Engineering & Shipbuilding Co., LTD (MES) announced that it would soon start operation of a first-in-the-world experimental plant for producing bioethanol by using EFB (empty fruit bunch) of oil palm in Malaysia. The test plant would be installed at a site adjoining to Tenaman palm oil factory owned by Sime Darby, one of big owners of palm plantation in Malaysia. The test plant would start production of bioethanol from February 2011 at a rate of 1.25 ton a day by using EFB. At the same time data collection would be made to verify the performance of the production plant. 2. In Vietnam: A trading firm ITOCHU Corporation intends to make investment into Orient Biofuel Co., jointly with Petro-Vietnam Co. of Vietnam, in order to take part in a business project for bioethanol production in Binfock Province in southern Vietnam. The project aims at annual output of 100,000 kL of bioethanol by using cassava as raw material. The production will get started in spring of 2012. 3. In Cambodia: The Chugoku Electric Power Co., INC, the National Institute of Advanced Industrial Science and Technology (AIST) and Hiroshima Environment Laboratory Co.,LTD in association with the Cambodian Institute of Technology and the Cambodian Ministry of Mining and Energy Industries started a test program for power generation by co-combustion of jatropha oil and biogas, from October 2010 using a test facility installed at the Cambodian Institute of Technology. The biogas can be obtained by gasifying mixture of agricultural waste made from squeezed lees of jatropha seeds and rice chaffs etc. The co-combustion experiment has been conducted by using a dual-fuel-type diesel engine that operates on simultaneous use of gas-type and liquid-type fuels. (**Authors' abstract**)

Keywords: *southeast asia, empty fruit bunch, bioethanol, cassava, jatropha oil, biogas, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/02,
(Filipiniana Analytics)

0342

JA group start regular production of domestic biofuel

JA (National Federation of Agricultural Cooperative Associations) group will launch regular production of bioethanol in March 2009. The project is one of the projects planned by the Ministry of Agriculture, Forestry and Fisheries (MAFF), called “Proof Model Experiments for Utilization of Local Biomass Fuels” undertaken by Niigata prefecture since 2007. The raw material is a breed of prolific rice crop improved for bioethanol production.

The bioethanol production plant was completed at the end of 2008. Trial operations were conducted last January and first successful production of ethanol was proved on February 2009. Annual production of ethanol from this plant is estimated to be 1,000 ton. The ethanol will be blended with gasoline at a bulk ratio of 3 to 97 to make E3 fuel. They intend to sell 33,000 kl of E3 at JA gas stations in Niigata prefecture at the same price as normal gasoline’s.

This JA project is the first fruit of the “Forestry and Fishery Biofuels Act” enacted in October 2008 and designated for the promotion of domestic production of biofuels. The Act allows for some tax exemption for the production facilities and provides favorable financing. (**Author's abstract**)

Keywords: *Japan, bioethanol, biomass fuel, ethanol, Forestry and Fishery Biofuels Act, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0343

Japan and India Agree upon the Japan-India Energy Partnership Initiative

In India, demand for power is surging as a result of economic growth. India’s composition of power sources consists of 59% coal, 9% natural gas, and other conventional power sources, as shown in Fig. 1. The Indian Government’s plan is to substantially increase its current share from renewable energies of 13% by introducing solar power and other renewables.

As of January 14, 2016, the cumulative installed capacity for solar power in India came to 5,130MW. A breakdown by state reveals that they are ranked in the order of Rajasthan (1,264 MW), Gujarat (1,024 MW), Madhya Pradesh (679 MW), Tamil Nadu (419 MW), Maharashtra (379 MW), and Andhra Pradesh (357 MW). The Indian Government has set the ambitious target of increasing its installed capacity of solar power by 20-fold to 100 GW (100,000 MW) by 2021-2022, and so it hopes to increase the installation of solar power in other states as well.

Against the backdrop of this aggressive adoption target by India, the Eighth Japan-India Energy Dialogue was held on January 12, 2016. There they signed the Japan-India Energy Partnership Initiative, which is a joint declaration related to enhancing cooperation between the two countries in the energy sector. As part of this initiative, it was agreed that Japan would provide support on the technical front for initiatives India is addressing such as increasing the electrification rate by coal-fired power generation, expanding the adoption of renewable energies, and promoting energy conservation. It was also agreed that the countries would initiate joint research in order for India to formulate a power source composition with the optimal ratio between nuclear power, renewable energies, and so forth. (**Author's abstract**)

Keywords: *Japan, India, renewable energy, partnership initiative, coal-fired power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/02,
(Filipiniana Analytics)

0344

Japan has set the world record for the conversion efficiency of compound thin film solar cells

Currently crystalline silicon solar cells predominate when it comes to solar cells. But compound thin film solar cells that do not use expensive, highly pure crystalline silicon and which have exceptional cost performance are being developed and put to practical use. With compound thin film solar cells a thin film (of several μm) of a compound is formed on a glass substrate, with these having two varieties depending on the composition of the compound: CIS thin film solar cells (which consist of copper, indium, selenium, gallium, and sulfur, and contain rare metals) and CZTS thin film solar cells (which are composed of copper, zinc, tin, sulfur, and selenium, and do not contain any rare metals outside of selenium).

In February 2012 Solar Frontier K.K. from Japan and NEDO achieved a conversion efficiency of 17.8% for CIS thin film solar cells through joint research, which was a world record. CIS thin film solar cells are already in the practical application stage, and it is expected that products with even greater performance will come along. What is more, in August 2012 a research group from Solar Frontier K.K. and IBM Corporation from the United States achieved a conversion efficiency of 11.1% with CZTS thin film solar cells, thereby setting the world record. CZTS solar cells are worthy of entering the development stage through this research.

On the other hand, First Solar, Inc. (the second largest producer worldwide in FY2011) from the United States has been selling CdTe solar cells, which is a type of compound thin film solar cell, worldwide. Yet because these contain cadmium as one of their components they have not gained traction in Japan. (**Authors' abstract**)

Keywords: *Japan, thin film solar cells, crystalline silicon, CIS, CZTS, CdTe, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/10,
(Filipiniana Analytics)

0345

Japan has the potential to install 8.98 million kW-worth of small hydropower

In July 2012, the Ministry of the Environment released the results of its investigation into the potential for small and medium hydropower in the form of the Study of Basic Zoning Information Concerning Renewable Energies. Small hydropower refers to hydropower generation with an installed capacity of 10,000 kW or less. Japan's cumulative installed capacity for FY2010 was 3.24 million kW, according to a report by the Institute for Sustainable Energy Policies (ISEP).

The investigation by the Ministry of the Environment revealed that there is the potential to install 8.98 million kW-worth of installed capacity for small and medium hydropower in river channels, and that there are approximately 19,700 sites for this. This potential for the small and medium hydropower was calculated as follows: the energy resources that can be introduced on account of the amount that can be logically calculated given factors like river flow rates, excluding the energy in regions where it would be difficult to install plants due to constraints arising from regulations and technical capacity, and also excluding energy from existing power plants.

One recent example of the introduction of hydropower is the Tateyama Alps Small Hydropower Generation Project (installed capacity of 1,000 kW) along the Kohayatsuki River in Toyama Prefecture, which went into operation in April 2012. This project was chosen as a Collaborative Power Generation Project with Citizens by the Ministry of the Environment, and marks the first time that small hydropower generation project has been performed in Japan through a civil fund. (**Authors' abstract**)

Keywords: *Japan, small hydropower, hydropower generation, energy resource, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/07,

(Filipiniana Analytics)

0346

Japan is advancing techniques for artificial photosynthesis

Plant photosynthesis consists of two processes. One process breaks down water into electrons and hydrogen ions and gives off oxygen through a “light reaction” that requires light. The other process is a “dark reaction” that uses the electrons and hydrogen ions produced during the light reaction to convert atmospheric carbon dioxide into organic matter. Artificial photosynthesis is a technique in which two electrodes are used to carry out this light reaction and dark reaction continuously.

In December 2013 Panasonic succeeded in achieving a conversion rate of 0.2% with methane production from artificial photosynthesis, then in September 2014 it succeeded in boosting this conversion rate to 0.3%. This was the first time in the world that anyone had surpassed the 0.2% rate (Note 1) seen with ordinary plants. This technique uses gallium nitride semiconductors treated with indium on the light reaction side and a copper catalyst on the dark reaction side, which makes it possible to create methanol and ethanol from carbon dioxide (see Fig. 1).

In November 2014 Toshiba announced at the International Conference on Artificial Photosynthesis 2014 (ICARP2014) that it had achieved a conversion rate of 1.5%, which is a world record. With this technique, carbon monoxide can be obtained by using multi-junction semiconductors that apply solar cell technology on the light reaction side, and gold nanocatalysts on the dark reaction side (see Fig. 2). Toshiba is aiming to refine this technology and put it to practical use manufacturing fuel from the carbon dioxide generated from thermal power plants and the like, with 2020 set as the goal for this. (**Author's abstract**)

Keywords: *Japan, artificial photosynthesis, light reaction, dark reaction, methane production, multi-junction semiconductors, gold nanocatalysts, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/02,
(Filipiniana Analytics)

0347

Japan is promoting a space solar power system

Space solar power systems (SSPS) began with a proposal by Dr. Peter Glaser (United States) in 1968, and have been studied in Japan in an ongoing manner since the 1980s. The technology converts electricity obtained from solar power generated in outer space into radio waves which are then beamed down to antennas on the ground, where it is once again used as electricity. The advantages of generating solar power in space are that power can be generated 24-hours a day without being affected by whether it is daytime or nighttime, or by the weather. There is also no impact from atmospheric scattering, making it possible to generate power from high intensity sunlight.

The world’s first experiment in terrestrial power transmission was begun by Kyoto University in December 2014 through a phased array (phase controlled antenna) system in order to improve the efficiency of wireless power transmission. Japan Space Systems, Mitsubishi Electric Corporation, and IHI Aerospace Co., Ltd. also took part in the experiment.

SSPS is a grand concept and, as indicated in the sample specifications in Table 1, the systems involved are enormous in scope. Terrestrial demonstration experiments are currently underway on the deployment equipment needed to construct a massive structure in outer space at the Japan Aerospace Exploration Agency (JAXA). Furthermore, with the wireless power transmission even minor misalignments with the angle when sending power from space turn into major misalignments with the receiver's position on the ground, and so high precision controls are required for this.

There are still a number of challenges left before the technology is perfected, and it is claimed that it will be the 2040s or beyond before it is actually realized. The Japanese Government clearly mentions SSPS in its Basic Plan on Space Policy (November 2014) and its Energy Technology Development Roadmap (November 2014), and has indicated its stance of promoting its development. (**Author's abstract**)

Keywords: *Japan, space solar power system, solar power, radio waves, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/01,
(Filipiniana Analytics)

0348

Japan ranked second in the world for solar power newly installed in 2013

Japan adopted a feed-in tariff scheme for renewable energies in FY 2012, and has been making progress in newly introducing solar power. As shown in Fig. 1, Japan's newly installed solar power in 2013, the second year since the scheme was introduced, reached 6.9 GW, ranking it second in the world with an 18.7% share of the total amount introduced globally of 36.9 GW. This represents a roughly four-fold increase over the course of one year from the 1.7 GW (fourth in the world) that was newly installed in Japan in FY 2012. Moreover, as indicated in Fig. 2, Japan's cumulative installed capacity up through 2013 reached 13.6 GW, constituting fourth place globally.

The following factors could be mentioned when it comes to Japan's rise in the ranks: 1. The 2013 revisions to the feed-in tariff scheme in Europe, which had gotten a head start in terms of introducing solar power, have caused a slowdown in the installation of solar power; 2. Excess production capacity for solar panels in China has led to a drop in their price, and there has been an influx and increased installation of inexpensive Chinese-made panels in Japan; and 3. As shown in Fig. 3, residential solar power constituted the primary use for solar power up until FY2011, but from FY 2012 onwards power generation and non-residential (industrial and public facility usage) have increased. (**Author's abstract**)

Keywords: *Japan, solar power, renewable energy, installation capacity, feed-in tariff scheme, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/08,
(Filipiniana Analytics)

0349

Japanese CO_2 emission in FY 2008 was fixed

On April 16, 2010, Japanese Government (Ministry of the Environment) announced the fixed value of CO_2 Emission in 2008. In 2008, Japanese CO_2 emission was 1.214 billion ton; this value was emission increase of 6.1% compared with the 1990 in the standard year of Kyoto Protocol. Under "New Strategy Plan for Growth" done by cabinet decision at the end of 2009, Japan has a goal of reducing emissions to 25% below 1900 levels by 2020. Table shows CO_2 emission in FY 1990, FY2010, and goal by 2020.

The CO_2 emission from transportation sector such as vehicles/ships was 235 million ton; 19% of the total. Compared with the 1990 result, CO_2 emission increased 18 million ton 8.3%), and exceeded total 6.1%.

The CO_2 emission from transportation sector is caused by gasoline and light oil from petroleum. CO_2 emission reduction is enabled by use biofuel in substitution for fossil fuel. Biofuel emits no CO_2 by combustion because of Carbon neutral, but CO_2 is emitted by cultivation and production of biomass.

Furthermore, biomass is used for energy generation such as electricity as well as biofuel, hence more efficient biomass utilization is expected. From this, Ministry of Economy, Trade and Industry announced in March, 2010, that "Biofuel has availability as an anti-warming measure, when CO_2 emission by biofuel combustion is less than 50% of CO_2 emission by gasoline (81.7g-CO_2/MJ) combustion".

Biofuel can be used as fuel by itself as well as mix with gasoline and light oil; in addition it is relatively easy to use biofuel for existing internal-combustion engine; and existing circulation infrastructure can utilize for biofuel transportation. Biomass has recognized as measures to prevent global warming. (**Authors' abstract**)

Keywords: *carbon dioxide emission, Japan, biofuel, energy generation, global warming, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/05,
(Filipiniana Analytics)

0350

Japanese Companies Received Orders for the First Waste Incineration Power Plants in Malaysia and Myanmar

In Malaysia and Myanmar, general waste is buried as landfill at final disposal sites. This furthers environmental pollution and poses problems in terms of properly disposing of the waste that is on the rise as a result of economic development. Conversely, power shortages as a result of their rising populations and the expansion of urban areas pose a serious problem. The adoption of power generation from waste incineration is being considered as a way to resolve both of these problems.

Given such circumstances, on November 12, 2015 Hitachi Zosen Corporation received an order for the first waste incineration power plant in Malaysia, and on November 26, 2015 JFE Engineering Corporation received an order for the first such plant in Myanmar.

For the project for which Hitachi Zosen Corporation received the order, the company will form a consortium with KNM Process Systems Sdn Bhd, a local partner, and will undertake the work of building and operating a waste incineration power generation plant from Cypark Resources Berhad1 in the Tanah Merah District, Port Dickson City, Negeri Sembilan State, which is located to the south of Kuala Lumpur. It will have a disposal capacity of 600 tons of waste per day, and will have an installed capacity for power generation of 18,000 kW.

In addition, the waste incineration power generation facility in Shwepyitha Township in the northern part of Yangon City for which JFE Engineering Corporation received the order will have a disposal capacity of 60 tons of waste from Yangon City per day, and an installed capacity for power generation of 700 kW. This project is the first time that the

Joint Crediting Mechanism (JCM) will be applied to a waste incineration power generation project, and at the same time it is the first project for which the JCM has been used in Myanmar.

Based on the extensive track record of generating power from waste incineration within Japan, these Japanese companies can be counted on to contribute to resolving the environmental problems and power problems in Southeast Asian countries. (**Author's abstract**)

Keywords: *Malaysia, Myanmar, waste incineration, power plant, renewable energy, power generating capacity, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/02,
(Filipiniana Analytics)

0351

Japanese cooperation in disseminating small hydropower in the Philippines

Despite the Philippines' dearth of fossil fuel resources, it is dependent on fossil fuels for roughly 65% of its power output (2010), thus necessitating the greater adoption of renewable energies owing to energy security, environmental issues, and for economic reasons. According to the National Renewable Energy Program (2011-2030) announced in 2011, the Philippines plans to raise its power output from renewable energies from its 2010 level of 5,438 MW to 15,304 MW by 2030. As indicated in Fig. 1, the Philippines have been characterized by the country's high proportions of hydropower and geothermal power, as of the year 2010.

With respect to hydropower, interest has been gathering on small hydropower instead of large-scale hydropower for the following reasons. 1. Large-scale hydropower produces difficulties from the perspectives of financing and for environmental and social considerations; 2. Irrigated rice cultivation has spread to all around the country, so there are lots of sites that are suited for small hydropower; 3. The dissemination of small hydropower to rural districts will lead to improving the electrification rate.

Given this rising interest, the Japan International Cooperation Agency (JICA) has conducted a project feasibility study for small hydropower. It is now carrying out a grant aid project to build small hydropower facilities in which Hokuriku Seiki Co., Ltd. will perform the construction in the Province of Isabela and IWATA CHIZAKI Inc. will build one in the Province of Ifugao, with design and construction management to be provided by Tokyo Electric Power Services Co., Ltd. Based upon this, the hope is that the dissemination of small hydropower will make forward progress in these regions. (**Author's abstract**)

Keywords: *Philippines, small hydropower, renewable energy, Japanese cooperation, improved electrification rate, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/09,
(Filipiniana Analytics)

0352

Japanese projects for bioethanol production from rice straw

A number of Japanese municipalities are running projects for bioethanol production from rice straw. The projects are supported by "The Program for Development and Establishment of Soft Cellulose Utilization Technology" designed by the Ministry of Agriculture, Forestry and Fisheries. At three selected model districts (municipalities of Hokkaido, Akita and Hyogo prefectures), proof experimental production plants were installed by fall of 2009, and soon after proof production experiments have been carried out. Subsequently, Chiba prefecture was selected as the fourth model district in FY2009, and has already installed a test plant that is now waiting for proof production.

The abovementioned test plants uses rice straw, a kind of soft cellulose, as raw material. In Japan, waste rice straw is generated as much as 9.2 million ton every year, and an estimate showed that it would be possible to produce 1.8 million Kl of bioethanol from the straw. The method of bioethanol production from rice straw is roughly divided into three processes, namely, pre-treatment, saccharification and fermentation. Each of the model municipalities, however, has independently developed its own production technique and test plant, and is running proof production experiments now, as summarized in Table.

Annual production capacities of bioethanol at the four model municipalities are as follows: Hokkaido 1,040 liter, Hyogo prefecture 800 liter, Akita prefecture 22,500 liter, and Chiba prefecture 6,700 liter (in total 31,040 liter). The quality of bioethanol produced by the test plants has cleared the specification stated in the quality assurance for hydrocarbon products issued by the Agency for Natural Resources. Now the bioethanol is mixed with gasoline and being sold in markets, under the name "Bio Gasoline" in Kanto area and in Kansai area (Kyoto, Osaka, Wakayama), and "Green Gasoline" in Niigata prefecture. (**Authors' abstract**)

Keywords: *Japan, bioethanol production, rice straw, fermentation, biogasoline, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/01,
(Filipiniana Analytics)

0353

Japan's feed-in tariff scheme for renewable energies in FY 2015

The feed-in tariff scheme for renewable energies was started in July 2012 as a scheme that mandates that electricity providers purchase electricity generated using renewable energies within a certain time period at a fixed price established by the government. This electricity is supplied to users via the power grid, with users bearing the costs that the electricity provider needs to purchase the electricity from renewable energies in the form of contributions that are indexed to their usage.

Of the different types of electricity from renewable energies, solar power can be installed over a short time period as it does not require an environmental assessment. Its purchase price was also set at a relatively higher level compared to others, and so significant progress has been made with its dissemination compared with that of other renewable energies as indicated in Fig. 1.

As shown in Figs. 2 and 3, the purchase price for solar power was decreased from 2013 onward as a reflection of the slump in system prices following their dissemination. When it comes to the purchase prices in FY 2015, since three years had passed since the start of the scheme as of this July, the premium of 1-2% that had been tacked on to the profits, which was appropriate at the outset, was cut. For systems of 10 kW or larger, price reductions were carried out over two stages, including the reduction in April. For residential systems that are smaller than 10 kW, in regions where there is spare capacity in the power lines, such as under the jurisdiction of the Tokyo, Chubu, and Kansai Electric Power Companies, this was set at 33 yen/kWh. For regions where there is no spare capacity in the power lines and where it is mandatory that remote adjusters for generated power be installed, this was set at 35 yen/kWh.

The purchase prices for power generated from renewable energies other than solar power were left as they were. Power generation from wood biomass with an installed capacity of less than 2,000 kW was newly segmented out as small-scale unused wood biomass. Creating new demand for forest and timber offcuts, which had previously gone unused, and promoting their effective use as resources is expected to have the effect of revitalizing local regions, such as by expanding employment in said regions. There are also harsh constraints on its profitability at small scales. For these reasons, the purchase price was set at 40 yen/kWh compared to the previous 32 yen/kWh for power generated from unused wood biomass. Fig. 4 shows the FY 2015 feed-in prices, including those for other renewable energies. (**Author's abstract**)

Keywords: *Japan, feed-in tariff system, renewable energy, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/05,
(Filipiniana Analytics)

0354

Japan’s Feed-in Tariff Scheme for Renewable Energies in FY 2016

At the meeting of the Calculation Committee for Procurement Price, etc., Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry held on January 19, 2016 to consider the fixed procurement prices for power from renewable energies, the introduced volumes and authorized volumes for five types of renewable energies were indicated as of the present (end of September 2015). For solar power, the authorized volume has already exceeded the installed capacity indicated in the energy mix (see Fig. 1). Moreover, cost data that is conducive to curbing purchase prices, such as the downward trend in panel costs and performance improvements in power generation, has also been indicated. As such, it is possible that for FY 2016 the fixed purchase price for solar power will be reduced from the FY 2015 prices for non-residential use (27 yen/kWh) and residential use (33-35 yen/kWh).

Conversely, wind power, small to medium hydro power, and geothermal power will require a long period of time compared with solar power until they receive FIT authorization once commercialization preparations have begun and the details for things like their power generating facilities have been ultimately finalized. For this reason, decisions on their fixed purchase prices have been deferred. When it comes to power sources which will require an extended period of time for such preparations, as things currently stand they have no choice but to move forward with preparations that require a long time and enormous costs, such as for things like environmental assessments and local procurement at the stage in which their purchase prices are as yet undetermined. The opinion has surfaced that initiatives will be needed to determine the fixed purchase prices for authorized projects several years down the road ahead of time. Fig. 2 shows the four methods for determining prices that are currently being considered.

The committee will consolidate a final plan by March 2016 with regard to transitioning to a variable price structure as well as the fixed purchase prices for FY 2016. Since this necessitated that the law be revised, a revised draft of the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities (FIT Act) that incorporates revisions to the facility authorization scheme for renewable energies, revisions to the methods for determining purchase prices (including the bid system), and a transition to obligating power distributors to purchase said energy will be deliberated by the National Diet. After this, if everything goes well, it is scheduled to be entered into effect in April 2017. (**Author's abstract**)

Keywords: *Japan, feed-in tariff system, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/02,

(Filipiniana Analytics)

0355

Japan’s feed-in tariff system to start on July 1, 2012

At last the feed-in tariff system for renewable energies got into effect in Japan starting on July 1, 2012. Feed-in tariff systems have been adopted in at least 65 countries and 27 regions throughout the world as a measure for popularizing renewable energies. This system mandates that electricity providers purchase electricity generated through renewable energies at a price stipulated by the national government for a fixed period of time. Under the system the public at large will bear the costs required for the electricity providers to purchase said electricity.

Renewable sources of power and their purchase prices are shown in the figure. In some cases, there will be discrepancies in the purchase price due to factors like the installed capacity even with the same power source. In the case of wind power the purchase price is 57.75 yen/kWh when it is less than 20 kW, but 23.1 yen/kWh when it is 20 kW or higher. In the case of biomass power, the purchase price is 40.95 yen/kWh by gasification, 13.65 yen/kWh by recycled wood and 33.6 yen/kWh by unused wood. Moreover, the purchase period has been set at 20 years for everything except for geothermal power, which is set for 15 years.

Solar power has a short lead-time from setting plan to operation, and recently the price of solar panels has continued to decline as imports from emerging countries have risen. Therefore, for the immediate future preference will conceivably go to installing solar power. (**Authors' abstract**)

Keywords: *Japan, tariff system, renewable energy, solar power, biomass power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/06,
(Filipiniana Analytics)

0356

Jatropha plantation plan of Myanmar government

The Myanmar Government intends to expand jatropha plantation up to 8 million acres (3.2 million ha) by the end of FY2010, and expects to produce jatropha oil as much as 12.8 million ton per year. At present, Myanmar is importing 40,000 barrels/day of crude oil (abt. 800,000 ton/year). It is, however, suffering from chronic shortage of crude-oil-based fuels. In this context, domestic efforts are being taken in order to develop and produce oil-alternatives like jatropha oil using domestic resources. As one of these efforts, a concrete plan has been proposed in which a 200,000 ha-scale plantation of jatropha to be developed in order to produce biodiesel fuels for use in military services.

There are serious disputes as to whether or not the country should convert existing farmlands and/or forests into jatropha plantation fields. Some claim that it is essential to reserve the forest areas as carbon dioxide sinks. Others say

such conversion of farmlands would inevitably induce a soaring of price of corn crops used for food and feed. Success or failure, the world is waiting for the outcome of Myanmar's jatropha plantation policy. (**Author's abstract**)

Keywords: *Myanmar, Jatropha, Jatropha plantation plan, biodiesel fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0357

Jatropha/biodiesel production project of Brunei and Malaysia

The territory of Brunei measures 576,5000 ha (as wide as Mie prefecture in Japan) with a small population of abt. 383,000. Brunei's major industry is exploitation of oil and natural gas that are exported overseas to make a good profit for Brunei's economy.

The forestry resources of Brunei is getting meager, because of deforestation. In ten years from 1990 to 2000, 2,500 ha of forest vanished every year. And from 2000 to 2005, 2,000 ha every year. Thus, 35,000 ha of forest (6% of the territory) vanished in fifteen years!

In this background story, a Brunei company called KOKAMI (Koperasi Kampung dan Mukim) has planned to start a new venture business jointly with a Malaysian company AWSB (Alam Widuri Sdn Bhd) so as to make a cultivation of 20 million Jatropha trees in Brunei as a trial. A business agreement was made in August 2008 between KOKAMI and AWSB. AWSB has been pushing forward their plantation plan to cultivate jatropha on 100,000ha of land in Sarawak state of Indonesia.

Reportedly, AWSB started another project of planting 150 million jatropha trees on 75,000 ha of land in Sarawak state by the end of FY2009, for which 20 million dollars was already invested. AWSB is constructing a refinery of jatropha oil (150,000 ton/year; building cost = 74 million dollars) at Bintulu port in Sarawak. The refinery is expected to produce 7,500 KL of biodiesel by the end of March 2010. In this consequent a new labor market will be created for 30,000 small farmers and 150 personnnels to operate the plants of the refinery. (**Author's abstract**)

Keywords: *Jatropha, biodiesel production, Jatropha oil, Malaysia, Brunei, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0358

Jet fuel from *Euglena*

Biomass fuels have begun garnering attention as a type of renewable energy on account of moves to cut emissions of CO_2. In the aviation industry the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) have set forth the objectives of: (1) improving fuel mileage by 1.5% each year up until 2020, (2) becoming carbon neutral by 2020, and (3) reducing CO_2 emissions by 50% compared to 2005 levels by 2050. As such, there are high expectations for bio jet fuels that use biomass as their raw materials.

When it comes to the fuel crops that serve as the raw materials for this, when plants that grow on land are used this presents the problem of competing with the cultivation of food crops and with cultivated land. Microalgae has characteristics like the fact that it does not compete with food and has a higher oil production output per unit of area compared with plants that grow on land (Table 1), but this presents a challenge for the future in that techniques for its mass cultivation have not been established. But there has been one report after another from nearby that new strains with a high oil content are being discovered and successfully cultivated, or that there have been successful trials in cultivating microalgae outdoors with a view towards its large-scale cultivation.

The West is also working on turning microalgae into bio jet fuel, and as indicated in Table 2 light crude oil that is suitable for jet fuel can be extracted from *Euglena*. In Japan the three companies of Euglena Co., Ltd. (founded in 2005 as a venture company for developing techniques for cultivating algae), JX Nippon Oil & Energy Corporation, and Hitachi Plant Technologies, Ltd. have jointly been developing low-cost production techniques based on mass cultivation techniques (Fig. 1) in the aim of commercializing jet fuel from this by 2018. Moreover, a research and development group from Kobelco Eco-Solutions Co., Ltd. and the University of Tsukuba have reported that in May 2013 they discovered a new strain that they anticipate will be more productive than anything that has come before it. While trials using bio jet fuels derived from plants that grow on land have been moving forward overseas, Japan has been getting a major head start when it comes to the practical application of bio jet fuels that use microalgae, which holds promise as a next generation raw material. (**Author's abstract**)

Keywords: *Euglena, renewable energy, jet fuel, carbon dioxide emission, microalgae, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/01,
(Filipiniana Analytics)

0359

The Kanagawa smart energy plan is focusing on thin film solar power

The Kanagawa Prefectural Ordinance on Promoting the Introduction of Renewable Energies was enacted in Kanagawa Prefecture in July 2013, based upon which the Kanagawa Smart Energy Plan was formulated. By way of numerical targets, it aims to cut electricity consumption by 15% and achieve a 45% share for distributed power sources of renewable energies and gas cogeneration by FY 2030, as is shown in Fig. 1. Solar power in particular is being focused on as one of these distributed power sources, and has been allocated a 17% share of the total. Due to its advanced state of urbanization, Kanagawa Prefecture is finding it difficult to secure large tracts of land for mega solar plants, and it has been lagging behind in the adoption of existing forms of solar panels on business sites such as its existing factories due to the load-bearing limits of their rooftops. As such, it has posited adopting thin, light thin film solar cells in addition to conventional solar panels as an effective way of resolving such challenges.

On July 21, 2014, the Thin Film Solar Cell Kickoff Forum was held at Osanbashi Hall at the Port of Yokohama in Yokohama City, Kanagawa Prefecture. Then on July 29, the screening results for projects to popularize and expand thin film solar cells in Kanagawa Prefecture were announced. As indicated in Table 1, six projects providing a total of 7,065 kW were chosen. These projects aim to promote the diversification of the uses for thin film solar cells and reductions in their prices. (**Author's abstract**)

Keywords: *Japan, renewable energy, thin film solar power, gas cogeneration, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/09,
(Filipiniana Analytics)

0360

Kyoto has begun a project to convert food waste and waste paper into ethanol

The net amount of general waste generated, which is a combination of the household waste given off by homes and the waste from business activities given off by offices, restaurants, shops, and so on, is on a downward trend in Japan. The net amount of general waste generated across Japan as a whole came to 52.73 million tons in FY2005, but was 46.25 million tons in FY2009. The amount of waste generated per day in FY2009 on a per capita basis was 994 g—less than 1 kg—with the amount of waste generated certifiably in decline. The Ministry of the Environment has stated that, "The decline in the net amount of waste generated has been backed by the impact from the recession, rising awareness of recycling, and the spread of an initiative to begin charging for trash bags."

The net amount of general waste generated is also declining in the city of Kyoto, which has a population of 1.46 million people. Five years ago the net amount of waste generated was 663,298 tons (October 2005-September 2006), but by FY2010 this had decreased by 26% to 488,829 tons. Kyoto's policy is to promote further reductions in the volume of waste, while at the same time actively working to recycle waste.

In August 2011 Kyoto announced that it would carry out a project to convert an amalgam of food waste and paper waste into ethanol, which would be the first such initiative in Japan, jointly with Hitachi Zosen Corporation and Kumamoto University. This is a project that is to be subsidized by the Ministry of the Environment and which will last for two years over FY2011 and FY2012.

The contents of the project entails machine sorting the general waste generated from within Kyoto, adding enzymes and yeast to the food waste and waste paper, simultaneously performing saccharification and fermentation, and ultimately producing ethanol that has a 99.5% concentration. Roughly 60 liters of ethanol can be produced from 1 ton of general waste, which is then used in place of gasoline or as fuel for power generators and the like. Household waste consists of 36.7% kitchen waste, which is food waste, and 30.2% paper, while waste from business activities consists of 41.1% kitchen waste and 33.1% paper, with this food waste and paper accounting for about 70% of the total. Up until now this had been incinerated, but now it is used as a biomass resource and energy recovery is performed.

Thus far Kyoto has been engaged in the utilization of biomass in a forward-thinking manner, as is evidenced by its project to switch over to biodiesel fuel and its demonstration project for biogas technology. This project is the first initiative of its kind in Japan, with its results being applicable in other municipalities as well. (**Authors' abstract**)

Keywords: *food waste, waste paper, ethanol, saccharification, fermentation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/10,
(Filipiniana Analytics)

0361

Laos – land of rich forest

Laos is an inland country located in the midst of Indochina, surrounded by five countries – China, Vietnam, Cambodia, Thailand and Myanmar. The land size of Laos is 237,000 km^2, nearly the same as the mainland of Japan. It has a population of 5.6 million, 80% of which live on agriculture. Forest is the most important domestic natural resource of Laos today. Annual export sum of lumber and wooden products in 2006 scored 72.5 million US dollars, sharing 7.8%

of total export sum of Laos. Forest area of Laos measured 173,000 km^2 in 1990, 165, 000 km^2 in 2000, and 161,000 km^2 in 2005, respectively. The forest area still covers some 70% of the country, but slowly lessening every year owing to cutting down.

Woody biomass is the major resource for primary energy of Laos. In 1994, 89% of total primary energy consumption of Laos came from woody biomass. Nearly 80% of the nation lives in countryside, and most family use firewood for cooking at their homes. Even in urban areas, firewood is burnt at 68% of households. Hence, woody biomass is the most important energy resource of Laos today.

Laos is not endowed with fossil fuels such as crude oil or natural gas in its territory. Laos depends on imported fuels for automobiles 100%. Import of crude oil has been increasing year after year, and amounted to 680,000 ka (kiloliter) in 2009. Being an inland country with no ports, Laos imports oil through ports of Thailand and Vietnam. In this circumstance, Laotian government is making efforts to promote production of biofuels, and it has set a goal to supply 15% of domestic fuel demand in the country by 2015.

Recently, production of biofuels in the interior of Laos has been attracting interest of overseas business as an object of investment. As a suitable resource for producing biodiesel, jatropha plantation is being made actively. A prominent investor is a Korean company KOLAO which plans to develop jatropha plantation as big as 240,000 ha. The biodiesel produced in Laos will be used for electric power generation. (**Author's abstract**)

Keywords: *Laos, forestry resources, woody biomass, Jatropha plantation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/08,
(Filipiniana Analytics)

0362

Largest biodiesel production factory in the world will start at Singapore

Singapore has literally no energy resource at all. Almost 100% of primary energy needed in Singapore is imported. Crude oil and natural gas are used as resource for Singapore's primary energy today. Annual supply of primary energy to Singapore in 2008 was 19.5 million ton COE (crude oil equivalent), in which crude oil's share was 64%.

Singapore ranks itself as world No. 3 oil refinery position next to Houston (US) and Rotterdam (Holland). Locating at the middle point of sea lanes that connect oil production area and consumption area, and taking advantage of adjusting demand and supply, Singapore's oil refinery industry grew rapidly in 1960s. Singapore is a strategic point for importing crude oil and refines it at domestic refineries, and sells various oil products such as fuels for ships and aircrafts to nearby countries. Recently Singapore's refineries are getting more and more purchase orders from Indonesia and Malaysia.

On 6 October 2010, Neste Oil Corporation of Finland expressed publicly that production of biodiesel from palm oil, as main raw material, would start soon. Neste Co. started construction of the biodiesel production plant in early 2008. The plant has a production capacity of 800,000 ton per year of biodiesel, and is ranked as largest in the world.

The production process has been developed by Neste Oil Co. and is named as NExBTL (Next Generation Biomass to Liquid Diesel). The process uses cracking technique, using hydrogen and catalyst, on palm oil that is transformed to oxygen-free paraffin (C_nH_{2n+2}). Spending 550 million euro, the plant was constructed at Tuas Industrial Zone situated in southwest of Singapore. The district has been developed to have a set of logistic infrastructure including a port and stores, which surroundings are very suited for distributing the biodiesel produced.

Palm oil, the major resource for biodiesel, will be purchased from Malaysia and Indonesia. Soon Singapore-made biodiesel will be exported to EU and north American countries, and even to Japan and Korea later on. (**Authors' abstract**)

Keywords: *Singapore, biodiesel production, crude oil, natural gas, cracking technique, palm oil, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/12,
(Filipiniana Analytics)

0363

Latest news topic of biofuel development in India

India began use of E5 (5% ethanol blended gasoline) in 2002. At the time of February 2007, biofuels have come into use in twenty states and four designated cities.

In FY 2006, two million kiloliter of bioethanol was produced from sugarcane that accounted for 4% of worldwide production 49.9 million kiloliter. India plans to promote and spread the use of biofuels, especially E10, throughout the country.

Research and development efforts are also being made in India to establish production technology of ethanol from non-food (cellulose) biomass such as corn pith and dregs of sugarcane.

On February 10, 2009, Praj Industries Ltd., major Indian R&D company for biofuel production technology, announced that the company succeeded in producing ethanol from cellulose biomass, and that the company's ethanol production would be doubled by 2012.

On February 3, 2009, India and US governments exchanged a memorandum for cooperation on the promotion of biofuels development in India. Both countries intend to build up, in the sectors of science, technology and policy, a cooperative framework for promoting the production, utilization, distribution, and marketing of biofuels in India. (**Author's abstract**)

Keywords: *India, E5, bioethanol, cellulose biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0364

Latest trend in biofuel use in Southeastern Asia

Southeastern Asia countries have been promoting to consume biofuels which produce in own country , and decrease to import crude oil. This is the government's policy. The economic conditions deteriorated in 2008 because of financial crisis, as the result of financial crisis each country reviews the policy. Otherwise some country increases biofuel

production in recent days. This article introduces latest information as to the use of biofuels in Indonesia, Malaysia and Thailand.

Indonesian Ministry of Energy and Minerals made announcement that the government would enforce the duty to use biofuels upon all industries from February 2010. The mixing ratio of biofuel to regular fuel is 1% for either biodiesel and bioethanol, so as to be qualified for getting governmental subsidy. The governmental subsidy is 1,450 rupiah/L for bioethanol and 1,660 rupiah/L for biodiesel. IMEM intended to begin enforcement to use biofuel at some time in 2009, but actually subsidy of biofuel was retarded. Now that the governmental subsidy has been put on the rail, the duty of biofuel use will be started in January 2009.

Indonesian government plans to increase the mixing ratio of biodiesel and bioethanol to conventional regular fuels. By 2025, for both transport and power generation industries, ratio of biodiesel to the total fuel consumption will be raised to 20%. Likewise, as for the transport industry, ratio of bioethanol to the total fuel consumption will be raised to 15%.

Malaysian government had an original plan to introduce B5 fuel (diesel oil containing 5% of biodiesel produced from palm oil) totally throughout the country. But lately, the government disclosed it would introduce B3 fuel (containing 3% of biodiesel) at first. One reason is that total introduction of B5 might increase the amount of subsidy that the government must offer, and another reason is that use of B5 is slow and low. An estimate shows the government would have to pay as much as 250,000,000 ringgit (6.6 billion Yen) of subsidy if B5 was totally introduced. Presently, B5 fuel is used for running 4,000 diesel-driven cars owned by Kuala Lumpur City Office, Ministry of Defense, and Public Works Department. But monthly consumption of B5 fuel stays no more than 40 tons. The government, therefore, decided to promote the use of B3 and save the subsidy budget.

In the fifteen-year plan of Thailand, the consumption of substitute energy is to be raised to 20% by FY2023, from its present value of 6.4%. Production of bioethanol from sugarcane stays 1,200,000-1,300,000 liter/year presently. Recently bioethanol production from tapioca has already come into operation, supply of bioethanol today is larger than the demand. The government of Thailand had come to a conclusion that the country need not to ban exporting bioethanol because domestic ethanol market has changed favorably. So far, because of shortage, export of domestic bioethanol has been banned temporally. (**Authors' abstract**)

Keywords: *biofuel, Indonesia, Malaysia, Thailand, bioethanol, biodiesel, B5 fuel, sugarcane, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0365

"Locally produce/locally consume" of woody pellets getting popular

Abundant waste woody biomass resources exist in Japan in the forms such as thinned wood/forest residue as well as construction waste of old wooden houses. These resources, however, exist thin and widely. Therefore, utilization of waste woody biomass in Japan has been done locally, using most efficient ways of collection and utilization that depend on the conditions of every local area. In order to realize low-carbon societies in Japan, it is thought to be a wise and effective way to promote utilization of woody biomass of every local area, by following the philosophy of "Locally Produce/Locally Consume".

The system of biomass utilization in this way would not necessarily be big in scale. Utilization of so-far-neglected biomass resources, however, would make it possible to realize recycling of natural resources and reduction of CO_2 emission. At the same time, this would revitalize forestry industry and wood industry of the area. In case of a sight seeing area, a well-attended beautiful forest zone would attract many more tourists to the area.

Utilization of woody biomass, in this way, is becoming more and more popular in many local municipalities as one of powerful trump cards to cope with the global warming. (**Authors' abstract**)

Keywords: *woody pellets, Japan, forest residue, carbon dioxide emission, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/02,
(Filipiniana Analytics)

0366

Local production and local consumption of biomass energy

Fourteen million ton of non-edible portion of agricultural products, such as rice straw and chaff, are generated every year in Japan. Only 30% of them are utilized: for making composts, for cattle foods, and for strewing on floors in cattle sheds. The remaining 70% was discarded as waste. Besides, 3.5 million ton of useless woody materials are carried out of the forests every year. Only 2% of them are used for making pulp and the rest are left unused (Statistics of Ministry of Agriculture, Forestry and Fisheries). Many local municipalities are trying to utilize those formerly unused woody biomass as biofuels and to consume them in the same district. A number of proof experiments of biofuel production for this purpose are in progress.

On February 13, 2009, a public organization “Project Union of Chino Town Development Ltd.” of Chino, Nagano Prefecture, announced that they were successful in producing ethanol from larch trees grown in Chino area. Larch trunks and branches were broken into powder and added with a kind of enzyme which turns the cellulose of the wood into saccharide, which was then fermented by adding yeast. In this way, they obtained 268 milliliter of ethanol from 1 kg of wood. They intend to use the ethanol to make E3 fuel to be burned by Chino Town’s on-demand buses. (**Author's abstract**)

Keywords: *unused woody biomass, biofuel, Japan, biofuel production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0367

Malaysia announces its national biomass strategy to turn “biomass to wealth”

The government of Malaysia announced its National Biomass Strategy (NBS) in November 2011. The theme of the NBS is “Biomass to Wealth,” and with this strategy Malaysia is aiming to create an innovative, world-leading bio-industry and has declared that it will strive to enhance its competitive edge in biomass.

Forests account for 60% of Malaysia's national territory, with 40% of its agricultural land consisting of growing regions for oil palms and 30% growing regions for rubber. It produces and exports enormous amounts of primary products such as palm oil, rubber, and lumber. Agriculture, fishing, and forestry industries constitute 11% as a share of GDP and occupy an important position within the national economy. The palm industry makes up 8% of this (50 billion RM=1.23 trillion yen), and the country boasts the second greatest production output in the world, with palm oil making up 50% of Malaysia's agricultural exports.

With respect to the biomass emitted by the palm industry in 2010, 80 million tons (on a dried basis) of solid biomass (empty fruit bunches, fibers, palm kernel lees, trunks, and branches) were generated, as were 60 million tons of palm oil mill effluent (POME). Preliminary calculations by the government show that by 2020 solid biomass will rise to 85-110 million tons and POME will reach 70-110 million tons.

The NBS plans to use the biomass that is discarded by the palm industry. Solid biomass is used for woody fuel (pellets), power generation, and as biofuels, while with POME efforts are being made to recover methane from it and expand its use as energy. It is forecasted that by 2020 the revenue from this will rise to 30 billion ringgit (738 billion yen) and it will create employment for 70,000 people. (**Authors' abstract**)

Keywords: *empty fruit bunch, palm oil mill effluent, woody fuel, power generation, soild biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/01,
(Filipiniana Analytics)

0368

Malaysia produces biofuels from palm oil

Primary energy supply of Malaysia in 2007 was 74.83 million ton COE (crude oil equivalent) in total. In which the share of crude oil was 37.4%, and that of natural gas was 46.3%. This means that Malaysia is heavily dependent on crude oil and natural gas. On the other hand, renewable energy's share was as small as 3.9%. Malaysian Government, however, intends to lessen the dependence on crude oil imports, and plans to raise the share of renewable energy up to 6% by 2010, 11% by 2015.

It is true that Malaysia is an energy exporting country. In fact, 54% of crude oil and natural gas that are exploited in Malaysia is being exported. Malaysia's domestically produced primary energy was 94.37 million ton (COE), of which 51.38 million ton (COE) is being exported. The government, however, has estimated that reserve of domestic crude oil might be consumed in 19 years, whereas domestic reserve of natural gas might possibly last 33 years. Based on this estimate and due to recent rise of domestic demand for crude oil, the country has started to import some amount of crude oil. As for natural gas, 46% of domestic production goes to overseas.

Export of natural gas to Japan in 2008 was 14.13 million ton, which occupied 19.6% in total amount of natural gas consumed in Japan. Today, Japan and Malaysia are strongly tied in energy trade.

Malaysia is known to be one of major palm oil producing countries. In 2008, the country produced 17.76 million ton of palm oil using a palm cultivating acreage of 1.2 million hectare. Malaysia came to the second in the world in palm oil production following after Indonesia that produced 20.25 million ton in 2008. Palm oil is one of Malaysia's major export materials, and in fact it earned foreign money that shared 4.2% of total export of Malaysia in 2002. Malaysian Government has been making efforts to promote production and use of biodiesel made from palm oil, so as to lessen the dependence on crude oil imports, and to stabilize palm oil price, as well as to increase export of biofuel. Production of biodiesel in 2007 was 120,000 ton. Officially permitted mixing ratio of biodiesel to regular diesel oil is 5% at maximum.

Of total production cost of biodiesel, 85% is the cost of palm oil. Therefore, if palm oil price rises, biodiesel would

become less competitive, and its production would be cut down. The government is keenly promoting export of biodiesel. Future export of biodiesel from Malaysia, however, will depend on whether demand for biodiesel in world market would increase or not, and also on whether palm oil cost would be stabilized or not. (**Authors' abstract**)

Keywords: *Malaysia, biofuel, palm oil, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/07,
(Filipiniana Analytics)

0369

Malaysia promotes utilization of waste biomass from palm-oil industry

Palm oil production in Malaysia scored 17.9 million ton in 2009, which was ranked as No.2 in the world, following after Indonesia's record of 22 million ton. Today Malaysia exports 90% of the domestic palm oil which occupies 9.2% of the export total sum. The most export is electricity and electronic parts, which is 41.2% of the export total sum. The palm oil export is the second largest, and palm oil production is regarded as the most important national industry.

Palm oil is a kind of plant oil that is extracted from fruits of oil palm. On the other hand, "palm kernel oil" is extracted from seeds of oil palm. After extracting both kind of oil, a lot of waste woody biomass is leftover. The leftover from palm oil production is called EFB (empty fruit bunch), and that from palm kernel oil production is called PKC (palm kernel cake). In addition, there remain other waste materials such as branches and leaves of palm trees, as well as palm oil mill effluent (POME). Furthermore, old palm trees are cut down and replaced by young trees at an interval of 25 years. Consequently, a large quantity of cut-down old palm trees is generated at times. Recent investigation proved that trunks of old palm trees keep a lot of sap (75-80% of tree weight) that contains rich amount of fermentable sugar such as glucose.

Malaysia produced 17.9 million ton of palm oil as well as 2.1 million ton of palm kernel oil in 2009, at the same time, quite a lot of waste biomass was generated, including 2.3 million ton of PKC, 30 million ton of EFB and waste fruit fiber and etc. Owing to new technology these waste biomass has become quite valuable today. The sum of all waste biomass emitted from palm oil industry of Malaysia, including POME, amounted to 65.5 million ton in 2009. If the waste material were turned into electricity by new technology, Malaysia would be able to supply additional 2,400 MW installed capacity per year.

In recent years Malaysian government has been keenly promoting utilization of renewable energy. In 2009. Malaysia could produce 498.9 MW installed capacity of electricity and 400 G joule of heat by utilizing various waste biomass, which amounted to 12.3 million ton in total, emitted from palm oil industry, sugar industry and municipalities. Malaysia invested 2.8 billion Ringitt (Malaysian money), =94 billion yen, for this project. Concerning the utilization of new energy, 18 new projects were selected and funded with a sum of 376.6 million Ringitt (12.6 billion yen) by the government. These projects created a new employment of 3449 persons. One of the projects, with a budget of 52 million Ringitt (1.7 billion yen), was designed to generate 11.5 MW installed capacity of electricity by utilizing 432,000 ton of waste emitted from palm oil mills. (**Authors' abstract**)

Keywords: *palm oil production, waste biomass, palm kernel oil, empty fruit bunch, palm kernel cake, palm oil mill effluent, Malaysia, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/01,
(Filipiniana Analytics)

0370

Manufacturing hydrogen from sewage sludge

The population diffusion rate for sewage treatment (percentage of the population with sewage out of the total population) in Japan at the end of FY2011 was 75.8%, which was an increase of 0.7% compared to the previous fiscal year. The installation of sewage is proceeding at the national scale, and as such the amount of sewage sludge generated through the sewage water treatment process comes to 2.3 million tons per year when converted to solid matter. Organic matter accounts for 60-80% of the solid content of this sewage sludge. This represents a stable energy source (crude oil equivalent: 1.08 million kiloliters) in terms of both quality and quantity, and is equivalent to approximately 0.2% of Japan's annual energy consumption.

Despite the fact that sewage sludge is a stable resource, only a mere 13.7% of the organic matter found within this sewage sludge is used as energy in the form of biomass or sludge-derived fuel, which is an extremely low figure.

A demonstration experiment to manufacture hydrogen from this sewage sludge was initiated in Izumo City, Shimane Prefecture in September 2012. This is a joint experiment by the four companies of Japan Blue Energy Co., Ltd., Mitsui Chemicals, Inc., Toyota Tsusho Corporation, and Daiwa Lease Co., Ltd. that uses BLUE Tower technology, which is the proprietary technology of Japan Blue Energy Co., Ltd. With this technology alumina balls are used as a heat carrier to thermally decompose the organic matter found within sewage sludge in order to obtain biogases like methane (CH_4). Next, the methane and water vapor (H_2O) are made to react through a steam reforming reaction to obtain hydrogen (H_2). The greatest feature of this technology is that hydrogen can be manufactured by performing thermal decomposition and steam reforming reactions at a single plant.

The hydrogen obtained from this will be used for the fuel cell vehicles (FCVs) and fixed fuel cells that are expected to grow in popularity in the future, with the aim being to realize hydrogen innovation towns (low-carbon, recycling-oriented towns) featuring local production for local consumption. (**Authors' abstract**)

Keywords: *hydrogen, sewage sludge, organic matter, biomass, alumina balls, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/11,
(Filipiniana Analytics)

0371

Methane generation by fermenting biomass is flourishing in Japan

House food-waste was produced 11 million ton and food-processing company food-waste also was produced 11 million ton annually in Japan (FY 2005). Total amount of food-waste was 22 million ton. 8 million ton was recycled and the rest 14 million ton was waste product of incineration disposal and disposal by landfill. The recycled material of food waste has been mainly feedstuff and compost. However in Japan energy generating activities from food waste is now developing. The energy is methane gas.

Methane-producing businesses and projects are flourishing all over Japan by utilizing various kinds of biomass such as plant waste, food waste, house garbage as well as sewage sludge. Methane fermentation is the key technology for the methane production. Organic substances contained in biomass are dissolved and turned in to methane by germs that perform anaerobic-digestion. Methane fermentation is the best for food-waste because food-waste has much moisture and various kind of organic component. New energy businesses/projects that produce methane from biomass, and utilize the methane for energy generation are considered to be a powerful trump card to cope with global warming and are keenly awaited for.

According to these flourishing of methane-producing businesses, various methane generation plants have been constructed. Table shows these examples in Japan. (**Author's abstract**)

Keywords: *methane fermentation, fermenting biomass, house food-waste, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0372

Microgrid on Semakau Island in Singapore

The first microgrid system in Southeast Asia will be installed on Semakau Island, which is a landfill reclaimed land, in Singapore. Since electric power systems have not yet spread out to the islands in Southeast Asia, they are dependent on free-standing energy sources. Therefore, the hope is that microgrids can both supply power to remote regions and serve as reserve power sources there, with the objective being to conduct a demonstration project.

This is being led by the Energy Research Institute (Erion) at the Nanyang Technological University (NTU), with the assistance of the Economic Development Board (EDB) and the National Environment Agency (NEA) of Singapore. The demonstration project will be carried out over the coming five years with an initial investment of 8 million Singapore dollars (about 670 million yen). Phase I will last until the second half of 2015, over which solar power, wind power, and energy storage equipment will be built. This will be followed by Phase II from 2016 to 2017, during which the plan is to add tidal power generation facilities in the vicinity around Semakau Island and Saint John's Island (see Fig. 1).

The installed power output from Phase I is projected to exceed 1 MW, but owing to the fact that there is spare capacity in the experiment area on Semakau Island, and that in the future new companies are expected to join in, it is foreseen that the scope of the experiment will grow larger. The ten local companies and global companies shown in Table 1 announced that they would take part in the demonstration experiment. (**Author's abstract**)

Keywords: *Singapore, microgrid, electric power system, solar power, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/12,
(Filipiniana Analytics)

0373

Ministop's waste oil turned into biodiesel fuel

Ministop Co., a convenience-store chain, has been providing its store-generated waste oil so as to be processed into biodiesel fuel since August 2008. At present, two hundred eighty Ministop stores in Tokyo (23-wards-district) are issuing in total 530 KL (440 ton) of waste oil every year. A factory of Sinanen Co. Ltd. processes the waste oil into 500 KL of biodiesel fuel (BDF) annually. By mixing the BDF with light oil at the proportion of 5%, 10,000 KL of B5-diesel fuel is obtained and this B5-fuel is used for running Toei buses and other municipal cars. By this recycling of waste oil, an estimate has shown that it is possible to reduce CO_2 emission by 1,000 ton annually.

According to the statistics of FY 2007, total annual consumption of cooking oil in Japan amounted to 2.35 million ton, of which food service industry and food industry put together shared 1.98 million ton, and general households 0.37 million ton, respectively. After use, waste oil emitted from the industries and general households was 0.35 million ton and 0.1 million ton, respectively. The waste oil is being reused and recycled in various ways such as animal feed, industrial resource, boiler fuel, and biodiesel fuel. At present, however, reused amount as biodiesel fuel stays around 5,000 ton that is used for blending only 100,000 ton of B5-fuel annually. Thinking of the total consumption of light oil in Japan that amounts to 33 million ton a year, the B5-fuel's share is so small as barely 0.3%.

Several local governments like Kyoto Prefecture Office are promoting reuse of household- waste oil as a resource to make biodiesel fuel. In Kyoto today, 1,500 KL/year of biodiesel fuel is produced and used to run municipal garbage collecting trucks and Kyoto buses. Biodiesel fuel is a partial substitute for light oil and has an effect to reduce CO_2 emission, and therefore popular use of biodiesel fuel is keenly awaited for.Food-processing company also process the company hold-waste oil into Biodiesel, and use B-5 Diesel in own company vehicles. However almost company use small amount of B-5 Diesel. At this case of Ministop Co, it is very important because Ministop Co supplies B-5 Diesel stably 10,000 KL for public vehicles. (**Author's abstract**)

Keywords: *waste oil, biodiesel fuel, Ministop, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0374

Ministry of Economy, Trade and Industry budget proposal for renewable-energy-related operations in fiscal 2016

In December 2015, the Ministry of Economy, Trade and Industry published its budget proposal for resource and energy-related operations. The realization of the energy mix (the division of power output among the various energy sources) in the long-term outlook for energy supply and demand announced in July 2015, and the initiatives taken in "System Innovation", have been adopted as basic policies, with the size of the market increasing by 5% to 838.4 billion yen compared to the full year while all efforts are being concentrated on the reconstruction of Fukushima.

It is estimated that the proportion of the total power generated occupied by renewable energy will increase from 12.2% in 2014 to 22-24% by 2030. As a result, a budget of 136.6 billion yen has been allocated to renewable energy (see Fig. 1).

The proposed budget includes initiatives to further expand capacity while lowering the national burden based on the characteristics and installed capacity of each power source (see Fig. 1).

"Support for renewable energy potential assessment and development and promotion of verification operations toward commercialization" includes measures for those operations that require a lot of time until commercialization–wind power, geothermal power and hydropower–such as support from the stage of resource surveying, support in the replacement of hydro power generators that have been in operation for 40 years, and promotion of use in wood biomass regions.

Under the “FIT Expense Exemption Measures”, an integrated review of the relevant systems will be carried out with the aim of expanding the use of renewable energy.

Under the “Research & Development of Renewable Energy”, the power generated for variable power sources such as solar power and wind power is forecasted from the changes in the weather, with the aim of developing technologies that can be easily implemented in the system while improving the performance and reducing the cost of each power source. In the advanced application field, a budget has been allocated to the development of wireless transmission and reception technology using microwaves that will be the core technology of a solar power generation system in space, and the demonstration of bio-fuel production using algae indigenous to Fukushima as a new project.

Through a series of demonstration projects, system innovation and research and development projects that have been budgeted this time, specific activities will be started to accomplish the energy mix goal for fiscal 2030. (**Author's abstract**)

Keywords: *renewable energy, budget proposal, system innovation, demonstration project, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/03,
(Filipiniana Analytics)

0375

Moving towards the practical application of biofuel derived from algae (Japan)

The amount of biodiesel fuel produced in Japan in FY2007 was 6,229 kiloliters, following which it continued to grow at a steady pace to reach 8,652 kiloliters in FY2010, with production costs that were 97.1 yen/liter. Yet at the same time, Japan’s production volume only accounts for a mere 0.04% of the 21.4 million kiloliters produced globally (2011). One of the reasons for this is that waste cooking oil is frequently used as the raw material for biodiesel fuel in Japan, but efficient collections systems have not yet to be created for this. In order to expand the amount of biodiesel fuel produced the raw materials for it must be diversified.

New developments have arisen regarding the practical application of biodiesel fuel production from micro algae. Trans Algae Corporation has a plan to begin a power generation business that uses biofuel from TAC algae.

What is more, it has been promoting the development of next-generation energy from micro algae since 2012 for the sake of rebuilding the Tohoku Region that was damaged during the Great East Japan Earthquake. There are great expectations on algae when it comes to diversifying the raw materials for biodiesel fuel.

JX Nippon Oil & Energy Corporation, IHI Corporation, and Denso Corporation announced that they established the Council to Promote the Development of Micro Algae Fuel in June 2012. A structure spanning all of Japan made up of ten private sector companies, including these three companies, will hasten the practical application of micro algae fuels by establishing an integrated production system for such fuels by FY2020.

A project to promote research and development on clean energies has been adopted in order to rebuild the Tohoku Region that was damaged during the Great East Japan Earthquake. The theme is on the development of next-generation energy from the oceans and micro algae, which will be carried out over five years from FY2012 until FY2016 under the leadership of Professor Toji of Tohoku University. The project scale for FY2012 will be 800 million yen.

Trans Algae Corporation, which is developing biodiesel fuels for power generation by using algae as their raw material, has said that it has achieved a production cost for algae fuel of 30 yen/liter. (**Authors' abstract**)

Keywords: *Japan, microalgae, biodiesel fuel, waste cooking oil, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/08,
(Filipiniana Analytics)

0376

Municipal trends over small hydro power generation from agricultural water in Japan

In the Study on Potential Hydroelectricity of Unused Fall Heads that was carried out by the Ministry of Economy, Trade and Industry in FY2008, the potential power generation from agricultural water by prefecture was summarized by being split up into dam systems and run-of-the-river systems. With the dam systems existing dams are used to generate power, while for agricultural run-of-the-river power generating facilities are installed at sections with swift currents, head sections, step-wise head sections, and pressure reducing valves.

Fig. 1. shows the rankings for potential hydropower from agricultural water by prefecture (total from unused and already in use), while Fig. 2 shows the rankings for potential hydropower from unused agricultural water by prefecture (dam systems and run-of-the-river systems). While the potential hydroelectricity from agricultural water is 157 MW throughout Japan, the amount that is already in use remains at only 38 MW.

Progress had not been made with disseminating the use of small hydropower from agricultural water due to the issue of water rights and because in some cases there are enormous differences in the flow rates between irrigation periods and non-irrigation periods. But given the start of the feed-in tariff scheme for renewable energies in July 2012, surveys on candidate sites for the application of small hydropower from agricultural water have been carried out in several municipalities. As indicated by the examples of initiatives for small hydropower from agricultural water in municipalities in Table 1, Akita Prefecture, Shizuoka Prefecture, Gifu Prefecture, Shiga Prefecture, and others have publicized these survey results and are soliciting the participation of businesses. As a result of this survey, in Gifu Prefecture construction work on a small hydropower generating facility with an installed capacity of 220 kW has begun in Ogo District, Kashimo, Nakatsugawa City which is slated to begin operating in April 2014.

The rankings for unused, potential hydropower from agricultural water are in the order of Hokkaido, Aichi, and Fukushima Prefectures, but as indicated in Table 1 Akita Prefecture (ninth), Shizuoka Prefecture (18th), Gifu Prefecture (30th), and Shiga Prefecture (39th) have been proactively working on plans to develop small hydropower from agricultural water. (**Author's abstract**)

Keywords: *Japan, renewable energy, small hydropower, agricultural water, power generation, dam system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/12,
(Filipiniana Analytics)

0377

Myanmar biofuel project using jatropha oil

Jatropha is a kind of tropical deciduous shrub tree. Oil content of jatropha seeds is very high, ranging from 30 to 35%, five times that of soybeans, three times that of rapeseeds. Therefore jatropha seeds are an ideal raw material for production of biodiesel fuel. A planted jatropha tree can yield 0.8 liter of biofuel and absorb 8 kg of CO_2 annually.

In 2004 Daimler-Benz AG as well as BP plc. respectively conducted running tests of real cars on jatropha oil under various conditions including sub-zero temperature. These tests proved that jatropha-refined-oil could be used as

substitute diesel fuel. From FY 2007 Boeing Co. started test flights with jatropha oil as jet fuel. Since the end of FY 2008, major world airlines companies followed Boeing, and they also have made successful test flights, using different substitute biofuels derived from inedible biomass materials including jatropha.

Myanmar is the largest jatropha-growing country that produces 90% of jatropha in the world. The Myanmar government promotes plantation of jatropha as a national project. The cultivated acreage of jatropha in Myanmar was 635,000 ha in FY 2006, 1,478,000 ha in FY 2007, 2,000,000 ha in FY 2008 (from April to December), and the government designates the acreage to be expanded to 3,200,000 ha in FY 2010.

Taking notice of abundant jatropha as a useful biomass, on February 27, 2009, Japan Bio Energy Development Co. Ltd. announced to the press that it would start a biofuel production project using abundant jatropha, by establishing a joint corporation with a general trading firm of Myanmar. The company plans to sell jatropha seeds, as much as 5,000 ton a year as a present target, as well as jatropha-derived biofuels including export, during FY 2009. (**Author's abstract**)

Keywords: *Jatropha, jatropha-refined-oil, jet fuel, inedible biomass materials, jatropha-derived biofuels, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0378

Myanmar has given the first priority to plantation of jatropha

Myanmar is situated in the western part of Indochina peninsula, and the biggest among the Indochina countries. Land area is 1.8 times as large as Japan. In 2007, the supply of primary energy of Myanmar scored 15.788 million ton COE (crude oil equivalent), of which 65.7% is shared by biomass energy that is generated by biomass/ wastes from forestry and agriculture.

The woody biomass is generated from the vast forest areas that cover 50% of Myanmar. But owing to excessive cutting-down of trees in recent years, forestry reserve of Myanmar is decreasing rapidly. Total forest area of Myanmar in 1990 was 392,190 km^2, but in 2005 it was reduced to 322,220 km^2. It is estimated that Myanmar's forest area would be reduced to 277,570 km^2 in 2010.

On the other hand, agriculture is the basic industry of Myanmar and 68% of the population is engaged in farming. The produce of rice in 2008 scored 30.5 million ton. And its byproducts, rice-straw and chaffs, are utilized as important biomass resources.

Meanwhile, Myanmar government is eagerly promoting domestic production of biodiesel fuel, especially that of jatropha, so as to lessen the import of diesel oil. In terms of the productivity of plant oil per unit farming area (ha), oil palm is the highest among various oil plant, scoring 4,995 kg/ha. Jatropha's oil productivity is 1,589 kg/ha, which is nearly one third that of palm.

The reason why Myanmar government is giving highest priority to production of biodiesel fuel from jatropha is that Myanmar so far has been importing palm oil, as food oil, as much as 200,000 ton a year. Myanmar is striving for enlarging domestic production of biodiesel fuel, and in fact it has set a goal of jatropha plantation as wide as 3.44 million hectare to be completed by 2010. (**Authors' abstract**)

Keywords: *Myanmar, Jatropha, woody biomass, biodiesel fuel, palm oil, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/10,
(Filipiniana Analytics)

0379

Myanmar to use agricultural waste and biogas to prevent the destruction of forests

Myanmar's policy for renewable energies was formulated by the Ministry of Energy (MOE), and lays out the following objectives: Expanding the use of renewable energies, promoting energy savings and increased efficiency, and preventing the destruction of forests from the excessive use of wood and charcoal.

It plans to cover 15-20% of the country's total electric power through renewable energies by the year 2020.

Myanmar's forest cover area of 340,000km^2 accounts for 50% of its total land area of 680,000km^2. The woody biomass (firewood, charcoal) produced from these forests is an invaluable household fuel for rural regions. Such biomass accounts for 64% of the country's primary energy consumption. But as things currently stand, there has been increased consumption due to the rising population, and so 22.5 million m^3 is consumed and 410,000ha of forests are lost every year.

The government is promoting various different means and measures when it comes to ways to prevent deforestation. These include boosting the efficiency of cooking stoves and using agricultural waste (rice husks) and wood chips from lumber production as briquette fuel. The 32.68 million tons of rice produced in 2009 generated 6.6 million tons of rice husks, while the 9 million tons of sugarcane generated 1.35 million tons of strained lees (bagasse), resulting in an abundance of agricultural waste.

The use of biogas produced from the excrement from livestock animals has also been promoted since 1980 as a replacement for woody biomass. The Ministry of Science and Technology has increased the number of biogas plants it has installed to 105 (between 2003 and 2005), achieving a generation facility capacity of 945 kW. Moreover, in 2007 an Indian company installed a biogas plant in the Mandalay Region that supplied electricity to 200 farming households. (**Authors' abstract**)

Keywords: *agricultural waste, biogas, deforestation, bagasse, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/02,
(Filipiniana Analytics)

0380

Three new bioethanol plants in Vietnam

Construction of a three new bioethanol production plant has started on 6 September 2009 at Kwangai City located in the middle of Vietnam. The plant has a production capacity of 100,000 KL/year and uses cassava as raw material (650,000 ton/year to be provided). The cost of construction is 86 million US dollars, and the plant is expected to be in

operation in 2011. In addition, this plant will produce 1,500 ton/year of industrial alcohol as well as some cattle feed as byproducts.

The first Construction of bioethanol production plant in Vietnam was decided in March 2007. PetroVietnam Tourism & Service Co. (Petrosetco) and Itochu trading firm concluded an agreement, in March 2007, regarding the construction of a bioethanol production plant at Ho Chi Minh City in Vietnam. The plant will have a production capacity of 100,000 KL/year of ethanol using cassava as resource.

Meanwhile, Bien Hoa Sugar Co. and Fair Energy Co. concluded an agreement as to the construction of bioethanol production plant that had a production capacity of 63,000 KL/year, using sugar cane as raw material. This plant was 2nd construction in Vietnum.The plant is to be constructed in Tainin district located in the northwest of Ho Chi Minh City. (**Authors' abstract**)

Keywords: *bioethanol plants, Vietnam, cattle feed, cassava, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0381

Nippon Oil Corporation started the full-scale sales of ETBE-mixed bio-gasoline

The Japanese Government decided to introduce bio-fuel for automobiles as one of CO_2 emission reduction measures for the entire country. To be specific, the bio-fuel equivalent to 500,000 kl of crude oil will be introduced as fuel for transportation in 2010, of which 210,000 kl will be introduced by the petroleum industry of Japan.

Currently, the following 3 types of use are developed for the bio-fuel for automobile in Japan. 1. Use of ETBE (Ethyl Tertiary-Butyl Ether) mixed with gasoline; 2. Use of bio-ethanol mixed with gasoline; and 3. Use of bio-diesel fuel mixed with light oil.

The oil industry is promoting the introduction of bio-gasoline mixed with 1 to 8% ETBE and it has implemented the demonstration business since 2007. ETBE, which is produced by synthesizing bio-ethanol and isobutene, is planned to be increased to 200,000 kl of ETBE in fiscal 2009 and 840,000 kl in fiscal 2010. The 840,000 kl of ETBE is equivalent to 210,000 kl of crude oil.

On May 29, 2009, Nippon Oil Corporation announced that it would sell the bio-gasoline as regular gasoline at 861 gas stations in Tokyo and 6 prefectures (Kanagawa Prefecture, Yamanashi Prefecture, Saitama Prefecture, Nagano Prefecture, Gunma Prefecture, and Tochigi Prefecture) from June 1, 2009. Nippon Oil Corporation trially sold the bio-gasoline at 13 gas stations in fiscal 2007 and 30 gas stations in fiscal 2008. In fiscal 2009, it will greatly increase the number of gas stations to 861, thus fully introducing the bio-fuel. 861 gas stations account for more than 40% of about 2,000 gas stations of Nippon Oil Corporation in Tokyo and 6 prefectures. This will be the first large-scale sales in Japan.

Nippon Oil Corporation will introduce 47,000 kl of ETBE in fiscal 2009. This will reduce the CO_2 emission by 30,000 tons per year. In fiscal 2008, while Japan imported 50,000 kl of bio-ethanol including ETBE, the domestic production was only 1,300 kl, which reveals a 97% dependence on imports. (**Author's abstract**)

Keywords: *Japan, carbon dioxide emission, crude oil, Ethyl Tertiary-Butyl Ether, bioethanol, biogasoline, biodiesel fuel, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,

0382

One of the world's largest power plants using biomass now under construction in Singapore

Singapore is composed of 63 islands, has a population of 5.08 million people, a national territory of 710km^2 (roughly the same as the 23 wards of Tokyo, Japan), and has gained a reputation as a clean, green "garden city." It has been experiencing solid economic growth, with growth of 14.5% in 2010 and forecasted growth of 5-6% in 2011. Yet the environmental problems of mass production, consumption, and disposal that have appeared in the wake of this rapid economic growth are now posing a serious challenge.

In 2002 the government laid out the Singapore Green Plan 2012, which aims to achieve a sustainable society. This plan stipulates the direction that the country should head in with respect to the environment with a view toward 2012, and includes measures like raising the recycling rate for waste from 44% to 60%.

In addition to this plan, the government is also working on countermeasures against global warming. One of its measures to reduce emissions of CO_2 is to use renewable energies, because with its tropical climate Singapore is largely favored to be able to utilize energy from sunlight. On top of this, it is also promoting the use of woody biomass, with a co-generation plant (that will jointly supply electricity and steam) fired by both biomass (20%) and coal (80%) currently under construction (first phase of the construction work). The plant will use the palm kernel shells left over after the palm oil has been squeezed out for the biomass, and will be completed at the end of 2012 with a generated output of 101MW.

A decision has been reached to construct a second co-generation plant fired by both biomass and coal after this one, which will be completed in 2014. This will result in a power output of 132.5MW from the first and second phases of the construction work combined, making it one of the world's largest plants jointly supplying electricity and steam through the use of biomass. Marubeni Corporation in Japan succeeded in getting the orders for both of these plants. (**Authors' abstract**)

Keywords: *power plant, garden city, global warming, biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/11,
(Filipiniana Analytics)

0383

Offshore wind turbines in China

In July 2014, the National Energy Administration and the National Development and Reform Commission (NDRC) of the Government of the People's Republic of China decided to adopt a feed-in tariff (FIT) for power from offshore wind turbines. The purchase price from power generated from wind turbines in coastal waters is 0.85 yuan (USD 0.14) per kWh while that from wind turbines in intertidal zones is 0.75 yuan (USD 0.12) per kWh, with separate prices having been established for the two types of ocean waters.

In addition, the Shanghai Municipal People's Government offered additional subsidies of 0.2 yuan (USD 0.03) per kWh to offshore wind turbines in May 2014. Following this, the Shanghai Municipal Ocean Bureau gave approval for the 100 MW from the first phase of a project to generate wind power in Shanghai Harbor, which is slated to have a total installed capacity of 200 MW.

China's goal is to install a cumulative total of 5 GW worth of power from offshore wind turbines by the end of FY 2015, and at the present stage it is promoting seven offshore wind turbine projects (for a total of 1.5 GW). In addition, it plans to begin constructing 3.5 GW-worth of offshore wind turbines in 2015. The thinking is that this recent decision to adopt a FIT for power from offshore wind turbines will further spur on their adoption. Fig. 1 shows China's wind power potential, including that for offshore wind turbines, while Table 1 shows offshore wind turbine projects that are currently under construction. (**Author's abstract**)

Keywords: *China, offshore wind turbine, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/10,
(Filipiniana Analytics)

0384

Oil palm biomass center established in Malaysia

Malaysia is the world's second largest producer of palm oil after Indonesia, and produced 18.3 million tons in FY2011. Palm oil is a major agricultural crop in Malaysia, with the approximately 3.5 million ha in area it has under cultivation accounting for 11% of its national territory. It produces 80 million tons of solid biomass (empty fruit bunches, fibers) and 60 million tons of palm waste liquid as a result of the production of palm oil, with 90% of this being discarded without being used.

The government has set out a plan to reduce the country's CO_2 emissions by 40% relative to 2005 levels by 2020. Using the biomass from palm oil is the key to success in achieving this objective. If the biogas (methane) generated from the palm waste liquid can be used to generate electricity, then 400 MW of electricity could be generated, which all on its own would have the effect of reducing CO_2 emissions by 12%.

The Oil Palm Biomass Center was established in March 2012 as a public-private partnership to efficiently promote the intensive use of biomass from palm oil. From Malaysia, companies that produce palm oil (Sime Darby, IOI, Felda) and universities (Technical Universities of Malaysia, University Purta Malaysia) have formed a coalition to develop biofuels, bio-energies, and biochemical products. The government's preliminary calculations show that through this it can boost its Gross National Income (GNI) from palm oil production, which is currently at 50 billion ringgits (1,250 billion yen) per year, by an additional 30 billion ringgits (801.3 billion yen) a year by 2020. (**Authors' abstract**)

Keywords: *Malaysia, oil palm biomass, waste liquid, carbon dioxide emission, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/07,
(Filipiniana Analytics)

0385

Palm cultivation in Papua New Guinea

The Government of the Papua New Guinea has procured 27.5 million dollars worth finance from the World Bank in January 2009 to be spent for palm cultivation promotion project in the West New Britain state and Oro state. This is the second procurement from the World Bank for the promotion of palm cultivation with which the country manages to get out of poverty. Under prevailing tropical climate the lands of Papua New Guinea are not suited for ordinary farming but they are suited for growing palm. The production of palm oil in Papua New Guinea amounted to 330,000 ton (in FY 2004), ranking No. 6 in the world, and the palm oil is exported to Europe. The total land area for palm cultivation might have exceeded 100,000 ha today.

On 6 August 2009, New Britain Co. Ltd., the biggest palm oil maker in Papua New Guinea, announced that the company would cultivate a new palm farmland, and that it would construct a methane-gas recovery system, at a place near Kimbe City that is the capital of the West New Britain State. The system utilizes liquid waste and squeezed lee, which are discharged from palm oil production process, so as to generate methane gas by fermentation. In addition, the company presented a plan to build a palm oil processing factory at Liverpool in England, which would be started in FY 2010. The reason why this plan was adopted is because the price of palm oil has risen from 550 to 700 dollars per ton recently. Thus, it seems that the palm cultivation promotion program of Papua New Guinea, which was initiated as a public enterprise in the Milne Bay State, is finally bearing fruits. (**Author's abstract**)

Keywords: *palm cultivation, Papua New Guinea, liquid waste, squeezed lee, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0386

Paper and pulp industry supplies electric companies with electricity from biomass

The amount of energy consumed by Japan's paper and pulp industry (paper industry) was 428,881 million MJ in FY2009, of which consumption from biomass energy accounted for about 37.9%. The biomass used by the paper and pulp industry as energy consists of the pulp liquor (black liquor) and scrap wood emitted from the pulp manufacturing process, with the energy from black liquor particularly high at 31.2%. When it comes to black liquor, 70 million tons are generated each year in Japan, 100% of which is reused as energy thus making it the most efficiently used biomass. As this indicates, Japan's paper and pulp industry is characterized by the fact that nearly 40% of the energy it consumes is covered by biomass.

Moreover, the amount of electricity consumed by the paper and pulp industry ranks it in fourth place among Japan's industries, and in FY2009 it consumed 28.954 billion kWh for the year. Of this, private power generation from black liquor and the like accounted for 76.4%, thus reaching the highest level out of Japan's industries.

Currently, the conservation of power is being sought all over Japan because of the Eastern Japan Earthquake, with attention being paid to a plan to supply the surplus power from the paper industry to power companies. Hyogo Pulp Co., Ltd. is engaged in the largest scale of power generation from biomass in Hyogo Prefecture. It operates two biomass power generating facilities (38,700 kW and 18,000 kW) that use black liquor and wood chips from construction scrap wood as fuel. It completely covers the power needs for its own plants, and it supplies any excess power to the Kansai Electric Power Co., Inc.

Daio Paper Corporation's Mishima Plant, which is located in Shikokuchuo City, Ehime Prefecture, uses black liquor, wood chips, tree bark, and other biomass fuels as its energy sources for the plant, with 45% of its energy consumption covered by biomass. The Mishima Plant announced in July 2011 that it would supply some of the power generated in-

house to Shikoku Electric Power Co., Inc. over the three months from July to September 2011. Through the plant's energy saving and electricity conservation measures, and with its facilities for generating power in-house from biomass at full operation, it claims that it will be able to supply up to 20,000 kW of excess power. (**Authors' abstract**)

Keywords: *Japan, paper, pulp liquor, electricity, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/08,
(Filipiniana Analytics)

0387

Pellet business turned profitable: Kamiina Shinrinkumiai

The Pellet Business of Kamiina Shinrinkumiai (a forestry cooperative in Ina city, Nagano) has been in full operation since FY 2004. The company produce woody pellets from thinned wood or forest wood residue generated in Kamiina forest regions, and sell them as fuel for boilers and stoves.

The pellet business has got into the black for the first time in FY 2008, profiting 580,000 yen. The sales amount of pellets was 362 ton in FY 2004, and steadily increased every year, scoring 1,177 ton in FY 2008. Red figures continued in the beginning years but the coop, on the other hand, made efforts to sell boilers and stoves which resulted in increased pellet consumption, and finally has got into the black. The coop plans to sell as much as 1,500 ton in FY 2009 that is 300 ton more than the previous year. At the same time they will also promote popular use of boilers and stoves in the district so as to increase the demand for the pellets.

Wood residues issued from sawmills, construction sites and forests are the major sources of woody biomass of Japan. By utilizing these woody biomass, pellet production has been widely expanding in recent years. In FY 2003 production of woody pellets of Japan was 3,800 ton, but in FY 2007 it has grown 9 times that of the starting year, up to 33,492 ton. In the mean time the number of pellet factory has increased from 10 to 47, nearly five-fold. This is because more and more boilers and electric power plants/generators that consume woody pellets have been installed every year.

So far, Japan's forest wood residue, which is one of important biomass resources of the country, has scarcely been utilized. It is reported that about 8 million ton of forest wood residue was generated in FY 2008, but only one percent was utilized. From now on, utilization of woody biomass is keenly awaited for, and therefore, it seems very important to create a new business which turns this unused resource into valuable goods. Hopefully, new employment and profit will be born in the forest districts. (**Author's abstract**)

Keywords: *pellet business, forest wood residue, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/07,
(Filipiniana Analytics)

0388

The petroleum industry achieved its target for the adoption of biofuels

Renewable energies accounted for a roughly 5% proportion of the primary energy supply in Japan in 2009, but in the interest of boosting energy security the government has set a target of increasing this to 10% by 2020. It also laid out a plan of boosting renewable energy-related markets which were at roughly 1 trillion in 2009 to 10 trillion in 2020 by aiming to expand the domestic market, create new markets, and acquire overseas markets.

Japan is almost entirely dependent on petroleum for its fuel for transportation. For this reason the government is focusing its efforts on introducing biofuels as its trump card for the adoption of renewable energies, and is aiming for its adoption in more than 3% of the gasoline throughout Japan by 2020 (1.8 million kL of gasoline, or a crude oil equivalent of 1.6 million kL). In addition, the government has established a quantitative target for the use of bioethanol by petroleum refiners for the seven years from FY2011 to FY2017, setting the amount to be adopted at 210,000kL for FY2011 and at 500,000kL for FY2017.

In response to this, the petroleum industry has set out and begun working towards its own voluntary target of introducing bioethanol in the form of 840,000kL of Bio-ETBE (ethyl tert-butyl ether) in FY2010, which is equivalent to 210,000kL of crude oil. Bio-ETBE is a fuel that is a synthesis of bioethanol and isobutene.

In April 2011 the Petroleum Association of Japan announced that for its performance in FY2010, it was qable to cut CO_2 emissions by approximately 600,000 tons in the transportation sector by introducing 870,000kL of Bio-ETBE, thus exceeding its target. This enabled it to achieve the government's target one year ahead of time. The further adoption and expansion of biofuels by the petroleum industry are anticipated in the future as well. (**Authors' abstract**)

Keywords: *petroleum, renewable energy, carbon dioxide emission, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/11,
(Filipiniana Analytics)

0389

The Philippines has agricultural biomass resources of 13.01 million tons per year

The Philippine government has been putting its efforts into developing renewable energy in order to boost its energy self-sufficiency ratio and improve its energy security. The Department of Energy (DOE) has been tasked with this duty, and has laid out the sizable target of doubling the country's installed capacity for renewable energy over the ten-year period from 2005 to 2014.

Of the types of renewable energies, biomass has been garnering particular attention. The Philippines is an agricultural country in which 40% of the total population is engaged in primary industry. Its major agricultural products include coconuts, rice, maize, and sugarcane, with their respective production outputs for 2009 coming in at 15.67, 16.27, 7.03, and 22.93 million tons. In particular, it boasts the world's second highest output for coconuts and its eighth largest output for rice.

The yearly agricultural biomass given off from these grains and fruits amount to a total of 13.01 million tons, with 4.7 million tons from coconut shells, 3.25 million tons from rice husks, 1.62 million tons from maize cobs, and 3.44 million tons from strained sugarcane lees (bagasse), giving it an enormous abundance of biomass resources.

A project to generate electricity by using agricultural waste was publicly announced in October 2011. EcoMarket Solutions, Inc. (EMS) from the Philippines announced that the company would begin operating a 2MW biomass power plant in Aurora within the year. It went on to add that the district in which the plant will be installed is currently only able to use four hours of electricity per day, but that the plant will be able to supply electricity 24 hours a day to 250 households by means of biomass power generation. Biomass power generation plays a major role in supplying rural areas with electricity. (**Authors' abstract**)

Keywords: *biomass power generation, renewable energy, agricultural produce, bagasse, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/12,
(Filipiniana Analytics)

0390

Make popular small-scale biomass power generation in Cambodia

Small-scale biomass power generation plants, 150-200 kW class, using rice chaff, corn cob, sugarcane, peanut shell as fuels, are increasingly constructed in Cambodia. As of the year 2002 (from January to December), the country's biomass power remained only 1,500 kW. In recent years, however, rapid growth of biomass power generation capacity has been observed, namely, 2,464 kW in FY 2007, and 5,584 kW in FY 2008. Notably, cumulative capacity has cleared over 11,000 kW by June 2009. Reportedly, current unit cost of electricity is around 0.23 US dollars/kWh. (**Author's abstract**)

Keywords: *small-scale biomass power generation, Cambodia, rice chaff, corn cob, sugarcane, peanut shells, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0391

Potential for biofuel production on deserted arable land and fallow land in Japan

The Environmental Improvement Policies and Agricultural Community Promotion Measures through Natural Energies announced by the Japan Institute of Irrigation and Drainage in March 2011 offered recommendations related to the use of natural energies in rural agricultural communities. The report provides recommendations on preliminary calculations of the potential from renewable energies and their use. This includes small hydropower through the use of agricultural waterways, solar power through the use of ponds, small-scale hydropower in agricultural communities, biomass power, and bioethanol production through wetland rice cultivation on fallow land, of which there is as much as roughly 400,000 ha nationwide.

Throughout these, it indicates ways of using land other than cultivated land, such as setting up mega solar plants on fallow land and "solar sharing" that installs solar power systems on farmland. It also demonstrates ways that paddy fields and farmland can be used sustainably for things like the production of biofuels.

The Center for Low Carbon Society Strategy of the Japan Science and Technology Agency and the National Institute of Advanced Industrial Science and Technology (AIST) have reported on the potential for producing biofuels by using deserted arable land and fallow land in Japan. According to them, of the deserted arable land and fallow land throughout Japan as much as 63,000 ha is immediately usable land that can be used right away for cultivation (160,000 kL ethanol equivalent) and 169,000 ha is usable land that can be used for agriculture (380,000 kL). They say that cultivating resource crops on deserted arable land that can be restored to paddy fields and farmland will make it possible to produce a total of 540,000 kL of ethanol, which is equivalent to 0.9% of Japan's annual gasoline

consumption (caloric equivalent). The Hokkaido Region has the greatest potential production output for ethanol nationwide at approximately 55,000 kL (Fig. 1). This is because Hokkaido has a vast area of deserted arable land, as well as high yields of sugar beets. What is more, it was also learned that the deserted arable land in the Kanto Region has enormous potential to produce large quantities of ethanol. It is estimated that approximately 35,000 kL of ethanol could be produced by using the deserted arable land that can be restored to farmland in Fukushima Prefecture. (**Author's abstract**)

Keywords: *Japan, biofuel production, deserted arable land, fallow land, natural energy, solar sharing, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/10,
(Filipiniana Analytics)

0392

Power businesses are adopting biomass/coal co-firing

The total power generated in Japan through FY 2007 amounted to 1,023.9 billion kWh. Energy resources for power generation were consisted of crude oil (13.2%), natural gas (27.4%), nuclear (25.6%), coal (25.3%), hydro/geo-thermal and various new energies (7.6%), and pumped-storage hydro-electric power (1%). The balance of energy resources in present Japan looks good.

Power generation cost to produce 1 kWh of electricity by using each of the resources is ranging as follows: 10.0-17.3 yen by crude oil, which looked rather costly, whilst 5.0-6.5 yen by nuclear, and 4.8-6.2 yen by coal, which seemed relatively cheaper. Coalmines and deposits exist in many places around the world and therefore coal is supplied steadily at relatively low prices, which is thought economically favorable. CO_2 emission by burning coal for generating 1 kWh of electricity, however, is the highest compared with those by using other resources, and hence burning coal is thought to be causing a bigger environmental burden.

Power generation by co-firing of coal and woody biomass such as forest residue and thinned wood is now regarded as a practical means to reduce CO_2 emission. In November 2009, Tokyo Electric Power Co. (TEPCO), Chugoku Electric Power Co., and Kyushu Electric Power Co., one after another, made announcements that each company would launch a proof project for cofiring power generation using woody biomass resources, and that their cofiring rate of woody biomass to coal might be 1-3% at present.

Utilization of woody biomass will not only contribute to reduce CO_2 emission from the coal power generation, but also foster sound forest development by making an efficient use of hitherto neglected forestry resources. In this regard, local people are looking forward to introducing aforementioned woody biomass utilization for cofiring power generation in order to revitalize their community.

As for power generation by cofiring of woody biomass and coal, Shikoku Electric Power Co., Hokuriku Electric Power Co., and Electric Power Development Co. (J-Power), respectively, have been conducting proof experiments. In addition, Kansai Electric Power Co. and Okinawa Electric Power Co., respectively, has plans for conducting proof projects. It is a large step forward to create a low-carbon society that Japanese major electric companies are coming into the cofiring power generation business. (**Authors' abstract**)

Keywords: *biomass, coal co-firing, Japan, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0393

Power generation and energy saving in Cambodia – a biomass-rich-country

Supply of primary energy in Cambodia in 2007 amounted 5.163 million ton COE (crude oil equivalent), in which domestic woody biomass, consisted of firewood, charcoal and rice straw, was 3.62 million ton COE, sharing 70.3% of the primary energy. Firewood shares most of the woody biomass and used as fuel for cooking in most of the households. On the other hand, all oil products – gasoline for automobiles, diesel oil for power generation, LPG (liquefied petroleum gas) for home and general use – are being imported.

Agriculture is the biggest key industry of Cambodia. Agricultural population shares 70% of Cambodia's total population of 14.5 million. As for the harvest in 2003, rice amounted to 4.71 million ton, cassava 0.33 million ton, corn 0.32 million ton, and sugarcane 0.17 million ton, respectively. Nearly 1.38 million ton of waste agricultural products such as rice chaff and bagasse (squeezed lee of sugarcane) are generated every year, and this is roughly 25% in proportion to the amount of harvest. This waste is now focused on as a new resource for biomass energy.

Meantime the European Council has been promoting popularization of co-generation in ASEAN countries. COGEN3-PLAN that supports the popularization of co-generation has made an assessment of biomass power plant to be constructed at a rice mill near Puhnon Peng. The assessment has shown that the plant could supply enough amounts of electricity and heat, which could replace use of light oil, and that the total investment would be 3.34 million euro.

As for firewood cooking stoves used at general homes, it is estimated possible to improve their performance by some modification to airflow and heat-insulation thereby raising burning efficiency. Fairly 30% of energy saving is expected. By introducing improved firewood cooking stoves, the country will be able to save 0.563 million ton COE of energy, since energy consumption by burning firewood is quite large in this country. Like the examples mentioned above, Cambodia is now keenly making assessment on various projects for power generation as well as energy saving, in view of utilizing the country's rich biomass resources. (**Authors' abstract**)

Keywords: *Cambodia, power generation, domestic woody biomass, agriculture, firewood, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/08,
(Filipiniana Analytics)

0394

Power generation potential by EFB and rice husk in Indonesia

Indonesia is an agriculture country producing the largest amount of palm oil in the world, besides it is ranked as No.4 rice producing country. Annually19 million ton of palm oil, and 60 million ton of rice are produced there, and consequently a huge amount of agricultural waste are being generated which is becoming a social problem to be urgently managed. As for the production of palm oil, same weight of EFB (Empty Fruit Bunches) is left as waste. Likewise Rice Husk generates as much as 20% of rice, in terms of weight. Annually the amount of generated EFB and Rice Husk are19 million ton and 12 million ton, respectively.

These wastes burn very well and with plenty of heat, so they are suitable for thermal power generation. Since one ton of EFB can generate 1,330 kWh of electric power, 19 million ton of EFB can generate 25,270 GWh. Current price of

electricity is 6 cent/kWh, therefore power generation using 19 million ton of EFB will be 1.52 billion dollars sales per year.

Looking from another aspect, total production cost for 19 million ton of palm oil is 6.6 billion dollars per year (based on small farm's production cost that is 348 dollars /ton). Hence, 23% of the total production cost of palm oil will be canceled out by sales of EFB power.

On the other hand, 1 ton of Rice Husk can generate 800 kWh of electric power. Hence, 12 million ton of Rice Husk can generate 9,600 GWh of power. Indonesia's total electric power generated in FY 2006 was 115,218 GWh. In conclusion, Indonesia's EFB and Rice Husk altogether can generate 34,870 GWh, and this may well cover 30% of the country's demand.

The International Finance Corporation stated, with regard to effective utilization of EFB, that production of palm oil of 1 ton leaves 1 ton of EFB as industrial waste, and that if all EFB is burnt at power stations, Indonesia would obtain 4,200 GWh of surplus electric energy even if energy consumed by plant itself be subtracted. PT PLN (Indonesian national electric power company) expressed that it would certainly welcome the project plan for constructing a bio-energy-driven power plant promoted by IFC. (**Author's abstract**)

Keywords: *Indonesia, palm oil, empty fruit bunches, rice husk, thermal power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/07,
(Filipiniana Analytics)

0395

Power generation that uses forest trimmings is making progress throughout Japan

Woody biomass is categorized into unused forest trimmings, timber offcuts from saw mills, and wood chips generated from construction, depending upon the manner in which it is generated. Of these, the reuse rates for timber offcuts from saw mills and wood chips generated from construction are 95% and 90%, respectively. But unused forest trimmings are woody biomass that is abandoned within forests and that is not reused for the most part because of the costs involved in collecting and transporting it. The Feed-in Tariff Scheme for Renewable Energy that was instituted in July 2012 set its purchase price at the highest at 33.6 yen/kWh. This is because there are costs involved in the collection and transportation of unused forest trimmings, and so its purchase price is high at 12,000 yen per ton.

It will be crucial to expand the use of these forest trimmings in order to promote the use of energy from woody biomass. What is more, using unused forest trimmings has enormous economic benefits for local regions in terms of regenerating forests, expanding employment in the forestry industry, and the production of renewable energies.

The commercialization of power generation by using forest trimmings has spread to all over Japan spurred on by the feed-in tariff scheme. This has enormous promise when it comes to revitalizing forestry and other related industries in local regions. (**Authors' abstract**)

Keywords: *Japan, power generation, forest trimmings, woody biomass, feed-in tariff system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/10,
(Filipiniana Analytics)

0396

Practical application of *Botryococcus* biofuels drawing Near (Japan)

Whereas the vegetable oils from rapeseed, palm, and jatropha and the oils produced from many types of microalgae are triglycerides (plant-derived oil), the oil produced from *Botryococcus braunii* is a hydrocarbon (petroleum-derived oil) that is close to petroleum. There are major advantages with the hydrocarbon produced by *Botryococcus*, such as the fact that it can be used in the machinery at current petrochemical plants as it is and it can produce gasoline and diesel oil.

Botryococcus uses light and CO_2 to produce large quantities of roughly 100 tons of liquid hydrocarbons per hectare each year, giving it an oil production capacity that is ten times to several hundred times greater than that of plants. Japan has accelerated development with a view toward the practical application of biofuel production from *Botryococcus*.

In August 2011 DIC Corporation (formerly Dainippon Ink and Chemicals) announced that it will develop technology for mass producing *Botryococcus* jointly with the University of Tsukuba. The University of Tsukuba (Professor Makoto Watanabe) has established technology for extracting oil from algae, refining it, and turning it into biofuels. DIC Corporation produces 800 tons of *Spirulina*, a type of algae for health foods, each year, making it the world's largest manufacturer. Cutting costs is a challenge when it comes to the practical application of biofuels, and so it is aiming for practical application through joint research.

In July 2011 the University of Tokyo announced that it had succeeded in identifying Botryococcus as an enzyme gene involved in the production of hydrocarbons. Associate Professor Shigeru Okada, et. al. studied the mechanisms for why and how *Botryococcus* produces hydrocarbons and releases them outside the cell. This success has enabled the conversion to *Botryococcus* with better productivity and can contribute enormously to the practical application of biofuel production. (**Authors' abstract**)

Keywords: *Botryococcus braunii, biofuel, hydrocarbon, oil production capacity, Spirulina, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/09,
(Filipiniana Analytics)

0397

Practical application of jet fuel from algae within five years (China)

The Civil Aviation Administration of China (CAAC), which is an administrative body that oversees airline companies within China, has laid out a policy of reducing CO_2 emissions from its commercial airline industry by 22% by the year 2020 compared to 2005 levels. The backdrop to this lies in the fact that the CO_2 emitted by China's aircraft flying international routes has risen by an annual rate of 7.75% from 1990 to 2007, and as of 2007 it had roughly doubled compared to the year 2000 to 21.15 million tons.

A distance of roughly 2,400 km separates Beijing and Guangzhou, and to fly this distance requires 18 tons (23,000 liters) of jet fuel which emit 57 tons of CO_2. Since the cost of jet fuel is 7,768 yuan per ton (93,200 yen per ton), this calculates out to costing 1.68 million yen in fuel expenses for a single flight. The cost of fuel oil accounts for 40% of the cost of Chinese airline company flights, making this their biggest expenditure. Steep rises in the price of petroleum

will continue for the future and the cost of petroleum will remain unstable, so there are demands for a stably priced fuel.

As such, the CAAC is pressing ahead with the use of biofuel as a fuel that reduces CO_2 emissions and is stably priced. A project to manufacture biofuel from algae and jatropha is currently being promoted in China. Biofuel from jatropha is supplied by Petro China, which is China's largest company for petroleum and natural gas.

Moreover, in September 2010 The Boeing Company (United States) and Qindao Institute of Bioenergy and Bioprocess Technology (QIBEBT; a research laboratory of the Chinese Academy of Sciences) established a joint research laboratory to facilitate research on biofuel for aircraft that is made from microalgae. This laboratory is aiming for the practical application of this technology within five years and its commercialization within ten years.

A test flight using these biofuels is scheduled to be carried out in China in 2011. Deutsche Lufthansa AG (Germany) began flying with the use of biofuels for its regular flights between Hamburg and Frankfurt in July 2011. It will run four round-trip test flights every day over the next six months. It has entered the stage of practically applying bio jet fuel through the use of biofuel for its regular flights. (**Authors' abstract**)

Keywords: *jet fuel, carbon dioxide emission, algae, jatropha, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/09,
(Filipiniana Analytics)

0398

New President Obama declares support for increasing production of biofuel

Crude oil reached USD 147 a barrel in July of 2008 and subsequently fell rapidly to USD 30. The US Department of Energy forecast is for an eventual increase, and the International Energy Agency (IEA) forecasts a price in excess of USD 200 a barrel in 2030. The new President Obama has indicated a desire to reduce reliance on imported petroleum from the viewpoint of national security, and has announced support for increased production of biofuels such as bioethanol. According to this policy, the administration plans to double within three years the supply of renewable energy as obtained from sources such as bio-fuels, wind power, and the sun.

In Japan as well, the use of biofuels as a petroleum substitute has assumed urgency in light of a number of factors including rapid changes in the price of petroleum, depletion of resources, and the need to prevent global warming. The Japanese bioethanol market amounted to 400,000,000 yen in 2007, and by 2015 is expected to reach 160,000,000,000 yen. The biodiesel market amounted to 600,000,000 yen in 2007, and is expected to reach 8,000,000,000 yen in 2015. (**Author's abstract**)

Keywords: *crude oil, renewable energy, International Energy Agency, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/01,
(Filipiniana Analytics)

0399

Process development active in New Zealand for producing biofuel from algae

It is well known that technology of producing biofuel from algae can utilize artificial fish reef. Aquaflow Bionomics Co. of New Zealand has been developing a new technology to collect 70 to 90 % of algae that grow in the aeration tank of urban sewage treatment system, and then produce biofuel from the algae. The pilot system (70 m3/h) has been operated for two years, and reportedly, it can be operated with sufficient output, even during winter season when ambient temperature stays low. This pilot plant has treated not only urban sewage but also sewage from agriculture factories and wineries, because urban sewage has a less BOD (Biochemical Oxygen Demand).

The company, jointly with Universal Oil Product Co. (one of leading companies of oil-making technology development in the country), has been also conducting research on the use of the biofuel extracted from algae.

Since 2003 a venture business called Solray Energy Co. has been developing technology of its own to extract biofuel from algae that were cultured in urban sewage treatment system. The algae are cultured in an outdoor aeration pond, by controlling CO2 content in the water and photosynthesis. As a result of high appreciation of the capability of the Solray Energy Co., the abovesaid two companies agreed to start a joint study to develop a production process for biofuel from algae. There are many systems of methane fermentation from sewage sludge, however this sewage treatment system has innovative and revolutionary technology because biofuel-oil can obtained from algae as by-product. (**Authors' abstract**)

Keywords: *biofuel production, algae, urban sewage treatment system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0400

Producing biogas from sewage sludge and coffee grounds

Kurobe City, Toyama Prefecture completed a sewage biomass energy utilization facility in May 2011. This facility conducts methane fermentation by mixing sewage sludge and the residual coffee grounds left over after coffee beans have been ground and brewed. The facility has been under construction since August 2009 within the Kurobe Municipal Purification Center. Using concentrated sewage sludge (26,248m^3 per year) and coffee grounds from the neighboring Asahi Soft Drinks Co., Ltd.'s Hokuriku Plant (2,884m^3 per year) as its raw materials, the facility produces 2,728m^3 of biogas per day.

The recovered biogas is used as boiler fuel to recover heat, and also for recovering both electricity and heat via a micro gas turbine. The recovered heat is used to dry the sludge that gives rise to the methane fermentation treatment, with the dried sludge then being sold to thermal power plants as fuel. In addition, the recovered electricity is used at the Kurobe Municipal Purification Center. Operating this facility will make it possible to reduce the amount of CO_2 generated by 1,000 tons a year.

Asahi Soft Drinks Co., Ltd.'s Hokuriku Plant produces 390 million cans of canned coffee a year, thereby generating a large amount of coffee grounds each year. It had previously been taking these grounds to a company outside of the prefecture as industrial waste and having it processed into fertilizer, with the treatment costs from this-including the transportation costs-exceeding 100 million yen per year. By using these coffee grounds for biogas within Kurobe City, all it needs to do is transport them the short distance of roughly 7km from the plant to the purification center. This has enabled the plant to substantially lower its transportation costs, while also cutting down on the emissions of CO_2 from transportation. On the other side, this allows Kurobe City to secure its raw materials in a stable manner.

Coffee grounds have a moisture content that is in excess of 65%, with more than 99% of their solid matter (percentage by weight) comprised of organic waste matter that is composed of carbon. This makes them ideal as a raw material for methane fermentation. No time or labor is needed to grind them, and it is claimed that the biogas they generate is 10-times that compared to that given off by just concentrated sewage sludge alone. Allowing Kurobe City to use the coffee grounds produced from the neighboring plant enable both the local company and the government to enjoy advantages. These include setting in place a structure whereby regional biomass is used for the sake of the region, and making significant advances in expanding the use of renewable energy. (**Authors' abstract**)

Keywords: *biogas, sewage sludge, coffee grounds, boiler fuel, biomass energy utilization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/07,
(Filipiniana Analytics)

0401

Production and utilization of bioethanol are getting up speed

Japanese Government has designated the targets of bioethanol popularization in the country to be 50,000 KL in FY 2010, 1,000,000 KL in FY 2020, and 3,800,000 KL in FY 2030. As for the raw materials for the bioethanol production in this plan of popularization, carbohydrate types of biomass are being used at the start, but in the future, it is planned to utilize grass and wood types biomass that do not compete nor interfere with production of agricultural food or feed.

For using bioethanol as fuel for automobiles, two different methods are being adopted in Japan today. 1. To mix some portion of ethanol with gasoline. For example, E3 fuel, containing 3% of ethanol, is being sold at market. 2. First, Bio-ETBE (Ethyl Tertiary Butyl Ether) is synthesized from bioethanol and isobutene, and then Bio-ETBE is mixed with gasoline. Bio-Gasoline containing 7% of Bio-ETBE is being sold at market.

Japanese Government promotes popularization of bioethanol by adopting the said two methods. During FY 2009, production and use of bioethanol has been getting up speed, with the setting-up of proof plants as well as regular operation of practical plants (see the Table). Thus, popularization of bioethanol in Japan is certainly in progress! (**Authors' abstract**)

Keywords: *bioethanol, bioethanol production, E3, Bio-ETBE, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/01,
(Filipiniana Analytics)

0402

The production of algae biofuel is making progress in India

Algae biofuel is attracting increased attention as a next-generation biofuel. Algae absorb CO_2 during its growth process to produce oil, and it also propagates rapidly. What is more, since there is no competition with foodstuffs, making biofuel from algae could simultaneously resolve the soaring costs of crude oil and food along with global warming.

With its proximity to the equator, India has numerous regions that have a tropical climate as well as tropical ocean areas with ocean surface temperatures of 29°C. This makes it suitable for growing algae, which can be harvested several times a year. As such, the production of algae biofuel is making progress in regions all over India.

Sea6 Energy, which is found in Chennai on the east coast of India, and Novozymes in Denmark concluded a partnership agreement regarding the production and development of bioethanol from seaweed in January 2012. Novozymes will develop an enzyme that will convert the carbohydrates found in seaweed into sugar, and Sea6 Energy will develop a low cost cultivation method through seaweed cultivation techniques.

A fuel trial using B20 was carried out with biodiesel fuel from salt-water micro algae cultivated by the Central Salt Marine and Chemical Research Institute (CSMCRI) in Bhavnagar on the west coast of India, which achieved a fuel efficiency of 12.4 km/liter (July 2012).

The National Environmental Engineering Research Institute (NEERI) announced in February 2012 that it would join forces with Purti Power and Sugar Ltd. to construct a plant for producing industrial-grade biodiesel fuel from fresh-water micro algae at Purti's industrial district in Bela. (**Authors' abstract**)

Keywords: *India, algae biofuel, seaweed, B20, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/08,
(Filipiniana Analytics)

0403

Production of bioethanol consistent with food supply

In August 2010, MAFF (Ministry of Agriculture, Forestry and Fisheries of Japan) released a draft for "the Basic Law for the Promotion of Biomass Utilization", in which MAFF designated a set of target values of biomass utilization ratio to be attained by 2020. At this moment, the following kinds of biomass have attained quite high ratio of utilization: cattle excrement (90%), black liquor (100%), waste wood from lumber mills (95%), and waste wood from construction (90%).

On the contrary, forestry residue has been utterly neglected and its reuse ratio stays nearly zero. As for waste food, its reuse ratio remains as low as 27%. Therefore, MAFF intends to raise the reuse ratio up to 30% for forestry residue and 40% for waste food, respectively, by 2020.

Regarding the use of biofuels, Japanese government has issued an energy policy in June 2010 that Japan should attain, by 2020, a level of biomass utilization that would replace 3% of annual domestic consumption of gasoline (corresponding to 1,800,000 kâ„). At present, bioethanol is being produced from sugarcane, corn and rice that are valuable food crops. For stable supply of food materials, however, it would be necessary, in near future, to produce bioethanol from other kinds of plant and woody biomass that would not compete nor interfere with production of food crops.

Non-edible part of food crops such as rice-straw and chaff have been generated as much as 14 million ton a year in Japan. About 85% of them have been used for making compost, cattle feed, cattle-barn floor-cover, fuel, as well as for mixing into farmland soil as fertilizer. For utilizing the non-edible parts as an energy resource, it is possible to produce bioethanol from them.

Kawasaki Heavy Industries Ltd.(KHI) made an announcement on 6 October 2010 that KHI has succeeded in producing bioethanol from rice-straw by "the bioethanol production technology using hot-water-method processing".

The newly developed production technology does not use sulfuric acid nor enzyme that is necessary in traditional saccharification process, and therefore it can drastically reduce production cost of bioethanol. For the time being, KHI intends to perform a range of proof experiments and improvement of production plant, aiming at reducing production cost down to 40 yen per liter, so that KHI may begin a commercial production by 2012.

By realizing this new technology in commercial base, rice can be used for two ways, i.e., as food on one hand and as an energy resource on another hand. Multiple-step use of biomass resource like this – as food and as energy – seems to be quite ideal. (**Authors' abstract**)

Keywords: *biomass, bioethanol, biomass utilization, saccharification process, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/11,
(Filipiniana Analytics)

0404

Production of biofuel from the exhaust gas from steel plants

LanzaTech NZ Ltd. was established in New Zealand in 2005 and is now a global company with its main office in Illinois in the United States. It has developed the gas fermentation technique shown in Fig. 1 in which ethanol is obtained from CO or CO_2 with the use of microalgae. Using this technology, the company has been operating a demonstration plant that manufactures 300 tons of ethanol each year by using exhaust gas from Baosteel Co., Ltd. and Shougang Steel in China. It also plans to begin operating two commercial furnaces in China sometime in 2014.

In addition, LanzaTech NZ Ltd. announced on August 14, 2013 that it had successfully developed the technology to manufacture acetic acid through its gas fermentation technique using the CO_2 contained within exhaust gas, which is based on the fermentation technique described above. This was jointly developed with Indian Oil Corporation Ltd. and the Department of Biotechnology, which is a governmental agency in India. Together with Jindal Steel and Power Ltd. (JSPL) of India it has jointly developed the technology to use genetically modified cyanobacteria that uses this acetic acid as its source of nutrients to produce oil, and have stated that they are aiming to commercialize this by producing 500,000 tons each year by 2018.

In March 2014 Mitsui & Co., Ltd. took the lead in providing USD 60 million in financial assistance to LanzaTech NZ Ltd. for its R&D on effectively using the emissions of CO or CO_2 from the steel industries in China and India, which will continue to grow in the future. (**Author's abstract**)

Keywords: *renewable energy, exhaust gas, steel plants, biofuel, New Zealand, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/05,
(Filipiniana Analytics)

0405

Production of biofuel using the world's most advanced fermentation technology

Japanese fermentation technology, developed in the production of sake, shochu, and miso, is recognized as world class, and research into the use of this technology to manufacture biodiesel from wood biomass as a diesel substitute is currently underway by the National Research Institute of Brewing. The manufacture of biodiesel from lignin using yeast is a world first, and commercialization is planned for 2015. Biodiesel is currently manufactured from rapeseed etc, however research and development focused on industrial production from ligneous materials is now a matter of urgency to avoid competition with food resources.

A research group from Gifu University led by Professor Takamizawa focusing on the manufacture of biomass fuels from ligneous materials using enzymes and microorganisms has succeeded in obtaining a yield of 90-100% in the production of high-quality ethanol from golf course grass clippings. (**Author's abstract**)

Keywords: *Japan, Fermentation technology, biodiesel, yeast, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/01,
(Filipiniana Analytics)

0406

Production of high purity hydrogen from sewage sludge

The sewage emitted from Japanese homes and factories is purified in sewage treatment plants, with the sewage sludge that is the treated residue from this coming to the enormous volume of 2.23 million tons (on a dried basis) in FY2008. At present this sewage sludge is treated by having its weight reduced by means of dehydration (160,000 tons), incineration (1.56 million tons), melting (210,000 tons), composting (240,000 tons), and drying (60,000 tons). But for the sake of making the switch over to a recycling-oriented society in the future, there is a need to convert over to a system that will utilize and reuse this as resources and energy by digesting, carbonizing, and composting this sewage sludge, as well as recovering phosphorous from it.

Tohoku University (Professor Fumiyoshi Saito) developed a technique for producing highly pure (89.4%) hydrogen gas from sewage sludge at a low cost. Professor Saito's group had previously studied hydrogen production from woody biomass (cellulose), and had succeeded at producing highly pure (98%) hydrogen. This time around they took this technique even further by applying it to sewage sludge.

An inorganic powder of calcium hydroxide $Ca(OH)_2$ and nickel hydroxide $Ni(OH)_2$ is mixed with raw materials for biomass like rice straw, printing paper, coffee grounds, and woody biomass from cedar wood and then dry pulverized. Afterwards, it is heated to 400°C in a non-oxidative environment, at which time the cellulose in the woody biomass reacts with the inorganic powder, which produces hydrogen and leaves behind calcium carbonate $CaCO_3$.

With the hydrogen obtained from the sewage sludge with this process, after sewage sludge with a moisture content of 80% is mixed with the inorganic powder, high purity hydrogen can be obtained just by heating it to about 600°C. Compared to hydrogen production from woody biomass, this does not require a drying and pulverizing process, thereby making it possible to lower the hydrogen gas production costs substantially. There are great expectations for this groundbreaking technology from the two dimensions that it both cuts the cost of treating the sewage sludge and makes it possible to produce hydrogen inexpensively. (**Authors' abstract**)

Keywords: *sewage sludge, high purity hydrogen, inorganic powder, cellulose, hydrogen production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/01,
(Filipiniana Analytics)

0407

Production of plant-derived polymers of high added-value

Kaneka Corporation plans to begin mass-production of a new kind of plant-derived soft polymer called Kaneka PHBH in 2010. Kaneka announced they would spend 25 billion yen for the production facilities and R & D, and its production capacity would be 1,000 tons per year. This soft polymer is biodegradable in soil and turned into carbon dioxide and water. In the world, this is the first case of practical use of biodegradable polymer.

Besides, a promising invention was made by a joint research among Forestry and Forest Products Research Institute, Tokyo University of Agriculture and Technology, and Nagaoka University of Technology. The research team succeeded in producing a high performance adhesive from lignin efficient for gluing together metals. Since lignin constitutes 30% of woody materials, this invention would help developing the use of biomass for industrial material production and processing of high added value. (**Author's abstract**)

Keywords: *Japan, Kaneka PHBH, plant-derived soft polymer, adhesive, lignin, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,
(Filipiniana Analytics)

0408

Production potential for bioethanol in Cambodia

In Cambodia, cassava is in second place in terms of agricultural production output after rice. As such, Idemitsu Kosan Co., Ltd. is carrying out a commercialization survey on producing bioethanol using cassava as a raw material. In 2012, Idemitsu Kosan Co., Ltd. concluded MOUs related to the development of bioethanol fuel with the Ministry of Agriculture, Forestry and Fisheries of Cambodia and the Cambodia Mine Action Center (CMAC). With these, the plan is to produce and sell 200,000kl of ethanol each year by the early part of the 2020s. The results of the survey that was the first stage in this were reported in June 2015.

Cassava production in Cambodia thrives in the provinces of Battambang, Kampong Cham, Pailin, and Bentey Meanchey, as indicated in Fig. 1. In Battambang, which was the target of this survey, cassava production doubled from 2 million tons in 2013 to approximately 4 million tons in 2014 (equivalent to 97,000 hectares of cassava fields). At present, Idemitsu Kosan Co., Ltd. has contracted out 100 hectares' worth, and it is moving forward with contracting out the 15,000 hectares of cassava fields it will need for the raw materials for its factory with a view towards commercialization. In the second stage survey that will be carried out in the future, the plan is to assess the undertaking's commercial viability, including the construction site for the factory and the construction of the factory. Once the factory is completed, local farmers who export their crops to Thailand will no longer be at the whim of the cassava market in Thailand, and can expect to earn a stable salary. (**Author's abstract**)

Keywords: *Cambodia, bioethanol, renewable energy, cassava, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,
(Filipiniana Analytics)

0409

Progress being made in using sewage sludge as energy

The sewage coverage rate in Japan has reached nearly 74%, with the sewage sludge produced from sewage treatment processes coming to 2.21 million tons (FY2008) on a dry weight basis each year. This sewage sludge is turned into 714,000 tons of solid matter by having its volume reduced (via anaerobic digestion, incineration, melting, composting, and carbonization). It is then reused in cement, construction materials, green farmland, etc., with the remainder being disposed of in landfills.

Roughly 80% of the dry sewage sludge consists of organic matter (biomass). When calorific value of the sewage sludge assumes 19MJ/kg(4,540 kcal/kg), the value of energy is approximately 42 x 109 MJ/year; and this is equivalent to crude oil of 1.08 million kL. Organic matter(biomass) is converted into solid matter and gas by means of having its volume reduced. However, digester gas (13.0%), green farmland (9.7%), and solid fuel (0.7%) are the only applications through which this is reused. The remaining 76.6% becomes combustion gas (CO_2) and goes unused, and so boosting energy utilization is orienting work in sewage business.

Moves to reuse the organic matter found within this sewage sludge as energy are spreading all across Japan (see table). The organic matter is converted to carbides and used as fuel. (**Authors' abstract**)

Keywords: *sewage sludge, anaerobic digestion, carbonization, biomass, biomass energy utilization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/06,
(Filipiniana Analytics)

0410

Progress in the deregulation of geothermal power in national parks

Japan has the third largest resources of geothermal power in the world. Of all the renewable energies, geothermal power is not governed by the weather and it can stably supply power year-round, on account of which there are expectations that its adoption will expand moving forward. However, since suitable areas for geothermal power are located within national parks and quasi-national parks, a state of affairs has persisted in which approval was denied for installing it in such locations. Due to the deregulation of March 2012, conditional approval was given for the construction of geothermal power facilities in ordinary zones and Class 2 and 3 special zones within national and quasi-national parks. Table 1 shows geothermal power plants that have begun operating since the establishment of the FIT scheme (July 2012). Aside from the Shichimi Onsen Hotel Keizantei Binary Power Plant, these are all outside of national and quasi-national parks, and no progress has been made on the adoption of geothermal within such parks.

In response to this, the Ministry of the Environment established the Review Committee for Facilitating the Creation of Best Practices related to Geothermal Development in National and Quasi-National Parks and began investigating this in March 2015. Based on its results, there was a new round of deregulation in October 2015 (Table 2). First off, regulations restricting the height of buildings housing power generating equipment to no more than 13 m were eased on the condition that consideration be given to the scenery. This has made it possible to install large-scale power generating equipment, with the expectation being that this will improve profitability. Moreover, when it comes to the excavation of generation wells, which had been forbidden in Class 1 special zones, approval was given for directional drilling to be performed from other regions on the condition that this does not affect the ground surface.

Taking large-scale development as the example, the estimated amount of geothermal power to be installed by 2030 (Table 3) announced by the Agency for Natural Resources and Energy in March 2015 would be 320,000 kW under the current regulations. But it indicated that if deregulation were to be carried out, then this would increase to roughly 610,000 kW. The hope is that the adoption of geothermal power will expand as a result of advances in deregulation. (**Author's abstract**)

Keywords: *Japan, geothermal power, deregulation, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/11,
(Filipiniana Analytics)

0411

Progress seen in the development of concentrating solar power in India

Concentrating solar power is a method of generating electricity by using reflective mirrors to concentrate sunlight in order to produce heat that generates high temperature steam which turns a turbine. Globally this holds promise for generating power over and above that from solar power, especially in the Sun Belt region where solar radiation is particularly intense (roughly 2,000 kWh/m^2/y or more).

Globally, concentrating solar power is expected to account for approximately 10% of the amount of electricity generated around the world by 2050. The reasons for this are because: Costs can be reduced by scaling it up (it could potentially be cheaper than solar cells); it can generate electricity even at night time via thermal storage that is less expensive than rechargeable batteries (it can supply baseload electricity); and it is suited to the Sun Belt region where direct solar radiation is particularly intense.

The International Energy Agency (IEA) has announced the proportion of total electricity consumption that concentrating solar power will account for in various countries throughout the world. It says that in Group 1 countries, where solar radiation is intense, this will reach 40% by 2050. India is a country in the Asian region where solar radiation is particularly intense. The country is moving ahead with the construction of concentrating solar power plants in the states of Rajasthan and Gujarat in the northwest part of the country, which will have generating capacities of 10MW and 25MW, respectively. There are other plans aside from this that are also being considered, as manufacturers with proven track records from the United States and Spain are aiming to enter the Indian market. As Japan is not a suitable location for concentrating solar power it has no plans to install any such facilities, but it is engaging in the development of equipment targeted at overseas markets. (**Authors' abstract**)

Keywords: *India, solar power, concentrating solar power, renewable energy, reflective mirror, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/10,

0412

Progress with Rural Electrification in Laos

In Laos, economic development has been advancing with a GDP growth rate that hovers around 7-8%. But in rural areas there are many regions that have not received the benefits from electrification, and so the country's electrification rate remains down around the 70%-level. The Ministry of Energy and Mines has been deploying its Power to the Poor program nationwide since 2010, which carries out projects to increase the electrification rate to 90% by 2020. There are households with power lines that run nearby, but which are unable to use electricity because they cannot bear the costs of connecting to the grid. This program promotes electrification by lending these households the money to connect to the grid.

Conversely, in those cases where there are no power lines nearby, it enables them to make use of the Rural Electrification Fund (REF), and also offers tax breaks for the purchase, construction, and management of imported equipment. When it comes to off-grid electrification in which people do not connect to the power grid, solar home systems (20-30 MW), solar power mini-grids, and other such equipment are used. Laos is moving forward with installing more than 16,000 solar power systems in rural areas each year (Fig. 2) by capitalizing on its abundant solar radiation conditions, which at their maximum are nearly twice those in Japan, as shown in Fig. 1.

Sunlabob is a company from Laos that has installed 10,000 solar power systems in more than 500 villages with such promotional measures. Using its experience in its own country, Sunlabob has announced that it has concluded a contract to install micro-grids in 11 rural areas in Myanmar with the Ministry of Livestock, Fisheries and Rural Development of Myanmar in October 2015. The funds needed to install these are slated to be provided by the Japan International Cooperation System, with this serving as an excellent example of a project to combat unelectrified regions through the use of multilateral cooperation. (**Author's abstract**)

Keywords: *Laos, rural electrification, grid-connected power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/01,
(Filipiniana Analytics)

0413

Projects of biomass heat utilization started throughout Japan

The so-called new energies including biomass, solar and wind-power, are thought to be valuable for realizing low-carbon societies. Therefore, Japanese Government intends to actively introduce the new energies throughout the country. The actual record of new energy consumption during FY 2005, however, was 11.6 million ton of crude oil equivalent, sharing only 2.2% in the total primary energy consumed in Japan. The government has designated escalating target values (upper ceiling) for the new energy to be consumed in the future, as 19.1 million KL in FY 2010, 20.36 million KL in FY 2020, 32.02 million KL in FY 2030. In this way, the share of the new energy will be raised to 3%, 4% and 6% of the total primary energy.

As for the introduction plan of heat utilization of biomass among new energies, the government designates escalating values as 3.08 million KL in FY 2010, 3.3 million KL in FY 2020, 4.23 million KL in FY 2030, in terms of crude oil equivalent, based on the record of FY 2005. This means the government is trying to expand the heat utilization of biomass to be tripled by FY2030 from that of FY 2005.

Typical or common way of heat utilization of biomass is direct burning of woody biomass in the forms of pellets and chips made from forest residue and/or thinned wood, to produce heat energy. The original resource of woody biomass, however, can be obtained in many places in Japan, but in a rather small quantity depending on each local condition. Therefore, every local region has developed its own way that is most suitable for utilizing woody biomass in the region. Recently, utilization of woody biomass has been evolving and expanding in many local areas in this manner. The Table introduces some examples that are reported from seven places from Hakodate in Hokkaido to Karatsu in Kyushu. (**Authors' abstract**)

Keywords: *Japan, biomass, biomass heat utilization, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/01,
(Filipiniana Analytics)

0414

A promise of a high efficiency bioethanol production from woody biomass

The Tokyo University of Agriculture (TUA), The Nagasaki Institute of Applied Science (NIAS) and Sekisui Chemical Co. announced, on 19 August 2009, that they have obtained a promise of a high efficiency, bioethanol production technique. Using gasification technique, woody biomass is turned into carbon monoxide (CO) and hydrogen (H_2), and the synthesis gas of CO and H_2 is directly changed into bioethanol.

So far, industries have adopted “saccharification and fermentation process” for producing bioethanol from woody biomass, where woody biomass is first dissolved into sugars and then the sugars are fermented by yeast and changed into ethanol that is finally refined by distillation. Sakai City in Osaka prefecture and Maniwa City in Okayama prefecture respectively are conducting proof experiments for production of bioethanol using aforementioned new technique, utilizing woody waste discharged from construction industries and lumber sawmills, in addition they are conducting running experiments of automobiles using E3 (3%-bioethanol mixed gasoline).

The new bioethanol production process developed by the three institutes is a kind of “direct synthesis process”, where synthesis gas (CO and H_2) that is obtained from woody biomass is directly processed into bioethanol using a kind of rhodium (Rh) system catalyst. This R&D project has been contracted to the Ministry of Agriculture, Forestry and Fishery since FY 2009. A proof plant has already been installed at UTA and is being put into a range of trial runs.

The direct synthesis process has markedly higher efficiency of bioethanol production. The yield ratio of the direct synthesis method is 51.3%, whereas that of saccharification and fermentation process is only 12.5%, where dried woody biomass is used as raw material. The direct synthesis method has 4 times higher yield than saccharification and fermentation method. The production cost of bioethanol by the new process is estimated to be less than 80 yen per liter. (**Author's abstract**)

Keywords: *bioethanol production, woody biomass, Japan, gastification technique, simultaneous saccharization-fermentation process, E3-gasoline, direct synthesis, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0415

Promoting biomass cogeneration in India

In the aim of reducing energy consumption, India is promoting biomass cogeneration in which power generation and thermal use are carried out simultaneously by using biomass as a fuel. In India's 11th Five Year Plan (2007-2012) it set its target for the adoption of cogeneration from bagasse (strained lees left over from sugarcane) at 1.2 GW. In FY 2012, the final fiscal year of this plan, it overshot this target by 1.4%, giving it a cumulative installed capacity of 2.3 GW in 2013. Biomass cogeneration has been enthusiastically adopted in the sugar manufacturing industry, with bagasse included amongst the waste that is part of the biomass and waste-derived power that accounts for 18% of the demand for industrial energy in India, as is shown in Fig. 1.

In India's 12th Five Year Plan (2012-2017) following this it set its target for the adoption of cogeneration from bagasse at 2.0 GW. As is indicated in Fig. 2, it has been deemed to have a cogeneration potential from other biomass besides bagasse of 9 GW, yet at present progress has not been made in using this.

In response to this, the Ministry of New and Renewable Energy has been providing support to promote its popularization through subsidies for captive consumption biomass cogeneration. In addition, as indicated in Table 1, unique feed-in tariff schemes and purchasing obligations for power companies have been established in different states. The expectation is that the use of these sorts of schemes will accelerate the adoption of cogeneration from biomass beyond just bagasse. (**Author's abstract**)

Keywords: *India, biomass cogeneration, renewable energy, waste-derived power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/11,
(Filipiniana Analytics)

0416

Promoting napier grass/biogas power generation in Thailand

In April 2012 the Thai government announced its Renewable and Alternative Energy Development Plan (AEDP: 2012-2021), which will boost the share of renewable energies out of its total energy consumption from 10% in 2012 to 25% by 2021, and which it has been moving forward with. The AEDP 2012-2021 was revised thereafter, and in June 2013 its target figure for biogas power generation in 2021 was raised from 600 MW to 3,600 MW.

This new policy is designed to achieve the following three goals: 1. Secure domestic energy supplies; 2. Produce compressed biogas and replace LPG and CNG; and 3. Secure income for farmers in rural communities through the cultivation and sale of energy crops (such as the Napier grass used as a raw material for biogas manufacturing plants, for example).

Napier grass is a gramineous perennial plant that can be harvested between five and eight times in a year in tropical regions. When this is used as a raw material, methane production comparable to the 7,000-17,000m^3/ha found with corn can be expected.

In order to popularize biogas power generation in Thailand, consideration is being given to keeping Feed in Tariff for power generated from biogas at 4.5 baht/kWh or higher (1 MW or smaller over a 20-year period). In addition, the Department of Alternative Energy Development and Efficiency (DEDE) is planning to give subsidies worth 300 baht per one ton of raw material crops to farmers. Proposed sites for the cultivation of Napier grass are shown in Fig. 1.

The Thai government reached the decision in November 2013 to contribute subsidies worth 20% of the amount invested (up to a maximum of 20 million baht) to 13 projects for biogas manufacturing plants of 1 MW or smaller using Napier grass as their raw material that are being carried out by companies. The Thai companies that were selected were Universal Adsorbents & Chemicals (UAC) PCL and SMC Power PCL. (**Author's abstract**)

Keywords: *Thailand, napier grass, biogas power generation, renewable energy, program policy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/05,
(Filipiniana Analytics)

0417

Promoting offshore wind power in India

The amount of wind power newly installed in India in 2013 of 1,729 MW placed it in fourth place in the world, and put it in second place in Asia after China. India has a long coastline that stretches 7,600 km, and it is in a good position to install offshore wind turbines along its coast. As indicated in Fig. 1, it has been garnering a great deal of attention for its wind power energy potential in the states of Tamil Nadu and Gujarat in particular, which are also suitable sites for onshore wind turbines. When it comes to the need for offshore wind turbines in India, the need to minimize the environmental impact from onshore wind turbines could be mentioned, as could the promotion of forays by the domestic wind power industry within India into the offshore wind turbine sector, which has been gaining global attention.

The Indian government is planning to get started with its National Wind Energy Mission (NWEM) sometime in 2014, and this is designed to further promote the adoption of wind power. Conversely, owing to the fact that the installation of wind power facilities has made progress in the states of Tamil Nadu and Gujarat, which are suitable sites for wind power, and therefore it will become difficult to secure sites in the future, the Indian government has worked out a plan for promoting offshore wind power. With the NWEM there is the possibility that policies for both onshore and offshore wind power will be laid out.

When it comes to offshore wind power, India has been giving consideration to setting in place a domestic promotion structure, as well as to collaboration with foreign countries with an advanced track record of offshore wind power. Specifically, the Draft National Offshore Wind Energy Policy 2013 was announced by the Ministry of New and Renewable Energy (MNRE) in August 2013. What is more, the National Offshore Wind Energy Authority (NOWA) was established as a lower branch of the MNRE in order to promote offshore wind power, and has been monitoring offshore wind energy, coordinating with various government ministries and agencies, and preparing guidelines.

In terms of cooperation with overseas countries, in January 2014 the MNRE, the EU, and the Global Wind Energy Council (GWEC) announced that they would carry out a project to prepare a roadmap over four years for offshore wind power. Moreover, in February 2014 a partnership between the United Kingdom and India related to offshore wind power energy was initiated. (**Author's abstract**)

Keywords: *India, offshore wind power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/06,
(Filipiniana Analytics)

0418

Promoting the adoption of ocean-based renewable energies in Indonesia

In March 2015, the Indonesian government revised its target for the adoption of renewable energies by the year 2025 up from 17% to 19% by the year 2019, and 25% by the year 2025. In conjunction with this, in May 2015 it announced that it would invest approximately 950 billion yen (500 trillion rupiah) in renewable energies over the next five years in order to promote their adoption.

As an island nation surrounded by ocean, Indonesia is second in the world only to Canada in terms of the length of its coastline. As such, ocean-based renewable energies serve as a promising energy source, as shown in Table 1. There are many sites suited for wave power on the southern side of islands such as Sumatra and Java, while the narrow channel linking the Pacific Ocean and Indian Ocean has been deemed promising for tidal power. Figs. 1 and 2 show the sites suited for wave power and the survey sites for tidal power.

A 2kW tidal power test is being carried out on the island of Flores by a local company in Indonesia, and a 20kW wave power test is being carried out on the island of Madura. In addition to these, in February PLP, which is a manufacturer of power line and electric power equipment, signed an MOU with Sabella of France in relation to tidal power. What is more, the state-run oil and gas company Pertamina signed an MOU with Akuo Energy of France regarding the introduction of renewable energies like ocean thermal energy conversion power. Furthermore, in June Anoa Power, which is local to Indonesia, concluded an agreement on technical development with Bombora Wave Power, which is based out of Perth in Australia. The expansion of the adoption targets in this manner is leading to the invigoration of ocean-based renewable energy development with the involvement of overseas agencies. (**Author's abstract**)

Keywords: *Indonesia, renewable energy, ocean energy, tidal power test, wave power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/08,
(Filipiniana Analytics)

0419

Promoting the Adoption of Renewable Energy Facilities at Eco-Schools

The Ministry of Education, Culture, Sports, Science and Technology is providing support for the adoption of renewable energy facilities at public schools through the Project to Promote Environmentally-Friendly School Facility (Eco-School) Renovations. The goal is to have the schools serve as bases for spreading the word on environmental and energy education to students and local communities.

According to the installation status for renewable energy facilities at public schools announced in December 2015, solar power facilities at public elementary and middle schools throughout Japan are the most commonly installed type of renewable energy facility, and have been installed at 7,371 schools (Table 1). Solar power facilities increased from 1,202 schools in FY 2009 to 7,371 schools in FY 2015 for an increase of more than six-fold over six years (see Fig. 1).

What is more, 711 public schools have been outfitted with wind power facilities, and 230 schools have adopted solar thermal facilities. Japan is putting its effort into the adoption of the three types of renewable energy of solar power, wind power, and solar thermal, such as by having the Ministry of Education, Culture, Sports, Science and Technology provide assistance for half of the cost of installing the facilities, as an example.

At the same time, it was learned that the share of renewable energy facilities installed at elementary and middle schools that can supply power even during power outages rose from 31.6% in FY 2013 to 44.5% in FY 2015. Since elementary

and middle schools often serve as local evacuation centers during disasters, the expectation is that their adoption will be further promoted with a view towards the contribution they make to the local community. (**Author's abstract**)

Keywords: *renewable energy, eco-schools, installation, solar-powered facilities, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/01,
(Filipiniana Analytics)

0420

Promoting the introduction of offshore wind power turbines in Taiwan

In 2012 in Taiwan, the Bureau of Energy in the Ministry of Economic Affairs of Taiwan initiated the Thousand Wind Turbines Promotion. The goal of this scheme is to install a cumulative total of 450 onshore wind turbines by 2020 and a cumulative total of 600 offshore wind turbines by 2030. In Taiwan, there are limitations when it comes to installing turbines on land in regions that are suitable for wind power as a result of the population density, and so it has been placing emphasis on offshore wind turbines. Through its feed-in tariff scheme it provides 19.181 US cents/kWh for power from offshore wind turbines versus 9.054 US cents/kWh for that from onshore wind turbines.

The potential for wind power is shown in Fig. 1. Compared to the capacity that can be installed onshore of 1.2 GW, its potential is 1.2 GW in regions with a water depth of 5-20 m, 5 GW in regions with a water depth of 20-50 m, and 9 GW in regions with a water depth of 50 m or deeper.

At present, progress is being made with the three projects in Table 1 through the Offshore Demonstration Incentive Program (DIP). Four wind turbines are slated to be completed by 2015, with a wind farm of 90 turbines ultimately scheduled to be completed by 2020. (**Author's abstract**)

Keywords: *Taiwan, offshore wind power turbine, renewable energy, feed-in tariff scheme, installation capacity, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/07,
(Filipiniana Analytics)

0421

Promoting the introduction of renewable energies for consumer cooperatives

The Japanese Consumers' Co-operative Union (JCCU), which is a nationwide organization of consumer cooperatives (CCs), is proactively working to disseminate renewable energies, and has been promoting the installation of solar power generation equipment at logistics facilities since FY 2012.

In order to further promote the generation and use of renewable energies, in June 2014 the JCCU established Chikyu Club Co., Ltd., a PPS that supplies power generated by the JCCU for private demand. This PPS purchases mostly renewable energy generated at the JCCU's facilities and supplies this to private homes and facilities and so forth at the same price as ordinary electricity. Table 1 shows the JCCU's existing facilities.

It will further expand this initiative for the future, and in September 2014 it reached the decision to invest in Noda Bio Power JP Co., Ltd., which will generate power from wood biomass and which is slated to go into operation in two years' time. Chikyu Club will carry out an undertaking in which it supplies electricity generated here to the JCCU. The company says that for the future it plans to go about incorporating biomass and wind power in addition to solar power in this manner. Table 2 shows facilities it plans to install in the future.

This business model makes use of the feed-in tariff (FIT) scheme for renewable energies, the structure of which is shown in Fig. 1. Under the FIT scheme Chikyu Club can purchase electricity and receive a levy for renewable energies, therefore it can set the level of its sales price ((1)-(2)) lower than that of normal electricity rates, making it viable as a business by selling this for normal electricity rates. (**Author's abstract**)

Keywords: *Japan, renewable energy, consumer cooperative, solar power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/11,
(Filipiniana Analytics)

0422

Promoting the introduction of renewable energies in Sri Lanka

From FY 2010 to FY 2012 Sri Lanka displayed a high economic growth rate averaging 7.5%, as a result of which its power consumption expanded by roughly 13% over these three years, as shown in Fig. 1. Conversely, as indicated in Fig. 2, wood fuel biomass that has been there since long ago and which is burned directly, such as wood and charcoal, as well as oil constitutes a large percentage of its primary energy consumption. A breakdown of its other 2% of renewable energies reveals that small hydropower accounts for the majority of this, followed by wind power, solar power, and biomass power.

In order to reduce the economic burden from importing oil, the Ministry of Power and Energy formulated the National Energy Policies and Strategies of Sri Lanka (2008), in which it states that it will raise the proportion of its total power comprised of renewable energies to 10% (for an installed capacity of 734 MW) by 2015. What is more, the Development Framework of the Government of Sri Lanka (2011) added the goal of increasing this to 20% (for an installed capacity of 1,114 MW) by 2020. Fig. 3 shows its performance with introducing renewable energies (up through September 2013). Furthermore, Fig. 4 shows its plans to introduce renewable energies up through 2020.

The following two cases are moves by Japanese companies that are involved in introducing and popularizing renewable energies in Sri Lanka that began in 2014. 1. IS Securities Co., Ltd. (Tokyo) has a business partnership with Hydro Power International (Pvt.) Ltd. through its securitization of hydropower projects in Sri Lanka; 2. ZE ENERGY Co., Ltd. (Tokyo), which manufactures and sells biomass generators, has concluded a basic agreement related to promoting the biomass power industry together with a company in the Sri Lankan power industry, through which it is planning to manufacture and sell biomass generators.

As indicated above, a wide-ranging cooperative structure is being built that includes initiatives such as cooperation from a financial standpoint and supplying generators. (**Author's abstract**)

Keywords: *Sri Lanka, renewable energy, wood fuel biomass, hydropower, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/09,
(Filipiniana Analytics)

0423

Promotion of a waste-to-energy policy in South Korea

South Korea is a country with scant energy resources, so it is dependent on energy from overseas for as much as 97% of its energy. In order to boost the country's energy self-sufficiency rate from the standpoint of energy security, the Ministry of Environment (MOE) of South Korea is promoting a waste-to-energy policy. However, its supply of renewable energies in 2010 came to 5.12 million tons (oil equivalent). This is still at a low level that is equivalent to about 2% of its primary energy supply.

The country's sources of renewable energies mainly consist of waste (78.9%) and hydropower (18.8%). Waste gas, industrial waste, wood scraps, household waste, and other types of waste are put to use in applications such as generating electricity, as fuel for vehicles, and for heating. On September 6, 2011, Cabinet approval was given for the First Master Plan of Resource Recycling (2011-2015), which aims for a society that turns all of its waste into energy and produces no waste. The purpose of this plan is to expand the use of renewable energies and reduce the cost of disposing of waste through incineration and other such means. This plan is expected to create 4 trillion won (280 billion yen) in economic results, cut emissions of CO_2 by 43.06 million tons, and create employment for 11,000 people by 2015.

In June 2011 a facility to produce biogas from food waste effluent was completed by Sudokwon Landfill Site Management Corporation. This can produce 10,000 m^3 of methane (that is 95% pure) from 800 tons of effluent in a single day. The biogas produced will be used as fuel for buses and trash collection vehicles for the first time in South Korea. The Ministry of Environment emphasizes that this facility is the first outcome from its waste-to-energy policy, and that in the future it plans to promote the installation of biogas production facilities in 20 regional cities. (**Authors' abstract**)

Keywords: *waste-to-energy policy, waste, hyower, carbon dioxide emission, methane, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/03,
(Filipiniana Analytics)

0424

Promotion of wind power in the Philippines

Thus far the introduction of renewable energies in the Philippines has focused mainly on hydropower and geothermal power. But based on the National Renewable Energy Program (NREP) that was announced by the Department of Energy in 2008, the country also added in the adoption of wind power and set forth the objective of roughly tripling its adoption of renewable energies from 5,438 MW as of 2010 to 15,304 MW by 2030.

According to the National Renewable Energy Laboratory (NREL), the country's wind power potential was indicated to be 76,600 MW based on the assumption of areas of 300 W/m^2 or greater. In terms of cumulative wind power adoption as of 2012, this is comparable to the 75,300 MW that China (ranked number one in the world) has (Fig. 1).

The introduction target for wind power is 2,345 MW as of the year 2030 as shown in Fig. 2, which constitutes approximately 24% of the additional amount of new renewable energies between 2011 and 2030, as indicated in Fig. 3.

Among these adoption plans, in October 2013 Kanematsu Corporation received an order for a 54 MW wind power plant at San Lorenzo, which it plans to complete in two years' time. (**Author's abstract**)

Keywords: *Philippines, wind power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/01,
(Filipiniana Analytics)

0425

Proposal for the best mix for Japan's energy portfolio in 2030

The Ministry of Economy, Trade and Industry held the tenth meeting of the Long-term Energy Supply/Demand Forecast Subgroup of the Advisory Committee for Natural Resources and Energy on June 1, 2015. There it released the Long-term Energy Supply/Demand Forecast (Proposal) for Japan by the year 2030. The proposal for the ideal energy portfolio (best mix) for 2030 set this at 22-24% renewable energies, 20-22% nuclear power, 27% liquefied natural gas (LNG)-fired thermal power, 26% coal-fired thermal power, and 3% petroleum-fired thermal power (see Fig. 1).

The government has set forth a policy to lower electricity costs (fuel costs + FIT purchase costs + grid stabilization costs) in 2030 below their current levels. This is predicated on lowering the electricity costs from 2013 of 9.7 trillion yen (9.2 trillion yen in fuel costs, 0.5 trillion yen in FIT purchase costs) to 9.5 trillion yen (5.3 trillion yen in fuel costs, 3.7-4 trillion yen in FIT purchase costs, 0.1 trillion yen in grid stabilization costs) in 2030 (see Fig. 2). Based on this, the 4 trillion yen portion for renewable energies (FIT purchase costs) has been divided up into approximately 1.3 trillion yen to maximize the adoption of geothermal, hydro power, and biomass, which are non-fluctuating power sources, with the remaining 2.7 trillion yen or so being allocated to wind and solar power, which are fluctuating power sources (see Fig. 3).

The trial calculations for the electricity costs by type of energy envisioned for 2030 that were announced at the same time are shown in Fig. 4. In order to further raise the proportion of renewable energies by 2030, it will be necessary to curb the cost of generating renewable energies, with solar power topping the list. Moreover, this has clarified biomass power's position as an important power source on par with solar power. (**Author's abstract**)

Keywords: *Japan, renewable energy, energy portfolio, nuclear power, liquefied natural gas-fired thermal power, coal fired thermal power, petroleum-fired thermal power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/07,
(Filipiniana Analytics)

0426

Quality standardization for wood chips in Japan

Popularizing wood biomass boilers is considered to be an effective way of working to promote the use of timber offcuts and other such wood. As shown in Fig. 1, wood chip boilers are being introduced primarily in Hokkaido Prefecture and the Tohoku Region. But design and operating know-how for wood biomass boilers has still not been systematized, and so there is a desire for countermeasures for when problems arise. Pellets, chips, and firewood are

used as the fuels for wood biomass boilers, and in 2011 the Japan Wood Pellet Association created the Wood Pellet Quality Standards to serve as a preventative measure for problems deriving from these fuels. Then in 2014 the Committee to Promote the Use of Wood Biomass Energy formulated the Quality Standards for Fuel Wood Chips and put thia into operation. Establishing standards on the fuel side makes it possible to avoid combustion problems caused by an excess of moisture, as well as fuel supply problems caused by variations in the shape of the fuel.

Table 1 indicates the framework for fuel wood chip quality standards. Class 1 chips have a higher calorific value relative to Class 4 chips due to their raw materials and moisture content, and represent a standard that is easier to use in small-scale boilers of 200 kW or smaller.

Class 4 are predicated on being for medium to large-scale boilers (1 MW or larger) with dust removal equipment. Establishing such standards makes it possible for equipment development manufacturers, wood chip processor manufacturers, and wood chip boiler users to have a shared awareness, and have enabled their further adoption and popularization for the future. (**Author's abstract**)

Keywords: *Japan, quality standardization, wood chips, woody biomass boilers, biomass energy, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/09,
(Filipiniana Analytics)

0427

Queensland of Australia is emerging as a biomass leader

Australian government has established a policy called “Renewable Energy Target”, or RET Program in short. The program dictates that the country should be able to supply 20% of total domestic electricity demand by use of renewable energy. The state of Queensland, second largest states in Australia and four times as big as Japan, has been aggressively promoting the RET Program. At present, 5.5% of total electricity of the state is generated by use of renewable energy. Of the renewable energy, 55% comes from waste woody biomass such as shells of macadamia nuts and lees of sugarcane, 22% comes from hydro power and 19% comes from solar heated water.

Numerous research institutes and R & D enterprises skilled for biotechnology are situated in Queensland, which is now regarded as a center of excellence for bioscience. The state possesses vast tropical forests and rich ocean resources, and therefore making strong efforts to be a leader for biomass production and utilization in Asia Pacific Region by 2020.

At present, the kind of bio-energy the state try to develop at top priority is a kind of biodiesel extracted from a legume called pongamia that is native to northern Australia and India. Pongamia beans contain some 40% of oil. The amount of biodiesel produced on one hectare per year is expected to be 5 ton, which is comparable to that of oil palm, and quite outstanding among various oil plants.

Besides, while palm oil is a food oil, pongamia is a non-food plant that does not compete with production of edible crops. Moreover, pongamia has rhizobium in its root, which produce nitrogen fertilizer from air-contained nitrogen and makes the soil richer. Thus, pongamia is a very ideal oil plant that can grow on a poor soil or salty land without any fertilizer, and persist against dry climate.

Bioenergy Research Co. of Australia has made an estimate calculation that showed that a plantation of pongamia over a land of 200 km square might provide with sufficient amount of liquid fuel demanded by all Australia. Further, the meal of pongamia (=lees left after extraction of oil from pongamia beans) has rich protein content and is suited for feeding domestic animals. Therefore, if pongamia plantation is created on a poor barren land, the land will become green and provide with biofuel, and also makes it possible to keep livestock. (**Authors' abstract**)

Keywords: *Australia, renewable energy target, pongamia, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/01,
(Filipiniana Analytics)

0428

Quick and efficient conversion of biomass into electricity, fuel and heat

The energy density of biomass in general is considerably low compared with that of fossil fuels such as coal and crude oil. Recently, various new methods/technique are, therefore, being developed to extract energy from biomass efficiently. Gasification of biomass is one of outstanding ideas among them.

Energy efficiency of conventional power generation by directly burning biomass in a boiler is as low as a few percent. However, burning the combustible gas that was extracted from biomass in the boiler could raise the energy efficiency dramatically, even up to 20%. Besides, it is also possible to make liquid type fuel such as methanol by using the combustible gas. Both power-generation and production of liquid fuel using the combustible gas are already established, industrial technology. Therefore, if an efficient production method of combustible gas from biomass could be developed, a highly efficient use of biomass energy would be realized by using existing high-efficiency energy conversion facilities.

Shimizu Corporation made an announcement, on 8 October 2009, that Shimizu has started a range of proof experiments of the "Buil-BiomasTER", a new generation energy-technology system, which could generate energy from various sort of waste biomass, quickly and with high efficiency. The system has been developed under the support of a national program "Field-test project of thermal utilization of local biomass" of NEDO (New Energy and Industrial Technology Development Organization), and installed at Tokyo Woodshop of Shimizu Corporation. In this hybrid system, biomass waste is first processed into combustible gas, and the gas is used for power generation as well as for production of methanol, and at the same time waste heat of the system is recovered and used for other purposes. The system, reportedly, can process 30 kg of waste biomass per hour. The merits of the system are summarized as follows: 1. Various sorts of biomass waste such as waste paper, waste wood, food waste, waste from agriculture etc. can be used as raw materials to be fed to the system; 2. A power-generation plant and a methanol production plant are installed in parallel and therefore production ratio of electricity/methanol can be varied in accordance with the energy demand from various facilities in the woodshop; 3. The time needed for gasification and methanol production could be drastically reduced (Methanol production by fermentation normally takes a few days whereas the new technology can do it in an instant.); 4. Synthesis of common industrial methanol is done in general under a pressure of 20-30 Mpa, and under a temperature of 250-400°C. Whereas in this system, the reaction is done in a far moderate conditions in which the corresponding figures are no more than 2 Mpa, and 210°C, respectively; 5. The size and volume of the plants are just a fraction of conventional ones. The gasification plant and the methanol synthesis plant are both as compact as a common autobus body.

Compared with fossil energy resources, most biomass exists in thin and widespread forms on the earth surface. Therefore, for sake of realizing a high efficiency recovery of biomass energy, it is essential that various sorts of biomass spreading over a region could be collected and processed together in a compact, high efficiency plant.

So far, facilities that can gasify biomass and generate power and/or recover heat, and facilities that can gasify biomass and produce methanol, were developed as a single-function plant, respectively. In this Buil-BiomasTER system, however, the unit that perform power generation and heat recovery, and the unit for producing liquid fuel are installed in parallel and can be operated independently.

Therefore it is possible to operate the system to generate power in daytime, while during night, to operate it for producing methanol that is to be stored. In this way, the system will make it possible to use biomass energy with higher efficiency than before. (**Authors' abstract**)

Keywords: *gasification, energy density of biomass, energy efficiency, Buil-BiomasTER, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0429

Recycling and energy use of food waste is advancing

In Japan, the total amount of food waste discharged from food-related industries amounted to 11.35 million ton in FY2006. The waste discharge is composed of: 1. 4.95 million ton from food manufacturing/processing industries; 2. 0.74 million ton from food wholesale industries, 2.62 million ton from food retailers such as department, super markets, convenience stores and green grocery stores; and 3. 3.04 million ton from food service industries such as buffets, restaurants, hotels and inns.

The rate of reuse of the food waste was highest in food manufacturing/processing industries (81%), followed by food wholesale industries (62%), food retailers (35%), and that of food service industries was the lowest (22%). The food production/processing industries have the highest (81%); the reasons are because it is easy to secure the required amount to reuse and the composition of food waste maintains the same. The most of food waste in food production/processing industries are reused as manure and feed for livestock.

In December 2007, Japan's Food Recycling Law was revised, which designated that the rate of reuse of food waste in the food retailing industries to be raised up to 45% by the end of 2012.

In this consequence, on 19 May 2010, Ito-Yokado Co.,Ltd. made an announcement that it has decided to establish a new corporate called Seven Farm Co. in order to expand the company's food-recycling network. A farming corporation called Seven Farm Tomisato Co. already started a complete recycling agriculture in Chiba Prefecture since 2008, based on reuse of waste food collected in nearby districts. Ito-Yokado Co.,Ltd from now on intends to expand nationwide their complete recycling agriculture system in order to raise recycle rate of waste food up to 45%.

Meanwhile, three companies Takenaka Corporation, Kobelco Eco-Solutions Co.,Ltd and Teral Inc. jointly announced, on 13 May 2010, that they successfully developed a practical urban biogas system, and that this system was adopted in the Tower Pavilion of Abenobashi Terminal Building in Osaka City. The system generates methane gas making use of waste food and kitchen wastewater etc. that are discharged from hotels, restaurants and department stores etc. of the complex terminal building. The methane gas is used as fuel for gas engines and boilers to generate electricity and heat. This system's big merit or sales point is that waste food discharged from urban high-rise buildings located in the city center can be reused as energy on the spot. (**Authors' abstract**)

Keywords: *Japan, food waste, Food Recycling Law, urban biogas system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/07,
(Filipiniana Analytics)

0430

Reduce CO_2 emission by biomass chips spreading in Japan

New bio-fuels businesses are coming into being! They utilize locally collectable woody waste such as thinned wood and residue from sawmill and produce chips and pellets as bio-fuels. The following table shows current utilization record of woody biomass in Yamaguchi, Miyazaki, Fukui and Shiga Prefectures. The businesses are aiming at realizing so-called "produce and consume locally", by producing biofuels from thinned wood or forest residue of local areas, and on another hand, by distributing the biofuels in the areas so as to activate and facilitate local industries as well as everyday life of the people.

Japanese government has been taking a range of measures in order to cope with global warming problems and to realize so-called recycling societies. To expand the use of biofuels is one of the important measures. In accordance with the Kyoto Protocol, Japanese Government presented an achievement plan for utilization of biomass energy, in which target values are shown as, 5.86 million KL of COE for waste-burning power generation and biomass power generation, and 3.08 million KL of COE for biomass heat utilization, respectively. (COE=Crude Oil Equivalent) (**Author's abstract**)

Keywords: *biomass chips, carbon dioxide emission, woody waste, crude oil equivlent, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0431

Reduce CO_2 emission by power generation using woody biomass

It is becoming more and more of importance for manufacturing industries to introduce use of new type of energy in order to mitigate the global environmental crisis represented by "the global warming". In order to reduce CO_2 emission drastically, electric power generation using woody biomass seems very promising.

The Tochigi Factory of Sumitomo Osaka Cement Co. has completed construction of power generation plant that is run by burning coal together with woody chips and thinned wood. The plant costs 6 billion yen, and it can supply 25,000 kW of electricity. It is scheduled to start to operate in April 2009. The fuel burnt in this plant consists of woody biomass (60%), coal (30%) and used tire tip (5%), based on calorific value. The plant will consume 100,000ton of woody biomass that account for the reduction of 910,000 ton of CO_2, annually.

In the mean time, the Hekinan Power Station of Chubu Electric Power Co. has been operated by burning coal. From March 2009, the company begins test use of a composite fuel, a mixture of coal and woody biomass, at this power station so as to examine the fuel's burning performance. The company wants to regularly operate all of the five power plants at Hekinan on this composite fuel by FY 2020. The total power output of five plants comes up to 4,100,000 kW, in which 1.5% will depend on woody biomass. As substitute for coal, annual consumption of woody biomass would amount to 300,000 ton, and expected to account for the reduction of CO_2 emission as much as 300,000 ton per year. (**Author's abstract**)

Keywords: *carbon dioxide, biofuel, composite fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0432

Regular bioethanol production from used clothes started

Currently in Japan, roughly two million ton of used textile products are discharged as waste every year. The waste is composed of 1.44 million ton of used clothes and 0.56 million ton of used bed clothes together with interior decoration textiles.

Of the used clothes, 100,000 ton comes from textile businesses (producers and retailers), and 1,340,000 ton comes from general households. Of the latter, only 280,000 ton is being recycled today. Thus, recycling percentage of used clothes remains as low as 19%. The whole rest, 1,160,000 ton of waste textile products, simply goes to incinerators or to landfill sites. The reasons for this low recycling rate are said to be: 1) diversified textile materials, 2) wide variety of clothing products, and 3) difficulty in finding new ways of reuse/recycling.

In June 2010, a venture business Japan Environment Planning CO., LTD (JEPLAN CO., LTD) has started a remarkable recycling campaign named as “Fuku-Fuku Project” in order to collect used clothes from general households and make use of them in an efficient material recycling process.

According to statistics, cotton-made clothes share 50-60% among whole clothing products consumed in Japan. Besides, cellulose content of cotton is known to be more than 95%, which can be used for producing bioethanol. By the way, cellulose content of rice chaff is some 40 %, and that of cedar and hinoki-cedar is 53 %, both of which are much lower than cotton. Therefore it seems to be much more efficient to use cotton for producing bioethenol in stead of using chaff and cedar wood.

Actually JEPLAN CO., LTD conducted already an experimental production of bioethanol from cotton scraps, using a small test plant constructed at Imabari city in Ehime prefecture in 2009. Imabari is the largest towel-producing place in Japan. It was proved that the experiment plant could produce 60 liter of ethanol from 100 kg of cotton scraps. The provided bioethanol is used as fuel of the boiler facility in a towel manufacturing process. Meanwhile, other textile materials such as wool and polyesters were turned into light oil, coke and coke oven gas. Thus, the JEPLAN’s experiment proved that 100 % recycling of most textile products has become possible.

In FY2009, experimentally, 3.2 ton of used clothes in total were collected by the Fuku-Fuku Project. The next year, 2010, the project will collect as much as 50 ton. Further, JEPLAN CO., LTD is inviting many business partners to join into this project so that they may collect 150,000 ton/year of used cloths, and realize 100% recycling of them. (**Authors' abstract**)

Keywords: *regular bioethanol production, used clothes, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/08,
(Filipiniana Analytics)

0433

Release of a planned strategy for the commercialization of biomass (Japan)

In February 2012 the Japanese government established the Study Team for Biomass Commercialization Strategies, which is comprised of members that include experts, private enterprises, and local municipalities, and which has engaged in considerations on a strategy for the commercialization of biomass. Thus far it has racked up a total of nine meetings, and at its eighth meeting (June 2012) it announced its Biomass Commercialization Strategy (Planned).

This planned strategy is geared towards achieving the objectives laid out in the Basic Plan for the Promotion of Biomass Utilization, which was approved by the Cabinet in 2010. By achieving these goals Japan can achieve "the supply of autonomous and distributed energy in local regions through the use of local biomass," which has become a serious challenge following the Great East Japan Earthquake and the ensuing nuclear accident.

Currently, Japan's resources of biomass is 255.5 million tons (when converted to carbon this is 34.44 million tons of carbon), with its reuse rate for all of its biomass being 74.8%. The objectives listed in the Basic Plan for the Promotion of Biomass Utilization by the year 2020 are: Use biomass equivalent to approximately 26 million tons of carbon (raise the reuse rate to 88.5%), create new industries on the order of about 500 billion yen; formulate plans to promote the utilization of biomass in 600 municipalities.

If these objectives were to be achieved then 13 billion kWh of power generation from biomass and energy from 11.8 million kL of fuel usage (crude oil equivalent) could be obtained, which would constitute a reduction in the amount of CO_2 emitted of 40.7 million tons (3.2% of the amount of CO_2 emitted by Japan).

Seven strategies have been set up under the planned strategy ((1) basic strategy, (2) technical strategy, (3) exit strategy, (4) entrance strategy, (5) individual focus strategy, (6) integrated support strategy, and (7) overseas strategy), and time tables have been created for each of them. For the future, the government plans to compile an official strategic plan and reflect this in its budget for FY2013. (**Authors' abstract**)

Keywords: *biomass, commercialization, carbon dioxide emission, planned strategy, biomass utilization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/09,
(Filipiniana Analytics)

0434

Renewable energies in New Zealand

New Zealand is a country that has a high usage rate for renewable energies internationally along with countries like Norway and Iceland, and as indicated in Fig. 1 it receives roughly 70% of its electricity from renewable energies. Moreover, it has historically made progress with the development of hydro power and geothermal power, but since it is also a suitable location for wind power the outlook is that it will move forward with introducing this in the future. In actuality, it has been building upon its track record with wind power as indicated by the trends in its installed capacity for power generation in Fig. 2.

The Ministry of Business, Innovation, and Employment set forth four scenarios for the introduction of renewable energies by the year 2040 in a document that it released in August 2013 (see Fig. 3). Scenario one is business-as-usual scenario, scenario two is where geothermal power is expanded to the utmost, scenario three is one where the price of emissions quotas for CO_2 is low and natural gas is inexpensive, and scenario four is one where restrictions are placed on geothermal power and the price of emissions quotas for CO_2 rise. In the above scenarios geothermal power will increase from 13.6% in 2012 to 21-29% in 2040. What is more, since wind power requires that costs be brought down,

it is estimated that for scenario three it will be minimal at 100 MW by the year 2040, but for scenario four it will increase by as much as 18% to reach 2,700 MW. (**Author's abstract**)

Keywords: *New Zealand, renewable energy, hydropower, geothermal power, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/12,
(Filipiniana Analytics)

0435

Renewable energy in Bangladesh

Bangladesh's installed capacity for power generation in 2014 came to 6,213 MW, which was an increase of 513 MW compared with 2013. The Ministry of Power, Energy & Mineral Resources plans to augment this to 10,970 MW by 2018.

However, only 64% of the total population is connected to the power grid and supplied with electricity. The residents of rural, unelectrified regions depend on conventional firewood and diesel generators for their power. The adoption of renewable energy in Bangladesh is being planned, with the focus being on these sorts of regions.

The installed capacity for renewable energy power generation adopted up through FY 2013 is 403 MW. A breakdown for this is shown in Fig. 1, with hydroelectric power accounting for the majority of this. Second place is occupied by the solar home systems (SHSs) for houses in unelectrified regions that were initiated in 1996, due to their track record in which 3 million units have been installed.

Moving forward, the adoption of renewable energy in the private sector will be promoted with the support of Infrastructure Development Company Limited (IDCOL). Emphasis is placed on SHSs in the adoption plan in Fig. 2 as well. What is more, the adoption of 100,000 biogas plants for cooking are slated in order to prevent the destruction of nature that results from people using firewood for cooking and other such purposes. (**Author's abstract**)

Keywords: *Bangladesh, renewable energy, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/02,
(Filipiniana Analytics)

0436

Research and development on microalgae in South Korea

As part of its research and development on microalgae through the use of genetic recombination technology, the Korea Advanced Institute of Science and Technology (KAIST) concluded a memorandum on joint research concerning genetic recombination for microalgae in September 2014 with ToolGen Inc. of South Korea, a company that possesses genome editing technology. The goal of this research is to increase the yield of biofuels through the use of microalgae.

In August 2014, a research team from the Korea Institute of Science and Technology (KIST) and Korea University announced a technique for producing succinic acid, which is a raw material in plastics, from microalgae. This

technique, which is the first of its kind in the world, is one that uses genetically engineered bacteria. Reacting this succinic acid derived from biomass with butanediol produced from biomass raw materials enables them to produce polybutylene succinate (PBS), which is a biodegradable plastic. As this indicates, trials are being carried out in order to replace the chemically-derived raw materials used in the chemical industry with biologically-derived raw materials.

In addition to this, the development of mass cultivation techniques for microalgae are being carried out in South Korea as shown in Table 1. The expectation is that this will play a part in the "Adoption of 10.36 million tons of bioenergy (crude oil equivalent) by 2030" found in South Korea's plan for the adoption of renewable energies. (**Author's abstract**)

Keywords: *South Korea, research and development, microalgae, genetic recombination technology, succinic acid, genetically engineered bacteria, polybutylene succinate, biodegradabe plastic, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/10,
(Filipiniana Analytics)

0437

Research enhances jatropha's oil-productivity

Jatropha is a prolific plant that grows widely in tropical and subtropical zones. Jatropha seeds are non-edible but have quite high oil content. Cultivation of jatropha is possible on dry and poor soils. Recently jatropha is more and more regarded as one of the most promising plants that can provide the next generation biodiesel fuels. The seeds of jatropha have some 30% of oil content, and one hectare of jatropha plantation can yield as much as 1.5 ton of oil a year, which is not comparable to that of oil-palm that can yield 4 ton of palm oil per hectare a year, but it is much higher than those of soybeans, castor bean and sunflower that are traditional major food oil plants.

The productivity of an oil plant is measured by its efficiency of photosynthesis and adaptability and/or resistance to environmental stresses such as draught. Today, a range of gene technology has been developed to breed in molecule level, and/or to operate a gene-conversion to enhance the productivity of jatropha. Recently, practicable fruits of gene technology that would dramatically enhance the productivity of jatropha have been published one after another.

Recently a joint research group of Kazusa DNA Research Institute (KDRI) and Osaka University has disclosed that they have completed whole genome analysis of jatropha by May 2010. This is a big step forward to realize a high-yield gene-converted jatropha.

Meanwhile, the Nara Institute of Science and Technology (NAIST) so far has conducted a research in order to improve the productivity of jatropha, aiming at increasing oil content and also enhance ability to cope with environmental stresses. In May 2010, NAIST research team succeeded in enhancing, by 30 times, the probability of appearance of improved heritable nature, which is the highest in the world.

Experimental cultivation of jatropha has been started in Japan recently. On 17 May 2010, the Narita International Airport Corporation announced that they would start an experimental cultivation, by planting some 60 trees of jatropha and aburagina on unused lands of 500 m^2 in and outside of the Narita Airport until July 2010. By the way, so far it has been said that jatropha could not survive in a cool region. The company is investigating the possibility of utilizing the jatropha oil as a fuel for their aircraft tractors and aircraft jet engines, in future. (**Authors' abstract**)

Keywords: *oil productivity, genome analysis, experimental cultivation, Jatropha, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/06,

0438

Research on ethanol production using effluent from sulfite pulping process

On 15 July, 2009, Nippon Paper Chemicals(NPC) Co., LTD and Cosmo Oil Co.,LTD announced that they would start a joint research project to develop an efficient ethanol production process using effluent (black liquor) generated from sulfite pulping process as raw material. Since FY 2008, NPC and Cosmo have been conducting a feasibility study on ethanol production method capable of 10,000 KL per year. The said joint project will be conducted during FY 2009 to FY2010, as a contract research with funding of 20 million yen per year from NEDO (New Energy and Industrial Technology Development Organization), inviting Tokyo University and Kyushu University as partners.

Sulfite waste liquor (black liquor) generated from paper production companies in Japan amounted to about 70 million ton during FY 2008, most of which was reused in the factories. Major components of the black liquor are organic substances such as lignin and hemi-cellulose. For sake of energy recovery and reuse, Paper factories burn the black liquor to generate electric power and steam. In this way, about 32.6% of total energy required to run the factories is being supplied from the reuse of the black liquor.

Among pulp production techniques, “kraft pulping process” based on sodium sulfite treatment is mainly adopted by Japanese paper makers. Today, however, “sulfite pulping process” is adopted by Gotsu Factory of Nippon Paper Chemicals only. Effluent of sulfite pulping process has considerably higher sugar content than the effluent of kraft pulping process has, which is favorable for ethanol production.

Ethanol production method using the effluent of sulfite pulping process is being adopted in European countries, USA, Canada and Russia, but not in Japan as yet. Therefore, practical ethanol production using effluent from sulfite pulping process is keenly awaited for in Japan. (**Author's abstract**)

Keywords: *effluent, sulfite pulping process, ethanol production, Japan, kraft pulping process, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/08,
(Filipiniana Analytics)

0439

Rural electrification in ASEAN countries

There are some villages outside of the periphery of urban areas in developing countries that are not supplied with grid-connected power, and so some regions get their electricity and heat from diesel generators and the burning of kindling. In the ten member nations of the Association of Southeast Asian Nations (ASEAN), the electrification rates are low in Myanmar, Cambodia, Laos, and Indonesia, as indicated in Table 1, with approximately 120 million people living in unelectrified regions in these countries. Moreover, roughly 90% of the population in unelectrified regions within ASEAN are concentrated in these four countries, as is indicated in Fig. 1.

Initiatives to learn about successful case examples of improving the electrification rate are being carried out through the ASEAN Plan for Action in Energy Cooperation 2010-2015. Technical cooperation within these regions is also

being taken up in regards to grid connections, independent solar power, biomass power, small-scale hydropower, and mini grids as part of this.

On the other hand, due to the falling costs from the popularization of solar and wind power in developed countries, renewable energy sources have achieved economic advantages relative to the costs of building large-scale power plants, laying power lines, and fuel expenses for the electrification of remote regions. For the future it is believed that the potential to practically utilize renewable energy sources as independent power sources and mini grid power sources will rise further. Examples of demonstration projects are shown in Table 2. (**Author's abstract**)

Keywords: *ASEAN, rural electrification, grid-connected power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/11,
(Filipiniana Analytics)

0440

The scale of mega solar projects in Japan is expanding

When it came to mega solar projects from prior to the start of the feed-in tariff (FIT) scheme, the Ogishima Solar Power Plant (Kawasaki City, Kanegawa Prefecture) of Tokyo Electric Power Company was the largest in Japan at 13 MW. But since the start of FIT, large-scale mega solar projects have been planned, completed, and begun generating power one after another.

As part of this, the 70 MW Kagoshima Nanatsujima Mega-Solar Power Plant, which is now the largest in Japan, was completed at Nanatsujima, Kagoshima City in November 2013. It has started to generate power using 290,000 photovoltaic power panels on a plot of land that could house approximately 27 Tokyo Domes. Its generating capacity is equivalent to 22,000 ordinary households.

The Kagoshima Mega Solar Power Corporation (Kagoshima City) that was funded by seven companies including Kyocera Corporation, built the Kagoshima Nanatsujima Mega-Solar Power Plant. Its overhead investment was approximately 27 billion yen, and it carries out procurement with Mizuho Bank, Ltd. as the managing organizer. As a result of having a total of 78,000 people from 208 construction companies in Kyushu working at the construction site, the plant was completed in one year and two months (see Fig. 1).

Moreover, there are a number of projects that are currently either under construction or being planned for within Japan, which are shown in Table 1. These include a 400 MW power plant being planned by Photovolt Development Partners of Germany on abandoned farmland on the Goto Islands in Nagasaki Prefecture, a 230 MW power plant that uses the former Kinkai-enden site in Setouchi City, Okayama Prefecture, a plant that is under construction in Watari Town, Miyagi Prefecture (NTT Group), a 100 MW power plant that is under construction in Abira Town, Yufutsu District, Hokkaido Prefecture (SB Energy Corp.), and a project in Hachinohe City, Aomori Prefecture (Eurus Energy) (see Fig. 2).

However, the construction of even more enormous power plants is proceeding apace around the world.

The Sumitomo Group is currently building a solar power plant (Desert Sunlight Solar Farm) that will be the largest such plant in the world at 550 MW (total project costs of roughly USD 2.3 billion), and which will require approximately 9 million solar panels. The plant is being built on approximately 16 km2 of land owned by the US government on the outskirts of Palm Springs, California, and is scheduled to be completed in the spring of 2015. The Sumitomo Group together with NextEra Energy and GE Energy Financial Services serve as the implementing body. Based on its RPS, the State of California has mandated that its power providers must procure 33% of the total amount of power generated from electricity from renewable energies by the year 2020, with the expectation being that this project will contribute enormously to the achievement of this goal. (**Author's abstract**)

Keywords: *Japan, mega solar, renewable energy, solar power, power plant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/02,
(Filipiniana Analytics)

0441

The second Asia biomass energy workshop took place in Kyoto (discussed on East Asia biofuel database)

During December 8-10 2009, The Second Asia Biomass Energy Workshop took place in Kyoto, hosted by the Ministry of Energy of Philippine, and co-hosted by the New Energy Foundation of Japan.

The objectives of the workshop were: 1. Establishment and management/maintenance of the East Asia Biofuel Database; and 2. Promotion of mutual cooperation among East Asian nations with regard to utilization of biomass energy.

In order to cope with suspending problems due to global warming and associated environmental changes as well as depleting fossil fuels, the 2nd East Asia Summit, held in January 2007, adopted the Cebu Declaration on East Asian Energy Security, and established the Task Force for Energy Cooperation. The task force was commissioned to create East Asia Biofuel Database as the first step, and assigned to promote utilization/development of biofuels, and international cooperation.

The database, being created by the Energy Ministry of Philippine and the New Energy Foundation of Japan as core members, will make it possible for the sixteen member countries of the EAS to mutually provide and share with the information related to policy and current state of biofuels development. The database can be browsed on the website of the Asia Biomass Energy Cooperation Promotion Office.

Thirty-one attendees from nine member countries including Indonesia, Cambodia, Thailand, Vietnam, Myanmar, Malaysia, Laos, Philippine and Japan, participated in the workshop. First, each representative presented status report of his country.

After the reporting session: 1. Presentations were made by Philippine delegate as to the Renewable Energy Act of Philippine; 2. Followed by three presentations from Japan made by delegates from the Ministry of Economy, Trade and Industry and other related institutes of Japan representing government, industry and academy. They were: Japanese Policy for Biomass Energy, Production and Utilization of Biodiesel, and ERIA Biodiesel Trade Handbook. Active and serious discussions were made as to the presentations.

On the last day of the workshop, a study tour was made on several biomass-energy related facilities in Kyoto and Shiga prefectures. Sincere and serious questions and replies were exchanged among the attendees during the excursion. (**Authors' abstract**)

Keywords: *East Asia Biofuel Database, Biomass Energy Workshop, biofuel development, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/01,
(Filipiniana Analytics)

0442

Second Asia Renewable Energy Workshop (AREW) Held in Jakarta

The Second Asia Renewable Energy Workshop (2nd AREW) was held in Jakarta, Indonesia, from December 2-4, 2015 through the joint sponsorship of the Agency of Natural Resources and Energy, Ministry of Economy, Trade and Industry, the National Institute of Advanced Industrial Science and Technology, and the New Energy Foundation from Japan, as well as the Ministry of Energy and Mineral Resources of Indonesia, the ASEAN Centre for Energy, the Agency for the Assessment and Application of Technology (BPPT), and more. The event was held in the current fiscal year following the success of AREW 2015, which was held at Universiti Putra Malaysia (UPM) in the suburbs of Kuala Lumpur, Malaysia in FY 2014 (February 2015).

This second AREW was held within the BPPT facility in the heart of Jakarta, and was attended by a total of 240 people representing governments, research agencies, universities, and companies from nine countries, including both ASEAN countries and Japan. At the workshops, status reports from the various countries and agencies related to renewable energy were given, and information was actively disseminated and opinions shared on attempts to overcome obstacles and modalities for international cooperation for solving challenges. In addition, an understanding was reached regarding shared challenges and targets through future international cooperation.

On the final day of December 4, the participants toured Kamojang Geothermal Power Plant, which is a facility of PT. Pertamina Geothermal Energy run by the state of Indonesia in the outskirts of Bandung.

This workshop was held as part of a project to foster research-related human resources pertaining to renewable energy with the goal of adopting and disseminating renewable energy to ASEAN countries and others where energy demand is growing substantially. (**Author's abstract**)

Keywords: *renewable energy, workshop, international operation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/01,
(Filipiniana Analytics)

0443

Selection of the FY 2014 biomass industry cities

Since 2013, seven governmental ministries and agencies have jointly promoted the Biomass Industry City concept in aiming for 100 such regions by FY 2018. In FY 2014, six regions were selected, including Imizu City in Toyama Prefecture, Sumoto City in Hyogo Prefecture, Okinoshima Town in Shimane Prefecture, Miyama City in Fukuoka Prefecture, Saga City in Saga Prefecture, and Saiki City in Oita Prefecture, and a ceremony to award them certification was held on November 18.

Biomass Industry Cities are regions that strive to create towns and villages that are environmentally friendly and resistant to disasters based around biomass industries that capitalize on the unique characteristics of the region. They do this by creating integrated systems that ensure economy over everything from the production of local biomass raw materials to their collection, transportation, production, and use, as well as by creating industries that use local biomass and strengthening energy reuse in local regions.

The Biomass Industry Cities that were selected in FY 2014 shown in Table 1 have been planning to commercialize several projects pertaining to biomass that have unique characteristics. Examples include projects that harness the characteristics of the local region, such as by effectively using rice husks in rice growing regions, or thinned or pruned wood in areas with mountain forests. (**Author's abstract**)

Keywords: *biomass industry cities, biomass resources, environmentally friendly, disaster resistant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/12,
(Filipiniana Analytics)

0444

Selection of the FY 2015 Biomass Industry Cities

The aim of the Biomass Industry Cities concept that seven related government ministries and agencies have been jointly promoting since 2013 is to set up biomass cities in 100 regions throughout Japan by FY 2018. In FY 2015, the 12 regions shown in Table 1 were newly selected, bringing the total to 34 regions. Biomass Industry Cities refer to the creation of towns and villages that are environmentally friendly and resistant to disasters by creating flows wherein economy is taken into consideration from everything from the production of biomass resources to their collection, transportation, production, and use in local regions. These also incorporate the creation of industries and local reusable energy in the wake of the Biomass Industrialization Strategy that was created in 2012.

The Biomass Industry Cities that were recently selected are planning a variety of different commercialization projects. These include eight regions that are each using the heat from forest thinnings and generating power from biogas from either livestock waste or food waste, as well as three regions that are working on producing biodiesel fuel (BDF) from discarded cooking oil. (**Author's abstract**)

Keywords: *biomass industry cities, renewable energy, biomass resources, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/01,
(Filipiniana Analytics)

0445

Sewage sludge turned into biomass fuel

Current level of spread of sewage system in Japan in the proportion of population scored 73%, as of the end of FY 2008. About 2,000 sewage treatment systems are in operation and the number is still increasing. Total amount of sewage sludge emitted from the treatment facilities scored 2.23 million ton in FY 2006. The sewage sludge was mainly composed of organic matters (1.79 million ton; 80%), and inorganic matters (0.45 million ton; 20%). About 70% of inorganic part of the sludge is utilized as raw materials for cement and bricks. On the other hand, only small part of organic part of the sludge is utilized for producing fertilizer (10%), for digester gas (12%), and for sludge fuel (0.6%). The major part (77%) is just burnt to ash or dumped for landfill purpose.

Supposing that all of the sewage sludge were utilized for producing thermal energy, total calorific value is estimated to be as much as 975,000 ton crude oil equivalence. Therefore, Japanese government is currently aiming at reducing CO_2 emission, by shifting from fossil fuels to bio-fuels made from sewage sludge.

There are two alternative ways for making use of sewage sludge as fuels, namely, “Digestion Method (to make methane gas)”, another is “Carbonization Method (to make carbonized solid fuel)”. At present, no more than 300

sewage treatment stations are adopting digestion method, and 25 of them is doing biomass power generation by burning methane gas. Some examples of energy-use of sewage sludge are shown in the Table. As everyone knows, sewage sludge is inevitably generated from our city life. If counted as a source of energy, sewage sludge could be considered a valuable resource that may be supplied steadily in urban regions. In this regard, it is sincerely hoped to make full use of sewage sludge as one of energy resource in the future. (**Authors' abstract**)

Keywords: *sewage sludge, biomass fuel, Japan, carbon dioxide emission, digestion method, carbonization method, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0446

Sewage sludge turned into fuel: a new way of energy recovery

At present, Sewage sludge generated at Yokohama city that has a population of 3.67 million amounts to 230,000 ton/year. Whole amount of the sludge is to be incinerated and turned into 20,000 ton/year of ash that is totally utilized as cement material (59%), soil improvement material (39%) and land-reclaiming (2%). A good material recycling is realized here!

Regarding the sludge, the J-Power Co. and Yokohama City jointly announced, on 31 July 2009, that they would start a joint research to produce fuel from the sewage sludge and that the fuel would be burnt at Isogo coal electric power station of the J-Power. Yokohama City has so far been studying the possibility of diversifying the use of ash and cost reduction as well as reduction of CO_2 emission. The study has come to a conclusion that the sewage sludge be turned into solid fuel and used as a kind of recovered energy.

A solid-type fuel is made by carbonizing the sludge. It can be burnt jointly with normal coal at coal-burning thermal electric power stations, and therefore some portion of coal can be substituted. In accordance with the result of the research, the J-Power and Yokohama city will decide the future plan of the utilization of the sludge. They would have three equal alternative ways of sludge utilization, viz., the ash of sludge to be utilized as cement material and soil improvement material as before, and rest of the sludge to be turned into solid fuel.

Production of solid fuel from sewage sludge helps to reduce the emission of carbon dioxide (CO_2). During FY 2007, Yokohama municipal office as a whole emitted 708,605 ton of CO_2, within which 24 % (167,905 ton) came from sewerage department. It was estimated that making 20, 000 ton of solid fuel from sewage sludge and burning it at coal power stations would result in reduction of CO_2 emission by 45,000 ton/year. (**Author's abstract**)

Keywords: *sewage sludge, Japan, biofuel, carbon dioxide emission, power plant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/09,
(Filipiniana Analytics)

0447

Six coal-burning power stations adopted biomass co-firing using forest residue

Because nearly 70% of Japan's land area is covered with forests, Japan looks to possess abundant forest resources apparently, but owing to steep mountainous geography, costs for logging and transportation are so large that a great portion of forest wood residue such as thinned wood has been left over as waste until now. Today, nearly 8 million ton of forest residue is generated every year, but barely 1% of it is being used by pulp industry.

The Ministry of Economy, Trade and Industry (METI) has been implementing a program for proof experiment project of co-firing of forest residue at several coal-burning power stations, so as to promote utilization of forest residue. In FY2009, some three-billion-yen subsidy was allocated for the project that would be carried out at selected six coal-burning power stations, where the ratio of biomass chips to coal would be in the range of 0.5-2%.

There appears one steel maker standing with traditional electric power businesses selected for carrying out the project. Generally, coal-burning power plants are in operation in most of steel works today. For example, at the Kamaishi Work of the Nippon Steel Company, annually 250,000 ton of coal is burnt at a power plant of 149,000 kW output capacity. NSC estimated that it would be possible to reduce annual coal consumption by 2% by burning 5,000 ton of forest residue, which would also contribute to the reduction of CO_2 emission.

Reportedly, it is estimated that annually 115,900 ton of CO_2 emission would be cut down by the six power stations put together. Following after the six power stations, biomass-coal co-firing power generation will be started in FY2012 at the Hitachi-Naka Power Station of the Tokyo Electric Power Company (TEPCO). TEPCO estimated that the co-firing would be able to reduce CO_2 emission by 110,000 ton annually, by burning 70,000 ton of woody biomass.

Power generation business by co-firing of forest residue with coal would not only be able to reduce CO_2 emission but also it would be certainly effective for revitalization of local community. Owing to the development of this power business, new jobs and employments would be created, including collection and transportation of forest residue and thinned wood, road construction in the forests, woody pellets manufacturing from woody waste and so on. (**Authors' abstract**)

Keywords: *coal-burning power station, forest residue, Japan, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/02,
(Filipiniana Analytics)

0448

Small hydroelectric power generation from river maintenance discharge

By ensuring the same volume of running water from dams to downstream areas as if the dam were not there, a certain volume of discharge is constantly provided in order to preserve the habitats and ecosystems of aquatic life. The River Act was enacted in December 2013 so that when the volume of flow discharged from dams for the purposes of maintaining this are used to generate power it will not affect the environment. As part of the contents of revisions to the law the installation of hydroelectric power generation from the discharge from river maintenance went from being a license system to a registration system in the aim of simplifying and facilitating the procedures.

A study on the business profitability of small-scale hydroelectric power generation through the use of the water discharged from a prefecturally-run dam in Fukuoka Prefecture was carried out. The results that were obtained showed that this would be profitable at four of the 12 dams (Zuibaiji, Fujinami, Rikimaru, and Jinya). Construction has begun on the Zuibaiji Dam, which is the most highly profitable of these.

What is more, Nippon Koei Co., Ltd. initiated the first dam energy service company (ESCO) business throughout Japan with a focus on small-scale hydroelectric power generation. This is a project that built hydroelectric power plants and earned revenue from selling power through the feed-in tariff scheme as a power generating business entity. At the same time, it also had the ESCO operator bear the electricity costs for dam management that had been born by Tochigi Prefecture, with the remainder left over after the facilities' operation and maintenance costs were subtracted being posted as profits.

The plans for power plants that use the maintenance discharge water are shown in Table 1 in the order in which they will go into operation. For its own dams, Chubu Electric Power Co., Inc. itself served as the operator in establishing a power plant that uses maintenance discharge. Not only that, but by working together with C-Tech Corporation, one of its group companies, it has been making progress with the project. (**Author's abstract**)

Keywords: *small hydroelectric power generation, river-based, maintenance discharge, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/06,
(Filipiniana Analytics)

0449

A smart community as energy resilience

On October 12, 2015, a discussion on the energy problems faced by countries in the APEC region was conducted at the APEC Energy Ministerial Meeting held in Cebu Island, Philippines. The importance of having robust facilities related to energy infrastructure to withstand natural and human disasters “Energy Resilience (Robustness) in promoting energy safety and security and sustainable growth was also recognized (See Photo 1).

Due to the lessons learnt from the East Japan Great Earthquake, a National Resilience (Disaster Prevention & Relief) Committee has been established in the Cabinet Secretariat to promote the “Establishment of an Independent & Decentralized Energy System in Local Regions” as one of the policies.

The fluctuation in the output of renewable energy, including solar energy, is intense and due to the introduction of a large amount of renewable energy, this has given rise to issues such as a rise in the power network voltage, insufficient frequency modulation capacity, and so on. In addition, there is a need for a peak cut to suppress power demand together with a reduction in the amount of power generated during the earthquake disaster. In order to respond to such issues, an energy-efficient system known as a “Smart Community” which includes heating and transport in addition to electricity using IT technologies such as energy management systems and storage batteries etc. has been adopted. Currently, a demonstration of the smart community is being carried out in 4 areas in Japan as shown in Fig. 1. The technologies and methods derived here are expected to be used in ensuring “energy resilience (robustness) as an international problem”. (**Author's abstract**)

Keywords: *energy resilience, smart community, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/03,
(Filipiniana Analytics)

0450

Smart grid demonstration project on Jeju Island, South Korea

South Korea has positioned smart grids as a strategic national industry, and started a smart grid demonstration project on Jeju Island in 2009. In 2010 the country announced its National Smart Grid Roadmap, and then in 2011 it enacted the world's first law related to support for smart grids.

Smart grids are electricity grids that achieve a highly efficient and highly reliable power supply by utilizing information technology for power networks from the power plant to the supply grid and to the homes that consume the power. They also hold promise as a means for handling the fluctuations in output for wind power and solar power and making the mass adoption of renewable energies possible.

Jeju Island, which is located at the southernmost tip of South Korea, is in the vicinity of the Tsushima Current, a warm water current. As such, it has a warm climate and is well-known as a tourist destination. What is more, within South Korea it is an ideal spot for wind power and solar power generation. Fig. 1 shows a wind speed distribution map for South Korea.

The demonstration project on Jeju Island was carried out by being divided up into a first stage for installing the system that lasted from December 2009 until May 2011, and an integrated operating period from June 2011 until May 2013. It was divided up into a number of themes, including Smart Places, Smart Transportation, and Smart Renewables, and was carried out with the participation of a large number of companies. Table 1 shows examples from the smart grid demonstration project on Jeju Island.

While it was promoting this demonstration project, in 2012 Jeju Province announced its Carbon Free Island Jeju by 2030 plan, which aims to achieve a carbon free island that generates power solely through wind power and other renewable energies and that only uses electric vehicles. (**Author's abstract**)

Keywords: *South Korea, demonstration project, small grid, information technology, wind power, solar power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/05,
(Filipiniana Analytics)

0451

Solar cells that can generate power via infrared rays

The Si solar cells currently in use primarily convert energy in the visible light wavelength range of sunlight into electrical energy. Conversely, dye sensitized cells (DSCs), which are one type of next-generation solar cell, harness a photo-reaction from dyes comprised of organic compounds to obtain electrical energy. By altering these dyes, these DSCs can expand the usable wavelength range to a broader range beyond that of visible rays.

The Research Center for Advanced Science and Technology of the University of Tokyo has a developed ruthenium complex dye DX (Dye-X) that can generate power from near infrared rays in the aim of improving the performance of DSCs, and Tanaka Kikinzoku Kogyo began marketing this in January 2015.

The energy from sunlight that reaches the earth's surface breaks down as follows: 52% of it is from visible rays, 42% is from infrared rays which have longer wavelengths than the visible rays, and 6% is from ultraviolet rays with short wavelengths (Fig. 1). The restrictions on wavelength length with conventional DSCs was around 800 nanometers, but

DX expands this to around 200-300 nanometers. It also uses light up to the range of near infrared rays, thereby giving it a light-power conversion efficiency of more than 10.0%, which is more efficient compared to other DSCs.

What is more, the research and development venture company International Frontier Technology Laboratory Inc. is developing a DSC that can generate power even indoors in total darkness with no visible rays by using infrared light.

DSCs currently offer low conversion efficiency compared to the approximately 18% from Si solar cells. But research and development on them is progressing with the goal of boosting their efficiency by handling a wide range of light wavelengths and accommodating usage methods that harness their quality of being able to generate power indoors and in poor light. (**Author's abstract**)

Keywords: *infrared rays, solar cells, Si solar cells, dry sensitized cells, renewable energy, ruthenium complex dye DX, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/06,
(Filipiniana Analytics)

0452

Solar power in Myanmar

Myanmar’s challenges when it comes to supplying power are meeting the country’s soaring demand for power and improving the electrification rate in rural areas. Myanmar is a country that is well-endowed with solar energy, and so solar power could conceivably be an effective way of dealing with these challenges. Fig. 1 shows trends in Myanmar's net power output, while Fig. 2 shows its annual amount of solar radiation.

In Myanmar, the purchase prices for solar power in its feed-in tariff scheme were raised in April 2014, with the purchase price for residential solar power going from USD 0.035 to USD 0.05 per kWh, while the price for industrial solar power went from USD 0.075 to USD 0.150 per kWh.

Given such circumstances, ACO Investment Group from the United States has concluded a contract with the Myanmar Government to construct two 150 MW solar power plants in the Mandalay Region, which is located in the center of Myanmar. These large-scale solar power plants are scheduled to be completed in 2016, and are projected to account for 10-12% of Myanmar's net power output. Since hydropower accounts for a large share of the power generated in Myanmar, it is faced with the problem that power supplies dwindle in the dry season. But the expectation is that introducing solar power will improve these seasonal fluctuations in power supplies. As this example illustrates, progress has been made in Myanmar in introducing renewable energies through foreign capital. (**Author's abstract**)

Keywords: *Myanmar, solar power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/10,
(Filipiniana Analytics)

0453

Solar power in Taiwan

Renewable energies accounted for a 2% share of the power output generated by Taiwan in 2013, with power derived from waste and wind power making up approximately 90% of this (Figs. 1 and 2). In September 2014 the Taiwanese government announced its targets for the introduction of renewable energies with a view towards 2030. These set the goal of boosting the share of power generated from renewable energies to 11% by 2030. As Fig. 2 indicates, the installed capacity for solar power in FY 2013 came to 392 MW, with the target being to raise this to 6,200 MW by 2030 (Fig. 3).

The Taiwanese government initiated the Million Rooftop PVs Program in 2012 as a measure to promote their adoption. For this, it has approved a business model in which Photovoltaic Energy Service Company (PV-ESCO) provides financing to installation companies, and collects funds from the installation companies' profits from electricity sales. Moreover, it has been applying the MOEA Solar Community Guidelines since 2013, in which subsidies are paid to both local municipalities and installation companies, which allows installation companies to cover their costs for connecting to the grid with said subsidies. (**Author's abstract**)

Keywords: *Taiwan, solar power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/06,
(Filipiniana Analytics)

0454

Sri Lanka modernizes biomass energy strategy

Sri Lanka's first biomass power plant (10 MW) started operation at Polonnaruwa, February 2009. Garbage-burning power generation (10 MW) is expected to start in FY 2010.

Sri Lanka has signed on a financing plan of 15 million dollars development aid from the International Finance Company in June 2008. The government intends to introduce and popularize small-scale hydroelectric plants, wind-power station, and various technology for biomass energy utilization, including biomass power generation of 1 MW class.

Among the Sri Lanka's energy demand spectrum today, biomass takes the largest share of 59%. Nearly 95% of households use wood for fuel, and 86% of inhabitants obtain wood from the forest for free. Therefore, efficient technology for making better use of wood energy will be promoted from now on. For example, promotion of wide use of wood chips (pellets), popularization of modern efficient woodstoves, calcined-lime kilns with improved furnace, brass smelting furnaces with biogas generation technology and etc. (**Author's abstract**)

Keywords: *Sri Lanka, biomass power plant, garbage-burning power generation, biomass energy utilization, wood pellets production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/07,
(Filipiniana Analytics)

0455

Start of a demonstration and development project to generate power from rice husks in Cambodia

The production output for harvested rice (unhulled rice) in Cambodia in 2010 came to 8.249 million tons, with this output undergoing a rapid increase of 1.38-fold over a six-year period relative to the 5.986 million tons from 2005. Since the yield of rice husks from the harvested rice accounted for about 20%, this means that 1.65 million tons of agricultural biomass were generated in 2010. As for the current uses for these rice husks, while some of them are used to fire bricks and as heat sources for brewing alcohol, the majority of them are abandoned and go unutilized.

The percentage of rice polished in the country remains at 64%, with the remainder exported to places like Vietnam and Thailand at a low price in an unhulled state. In order to break out of this state of affairs and have Cambodian rice gain recognition internationally, the government has laid out the goal of increasing the amount of rice produced and boosting exports of polished rice. In this manner, as the rice production and polishing rates rise an even larger quantity of rice husks will be generated.

The New Energy and Industrial Technology Development Organization (NEDO) has started a demonstration and development project using these rice husks in an agricultural region within Cambodia. This project is a tri-benefit project that is characterized by having the following three benefits: Raising rice prices and expanding rice exports through the use of highly efficient rice polishing machines, supplying electricity to agricultural regions by generating power with rice husks via pyrolytic furnaces, and improving agricultural soil via the residue from the pyrolytic furnaces (biochar).

The electrification rate in Cambodia is 29% generally, and particularly low for households in rural areas at 12.3%. This project is expected to boost the electrification rate in agricultural regions. The project period will last from November 2011 until March 2013, and has an estimated sum total of 535 million yen. (**Authors' abstract**)

Keywords: *rice husk, pyrolytic furnace, agricultural biomass, biochar, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/01,
(Filipiniana Analytics)

0456

Start of a demonstration experiment for the mass cultivation of algae through hybrid propagation

In December 2011 the University of Tsukuba, Ibaraki Prefecture, and Tsukuba City received a designation from the national government (Japan) as the Tsukuba International Strategic Comprehensive Special Zone. International Strategic Comprehensive Special Zones were created with the objective of fostering industries that are competitive internationally, with three projects having been initiated at Tsukuba. In order to advance their projects, these zones can receive preferential measures when it comes to deregulation, the tax system, financing, and financial matters.

The Project for the Practical Application of Energy from Algal Biomass is one such project which aims to create new industries by producing high-value substances (cosmetics) in the form of oil and squalene from algae. The greatest feature of algae as a biofuel resource lies in its high productivity. Compared to corn, from which 172 liters of oil per hectare can be obtained in a year, with algae mass production of anywhere from tens of thousands to hundreds of thousands of liters per hectare or more can be expected. If, by way of example, all of the world's oil demand were to be covered by biofuels, then with algae only a small percentage of the world's area under cultivation would be needed.

The establishment of mass cultivation techniques on outdoor agricultural land will be crucial for its practical application. The plan is to use arable land that has been abandoned (2 ha) within Tsukuba City for the agricultural land. Preferential measures related to converting this to agricultural land have been proposed, and a demonstration experiment will begin in 2012. By the year 2020 they will establish techniques for producing 14,000 tons of hydrocarbon oil each year. Two varieties of algae will be used: *Botryococcus* and *Aurantiochytrium*, which will be bred through hybrid propagation.

Botryococcus grows and propagates through photosynthesis. Conversely, *Aurantiochytrium* does not carry out photosynthesis but rather propagates by ingesting organic matter, which means that it can continue to grow even at nighttime so long as it has organic matter. With hybrid propagation, combining these two different types of algae makes it possible to boost oil productivity to higher levels than with either one on its own. The residue left over after the oil has been extracted and the sugar that *Botryococcus* algae excretes out of its body as part of its propagation process are consumed as feed by *Aurantiochytrium* in order to grow.

This hybrid propagation came about from an original idea from a research group at the University of Tsukuba. This research group posits that it is possible to produce oil at 160 yen per liter through mass production. (**Authors' abstract**)

Keywords: *Japan, squalene, algae, hybrid propagation, Aurantiochytrium, Botryococcus, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/11,
(Filipiniana Analytics)

0457

Start of a feasibility study on a project to generate and sell power from empty fruit bunches in Indonesia

Since petroleum accounts for 52% of Indonesia's primary energy, the country is highly dependent on it. The government has adopted a policy of lowering Indonesia's dependence on petroleum and expanding coal and renewable energies. It has devised the Target Energy Mix, which will decrease petroleum to 20%, increase coal to 33%, and increase renewable and other types of energies to 17% by 2025.

The use of empty fruit bunches after palm oil has been extracted from the fruit and seeds of oil palms has been garnering attention with respect to the use of renewable energy. Indonesia is the world's number one producer of palm oil, and has had annual production growth of 7% or more over the past five years, with it expected to achieve a production output of 25.4 million tons in 2011. The world's second largest palm oil-producing country is Malaysia, with these two countries accounting for 87% of the production output for the entire world.

The amount of empty fruit bunches which is the residue from this production continues to rise on account of the increase in the production output for palm oil. Since 1.1 tons of empty fruit bunches are given off for every 1 ton of palm oil produced, this means that in 2011 approximately 28 million tons of residue will be generated. These empty fruit bunches are an effective fuel that have a moisture content of around 60% and a calorific value of 4,000 kcal/kg, but due to their large shape they are difficult to store, transport, and handle (reference: the calorific value of coal for power generation is 7,000 kcal/kg). Furthermore, they have a large potassium content at 2%, and this potassium adheres to the furnace walls in the form of combustion ash when used in boilers. Since this causes problems with combustion, progress has not been made on recycling them.

In August 2011 Shimizu Corporation announced that it had initiated a feasibility study (FS) on a project to generate power using boilers at state-run palm oil plants in Indonesia. This is a research project by the New Energy and Industrial Technology Development Organization (NEDO) that is scheduled to last until March 2012.

Shimizu Corporation estimates that if the empty fruit bunches that are currently not being reused were to be used as fuel for power generation through the use of cutting-edge biomass boilers, then 180 MW of power could be generated at all 72 state-run plants in Indonesia, thereby obtaining reductions of CO_2 emissions of 1.15 million tons per year (more than 16 million tons over 14 years). Since this promises results in terms of power generation and reducing CO_2 emissions, the company will examine the commercial potential with respect to optimizing methods for collecting empty fruit bunches, the size of the boiler equipment, and the implementation period. (**Authors' abstract**)

Keywords: *empty fruit bunch, renewable energy, potassium, carbon dioxide emission, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/10,
(Filipiniana Analytics)

0458

Start of a project for convert raw garbage to biogas in Nagaoka City

Of the garbage generated from homes and businesses in Nagaoka City, Niigata Prefecture, with its population of 282,400 people (May 2011), 70,000 tons is combustible garbage, which in turn contains 20,000 tons of raw garbage. The cost for disposing of this garbage in FY2008 was about 3.13 billion yen, costing each resident roughly 11,000 yen per year.

Currently the total volume of combustible garbage, including raw garbage, in Nagaoka City is disposed of by incineration. A unique characteristic of household raw garbage and raw garbage from businesses (food waste from restaurants, school lunches, and hospitals) is its high moisture content, with 60-70% of its weight being moisture. When biomass like this with lots of moisture is incinerated a great deal of energy is needed, increasing the amount of CO_2 generated by that much more. As an alternative method to incineration, there is a method where methane fermentation is carried out and the methane is recovered as energy.

In Nagaoka City methane fermentation will be carried out on raw garbage, and then the methane gas derived from this will be used as fuel to generate electricity. The residue from the methane fermentation will be dried and used as solid fuel for generating electricity. This project was initiated in FY2011, with the aim being to put it into operation in July 2013. Every day 55 tons of raw garbage is disposed of, with the facilities operated by the municipality among the largest in the country. The cost of constructing the facilities will be approximately 1.9 billion yen, and the operating costs over the 15 years after they go into operation will be about 2.81 billion yen.

The amount of electricity generated by the methane gas will be 4.1 million kWh per year, which is equivalent to that used by about 1,000 ordinary households. Furthermore, it will also cut the amount of CO_2 generated by 2,000 tons per year, which would decrease the costs of disposing of garbage by 3.5 billion yen over 15 years. In order to promote this project, it will be essential to separate out only the raw garbage from among the combustible garbage. Starting from July 2013, Nagaoka City will change how garbage is thrown out by ordinary households and businesses, and will collect raw garbage and combustible garbage that has been separated. (**Authors' abstract**)

Keywords: *raw garbage, biogas, methane fermentation, Nagaoka City, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/06,
(Filipiniana Analytics)

0459

Start of a project to manufacture biomass coke from the empty fruit bunches of oil palms

Nippon Steel Engineering Co., Ltd. announced on October 17, 2011 that it would embark upon a project to manufacture biomass coke in Malaysia. The empty fruit bunches (EFB) that are generated from the process of extracting palm oil are used as the raw materials, which are compacted through heating and compression, and then carbonized to produce biomass coke. The biomass coke obtained from this will then be supplied as a substitute for the blast furnace coke used in shaft gasification and melting furnaces.

A manufacturing plant for biomass coke is slated to be built near Sungai Klang in Perak, Malaysia. Construction work will begin at the early of 2012, with the goal of completing the plant and entering it into operation in spring of 2013. The annual production will be 3,000 tons initially, with consideration being given to expanding this to 10,000 tons in the future. Bio-coke is rod shaped, with a diameter of 40 millimeters and a length of 20 to 100 millimeters. This is said to be the first bio-coke project to be carried out on a commercial basis in the world.

Blast furnace coke is used as a heat source for melting and a reducing agent in gasification and melting furnaces. Nippon Steel Engineering Co., Ltd. conducted a trial to produce biomass coke from the sawdust that is the waste matter from sawmills to serve as a blast furnace coke substitute. Compared to blast furnace coke, this biomass coke has a slightly higher content of volatile matter, but its fixed carbon and lower calorific value are roughly the same. As such, it was confirmed as offering stable operation even in trials in shaft gasification and melting furnaces.

After the completion of this biomass coke manufacturing plant in Malaysia, the full quantity of the coke will be exported to Japan, with the expectation that this will be sold to the shaft gasification and melting furnaces that are used at waste processing plants in Japan. They will be able to achieve CO_2 reductions of 168kg for each ton of garbage by switching from blast furnace coke to biomass coke. But since the production costs are fairly expensive compared to those for coal, the extent to which they will be able to reduce this price will serve as a challenge for the future. (**Authors' abstract**)

Keywords: *empty fruit bunch, biomass coke, blast furnace coke, bio-coke, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/12,
(Filipiniana Analytics)

0460

Start of a project to promote the use of biomass in the Greater Mekong subregion

The Mekong River that flows through Southeast Asia is a stereotypical international river that originates in the Tibetan Plateau; flows through the six countries of China, Myanmar, Laos, Thailand, Cambodia, and Vietnam; and then empties out into the South China Sea. This region wherein the Mekong River forms a basin is referred to as the Greater Mekong Subregion (GMS), in which six countries are affiliated and which has an area of 2.6 million km^2 and a population of 326 million people.

In July 2011 the Asian Development Bank (ADB) announced that it had decided on a project to promote the use of biomass in the GMS. With the provision of USD 4 million by the Nordic Development Fund (NDF) and USD 600,000 in funds from Cambodia, Laos, and Vietnam, these three countries will promote the project from July 2011 through until December 2014.

The rice husks and livestock excrement that are given off in large quantities as agricultural byproducts in the countries of Cambodia, Laos, and Vietnam are not used effectively as clean energy or fertilizer. At the same time, grain and

cereal agriculture is carried out at a large scale in order to produce biofuels, with the result of this being that grain and cereal production for food and forest area are both decreasing, which is giving rise to problems in terms of food security.

This project plans to install: 500 biogas systems for general households (to manufacture methane gas from livestock excrement), 600 biochar production stoves (to manufacture charcoal by baking firewood), and 75,000 cooking stoves (to improve combustion efficiency and prevent indoor air pollution).

Most of the households in the agricultural regions of Cambodia, Laos, and Vietnam use wood for fuel (firewood) for cooking. According to a 2005 report by the United Nations Children's Fund (UNICEF), each year 1.6 million people worldwide die due to indoor air pollution caused by the use of cooking stoves with poor combustion efficiency and wood fuels of poor quality indoors.

This project will also consider the use of land and forests in order to ensure food security. It will produce clean energy to reduce CO_2 emissions, while also aiming to improve the lives of those living in poverty in rural areas, through the efficient use of unutilized biomass. (**Authors' abstract**)

Keywords: *biomass, rice husks, livestock excrement, biogas, biochar, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/10,
(Filipiniana Analytics)

0461

Start of a promotion structure for the development of geothermal power in Japan

Japan is ranked third in the world in terms of its geothermal resources, but since the majority of these resources are located in national parks no progress was being made in developing them. However, moves to promote the development of geothermal power have been gathering steam as a result of the easing of regulations on the development of geothermal resources within national parks in FY 2012 and the start of the feed-in tariff scheme for renewable energies. As shown in Table 1, there have been 65 project plans that have been adopted which serve as promotion projects that are being carried out by the Japanese government.

The Geothermal Resources Development Survey Project conducted by Japan Oil, Gas and Metals National Corporation (JOGMEC) included the first survey within a national park following this regulatory easing. The Project to Promote Understanding of the Development of Geothermal Power being carried out by the Ministry of Economy, Trade and Industry adopted proposals with a wide variety of content, such as study sessions to promote local understanding among hot springs operators and others, field trips to existing geothermal power facilities, and using the secondary hot water following power generation for cultivating plants in plastic greenhouses and for snow melting pipes. The Ministry of the Environment's Project to Accelerate and Lay a Foundation for the Development of Geothermal Power consists of support for conference activities in which a variety of concerned parties from local regions take part, including local public bodies, with a view towards formulating plans to commercialize geothermal power.

Table 2 shows the eight survey sites within the national and quasi-national parks that are the targets of the Geothermal Resources Development Survey Project. Of these, the ground surface survey stage for the one in Yuzawa City, Akita Prefecture has concluded and the exploratory excavation work got underway in July 2013, with several additional exploratory excavation holes planned by the fiscal year 2015. (**Author's abstract**)

Keywords: *Japan, geothermal power, renewable energy, promotion structure, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/01,
(Filipiniana Analytics)

0462

Start of a tidal power generation experiment in the region affected by the great east Japan earthquake

The Institute of Industrial Science of the University of Tokyo and Shiogama City installed tidal power generation equipment along the coast of Sabusawajima Island in Shiogama City, Miyagi Prefecture on November 18, 2014. The development is scheduled to be carried out between FY 2012 and 2016 as part of the Tohoku Recovery Next-generation Energy Research and Development Project by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In FY 2012, which was the first fiscal year of the project, a small-scale experiment was carried out at a water tank at the Chiba Experiment Station of the University of Tokyo, and tidal measurements were taken at a candidate site. Then in FY 2013 preparations were advanced by developing a power generation control method by setting up an experiment on a land bench.

This manufacturing and installation was carried out by the local company Tohoku Dock Kogyo Co., Ltd. It will begin generating power in February 2015, which it will supply to the facilities of a local fishery cooperative association, with plans for the electricity to be both produced and consumed locally. In actuality, this is the first instance in Japan of tidal power generation that is directly connected to a power company.

The power generating equipment consists of rotors that are 4 m in diameter on a vertical axis and that are fixed in place in the sea at a depth of 6 m. Two types of systems are installed, with a power output of 5 kW. As for the installation sites, it is installed at points where floating piers that had been washed out during tsunamis were situated, so that it would not interfere with sea routes. The installation sites are shown in Fig. 1. (**Author's abstract**)

Keywords: *Japan, tidal power generation, test experiment, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/12,
(Filipiniana Analytics)

0463

Start of a trial to manufacture bio-coke from palm trees in Malaysia

Kinki University and Osaka Gas Engineering Co., Ltd. have announced on March 3, 2014 that they began a trial to manufacture bio-coke using biomass derived from palm trees as the raw material in Malaysia.

Bio-coke is a solid fuel that is produced by pulverizing biomass materials and loading them into a reaction container, where heat and pressure are then applied to them. Whereas the conventional method required that the materials be heated to about 800°C for carbonization, with the manufacturing process for bio-coke developed by Kinki University bio-coke is produced through a new type of solidifying transformational technology under conditions of approximately 180° and 20 MPa. This does not cause the materials to carbonize, and therefore there is almost no loss of volume from the conversion to fuel. A comparison of bio-coke against wood pellets and wood chips is shown in Table 1.

As shown in Table 2, since 2008 Kinki University has been engaged in demonstration trials and the development of production equipment for bio-coke in an ongoing manner. This initiative has received acknowledgment, and has won the FY 2011 New Energy Award (Director-General Prize of Agency of Natural Resources and Energy) implemented by the New Energy Foundation, as well as the Ministry of the Environment's FY 2012 Environment Minister's Award for Global Warming Prevention Activity.

This manufacturing trial in Malaysia came about as a result of the Joint Industry-Academia Implementation and Development Project being conducted by the Japan Science and Technology Agency (JST). For the trial Osaka Gas Engineering Co., Ltd. will install a pilot plant in Malaysia and produce about 650 tons of bio-coke a year over a two-year period. Through the results of this they are aiming to install a commercial plant, mass produce bio-coke, and sell it to melting furnaces within Japan. (**Author's abstract**)

Keywords: *Malaysia, bio-coke, palm trees, biomass material, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/05,
(Filipiniana Analytics)

0464

Start of construction on a biomass power plant using napier grass in the Philippines

The Philippines' is moving forward with its plans for introducing renewable energies via the National Renewable Energy Program (NREP) that its Department of Energy announced in 2008. The country plans to roughly triple its capacity for generating energy from renewable energies from 5,438 MW as of 2010 to 15,304 MW by 2030. Fig. 1 shows the installed capacity for each type of power generation as of 2013, with the cumulative installed capacity for generating power from renewable energies, including geothermal and hydropower generation, accounting for 31% of the total.

In February 2015, the Department of Energy gave its approval for the construction of a 12 MW biomass power plant in Bataan Province that will use napier grass for fuel. The plant is being planned by the state-run Clean Green Energy Corp. (CEC), which aims to complete it in October 2017. This will be followed by a second phase in which it will be expanded to 24 MW. The napier grass used as its fuel will be supplied by CEC's affiliate Greenday Agri Farm, which will develop a new plantation for this purpose.

Napier grass, which is a fast-growing plant in the Poaceae family, is not used for food and can be cultivated on marginal growing land with even poorer conditions than those for sugarcane. In addition, after it is harvested sprouts bud from the stumps, allowing it to be harvested for five to ten years in a row.

The power plant that was recently granted approval will first dry the napier grass, then use cutting edge technology to directly burn it to generate steam with 90% efficiency. It is also designed to handle the caustic components contained within the napier grass.

The hope is that successfully generating power from napier grass will popularize biomass power in the Philippines. (**Author's abstract**)

Keywords: *Philippines, napier grass, biomass power plant, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/06,

(Filipiniana Analytics)

0465

Start of deliberations on international standardization for redox flow batteries

Redox flow batteries have been developed as large-scale storage batteries that are suitable for equalizing fluctuations in output from renewable energies such as solar power and wind power. In Japan, Sumitomo Electric Industries, Ltd. has been carrying out research and development, with demonstration tests being carried out by Hokkaido Electric Power Co., Inc. and at Sumitomo Electric Industries, Ltd.'s own plant in Yokohama.

As can be seen from Table 1, redox flow batteries are being developed and sold all over the world. In February 2014 the International Electrotechnical Commission (IEC) gave its approval for the establishment of international standards for redox flow batteries in the aim of popularizing them around the world in the future. China and Spain have also filed motions for international standardization with the IEC, which appointed Japan as the convener (chair) of the working group to deliberate over these. Sumitomo Electric Industries, Ltd. will serve as the project leader when it comes to standardization for safety in particular, and has also been contributing to the international development of redox flow batteries. (**Author's abstract**)

Keywords: *international standardization, redox flow batteries, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/07,
(Filipiniana Analytics)

0466

Start of Demonstrations for Jet Fuel Made from Municipal Waste

The amount of energy consumed by the air transport sector is on the rise globally, with airline companies around the world undertaking initiatives to introduce bio jet fuel. In Japan, the Committee for the Study of a Process Leading to Introduction of Bio Jet Fuel for the 2020 Summer Olympic Games and Paralympic Games in Tokyo was established in July 2015, and such initiatives have been enhanced.

As part of this, a group comprised of Japan Airlines Co., Ltd., Japan Aerospace Exploration Agency (JAXA), Toyo Engineering Corporation, and others announced in January 2016 that it will build the first demonstration facility in Japan that will produce bio jet fuel from municipal waste in Chiba Prefecture. This facility will convert biogas (hydrogen, carbon monoxide) generated from municipal waste treatment facilities into jet fuel via the Fischer–Tropsch (FT) process. Jet fuel created from the FT process has been stipulated in ASTM standards as a drop-in jet fuel that can be used in combination with conventional petroleum-derived jet fuels without the need to revamp the airplanes, engines, and refueling equipment that is currently in use (see Table 1).

In addition, Hitachi Zosen Corporation is carrying out research on Alcohol-to-Jet (ATJ) fuel, in which ethanol, butanol, and other substances are produced from municipal waste via saccharification and fermentation, and are then used as raw materials to produce jet fuel-grade hydrocarbons.

As this indicates, plans to operate airplanes using jet fuel derived from municipal waste during the 2020 Summer Olympic Games and Paralympic Games in Tokyo are being advanced. (**Author's abstract**)

Keywords: *renewable energy, municipal waste, jet fuel, Fisher-Tropsch process, saccharification, fermentation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/02,
(Filipiniana Analytics)

0467

Start of examinations for recycling solar panels

It has been three years since the start of Japan's feed-in tariff (FIT) scheme for renewable energies in 2012, and the adoption of solar power is making rapid progress. The scheme sets the purchase period for solar power at ten years for less than 10 kW, and 20 years for any more than this. Therefore, the purchase price will drop after the end of these periods when the solar panels are reaching the end of their life spans, giving rise to the possibility that large quantities of solar panels will be discarded once ten and 20 years have passed. The glass substrate in typical polycrystalline silicon solar panels is heavy, and these also contain aluminum frames, silicon substrates, and wiring. In addition, the silicon substrate and wiring are firmly sealed in EVA resin in order to boost their durability. As things currently stand, it is difficult to separate this from the glass substrate, so progress has not been made on their recycling. The Ministry of the Environment released a report in June 2015 on the reuse and recycling of this sort of solar panel waste materials. This report estimated the amount of waste anticipated in each of three cases in which the life spans were either 20, 25, or 30 years. It claims that in the case of a 25-year lifespan, approximately 3,000 tons of solar panels will be discarded in FY 2020, followed by approximately 30,000 tons in FY 2030, and approximately 800,000 tons in FY 2039 (see Fig. 1).

In FY 2014, NEDO began developing technology in order to reuse and recycle the solar panel waste that will be generated in vast quantities like this, rather than disposing of it as industrial waste, and is aiming for a separation and disposal cost of 5 yen/W. Five development themes were newly adopted for FY 2015 (Table 1).

As a result of these technological developments, the expectation is that it will be possible to recover materials like the aluminum frames, glass, and silver (which makes up the wiring) in solar panels in an economical manner. (**Author's abstract**)

Keywords: *solar panels, Japan, renewable energy, recycling process, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/10,
(Filipiniana Analytics)

0468

Start of installation of large-scale solar power in Vietnam

Vietnam has an abundance of solar energy, with an intensity of solar radiation that is comparable to that of Spain and Italy, which were among the first in the world to adopt solar power. Spanish research institutes like the Centre for Energy, Environment and Technology (CIEMAT) and the Ministry of Industry and Trade of Vietnam created the map of solar radiation intensity shown in Fig. 1 in 2015.

While Vietnam has an abundance of solar radiation, the amount of solar power generation it had adopted as of 2014 was only 45 MW. Of this, 80% was used off-grid, which is independent from grid electricity, and 20% was used on-grid by being connected to grid electricity. Off-grid solar power is used to supply power locally via pico solar voltaic cells of about 1 W, residential systems of about 1 kW, as well as larger power sources and diesel power for schools and hospitals in conjunction with wind power. Conversely, on-grid types include 1-50kW units installed on the roofs of residences, units that are 40 kW and larger installed on the roofs of industrial facilities and factories, and units installed on the ground, and are being adopted as part of a demonstration project.

One new development is that Thien Tan Company Limited1 began building Vietnam's first on-grid mega solar power plant in a suburban environmental district in Quang Ngai Province on September 1, 2015. It is slated to have an installed capacity of 19.2 MW, and will be connected to the grid in June 2016. A sum of USD 40 million is being invested in this, with the expectation being that it will be viable from a business standpoint owing to the falling price of solar panels due to the global spread of solar power. Thien Tan Company Limited is also planning to install a solar plant in Ninh Thuan Province, with the hope being that the success of these projects will spur on the spread of solar power in Vietnam, with its abundance of sunlight. (**Author's abstract**)

Keywords: *Vietnam, solar power, renewable energy, solar power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/11,
(Filipiniana Analytics)

0469

Start of operation for the world's first blowhole wave power generation system demonstration and research facility

The world's first blowhole wave power generation demonstration and research facility appeared on the coast of Kokonogi in Echizen Town, Fukui Prefecture on October 2, 2014. The facility was developed by the Research Center for Advanced Science and Technology of the University of Tokyo, with Project Associate Professor Iida serving as the project leader. For the blowhole wave power generation used here, the blowholes that appear in rocky surfaces along the coast where the waves are rough are reproduced by artificially boring holes in bedrock. The vertical motion of the waves inside these holes produces wind, which is used to turn air turbines to generate power. For this facility, three holes with a diameter of 1.4 m and a length of approximately 50 m will be dug out as artificial boreholes, which will generate up to 30 kW of power.

Compared with the wave power generation that has been studied thus far, the blowhole power generation that was recently installed here has a simple structure, and thus it has been deemed possible to keep its construction and maintenance costs in check. Table 1 and Fig. 1 show examples of blowhole and other similar types of oscillating water column forms of wave power generation for which demonstration experiments have been carried out in actual water areas in Japan to date. What is more, the newly developed air turbines employ new technology that prevents the turbine blades from stalling out, which had previously been a problem, and also improves efficiency by controlling the number of rotations. This project has been carried out as a three-year plan from FY 2012 to FY 2014 as a Development, Demonstration, and Research Project for Technologies to Counter Global Warming by the Ministry of the Environment. (**Author's abstract**)

Keywords: *blowhole wave power generation system, renewable energy, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/11,

0470

Start of Operations for Large-Scale Offshore Wind Farm Projects in China

Europe has gotten a head start with the installation of offshore wind farms, but China has set a target of installing 5GW by the end of 2015 and 20 GW by 2020. As shown in Fig. 1, China is ranked fifth in terms of its cumulative installed capacity for offshore wind turbines at 658 MW, and is ranked third in the world in terms of the amount newly installed in 2014 after the United Kingdom and Germany with the addition of 229 MW (Fig. 2).

In China, wind farms have primarily been installed in intertidal zones to date in order to promote offshore wind power, with plans to continue to promote their installation in coastal waters with deep waters in the future. A feed-in tariff price that gives favorable treatment to coastal waters was set in 2014. Since onshore wind turbines, for which development has been promoted on land, are far away from the regions where there is electricity demand, new power supply networks will have to be installed. Compared with this, coastal areas have the advantage of having large populations and so wind power is close to the regions where there is demand for it, so power lines can be short.

As shown in Table 1, large-scale offshore wind farm projects in China that newly went into operation in 2015 include two locations in Jiangsu Province–the Chenjiagang Xiangshui Offshore Wind Farm and the Longyuan Rudong Intertidal Wind Farm–as well as one in Shanghai in the form of the Donghai Bridge Wind Farm. Other projects that are currently under construction include the Putian Nanri Island Wind Farm, the Rudong Wind Farm, and others. The development of offshore wind farms in China has been promoted by focusing on cultivating industries related to offshore structures and the laying of undersea cables, as well as on overseas expansion. (**Author's abstract**)

Keywords: *China, wind farm project, offshore wind turbine, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/11,
(Filipiniana Analytics)

0471

Start of operations for the largest bioethanol plant in Vietnam

Vietnam has a total population of 86 million people, 71% of which live in rural districts. The percentage of GDP accounted for by primary industry (agriculture, forestry, and fishery industries) is 22%, while the percentage of the working population of 42.7 million people that such industry accounts for is 57%. As such, agriculture is an important industry for Vietnam. Agricultural production mainly consists of rice, of which 4 million tons are exported a year, with this accounting for more than 10% of the production output. In addition to rice, the country also produces a great deal of sugarcane and cassava (Table 1).

Vietnam is promoting plans which use the biomass from its abundant agricultural produce and the waste matter generated from this as energy. With regard to biofuels in particular, there is the Biofuel Development Program that was announced by the Vietnamese Government in November 2007. This program sets out production targets for the annual production of 250,000 tons of bioethanol by 2015, and 1.8 million tons by 2025.

In concert with the government's Biofuel Development Program, a large-scale plant which produces more than 50 million liters of bioethanol a year is in operation, with the construction of other plants moving forward as well (Table

2). The total production capacity is planned to reach 822.7 million liters (660,000 tons) by 2013. With such production capacity Vietnam will adequately be able to cover its production target of 250,000 tons for 2015.

One such plant is the Dong Xanh Joint Stock Company, which went into full-scale operation for bioethanol production in April 2011. It has a total investment amount of 600 billion dong (2.419 billion yen), a lot size of 18 hectares, and an annual production capacity of 100,000 tons (125 million liters), making it the largest bioethanol production plant in Vietnam. It uses cassava as its raw materials, which it purchases from 20,000 nearby farm households. (**Authors' abstract**)

Keywords: *Vietnam, bioethanol, agricultural produce, waste matter, cassava, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/05,
(Filipiniana Analytics)

0472

Start of public road tests for algae biofuel vehicles in Japan

On March 24, 2014, public road driving tests of diesel cars using diesel oil with biofuel created from microalgae intermixed began. This test is a part of the Project for the Practical Use of Algal Biomass Energy of the Tsukuba International Strategic Zone. This is the first case in Japan where vehicles that use oil produced from algae (hydrocarbon oil) as fuel were driven on public roads. As part of the aforementioned project, the University of Tsukuba, Tsukuba City, Ibaraki Prefecture, Sekisho Corporation, and Sinanen Co., Ltd. entered into an agreement concerning the driving tests, with the plan being to continue holding the trials up through FY 2015. Moreover, the aforementioned project was started in 2012, as shown in Table 1. Concurrent with the start of the diesel car driving tests, in FY 2014 construction work was completed on the Large-scale Proving Facility for Algal Biomass Energy, which aims to establish mass production techniques for algae that will produce hydrocarbon oil through the use of deserted cultivated land. The objective with this project is to complete a facility that has an annual production capacity of 14,000 tons of hydrocarbon oil in 2020.

Oil produced by algae that manufactures microalgae into fuel has high production efficiency, while the annual potential fuel production output per 1ha with microalgae is about 340-800 times that from corn and 10-23 times that from palm oil, as shown in Fig. 1. This project originated from the research results of the M.M. Watanabe & K. Kaya Lab of the University of Tsukuba, with the focus of its research when it comes to microalgae placed on *Botryococcus* and *Aurantiochytrium*. (**Author's abstract**)

Keywords: *Japan, algae biofuel vehicle, public road test, microalgae, Botryococcus, Aurantiochytrium, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/06,
(Filipiniana Analytics)

0473

Start of sales of next-generation power conditioners for solar power

The electricity obtained from solar power systems is direct current, and so in order for power companies to connect this up to the power grid they first have to convert it to alternating current (see Fig. 1). The device that handles this conversion is called a power conditioner, and until now they have used silicon semiconductors in the major parts of their electrical circuits.

Yaskawa Electric Corporation has developed a power conditioner for residential solar power that uses gallium nitride (GaN) semiconductors instead of silicon semiconductors, and is be the first in the world to put this on the market as of January 2015. These GaN semiconductors are also used in blue light-emitting diodes (blue LEDs). When used in power conditioners, they improve the current conversion efficiency of roughly 96% found with silicon semiconductors to 98%. What is more, this time around they will be putting a power conditioner for residential use that is installed indoors and which has a rated output of 4.5 kW on the market. Its installation area is about half that of conventional models, allowing for substantial space savings.

These sorts of semiconductors that are used for power conversion are called power semiconductors. Silicon carbide (SiC) semiconductors are one type of power semiconductor, for which progress is being made in applying them in power conditioners by Mitsubishi Electric Corporation, ROHM Semiconductor, and OMRON Corporation. Mitsubishi Electric Corporation will also begin selling power conditioners for residential solar power in January 2015. This product is one that applies its technology from power conditioners for automobiles, which went on the market in July. Power conditioners that utilize next-generation power semiconductors are an important technology when it comes to using the electricity obtained from solar cells with low losses, and the hope is that they will grow in popularity in the future. (**Author's abstract**)

Keywords: *next-generation power conditioner, solar power, renewable energy, Japan, solar power system, gallium nitride, power semiconductors, silicon carbide, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/01,
(Filipiniana Analytics)

0474

State of solar power in Cambodia

As indicated in Fig. 1, Cambodia is well suited for solar power as the country receives an abundance of sunlight.

The use of solar power in Cambodia is being promoted primarily through the introduction of household solar power for non-electrified regions. In 2011, the Cambodian NGO PicoSol created a roadmap for solar power with the assistance of the Asian Development Bank, in which it set the goal of extending electricity to 200,000 households in non-electrified regions by 2020.

The introduction of solar power in non-electrified regions is being promoted by means of handling lighting through solar lanterns and accommodating home electronic appliances through solar home systems (SHSs). SHSs consisting of 100 W solar panels are sold for USD 295 to 460. The expectation is that further progress will be made with the dissemination of solar power in non-electrified regions as the sales price of solar panels continues to fall globally.

At the same time, solar-powered tuk-tuks have begun to be manufactured within Cambodia since March 2014 as a way of using solar power that is unique to Cambodia. The tuk-tuks were developed by Star 8, a manufacturer of products for solar power with its headquarters in Australia. They are equipped with solar panels ranging from 500 W to 2.2 kW on their rooftops and sides, and can travel roughly 100 km on a full charge. What is more, they can also be used for household electricity in place of storage batteries, making them effective as a means for reducing non-electrified regions. (**Author's abstract**)

Keywords: *Cambodia, solar power, renewable energy, solar lanterns, solar-powered tuk-tuks, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/11,
(Filipiniana Analytics)

0475

Status for renewable energies in Malaysia

The adoption of renewable energies has been making progress in Malaysia, which has been spurred on by the Renewable Energy (RE) Act 2011 that was approved by the parliament in April 2011. As a result of this law, a feed-in tariff (FIT) scheme was adopted in December 2011. The purchase period for biogas and biomass power, which are eligible under the FIT, has been set at 16 years, while this is 21 years for small hydropower and solar power.

Fig. 1 shows the introduction targets for renewable energies. The installed capacity for power generation from renewable energies in 2030 has been set at 4,000 MW, which is equivalent to 17% of the total amount of power generated in the country. This is equivalent to 17% of the total amount of power generated in the country. From Fig. 2 it can be seen that biomass, small hydropower, and solar power (non-individual) have received FIT authorization in largely equal proportions. However, a look at the cumulative installed capacity at the start of power generation from renewable energies from Fig. 3 reveals that the installation of solar power, which is easy to build, has been given first priority. Malaysia’s FIT is structured so that the authorized installed capacity is determined for each recruitment period, and the purchase price is reduced according to the authorization period and the period in which operation begins. As this indicates, it was designed as a system for promoting the steady dissemination of renewable energies and curbing excessive increases in the share of surcharge borne by electricity consumers. (**Author's abstract**)

Keywords: *Malaysia, renewable energy, biogas, biomass power, hydropower, solar power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/11,
(Filipiniana Analytics)

0476

Status for the use of sewage sludge in Japan

As of the end of March 2013 the sewerage penetration rate in Japan stood at 76.3%, with the country generating more than 2.2 million tons of sewage sludge on a dry basis. Sewage sludge contains 60 to 80% organic matter, and

constitutes a stable source of energy in both a quantitative and a qualitative sense. Yet the energy usage rate for biogas, sludge fuel, etc. remained down at 12.6% for FY2011 (Fig. 1).

Nearly 80% of sewage sludge is recycled and reused, with material recycling in the form of ingredients for cement and so forth constituting the vast majority of this (Fig. 2). In the Basic Act for the Promotion of Biomass Utilization from 2009 the government aims at recycling and reusing 85% of this by 2020 by means of promoting the use of energies such as from the conversion of sewage sludge to biogas. Local municipalities have been promoting the practical use of energy and plans for this under such circumstances. Examples of this are shown in Table 1. What is more, the Ministry of Land, Infrastructure, Transport and Tourism has been promoting research and development for energy use through the Breakthrough by Dynamic Approach in Sewage High Technology Project (B-DASH Project). (**Author's abstract**)

Keywords: *Japan, sewage sludge, recycling, reusing, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/03,
(Filipiniana Analytics)

0477

Status of bioenergy in Australia

According to the 2013 Australian Energy Statistics, which were released by the Bureau of Resources and Energy Economics (BREE) of Australia, the net amount of renewable energies in FY2011 (Australia's fiscal year is from July to June) came to 265 PJ, or 1.5% of its total energy. Bioenergy accounted for the largest proportion of this, followed by hydropower, wind power, and then solar power (see Figs. 1 and 2). (Note: All of the uranium oxide from Fig. 1 is exported.)

A project by the Bureau of Agricultural and Resource Economics and Sciences (ABARES) set forth the target of increasing bioenergy to 340 PJ, or 2.2% of its primary energy supplies, by FY2029. Moreover, Australia has also set out the goal of raising the 2 TWh of power generated from bioenergy in FY2007 to 3 TWh, with the performance from FY2011 coming to 2.34 TWh as shown in Fig. 3.

According to the Australian Energy Resource Assessment 2010, further work will be done to introduce bioenergy, and as such there are hopes for the manufacture of biofuels and generation of power from the woody parts of plants that constitute the non-food portions. What is more, Australia also has the potential to use discarded wood from plantations and forests. The country has the advantage that it can cultivate non-food plants for bioenergy on land that is unsuitable for farming, which has the potential to tie in to the effective use of its vast national territory. Fig. 4 shows the land use in Australia and its bioenergy-related facilities. (**Author's abstract**)

Keywords: *Australia, bioenergy, renewable energy, biofuels, woody biomass, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/02,
(Filipiniana Analytics)

0478

Status of hydropower in Laos

With a population of approximately 6.9 million people and a per capita GDP of USD 1,697, Laos is considered a Least Developed Country (LDC). But its GDP growth rate of 7.4% is one of the highest in Asia, and it is growing based mainly around its industrial sector, including its service industry and construction, with the goal of breaking free of its LDC status. The Mekong River, which flows into Laos from Yunnan Province in China, bisects the country longitudinally, traveling 1,500 km north to south. Power generating projects that harness its abundant hydropower resources have been contributing to the country's economic development.

The Mekong River Basin has 18,000 MW of latent hydropower. As of November 2014, 3,244 MW of hydropower plants had been built here and were being operated to meet the country's demand for power and to export electricity. There are currently plans to build nine large-scale hydropower plants in the main Mekong River Basin. But there have been calls from countries further downstream for greater rigor when it comes to the environmental assessments of large-scale hydropower plants. Conversely, it is estimated that there is 12,500 MW of potential hydropower for small-scale hydropower generation (which is less than 5MW in Laos) that can be developed in tributary regions along the Mekong River, where the environmental impact would be comparatively minimal.

Laos is aiming to reach a household electrification rate of 90% by 2020, and while electrification was at 73% in 2010 it had advanced to 87.34% by 2013. Of this, roughly 2% comes from non-grid connected (off-grid) power sources derived from renewable energies. For the roughly 136,000 households in remote regions and mountainous areas which still have yet to be electrified, off-grid power sources hold promise in terms of their economic performance in regions that consume small hydropower, solar power, and so forth, more so than extending power lines to these areas does.

Japan is lending its cooperation for the development of hydropower through its official development assistance (ODA) as shown in Table 1. The Nam Ngum 1 Hydroelectric Power Plant, which went into operation in 1971 with the help of development assistance, was the first hydropower plant in Laos. In 2009 a preparatory survey for its expansion was carried out with the involvement of Japanese officials, as a result of which construction is moving forward with plans for it to go into operation in 2018. What is more, a group affiliated with Japan is undertaking everything from the preliminary survey through to construction for a small hydropower plant in Phongsaly Province in the north where progress on electrification has stalled, as shown in Fig. 1. This is slated to be completed in 2015. (**Author's abstract**)

Keywords: *Laos, hydropower, renewable energy, hydropower plant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/06,
(Filipiniana Analytics)

0479

Status of Japan's (stationary) offshore wind farms

When it comes to offshore wind turbines, there are Stationary types that are suited for coastal areas with shallow water depths, and floating types that are suited for water regions between about 50 m and 200 m deep. With regard to the floating wind turbines, demonstration trials aimed at their practical implementation several years down the road have only just begun, and so at this point in time when discussing offshore wind turbines, it is safe to assume that the Stationary variety is what is being indicated.

The majority of those that have been installed at this point in time have been the Stationary variety, the introduction of which has been making progress throughout Europe as shown in Fig. 1. The cumulative installed capacity for offshore wind turbines worldwide came to 5,415 MW as of the end of 2012, which was only about 2% of the 282,430 MW of cumulative installed capacity for all wind turbines. But the European Wind Energy Association (EWEA) has set forth the targets of introducing 40,000 MW of offshore wind power by 2020 and 150,000 MW by 2030. Recently the London Array (630 MW), which is the world's largest offshore wind farm, began operating in the United Kingdom in July 2013.

As indicated in Table 1, offshore wind power in Japan has been introduced ever since 2004. But full-scale Stationary offshore wind power located out to sea has been installed off the coasts of Choshi and Kitakyushu since 2013 as an offshore wind turbine demonstration project by NEDO, which began operating on a trial basis one after another.

The waters off the coast of Choshi constitute an ocean region with particularly strong swells in Japan, while those off the coast of Kitakyushu constitute on ocean region that is prone to the effects of typhoons. The plan is to collect data for the future adoption of offshore wind power by installing wind turbines and towers for monitoring offshore wind conditions in these regions. (**Author's abstract**)

Keywords: *offshore wind turbine, renewable energy, Japan, stationary variety, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/01,
(Filipiniana Analytics)

0480

Status of small wind turbines

In the wind power sector large-scale turbines typified by offshore wind turbines garner all of the attention, but power generated from small wind turbines with outputs of less than 20kW is also eligible for the feed-in tariff (FIT) scheme for renewable energies. The purchase price for such power has been set at 55 yen/kWh based on the assumption that the construction costs for small wind turbines are 1.25 million yen/kW. Conversely, the purchase price for power generated from 20kW or larger wind turbines is 22 yen/kWh.

The application of the FIT scheme requires third-party certifications concerning the safety and quality of small wind turbine machinery, and Nippon Kaiji Kyokai (Class NK) began performing certifications in December 2011. What is more, considerations are currently underway at Japan Electrical Safety & Environment Technology Laboratories (JET) and others, with a view towards organizing technical standards for the JET certifications as electrical device safety certifications needed to connect these turbines to the grid. Given such circumstances, the number of certifications via the FIT scheme is ten cases, while only two have actually been adopted.

The Japan Small Wind Turbines Association, composed of small wind turbines manufacturers, has released the aggregate actual performance for the adoption of small wind turbines for 2010 shown in Fig. 1, as well as the future outlook up through FY2020 shown in Fig. 2. From this it is apparent that most of the actual performance comes from decentralized power sources rather than grid connected ones. At present, the Japan Small Wind Turbines Association is working to set in place a market environment that is suited to the FIT scheme, with this including equipment certifications and organizing technical standards for connecting to the grid. (**Author's abstract**)

Keywords: *small wind turbines, wind power, renewable energy, performance, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/03,
(Filipiniana Analytics)

0481

Status of wind power in New Zealand

New Zealand is a country with high utilization rates for renewable energies internationally, with renewable energies accounting for a share of approximately 75% of its total power output in 2013. In the Energy Strategy 2011-2021 of the Ministry of Business, Innovation and Employment, New Zealand set forth the target of raising its share of renewable energies to 90% by the year 2025. Following this, the New Zealand Wind Energy Association stated that New Zealand must raise its share of wind power from 4.8% in 2013 (see Fig. 1) to at least 20%.

As indicated in Fig. 2, New Zealand is a country with an abundance of wind energy, and it has enormous potential to adopt wind power in the future. According to the New Zealand Wind Power Association, the country's cumulative installed capacity as of 2014 came to 683 MW (Fig. 3). The installed capacity from wind farms that have already been approved as of this point in time has reached 1,272.5 MW, while that from those that are pending would amount to 1,152.9 MW. If all of these were to be built, then this would constitute roughly 3,100 MW, which is more than four times the amount installed as of 2014. It is projected that this would achieve the target for a share of wind power that was 20% of total power output. (**Author's abstract**)

Keywords: *New Zealand, renewable energy, wind power, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/01,
(Filipiniana Analytics)

0482

Steadily increasing the production of biodiesel fuel from waste cooking oil

The amount of cooking oil consumed in Japan in FY2008 came to 2.27 million tons, of which 1.9 million tons was consumed by the food service industry/food manufacturing industry and 370,000 tons was consumed by ordinary households. Canola oil is the most abundant of the cooking oils, which was followed by palm oil and soybean oil. Conversely, 330,000-350,000 tons and 90,000-110,000 tons of waste cooking oil are simultaneously generated by the food service industry/food manufacturing industry and ordinary households, respectively. Of this, as much as 60,000-80,000 tons of waste cooking oil from the food service industry/food manufacturing industry and 90,000-100,000 tons from ordinary households go unused.

The majority of the waste cooking oil is reused as animal feed (additives for compound feeds), followed by industrial uses (soap, paint, ink) and for use as fuel (diesel, boiler fuel). In addition to these uses, progress is being made on developments for manufacturing machining oil (lubricating oil, cutting lubricant, press oil) from waste cooking oil. This can be manufactured via a process similar to the method for manufacturing biodiesel.

The amount of biodiesel fuel produced from waste cooking oil has been steadily increasing from 4,471ka (FY2006), to 6,229ka (FY2007), 6,949ka (FY2008), and 8,568ka (FY2009). Conversely, the manufacturing costs have been dropping from year to year; from 104 yen/a (FY2006, though this was 135 yen/a in local municipalities), to 124 yen/a (FY2007), 117.6 yen/a (FY2008), and 99.8 yen/a (FY2009).

Waste cooking oil is a promising resource as a raw material for domestically produced biofuel, with the greatest challenge being to construct a highly efficient recovery system for them. As part of the manufacturing cost for waste

cooking oil, the average cost of collecting the waste oil came to 34.4 yen/kg (FY2010). The recovery costs account for roughly 34% of the manufacturing costs. By taking initiatives that reduce the recovery costs, such as collecting the amount of waste cooking oil generated by ordinary households after it has been collected together in the containers which contained the cooking oil, further progress toward the use of biodiesel will be possible. (**Authors' abstract**)

Keywords: *Japan, cooking oil, biodiesel fuel, canola oil, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/07,
(Filipiniana Analytics)

0483

Steady expansion of co-firing power generation by woody biomass with coal

CO_2 Emission by electric power industry has a big share, amounting to 25%, in the total domestic CO_2 emission of Japan. Therefore, a drastic reduction of CO_2 emission is a suspending issue for the industry. In this regard, the association of Japanese electric power industry including Tokyo Electric Power Co., Inc (TEPCO), Kansai Electric Power Co.,Inc and so on has established a goal in which they will increase the share of nuclear, hydroelectric and so-called new energy up to 50% by 2020. Among the new energy, expansion of power generation by co-firing of coal and woody biomass is notable.

Recently, TEPCO and Soma Kyodo Power Co., Ltd respectively announced new plans for introducing co-firing system. Reportedly, the No.1 Plant of the Hitachi-Naka Power station of TEPCO, as well as the No.1 and 2 plants of Shinchi Power Station of Soma Kyodo Power Co.,Ltd, respectively, would start co-firing power generation in 2012.

Other electric companies also began introduction of co-firing as well as new expansion of this system. The Hokuriku Electric Power Co. has already implemented co-firing at Tsuruga Power Station since June 2007. The company newly started co-firing at Nanao-Ohta Power Station from September 2010. The Chubu Electric Power Co.,Inc started trial operation of co-firing at Hekinan Power Station since May 2009, and subsequently, the company put it into full commercial operation in September 2010.

The amount of woody biomass consumed at a conventional coal power station is enormous, ranging from 20,000 to 300,000 ton annually. Therefore, co-firing is expected to reduce CO_2 emission drastically. In this context, some Japanese firms are considering of importing woody biomass from southeastern Asia where neglected/unused biomass exists abundantly. In southeastern Asia, large quantities of palm oil residue are incinerated, and not reused. By exporting woody biomass produced from palm oil residue, new employment for woody biomass production would be created in southeastern Asia. Furthermore, there is the merit that Japan can resource woody biomass stable in the long term. In this way, co-firing power generation in Japan would strengthen collaboration between Japan and southeastern Asian countries. (**Authors' abstract**)

Keywords: *carbon dioxide emission, co-firing power generation, woody biomass, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/10,
(Filipiniana Analytics)

0484

Sub-critical or supercritical water can change waste woody biomass to useful energy resources

A new technology that can change waste woody biomass into useful resource by means of sub-critical or supercritical water is now attracting worldwide attention. The phase diagram of water (Fig.1) illustrates the critical temperature (Tc=374°C) and the critical pressure (Pc=22.1MPa) of water, as well as supercritical zone and sub-critical zone. The reason why this technology has great merit and is regarded as promising in near future lies in the facts that water is quite cheap, handy, and available almost everywhere in the world, and that water is chemically stable, safe, and harmless to environment.

Researches on hydrolysis processes in sub-critical or supercritical water are in progress for the purpose of decomposing waste woody biomass such as forestry residue, woody scraps from lumber mill and bagasse (lees of squeezed sugarcane). The molecular structure of woody biomass is composed of three carbohydrate molecules - cellulose, hemi-cellulose and lignin that form complicated structure. By hydrolysis in sub-critical or supercritical water, cellulose can be decomposed into glucose (C6 sugar) and cellobiose (C6-C6 sugar), and hemi-cellulose into xylose (C5 sugar) and arabinose (C5 sugar). These sugars can be made into bioethanol by means of fermentation.

Japan is now advancing ahead in research and development as well as industrialization of technology for changing woody biomass into useful resource by means of hydrolysis processes. As an example of industrialization, Mitsubishi Kakoki Kaisha Ltd. is selling a continuous hydrolysis plant that can change sewage sludge into solid fuel (as substitute coal) and biogas by means of a process in sub-critical water where pressure and temperature are kept 1.6Mpa-2.9MPa, 200°C-230°C, respectively. Since the abovementioned processes that can turn waste biomass into energy using hydrolysis in sub-critical or super critical water are safe and eco-friendly, popularization of the technology is keenly waited for. (**Authors' abstract**)

Keywords: *Japan, waste woody biomass, sub-critical water, supercritical water, fermentation, hydrolysis, bioethanol, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/01,
(Filipiniana Analytics)

0485

Success with the production of methane via artificial photosynthesis

Research on photosynthesis, whereby plants create sugars and other organic matter from water and carbon dioxide using energy from sunlight, began in the 1910s. Research on artificial photosynthesis began in earnest due to the explanation of the theoretical foundations of photosynthesis as being related to the movement of electrons in 1992.

As shown in Table 1, in Japan companies like Panasonic Corporation and Toyota Central R&D Labs, Inc. are engaged in research and development, in addition to which numerous universities have been carrying out research as part of a project by the Ministry of Education, Culture, Sports, Science and Technology since 2012.

As part of the recent outcomes from this, Panasonic Corporation succeeded in producing methane from sunlight, water, and carbon dioxide in December 2013. Artificial photosynthesis consists of a two-stage process that includes a reaction that decomposes water into hydrogen and carbon dioxide via light and then composes organic matter from the carbon dioxide. This success was brought about via the development of a photocatalyst that aids the reaction mentioned above. While its conversion efficiency is still low at 0.04%, which is 1/5 that of plant photosynthesis, for the future its development will continue in its capacity as a method that is capable of supplying methane without any of the resource restrictions of obtaining it from fossil fuels. (**Author's abstract**)

Keywords: *artificial photosynthesis, methane, photocatalyst, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/02,
(Filipiniana Analytics)

0486

Successful flight experiments with biofuels

The total carbon dioxide emission from commercial aircrafts in the world is estimated to be around 2.5 to 3 percent of the total CO_2 emission by the consumption of fossil fuel throughout the world (ICAO: International Civil Aviation Organization). To reduce CO_2 emission, air-transport industries are paying big efforts on R&D for utilization of biofuel.

On January 7, 2009, Continental Airlines of USA, first among US airline-companies, conducted an experimental flight using biofuel. The biofuel was produced from Jatropha (60%) and a kind of alga (40%). This is also the first flight in the world using alga. A Boeing 737-800 type aircraft was used in the test flight. Mixture of biofuel (50%) and regular jet-fuel (50%) was burnt in one of the two engines of the aircraft that flew about 90 minutes.

In Asia, the Japan Airlines Co. conducted a similar test flight first in Japan, using biofuel of different components. Raw materials used for this biofuel were Camelina (84%) which grow on poor soil, Jatropha (15%) and a kind of alga (1%). Mixture of the biofuel (50%) and regular jet-fuel (50%) was burnt in one of the four engines of the Jambo aircraft, which flew for one and half hour from Haneda to Sendai and returned to Haneda.

The first flight using biofuel was attempted by the Virgin Atlantic Airlines Co. on February 24, 2008. They used a biofuel produced from babasu oil and coconut oil, and the flight lasted forty minutes. The second test flight was successfully made on December 30, 2008, by the Air New Zealand Co., where they used Jatropha biofuel, and the flight lasted for two hours. Thus, JAL's test flight comes to the fourth record in the world. It is expected, in this year, many other airlines companies may conduct more elaborate flight experiments using biofuels. (**Author's abstract**)

Keywords: *Japan, carbon dioxide, commercial aircraft, biofuel, Jatropha, algae, Camelina, babasu oil, coconut oil, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/02,
(Filipiniana Analytics)

0487

Successfully manufacturing biobutanol from unused citrus fruit waste matter

In June 2014 Mie University announced that it had succeeded in manufacturing biobutanol from the waste matter from mandarin oranges. This came about as a result of research performed by Tsuji Oil Mills Co. Ltd., a small to medium-sized enterprise (SME) of Mie Prefecture, Nakano Co., Ltd., and Mie University as part of the New Energy and Industrial Technology Department (NEDO)'s New Energy Venture Business Technology Innovation Program from FY 2013. The hope is that butanol derived from biomass will be used as fuel for vinyl greenhouse boilers and for agricultural machinery and equipment in its capacity as a fuel that is locally produced for local consumption. Research and development was recently carried out on the following process (refer to Fig. 1).

The fat-soluble limonene that is the natural fragrance contained in the rinds of mandarin oranges and a useful component, as well as a fermentation inhibitor, is extracted through preprocessing to obtain high quality cellulosic biomass.

Instead of the conventional process in which preprocessing, saccharification, and fermentation are carried out in a stratified manner, through the use of consolidated bioprocessing (CBP), saccharification and fermentation are carried out within a single tank to produce biobutanol.

Mie Prefecture established the Mie Biorefinery Research Forum in 2013 as an initiative to produce fuel and chemicals from biomass. This research was carried out as part of this, with bench model evaluations scheduled for FY 2014, the formulation of the overall system design and project plan scheduled for FY 2015, and the construction of a demonstration plant in Mihamacho, Mie Prefecture scheduled for FY 2016. (**Author's abstract**)

Keywords: *unused citrus, fruit waste matter, biobutanol, mandarin oranges, research and development, saccharification, fermentation, consolidated bioprocessing, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/08,
(Filipiniana Analytics)

0488

Synthesizing DME (dimethyl ether) from wooden biomass

Iwatani Corporation and National Institute of Advanced Industrial Science and Technology announced on May 12, 2009, "We succeeded in synthesizing DME from wooden biomass eucalyptus chips". DME (Dimethyl Ether: CH_3-O-CH_3) is used as gas for spray cans in Japan, but it has characteristics similar to those of LP gas (liquefied petroleum gas) and can also be utilized as automobile fuel. DME can also be produced from natural gas, coal, heavy oil, biomass, etc. The development of DME derived from the wooden biomass leads to the spread of domestic biomass fuel, and it has an important significance for Japan that depends on overseas sources for its energy resources.

In the DME producing method announced this time, DME is synthesized at a relatively low pressure, lower than 1MPa. Since it is not subject to the High Pressure Gas Control, the manufacturing equipment is small in scale. It is, therefore, possible to produce biomass DME using small-scale equipment at biomass production place and consume

it at the place. This research result is expected to develop into “a business model utilizing mobility and also a model of local production for local consumption of bio-fuel.”

DME is a “clean” energy that does not contain sulfur and produce sulfur oxides (SOx) and particulate matter (PM) when it is burnt. Since it is produced from biomass, it is expected to become “carbon-neutral energy that does not discharge CO_2.” In the future, they will continue their research mainly on use automobile fuel and its mixed use with LP gas for home use taking advantage of the characteristics of biomass DME.

The exhaust gas control of diesel vehicles in Japan is increasingly severe year by year as shown in the figure. The short-term control was applied in 1994, long-term control in 1998, new short-term control in 2003, and new long-term control in 2005. In 2009, the post new long-term control is planned to be established. As severe control has been introduced in succession in a short period, the development of DME vehicles that run operating diesel engines with DME has been promoted. The running tests demonstrate that DME vehicles comply with the new control. (**Author's abstract**)

Keywords: *dimethyl ether, wooden biomass, eucalyptus chip, biofuel, carbon-neutral energy, Japan, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/06,
(Filipiniana Analytics)

0489

New technology for promoting use of bio-diesel fuels

The target value of biomass fuel consumption by transport industry to be achieved by FY 2010 designated by Japanese government was 500,000 KL/year in crude oil equivalent. This figure is consisted of 10,000-20,000 KL of biodiesel fuel and 480,000-490,000 KL of bioethanol. As for FY 2007, total production of biomass fuels scored 6,200 KL, and production cost was 124 yen per liter in average.

Various efforts have been made to produce and utilize biodiesel fuel from used food oil collected from general households and food processing/catering industries. These efforts are mainly promoted by the system of so-called “local production and utilization” created by municipalities, NPO, and business companies of the local communities concerned. From now on, it seems very important to take advantage of strong points of every district of Japan, in order to develop systems for production and consumption of biodiesel fuel best suited for the specific local community.

Yokohama City has launched a project, in November 2009, to expand the utilization of biodiesel fuel made from used food oil. During FY2009, the city intends to collect used food oil from twenty-two public elementary schools in Kanazawa ward to produce biodiesel fuel that will be used at the water recycling center of Kanazawa ward as a substitute of heavy oil for the diesel electricity generator. The city plans to expand the project in FY 2010 and thereafter to every wards of the city, where 200 KL of used oil would be collected and turned into biodiesel fuel. The city estimated the project would reduce the city’s CO_2 emission by 542 tons annually.

At present, production of biodiesel fuel has been done, mainly, by adopting “Fatty Acid Methyl Ester” method. The drawback of this method is that it necessarily generates glycerin as by-product that has been disposed as an industrial waste. Nippon Shokubai Co. made an announcement, in October 2009, that the company has succeeded in developing a high performance catalyst to produce acrolein, which is an intermediate substance generated in the process to produce acrylic acid, by utilizing the glycerin.

This new technology has been qualified for NEDO’s innovative technology development grants of FY2009. Consequently, Nippon Shokubai plans to build a pilot plant as a next step. In this way, the glycerin will be turned into acrylic acid that will be utilized for producing absorbent polymers and polymeric flocculant materials for sewage

treatment. The new technology has opened a way to utilize glycerin, which so far has been disposed as waste, for producing useful high polymer material. In addition, it will also add a thrust for production and utilization of biodiesel fuel. (**Authors' abstract**)

Keywords: *biofuel, acrolein, Japan, used food oil, local production and utilization, fatty acid methyl ester method, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/12,
(Filipiniana Analytics)

0490

Test use of E3-gasoline has started

On February 26, 2009, Nippon Steel Engineering Co.(NSE) announced that the company has started test use of E3-gasoline (gasoline with 3% of bioethanol content) on real engines. NSE also presented to the public their facilities used for blending and supplying the E3-gasoline. The bio-ethanol was manufactured from waste foods using NSE-developed process. This is an outcome of the R & D project named "Food Recycling Experiment Project-Ethanol Production from Waste Foods", which NSE has been conducting under the contract to New Energy and Industrial Technology Development Organization (NEDO), for five years from FY 2005 to FY 2009.

Waste foods collected at Kitakyushu City and surrounding areas are used to produce ethanol. The waste foods are first ground into pieces and added with water, and put into saccharification process. Then it is fermented by adding yeast and turns into ethanol. Presently, ethanol production rate at NSE is 400 liter/day. NSE is conducting test use of their E3-gasoline on 20 different cars operated by the municipal offices and cars of NSE for business use.

At Miyakojima Island in Okinawa prefecture and in Osaka prefecture, test use of E3-gasoline has already begun. The raw material for production of bio-ethanol, however, is construction waste wood in the case of Osaka, while it is molasses of sugar cane in the case of Okinawa. So this is the first pioneering case in Japan, where waste foods are used for producing ethanol. (**Author's abstract**)

Keywords: *Japan, E3-gasoline, bioethanol, saccharification process, waste foods, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0491

Thailand is a biofuel pioneer in Asia

Thailand's biofuel production output for 2009 came to 400 million liters of bioethanol fuels and 600 million liters of biodiesel fuels, for a total of 1 billion liters. This makes it the most prolific in Asia after China (which has 2.1 billion liters of bioethanol fuels and 400 million liters of biodiesel fuels for a total of 2.5 billion liters), and it could be described as a pioneer in biofuels.

In 2008 the government established its 15-Year Renewable Energy Development Plan, which sets production targets for bioethanol fuels of 3 million liters/day (1.095 billion liters/year) from 2008-2011, 6.2 million liters/day (2.263 billion liters/year) from 2012-2016, and 9 million liters/day (3.285 billion liters/year) from 2017-2022. Against this backdrop, its aims are to reduce imports of petroleum, produce biofuels from crops grown in Thailand, and improve its energy self-sufficiency ratio.

Bioethanol is combined with gasoline and used as "gasohol". The predominant gasohol is E10 (ethanol mixing ratio of 10%), which comes in two varieties: one with an octane value of 95 (high octane) and one with 91 (regular). The government has set the retail price of gasohol as being cheaper than gasoline in the aim of spreading and popularizing bioethanol. Compared to regular gasoline which is 43.04 baht/liter (113 yen/liter), E10 (octane value 91) is 35.64 baht/liter (93 yen/liter) and E10 (octane value 95) is 38.14 baht/liter (100 yen/liter).

Presently, the main raw material for the production of bioethanol is molasses, which is a byproduct from manufacturing sugar from sugarcane. The production output for bioethanol has been steadily rising from 920,000 tons/day in 2008 to 1.1 million tons/day in 2009 and 1.17 million tons/day in 2010, but has not yet reached the target of 3 million tons/day. One of the reasons for this is because the use of Natural Gas for Vehicle (NGV; retail value of 8.5 baht/kg (22 yen/kg)), which receive price subsidies from the government, is expanding.

For the future, the Thai Government plans to promote the spread and popularization of bioethanol. This is because bioethanol production gives rise to profits for farmers and stabilizes their income. The cost of petroleum will be on an upward trend hereafter, and so it is predicted that the production of bioethanol will rise in the future as well. (**Authors' abstract**)

Keywords: *Thailand, biofuel, bioethanol, gasohol, E10, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/08,
(Filipiniana Analytics)

0492

Thailand Is an export powerhouse for bioethanol

The Thai government has revised its 15-year Alternative Energy Development Plan (2008-2022) and released a new 10-year Plan (2012-2021) in November 2011. The former plan laid out the objective of increasing the percentage of the country's total energy consumption accounted for by renewable energies from its current 9.4% to 20% by 2021, but the new plan has raised this to 25%.

In terms of its biofuel production output for 2011, Thailand produced 520 million liters of bioethanol and 630 million liters of biodiesel. Under the 10-year Plan the country will produce 3.285 billion liters of bioethanol per year (9 million liters per day) and 2.18 billion liters of biodiesel (5.97 million liters per day) by 2021, marking 6-fold and 3.5-fold increases for these, respectively. In addition, it has also laid out the objective of replacing 44% of fossil fuels with biofuels.

Thailand's production output for bioethanol was 336 million liters in 2008. But the expectation is that this will continue to rise favorably, reaching 695 million liters in 2012 and 785 million liters in 2013. This increase has been sustained by vigorous overseas exports (to the Philippines and Singapore). Exports bound for China have newly risen to 100 million liters, starting from 2012 in particular, and so Thailand will construct bioethanol manufacturing plants that use cassava as their raw material in order to accommodate this. (**Authors' abstract**)

Keywords: *Thailand, bioethanol, renewable energy, biodiesel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/07,
(Filipiniana Analytics)

0493

Thailand – the biggest biomass fuel producer of Southeast Asia

In FY2008, total amount of biomass fuels produced in the world scored as follows; 67 million ka for bioethanol, and 12 million ka for biodiesel. Compared to records of FY2007, 34% increase for bioethanol, and 33% increase for biodiesel. Among southeastern Asian countries Thailand stood as the biggest biofuel producer, producing 300,000 ka of bioethanol and 400,000 ka of biodiesel in FY2008.

The domestic production of primary energy in Thailand during FY2008 came up to 62,695 ktoe (kilo-ton oil equivalent), of which renewable energy was 19,295 ktoe (30.8%), biofuel was 626 ktoe (1%). The renewable energy resources are woody waste, chaff, bagasse and waste agricultural products.

The Thai government aggressively promotes domestic production of biofuels because of the following reasons: 1. It intends to cut down, five years later, import of oil from overseas by 1,000,000 ka to save 42 billion bahts (about 120 billion yen) (Oil import in FY2008 scored 40 million ka); 2. It expects the increase of income of farmers, by producing biofuels of higher market value than conventional agricultural products.

Reportedly, in Bangkok as of April 2010, market price of regular diesel oil was 29.39 bahts (83 yen) per liter, and 28.19 bahts (80 yen) for B2-fuel (diesel oil containing 2 % of biodiesel). The latter is sold at somewhat cheaper price. (**Authors' abstract**)

Keywords: *Thailand, biomass fuel, bioethanol, biodiesel, producer, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/06,
(Filipiniana Analytics)

0494

Thermal power station is beginning a full-scale process for utilizing biomass

Sewage sludge has now become regarded as one of useful biomass resources. As an example of utilization of sewage sludge for thermal electric power generation, the sewage sludge of Tokyo is presently heat-processed under 500 deg. Celsius, and made into a solid-type carbonized fuel This carbonized fuel is mixed with coal and used as fuel at Nakoso thermal power station of Joban Joint Power Co. Ltd.. Nakoso power station consumes three million ton of imported coal every year to generate electric power. The present mix ratio of the carbonized fuel to coal is about 1 percent. Thus, to reduce coal by this amount is possible.

As regards the use of sewage sludge for thermal power generation, on 27 March 2009, J-Power (Electric Power Development Co., Ltd) presented a project plan of utilizing sewage sludge discharged from Hiroshima City. 100 ton/day of sewage sludge (46 % of the total generated in Hiroshima City) will be made into pellets and carbonized under the temperature of 250 to 350 deg. Celsius so as to enrich the calorific value (4,500 to 5,300 Kcal/kg). The pellet

fuel will be mixed (at a ratio of 0.2%) with coal and burnt at some of their thermal power plants. J-P ower plans to accomplish this challenge by 2011.

Meanwhile, on 1 April 2009, Asahikasei Chemicals Co. presented a power generation project of 14 MW, where 100,000 ton/year of woody biomass will be mix-burnt with coal (at 60% mix ratio). A woody pellet production plant will be constructed at Nobeoka No.2 power station site. The construction of pellet plant will start in July 2010 and the plant will be put into operation in July 2012. Incidentally, the company has already realized mix-burning of biomass with coal at a rate of 10,000 ton/year.

It is reported that, in northern Miyazaki prefecture, Forest Energy Kadogawa Co. has already started production of woody pellets (25,000 ton/year). The forest industry in Miyazaki prefecture gets new market by this woody biomass utilization. This news proves that business circumstance for supply of woody pellet has readily established. (**Author's abstract**)

Keywords: *Japan, sewage sludge, biomass resources, woody biomass, pellet plant, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/05,
(Filipiniana Analytics)

0495

Thermal use of woody biomass is spreading in Japan

In total 31,200,000 m^3 of woody biomass waste is currently generated in Japan (FY 2006). Waste wood from construction industry has the largest share, next comes the waste wood from lumber mills, and then followed by forestry wood residue. Of the total waste woody biomass, 41% (1,280,000 m^3) is not reused. Table shows annually generated amount of waste woody biomass and state of reuse in Japan recently.

Almost 99% of forestry wood residue is abandoned without being reused. Thinning trees in the forests is necessary for preserving good forestry environment and this in turn generates a lot of forestry wood residue that is now calling for a smart way of utilization.

In many local places in Japan, various challenges are being noted concerning the utilization of hitherto unused woody waste as a new source of thermal energy in place of fossil fuels. In fact, strong promotions by Japanese government and local municipalities are backing up these challenges so as to cut down CO_2 emission nationwide. For example, Yokohama City intends to implement a decree to make it compulsory that new buildings with floor space bigger than 2,000 m^2 should use an amount of recyclable energy. (**Authors' abstract**)

Keywords: *woody biomass, Japan, waste wood, thermal energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0496

Tokyo Gas Co. presented a biogas generation research plant

On 4 June 2009, Tokyo Gas Co. made a public presentation on a biogas generation research plant installed at "Ecokkuru-Koto" a showroom of town-cleaning office, Koto Ward, Tokyo. The proof plant can produce methane gas, by methane-fermentation technique, using paper trash and food waste issued from offices and factories in the ward. The construction of the plant started in December 2008, completed in February 2009, and trial run was duly made. Two years from now of proof experiment/production is on the plan.

Everyday, about 300 kg of paper trash and food waste are collected and put into methane-fermentation tank of the plant. The bio-gas generated by the plant will be removed impurities like sulfur. The purified methane will be mixed with city gas, and distributed among the district. The plant can recover 63 cubic meter/day of bio-gas, which is equivalent to city gas consumption by thirty standard households. The plant is designed so that it can recover more than 150 Nm^3 of biogas per one ton of garbage. This criterion is designated in "the Standard for Efficient Biogas Recovery System" by the Ministry of Environment as a hurdle for applying for the Promotion Grant for Forming Recycling Society. This proof experiment is the first case of "urban biomass-energy recovery system" in Japan.

Tokyo Gas Co., before constructing the test plant, conducted a range of laboratory experiment for generating biogas from office garbage using methane fermentation technique. The result is shown in the Table. This experiment has shown that 1 ton of office garbage could yield 160 to 282 Nm^3 of bio-gas, in which methane content was 53 to 56%. This experiment verified that the criterion, more than 150 Nm^3 per one ton of garbage, designated in "the Standard for Efficient Biogas Recovery System" by the Ministry of Environment was cleared with much margin. Getting this result, Tokyo Gas Co. decided to construct the proof research plant in the Ecokkuru-Koto, which would verify biogas generation capability further in detail. (**Author's abstract**)

Keywords: *Japan, biogas generation, methane-fermentation technique, paper trash, food waste, urban biomass-energy recovery system, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/07,
(Filipiniana Analytics)

0497

The Tokyo Metropolitan Area will expand its proportion of renewable energies to 20% through comprehensive adoption measures

On June 3, 2014, the Tokyo Metropolitan Government convened the Review Committee for Expanding Renewable Energies with the aim of boosting the proportion of power comprised of renewable energies in the Tokyo Metropolitan Area from its current level of 6% to around 20% by 2020 when the Olympics will be held.

As it shows in Fig. 1, the Tokyo Metropolitan Government is making progress in introducing two types of renewable energies, since it has persisted with a subsidy scheme for solar power and it has installed waste power generation plants at its municipal incinerators.

In order to achieve this 2020 target, the Tokyo Metropolitan Government will consider specific measures from the two dimensions of expanding the adoption of renewable energies within the city and developing and expanding the use of renewable energies outside of the city. Specific examples are shown in Table 1.

The Tokyo Metropolitan Area is dependent on areas outside of the city for roughly 80% of the power it uses, with the Great East Japan Earthquake exposing the vulnerabilities in its power supply. Following this, the Tokyo Metropolitan Government has been installing renewable energy facilities outside of the city and has begun investing in a public-

private partnership fund aimed at stably securing power for the sake of the daily lives of its residents and business activities within the city. Such investments will enable the Tokyo Metropolitan Government to secure income from selling electricity while also ensuring the city's own power supply. While suitable sites for building mega solar plants are limited within the city, it is possible to promote their adoption outside of the city without being bound by such restrictions. Table 2 shows examples of the Public-Private Partnership Renewable Energy Fund, such as the Matsukawa Mega Solar Plant in Fukushima Prefecture. (**Author's abstract**)

Keywords: *Japan, renewable energy, comprehensive adoption measures, subsidy scheme, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/08,
(Filipiniana Analytics)

0498

Trends in the construction of large scale solar power plants in the Philippines

In the Philippines, the government has been promoting the Philippine Energy Plan 2012-2030 (PEP 2012-2030) in order to reduce its dependence on petroleum and other fossil fuels following in the wake of its increased demand for electricity. As part of this, it has set its target for introducing solar power from 2012-2030 at 284 MW.

In May 2014, San Carlos Solar Energy Inc. began operating SaCaSol Phase I (13 MW), the first large-scale solar power plant operating for commercial purposes in the Philippines, in the city of San Carlos on the island of Negros. The company is aiming to expand its solar business by making use of a feed-in tariff scheme. It plans to expand the facilities for SaCaSol Phase I to 22 MW by the latter half of 2014, and to complete SaCaSol Phase II (18 MW) in the city of La Carlota by the end of 2014. Fig. 1 shows the construction sites for these plants. San Carlos Solar Energy Inc. is a joint venture between the local clean energy development company Bronzeoak Philippines Inc. and the investment firm ThomasLloyd.

In the Philippines, which has favorable solar radiation conditions, this project has served as a springboard in accelerating the introduction of solar energy, with it expected that the country's 1 MW of solar power in 2010 will increase to a cumulative target value of 285 MW by 2030. (**Author's abstract**)

Keywords: *Philippines, solar power plant, renewable energy, feed-in tariff scheme, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/07,
(Filipiniana Analytics)

0499

Trends in the development of biobutanol

As indicated in the table, butanol comes in different isomers such as n-butanol and isobutanol. Butanol has a high concentration of energy compared to ethanol, and can be easily mixed into gasoline and used by existing fueling facilities. Isobutanol in particular has a higher octane rating than n-butanol, and can be added to gasoline up to 16%,

which is higher than ethanol's acceptable concentration of 10%. As such it has begun to garner attention as an exceptional biofuel.

Butamax Advanced Biofuels LLC, which is a joint venture between BP and Dupont, manufactures bioethanol from corn and sugarcane and then produces isobutanol from this ethanol using the existing Guerbet method. In December 2013, it announced that it would set to work on the construction of an isobutanol plant by 2015.

It has also been conducting research on an ABE fermentation method that uses anaerobic bacteria, which is the bacteria that produces butanol acetone (ABE producing bacteria), as a way of manufacturing biobutanol in the United States and Japan. Though this method produces butanol, acetone, and also ethanol simultaneously, its low productivity for butanol and the fact that it produces byproducts such as acetone pose challenges.

In response to this, research on biobutanol in Japan is being advanced by the Biobutanol Manufacturing Technology Research Association, which was established in 2010 by Idemitsu Kosan Co., Ltd. and the Research Institute of Innovative Technology for the Earth (RITE). With this research from 2011 to 2014 studies have been done on the technological feasibility of establishing an industrial production process for bioethanol from non-food biomass via an innovation process using coryneform bacteria, which differs from the process using the ABE fermentation method. It has been moving forward with a plan to construct and operate a bench scale demonstration plant between 2015 and 2019, and then achieve commercialization from 2020 onwards. (**Author's abstract**)

Keywords: *biobutanol, isobutanol, n-butanol, ABE fermentation method, anaerobic bacteria, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/05,
(Filipiniana Analytics)

0500

Trends in woody biomass power generation in Japan

Following the adoption of the government's feed-in tariff scheme targeting renewable energies, woody biomass power generation that uses wood chips and other unneeded wood has begun to spread to projects that use assets owned by companies.

Table 1 shows examples of domestic biomass power generation plans. A number of different projects are unfolding, such as a biomass power plant with an output of 50,000 kW, making it one of the largest in Japan, being built in Monbetsu City, Hokkaido by Sumitomo Forestry Co., Ltd., as well as a biomass power facility exclusively for electricity sales being built by Oji Holdings Corporation within its Ebetsu Plant. What is more, the three entities of Idemitsu Kosan Co., Ltd., Tosa Electric Railway Co., Ltd., and Kochiken Shinrinkumiai Rengokai are planning to jointly build Japan's first integrated power plant that includes processes for crushing and drying unused wood, while Showa Shell Sekiyu K.K. is making arrangements for a 49,000 kW power plant at the former site of the Ohgimachi Factory of its Keihin Refinery. Nippon Paper Industries Co., Ltd. is also planning to get started with a power generating project that uses 100% unused wood in 2015, while also considering a project to turn thinned wood into wood chips and supply these externally in conjunction with this.

Renewable energies in Japan are being expanded primarily based around solar power at this point in time, with biomass remaining down around 20% of the total for this even if you include power generated using sources like sludge. However, as long as systems that can use forests owned by companies and other assets that have heretofore gone unused can be set up then these could potentially make it possible to procure wood resources in a stable manner and serve as promising energy sources. (**Author's abstract**)

Keywords: *Japan, renewable energy, woody biomass, power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/12,
(Filipiniana Analytics)

0501

Two types of novel biomass power stations in China

Plan of a Solar-heat/Biomass Hybrid Power Generation Plant - On 8 January 2010 Shandong Penglai Electric Co. announced that SPE plans to construct, within ten years, a solar-heat/biomass hybrid power station with a capacity of 2000MW at Yulin Energy Park (171 km^2) in Inner Mongolia Autonomous Region, introducing technology of Solar Inc. of USA. The share of solar heat will be 10% of the 2000 MW (=200MW). A standard unit of solar-heat power plant (46 MW output capacity) requires 176,000 mirror panels. SPE intends to complete two units of solar-heat power stations in 2010, to supply 92 MW of electricity.

Biomass Power Stations Fueled by Straw and House Garbage - On 25 January 2010, China Everbright International Ltd. announced that the company plans to construct a novel biomass power station with two units of 18 MW output capacity, at Danshang city (69 km south of Hangzhou) in Anhui Province, by 2012, investing 48 million dollars. The power plants burns various waste biomasses including straws, decaying fruits and house garbage collected in the city and nearby areas, by getting cooperation of Danshang city. Among different biomass resources, the major fuel material is rice straw that is generated as much as 280,000 ton per year. In the next step, Danshang city plans to construct another 18 MW straw-burning power. Thus total electric supply from biomass power stations will be 54 MW. (**Authors' abstract**)

Keywords: *China, solar heat, biomass hybrid power, straw and house garbage, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/03,
(Filipiniana Analytics)

0502

The United Kingdom and South Korea are strengthening relations through the development of offshore wind turbines and tidal power generation

In April 2012, Renewable UK and a South Korean wind power association (Korean Wind Energy Industry Association) exchanged a memorandum of understanding on developing renewable energies. Following this, the UK-Korea Ocean Energy Technology Co-Operation Project was announced in June. The Korea Maritime University (KMU) will develop offshore wind turbines and tidal power generation in cooperation with IT Power, a UK company.

The United Kingdom is the number one country globally when it comes to the amount of offshore wind turbine that it has introduced, which was 2,094 MW as of 2011. Second place and below is occupied by Denmark, China, the Netherlands, and then Germany. What is more, through a plan to introduce offshore wind turbines off its southwest coast, South Korea is planning to introduce 100 MW by 2014, 500 MW by 2016, and 2,500 MW by 2019.

In August 2011 South Korea completed and began generating electricity with the Sihwa Lake Tidal Power Station, which has the world’s largest installed capacity at 254 MW. (**Authors' abstract**)

Keywords: *United Kingdom, South Korea, offshore wind turbine, tidal power generation, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/07,
(Filipiniana Analytics)

0503

Upgrading Deteriorating Small and Medium Hydropower Facilities and FIT

Japan has a long history of small and medium hydropower, with numerous facilities that have opened more than 50 years ago, as shown in Fig. 1. Some of these facilities are suffering from advancing deterioration.

The feed-in tariff (FIT) scheme will be applied to upgrading existing small and medium hydropower facilities. These cases have been divided up into two types: a “new construction category” in which the small and medium hydropower facilities will be fully upgraded, and an “existing waterway usage category” for cases in which the electrical equipment and penstocks on existing small and medium hydropower facilities will be upgraded. Particularly for cases that fall under the new construction category, a purchase price that is the same as that for new construction will be applied (24-34 yen).

Since the FIT scheme will also be applied to upgrading existing facilities (14-25 yen), examples of these being upgraded are on the rise, as shown in Table 1. Tokyo Electric Generation Company plans to upgrade ten power plants between 2015 and 2019 beyond those shown in the table. Moreover, Oji Paper Co., Ltd. is moving forward with upgrading ten power plants. Oji Paper Company established Oji-Itochu Enex Power Retailing Co., Ltd. in February 2015 in order to enter the power retailing business in preparation for the liberalization of power retailing that will begin starting in FY 2016.

In some cases, the expectation is that using state-of-the-art water wheels and power generators through the upgrades will enable performance improvements of 10% or more, even for the same water volume and head. In addition, large-scale facilities will be concentrated together by reducing the number of water wheels and power generators, and variable speed water wheel technology that can adapt to changes in the conditions due to the seasons will be adopted, thereby contributing to improving performance. (**Author's abstract**)

Keywords: *Japan, hydropower, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/11,
(Filipiniana Analytics)

0504

Urban oil field exploration project

The Urban Oil Field Exploration Project, which generates bioethanol and methane gas using paper waste and raw waste as its raw materials, has been carried out since 2011 by Kyoto City, Kumamoto University, and Hitachi Zosen Corporation. A demonstration plant was completed and a demonstration experiment was begun in Nishikyo Ward, Kyoto City in January 2015. This project uses a yeast that was newly developed by Kumamoto University that makes it possible to perform ethanol fermentation on paper waste that is superior to the bacteria found within waste.

Kyoto City is currently implementing its Plan to Promote the Use of Biomass. This sets the goal of raising the city's net biomass usage rate, which indicates the extent to which the biomass found within the city is utilized, from 39% in FY 2011 to 55% by FY 2020. This project is a part of this plan.

The demonstration plant produces bioethanol from biomass such as paper waste and raw waste collected from homes within Kyoto City, and also produces methane gas from the fermentation residue. Waste heat from the generation of power by incinerating the waste is used as the heat source needed for the bioethanol distillation and methane fermentation processes, so that energy is effectively utilized in a comprehensive manner. This is the first plant in the world to produce ethanol from paper waste and raw waste like this, with hopes that it will contribute to the environmental and energy sectors in the future. (**Author's abstract**)

Keywords: *urban oil field, exploration project, Japan, bioethanol, methane gas, paper waste, raw waste, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/05,
(Filipiniana Analytics)

0505

Usage status for biomass energy in South Korea

The targets for the introduction of renewable energies in South Korea in the South Korean National Basic Energy Plan of 2008 was set at raising the amount of primary energy supplies from 2007 of 5.76 million toe (2.4%) to 33.027 million toe (11%) by 2030, as shown in Fig. 1. The draft of the second version of this basic plan, which is revised every five years, was established in December 2013 and indicated that the country will raise its dependence on nuclear power from its current level of 26.4% to 29% by 2035. Conversely, it left its targets for renewable energies as they were.

Within its targets for the introduction of renewable energies shown in Fig. 1, for bioenergy the proportion of energy derived from waste accounts for the majority. However, the performance from 2011 shown in Fig. 2 was 0.963 million toe, which did not achieve the target of 0.987 million toe from 2010.

In order to promote the introduction of such energies, South Korea has reinstated a Renewable Portfolio Standard (RPS) scheme from its FIT scheme in 2012, and is changing over to a policy of imposing on power companies the obligation of introducing renewable energies. By way of recent moves related to biomass in response to such developments, in July 2013 Korea East-West Power (EWP) began operating a 20 MW biomass power plant in the city of Donghae. In addition, it also plans to begin operating a 4,000 MW biomass co-combustion power plant (3% wood pellets) in May 2014 in the city of Dangjin. (**Author's abstract**)

Keywords: *South Korea, biomass energy, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/02,
(Filipiniana Analytics)

0506

The use of biodiesel is spreading all across Malaysia

At the 15th Conference of the Parties (COP15) in 2009, Malaysia declared that it would reduce its CO_2 emissions by 40% by the year 2020 relative to 2005. As such, it is strongly pushing ahead with efforts like the efficient use and conservation of energy, the use of renewable energies, and thorough waste management.

In 2006, three years before making this declaration, the government laid out a plan of promoting the use of biodiesel with a view towards reducing Malaysia's dependence on fossil fuels. Since then it has made progress with research and development, and in 2009 it started holding test runs for vehicles that use biodiesel for their fuel. There have been 3,900 official vehicles for the city hall in the capital of Kuala Lumpur and for the army that have used biodiesel fuel.

Malaysia is the world's second largest producer of palm oil, and the government plans to further foster and expand its production of palm oil going forward. Biodiesel uses palm oil for its raw material with the most prevalent type being "B5," which is a mixture of 5% biodiesel into diesel oil from fossil fuels. The government is allocating 200 million ringgit (approximately 5.2 billion yen) for mixing facilities.

Currently, 1 million liters of B5 is sold each month at 247 gasoline stands in Kuala Lumpur. B5 has also begun to be sold at gasoline stands in Putrajaya, Melaka, Negeri Sembilan, and Selangor, and the use of biodiesel is steadily spreading all across the country. (**Authors' abstract**)

Keywords: *biodiesel, carbon dioxide emission, palm oil, B5 fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/03,
(Filipiniana Analytics)

0507

Use of E5 obligatory in the Philippines

From the viewpoint of energy security, the Republic of the Philippines, where most oil and coal are imported from abroad, issued the 2006 Biofuels Law (Republic Act 9367). The Act designates obligatory use of bioethanol and biodiesel produced from domestic biomass resources such as coconut, jatropha, sugarcane, etc. These biofuels are to be used for running automobiles, motorcycles and various combustion engines.

The Biofuels Act has been enacted since February 6, 2009. The law makes it obligatory that every oil company should sell E5 (gasoline containing 5% of bioethanol). Sugarcane is the main raw material for the ethanol. By this enactment, the demand of ethanol for the country's annual consumption will be 230,000 kl, which corresponds to 20 million tons of sugarcane. Further, the use of E10 (gasoline containing 10% of bioethanol) will be made compulsory by 2011. (**Author's abstract**)

Keywords: *Biofuels Law, bioethanol, biodiesel, E5, sugarcane, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0508

Use of renewable energies in Cambodia

Cambodia is a country located on the Indochina Peninsula surrounded by Thailand, Laos, and Vietnam on which 13.4 million people live on an area that is roughly half the size of Japan. Moreover, it has a nominal per capita GDP of USD 853 per year (2011), and a real economic growth rate of 6.0% a year (2011). Its electrification rate is the lowest among the surrounding countries at 24%.

Fig. 1 shows a breakdown of its primary energy, while Fig. 2 shows its energy consumption by sector. Regarding the civilian sector, since the rate of electrification is low and firewood is used, giving it a high ratio of biomass in its primary energy consumption. As shown in the amount of its electricity supplies from Fig. 3, it has a shortage of power generated from imported petroleum and generation facilities, so it imports electricity from Thailand, Laos, and Vietnam via power lines. As a result of this, it has the highest electricity fees in Southeast Asia at 11.71-14.63 US cents per kWh. The Cambodian government has set forth a plan to maintain its petroleum-fired power generation and electricity imports at their current levels while augmenting its hydro power and coal-fired power generation, as shown in the electricity supply plan from Fig. 4, in order to supply adequate electricity at appropriate prices.

With regard to renewable energies it is at the initial stages of its development and demonstration compared with its neighboring countries. Table 1 shows its potential and implementation examples. Japan is providing support for the adoption of renewable energies through survey and demonstration projects. Cambodia's objective is to electrify all of its villages in remote locations by the year 2020, and considers the use of renewable energies to be an effective way to accomplish this. (**Author's abstract**)

Keywords: *Cambodia, renewable energy, electrification, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2013/12,
(Filipiniana Analytics)

0509

Using 50% Jatropha-oil-containing fuel, trial of fishing boat conducted at Hachijojima

Being a kind of non-food crops, jatropha does not compete with traditional food/oil crops such as soybeans. Because of this, jatropha has been attracting expectation from the world as a new source of biomass-energy that is also environmentally friendly. The oil content of jatropha seeds is as much as 30%. Oil yield per unit land area amounts to 2.5 times that of sunflower seeds, 3.6 times that of soybeans.

In addition, jatropha can grow well on poor soils such as sand. Climatic conditions, however, are the hardest hurdle, especially ambient temperature no less than 25 degree centigrade is the minimum requirement. Because of this, no one ever tried growing jatropha in Japan to date.

Miyazaki, Kagoshima, Kumamoto, Nagasaki and Okinawa prefectures respectively, are currently promoting cultivation tests of jatropha using idle farm lands, abandoned arable lands, converted rice-fields, and waste lands among mountains. In these challenges, local municipalities are taking initiatives and collaborating with civic organizations and private businesses.

The aim of the municipalities is "produce and consume energy locally". Production of biofuel from jatropha can contribute to utilization of idle/unused lands as well as cost reduction of farmers. A civic body named "Minami-Kyusyu Jatropha Project" based in Miyazaki City has completed growing of 10,000 young jatropha trees by

August 2009 among the southern Kyushu region including Miyazaki, Kagoshima and Kumamoto prefectures. In this project, produced jatropha-oil will be blended with A-heavy oil and used for heating greenhouses and other purposes.

In addition, an one-hour test run of a fishing boat was carried out successfully at off-Hachijojima Island, using blended heavy fuel with 50% jatropha-oil-content. A NPO "Nadeshiko Family" and Hachijojima-based company "Sakagami" jointly conducted this running test. For producing the abovementioned jatropha-oil, a high-speed stirring method was used.

Traditional method for producing biodiesel from fat is called "fatty acid methyl esters (FAME) method. Here, biodiesel is made by exchange of ester between fat and methanol. The high-speed stirring method has a merit that it does not use methanol at all and hence it does not generate glycerin as by-product. At present jatropha is not grown in Hachijojima. The Hachijojima-town, however, plans a full-scale cultivation of jatropha so as to establish self-sufficient supply of fuel oil and to make full utilization of idle farmlands. (**Authors' abstract**)

Keywords: *Jatropha, Japan, fatty acid methyl ester method, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0510

Using algae to provide rural areas with new business (Japan)

In February 2011 the Ministry of Agriculture, Forestry and Fisheries of Japan announced its Comprehensive Strategy for Environmental Technology Revolution regarding Greenery and Water, which is designed to give rise to new businesses through the use of biomass and natural energy in rural areas and foster these into 6 trillion yen industries. One idea that has been garnering attention as part of this is the use of algae as a new resource crop.

This comprehensive strategy sets the goal of establishing technology for the production and use of algae biomass that is competitive against petroleum by 2020. Because the oil production capacity of algae is ten to several hundred times higher than that of plants, research is being promoted on using the oil produced by algae as fuel for automobiles and ships. There have already been successes when it comes to test flights on using this as jet fuel for aircraft.

In addition to being used as fuel, it can also be used as energy. After the oil has been extracted from the algae, this generates a residue of organic matter. It is claimed that this residue accounts for 30-70% of the algae, and the sustainable manufacture of algae fuel can be achieved only once the oil and residue are used effectively. This residue is used as energy by converting it to solid fuel and using it to generate electricity and heat, or using it in methane fermentation, as examples.

Algae can also be used as cosmetics and health food. *Aurantiochytrium*, which is an alga that has an enormous rate of propagation, produces squalene, which has a high added value. Squalene is an oily component that accounts for 90% of the liver oil in deep-sea sharks, and it is claimed to have the functions of restoring liver function and boosting metabolism. The squalene produced by algae is reborn as new, high priced (4,000 yen/kg) commodities such as cosmetics and health supplements.

As indicated, algae biomass has a variety of potential uses as fuel, energy, and health food. Thus far Japan has accumulated technology on using algae and has transmitted this to the world. The utilization of algae biomass will be beneficial in terms of stabilizing Japan's energy supply and revitalizing its industries, with the hope being that it will be practically applied as soon as possible. (**Authors' abstract**)

Keywords: *Japan, Aurantiochytrium, oil production, squalene, algae, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/09,
(Filipiniana Analytics)

0511

Using cattle manure biomass in Hokkaido Prefecture

The number of dairy cows raised in Hokkaido Prefecture came to 795,400 (out of a total of 1.395 million nationwide) as of February 2014, ranking it first in the country. Since the start of the feed-in tariff scheme for renewable energies, there has been gathering momentum behind using the cattle manure generated from these dairy cows as energy.

In May 2014, it was announced that one of the largest methane fermentation businesses from cattle manure in Japan would start in Betsukai Town, Hokkaido Prefecture. Betsukai Biogas Power Co., Ltd. is a special purpose company that was established for this business through a joint investment by Betsukai Town and Mitsui Engineering & Shipbuilding. Starting from July 2015, the plan is to perform methane fermentation using the raw material of 280 tons of cattle manure each day from 4,500 head of dairy cows, and then use the methane generated from this to generate approximately 9,600 MWh per year.

What is more, in July 2014 the Japan Livestock Trading Corp. of Obihiro City completed a power generation system that directly burns biomass, which is the first of its kind in Japan. This system came about through joint research and development by Ecomax Japan Inc. and the Obihiro University of Agriculture and Veterinary Medicine. As shown in Fig. 1, the system converts cattle excrement into compost, places the mature compost in a drying chamber and dries it with warm air, and then burns the dessicated compost in a special boiler to generate power. It aims for greater simplicity and cost reductions over methane fermentation due to the fact that it requires neither a fermenter nor a gas holder.

The large power generation systems from methane fermentation and simple direct combustion power generation described above have been proven, with the expectation being that they will further promote the use of cattle manure biomass. (**Author's abstract**)

Keywords: *Japan, cattle manure, biomass resource, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/09,
(Filipiniana Analytics)

0512

Using Hydrogen Compounds as Renewable Energy Carriers

Lessening dependence on fossil fuels and cutting CO_2 are important challenges. Using hydrogen, which can be produced from renewable energies without generating CO_2 from combustion, is important from the perspective of diversifying sources for supplying energy. Since FY 2014, as part of the Strategic Innovation Promotion Program (SIP) the Cabinet Office has regarded hydrogen and hydrogen compounds like ammonia and organic hydride as energy

carriers, as they are a means of transporting and storing energy, and has been engaged in research and development on them.

As an example of transporting renewable energies, consideration has been given to transporting hydrogen produced via water electrolysis from wind power in the Patagonia Region of Argentina and hydropower in Russia via ships between continents to Japan. Japan is the only country working on developing such technology, and is eyeing the possibility of deploying it to other countries that lack energy resources at home in the future.

Table 1 shows a comparison of energy carriers. Organic hydride, which is a liquid under normal temperatures, can be transported in chemical tankers the same way that gasoline can. Liquid hydrogen and ammonia turn into liquids when they are cooled, and so they require insulated tanks like those used on LNG ships, and in liquid hydrogen's case it must constantly be kept at extremely low temperatures. Since the hydrogen density per unit volume of ammonia is larger than that of liquid hydrogen, it offers superior transport efficiency.

In the energy producing regions, they will require the technology to react hydrogen with toluene to turn this into methylcyclohexane, as well as technology for synthesizing ammonia from hydrogen and nitrogen in a highly efficient manner. The Haber–Bosch process is an established process for synthesizing ammonia, but electrolytic synthesis is being studied as a method for this.

In the energy consuming regions, the hydrogen can be converted into electricity using fuel cells, but the development of turbines that convert this into power by using the hydrogen directly as fuel has begun.

With methylcyclohexane, a dehydrogenation reaction is required in order to extract the hydrogen, and this is broken down into hydrogen and toluene. This toluene will be returned to the energy producing regions and reused. Ammonia does not produce CO_2 even when burned, and so a method of producing power by burning this as fuel via a turbine is being examined. In September 2015 the National Institute of Advanced Industrial Science and Technology (AIST) succeeding in producing 41.8 kW of power by turning a gas turbine using a mixed gas of methane and ammonia, as well as 100% ammonia, as fuels. As these examples indicate, there are hopes that this will be established as a proprietary Japanese technology. (**Author's abstract**)

Keywords: *renewable energy, hydrogen, carbon dioxide emission, Haber-Bosch process, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/12,
(Filipiniana Analytics)

0513

Using hydrogen to counter fluctuations in output from renewable energies

The output from power generated by renewable energies like solar and wind power fluctuates according to the intensity of the solar radiation or wind. Storage batteries are being considered as a means for absorbing these fluctuations, and demonstration tests which install them at some wind power plants and the like are being carried out.

Another technical countermeasure that is being considered apart from this method of using storage batteries is to perform electrolysis on water through the generated power to generate hydrogen, then build up and transport energy in the form of hydrogen. In such cases the hydrogen is called an energy carrier. With storage batteries the capacity of power that can be stored is limited by factors like the installation space, but with hydrogen so long as you have water electrolysis equipment you can store the created hydrogen in tanks, and transporting the hydrogen from tanks to other locations removes the restrictions on the installation space.

Large-scale demonstration projects have recently been carried out in Germany and other countries, while a demonstration project that combines wind power and solar power has gotten underway in Japan. Hydrogen also has the advantage that it can be put to direct use as a fuel for fuel cell vehicles.

Table 1 shows types of water electrolysis equipment, while Table 2 shows examples of demonstration projects carried out in conjunction with renewable energy sources in Japan. (**Author's abstract**)

Keywords: *renewable energy, hydrogen, counter fluctuation, storage batteries, energy carrier, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2014/03,
(Filipiniana Analytics)

0514

Using Imported Palm Kernel Shells (PKS) for Biomass Power Generation

In terms of the long-term supply-demand outlook for energy in Japan up until 2030, the expectation is that 6.02-7.28 million kW of power generated from biomass, which is classified as a stable power source, will be introduced. In the general lumber and crop residue category in particular, 2.74-4 million kW is expected to be introduced, compared with the 100,000 kW that has already been adopted for this. As the situation now stands, this cannot be achieved with just domestically-produced sawing and lumber waste and crop residue, imported fuels in the form of palm kernel shells (PKS) and chips will be needed for this.

PKS is a type of crop residue generated when oil is manufactured from oil palms, of which Indonesia and Malaysia have the capacity to supply approximately 10 million tons every year. The volume of PKS imported to Japan has been rising dramatically since 2013 (Fig. 1), and the price has been trending upward as well (Fig. 2).

When it comes to power generated from biomass, previous attempts to scale up have been met with constraints in the form of the difficulty of securing a stable supply of the biomass that serves as the fuel for this. Securing PKS from overseas to use as a fuel will make it possible to secure biomass fuel in a stable manner, and will also allow even larger single-fuel-fired power plants to be built. Progress is being made on the construction of power plants that use PKS, as shown in Table 1. Power generated from biomass has entered a new type of dissemination stage that is premised on supplies of biomass fuel from other countries. (**Author's abstract**)

Keywords: *power plants, biomass power generation, palm kernel shell, Japan, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/12,
(Filipiniana Analytics)

0515

Utilization of algal biomass (1) “regular production of biofuel from algae that are non-food vegetation”

Research and development efforts are being intensified in Japan in order to produce biofuel from algae that are non-food marine vegetation, and expected to replace corn and sugar cane. The reason why algae are in focus is not only that algae are non-food vegetation, but also that relatively large amount of oil can be extracted from algae grown in a limited area. In fact algae can yield several times larger quantity of oil for biofuel than soybean and oil-palm do.

In June 2008, “Marine Biomass Research Consortium” was founded. Founders are Prof. Kashiwagi (Tokyo Institute of Technology), Prof. Takeda (Chubu University), Prof. Kurushima (Toyo University) and Prof. Mochida (Kyushu University). Japan has a rather small land area, but being surrounded by oceans Japan has a vast marine area, ranking No.6 in the world. The researchers want to exploit the valuable marine resources, and intend to make use of algae in order to produce biofuel from them.

They are proposing a concrete idea that a marine-culture base to be constructed on a seaside land next to an oil refinery or a thermal power station. CO_2 emitted from the factory to be brought to the base and dissolved into the seawater. In this CO_2-rich water, algae are made to grow rapidly (mass-production) by stimulating photosynthesis. The cultured algae will be collected and used for producing biofuel, or for purposes of marine farming. The research consortium is presently putting up a long-term target to reduce worldwide CO_2 emission to a half by 2050 using their concept.

Under the initiative of Ryukyu University, the consortium has been conducting a range of proof experiments of culturing micro algae as well as tests of marine farming, at Uruma City, Okinawa, since FY 2009. Recovered CO_2 at the thermal power station of Okinawa Power Co. is used for dissolving experiment. Various species of algae found in marine plankton are used for culturing experiment as well as for producing biofuels. (**Authors' abstract**)

Keywords: *algal biomass, non-food vegetation, photosynthesis, carbon dioxide emission, biofuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0516

Utilization of algal biomass (2) "the world is focusing on algae"

Microalgae have been utilizes for producing so-called fine-chemicals, rather than regarded as energy resource. For example, like astaxanthin that is cultured in a bio-reactor, microalgae have been used for producing chemical components for medicines, cosmetics, health food and food-additives that are rather expensive products. After 2009, however, a change was seen. Because of suspending necessity of reducing CO_2 emission worldwide, strong movements are taking place to realize production of biofuels from algae. Here are some examples: 1. 29 January 2009: Biofield Co. made an announcement that the company would construct a 3,785,000 kL/y-class ethanol production plant, investing 850 million USD into the technology of Algenol Co.; 2. March 2009: US President Obama signed the government grant given to Sapphire Energy Algiers Co. that is striving for the production of “Green Oil”. 951,000 USD is to be granted to Sappire to build a demonstration plant. Sapphire declared it would construct a full-scale plant, in five year, that would produce as much as 1,590 kL/day; 3. 29 June 2009: Dow Chemical Co. announced that the company would construct a bio-ethanol production plant of 300,000 kL/y capacity in Texas, using technology of Algenol Co.; and 4. 14 July 2009: Exxon Mobile Co. announced that the company would invest 800 million USD on Synthetic Genomics Co., a venture business skilled in micro algae utilization.

At present seventy businesses, including US venture enterprises, are striving for developing technology for biomass energy utilizing micro algae. Direct recovery methods of energy resource from algae and micro algae cultured in ponds and sea, without using artificial bioreactors, is also being investigated. (**Authors' abstract**)

Keywords: *algae, algal biomass production, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0517

Utilization of algal biomass (3) present state and trend of algae biomass utilization in Southeastern Asia

Competition for biomass fuel development from algae has been heated up among various countries of the world. Let's look into current activities in southeastern Asian countries, and Japan, China and Oceania countries. Table shows representative R&Ds that are on-going. It is noted that many are still of laboratory stage, but in a few cases, proof experiments using pilot plants have come into the schedule ahead like the case of China. (**Authors' abstract**)

Keywords: *biomass utilization, algae, southeastern asia, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/11,
(Filipiniana Analytics)

0518

Utilization of waste agricultural biomass in Philippines

Philippines is rich in agricultural biomass. Agricultural production in 2006 scored as follows: unhulled rice 15 million ton, sugarcane 23 million ton, coconut 14.8 million ton. In association with the production enormous amount of waste biomass is generated as follows: rice straw 16.9 million ton, rice chaff 2.9 million ton, bagasse (lee of sugarcane) 5.75 million ton, and coconut shell 1.8 million ton.

NREL (National Renewable Energy Laboratory) of USA has made an estimate of power generation capability by the waste biomass. The estimate showed potential power generation capability of the rice straw, bagasse and coconut shell would be as much as 360MW, 540MW and 20MW, respectively. For the time being, Philippine Government is promoting 26 projects of renewable energy development, and expects to obtain 466MW of electric power when the projects are completed. The project budget amounts to 277 million USD (23.5 billion yen). A couple of news depicting Philippine's biomass power generation projects are presented in the followings.

Phil-Korean Renewable Energy Corporation, a Korean company specialized for development of renewable energy, plans to construct a 30 MW class, biomass-burning electric power station at Palawan in Philippine, investing 71.26 million USD (6 billion yen). This project is one of the 26 projects promoted by Philippine Government. Full commercial operation of the power plant is expected to begin in 2013. Waste biomass including woody chips, ipil, and coconut shell will be used as fuel. Besides, in order to secure biomass resources for fuel for the power plant, plantation of ipil and coconut trees is intended by cultivating 80,000 ha of land at Palawan. New jobs for 3,000 persons will be created by the power generation and plantation business.

Pepsi Cola Products Philippines Inc. plans to construct 11 biomass power stations in Philippine within a couple of years. Total output capacity would be as much as 11-15 MW. A power station will be constructed on each of the following 11 sites - La Union, Pampanga, Muntinlupa, Naga, Cebu, Bacolod, Leyte, Iloilo, Zamboanga, Davao, and Cagayan – where a bottling factory of Pepsi-Cola Co. exists. Each power station will be fitted with a 1.2 MW class co-generation power unit, and construction cost is estimated to be 2.7 million USD (230 million yen). Rice chaff and

woody chips will be the fuel resources that are to be bought from farmers. The electricity and steam generated by the power plant will be consumed at the bottling factory. (**Authors' abstract**)

Keywords: *Philippines, waste agricultural biomass, renewable energy, biomass power generation, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/12,
(Filipiniana Analytics)

0519

Vietnam Is allocating bioethanol for export as domestic consumption fails to grow

In 2007 the Vietnamese government announced targets for the use of biofuels (bioethanol and biodiesel; Decision No. 177/2007/QD-TTg). It had planned that 150,000 tons of biofuels (0.4% of its domestic demand for gasoline and diesel) will be used domestically by 2010, 250,000 tons (1% of said demand) by 2015, and 1.8 million tons (5% of said demand) by 2025.

In accordance with this government policy, the state-run oil company Petrovietnam (PV) invested USD 270 million (22 billion yen) in construction costs for plants in Vietnam's northern, central, and southern regions in order for it to sell bioethanol in various regions throughout the country. The amount of bioethanol that they will produce annually will be 100,000 kiloliters at each plant, giving the company a total of 300,000 kiloliters (240,000 tons) per year. These began operating in the northern and central regions in 2011, and will go into operation in the southern region in 2012. The plants use cassava as their raw material.

Blended gasoline with 5% bioethanol (E5 gasoline) is 500 VND (1.9 yen) cheaper per liter than ordinary gasoline, but its usage has not been growing. The reason for this is that users are concerned that E5 gasoline lacks power and that using it will cause engines to deteriorate.

The amount of bioethanol sold domestically by Petrovietnam in 2011 remained at 20,000 kiloliters. The company estimates that in the absence of any governmental policies the amount it will sell each year from 2013 on will be around 100,000 kiloliters, with the gap between the supply (300,000 kiloliters) growing larger.

In order to close this gap between supply and demand, Petrovietnam has initiated export negotiations with Singapore and the Philippines. It has wrapped up its business discussions with the Philippines and exported 4,300 kiloliters to the country in June 2012. It plans to increase exports in the future, and to allocate 85% of its production output to exports by 2013.

In May 2012 the Vietnamese government announced that it has plans to mandate the use of bioethanol in seven provinces and cities within the country starting in December 2013, and then across all of Vietnam by June 2015. Upon hearing about this policy from the national government, Petrovietnam has said that it plans to reduce its exports of bioethanol by 20-30% and set this aside for the domestic market. (**Authors' abstract**)

Keywords: *Vietnam, bioethanol, biodiesel, cassava, E5 gasoline, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2012/10,
(Filipiniana Analytics)

0520

Vietnam's first rice chaff power station starts in January 2010

In the Republic of Vietnam, the country's first rice-chaff-burning power station of 10 MW capacity has been in operation since January 2010 at Lap Vo in the province of Dongtap, located about 140 km from and in the southeast of Phnom Penh. The power plant was designed and built in accordance with CDM (Clean Development Mechanism), by RWE Power Co. in Germany. It will provide 72-80 million kWh of electricity per year. The amount of reduction of CO_2 emission is estimated to be 50,000 ton annually, and 350,000 ton in seven 7 years.

Rice chaff has a low calorific value of 3,346 kcal/kg in average. Rice chaff generated in Vietnam in FY2010 was estimated to be 7.52 million ton, and would increase up to 7.90 million ton in FY2020. Currently, a larger rice-chaff-burning power station of 18 MW class is under construction at Kanto City in the Mekong Delta region, which will be completed in this year. Consequently, annual use of rice chaff in this country will become 1.5 million ton that can generate a sum of 1.2 billion kWh of electricity, assuming efficiency of power generation to be 20%.

In this connection, the following table depicts the present state of chaff-burning power generation in Thailand which is a pioneer in this technology. As noted, the total capacity of chaff-burning-specialized power stations in Thailand has now reached to 88.55 MW. (**Authors' abstract**)

Keywords: *Vietnam, rice chaff, power station, carbon dioxide emission, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/03,
(Filipiniana Analytics)

0521

Volumes of Wood Pellets Produced and Imported

Wood pellets are woody fuels formed by compression molding the sawdust and other byproducts generated during wood processing. They offer numerous advantages, like the fact that they are easy to handle due to their standardized shape, have high energy density, are easy to burn because of their low moisture content, and are easy to transport and store. In recent years, progress has been made in the adoption of boilers and stoves that use wood pellets in public facilities, ordinary homes, and farm houses, and so the volume of wood pellets produced has also increased. In addition to this, following the introduction of the FIT scheme in 2012, wood pellets have also begun to be used to generate power, thus increasing the demand for wood pellets.

The volume of wood pellets produced domestically in 2013 came to 104,000 tons (Fig. 1), with the volume imported coming to 84,000 tons (Fig. 2). By September 2015 imported pellets had increased rapidly, and surpassed 130,000 tons. Fig. 3 shows trends in the number of production facilities. In terms of the production scale for the wood pellet factories in Japan, most of these are small-scale factories producing on the order of 100-1,000 tons each year. But overseas these are produced by major factories producing on the order of several tens of thousands of tons each year, giving them a strong competitive edge. The sales price for wood pellets produced within Japan for use as boiler fuel is 23,000-39,000 yen/ton (second half of 2009: NEDO Renewable Energy Technology White Paper), whereas the

price of importing wood pellets is 21,500-26,700 yen/ton (first half of 2012-2015: the import price comes from the Trade Statistics of Japan) (Fig. 4), making them cheaper than domestically-produced pellets. As such, the demand for pellets produced overseas is enormous among power plants that use large quantities of wood pellets. (**Author's abstract**)

Keywords: *wood pellets, woody fuel, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/12,
(Filipiniana Analytics)

0522

Wave and tidal energy potential in India

According to a study by CRISL and the Indian Institute of Technology Madras (IIT-Madras), India has 150 GW of renewable energy potential, yet it has only developed about 14% of this. Conversely, the National Action Plan on Climate Change (NAPCC) deemed it necessary to raise renewable energy to 10% by 2015 and to 15% by 2020. As such, ocean energy, which India has the potential for but is seeing no progress in its usage due to various restrictions, has been garnering attention.

According to tidal energy estimates by the National Institute of Oceanography (NIO) and IIT-Madras, the highest levels of tidal energy were measured at Sunderbans in West Bengal, as well as at the Gulf of Khambat and the Gulf of Kutch in Gujarat (Fig. 1). When six candidate sites such as these are added together, the tidal energy potential comes to 12.5 GW.

Moreover, the west coast has enormous potential when it comes to wave energy due to the effects from seasonal winds there, as indicated in Fig. 2, amounting to 15-20 kW per 1 m of coastline. When sections of the coastline with 10 kW or more of wave energy per 1 m are added together, the wave energy potential comes to 41 GW.

The total potential from tidal energy and wave energy is 53.5 GW, which is roughly equivalent to 1/3 of India's total renewable energy potential of 150 GW.

In terms of specific moves by India, priority is being given to the development of tidal energy, which is being promoted by the issuance of subsidies for 50% of the costs for this by the Ministry of New and Renewable Energy (MNRE) starting from 2011. In 2011, Gujarat State gave its approval for the construction of a 50 MW tidal power plant in the Gulf of Kutch to a group consisting of Gujarat Power Corporation Limited from India and Atlantis Resources Limited from the United Kingdom. In addition, in 2014 Atlantis Resources Limited proposed installing a 50-200 MW tidal power plant in Khambhat. (**Author's abstract**)

Keywords: *India, wave power, tidal energy potential, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/10,
(Filipiniana Analytics)

0523

New ways opened for bio-DME (dimethyl ether) use

Biological research is in progress in regard of how to produce biofuels from algae. Some algae can produce oil by photosynthesis twice as much, in volume, as itself per year. Typical annual rate of biofuel (oil) production by traditional oil crops per one hectare of land area are as follows: 0.4 ka for soybean, 2.1 ka for corn, 5.2 ka for sugarcane. Whereas rate of biofuel (oil) production of some algae range between 11-90 ka/hectare, which is some tens of times as much as that of the traditional oil crops. In addition, cultivation of algae does not hinder the production of traditional food crops.

On 18 March 2010, NEDO (New Energy and Industrial Technology Development Organization) and CRIEPI (Central Research Institute of Electric Power Industry) made an announcement that they have succeeded in developing a technology to extract oil from blue-green algae at low cost. Blue-green algae tend to grow on the surface of extra-enriched lakes and marshes, and consequently do harm to aqua-ecosystem, hinder fishing work, and generate bad smell. Therefore, a smart and profitable utilization of the algae has been long waited for.

The extraction of oil from blue-green algae can be done by using DME (dimethyl ether: CH_3-O-CH_3). This method makes it possible to eliminate dehydration and drying of algae, and therefore makes biofuel production easier and cheaper. Traditional extraction method barely yielded oil as little as only 0.6% of dried weight of blue-green algae, whereas by the new method using DME, extraction of oil can be raised up to 40%, a great reap of productivity (70 times as much as ever), indeed.

DME has been known as a clean fuel because it is sulfur-free. Therefore, it does not emit sulfur oxides nor particle materials (PM), when burnt. On 18 May 2010, a private association called DME Vehicle Promotion Committee announced that they made a proof experiment for running trucks by using diesel fuel containing 5% of DME that was extracted from eucalyptus chips and that they found no trouble in the test runs.

Thus, it has been proven that DME extracted from woody biomass could not only be used as biofuel but also be used for extraction of oil from blue-green algae. Practical use of bio-DME seems to be widening from now on! (**Authors' abstract**)

Keywords: *Bio-DME, dimethyl ether, algae, biofuel production, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2010/06,
(Filipiniana Analytics)

0524

Wind Power in Sri Lanka

The economic growth in Sri Lanka has brought about increased demand for electricity and a rise in petroleum imports, and so the country has been promoting the adoption of renewable energy as a countermeasure to these. The Long Term Generation Expansion Plan 2015-2034 announced by the Ceylon Electricity Board (CEB) in July 2015 indicated a target of quadrupling the installed capacity for generating power via renewable energy over its current levels by 2034. By the end of 2014, there was 442 MW in electricity from renewable energy, which corresponded to 11% of the 3.9 GW of total installed capacity. But the plan is to expand this to 972 MW by 2020, which will exceed 20% of the total installed capacity of 4.8 GW. By 2034, which is the last year of the plan, it will increase small hydropower to 673 MW, wind power to 719 MW, biomass power to 279 MW, and solar power to 226 MW, increasing the total renewable energy to 1,897 MW (Fig. 1).

As shown in Fig. 2, its wind power potential is 20,740 MW, with the plan being for wind power to account for the largest share of renewable energy adopted by 2034. The adoption of wind power is proceeding in the peninsula area

of North Western Province, with plans to install 375 MW of wind power between 2018 and 2025 in Mannar, North Province. Aside from this, there is strong potential for wind power in the northwestern coastal regions of Northern Province, the highland areas of Central Province, Sabaragamuwa Province, and Uva Province, with hopes that wind power will be developed in these areas in the future. (**Author's abstract**)

Keywords: *Sri Lanka, wind power, renewable energy, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/01,
(Filipiniana Analytics)

0525

Wood pellets production business is rising

So far in Japan, about forty factories have been producing wood pellets, amounting to about 30,000 ton a year. Recently, however, more and more companies are planning to come into wood pellets production business that is now regarded as promising. Particularly pellets production from coffee lees seem to be worth noting. It appears that pellet business is becoming viable not only in rural areas but also in urban.

The reason for the rise of this new eco-business may be the frantic rise-and-fall of crude oil price in recent years on one hand, depletion of fossil resources and governmental efforts such as “Carbon-Offset Life Campaign” by the Ministry of the Environment, “Biomass Town Project” by Ministry of Agriculture, Forestry and Fisheries on the other hand. Off course, the fact that Meiken Lamwood Corporation at Maoka, Okayama has produced 10,000 ton of wood pellets in FY 2008, selling 2 billion yen and expecting enough profit, would be a good promise of this business, indeed.

Selling wood pellets (of 4,100 kcal/kg rating) at 40 yen/kg on the market, inclusive of distribution cost, seems to be viable. Like the case of the greenhouse of tropical botanical garden in Honai Park of Sanjo City, Niigata, the pellet-fuel will find a way to be used for small scale heating of local area. Some municipalities have already began planning how to utilize wood pellets made from sawdust or thinned wood. (**Author's abstract**)

Keywords: *Japan, wood pellets production, coffee lees, pellet-fuel, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/03,
(Filipiniana Analytics)

0526

Woody bioethanol proof production plant in Akita

Japanese government has set a goal for domestic production/consumption of bioethanol, that will replace gasoline in the future, as 50,000 KL in FY 2010, 1,000,000 KL in FY 2020, and 3,800,000 KL in FY 2030.

In order to drastically expand domestic bioethanol production, use of woody biomass is becoming attractive because it would not interfere with the production of agriculture foods or feeds. Rice straw, waste wood, sorghum grown on

idle farmlands, as well as forest wood residue that is estimated as much as 8.5 million cubic-meter every year, these materials seem to be promising as sustainable raw materials in the future.

At Akita City, Akita prefecture, the Forestry and Forest Products Research Institute (FFPRI) has been installing a bioethanol production proof plant that will utilize woody biomass. The plant has been completed and its celebration ceremony was held on 23 June 2009. Seven hundred million yen were spent for the plant that can produce 125 KL of ethanol annually. The development project for production technology of bioethanol from domestic woody biomass is promoted and funded by the Forestry Agency. Under general management and supervision of FFPRI, the project has been conducted jointly by Tokyo University, Waseda University, Akita Prefectural University, Akita Prefecture and Kita-Akita City. Various technical verification and plant improvement will be carried out during five years from FY 2008 to FY 2012.

Wood residue generated in cedar forests owned by Akita Prefecture and Kita-Akita City will be used as main raw material. First, alkaline pulping process using aqueous sodium hydroxide eliminates lignin from mashed wood. Then, “simultaneous saccharization-fermentation process” using enzyme and yeast will be adopted to produce bioethanol efficiently. The research team intends, within four years, to achieve a yield that will produce 250 liter of bioethanol from 1 ton of woody biomass, and also a production cost of 100 yen/liter. (**Author's abstract**)

Keywords: *Japan, bioethanol, woody biomass, wood residue, simultaneous saccharization-fermentation process, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/07,
(Filipiniana Analytics)

0527

A woody biomass trading center completed in Maniwa City

Maniwa City is located in the northern part of Okayama prefecture, where forest covers 79% of total land area of the city (828 km^2). Since long time ago, the city has been one of the major trading center of wood, and even today more than thirty wood mills are operating there. The city intends to utilize forest resources in order to revitalize the forests and activate forestry-related industries. As one of measures, the city has been fostering and implementing woody biomass business projects since FY 2005. In this consequence, woody biomass is made into fuel and distributed among the district, and used for electric power generation, as well as for various heating or thermal purposes. As shown in the Table, various woody-biomass-using facilities have been introduced and popular use of woody biomass energy has been realized today.

In order to further develop biomass business projects aiming "Woody Biomass Town-Japan ’NO-1", "Maniwa Biomass Trading Center" has been completed in March 2009, which is designed for steadily collecting woody biomass resources and manufacturing them into other form of energy resources which is sold user constantly. 330 million yen was spent for the center that is constructed on a land of 10,550 m^2. Thinned wood and other forest residue are brought in and bought by the center, and the center processes them into products for sales, in forms such as woody fuel chips, pulp chips and crushed bark etc.

Maniwa City was designated as one of "Biomass Town" in FY 2006, selected as "Next Generation Energy Park" in FY 2007 outfitted with new energy facility and experience facility. Further in FY 2009, the city was selected among NEDO’s "100 New Energy". Thus, "Maniwa Biomass Trading Center" has now become a solid basis for developing biomass projects to activate local industries and Maniwa City will be "Advanced Biomass Town". (NEDO: New Energy and Industrial Technology Development Organization) (**Author's abstract**)

Keywords: *woody biomass, Maniwa City, facilities, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2009/10,
(Filipiniana Analytics)

0528

The World Bank is financing a mega solar plant in Nepal

In Nepal, the addition of new power plants cannot keep pace with the surging demand for electricity (see Fig. 1), and so its electrification rate remains at 55%. Especially during the winter, the country experiences blackouts lasting 18 hours a day. The country lacks natural gas and coal resources, and its ample hydroelectric power resources remain unutilized. For this reason, even though hydroelectric power is being installed it still only accounts for 1.22% of the final energy consumption for renewable energies (see Fig. 2). Firewood accounts for 71.5% of its energy consumption. This is impacted by the fact that, when energy consumption is viewed by industry, the housing sector accounts for the largest piece at 80.4% while the industrial sector is at 7.9%.

Nepal sits at a high elevation, and receives sunlight approximately 300 days out of the year. This gives it a large average daily intensity of solar radiation at 3.6–6.2 kWh/m^2/day, and makes it suited for solar power generation. Therefore, in December 2014 the World Bank decided to provide financing of USD 130 million for the construction and operation of a mega solar plant with a total output of 25 MW to alleviate Nepal's power shortages. This project includes connecting up with the power grid of the Nepal Electricity Authority, a state-run electricity provider, and reducing losses in the supply network. Through the installation of some 280,000 sets of home solar power devices in 2011, the installed capacity for solar power of 7.4 MW was expanded by more than four-fold. (**Author's abstract**)

Keywords: *Nepal, mega solar plant, hydroelectric power resources, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/02,
(Filipiniana Analytics)

0529

World's first success with generating electricity and recovering phosphorous via microbial fuel cells

Obtaining methane gas via methane fermentation is used extensively as a method for recovering energy from wastewater. Separate from this are microbial fuel cells, wherein the electrons generated when microbes decompose the organic material found within effluent are used to generate electricity. Electron-producing microbes are retained in the anode, while the cathode is made of a platinum catalyst (see Fig. 1.). The electrons generated in the anode flow through a circuit that passes through a load, where they produce hydroxy-ions in the cathode.

Gifu University announced in December 2014 that it was the first in the world to successfully recover phosphorous from wastewater while generating power through the use of microbial fuel cells. This technology has gained attention because the vicinity around the positive electrode becomes alkaline due to the hydroxy-ions. It can recover magnesium ammonium phosphate (MAP) from wastewater (wastewater from raising pigs) that contains phosphorous, magnesium, and ammonium. The conventional MAP production method required the addition of chemicals for pretreatment in order to make the effluent alkaline, but with this method MAP can be manufactured by combining this with power generation. Since alkaline chemicals are not added there is no need to neutralize this, and so it can be used as fertilizer.

As for its capacity for generating power, the energy contained within the organic matter that is consumed is converted to electricity at a rate (generating efficiency) of 25%, with the amount of power generated per electrode at 2 W/m^2. At present this is nothing more than laboratory-level research, but there are high hopes for the practical implementation of microbial fuel cells that are capable of simultaneously generating power and recovering phosphorous that can be used as fertilizer. (**Author's abstract**)

Keywords: *microbial fuel cells, methane gas, methane fermentation, electron-producing microbes, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/01,
(Filipiniana Analytics)

0530

The World's Greatest Conversion Efficiency Has Been Achieved with CIS Solar Cells

CIS solar cells, which are a type of thin film solar cell, can be produced by depositing a compound on top of a glass substrate without using silicon, and thus they hold promise as a type of inexpensive solar cell. NEDO and Solar Frontier K.K., which are moving forward with joint research on thin film solar cells, announced on December 8, 2015 that they had achieved a conversion efficiency of 22.3%, which is a world record for CIS solar cells. This recently achieved conversion efficiency surpassed the 21.2% conversion efficiency from polycrystalline silicon solar cells, which are currently the most widely used type (Fig. 1).

CIS solar cells make it possible to boost the conversion efficiency by using a semiconductor with a chalcopyrite crystal structure comprised of copper (Cu), indium (In), and selenium (Se) as the light absorbing layer and also adding gallium (Ga). Their structure consists of a molybdenum electrode layer deposited atop a glass substrate, with a p-type CIS light absorbing layer and an n-type thin film layer (ZnO) laminated on top of these. The conversion efficiency recently obtained was achieved by improving the surface quality of the CIS light absorbing layer and improving the technology for forming the p-n junction.

Solar Frontier K.K. has been consistently developing CIS solar cells since it was commissioned to perform research and development by NEDO in 1993. In 2011 it set up the Kunitomi plant in Miyazaki Prefecture that generates 900 MW annually, making it the world's largest manufacturer of CIS solar cells. The expectation is that reflecting these recent research results into products will further disseminate low-cost, high-efficiency solar cells. (**Author's abstract**)

Keywords: *CIS solar cells, renewable energy, conversion efficiency, chalcopyrite crystal structure, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2016/01,
(Filipiniana Analytics)

0531

Yachiyo Town makes way for a small and distributed onsite model of a biomass town

A “Biomass Town” is a MAFF-attested municipality where an appropriate comprehensive system for utilizing biomass of the district, from generation to utilization/consumption, has been established, or a district that is expected to be a qualified town of such kind. The Biomass Nippon General Strategy Promotion Council, formed by representatives from seven related governmental branches including the Cabinet Office, the Ministry of General Affairs, the Ministry of Education and Science, the Ministry of Agriculture, Forestry and Fisheries (MAFF), the Ministry of Economy and Industry, the Ministry of Land and Transportation, and the Ministry of Environment, is in charge of fostering Biomass Towns. Every year the Council examines each biomass town concept designed by different municipalities in the light of MAFF’s Biomass Town Requirement, and if the concept fulfills the requirement, then the town will be specified as a Biomass Town and be officially introduced to the public.

By February 2010, 286 municipalities have been nominated as Biomass Towns of Japan. If a town has been authorized to be a Biomass Town, then the town itself or its private businesses skilled for biomass utilization can apply for grant from the Japanese government. In such cases, of course, the town has biomass resource peculiar to the town and at the same time the town adopts the most appropriate scheme for the utilization of the biomass. Among the 286 Biomass Towns, Yachiyo town in Ibaraki prefecture proposes a unique way of biomass utilization. Yachiyo town is an agriculture town with a population of 14,500, ranking No.1 in the produce of hakusai (chinese cabbages). The town implemented a scheme to make compost from various waste biomass resources including cattle manure, house garbage, rice chaffs and so on, from 2011. This type of scheme is commonly termed as “a small, distributed onsite conversion and utilization scheme”. Yachiyo town installed a number of small compost machines at some appropriate places in the town. In this way, local waste biomass can be changed into useful compost that is to be used by local farmers to grow rice and vegetables. Contrary to a centralized large-scale facility for waste biomass treatment, a number of small and distributed onsite type facilities can save transportation cost quite a lot. Yachiyo town named their present scheme as “Yachiyo Model”, and intends to spread this model to all over Japan. Yachiyo people are expecting that their scheme will revitalize agriculture of the district and that it will make the town popular in Japan, too. (**Authors' abstract**)

Keywords: *Japan, biomass town, onsite model, biomass utilization, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2011/03,
(Filipiniana Analytics)

0532

New Zealand’s Positioning of Biomass within Renewable Energies

New Zealand has an abundance of hydropower and geothermal resources, and the country is aiming to increase the share of its total power accounted for by renewable energies to 90% by 2025. In 2014, it already reached a share of power accounted for by renewable energies of 80% (Fig. 1). Furthermore, when you look at final energy consumption (including for types other than electricity), you see that oil consumption has the largest share at 44% (Fig. 2 and Fig. 3). In addition, energy use from wood is at 9%, with this used as fuel for the lumber processing industry and homes. When viewed by industry, the transportation sector accounts for a large share of energy consumption.

The use of biomass energy in New Zealand is a sector with enormous growth potential for the future. As such, industry organizations and agencies such as the Bioenergy Association of New Zealand and the New Zealand Forest Research Institute proposed the New Zealand Bioenergy Strategy in 2010. This set the target of having New Zealand cover 25% of its final energy with bioenergy by the year 2040, which included carrying out initiatives to increase the production of biofuel in order to reduce oil consumption as part of this.

In terms of recent developments, Anchor Ethanol Limited has been producing bioethanol by fermenting the whey that is a byproduct of cheese at three dairy product plants. In addition, it is also producing biodiesel from waste oil and the tallow generated from the meat processing industry. New Zealand has a thriving livestock industry, and is

characterized by the fact that whey and tallow are used as biomass there. Z Energy, which is a fuel distributor, has said that it plans to build a plant that can produce 20 million liters a year and begin selling this in 2015. It has claimed that the amount of biodiesel produced will increase 20-fold compared to 2014 through the completion of this plant, as shown in Fig. 4. (**Author's abstract**)

Keywords: *New Zealand, biomass, renewable energy, bioethanol, hydropower, geothermal resources, Industry*

Renewable Energy Topics in East Asia, Volume No. Issue No. ,
2015/11,
(Filipiniana Analytics)

INFORMATION AND COMMUNICATIONS TECHNOLOGY

0533

Comparison of the horizontal positional accuracy of single-base and network RTK within the Mega-Manila sub-network

Cayapan, Charisma Victoria D. , Lim, Joy C. , Braza, Clarizza Mae DR. , Reyes, Rosa

Real Time Kinematic (RTK) Global Navigation Satellite System (GNSS) survey is a reliable and efficient survey method that has been used in applications that require centimeter level positioning in real time since the late 1900s. Two methods are commonly used for RTK positioning namely single-base RTK (SBRTK) and network RTK (NRTK). This research assessed the horizontal positional accuracy of SBRTK and NRTK with respect to derived positions using static positioning method. The Philippine Active Geodetic Network (PageNET) stations of the National Mapping and Resource Information Authority (NAMRIA), specifically the stations belonging in the Mega-Manila sub-network, were used as reference stations. Five (5) points with increasing distance from PTAG station were tested for this study in SBRTK method. Three techniques in NRTK were also experimented, namely: Virtual Reference System (VRS), Master Auxiliary Concept (MAC) and Flächen-Korrektur Parameter (FKP).

The coordinates of the test points measured using RTK were evaluated by comparing with the coordinates of the same points observed in static mode. The results showed that NRTK techniques excepting MAC that is giving inconsistent results are better than SBRTK in distances more than 10 km from the base station PTAG. The FKP and VRS gave average coordinate differences of 5.64 cm and 5.63 cm, respectively, compared with the 6.61 cm coordinate difference of SBRTK for the five test points. The FKP NRTK and SBRTK provide the fastest initialization time of less than 30 seconds in most of the test sites. The VRS method gave almost similar coordinate difference average as the FKP method; however, the latter method had a faster initialization time with an average of 54 seconds as against 138 seconds for the former. The results also show the distance dependency of the accuracy of the SBRTK technique. The results ranged from 2.3 cm to 11.2 cm for distance range of 5.2 km to 23.3 km, respectively. Thus, NRTK is a better alternative to SBRTK because of this. However, SBRTK can provide faster initialization than other NRTK techniques.

The accuracies of the different RTK techniques were also assessed with respect to the geodetic control specifications of the Philippine Reference System of 1992 (PRS92) mandated as the standard reference system for all surveys in the Philippines in Executive Order No. 45, series of 1992, as amended. From the results, all RTK techniques gave less than 10 ppm linear error, which is the allowable error for first-order geodetic control survey. Therefore, RTK techniques can supplant the use of Static post-processing (PP) method for first-order and lower accuracy surveys where productivity is a prime requirement. (**Author's abstract**)

Keywords: *FKP, GNSS, MAC, Real-Time Kinematic, Single-base RTK, Network RTK, VRS, Information and Communications Technology*

Philippine Engineering Journal, Volume No. 39 Issue No. 1, 1-12
2018,
(Filipiniana Analytics)
NP

MARINE SCIENCE

0534

Short-term assessment of phytoplankton composition and abundance in Cebu and Subic Bay Ports, Philippines

Azanza, Rhodora V. , Austero, N

A short-term study to evaluate the composition and abundance of marine diatoms and dinoflagellates in two major ports in the country was conducted in May 2015 and July 2015. *Pseudo-nitszchia* spp. bloom comprising about 42.3% of the total phytoplankton population was observed in Cebu International Port in May 2015. Furthermore, *Chaetoceros* spp. comprised about 53.58% of the total phytoplankton population in Naval Supply Depot (NSD) terminal in May 2015, while *Thalassionema* spp. and *Leptocylindrus* spp. accounted for 50.16% and 34.78%, respectively, of the total phytoplankton population in July 2015. Bloom-forming and potentially harmful species including diatoms, such as *Coscinodiscus* spp., *Nitzschia* spp., and *Pseudo-nitzschia* spp., and dinoflagellates, such as *Ceratium* spp., *Ceratium furca*, *Gonyaulax* spp., *Gymnodinium* spp., *Linguludinium* spp., *Phalacroma* spp., *Prorocentrum micans*, *Prorocentrum* spp., and the IOC-UNESCO listed Harmful Algal Bloom (HAB) species *Dinophysis caudate*, were also recorded. The results of this study contribute to the establishment of baseline data for phytoplankton composition and abundance, which are necessary for the identification of potentially toxic/harmful microalgae which pose risks of ballast water inclusion and transport. (**Author's abstract**)

Keywords: *Phytoplankton, ports, harmful algal blooms, diatoms, dinoflagellates, Marine science*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 30 Issue No. 2, 1-22
2018,
(Filipiniana Analytics)
NP

0535

Viability of phytoplankton from ballast waters of international vessels berthing at ports of Cebu and Subic Bay, Philippines

Azanza, Rhodora V. , Sawant, Subhash S. , Austero, N

The viability of ballast water phytoplankton was assessed through incubation experiment. *Leptocylindrus* sp. and *Thalassionema* spp. were found to be viable when incubated in port water and ballast water media showing some increase in cell numbers. Bloom-forming diatom taxa, such as *Chaetoceros* spp. and *Coscinodiscus* spp., potentially harmful diatom species *Pseudo-nitzschia* spp., and dinoflagellates, *Gambierdiscus* spp. and *Prorocentrum* spp. were also identified in ballast waters from international vessels. These results further suggest possible successful transport of these organisms via shipping, which could facilitate the introduction and lead to bioinvasion in the local aquatic environment. (**Author's abstract**)

Keywords: *Ballast water, diatoms, dinoflagellates, phytoplankton, ports, Marine science*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 31 Issue No. 1, 1-10
2019/06,
(Filipiniana Analytics)
NP

MATHEMATICS

0536

Fuzzy on ideal sets and a fuzzy on ideal Hahn-Banach Theorem

Mernilo-Tutanes, Lezel N., Caga-anan Randy L

In set theory, an ideal is a collection of sets that are considered to be small or negligible, such that every subset of an element of the ideal must also be in the ideal and the union of any two elements of the ideal must also be in the ideal. A fuzzy set is a class of objects with grades of membership in the interval [0, 1]. It is used to mathematically represent uncertainty and provide a formal tool to deal with imprecisions present in many problems. We use ideals to define fuzzy on ideal sets, which can be seen as a generalization of the fuzzy sets. We establish some of its basic properties, and we state and prove a Hahn-Banach Theorem with the fuzzy on ideal sets, which can be seen as a generalization of a fuzzy Hahn-Banach Theorem, which in turn, is a fuzzified generalization of an analytic form of the classical Hahn-Banach Theorem. (**Author's abstract**)

Keywords: *Fuzzy, ideal, Hahn-Banach theorem, Mathematics*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 30 Issue No. 2, 1-17
2018,
(Filipiniana Analytics)
NP

MEDICINE

0537

Advances in the treatment and management of Filipino patients with multiple myeloma: from deadly to chronic disease with possibility of remission

Tomanan, Kristine Joy L. , Angeles, Marvin P. , Benedicto, Erwin G., Antonio, Carl Abelardo T.

Multiple myeloma is a malignant proliferation of plasma cells that accumulate in the bone marrow and results in several organ dysfunc-tions that are debilitating and fatal. For the past 20 years, advances in the understanding of genetic abnormalities, interactions in the bone marrow microenvironment, developments in the diagnosis and staging in myeloma and introduction and incorporation of novel agents early in the disease course have been pivotal in the clinical treatment and management of patients with multiple myeloma. However, the burden associated with the disease, including treatment costs, is significant for Filipino patients as it is still incurable. In the Philippines, the introduction of bortezomib in the market in the last decade have brought hope to many patients by expanding the availability of treatment options, improving quality of life and extending survival. This paper documents the proceedings of a forum on multiple myeloma conducted last March 2018 at Makati City. The purpose of the forum was to discuss the major clinical presentations of the disease as well as treatment and management of selected patients. Speakers were hematology and medical oncology experts in the Philippines. Five cases of multiple myeloma with

different clinical presentations and management were discussed: (1) renal insufficiency, (2) easy fatigability, (3) bone pain, (4) autologous stem cell/bone marrow transplantation, and (5) coagulopathy. Short videos of selected patients (or their family members) after each presentation was showed, describing their treatment journey with myeloma. Other patients with multiple myeloma who were treated with bortezomib were present in the forum and briefly shared their experiences. As multiple myeloma is a highly heterogeneous molecular disease, approaches and provision of care will need to be individualized for each patient. Because of its impressive performance, bortezomib is likely to continue being an important part of the clinical treatment and management of Filipino patients with myeloma. (**Author's abstract**)

Keywords: *multiple myeloma, plasma cell disorders, monoclonal gammopathies, targeted therapy, bortezomib, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-6
2018 - 2019,
(Filipiniana Analytics)
NP

0538

Aggressive angiomyxoma of the vulva: a case report

Plurad, Karen Gr

Aggressive Angiomyxoma is a rare, slow growing, benign mesenchymal tumor arising from the pelvis and perineum which commonly affects women in the reproductive age group. Though benign, it is locally infiltrative with a marked tendency for local recurrence. We report a case of aggressive angiomyxoma of the vulva with translevator extension into the pelvic cavity in a 33-year old G2P2(2002). She presented with a left labial mass that recurred two years after excision was done. Debulking of the mass was carried out by abdominal and perineal approach. Histopathologic studies of the mass confirmed aggressive angio-myxoma. Long-term periodic follow-up with imaging studies was advised because of its high rate of recurrence in spite of negative tumor margins after wide excision. (**Author's abstract**)

Keywords: *Aggressive angiomyxoma, vulvar tumor, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-6
2018 - 2019,
(Filipiniana Analytics)
NP

0539

Annular pustular psoriasis in a 6-year-old child: case report

Rivera, IV, Francisco D. , Espinosa, Patricia Ga

Annular pustular psoriasis (APP) is a rare variant of pustular psoriasis occurring only in about 1-5.4% of children with psoriasis. Pustular psoriasis is triggered by endogenous and exogenous factors. Exogenous factors include stress, upper respiratory tract infection and withdrawal of systemic corticosteroids.

This condition usually requires systemic treatment. However, there are still no randomized controlled trials or standardized guidelines proving the advantage of any specific treatment modality over the other.

We report a case of a 6-year-old male who presented with diarrhea followed by appearance of erythematous annular plaques with pustules and nail changes. Punch biopsy showed pustular psoriasis. Patient was treated with topical betamethasone valerate and calcipotriol, and there was noted to have no recurrence of skin lesions for 4 months. (**Author's abstract**)

Keywords: *annular pustular psoriasis, children, pustular psoriasis, psoriasis, topical steroids, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-5
2017 - 2018,
(Filipiniana Analytics)
NP

0540

Association of individual risk factors and workplace factors to self-reported body discomfort of Filipino small-scale gold miners

Custodio, Benette P., Matias, Aura C. , Soriano, Virginia J.

Work-related Musculoskeletal Disorder (WMSD) was identified as a significant and costly health and safety problem for the large-scale mining industry. WMSD is often characterized by discomfort such as pain, tingling, numbness, stiffness, and aching perceived on the different body parts. The risk factors of WMSD in large scale mining can also be observed in small-scale gold mining. However, there is little information on the association of individual and workplace risk factors to the perceived body discomfort of the workers in the small-scale gold mining and extraction in the Philippines.

This study aimed to provide a baseline data on the prevalence of body discomfort and its association to individual and workplace risk factors. To achieve this, a survey of 124 small-scale gold mining and extraction workers in seven different mining and extraction sites from selected regions in the Philippines was conducted.

The results showed that ninety-five percent (95%) of the survey participants perceived body discomfort in at least one part of their bodies. The highest percentage of discomfort on body parts were on the lower back (65.32%), shoulders (59.68%), and neck (54.03%). Using correlation analysis, results showed that the severity of lower back discomfort and the estimated alcohol consumption per week has low positive correlation. Likewise, the frequency and severity of knee discomfort have a low positive correlation to years of experience in mining. Furthermore, by using binary logistic regression, it was found that drinking alcohol and the Rapid Entire Body Assessment (REBA) score which characterizes physical demand were found to be significantly associated with presence of discomfort on the lower back; years of experience in mining and estimated height were significantly associated to the presence of discomfort on the knees.

Further analysis of workplace factors and other possible risk factors of the body discomfort is recommended. (**Authors' abstract**)

Keywords: *Body discomfort, Individual risk factors, Workplace risk factors, Filipino Small-Scale Gold Miners, Medicine*

Philippine Engineering Journal, Volume No. 39 Issue No. 1, 1-12
2018,
(Filipiniana Analytics)
NP

0541

Behavior and practices of family physicians in the referral of dermatological diseases: a cross sectional study

Tianco, Elizabeth Amelia V. , Tan, Wind

Referrals are the link between primary and specialty care. While the referring provider can be any type of physician, the focus in the literature has been on primary care physicians (PCPs). In their area of expertise, specialists are able to provide evidence-based care, and several studies have shown that specialists' co-management of care with PCPs results in better health care outcomes for patients with chronic diseases. The research design used was cross-sectional. A validated self-made questionnaire was disseminated to the family physicians (FPs) who are active members of the Philippine Academy of Family Physicians (PAFP) from the National Capital Region (NCR). Majority of FPs refer to dermatologists and more than half are affiliated with a hospital. Twenty percent had dermatology training which was not specified, and 44.2% took continuing medical education/seminars in dermatology. The top 3 most common dermatological diseases among the top ten existing dermatological diseases from January to December 2014 seen at the 11 accredited training institutions of the Philippine Dermatological Society (PDS) ranked by FPs as seen in their private practice were contact dermatitis, atopic dermatitis and acne vulgaris. The primary reason for referral of FPs to a dermatologist was for "treatment" and "difficult cases." Average referral frequency within a month was two times while within a year it was more than five times. The criteria for choosing a particular dermatologist were good medical skill, geographic consideration and good FP-dermatologist communication. For the manner of referral, majority referred through letter, followed by phone calls and text messages. There were 53.8% FPs who were satisfied with the quality of communication with the dermatologists. Few FPs encountered difficulties in referring patients such as unavailability of the dermatologist, patient's financial constraints, patient's refusal, and the patient not being referred back to the primary physician by the dermatologist. According to 68.6% of FPs, their patients followed-up after referral to a specialist. The existing referral system among FPs and dermatologists, based on the study parameters, is generally properly implemented at the NCR. However, further studies should be done to determine the current state of referral system in the rural areas, where further health care management is needed, due to the unavailability of specialists like dermatologists. (**Authors' abstract**)

Keywords: *family physicians (FPs), Philippine Academy of Family Physicians (PAFP), Dermatological Diseases, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-8
2018 - 2019,
(Filipiniana Analytics)
NP

0542

Bejeweled: chronic bullous disease of childhood in a 2-year old treated with colchicine - a case report

Ramirez-Quizon, Mae , Mejia, Danielle Nicolle Di

Linear IgA bullous dermatosis, also known as chronic bullous disease of childhood when present in the pediatric age group, is a rare blistering disease more predominantly seen in females less than five years old. This case describes a 2-year old girl who presented with scattered, tense vesicles and bullae on an erythematous base forming the classic "cluster of jewels" appearance. This clinical picture is often mistaken as bullous impetigo, commonly seen in children, delaying diagnosis and prompt treatment. Histopathologic examination showed subepidermal blistering with a predominantly neutrophilic inflammatory infiltrate. The direct immunofluorescence studies re-vealed a linear band of IgA deposition in the basement membrane zone consistent with the diagnosis of CBDC. The patient was started on

colchicine and oral prednisone at 1 mg/kg/day and complete resolution was achieved within two weeks of therapy. (**Author's abstract**)

Keywords: *Linear IgA bullous dermatoses, Chronic bullous disease of childhood, colchicine, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-5
2018 - 2019,
(Filipiniana Analytics)
NP

0543

Bilateral pallidal stimulation in parkinsonism predominant XDP

Jamora, Roland Dominic G. , Layog, Allister Vinc

X linked Dystonia Parkinsonism (XDP) is a progressive movement disorder among male inhabitants of the island of Panay in the Philippines, it would start as a focal dystonia then become generalised. The disease is believed to be due to a founder mutation of some 50 meiotic generations ago. Although initially seen in male population, current data shows otherwise. Reports of about 11 female cases are detected and listed in the registry. Male more than female predilection is seen with a ratio of 75:1. XDP is a very disabling degenerative disease causing involuntary torsion of the body, torticolis, blepharospasm and eventually parkinsonian features. There is no known treatment, and alleviation of symptoms is difficult to achieve, some patients even die due to infection and self harm. This report will present a case of XDP with predominating parkinsonian feature, who has undergone bilateral Globus Pallidus lnterna (GPi) Deep brain Stimulation (DBS). After the operation, return to functionality and improvements in activities in daily living is seen. The UPDRS and FMDRS scores show improvement noted on regular follow up. However adverse effects such as slurring of speech and minimal blepharospasm are still observed. (**Author's abstract**)

Keywords: *X linked Dystonia Parkinsonism (XDP), Globus Pallidus lnterna(GPi), Deep brain Stimulation (DBS), Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-4
2017 - 2018,
(Filipiniana Analytics)
NP

0544

A case of a 32-year-old male with rare presentation of secondary syphilis

Imson, Ruby

Nodular secondary syphilis is a rare condition with only 12 cases reported from 1980 to 2005. Cutaneous nodular granulomatous lesions, a positive serologic test for syphilis, and rapid resolution of symptoms with administration of Benzathine Penicillin are usually seen in previous cases. We report a case of a 32-year old male with clinical manifestations and laboratory findings consistent with nodular secondary syphilis, and concurrent manifestations of primary and secondary stages. This is the first documented case in East Avenue Medical Center and possibly in the Philippines, highlighting the need for meticulous history taking, physical examination and laboratory work-up to determine the correct diagnosis. (**Author's abstract**)

Keywords: *Secondary syphilis, nodules, HIV, sexually transmitted disease, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-6
2018 - 2019,
(Filipiniana Analytics)
NP

0545

A case of nevus lipomatosus superficialis in a 14-year-old Filipino female

Torres, Milali T. , Ang-Tiu, Charlene U. , Santos, Ana Aurelia M., Prieto, Karen M.

Nevus lipomatosus superficialis is a rare benign hamartomatous skin lesion. It is classified into 2 types: solitary and multiple. Lesions consist of multiple, flesh-colored or yellow papules and/or nodules in a segmental pattern, with a linear, zosteriform, or along the lines of skin folds distribution. Surfaces are smooth, but may also have verrucous or cerebriform appearance. Pathogenesis is unknown, but there is speculation that precursor cells around dermal blood vessels give rise to mature fat cells in a mosaic pattern. Incidence is presently unknown, but this is the first reported case in this institution. Histopathology reveals presence of aggregates of mature adipose tissue among the collagen bundles of the dermis. DF is a 14-year-old, Filipino, female, who consulted due to multiple, pedunculated, soft papules over the right lower back, and extending to the right flank, with a clustered arrangement. There was no history of trauma or manipulation, nor was there pain, pruritus, or other associated symptoms. Past medical, family, and social history were noncontributory. Initial impression was acrochordon. Excision biopsy revealed mature adipose tissue in the dermis, which is diagnostic for nevus lipomatosus superficialis. Serial excision was done. Excision is the treatment of choice. Other treatment options that can be explored are CO_2 laser, cryotherapy, and intralesional injection of phosphatidylcholine, which yield promising results recommended by other studies. Dermatopathology plays a vital role in the diagnosis of this condition. A high index of suspicion, a good clinical eye, and dermatopathologic analysis are essential tools in clinching the diagnosis. (**Authors' abstract**)

Keywords: *Nevus lipomatosus superficialis, cryotherapy, Dermatopathology, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-4
2016 - 2017,
(Filipiniana Analytics)
NP

0546

Classic dermatomyositis in a 36-year-old Filipino female: a case report with emphasis on the early recogniton of cutaneous findings of dermatomyositis

Jamora, Maria Jasmin J. , Belen, Katrina Carmela M. , Ingente, Maria Ceci

Dermatomyositis is a rare idiopathic inflammatory myopathy with characteristic skin manifestations and proximal muscular weakness. In 30 percent of classic dermatomyositis, skin findings precede muscle weakness. Since the initial skin lesions are not always highly characteristic of dermatomyositis, there may be a delay in diagnosis and treatment. This is a case of a 36-year-old Filipino female who initially presented with erythematous patches and plaques on the face, arms, and thighs. One week later, she developed multiple, well-defined, erythematous to violaceous, edematous, tender patches and plaques on the face, V of the neck, upper back, proximal extremities and buttocks. Seven weeks later, she developed proximal muscle weakness described as difficulty in raising her arms and difficulty in standing up from a sitting position. Histopathology was consistent with dermatomyositis. SGPT, C3, ANA, and anti-dsDNA were normal. SGOT and creatine kinase were 5 and 15 times the normal value, respectively. She was treated with

prednisone from the first week of illness and hydroxychloroquine from the fifth week of illness. Her condition greatly improved with no progression of the disease for the succeeding 3 years. Even in the absence of muscle weakness, there should be a high index of suspicion for dermatomyositis in patients with confluent, erythematous patches and plaques on the face, trunk and proximal extremities. Adequate work-up and clinical monitoring will pave the way for early diagnosis and consequently early treatment and a better patient outcome. (**Authors' abstract**)

Keywords: *dermatomyositis, inflammatory myopathy, corticosteroids, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-7
2017 - 2018,
(Filipiniana Analytics)
NP

0547

Comparison of the anxiety levels in children with acute lymphoblastic leukemia and their well siblings using the child drawing: hospital manual

Resurreccion, Michael M. , Sievert-Fernandez, Angie , Culminas, Efr

The study aims to determine and compare the anxiety of children with acute lymphoblastic leukemia and their well siblings based on Child drawing: Hospital manual and to identify factors associated with the level of anxiety. A prospective cross-sectional study was done in the hematology-oncology outpatient clinic and private clinics of hema-oncology specialist in tertiary pediatric hospitals. The study included children five to eleven years old diagnosed with Acute Lymphoblastic Leukemia (ALL) and their well siblings. A total of forty dyads of participants were included in the study. ALL patients presented higher anxiety scores than their siblings. However, this was not statistically significant. There is a weak direct correlation between overall anxiety scores of ALL patients and their siblings (p=0.017). There is insufficient evidence to demonstrate an association between select clinical factors with anxiety scores. The linear regression model showed 49.77% in the variation of the anxiety scores. There is a direct correlation between overall anxiety scores of ALL patients and their siblings. There is a positive association with larger family size and child's response to sibling's illness. A larger families are likely to have a healthier environment. The study showed low to average anxiety levels among participants which may be related to quality of care and support given by the institution and inherent resiliency of the family. Future research should aim to develop psychological, emotional and behavioral programs in partnerships with families and other social support groups. Future studies should examine other possible cultural and psychodynamic factors prevalent in Filipino Family. (**Author's' abstract**)

Keywords: *Anxiety, Siblings, Children, Chronic illness, Acute Lymphoblastic Leukemia, Child Drawing: Hospital Manual, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-14
2018 - 2019,
(Filipiniana Analytics)
NP

0548

Comparison of the risk of depression and anxiety between adolescent and adult patients diagnosed with acne vulgaris in a tertiary government hospital

Montelibano, Andrea Aileen Ma

Acne vulgaris is a common condition, affecting at least 80% of adolescents and adults aged 11-30. In a on fourth of the adolescents affected, it is moderate to severe. Once considered a disease occurring in puberty, studies have shown the prevalence of acne occurring up to the 5th decade. Many studies have shown the relationship between skin disease and mental health. And among acne vulgaris patients, there are reports of psychological disorders and negative quality of life. Many studies have been done about the risk of anxiety and depression among adolescents. However, because acne is more common among adolescents, limited studies have been done regarding the psychological impact of acne among adults. To compare the proportion of risk of anxiety and depression between adolescent and adult acne vulgaris patients in a tertiary government hospital OPD and Skin Center using the Hospital Anxiety and Depression Scale in English and Pilipino (HADS/HADS-P). A cross-sectional study design was used. Forty-six subjects (23 adolescent and 23 adult) diagnosed with acne vulgaris were included in the study. Eligible subjects underwent a thorough dermatologic evaluation. The Global Acne Grading System (GAGS) was used to evaluate the severity of acne. The validated HADS/HADS-P questionnaire was used to assess the risk of anxiety and depression. Independent Students t-test was used to compare means between the groups. Chi-square test was used to compare proportions. Statistical significance was based on p-values ≤0.05. Among the adolescents included, 56.5% were female, and 43.5% were male ranging from 13-24 years old. The adult subjects were consisted of 87% females and 13% males ranging from 25-47 years old. The most frequent age of onset of acne was between 11 to 19 years among adolescents and 12 to 18 years among adults (91.3% vs 56.5%; p=0.017). Duration of acne among adolescents was 4.4±3.0 years and 10.3±6.4 years among adults (p<0.0001). In the adolescent group, subjects had moderate (56.5%) or mild (43.5%) acne. Adults had mild (60.5%), moderate (30.4%) or severe (8.7%) acne. There was a significant difference in the risk of anxiety and depression between adolescents and adults (p=0.007). There were 21 adolescents (93%) and 12 adults (52.2%) who were at risk. Of the subjects included in the study, adolescents were approximately 10 times more likely to be at risk of anxiety and depression (OR=9.625, 95% CI: 1.821, 50.866). Acne vulgaris is associated with negative psychosocial effects on both adolescent and adult patients. The results of this study are consistent with previous findings across cultures. Because acne is not just a physical problem for many patients, it is important for healthcare practitioners, especially dermatologists to be able to see the red flags for psychological comorbidities among patients. The Hospital Anxiety and Depression Scale is a quick and simple tool to use for physicians for risk assessment that can be done in the clinics and can aid in providing a more holistic treatment for patients. (**Author's abstract**)

Keywords: *Acne vulgaris, anxiety, depression, skin disease, mental health, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-9
2018 - 2019,
(Filipiniana Analytics)
NP

0549

Confusion in deglutition: a case of botulinum toxin ingestion

Singson, Ami

It is a case report of dysphagia secondary to botulinum toxin ingestion of a 30-year-old female with no comorbidities, presented with dysphagia associated with ptosis and diplopia 12 hours after ingestion of double dead pork. Probable diagnoses of a neurologic, esophageal problem or a neoplasm were initially considered. Ancillary procedures to support diagnoses were performed including esophagogastroduodenoscopy, cranial CT scan and Facial and Extremity Nerve Conduction Velocity which all revealed unremarkable results. A possible polyneuropathy specifically foodborne toxicity was considered given a history of dysphagia, ptosis and diplopia with consumption of double dead pork. Confirmatory stool culture studies revealed Clostridium botulinum, hence appropriate antibiotics and supportive therapy were provided which led to the patient's recovery. Early diagnosis and a high index of susp1c1on is important in cases with unfamiliar presentations, therefore a careful history and physical examination is warranted. Foodborne botulinum toxicity is a public health matter that should be addressed. Proper food handling and storage must always be practiced. (**Authors' abstract**)

Keywords: *botulism, foodborne botulism, deglutition disorders, dysphagia, public health, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 1, 1-4
2017 - 2018,
(Filipiniana Analytics)
NP

0550

Congenital methemoglobinemia

Santos, Elaine Di

This report a case of a ten-year-old female with progressive cyanosis and dyspnea on exertion. Clinical and laboratory work up ruled out a cardiac and pulmonary pathology warranting further investigation for possible hemoglobinopathies. Enzyme assay showed deficiency in cytochrome b5 reductase seen in patients with congenital methemoglobinemia. Ascorbic acid at 200 mg daily afforded gradual improvement in cyanosis. (**Author's abstract**)

Keywords: *methemoglobinemia, cytochrome b5 reductase, cyanosis, ascorbic acid, child, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-9
2018 - 2019,
(Filipiniana Analytics)
NP

0551

Correlation of sterno-aortic distance with FEV1/FVC and FEV1 in patients with COPD

Drilon, Carolina A. , Manganda, Regina Cristina Q., Villarosa, Alfredo F.

Chronic obstructive pulmonary disease (COPD) is defined by the Global Initiative for Chronic Obstructive Lung Disease as "a disease state characterize by airflow limitation that is not fully reversible". Several qualitative and quantitative CT parameters have been studied in diagnosing patients with COPD. The clinical application of CT scan in quantitative assessment of the morphologic features of airways in patients with COPD has been subjects of numerous investigations. However, studies on sterno-aortic distance as a parameter in assessing morphologic feature of COPD in CT scan has been rare. Hence, this study aims to find a correlation of sterno-aortic distance with pulmonary function test in patients with COPD. Eighty-one patients diagnosed with COPD who underwent chest CT scan and PFT within the period of one year were included. Sterno-aortic distance were measured and correlated with PFT results and severity of COPD. Most patients enrolled were males with average age 64$\pm$11 years old. Most of these patients are categorized as mild COPD with 38% and severe COPD with 38% of the total population. Patients classified as moderate COPD comprise 24% of the total population. There is significant weak inverse correlation between sterno-aortic distance and PFT results FEV1 ($r=-0.419$, $p<0.001$) and FEV1/FVC ($r=-0.322$, p value of 0.003). There is a significant correlation derived between sterno-aortic distance and severity of COPD (rho=0.88, p-value of

<0.001). Sterno-aortic distance is a valuable parameter in patients with COPD as well as its severity. (**Author's abstract**)

Keywords: *chronic obstructive pulmonary disease, COPD, sterno-aortic distance, chest CT scan, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-7
2016-2017,
(Filipiniana Analytics)
NP

0552

Delayed prosthesis fitting in an elderly with congenital lower limb deficiency: a case report

Zambrano, Jhoana Ma

Congenital anomalies, including limb deficiency, affect approximately 7.9 million newborns annually. Fitting the prosthesis at an early stage will aid the patient to achieve two-legged standing, to develop reciprocating gait and to attain an optimal body image. A 64-year-old female diagnosed with congenital limb deficiency, right, using a customized shoe was admitted for prosthetic management at the study hospital.

Patient underwent inpatient prosthetic training with physical and occupational therapy. Psychological evaluation was done to assess for depression and anxiety and to determine the patient's response to the prosthesis. The Prosthesis Evaluation Questionnaire (PEQ), an instrument to measure prosthesis-related quality of life and functional outcome, was administered. 30 motion analysis was done to observe the temporospatial parameters of the patient's gait with and without the prosthesis.

The patient had generally positive response towards her prosthesis based on PEQ administered 1 month after the provision of prosthesis. Psychological evaluation showed that the patient had improved general outlook after the provision of the prosthesis. Patient had slower self-selected walking speed compared to transtibial amputee using prosthesis.

Early fitting and fabrication of prosthesis is recommended for the patient with congenital amputation. Studies showed that delayed fitting of prosthesis may decrease acceptance and use of prosthesis. However, provision of properly fitted prosthesis may still improve the quality of life of the patient who is already functionally independent without it. More than increase in physical activity, participation in leisurely activities that promote social interaction motivates elderly patients to use their prosthesis more often. (**Author's abstract**)

Keywords: *elderly, congenital limb deficiency, leg prosthesis, delayed fitting, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 1, 1-9
2017 - 2018,
(Filipiniana Analytics)
NP

0553

Dermatofibrosarcoma protuberans of the hand

Abad-Casintahan, Ma. Flordeliz , Velasquez, Sa

Dermatofibrosarcoma protuberans (DFSP) is a rare, locally aggressive dermal, and subcutaneous mesenchymal neoplasm that often presents as a slow-growing lesion on the trunk, proximal extremities, head, and neck. We report a rare case of DFSP arising on the dorsum of the left hand. A 35-year-old male, who presented with a solitary verrucous nodule on the dorsum of the left hand and had experienced two recurrences of the lesion following local excision and electrocautery. Histopathologic examination was consistent with DFSP. CD34 immunostain was positive. Wide surgical excision with a three centimeter margin and direct skin closure was done. Although metastasis is rare, DFSP is associated with marked tendency towards local recurrence after surgery hence patient is for follow-up every six to twelve months post operatively. (**Author's abstract**)

Keywords: *dermatofibrosarcoma protuberans, CD34 immunostain, wide surgical excision, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-6
2016 - 2017,
(Filipiniana Analytics)
NP

0554

Diffuse cutaneous mastocytosis in a Filipino newborn: a case report

Jamora, Maria Jasmin J. , Sarmiento, Leona Car

Cutaneous mastocytosis is the accumulation of mast cells in the skin. Diffuse cutaneous mastocytosis is a rare variant accounting for only 1.74% of al mastocytosis cases reported. Ninety percent of cases are seen in children presenting with multiple erythematous to yellow-tan papules and plaques with leathery texture. The pathogenesis is in the structure and activity of kit receptor expressed on mast cells, melanocytes, and other cells. This is a female neonate born to an 18-year old mother, G1P1 via vaginal delivery at 37 weeks age of gestation. Patient presented with a generalized involvement of multiple, well defined, indurated, leathery, brown papules, and confluent plaques. Darier sign was positive. Histopathological examination revealed diffuse involvement of the dermis with mast cells. Giemsa stain was positive. Patient was diagnosed both clinically and histopathologically with diffuse cutaneous mastocytosis without systemic involvement. She was treated with H1 antihistamines and topical glucocorticoids. Diffuse cutaneous mastocytosis can be diagnosed both clinically and histopathologically. Treatment is mostly symptomatic. It is always prudent to inform co-managing physicians, the patient, and their families of potential mast cell degranulating stimuli and to watch out for signs and symptoms for systemic involvement. (**Author's abstract**)

Keywords: *Cutaneous mastocytosis, Diffuse cutaneous mastocytosis, mast cells, melanocytes, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-5
2018 - 2019,
(Filipiniana Analytics)
NP

0555

A double-blind randomized controlled trial of the efficacy of 5% tea tree oil cleanser versus mild cleanser in the treatment of mild-moderate facial seborrheic dermatitis

Lavadia, Ma. Angela M., Mendoza, Catherine C., Cuizon, Ma. Luisa, Moreno, Deanna

Seborrheic dermatitis is a chronic, relapsing, inflammatory disease characterized by erythema, scaling, pruritus over the areas of the scalp, face, ears, sternum and upper back. Tea tree oil is rich in terpene alcohols such as terpinen-4-ol which is thought to be the active germicidal component. To determine the efficacy of 5% tea tree oil cleanser in the treatment of mild-moderate facial seborrheic dermatitis and to determine the adverse side effects. Forty-five patients with clinical signs of seborrheic dermatitis were randomly assigned to one of the two treatment groups: mild cleanser and the 5% tea tree oil group. This study was done as a double-blind randomized controlled trial for 4 weeks. The parameters-area involved, erythema, scaling, and Seborrehea Area and Severity Index were taken at baseline and weekly for 4 weeks. At the end of 4 weeks, the difference of the two groups were compared using paired t-test. After 4 weeks, significant clinical improvement of the area involved, erythema, and scaling and the reduction of Seborrhea Area and Severity. The use of 5% tea tree oil cleanser provides significant improvement in the treatment of mild-moderate facial seborrheic dermatitis with no adverse side effects. (**Author's abstract**)

Keywords: *Seborrheic dermatitis, inflammatory disease, Tea tree oil, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-9
2016 - 2017,
(Filipiniana Analytics)
NP

0556

Dysembryoplastic neuroepithelial tumor: a case report

Holgado, Anna Victo

This reports a case of dysembryoplastic neuroepithelial tumor (DNET) in a 5-year old male presenting with visual hallucination and seizures. Diagnostic workup revealed a homogenous cystic tumor located in the right temporo-parietal area which was considered as a low grade glioma. The patient underwent endoscopic third ventriculostomy with complete tumor excision and biopsy, revealing DNET. Findings were confirmed by immunohistochemical staining with glial fibrillary action protein (GFAP), Alcian blue and synaptophysin.

DNET is a recently described intracranial tumor under the World Health Organization classification of central nervous system (CNS) tumors. It is a unique entity of neuroglial tumors with excellent prognosis. Its worldwide incidence among all neuroepithelial tumors is 1.2% in patients under 20 years and 0.2% among patients over 20 years.

This is the first case of DNET in the country as well as in our institution. Key points on the clinical manifestation, approach to diagnosis, distinctive radiologic and histopathologic characteristics, and management are discussed. (**Authors' abstract**)

Keywords: *dysembryoplastic neuroepithelial tumor, DNET, glial fibrillary action protein (GFAP), Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 1, 1-10
2017 - 2018,
(Filipiniana Analytics)
NP

0557

Effect of aspiration and non-aspiration of syringe prior to intramuscular administration of influenza vaccine in pain perception of children 9 to 15 years of age consulting at the out-patient department of a tertiary government hospital

Resurreccion, Michael M. , Otero, Jovy A

The study was conducted to determine the effect of aspiration and non-aspiration of syringe prior to intramuscular administration of influenza vaccine in pain perception of children 9 to 15 years of age consulting at the Out Patient Department of a Tertiary Government Hospital in a randomized controlled clinical trial. One-hundred twenty children 9 to 15 years old consulting at the Out Patient Department were randomized into two groups and were given influenza vaccine with and without aspiration prior to intramuscular injection. Primary outcome measure is the degree of pain experienced by the subject using the Numeric Rating Scale. A total of one hundred twenty children were randomized to either Group A or Group B. IBM SPSS version 21 was used as statistical software. Differences in mean heart rate at baseline and after the intervention within group is significantly different (p value <0.01). Mean heart rate in between group at baseline and after administration of influenza vaccine is not significantly different (p value >0.05). The difference in mean oxygen saturation at baseline and after immunization within group is significantly different. Mean oxygen saturation between group pre and post immunization is not statistically different (p value 0.309). Analysis showed there is a significant difference in mean pain scores between Group A and Group B (p value at 0.046). This study showed a statistically significant lower pain score for Group A (without aspiration) than Group B (with aspiration). The physiological pain responses, used as outcome measures in this study did not have significant differences between two groups. The result of this study will unleash in health care professionals the burden on whether or not to aspirate before intramuscular administration of vaccine. (**Author's abstract**)

Keywords: *aspiration, non-aspiration, influenza vaccine, pain assessment, intramuscular injection, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-9
2017 - 2018,
(Filipiniana Analytics)
NP

0558

Effect of regular progression of diet, early oral feeding and early oral feeding with domperidone on post cesarean diet tolerance in a tertiary hospital

Dequina, Lucky Fa

The rate of admission in the Obstetrics and Gynecology Department in a tertiary hospital in Quezon City is continuously increasing, sometimes more than its bed capacity. An average of 2-3 mothers occupying a single bed with their newborn children can be overwhelming, to the point where the comfort, hygiene, and wellness of the patients after delivery are sacrificed. It is important for us to find a way in which the ward can accommodate all patients without any risk of losing the comfort that the hospital can offer during their stay. A faster patient turnover can at least help in this kind of situation.

This study aims to investigate if early feeding can lead to early return of normal bowel function which could mean shorter hospital stay due to lesser post-operative discomfort and early ambulation. A randomized, three arm study was done in a tertiary hospital from June 2016 to September 2016. Ninety-three women who underwent elective Cesarean Section were admitted and were randomly assigned into three groups. Group A had regular progression of diet, Group B were those who were fed early and Group C those who were given Domperidone before they were fed early. The primary outcome would be the time to regular diet tolerance. Secondary outcomes include the time of first flatus, time

to ambulation out of bed, duration of intravenous infusion, duration of indwelling foley catheter and finally, length of hospital stay. (**Authors' abstract**)

Keywords: *post-operative discomfort, ambulation, diet, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 1, 1-7
2017 - 2018,
(Filipiniana Analytics)
NP

0559

Gorlin syndrome in a 48-year-old Filipino woman: a case report

King-Ismael, Daisy , Geraldez, April Ja

Gorlin syndrome is a rare autosomal dominant disorder characterized by a wide range of developmental abnormalities and a predisposition to neoplasms. The estimated prevalence is 1/57,000 to 1/256,000. Main clinical manifestations include multiple basal cell carcinomas, odontogenic keratocysts, skeletal abnormalities, ovarian fibromas, and other disorders. A 48-year old woman presented with multiple brown-black to skin-colored pearly macules, papules and nodules over the scalp, face, neck, trunk, upper, and lower extremities. Histological examination at 2 sites revealed basal cell carcinoma. This was accompanied by findings of odontogenic keratocysts, palmar pits, posterior falx calcification, exotropia, and multiple myoma uteri. Electrodessication with curettage of superficial basal cell carcinomas (<1 cm.) was combined with wide excision of nodular basal cell carcinomas on the left temporal area (followed by rotational scalp flap reconstruction), right lateral breast, left inframammary area, right and left anterior thigh. Gorlin syndrome is a hereditary condition affecting various organ systems. Management requires a multidisciplinary approach and regular medical surveillance is required. (**Author's abstract**)

Keywords: *Gorlin Syndrome, multiple basal cell carcinomas, odontogenic keratocysts, skeletal abnormalities, ovarian fibromas, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-8
2018 - 2019,
(Filipiniana Analytics)
NP

0560

Hyper immunoglobulin E syndrome with concomitant folliculotropic mycosis fungoides in a Filipino child treated with narrowband UVB phototherapy: a case report

Abad-Venida, Ma. Luisa, Rescober, Ma. Crise

Hyper lmmunoglobulin E Syndrome (HIES) is a primary immunodeficiency disorder characterized by the classic triad of recurrent staphylococcal abscesses, frequent airway infections, and increased serum immunoglobulin E. It is now widely accepted as a multisystem disorder with involvement of the skeletal, connective tissue, dental, and vascular systems. Lymphoma has been reported to occur at an increased frequency. Folliculotropic mycosis fungoides (FMF) is a rare variant of cutaneous T-cell lymphoma in which the neoplastic T lymphocytes display tropism for the follicular epithelium. We report a case of a 14-year old Filipino male with the classic type of HIES presenting with severe eczema associated with intractable pruritus, recurrent respiratory tract infections, cold abscesses, and a serum lgE of 9,350 IU/ml. Skin biopsy also revealed findings consistent with FMF. Narrowband UVB (NB-UVB) phototherapy

was initiated three times a week with continuation of supportive medication. Patient reported significant relief of pruritus and gradual improvement of eczematous lesions after one month. (**Author's abstract**)

Keywords: *Hyper lgE syndrome, Job's syndrome, Follliculotropic mycosis fungoides, narrowband UVB phototherapy, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-12
2016 - 2017,
(Filipiniana Analytics)
NP

0561

Keratoacanthoma on an epidermal nevus in a Filipino male

Padlan-Ramos, Janelle Marie S., King-Ismael, Dais

Keratoacanthoma is a cutaneous tumor that most often presents as a solitary lesion in middle-aged to elderly, light-skinned individuals on sun-exposed areas. It is characterized by rapid growth and may be followed by spontaneous involution. This is a case of a seventy-year-old Filipino male who had a one-month history of a solitary nodule that suddenly appeared on an epidermal nevus. Histopathologic diagnosis revealed a keratoacanthoma. (**Author's abstract**)

Keywords: *Keratoacanthoma, Epidermal Nevus, Histopathologic diagnosis, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-3
2017 - 2018,
(Filipiniana Analytics)
NP

0562

One mistake, one life at stake: a case of methotrexate toxicity in a 57-year old male presenting with painful plaques with erosions

Prieto, Elizabeth P., Quinio, Maria Franche

Methotrexate is being given by dermatologists in only extreme cases of skin disorders such as in severe Psoriasis vulgaris. Strict precautionary measures are done to avoid its well-known adverse effects. An early but less common sign of its toxicity are painful erosions on plaques. Methotrexate is an effective but potentially toxic treatment for different severe dermatologic disorders such as in severe Psoriasis vulgaris. Meticulous and complete history-taking, physical examination and laboratory work-up to come up with a correct diagnosis as well as, knowledge of indications for treatment, proper dosing, folate supplementation, monitoring, proper referral and early detection of its toxicity are important in order to avoid cutaneous and systemic adverse effects including death. A case of a 57-year old male with a 2-day history of painful erosions on plaques on both upper and lower extremities after eleven days of taking Methotrexate 2.5 mg/tablet one tablet three times a day without folate supplementation. He was then being treated by a general physician as a case of Psoriasis vulgaris. He was subsequently admitted under the Internal Medicine service due to epigastric pain, nausea, anorexia, generalized body weakness, and passage of black tarry stools. He was referred to the Department of Dermatology for the painful erosions on plaques. He expired two days after admission due to acute respiratory failure. Post-mortem skin punch biopsy was done and revealed chronic eczematous dermatitis

consistent with Lichen simplex chronicus with superimposed drug induced hypersensitivity reaction. (**Authors' abstract**)

Keywords: *Methotrexate toxicity, painful erosions on plaques, Lichen Simplex Chronicus, Psoriasis Vulgaris, folate supplementation, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-6
2016 - 2017,
(Filipiniana Analytics)
NP

0563

A pilot study comparing the clinical efficacy of freshly reconstituted and botulinum toxin A reconstituted 1, 2 And 3 months before application in the treatment of axillary hyperhidrosis

Espinoza-Thaebtharm, Agnes , Pineda, Czar

Most manufacturers of commercially available botulinum toxin A (BTX-A) recommend that the vials should be used within 24 hours after reconstitution to ensure efficacy, which in some instances would mean wastage of remaining reconstituted solution. Several studies have evaluated the efficacy of stored reconstituted BTX-A and have concluded that the use of BTX-A reconstituted and refrigerated for up to 6 weeks prior to administration does not significantly alter its efficacy in the treatment of facial rhytides. Our study aimed to compare the clinical efficacy and safety of freshly reconstituted BTX-A and BTX-A reconstituted 1, 2, or 3 months prior to administration in the treatment of axillary hyperhidrosis. Patients with primary axillary hyperhidrosis were enrolled in this pilot study. Freshly reconstituted BTX-A and BTX-A reconstituted 1, 2, and 3 months prior were administered in 4 pre-determined areas in the same patient. The degree of hyperhidrosis was assessed subjectively using Hyperhidrosis Disease Severity Scale (HDSS) and objectively using Minor's iodine starch test followed by Sweating Intensity Visual Scale (SIVS) at 0, 2, 6, and 12 weeks after administration. Five patients were enrolled in the study. Kruskall-Wallis test showed that HDSS at baseline was significantly different from follow-up periods with noted improvement from baseline to 2 weeks follow-up. Using Kruskall-Wallis test, SIVS was found to be not significantly different among these 4 treatment areas. In addition, significantly improved SIVS scores were noted as early as 2 weeks after administration in all 4 areas of treatments. There were no noted adverse effects in all patients at baseline and at all follow-up visits. The clinical efficacy and safety of BTX-A reconstituted 1, 2, and 3 months prior to administration is comparable to that of freshly reconstituted BTX-A in the treatment of axillary hyperhidrosis. (**Author's abstract**)

Keywords: *stored botulinum toxin A, reconstituted botulinum toxin A, axillary hyperhidrosis, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-7
2018 - 2019,
(Filipiniana Analytics)
NP

0564

Preoperative hemoglobin A1C level and preoperative capillary blood glucose level as predictors of clinical outcomes of patients who underwent low to intermediate risk, non-cardiovascular surgical procedures

Marquez, Mary

Hyperglycemia has been associated with poor clinical outcomes in both diabetic and non-diabetic patients. The aim of this study is to determine if preoperative hemoglobin A1C level and capillary blood glucose level can be used as predictors of clinical outcomes of patients who underwent low to intermediate risk, non-cardiovascular surgical procedures. A Single Center Cohort Retrospective Study was conducted and data were obtained from lists of patients who underwent low to intermediate risk, non-cardiovascular surgical procedures admitted for more than one day from January 2016 to December 2016. Chart review was done and provided information on demographics, presence and status of co-morbidities, availability of hemoglobin A1C ninety days prior to surgery or pre-operative capillary blood sugar, and surgical outcomes (length of hospital stay, surgical site infection, postoperative sepsis, acute renal failure or mortality). Comparison of outcomes among different levels of A1C was analyzed using Analysis of Variance and Fisher's exact test. Comparison of outcomes between normal and elevated CBG was analyzed using independent t-test and Fisher's exact test. The level of significance was set at 5%. A total of one hundred forty-five patients were included in the final analysis. Of which, 69 patients had an HbA1C available within 90 days prior to surgery with the mean A1C at 8.04% ± 2.48%, and 93 patients had pre-operative capillary blood glucose with a mean value of 125.16 ± 55.94. Longer hospital stay was shown in patients with A1C level of 8-10% (4.7 ± 5.16 days). However, the association is insignificant with a P value of 0.1412. There was no significant difference in the length of hospital stay in patients with CBG level of <140mg/dL and ≥140mg/dL, with a mean value of 2.9014 ± 1.7167 days and 2.8636 ± 1.2834 days, respectively. (P=0.9244). There were too few events to meaningfully evaluate for secondary outcomes. Our study suggests that neither preoperative capillary blood glucose level nor hemoglobin A1C is significantly associated with longer hospital stay. But the findings on patients with hemoglobin A1C values of 8.0%-10% warrants further investigation. Providing a preoperative intervention to improve glycemic control in individuals with hemoglobin A1C values of 8.0%-10% may improve surgical outcomes, but prospective studies are needed. (**Authors' abstract**)

Keywords: *Hyperglycemia, hemoglobin A1C level, capillary blood glucose level, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 1, 1-9
2018 - 2019,
(Filipiniana Analytics)
NP

0565

Prevalence, epidemiology and clinical characteristics of melasma in Philippine dermatology patients: a multicenter, cross-sectional study

Loginus, Wilson , Lavadia, Ma. Angela M., Carpio, Benedicto D., Gabriel, Ma. Teresita, Gener-Pangilinan, Liezel A., Handog, Evangeline B.

Melasma is an acquired hyperpigmentary disorder occurring in the sun-exposed areas of the face and neck. There is little information on its prevalence, epidemiology and clinical characteristics in the Philippines. To determine the prevalence, epidemiology and clinical characteristics of melasma in Philippine dermatology patient. This was a multicenter, cross-sectional study conducted from July to December 2013. The investigators determined the prevalence of melasma in 12,068 dermatology patients from 6 government hospitals and private centers in Metro Manila, Philippines. The melasma patients, aged 18 years and above were examined and given self-administered questionnaires to determine the epidemiological and clinical characteristics of their melasma. Of the 12,068

dermatology patients who were seen at the selected hospitals and private centers, 153 (1.26%) were clinically diagnosed with melasma. Majority of the melasma patients were Filipinos (73.20%), aged 41-50 years old (37.91%), with an average age of 42.40 + 9.68 years, and Fitzpatrick skin types III and IV (29.41% and 57.52%, respectively). Melasma was more prevalent in females (81.70%), wherein majority had a prior history of pregnancy (76.8% of the females). Oral contraceptive use was also reported in 37.6% of the female patients and 63.83% of those who have used OCP, have used it for only 1 year or less. Majority had no thyroid disease (75.16%) and daily sun exposure was limited to 1 hr or less for most patients (43.14%). Their melasma was mostly malar in distribution (60.13%), epidermal (61.44%), and mild (51.63%) to moderate (27.45%) in severity. The average mMASI score was 4.63 + 3.32. Prevalence of melasma was low among the Philippine dermatology patients sampled. Majority of the melasma patients were Filipinos, aged 41-50 years old, with Fitzpatrick skin type IV, limited sun exposure, and no thyroid disease. They were mostly females, with a prior history of pregnancy. Their melasma was mostly malar, epidermal, and mild in severity. These descriptive data can serve as baseline information for further studies on melasma in the Philippines. (**Author's abstract**)

Keywords: *melasma, Asian skin, chloasma, Philippines, Filipinos, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-9
2018 - 2019,
(Filipiniana Analytics)
NP

0566

A randomized double blind controlled study on the efficacy of *Spirulina* as an adjunct therapy in the management of pediatric community acquired pneumonia-C in patients 6 months to 5 years old admitted in a tertiary government hospital

Resurreccion, Michael M. , Crisostomo, Mich

The study determined the effect of *Spirulina* among patients with community acquired Pneumonia-C (PCAP-C) based on the resolution of the following symptoms; fever, respiratory rate, chest indrawings, rales, oxygen saturation and compare their length of hospital stay in a randomized-double blind, placebo controlled clinical trial. Children 6 months to 5 years old with PCAP-C were randomized to either treatment group A or B. The two groups received the standard treatment for pneumonia and adjunct treatment of *Spirulina* for group A and placebo for group B. A total of 147 patients participated in the study. Seventy-four patients were randomized to group A and 73 patients to group B. Respiratory rate showed greater improvement with *Spirulina* supplementation starting day 3, 4, and 5. Resolution of chest in-drawing was significant in *Spirulina* group on day 2 (p-value <0.05), day 3 (p-value <0.05), and day 4 (p-value <0.05). There were more patients in *Spirulina* group with decreased to absent rales on day 2 (p-value 0.02), day 3 (p-value 0.039), day 4 (p-value 0.01) and day 5 (p-value 0.01). Temperature and oxygen saturation on both groups had almost similar trends. The mean hospital stay in *Spirulina* group (3.09 days) is shorter as compared to the placebo group (p-value 0.02). *Spirulina* supplementation showed positive effects in PCAP-C. Its immunemodulating effect played a positive role in the treatment outcome of pneumonia. (**Authors' abstract**)

Keywords: *pneumonia, Spirulina, PCAP-C, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-12
2017 - 2018,
(Filipiniana Analytics)
NP

0567

A randomized, double-blind, controlled trial on the efficacy and safety of 1.5% *Carica papaya* latex cream compared to 1% terbinafine cream in the treatment of localized tinea corporis and/or tinea cruris

Barcelona-Tan, Jesusa , Castillo-Yaptinchay, Vesna , Abejo, Mari

Tinea corporis and cruris are superficial fungal infections mainly caused by dermatophytes. The antifungal effect of *Carica papaya* latex cream has been demonstrated in clinical studies, however, larger population and comparative studies to standard antifungal agents are needed to further strengthen this conclusion. This study determined the efficacy and safety of 1.5% *Carica papaya* latex in cream base as treatment for tinea corporis and/or cruris compared to 1% terbinafine cream. This is a randomized, double-blind controlled trial wherein subjects with a clinical diagnosis of tinea corporis or cruris confirmed by microscopy applied terbinafine or carica papaya latex cream twice daily for 6 weeks. The efficacy and safety were assessed 2, 4, and 6 weeks using clinical and mycological cure parameters. The incidence of adverse effects was likewise evaluated. 90 subjects were randomized, 45 in *Carica papaya* group and 45 in the terbinafine group. Both groups had statistically comparable improvements based on symptoms and mycological cure rates. Adverse events are significantly higher in the papaya latex cream group. *Carica papaya* latex cream is as effective as terbinafine cream in the treatment of tinea corporis and/or cruris, but it has a higher incidence of adverse events. (**Author's abstract**)

Keywords: *tinea corporis, tinea cruris, carica papaya latex cream, terbinafine cream, Medicine*

Journal of the Philippine Medical Association, Volume No. 95 Issue No. 2, 1-8
2016 - 2017,
(Filipiniana Analytics)
NP

0568

Recovery in schizophrenia: perspectives from psychiatrists in the Philippines

Sia, Angelica Beth T. , Tinaja, Charlene J. , Tolentino, Jr., Edgardo Juan L. , Malipot, Jessa Joy C. , Ortega, Dorothy Jean N. , Reyes, Ma. Sophia Graciela L. , Sta. Ana-Ponio, Benita , Hembra, Mariano S. , GarduÃ±o-Cruz, Monina , Banaag, Carlo Eugenio V. , de Guzman, Ma. Lourdes Rosanna E. , Antonio, Carl Abelardo T. , Torres, Chelseah Denise H. , Sionzon, Michael P., Aldea, Patrick Joseph , Benedicto, Erwin G

A reliable and socially validated definition of recovery in schizophrenia is essential to decrease stigma associated with the illness. This study aimed to define recovery in schizophrenia in the Philippine context, determine its specific elements, and describe methods of assessment in clinical practice. We invited a group of purposively selected Filipino psychiatrists to participate in six simultaneous roundtable discussions to gather their opinions and perspectives on recovery in schizophrenia. Transcripts of the discussions were then subjected to framework analysis. Most Filipino psychiatrists were of the considered opinion that recovery in schizophrenia is possible, and their vision of a recovered patient resembles a combination of psychological and medical models. The mini-FROGS tool was deemed generally applicable in the Philippine setting except for self-esteem and sense of independence primarily because it is difficult to evaluate. The SWN was received with mixed reactions among the psychiatrists. Spirituality as an element of recovery and the family-oriented culture of the Filipinos were emphasized as important considerations in assessing patients. Other suggestions were given to tailor-fit these tools to the Philippine context. (**Author's abstract**)

Keywords: *schizophrenia, mental health recovery, mini-FROGS, Subjective Well-being Under Neuroleptics (SWN), Philippines, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-9
2018 - 2019,
(Filipiniana Analytics)
NP

0569

A retrospective study on the accuracy of sassone, lerner and IOTA simple rules in determining malignancy of ovarian masses in a tertiary hospital ob-gyn ultrasound diagnostic unit

Morales, Arri

Ultrasonography has been established as one of the important diagnostic tools in detecting and classifying ovarian masses. Several studies have been made in determining the sensitivity and specificity of the different scoring systems as to determining the malignancy of ovarian masses. In a tertiary hospital ultrasound diagnostic unit, three scoring systems are utilized namely Lerner, Sassone, and IOTA simple rules. With this reason, it is important to determine and compare the sensitivity and specificity on the most utilized ultrasound scoring systems in determining malignancy of ovarian masses. A single center observational, analytical, cross-sectional study utilizing review of the transvaginal or pelvic ultrasound results of women with ovarian masses that were scored using Sassone, Lerner, and IOTA Simple Rules in a tertiary hospital ultrasound diagnostics unit from January 2013 to June 2016 was done. The sensitivity, specificity, positive and negative predictive values of each scoring system utilized was determined and compared with the histopathologic result. Out of the 111 ovarian masses that were included in the study, 44 ovarian masses were scored using Lerner Scoring system with a sensitivity, specificity, positive and negative predictive values of 100%, 65%, 22.2%, and 100%. 105 ovarian masses screened using Sassone Scoring System showed a sensitivity, specificity, positive and negative predictive values of 100%, 68%, 20.5%, and 100%. A total of 33 out of the 111 ovarian masses were scored using the IOTA scoring system with a sensitivity, specificity, positive and negative predictive values of 100%, 85.6%, 55.5%, and 100%. In conclusion, IOTA simple rules had a high sensitivity and specificity compared to Sassone or Lerner Scoring System. However, we cannot fully conclude that individual specificity will be better than combined tests since there is limited number of ovarian masses analyzed. (**Author's abstract**)

Keywords: *ultrasound, IOTA simple rules, sassone, lerners, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 1, 1-10
2017 - 2018,
(Filipiniana Analytics)
NP

0570

Safety and efficacy of topical essential oil as steroid-sparing agent in the treatment of atopic dermatitis in a community outreach care program of New Era University second year medical students, randomized double blind placebo controlled trial

Cayabyab, Camille , Mangunay, Jan Michael , Rivera, Genesis C. , Abalos, Alvin , Ruiz, Florence , Esto, Concepcion , Legaspi, Cather

The high rates of atopic dermatitis among children, treatment failures and treatment costs have created the search for new therapies to control flares of atopic dermatitis. The researchers compared the efficacy and safety of topical essential oil (German Chamomile) versus topical steroids (hydrocortisone 1%) in controlling flares of atopic

dermatitis. The researchers randomly selected 60 children diagnosed of AD or children that qualified to the criteria of AD. They were randomly grouped into three. Twenty for Essential Oil (EO) group, twenty for Steroid group (SG), and Twenty for placebo (distilled water) group. They were advised to apply medicine kept in uniform brown plastic bottles 3x a day for 4 weeks. Data were recorded weekly using the EASI (Eczema Score Index) scoring. Other topical medications such as emollients and moisturizers were continued. At week 4 control of flaring was achieved; 42% for EO group and 55% for steroid group. The differences in treatment effects were not statistically significant. Essential oil was comparable in cure rate to mild topical steroid. Essential oil can be safe and affordable. However further study in a wider scale is recommended. (**Author's abstract**)

Keywords: *Atopic Dermatitis, Barrier Function, Eczema, Essential Oils, Roman Chamomile, Jojoba oil, Chamazulene, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-5
2018 - 2019,
(Filipiniana Analytics)
NP

0571

Syringocystadenoma papilliferum arising within a nevus sebaceous: a case report

Regalado-Morales, Eileen , Cua, Anna Meli

Syringocystadenoma papilliferum is a rare benign adnexal skin tumor of apocrine or eccrine differentiation. It usually appears at puberty wherein a third of cases arise within a nevus sebaceous. We report a 14-year-old male with an erythematous fleshy plaque on the scalp of 3 years duration that developed from a pre-existing hairless plaque since birth. Histopathology confirmed the above diagnosis. (**Author's abstract**)

Keywords: *Syringocystadenoma papilliferum, nevus sebaceous, adnexal tumor, Medicine*

Journal of the Philippine Medical Association, Volume No. 97 Issue No. 2, 1-4
2018 - 2019,
(Filipiniana Analytics)
NP

0572

Trans-sacral epiduroscopic laser decompression (SELD) for low back pain secondary to herniated lumbar disc in the Philippines: a case report and review of literature

Meceda, Elmer Jose A. , Paez, Wa

LBP has a lifetime prevalence ranging from 54% to 80%, an annual prevalence of 15-45%, and a point prevalence of 30%. Lumbar radicular pain often results from a Lumbar disc herniation. With recent advances in technique and access in instrumentation, minimally invasive spine surgery has ushered in a renaissance of spine care. SELD has promising positive effects in controlling LBP following HLD.

This is a case of a 26 year old with radicular LBP of 2 years duration secondary to HLD, underwent conservative management of LBP but offered no relief and improvement, hence he became the case for the pioneering procedure of SELD in the Philippines. Immediate and significant improvement in the patient was noted. SELD was proven to be an effective therapeutic modality for patients with LBP secondary to HLD. (**Authors' abstract**)

Keywords: *Herniated Lumbar Disc (HLD), Trans-Sacral Epiduroscopic Laser Decompression (SELD), Minimally Invasive Spine Surgery (MISS), Low back pain (LBP), Epiduroscopy, Medicine*

Journal of the Philippine Medical Association, Volume No. 96 Issue No. 2, 1-6
2017 - 2018,
(Filipiniana Analytics)
NP

NUTRITION

0573

Analysis on the nutritional facts, shelf life potential and acceptability of bottled lemon grass tea (*Cymbopogon citratus* DC ex Nees wildtype var.)

Tumaliuan, Pablo , Malana, Richell T. , Cabauatan, Jane G. , Ramos, Paz Victoria T. , Agron, Jemmalyn , Allam, Ka

Fresh lemon grass tea samples were processed and formulated into a health drink, a suitable substitute for synthetic beverages like soft drinks. Juice samples (in natural flavour, with citric acid and with calamansi) were aseptically dispensed into 437mL glass bottles. Acceptability was evaluated immediately after preparation. 100 taste test panels evaluated the sensory attributes (color, odor, flavour, and general acceptability) of the samples using the nine-point hedonic scale. Physico-chemical properties which include the nutritional aspects and the microbiological qualities were also tested. Results showed that lemon grass tea samples contain valuable nutrients such as carbohydrates, proteins, fats, and minerals. Vitamin C was not detected in the sample due to processing and heat. Sensory tests in terms of color, odor, flavour, and general acceptability also indicated that the sample was acceptable and obtained "like moderately". Microbiological analysis of *E. coli* and Aerobic Plate Count (APC) were both satisfactory. Samples in natural flavour had the shortest span of only 5 days under room temperature. (**Author's abstract**)

Keywords: *Lemon grass tea, sensory tests, physicochemical properties, E. coli, Aerobic plate count, Nutrition*

Cabagan Journal of Research, Volume No. 22 Issue No. 1, 1-6
2013/06,
(Filipiniana Analytics)
NP

0574

Effect of concentrate to forage ratio on milk urea nitrogen, milk production and reproductive performance of dairy cow.

Mulyati, Sri , Mustofa, Imam , Utama, Suzanita, Wurlina, Wurlina

This study aimed to determine the effect of concentrate to forage ratio (C/F) on milk urea nitrogen (MUN), milk production, and reproductive performance of dairy cows of smallholder farmers of Tani Wilis cooperative in Sendang, Tulungagung, Indonesia. A survey was conducted to identify productive cows based on records from the cooperative. Sampling was conducted twice. First sampling was based on reproductive efficiency and milk production criteria. Data on age, parity, postpartum lactation, milk production, reproductive efficiency, body condition score, weight, and feed measurements (forage and concentrates) were obtained from 60 productive cows. Second sampling selected 26 dairy cows with normal estrous cycle. These cows were then allocated into two groups based on their C/F. Their milk

and feed were sampled to measure MUN and conduct proximate analysis, respectively. T-test showed that cows that received dietary intake with C/F >30% showed higher (P <0.05) MUN, milk production and reproductive performance than those with C/F <30%. (**Author's abstract**)

Keywords: *milk urea nitrogen, reproductive efficiency, smallholder dairy farmers, Nutrition*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-10
2018 Special issue,
(Filipiniana Analytics)
NP

PHYSICS

0575

Plasma characterization of Argon DC glow discharges

Culaba, Ivan B. , Ramos, Paz Victo

The discharge characteristics of a DC glow discharge with argon as the working gas in a reconfigured high kinney vacuum system was investigated by evaluating the glow discharge Paschen curve, current-voltage and current-pressure curves at different pressure regimes and applied voltages. Optical emission spectroscopy was employed to identify active argon ion species found in the cathode, positive column and anode regions of the glow discharge. Results show that the minimum breakdown occurs at 220V at 0.2073 torr-cm at a fixed electrode distance of 9.0 cm. The discharge current I varies at different pressure regimes and magnitude of applied voltages. The I-V and I-P curves exhibited the characteristic of an abnormal glow discharge. Optical emission spectra show that active argon ions are mostly found in the cathode and positive column regions of the glow discharge which indicates that optimal surface modification of substrates due to ion bombardment will occur in these regions. Such results become increasingly important for future works on plasma treatment of polymer surfaces. (**Author's abstract**)

Keywords: *DC discharge, Optical emission spectroscopy, Plasma application, Physics*

Cabagan Journal of Research, Volume No. 21 Issue No. 2, 1-11
2012/12,
(Filipiniana Analytics)
NP

0576

Preliminary development of thoron exposure system in the Philippines

Tokonami, Shinji , Hosoda, Masahiro , Aniago, Ryan Joseph , dela Sada, Christian L. , Mendoza, Christopher O. , Olivares, Juanario U. , Enriquez, Eliza B. , dela Cruz, Fe M. , Palad, Lorna Jean H. , Iwaoka,

The influence of 220Rn (thoron) which is a gaseous radioisotope like ^{222}Rn (radon) has been the focus of attention of recent studies concerning the protection of the general public from natural radiation. Hence, it is necessary to investigate the possibility of exposure to thoron in the Philippines. Passive detectors, which do not need external power, are often used for measurements for thoron concentration in the environment. However, it is necessary to check if the passive detectors can appropriately work by being exposed to thoron at several thoron concentrations before conducting the investigation. In this study, a thoron exposure system was developed in the Philippines to validate the

passive detectors for thoron measurement and to test its performance. The thoron exposure system in this study can control the thoron concentration at the range of $5.9x10^4$ to $1.5x10^5$ Bq m^{-3}. The thoron exposure system will be utilized to validate the passive detectors for the investigation of thoron exposure in the Philippines in the future. (**Author's abstract**)

Keywords: *Thoron, radiation measurement, quality assurance, natural radionuclides, Physics*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 30 Issue No. 2, 1-9
2018,
(Filipiniana Analytics)
NP

0577

Surface modification of polymethylmethacrylate by argon plasma treatment

Culaba, Ivan B. , Ramos, Paz Victo

The surface modification of polymethylmethacrylate (PMMA) was done using a reconfigured high vacuum system without breaking the vacuum at 1500V voltage discharge and 6 mA current discharge for ten-minute exposure of PMMA surface to argon plasma at $1.8X10^{-2}$ argon pressure. The surface analysis and characterization are performed using contact angle measurements, fourier transmission in infrared region (FTIR), x-ray photoelectron spectroscopy, and atomic force microscopy before and after argon plasma treatment. The results showed that surface treatment induces a more hydrophilic surface of the PMMA as indicated by a decrease of the contact angle measurement from 73° to 46°. This is due to the increase of oxygen containing groups as indicated by the increase of OH bonds in FTIR and increase of oxygen/carbon ratio as determined by XPS. The RMS roughness of the plasma treated sample is 12.60 nm. Correspondingly, the treated PMMA exhibit a more hydrophilic surface due to increase in OH bonds and increase in the ratio of oxygen containing groups, which may lead to increase adhesion work of PMMA to other materials for optical, microelectronic and biomedical applications. (**Author's abstract**)

Keywords: *Surface modification, Plasma treatment, hyhilic, Polymethylmethacrylate, Physics*

Cabagan Journal of Research, Volume No. 21 Issue No. 1, 1-10
2012/06,
(Filipiniana Analytics)
NP

SCIENCE AND TECHNOLOGY

0578

Polyelectrolyte complex of chitosan and k-carrageenan as potential scaffold for tissue engineering

Chua, Modesto T. , Chua, Edward King Lim , Yatco, Kristina Angelica M. , Chakraborty

Chitosan, k-carrageenan scaffolds were fabricated by forming their polyelectrolyte, followed by crosslinking k-carrageenan with calcium chloride. The scaffolds were reinforced with hydroxyapatite of nano and micron sizes. Most stable scaffolds were formed when chitosan and k-carrageenan were in 1:1 molar ratio, and when 1 wt% nanohydroxyapatite was used as the reinforcing agent. The scaffolds in dry form were sponge-like, flexible, and strong

enough to be handled in dry conditions without undergoing any deformation. Scanning electron microscopy (SEM) revealed that the scaffolds were porous at 79-95% porosity, depending on the type of hydroxyapatite used. The scaffolds swelled moderately and showed slow rate of degradation in the presence of lysozyme under human physiological condition. The extent of swelling and degradation was influenced by the type of hydroxyapatite incorporated. The scaffolds also supported the growth of BT-20 cells, proving that they are not cytotoxic. (**Author's abstract**)

Keywords: *Chitosan, K-carrageenan, hydroxyapatite, scaffold, Science and technology*

Science Diliman: A Philippine Journal of Pure and Applied Science, Volume No. 30 Issue No. 2, 1-16
2018,
(Filipiniana Analytics)
NP

VETERINARY MEDICINE

0579

Activated IGF-I supplementation during late gestation and lactation period affects sow and piglet performance

Magpantay, Veneranda A. , Cabigting, Soleil A. , Angeles, Emily P. , Cardona, Jose Karlo M. , Reyes, Francis Carlo C., Regaspi, Anthony Francis S.

The study was conducted to determine the eï¬€ects of supplementing activated IGF-I (aIGF-I) in lactating diets on sow and piglet performance. Fifty-nine crossbred female pigs (average parity 1.91 ± 0.30) were randomly assigned to two dietary treatments following randomized complete block design with parity as blocking factor. Treatments were basal lactation diets added with 0 (n=30) or 3 kg/ ton aIGF-I (n=29). The feeding trial started from day 100 of gestation until weaning. Dietary supplementation of aIGF-I reduced backfat loss of sows associated to reproduction (1.35 vs 3.87 mm, P<0.05). Piglets from sows fed diets with aIGF-I have higher body weight gain at 24 hours post-farrowing (0.12 vs 0.08 kg, P<0.05) and adjusted 30-day weaning weight (7.86 vs 7.16 kg, P<0.01); while preweaning mortality was reduced by 50.12% (4.08 vs 8.18%, P<0.05). Results demonstrated the potential of supplementing aIGF-I during late gestation and lactation in reducing backfat thickness loss at lactation of sows associated to reproduction and increasing growth and survivability of piglets. (**Author's abstract**)

Keywords: *Activated IGF-I, IGF-I, performance, swine, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-5
2016,
(Filipiniana Analytics)
NP

0580

Bacterial isolates from the cervical mucus of dairy cattle at follicular and luteal phases

Widodo, Oky Setyo , Srianto, Pudji , Rimayanti, Rimayanti , Tyasningsih, Wiwiek , Madyawati, Sri Pantja , Sudrajad, Kim

The research aimed to identify the bacteria present in the reproductive tract of dairy cattle at follicular and luteal phases of the estrus cycle. Seven samples of cervical mucus were each obtained from the reproductive tract, at follicular and luteal phase, of fourteen healthy cattle, 2-3 years of age, with body condition scores of 2.0-8.3. Sporet, motility, triple sugar iron agar, mannitol and glucose tests were done to obtain gram characteristics and bacterial morphology, which enabled identification at the genus level. Non-specific bacteria isolated at follicular phase were *Staphylococcus* (50%), *Corynebacterium* (25%), and *Escherichia* (25%). At luteal phase, *Staphylococcus* (45.5%), *Escherichia* (45.5%), and *Corynebacterium* (9%) were isolated. The results suggest that a number of bacteria can be found in the reproductive tract of dairy cattle, both at follicular phase and luteal phase. (**Author's abstract**)

Keywords: *bacteria, dairy cattle, follicular phase, luteal phase, reproductive tract, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0581

Blood glucose and cholesterol levels in alloxan-induced diabetic mice after oral administration of serpentina (*Andrographis paniculata*) and papait (*Mollugo oppositifolia* L.) aqueous extracts

Visaya, Kimberly M. , Cauinian Emmanuel R. , Nicolas, Karina Ma

The eï¬€ects of Serpentina (*Andrographis paniculata*) and Papait (*Mollugo oppositifolia* L.) aqueous extracts on blood glucose and cholesterol levels of 24 alloxan-induced diabetic 6-8 weeks old ICR male mice were investigated. The animals were distributed equally in a completely randomized design into three treatment groups with T1- Metformin at 500mg/kg, T2- Serpentina and T3-Papait at 400mg/kg BW PO. The substances were administered orally bid for 14 days. Blood glucose and cholesterol were determined using wet reagent chemistry. Blood glucose levels of all the animals in the treatment groups were greater than 200mg/dl, however T3 showed a consistent blood glucose lowering eï¬€ect from day 0 to 14 causing 36.07% reduction compared to T2 which caused a ï¬‚uctuating eï¬€ect on blood glucose levels and a reduction of 22.53% while the animals in T1 showed the highest reduction at 45.29%. Also, animals in T3 at day 14 post administration (322.93 mg/dl) had comparable blood glucose levels ($p>0.05$) with T1 (284.50 mg/dl). No signifcant diï¬€erences were observed in the cholesterol levels. Results showed that Papait has comparable blood glucose lowering activity with Metformin as compared to Serpentina. (**Authors' abstract**)

Keywords: *alloxan, blood glucose, diabetes, cholesterol, Serpentina, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-5
2016,
(Filipiniana Analytics)
NP

0582

Body weight estimation using body measurements in goats (*Capra hircus*) under field condition

Sandoval, John Fritz Gerald J. , Ybañez, Rochelle Haidee D. , Ybañez, Adrian P. , Perez, Zan

Body weight information of livestock animals is significant for trade, routine animal health monitoring and dosage calculations for treatment of diseases. Under field conditions, a convenient body weight estimation formula in goats (*Capra hircus*) using body measurements was developed and evaluated. A total of 300 adult goats in Barili, Cebu were used for the development of the formula, and 66 goats from the VSU Goat Project, Baybay City, Leyte and Ubay Stock Farm, Bohol were used for its field reliability testing. Animals were selected by convenience sampling regardless of sex and breed. In the univariate level of analyses, all body measurement parameters (rump height [RH], body length [BL], heart girth [HG], and wither height [WH]) showed significant correlation ($P<0.05$). In the multivariate level (stepwise regression), the wither height was removed in the final equation [estimated live weight={((2xRH)+(4XBL)+(6XHG))/10}-53] which resulted into a stronger correlation with the actual live weight ($R=0.899$, $R2=0.81$, $P<0.05$). Body weight estimation from other authors were compared with the current formula developed. Results revealed that the technique utilizing this formula demonstrated high reliability in goats in the study areas, implying good potential for generalized applicability. (**Authors' abstract**)

Keywords: *body measurements, body weight, goats, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-4
2016,
(Filipiniana Analytics)
N/P

0583

Breed standards and trends in performance test traits in the national boar performance testing program (1990-2016)

Chua, Jimmy N. , Bondoc, Orvi

Data from 607 performance-tested boars belonging to Landrace, Large White and Duroc breeds and four terminal crossbreeds were obtained from the National Boar Performance Testing Program held by the Philippine Swine Industry Research and Development Foundation, Inc. (PSIRDFI) from 1990 to 2016. Breed standards and trends in age in days at 90 kg body weight, average daily gain (ADG), backfat thickness (BFT), feed efficiency (FE), and selection index (SI) value were determined. Boar performance traits were all found to be significantly affected by auction number (batch effect), farm, and breed ($P<0.01$). Among pure breeds, Large White boars were most outstanding for age at 90 kg (144.6 days), FE (2.40 g/g), and SI (190.8 points). Landrace was best for its low BFT (1.44 cm), while Duroc was top for ADG (922.9 g/day). Small annual improvements in boar performance traits from 1990 to 2016 were also consistently highest for Large White for age at 90 kg (-1.71 days), BFT (-0.04 cm), FE (-0.03 g/g), and SI value (3.6 points). Among crossbreeds, Pietrain x Large White boars was best for age at 90 kg (141.2 days), ADG (903.8 g/day), BFT (1.33 cm), and SI (194.9 points), while Duroc x Pietrain crosses were had the better FE (2.45 g/g). (**Author's abstract**)

Keywords: *Boars, reproductive performance, swine, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 1, 1-10
2017,
(Filipiniana Analytics)
NP

0584

Chlamydophila felis antibodies in stray domestic short-haired cats (*Felis catus*) from a tertiary public hospital

Reyes, Marco F. , Valdez, Frances Aub

Forty-two stray domestic short haired cats (*Felis catus*), of both sexes and various ages (four to 48 months), were captured within a tertiary public hospital in Metro Manila and used in the study. These animals had no deworming and vaccination records. Convenience sampling was done by working in a specified time frame set prior to the study. Routine physical examination was done and blood samples were collected from the animals and tested against *Chlamydophila felis* antibodies using a commercially available ELISA antibody test kit. The qualitative and quantitative classifications of the results were acquired through digital image scanner software that uses a TWAIN compliant scanner. Of the samples tested, one (2%) female adult cat had a titer of >1:32 and was interpreted as positive. Two (5%) were suspicious with a titer of ≤1:16 and 39/42 (93%) had no serologic evidence of exposure to *Cp. felis*. Spearman's Test of Independence showed no significant correlation between the animal's sex and age to the presence of antibodies against *Cp. felis*. This study shows that stray domestic short haired cats within the vicinity of a certain tertiary public hospital are exposed to *Chlamydophila felis*. (**Authors' abstract**)

Keywords: *cat, Chlamydophila felis, domestic, hospital, public, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-4
2016,
(Filipiniana Analytics)
NP

0585

Comparative evaluation of carcass and meat characteristics, and consumer preference of free-ranged and conventionally-raised chickens

Oliveros, Maria Cynthia R. , Salazar, Feliz Louie , Esteban, Michael Angelo S. , Lumbo, Noel B. , Alag, Von Kevin B. , Dominguez, Jorge Mich

The carcass and meat characteristics of and consumer preference for free-ranged Banaba native chickens, free-ranged commercial broiler chickens, and conventionally-raised commercial broiler chickens were compared. The conventionally-raised commercial broiler chickens had the highest ($P<0.05$) percent breast meat, CIE L* values, and crude fat, while free-ranged chickens had the highest percent ash. Overall, Banaba native chickens grown under free ranged system produced carcasses that are comparable in meat quality and lean color with the commercial broiler chickens grown under both free-ranged and conventional production systems. However, the free-ranged Banaba native chicken meat was the least preferred by the consumers. (**Author's abstract**)

Keywords: *broiler chickens, chicken meat, carcasses, consumer preferences, free-range husbandry, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-5
2016,
(Filipiniana Analytics)
NP

0586

Comparative histopathologic changes in rabbit (*Oryctolagus cuniculus*) (Mammalia: Lagomorpha: Leporidae) skin in relation to degree of infestation with *Sarcoptes scabiei* (Arachnida: Acari: Sarcoptidae)

Yustinasari, Lita Rakhma , Hastutiek, Poudji , Legowo, Djoko , Arimbi, Arimbi , Retno Lastuti, Nunuk D , Azhimah, Am

The aim of this research was to observe the histopathological changes in rabbit ear skin tissue caused by varying degrees of *Sarcoptes scabiei* infestation. This study used twelve 7-12 months old female local rabbits obtained from rabbit farms with poor sanitation. Clinical symptoms of ear infection include presence of papules, vesicles, erythema, crusta, and alopecia in the ear, nose, eyes, and feet. Twelve local rabbits infected by *S. scabiei* were divided into three groups with four rabbits each: P1 with mild scabies, P2 with moderate scabies, and P3 with severe scabies. Histopathologic changes, which manifested in lesions, varied from parasitic infestation, parakeratosis, acanthosis, congestion, inflammation, and cell degeneration. These were given scores from 0 to 4 (0, not seen; 4, highly visible). The mean score was highest in those with severe scabies. Histopathological changes in rabbit ear skin tissue using Mann-Whitney U test was significant ($P<0.05$): mild scabies (4.625±0.75), moderate scabies (8.8125±1.95), and severe scabies (17.5625±1.59). Severe scabies had the highest degree of damage, defined by parakeratosis, acanthosis, substantial cell degeneration and congestion and serious inï¬ammation. This study suggests significant differences in histopathologic changes in skin tissue of rabbits with mild, moderate, and severe scabies. (**Author's abstract**)

Keywords: *histopathologic changes, rabbit, Sarcoptes scabiei, scabies, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0587

Comparison of anesthetic effect of three dose regimens of tiletamine-zolazepam-propofol combination in Philippine domestic cats

De Luna, Maria Catalina T. , Paraso, Michelle Grace V. , Abalos, Jovencio Hubert A., Cruzat, Jenilyn M., Gicana, Karlo Romano

Forty sexually mature, 1-5 years old Philippine domestic cats with body weight of 1-3 kg, were subjected to tiletamine-zolazepam (TZ) and to tiletamine-zolazepam-propofol (TZP) anesthetic combinations. TZ at 2.5 mg/kg (T2; n=10), 3.75 mg/kg (T3; n=10) and 5.0 mg/kg (T4; n=10) were combined with a constant dose of propofol (6 mg/kg) and compared with TZ at 5 mg/kg (T1; n=10) in terms of onset and duration of anesthesia, sternal and standing recovery times, vital signs, peripheral capillary oxygen saturation (SpO_2), obliteration of reflexes and presence of atrioventricular (AV) blocks. T2, T3 and T4 had a more rapid onset of anesthesia than T1. Both T3 and T4 exhibited significantly longer duration of anesthesia and obliteration of pupillary reflexes, as well as longer sternal and standing recovery times than other groups. Cats subjected to T3 had significantly higher SpO_2 while T4 had the lowest AV blocks compared to other groups. The results show that propofol, in combination with tiletamine-zolazepam at 3.75 mg/kg or 5.0 mg/kg, can provide a faster onset, and longer and better quality of anesthesia than tiletamine-zolazepam alone in Philippine domestic cats. (**Author's abstract**)

Keywords: *analgesia, atrioventricular block, cats, propofol, tiletamine-zolazepam, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018,
(Filipiniana Analytics)
NP

0588

Detection of pathogenic leptospires and analysis of factors and clinical signs associated with canine leptospirosis

Flores, Marianne Leila S. , Armea, Stephanie Rose D. , Vergara, Emil Joseph S. , David, Joanna Marie F. , Collantes, Therese Ma

Early diagnosis of canine leptospirosis in the leptospiremic phase is crucial to provide appropriate treatment and better prognosis to affected patients, however, this may be challenging due to varying risk factors, non-specific signs and non- predictive hematological values. In this descriptive, cross-sectional study, 60 blood samples from canine patients were tested for leptospirosis using polymerase chain reaction assay. Of the 60 samples, 11 samples (18%) tested positive for pathogenic leptospires which is statistically significant based on Z-test (α=0.05). In contrast, statistical analysis revealed no significant correlation between positive result upon PCR and several variables (age, sex, breed, type of housing and vaccination history). Majority of the clinical signs observed in dogs which tested positive for pathogenic leptospires were vomiting and diarrhea (7/11) while leukocytopenia (5/11) was the predominant hematologic finding. This study was able to detect leptospiral DNA in the blood of dogs and provided a clinical picture of dogs infected with pathogenic leptospires. (**Authors' abstract**)

Keywords: *dog, clinical signs, DNA, leptospirosis, PCR, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-5
2016,
(Filipiniana Analytics)
NP

0589

Echocardiographic evaluation of cardiac chamber dimensions and functions and right pulmonary artery distensibility index in dogs with heartworm infection

Cardenio, P

This study evaluated the changes in cardiac chamber dimensions and functions and right pulmonary artery distensibility (RPAD) index in dogs with canine heartworm infection using B-mode and M-mode echocardiography. Echocardiography was performed using an ultrasound machine with 5 MHz microconvex scanner in 15 untreated heartworm-positive dogs, aged 3.8±2.62 years old and weighing 9.78±4.99 kg. Chamber measurements and ventricular systolic function were measured using B-mode and M-mode in parasternal views, while pulmonary hypertension was measured and evaluated indirectly based on RPAD index and left ventricle eccentricity index using B-mode in parasternal views. Left and right ventricular dimensions and ejection fraction in heartworm-infected dogs were lower than expected normal values based on their body weights. Left ventricular function indices, such as fractional shortening, cardiac output and end-diastolic volume index were within normal values. Pulmonary hypertension was also evident based on RPAD index, and heartworm-infected dogs showed right ventricular wall enlargement and right-sided chamber dilation. The results suggest that left and right ventricular dimensions, ejection

fraction and RPAD index in dogs with canine heartworm infection may differ from expected values based on their body weights and from established reference values. (**Author's abstract**)

Keywords: *dog, echocardiography, heartworm, pulmonary hypertension, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018,
(Filipiniana Analytics)
NP

0590

Effect of bovine seminal protein on the quality of frozen spermatozoa from goats

Wurlina, Wurlina , Arimbi, Arimbi , Suprayogi, Tri Wahyu , Triana, Indah Norma , Susilowati, S

The aim of this study was to determine if the quality of frozen spermatozoa from goats can be improved by adding bovine seminal protein to sperm diluent. Thirty-six healthy, 3-5 years old, 40-45 kg high-libido goats were used. Seminal protein was obtained from two five-year old Simmental bulls. The 36 goats were equally distributed into three groups: P0, with only egg yolk citrate diluent and goat semen; P1, with 2.5 mg/ml bovine seminal protein, egg yolk citrate diluent, and goat semen; and P2, with 5 mg/ml bovine seminal protein, egg yolk citrate diluent, and goat semen. Results suggest that addition of 2.5 mg/ml bovine seminal protein to goat sperm diluent can improve the quality of frozen spermatozoa of goats. (**Author's abstract**)

Keywords: *bovine, frozen spermatozoa, goat, seminal protein, spermatozoa quality, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0591

Effect of guava (*Psidium guajava*) cream on the gross and microscopic features and healing rate of incisional wounds in domestic short-haired cats

Adao,Janelle G., Matawaran, Veronica A. , Acorda, Jezie A.

The study was conducted to investigate the feasibility of guava cream as replacement for topical antibiotic for wound healing. Twelve cats were divided into four groups and subjected to different concentrations of guava cream: 0% (antibiotic wound cream group), 1%, 3%, and 5% having 3 animals per group. A dorsal midline incision (at the level of T6 to T7, with a length of 2.5 centimeters in full thickness) was made and was left open for second intention healing. A thin layer of cream was applied over the wound every other day starting day 0 until day 20 and an incisional biopsy was done at day 0, 7, and 14. Wound contraction and gross appearance was graded. There was no significant difference ($P<0.05$) on the effect of wound healing of the different percentages of guava cream compared to the wound cream however, the results of the 3% and 5% guava cream had a faster wound contraction. All treatments of guava cream produced comparable results with the antibiotic wound cream therefore, this study concludes that guava cream can be used as an alternative antiseptic and antibacterial treatment for wounds. (**Author's abstract**)

Keywords: *feline, guava cream, Psidium guajava, wound healing, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-9
2017,
(Filipiniana Analytics)
NP

0592

Effect of sapogenin extract from sambiloto (*Andrographis paniculata*) (Lamiales: Acanthaceae) on creatinine and bun levels and gentamicin-induced nephrotoxicity in rats

Putri, Desak Ketut Sekar Cempaka , Suwasanti, Niluh , Basori, Achmad , Safitri, Erma , Susilowati, Suherni , Hariadi, Masâ€™ud , Mustofa, Imam , Meles, Dewa Ketut , Wurlina, Wurlina , Zakaria, S

The purpose of this study was to investigate the effect of sapogenin crude extract of sambiloto (*Andrographis paniculata*) on creatinine and blood urea nitrogen (BUN) levels and on nephrotoxicity in gentamicin-induced rats. Fifty apparently healthy rats (*Rattus norvegicus*) were divided equally into five groups: 1) K-, given sapogenin crude extract of sambiloto (SCES) carrier; 2) P0, given SCES carrier and gentamicin; 3) P1, given SCES at 3.78 mg/200 g body weight and gentamicin; 4) P2, given SCES at 7.56 mg/200 g body weight and gentamicin; 5) P3, given SCES at 11.34 mg/200 g body weight and gentamicin. The rats were observed for 14 days. Blood samples were collected, the animals were euthanized and the kidneys and examined histopathologically. Parameters measured were creatinine and BUN levels and histopathological changes in renal structures of gentamicin-induced rats. Data were analyzed with one-way ANOVA and least significant difference test. Results suggest that sapogenin crude extract from sambiloto can reduce creatinine and BUN levels and prevent nephrotoxicity in gentamicin-induced nephrotoxicity in rats. (**Author's abstract**)

Keywords: *gentamicin, kidney, necrosis, rat, sambiloto, saponin, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0593

Effect of selenium and vitamin E on the humoral immune response of calves to hemorrhagic septicemia vaccination

Khan, Muhammad Sarwar , Ijaz, Muhammad , Anjum, Aftab Ahmad , Prince, Atif , Ahmad, Nisar , Ali, Muhammad Asad , Prince,

A study was structured to evaluate the effect of selenium and vitamin E supplementation on the humoral immune response to hemorrhagic septicemia (HS) vaccination in calves. Twenty unvaccinated calves, two to four months old were randomly selected and divided into four groups, each group consisting five calves. Group A was control; Group B was vaccinated against HS, Group C was supplemented with selenium and vitamin E (VESS) and Group D was vaccinated against HS along with VESS. Groups C and D were supplemented with VESS on day 0 of experimental trial. After fifteen days, vaccine was administered to Groups B and D. Blood samples were collected at day 0, 30 and 45 from each animal and serum was separated by centrifugation. Antibody titer was determined by complement fixation test. One-way analysis of variance and Tukey’s post hoc test were used for statistical analysis of data with 0.05 as level of the significance. Results showed significantly higher antibody titer ($P<0.05$) in Group D as compared

to Group B at day 45 of experimental trial. It was concluded that selenium and vitamin E significantly improve the antibody titer when given along with HS vaccine in calves. (**Author's abstract**)

Keywords: *antibody titer, calves, hemorrhagic septicemia, selenium, vitamin E, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-6
2017,
(Filipiniana Analytics)
NP

0594

Efficacy of ipil-ipil (*Leucaena leucocephala*), betel nut (*Areca catechu*) and papaya (*Carica papaya*) seeds against roundworms of Darag native chicken

Ozaraga, Ma. Sylvia I., Ozaraga, Bede P

The study aimed to evaluate the efficacy of ipil-ipil (*Leucaena leucocephala*, Lam. de Wit), betel nut (*Areca catechu* L.), and papaya (*Carica papaya* Linn.) seeds as anthelmintic in Darag native chicken. The study utilized 165 Darag native chickens subjected to a 3 x 3 factorial experiment in Randomized Complete Block Design with three replications. Two factors were considered: (A) the kind of ethnobotanical dewormer (Ipil-ipil, Betel nut or Papaya) and (B) the dosages (2 g, 4 g, or 6 g/ kg BW). T-test was used to compare the efficacy with the commercial dewormer. Data on the efficacy of the ethnobotanicals were obtained by getting the percent reduction of egg per gram (EPG) count before the administration of experimental treatments and on the 7^{th}, 14^{th}, 21^{st}, and 28^{th} day post treatment. F-test and Duncan Multiple Range Test interpreted at 5% and 1% levels of significance were used for statistical analysis. Results showed that the ethnobotanical dewormers under study can significantly reduce the EPG count of roundworms of Darag native chickens. A dosage of 6 g/kg BW of the three ethnobotanicals is effective in controlling gastrointestinal helminths. The efficacy of the kind of ethnobotanical is dependent to the dosage on the 21^{st} and 28^{th} day post treatment. The higher the dosage, the more effective is the ethnobotanical. The ipil-ipil, betel nut, and papaya seed powder were found to have a comparable percent reduction of EPG count with the commercial dewormer. (**Author's abstract**)

Keywords: *Areca catechu, Carica papaya, chicken, phytotherapy, round worms, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 1, 1-5
2017,
(Filipiniana Analytics)
NP

0595

Electrocardiographic parameters and serum electrolytes and enzymes values in peri-parturient Ghezel ewes (*Ovis aries*)

Zarei, Mohammad Hadi , Akhtar, Iman Saadat , Sebdani, Mohammad Mazrouei , Mirzaei, Abdolah , Badiei, Khalil , Pourjafar, Mehrdad , Chalmeh, Aliasghar, Akbarpour, Hamed

Information regarding the physiologic effects of pregnancy, parturition and lactogenesis on heart electrical activities in sheep can aid in better understanding of the status of the cardiovascular system and performance of these animals. Five adult clinically healthy Ghezel ewes were selected at four weeks before parturition. Electrocardiography and

blood sampling were performed in ewes: at four and two weeks before parturition; two and four weeks after parturition; and two, three and four months after parturition. Serum concentrations of sodium, chloride, potassium, calcium, magnesium, phosphorus, aspartate aminotransferase, alanine transaminase and lactate dehydrogenase were assayed in all specimens. The R and T amplitudes increased significantly from four weeks before parturition to two weeks after parturition, and decreased at three months after parturition ($P<0.05$). RR interval at pre-parturition periods was significantly shorter than at post-parturition ($P<0.05$). Serum concentrations of all the parameters were significantly lower at pre-parturition periods than at post-parturition. The results of the study suggest that physiological changes in electrocardiographic parameters, serum electrolytes and enzymes values occur during the peri-parturient stage of Ghezel ewes. (**Author's abstract**)

Keywords: *Electrocardiography, electrolytes, enzymes, Ghezel ewes, lactation, pregnancy, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018,
(Filipiniana Analytics)
NP

0596

Erythrocytic oxidative stress indices and clinico-biochemical alterations in gastroenteritis in dogs with varied clinical scores

Sardar, Kautuk Kumar , Rautray, Amiya Kumar, Parida, Ghanashyam S. , Patra, Ramesh Chandra , Panda, Niranja

The erythrocytic lipid peroxidation and antioxidant enzymes were assessed in 106 dogs with diarrhea and/ or vomition and 21 apparently healthy dogs. The total clinical score (CS) was calculated based on fecal consistency, depression and dehydration. Twenty-fve of 106 aï¬€ected dogs were moderately aï¬€ected (CS = 4 to 6), and 81 were severely aï¬€ected (CS = 7 to 9). The dogs' erythrocyte oxidative index (lipid peroxides level, LPO) and antioxidant enzyme activities (superoxide dismutase, SOD and catalase, CAT) were measured with respect to clinical score, ±blood in stool, breed and sex of the dog. The severely aï¬€ected dogs had signifcantly ($p<0.05$) higher LPO (7.16 ±0.20 vs 4.94 ±0.17 nmol of MDA/mg of Hb) and CAT activities (0.33 ±0.01 vs. 0.21 ±0.01 units/mg of Hb) as compared to control dogs with clinical score 0. Dogs with bloody stool (n=39) with mean clinical score of 8.56 ±0.08 had signifcantly lower SOD activity (1.56 ±0.06 vs 1.93 ±0.09 units/ mg of Hb) as compared to dogs without blood in stool (mean CS 6.73 ±0.17). However, the level of LPO, and activities of SOD and CAT were signifcantly higher than healthy dogs (CS 0). It is concluded that increasing CS was associated with increased level of LPO along with alteration in activities of the antioxidant enzymes such as SOD and CAT. (**Authors' abstract**)

Keywords: *dogs, catalase, gastroenteritis, lipid peroxides, superoxide dismutase, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-6
2016,
(Filipiniana Analytics)
NP

0597

Evaluation of teat ultrasound measurements for diagnosis of subclinical mastitis in Holstein dairy cow

Hivechi, Atefe , Javan, Ashkan Jebelli , Yousef, Mohammad Hasan , Sani, Reza N

The aim of this study was to evaluate the use of teat ultrasound measurements for diagnosis of subclinical mastitis (SCM) in one hundred ten (110) teats from 110 Holstein dairy cows, 3-6 years old, 1-4 parity and 19-45 kg/day milk production. Teat–canal length (TCL), teat–end width (TEW), teat–wall thickness (TWT), teat–cistern width (TCW), and the ratio between teat–cistern width to teat–wall thickness (TCW/TWT) were measured by ultrasonography using an ultrasound scanner with a 7.5 MHz linear probe in 55 California mastitis test (CMT) positive and 55 CMT negative cases. SCM cases were samples that had both CMT and bacteriological culture–positive results. Results showed that there were 45 normal and 46 SCM cases. TCL, TWT and TEW were similar in normal and SCM cases ($P>0.05$), and TCW and TCW/TWT were lower in SCM animals than in healthy animals ($P<0.05$) with the cut-off point of 1.05 cm and 1.49 cm, respectively. The results suggest that measurements of TCW and TCW/TWT can be used to assist in the detection of subclinical mastitis in Holstein dairy cows. (**Author's abstract**)

Keywords: *dairy cow, Holstein, subclinical mastitis, teat, ultrasound, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-6
2017,
(Filipiniana Analytics)
NP

0598

Farrowing and weaning performance of Black tiaong and Kalinga native pig breeds at a conservation farm, Philippines

Santiago, Rene C. , Sandoval, Roberto F. , Vega, Renato SA. , Dominguez, Jorge Michael D. , Bondoc, Orvi

Data from 159 Black Tiaong litters and 81 Kalinga litters born from 2011 to 2015 at the native pig conservation farm of the National Swine and Poultry Research and Development Center, Bureau of Animal Industry, Department of Agriculture, Tiaong, Quezon, Philippines were analyzed to establish breed standards for farrowing and weaning performance. Average parity per sow, farrowing interval, and litter size at birth were not significantly different ($P>0.05$) between breeds. Black Tiaong sows were significantly older at first farrowing ($P<0.01$), had significantly heavier pig weight at birth ($P<0.05$), had piglets weaned at a younger age ($P<0.01$), and had heavier piglets at weaning ($P<0.05$) with higher pre-weaning average daily gain (PreADG) ($P<0.01$) than Kalinga sows. While litter size at weaning was slightly higher in Black Tiaong than Kalinga, farrowing index (FI) and sow productivity index (SPI) were lower in Black Tiaong than Kalinga sows. Litter size at birth and at weaning, weaning age, pig weight at birth and at weaning, PreADG, FI, and SPI in Black Tiaong and Kalinga native breeds were all inferior than the 2012 average performance of commercial swine farms in the Philippines. The only advantage of native breeds over commercial breeds was the lower number of mummified piglets, stillbirths, and piglet mortality before weaning. (**Author's abstract**)

Keywords: *Black Tiaong, Kalinga, reproductive performance, swine, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 1, 1-11
2017,
(Filipiniana Analytics)
NP

0599

Genetic structure of four bovine populations in the Philippines using microsatellites

Ludan, Geronima , Mendioro, Merlyn S. , Icalia, Peter James C., Sevilla, Cesar C. , Salces, Agapita J

This study evaluated polymorphism of 11 microsatellite markers in four local genetic groups of cattle. Batanes cattle which has never been studied using microsatellite was evaluated for its genetic distance from the Ilocos cattle while Brahman and Holstein-Sahiwal were also included as the government uses these two breeds in their insemination program. PCR products for each marker were analyzed using POPGENE v32. Results showed that 55% (Fst=0.5501) of the genetic variation is due to the differences between populations while the remaining 45% is due to individual variation. The Fst value also indicates that there were very great differences from population to population using the range proposed by the geneticist Sewall Wright. The constructed phylogenetic tree based on Nei's genetic distance using the modified neighbor joining procedure of PHYLIP v3.5 showed the admixture of Brahman and Holstein-Sahiwal having them grouped in the same clade. Batanes and Ilocos cattle were grouped in a different cluster showing that they have descended from a single parental population. This would presumably address the claim that Batanes and Ilocos cattle are genetically distant from other groups and still exist despite the artificial insemination program of the government using Brahman and other imported breeds. The knowledge about the genetic structure of this population supports the development of conservation programs for the smallholder farmers. (**Authors' abstract**)

Keywords: *cattle, microsatellites, Philippines, population genetics, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-3
2016,
(Filipiniana Analytics)
NP

0600

Genetic variation and relationships among Visayan native chicken genetic groups Boholano and Darag (*Gallus gallus* L.)

Dominguez, Jorge Michael D. , Salces, Agapita J. , Yebron, Jr, Medino Ged

The present study was conducted to evaluate the genetic diversity and relationships of two Visayan native chicken genetic groups (Boholano and Darag), the native chicken (Labuyo) and commercial breed layer chicken (Lohman). Thirteen microsatellite or simple sequence repeats (SSR) markers were used covering 8 linkage groups or chromosomes. Four to eight alleles per locus were detected across all the breeds. The highest PIC value (0.773) was detected in primer ADL0268 and the average across primers was 0.6114. The mean number of alleles per locus (MNA), the observed heterozygosity (Ho), expected heterozygosity (He) and the inbreeding coefficient (FIS) were obtained for the Boholano (5.08, 0.6859, 0.6433, and -0.0998 respectively), the Darag (5.61, 0.6667, 0.6646, and -0.0225 respectively), the Labuyo (4.46,0.5944, 0.6486, and 0.0711 respectively) and the Lohman (2.46, 0.5, 0.3943, and 0.0258 respectively). The degree of genetic distance of the Boholano was moderate from Darag but great from Labuyo; but close between Darag and Labuyo. These indicate that the Darag, but not the Boholano, may have originated from the Labuyo. The high MNA, Ho, He, negative inbreeding coefficient and high interpopulation genetic differentiation (FST) [D1] values between genetic groups shows the richness of our native chicken genetic resource in Bohol and Panay Islands. (**Authors' abstract**)

Keywords: *Boholano, Darag, Labuyo, microsatellite, native chicken, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-4
2016,
(Filipiniana Analytics)
NP

0601

Growth performance and carcass characteristics of broiler chickens and growing-finishing pigs fed diets with corn-soya replacer meal

Angeles, Amado A. , Agbisit, Jr., Elpidio M. , Cordoves, Rodeza Kristine C. , Aguirre, Aira Therese A., Quimio, Julienne Maria Undine Paz H. , Carandang, Nelia F.

Feeding trials were conducted to determine the effect of replacing yellow corn (YC) and soybean oil meal (SBOM) with corn-soya replacer meal (CSRM) with and without antibiotic growth promoters (AGPs) on growth performance and carcass characteristics of broiler chickens and growing-finishing pigs. Growth performances were determined from starter to finisher stages. Carcass characteristics were evaluated after slaughter. The dietary treatments were: T1-basal diet without CSRM with AGPs; T2 and T3-diets replacing 40% and 10% of YC and SBOM inclusions, with and without AGPs, respectively; and T4 and T5-diets replacing 80% and 20% of YC and SBOM inclusions, with and without AGPs, respectively. Based on the results of the broiler experiment, diets with CSRM replacing 40% YC and 10% SBOM with and without AGPs can be fed to broilers without affecting performance and carcass characteristics. In the growing finishing pigs, there were no significant differences on all the performance parameters and carcass characteristics measured. It can be concluded that CSRM can be used to partially replace YC and SBOM in the diets of growing-finishing pigs and of broiler chickens. (**Authors' abstract**)

Keywords: *broiler chickens, maize, soybean meal, swine, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-5
2016,
(Filipiniana Analytics)
NP

0602

Growth performance and coccidia occurrence in Philippine native chicken given diets added with organic selenium, probiotics and prebiotics

Puso, Clarita S. , Manugo, Josefina Linda B. , Nagrampa, Mona

Coccidiosis must be controlled due to its detrimental eï¬€ect on weight gain and feed conversion of chicken. Routine anticoccidials, however, are unacceptable for organic farming. With the increasing demand for natural and safer food, Philippine native chicken were used to evaluate growth and coccidian incidence when given traditional or alternative anticoccidials. One hundred day old chicks were brooded for three weeks then ranged until week 12 for the study. Birds were distributed randomly to fve treatments (four replicates per treatment, fve birds per replicate): Sel: 0.2% organic selenium, Prob: 2% probiotics [*Aspergillus niger, Bacillus subtilis, Enterococcus faecium and Bifdobacterium* spp.], Preb: 0.4% prebiotics [mannan-oligosaccharide], Mad: 0.5% maduramicin (positive control) and Cont: diet without anticoccidia. Feed intake, body weight and average oocysts per gram per bird were recorded between the 0-3, 4-8 and 9-12 weeks. Average daily gain was improved ($p<0.05$) only in Mad between 9-12 weeks. Feed conversion ratio (FCR) was improved ($p<0.01$) by Mad, Sel, Prob and Preb while feed cost per kg were better ($p<0.01$) in Mad, Sel and Preb during the same period compared to Cont. Diï¬€erences in OPG counts were insignificant but indicate

subclinical infection. The study suggests organic selenium- and prebiotic-fed birds can have similar FCR as those given maduramicin at the same feed cost. (**Authors' abstract**)

Keywords: *coccidia, native chicken, oocyst, prebiotic, probiotic, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-4
2016,
(Filipiniana Analytics)
NP

0603

Healing rate and gross appearance of wounds in goats subjected to exploratory laparotomy under distal paravertebral nerve block and aquapuncture

Jezie A. Acorda, , Cadoy, Jess

In order to determine whether acupuncture affects post-surgical wound healing rate and gross appearance, twelve apparently healthy 1-3 years old female Philippine native goats, weighing 10-20 kg, were subjected to exploratory laparotomy under distal paravertebral nerve block (DPNB) and aquapuncture using 2% chili pepper decoction (AQP). For AQP, eight acupuncture points were stimulated - Acupoints BA04 (four points), 31, 22, 26 and 47 (single points). The rate of wound healing and gross appearance of wounds were determined during the 14- day observation period. Wound healing rate was similar in both groups throughout the 14-day observation period. Complete wound healing was not observed in any of the animals in DPNB, while in AQP 40% of the animals showed complete wound healing. No differences were observed on the occurrence of inï¬‚ammation, hyperemia, apposition of wound edges and exudate during the 14-day observation period between groups. Increased hair growth was observed in AQP compared to DPNB. The results of the study suggest that aquapuncture analgesia produces relatively more complete wound healing and hair growth than distal paravertebral nerve block in goats subjected to exploratory laparotomy. (**Author's abstract**)

Keywords: *aquapuncture, exploratory laparotomy, goat, nerve block, wound healing, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-10
2017,
(Filipiniana Analytics)
NP

0604

Heat stress induces histopathological changes in lymphoid organs of broiler and Philippine native chickens

Lola, Ma. Suzanneth G., Paraso, Michelle Grace V., Divina, Billy P., Gobonseng, Delia A., Bombio, Ariel M., Collantes, Therese Marie A.

This study was conducted to describe histopathologic changes in lymphoid organs of broiler and native chickens in response to heat stress. A total of 60 day-old broiler and native chicks were allocated in 3 treatment groups. The control group (T1) was exposed to ambient environmental temperature (AET); Treatment 2 (T2) was exposed to AET + ≈1°C; and T3 was exposed to AET ≈3°C. Each treatment was exposed to the required temperature for 7 hours from d 29 to 35 (AET = 29.8°C) and from d 43 to 49 (AET = 31.7°C). Results showed significant microscopic changes in

the lymphoid deplation and lymphocytic degeneration in the germinal centers of the spleen. The thymus had minimal to mild degenerative changes mainly in the cell population of the modulla. The results also showed more pronounced microscopic changes in the Bursa of Fabricius and spleen of broiler chicks compared to native chicks. The degree of response to heat stress appears to be breed-dependent with the lymphoid organs of broiler chickens showing lesser adaptive capacity to withstand high temperature than the lymphoid organs of native chickens. (**Authors' abstract**)

Keywords: *broiler, Heat stress, histopathology, lymphoid organs, Philippine native chicken, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 2, 1-4
2016,
(Filipiniana Analytics)
NP

0605

Hemorrhagic septicemia prevalence and vaccination coverage in Bohol, Philippines, January 2011 to July 2012

Salces, Caro B., Tapdasan, Emer

Hemorrhagic Septicemia is a disease among ruminants which is of economic importance that affects livelihood of farmers who mainly rely on livestock raising as a source of income. This study described the spatio-temporal distribution of HS cases and vaccination coverage in Bohol island-province to elicit a holistic control of the disease. Data on HS cases and vaccination coverage were sourced out from the Philippine Animal Health Information System stationed at the Office of the Provincial Veterinarian of Bohol. Simple descriptive statistics were used to analyse animal and spatio-temporal distribution of HS cases and vaccination coverage. Regardless of species, the prevalence was 0.33% (4 per 1,000). Cattle had the highest individual prevalence at 0.65% (7 per 1,000) followed by buffaloes and goats at 0.26% (3 per 1,000) and 0.04% (1 per 1,000) respectively. Majority of cases were reported in February 2011 mostly in municipalities with low topography: Maribojoc, Loon, Panglao and Anda. Vaccination coverage for the whole province was only 3.5%. Vaccination drives must be intensified in municipalities identified with higher disease prevalence particularly in cattle and buffaloes. (**Authors' abstract**)

Keywords: *Bohol, hemorrhagic septicemia, prevalence, vaccination coverage, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-4
2016,
(Filipiniana Analytics)
NP

0606

Human chorionic gonadotropin from urine of pregnant women for *in vitro* maturation of madura cattle oocytes

Safitri,Erma , Hermadi, Herry Agoes, Adikara, Raden Tatang Santanu , Hariadi, Masaud

The purpose of this study was to test whether human chorionic gonadotropin (hCG) from urine of pregnant women can be used for *in vitro* maturation of Madura cattle oocytes. Urine samples were collected from 50 healthy pregnant women gestating for 1.5 to 3.5 months. Molecular weights of hCG were 37 kDa and 22 kDa. hCG levels measured via ELISA had 10 times the deposition, with an average of 27,333 mIU/l at 1.5 months and 105,667 mIU/l at 3.5

months, respectively. T-test showed no significant difference in oocyte maturation rate between the control group with patent hCG and hCG from pregnant women at P>0.05. This study illustrates that hCG from pregnant women at 1.5 to 3.5 months can aid in *in vitro* maturation of Madura cattle oocytes. (**Author's abstract**)

Keywords: *hCG, in vitro maturation, Madura beef cattle, oocytes, urine of pregnant women, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0607

Immunohistochemical detection of S-100 in the spleen of Philippine domestic cat

Vitor, Rodel Jonathan S., Ostwani, Jr., Khale

The spleens from 20 (ten male and ten female) two to five year-old apparently healthy domestic cats (*Felis catus* L.) were collected and examined by immunohistochemical methods to identify S-100 immunoreactive structures. In all sections of the spleen, S-100 was found in the nerve elements, endothelial cells lining the capsular arteries, trabecular arteries, penicillar arterioles and sheathed capillaries in the red pulp, splenic arterioles in the white pulp, as well as in the macrophages and reticular cells that formed a sleeve around the penicillar arterioles and sheathed capillaries of the spleen, lymphoid follicles and periarteriolar lymphatic sheaths (PALS) of the white pulp. On the other hand, S-100 was not observed in the veins in both the stroma and parenchyma. It is hypothesized that S-100 in the endothelial cells of sheathed capillaries is suggestive of its function in regulating the semi-permeability of blood vessels, while the demonstration of S-100 in the nerves may indicate that it is transported from gliocytes, secreting it to the target cells. The present findings showed that S-100 is positive in nerve elements, endothelial linings of arterial vessels and capillaries, lymphoid follicles and PALS of the Philippine domestic cat. (**Author's abstract**)

Keywords: *cat, immunohistochemistry, S-100, spleen, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018,
(Filipiniana Analytics)
NP

0608

In vitro duodenal enzyme activity assays and protein profiling as feed evaluation method

Angeles, Amado A. , Valientes, Rolando A. , Tuaño, Arvin Paul P. , De Leon, Renhart C. , Manalaysay, Jeremae B. , Santos, Avig

To determine the validity of *in vitro* feed evaluation method, 20 day-old broilers were divided into four (4) groups and assigned to four (4) treatments, specifically: a basal diet, basal diet + 10 ppm avilamycin, basal diet + 150 ppm plant extract containing thymol (*Thymus vulgaris*), eugenol (*Cinnamomum* spp.) and piperine (*Piper* spp.), and basal diet + 300 ppm plant extract, following Completely Randomized Design (CRD). All growth parameters were recorded. After slaughter, duodenal digesta samples were collected and subjected to α-amylase and total proteolytic activities assays using potato starch and bovine serum albumin as substrates, respectively. Subsequently, the protein profiles of the crude duodenal digesta were determined using sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). Results showed no significant differences in all growth performance parameters, in duodenal α-amylase and

total proteolytic activities of the broilers fed with the different dietary treatments (P>0.05). The SDS-PAGE electrophoretogram showed qualitative differences in band intensity of the different proteases and the α-amylase present in the duodenal digesta samples. Results on the growth trial and enzyme activity assays are in agreement indicating that duodenal enzyme activity assays may predict feed quality and digestibility. This study suggests that duodenal *in vitro* enzyme activity assays coupled with digesta protein profiling can be used as a tool in feed evaluation. (**Authors' abstract**)

Keywords: *broilers, duodenum, enzyme activity, in vitro feed evaluation, SDS-PAGE protein profile, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-5
2016,
(Filipiniana Analytics)
NP

0609

In vitro production of embryos from vitrified buffalo and bovine oocytes following intracytoplasmic sperm injection technique

Atabay, Eufrocina P., Atabay, Edwin C

In vitro embryo production through *in vitro* fertilization (IVF) using cryopreserved oocytes results to poor outcome due to the hardening of the zona pellucida during freezing. More recent *in vitro* fertilization alternative is the intracytoplasmic sperm injection (ICSI), which allows for the mechanical injection of a single sperm into the ooplasm, maximizing the use of cryopreserved oocytes to produce embryos *in vitro*. A total of 96 ovaries from 48 swamp buffaloes with ages 5 to 10 yrs old, and 104 ovaries from 52 crossbred cattle with ages 3 to 8 yrs old were utilized in the study. Cryopreservation of buffalo and bovine oocytes was done using the Cryotop vitrification protocol. Vitrified-warmed oocytes were subjected to IVF or ICSI for production of embryos *in vitro*. The rates of blastocyst development were significantly higher with ICSI than IVF in both species implying that the procedure aided the penetration of sperm through the hardened zona pellucida of the vitrified oocytes without damage to the internal ooplasm. Buffalo oocytes survived cryopreservation better than those of cattle. The results suggest that ICSI can be used as an alternative to IVF for cryopreserved bovine and buffalo oocytes. (**Author's abstract**)

Keywords: *cryopreservation, intracytoplasmic sperm injection, oocytes, vitrification, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-7
2017,
(Filipiniana Analytics)
NP

0610

Larvicidal activity of nematophagous fungi *Duddingtonia flagrans* against common strongyle roundworms of bufaloes (*Bubalus bubalis*)

Mingala, Claro N. , Collantes, Therese Marie A. , Barroga, Toni R

Infestation of gastrointestinal nematodes is a major problem in grazing animals. Control is achieved through administration of anthelmintics; however, because of indiscriminate use, there have been increased reports of

resistance to chemical anthelmintics which led to the failure of parasite control. This study determined the efficacy of the chlamydospore of *Duddingtonia flagrans* as biological control against common strongyle roundworms of buffaloes. Using corn meal agar assay, strongyle infective larvae were treated with and without *D. flagrans*. The chlamydospore/gram (CG) assay tested a dose-dependent concentration wherein feces with 2,100 eggs/ gram (EPG) strongyles were treated with *D. flagrans* at an increasing doses of CG (100,000, 250,000 and 500,000). Results showed an 84.39% larval reduction after treatment with 500,000 CG. The chlamydspore/egg assay evaluated increasing ratios of egg to chlamydospore dose (1:0, 1:100, 1:500, 1:1000) using the 2,100 EPG feces. The ratio 1:500 achieved the highest percent larval reduction (78.88%). *D. flagrans* was directly fed to buffaloes at varying concentrations (50,000, 150,000, 250,000 chlamydospores/kg BW). A 78.77% larval reduction was observed at 50,000 chlamydospore/kg BW oral administration for 5 days. This study showed the efficacy of *D. flagrans* as a potential alternative for anthelmintics in buffaloes. (**Authors' abstract**)

Keywords: *biological control, Duddingtonia flagrans, larval reduction, nematophagous fungi, strongyles, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-6
2016,
(Filipiniana Analytics)
NP

0611

M-mode echocardiographic measurements in pregnant and non-pregnant holstein-friesian x sahiwal crossbred dairy cattle

Pajas, Arville Mar Gregorio A. , Rayos, Antonio A. , Constante, Jesalyn L. , Acorda, Je

The study was conducted to determine the M-mode echocardiographic measurements in pregnant and non-pregnant dairy cattle and identify possible relationships between the echocardiographic measurements and pregnancy status. Ninety-one (91) 2-13-year-old Holstein-Friesian x Sahiwal crossbred dairy cattle, weighing 275-450 kg were utilized in the study. The animals were grouped by status of pregnancy into pregnant (63 animals) and non-pregnant (28 animals). Pregnant animals were further grouped into easy breeders (with 1-2 inseminations/pregnancy) and repeat breeders (with more than 2 inseminations/pregnancy). The heart was examined on the right thorax using an ultrasound machine equipped with a 3.5 MHz convex scanner. The cardiac structures were identified using B-mode ultrasonography and measurements were made using M-mode echocardiography. No significant differences were observed between pregnant and non-pregnant animals, except for higher interventricular septum at systole in pregnant compared to non-pregnant animals. No differences were observed between easy breeders and repeat breeders. The results suggest that status of pregnancy does not affect the echocardiographic measurements. The echocardiographic values obtained in the study can be useful in diagnosing cardiovascular disorders of pregnant and non-pregnant crossbred dairy cattle. (**Authors' abstract**)

Keywords: *cattle, echocardiography, heart, M-mode, pregnancy, ultrasound, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 42 Issue No. 1, 1-4
2016,
(Filipiniana Analytics)
NP

0612

Morphological characterization of tunica mucosa of jejunum and cecum of swine given probiotics (*Lactobacillus casei* KE-99) in drinking water

Olarve, Joseph P. , Maala, Ceferino P. , Cautiver, Mer

This study was conducted to describe the morphology of tunica mucosa of jejunum and cecum of swine given probiotics (*Lactobacillus casei* KE-99) in the drinking water. A total of 27 pigs weaned at 21 days of age crossbred pigs [Landrace × (Large White × Duroc)] of both sex and of the same age (~30 days) with initial weight of 7 to 10 kg were allocated in 3 treatment groups and reared for 3 months. The control group (T1) followed the conventional or the recommended farm medication program which included antibiotic (tylosin and zinc bacitracin) in the feeds and without probiotics in drinking water. Treatment 2 (T2) was given 12 g of probiotics mixed with drinking water every other day, while Treatment 3 (T3) was given 12 g of probiotics mixed with drinking water every day. Both T2 and T3 consumed non-medicated feeds. After 3 months, pigs were slaughtered in Animal Science abattoir, College of Agriculture, University of the Philippines Los Baños. After which, the middle part of jejunum and cecum that were about 5 cm long were collected. The results showed that the various morphometric observations (mucosal thickness (µm) and crypt depth (µm) of jejunum and cecum; and villus height (µm), villus width (µm) and villus volume (μm^3) of jejunum) on the tunica mucosa of pigs given probiotics supplementation in drinking water (T2 and T3) did not differ significantly from those antibiotic supplemented pigs (T1). (**Author's abstract**)

Keywords: *pigs, probiotics, Lactobacillus casei KE-99, jejunum, cecum, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-9
2017,
(Filipiniana Analytics)
NP

0613

Morphological detection of the intestinal parasite *Blastocystis* sp. in fresh and cultured feces of pet sugar glider (*Petaurus breviceps*) (Mammalia: Marsupialia: Petauridae) in Surabaya, Indonesia

Suprihati, Endang , Kusnoto, Kusnoto , Srianto, Pudji , Koesdarto, Setiawan , Suwanti, Lucia T , Natalia,

Many deadly sugar glider diseases remain underdiagnosed. Thus, this study aimed to detect the presence of *Blastocystis* sp. in sugar gliders (*Petaurus breviceps*). Fresh stools were taken from 100 3-month to 4-year old male and female sugar gliders from enthusiasts and breeders. Samples were directly observed in wet mount, stained with iodine, methylene blue, and giemsa, and cultured on simple and RPMI 1640 media. Results showed high detection of the parasite: 87% on wet mount, 94% on iodine staining, and 100% on methylene blue, giemsa staining and cultured media. *Blastocystis* sp. in sugar glider can be described as vacuolar, granular, cyst, and amoeboid, wherein vacuolar form predominated with size 0.38–2.95 µm (average of 1.46 µm). The parasite lived for 6 days in simple culture medium and 5 days on RPMI 1640 medium. Growth peak was marked on the third day for both media. This study is the first to report *Blastocystis* sp. in sugar gliders, revealing its presence in both fresh and cultured sugar glider stools. (**Author's abstract**)

Keywords: *Blastocystis sp., culture medium, protozoan, staining, sugar glider, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0614

Physiological responses, cortisol level and analgesia in goats subjected to exploratory laparotomy under acupuncture and regional analgesia

Acorda, Jezie A. , Cadoy, Jess

The study was conducted to explore an alternative method of producing analgesia for surgical procedure in goats. Eighteen apparently healthy 1-3 years old female Philippine native goats, weighing 10-20 kg, were divided randomly into three groups with six animals each and subjected to the following: 1) distal paravertebral nerve block (DPNB) using lidocaine hydrochloride; 2) conventional needle acupuncture (CNA) through needling of Acupoints BA04, 31, 22, 26 and 47; and 3) aquapuncture using 2% chili pepper decoction (AQP) to stimulate the same acupoints as in CNA. Exploratory laparotomy was conducted, and analgesia, physiological responses and cortisol level in the animals were determined. Good to excellent surgical analgesia was produced in all six goats of DPNB, five animals in AQP and one animal in CNA. Heart rate, respiratory rate and temperature were within normal levels in all groups, although higher values were observed in CAN and AQP than in DPNB. A higher than normal cortisol value was recorded in all treatment groups perioperatively. The results suggest that aquapuncture using chili pepper decoction can be used as an alternative to distal paravertebral nerve block in producing surgical analgesia for laparotomy in goats. (**Author's abstract**)

Keywords: *acupuncture, analgesia, cortisol, exploratory laparotomy, goat, regional analgesia, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-10
2018,
(Filipiniana Analytics)
NP

0615

Prevalence and antibiotic susceptibility profile of virulent multi-drug resistant *Escherichia coli* O157 isolates in native cattle (*Bos taurus* L.) from selected farms in Indang, Cavite, Philippines

Borja, Loren V. , Rundina-dela Cruz, Ma. Cynthia N., Dalmacio, Ida

The study was done to ascertain the prevalence of virulent *Escherichia coli* O157 in the fecal samples of native cattle (*Bos taurus* L.) from selected farms in Indang, Cavite, Philippines and determine the antibiotic susceptibility profile of the isolates against selected antimicrobials. A total of 24 presumptive enterohemorrhagic *E. coli* (EHEC) cells were isolated from the feces of native cattle among the 70 animals sampled. Of these, five isolates were *E. coli* O157 based on the agglutination test and PCR detection of the O157 (*rfb*O157) gene. All isolates were hemolytic on washed sheep red blood agar plate and possessed the *hly*A gene for hemolysin as detected through PCR, showing the virulence potential of the organisms. Results of the antibiotic sensitivity test showed that the isolates were resistant to erythromycin, trimethoprim/sulfamethoxazole and clarithromycin, except for two isolates that showed intermediate susceptibility to the latter. However, susceptibility of the isolates to newer classes of antibiotics was also observed. The overall prevalence rate was 7.14% and confirmed the presence of enterohemorrhagic *E. coli* O157 in native cattle in Cavite. This showed that native cattle is a source of the pathogen. (**Author's abstract**)

Keywords: *enterohemorrhagic E. coli, multidrug resistance, native cattle, virulence, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-10
2017,
(Filipiniana Analytics)
NP

0616

Prevalence of feline immunodeficiency virus, feline leukemia virus and *Taxoplasma gondii* in captive tigers (*Panthera tigris*) in a wildlife facility in the Philippines

Moralde, Keeno Ian A. , Flores, Marianne Leila S. , Favila, Marian Joy B. , Barrios, Ebbamir R. , Reyes, Ma

The aim of the study is to determine the prevalence of Feline Immunodeficiency Virus (FIV), Feline Leukemia Virus (FeLV), and *Toxoplasma gondii* in the captive tigers of a wildlife facility in the Philippines. Nine of the ten captive tigers (*Panthera tigris*) in the facility were used: six were adults and 3 were juvenile. Furthermore, five of these nine animals were males and four were females. There have been no reports of disease outbreaks and all the animals were apparently healthy during the time of the study as the mean (±SD) hematologic values were within the normal range. Of the nine samples, 33% (3/9) were exposed to *T. gondii* but none of the animals had evidence of exposure to either FIV or FeLV. Control of stray domestic short haired cats within the wildlife facility should be maintained to control disease spread and maintain the health of the captive animals. (**Author's abstract**)

Keywords: *feline immunodeficiency virus, feline oncovirus, Taxoplasma gondii, tigers, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 1, 1-6
2017,
(Filipiniana Analytics)
NP

0617

Relationship between prolactin and thyroid hormones in insulin-resistant dairy cows

Sebdani, Mohammad Mazrouei , Zohrati, Hosein , Mirzaei, Abdolah , Chalmeh, Ali

Insulin resistance can compromise metabolic pathways in dairy cows. This phenomenon may affect metabolic hormones such as prolactin and thyroid hormones. Twenty-five multiparous Holstein dairy cows were divided into five equal groups containing early, mid and late lactations, far-off and close-up dry periods. All cows received dextrose 50% intravenously at 500 mg/kg, 10 ml/kg/hr. Blood samples were collected from all animals prior to and 1, 2, 3, and 4 hr after dextrose 50% infusion and sera were separated to determine the levels of glucose, insulin, prolactin, and thyroid hormones containing T3 and T4. Insulin resistance phenomenon was detected in early and mid lactation and close-up dry periods. There were positive correlations between thyroid hormones and prolactin in the early lactation group, but these relationships were negative during mid lactation. Regarding the effectiveness of prolactin and thyroid hormones on the metabolism and lactogenesis of dairy cows, it may be stated that they can directly affect metabolism enhancement in different situations such as insulin resistance. These findings provide some clues on the relationship between prolactin and thyroid hormones in insulin-resistant Holstein dairy cows. (**Author's abstract**)

Keywords: *insulin resistance, prolactin, thyroid hormones, dairy cow, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-5
2017,
(Filipiniana Analytics)

NP

0618

Relationship of backfat thickness and body weight on sow health and reproductive performance

Dizon, Precy B., Alcantara, Amadeo A

The study was performed to investigate the relationship of backfat thickness (BFT) and body weight (BW) of sows of different breeds and parities to their health and reproductive performance. Data analyzed included 346 sow individual records from a commercial farm in Balayan, Batangas, Philippines. BFT had weak negative correlations with respiratory-related clinical signs (RRCS, r=-0.140) and weaning-to-service interval (WSI, r=-0.164) overall set of clinical signs (CS, r=-0.231) and number of mummified (MM, r=0.310) fetuses. There was significant moderate negative relationship between BFT and total born (TB, r=-0.439) and born alive (BA, r=-0.405) piglets. Moderate positive correlations between BFT and average piglet weight at birth (APWT, r=0.411) in parity 4, and with weaning-to-conception interval (WCI, r=0.310) and farrowing interval (FI, r=0.360) in parity 1. BW had a weak to moderate positive relationships with number of stillborn (SB, r=0.117), lactation-related clinical signs (Lact-CS, r=0.204), TB (r=0.334), BA (r=0.334) and litter weight (LWT, r=0.318) across breeds and evidently seen in parity 3 (TB, r=0.486; BA, r=0.501; LWT, r=0.422). In parity 5 > BW had positive correlations to the overall set of CS (r=0.449), Lact-CS (r=0.346), Systemic clinical signs (SCS, r=0.326) and RRCS (r=0.360). BW had negative correlations with WSI (r=-0.273) and WCI (r=-0.214) for F1 sowsand with FI (r=-0.480) at parity 5 >. Hence, with the observed association of BFT and BW to sow health and reproductive performance, they can be used as tools in the implementation of a more efficient breeding management program. (**Author's abstract**)

Keywords: *animal health, backfat, body weight, reproductive performance, sows, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 1, 1-11
2017,
(Filipiniana Analytics)
NP

0619

Tetracycline resistance gene in *Streptococcus agalactiae* isolated from bovine subclinical mastitis in Surabaya, Indonesia

Oktavianto, Angga , Hastutiek, Poedji , Effendi, Mustofa

The aim of this research was to isolate, identify and determine *tetO* resistance genes in tetracycline-resistant *Streptococcus agalactiae* isolated from cows with subclinical mastitis in Surabaya and surrounding areas of Indonesia. Milk samples from cows with subclinical mastitis in six dairy farms were collected. *S. agalactiae* was isolated and antibiotic resistance was determined. Results showed that out of 173 samples analyzed, 131 (75.7%) were positive for California Mastitis Test. *S. agalactiae* was isolated in 36 out of the 131 CMT-positive samples. Antibiotic sensitivity test revealed that out of 36 *S. agalactiae* samples, nine were resistant to tetracycline. PCR analysis showed that six of the nine tetracycline resistant *S. agalactiae* isolates were positive for the *tetO* resistance genes. (**Author's abstract**)

Keywords: *Streptococcus agalactiae, subclinical mastitis, tetO gene, tetracycline, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-6
2018 Special issue,
(Filipiniana Analytics)
NP

0620

Toxicity, stability and renal histopathology of alkaloid of jarong (*Achyranthes aspera* Linn.) (Caryophyllales: Amaranthaceae) leaf on mice

Suwasanti, Niluh , Putri, Desak Ketut Sekar Cempaka , Mustofa, Imam , Safitri, Erma , Hariadi, Masaud , Basori, Achmad , Zakaria, Sunarni , Wurlina, Wurlina , Meles, Dewa

The aim of this research was to conduct toxicity tests, both acute and chronic, to determine the lethal dose (LD50) of the alkaloid of jarong leaf (*Achyranthes asperara*) and characterize histopathologic renal damage on mice (*Mus musculus*) in terms of congestion, degeneration and necrosis. Acute toxicity test was performed for 24 h on thirty 3-month old adult female mice, divided randomly into six groups, while chronic toxicity test was done for 90 days using 60 adult female mice, divided into two groups. Results showed that acute toxicity test at 15 g/kg bw did not cause death in rats and, overall, no major or irreversible histopathological changes were found in renal organs, suggesting that *Achyranthes asperara* alkaloid can be considered a non-hazardous substance. Direct heating stability test with UV rays and heating test with boiling water suggested no changes in the alkaloid's color, texture/shape and pharmacological activity. (**Author's abstract**)

Keywords: *Achyranthes aspera, degeneration, kidney, mice, necrosis, toxicity, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,
(Filipiniana Analytics)
NP

0621

Treatment duration and milk production in dairy cattle with foot diseases

Kilic, Nuh , Cecen, Goksen , Sarierler, Murat , Bardakcioglu, Husnu Erbay , Belge, Ali , Akin, I

The objective of this study was to describe the treatment of foot diseases–heel erosion (HE), sole ulcer (SU), digital dermatitis (DD), and white line disease (WLD)–and evaluate the effect of treatment on milk production in dairy cows. The study was conducted using 57 Holstein dairy cows from a commercial dairy farm in Aydin, Turkey. The duration of treatment was determined, and milk production traits were obtained from daily computer records at four stages: beginning day of milk production (BMP), peak milk production before diagnosis day (PMP), beginning of treatment milk production, concurrently diagnosis day milk production (BTMP), and after-treatment milk production (ATMP). Bandages with antibiotic were applied for treatment of each foot disease and were changed weekly. The longest treatment period was observed in WLD, followed by SU, DD, and HE. Significant increase in milk production was obtained in all groups after diagnosis and treatment of foot diseases in the study. The results suggest that treatment of foot diseases in dairy cattle has a positive impact on milk production if PMP is considered as the baseline for BTMP and ATMP in each disease group. (**Author's abstract**)

Keywords: *dairy cattle, foot diseases, milk production, treatment, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018,
(Filipiniana Analytics)
NP

0622

Ultrasonographic features of the liver, spleen and right kidney in Philippine native horses (*Equus ferus caballus*)

Acorda, Jezie A. , Pajas, Arville Mar Gregorio A. , Kidaka,

The study was conducted to determine the ultrasound features of the liver, spleen and kidney of the Philippine native horse. Thirty horses (16 male, 14 female) weighing 19.9-344.7 kg, 1 month to 10 years old were used in the study. The horses were divided into three age groups, <1 year old (3 male, 3 female), 1-3 years old (6 male, 5 female) and >3 years old (7 male, 6 female). An ultrasound machine equipped with a 3.5-MHz convex linear array scanner was used for transabdominal ultrasonography of the liver, spleen and right kidney. Echo mean values (EMV) of the different structures of the organs were determined using histogram analysis. The hepatic parenchyma was visualized as homogenously hypoechoic with distinct margins. Portal and hepatic veins were also visualized. The splenic parenchyma was hypoechoic with hyperechoic capsule. The renal capsule, cortex, medulla and pelvis were all easily distinguishable. Significant differences in EMV were observed in the spleen by age and sex ($P<0.05$). The kidney thickness (male and female) and width (male) was highly associated with body weight. The results obtained in the study can be used as references for diagnosis of hepatic, splenic and renal disorders in Philippine native horses. (**Author's abstract**)

Keywords: *kidney, liver, Philippine native horse, Spleen, ultrasound, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-10
2017,
(Filipiniana Analytics)
NP

0623

Ultrasonorgraphic features of the liver and gall bladder of water buffaloes with patent *Fasciola* spp. infection

Acorda, Jezzie A., Saludes, Thelma A., Divina, Billy P., Robles, Jay

Seventy-nine purebred and crossbred water buffaloes consisting of 43 animals without fasciolosis and 36 animals positive for fasciolosis through fecalysis were utilized to determine the ultrasonographic features of the liver with patent fasciolosis. Sedimentation technique of fecal samples revealed mixed parasitic infection of *Fasciola* spp. with strongyles, *Moniezia* sp., and *Eimeria* spp. However, besides *Fasciola* spp., the other parasites are not known to cause liver damage. Ultrasonographic features observed in the water buffaloes with patent *Fasciola* spp. infection were significantly more echogenic liver parenchyma due to presence of multiple hyperechogenic foci, thicker hyperechoic gall bladder wall, wider gall bladder lumen and less echoic gall bladder lumen. However, other abnormal liver and gall bladder conditions should be ruled out. The thickness of the liver parenchyma was not different between the two groups. The results of the study suggest that ultrasonography can be used as a complementary tool for diagnosis of patent fasciolosis in water buffaloes. (**Author's abstract**)

Keywords: *Fasciola, fasciolosis, gall bladder, liver, ultrasonography, Veterinary medicine*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-8
2017,
(Filipiniana Analytics)
NP

0624

Ultrasound features and echo mean values of the urogenital organs of red-eared slider turtles, *Trachemys scripta elegans* (Wied, 1839) (Reptilia: Testudines: Emydidae)

Rodriguez, Rosa Angela R., Lastica-ternura, Emilia A. , Acorda, Jezie A

In order to determine the ultrasound features as reference for diagnosis of diseases and disorders, the kidneys, urinary bladders, testes and ovarian follicles of 24 apparently healthy adult red-eared slider turtles (*Trachemys scripta elegans*) were examined using an ultrasound machine equipped with a 5.5 MHz microconvex multifrequency scanner. Ultrasonographic appearance and brightness, expressed as echo mean values, of the organs were obtained for comparison with the animals' biometrics. The left and right prefemoral windows were effectively used for examination of the different organs. The kidneys appeared elliptical and hypoechoic. The different renal structures, however, were difficult to visualize. The urinary bladder appeared elongated with hyperechoic wall and anechoic lumen. Testes were observed to be round and hyperechoic, and the ovarian follicles were hyperechoic with round anechoic centers. No significant variations in organ dimensions and echo mean values for testes and ovarian follicles were found based on turtle size. The data obtained may be used as a reference for normal baseline values of organ dimensions and echogenicity of red-eared slider turtles. (**Author's abstract**)

Keywords: *kidney, ovary, slider turtle, testes, ultrasound, urinary bladder, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018,
(Filipiniana Analytics)
NP

0625

Viability of rabbit adipocyte stem cells cultured under different oxygen concentrations *in vitro*

Sandhika, Willy , Widiyatno, Thomas Valentinus , Srianto, Pudji , Safitri, Erma, Prasetyo, R. Heru

The aim of this research was to determine if rabbit adipocyte stem cells (r-ASCs) can still be viable before transplantation when these are cultured in vitro under hypoxic preconditioning (3% O_2 concentration). Samples were divided into two groups, one under hypoxic preconditioning and the other in hyperoxia (20% O_2 concentration). Observations were made through flow cytometry, immunofluorescence, and immunocytochemical analyses. Flow cytometric analysis showed that in r-ASCs hypoxic culture, the levels of CD90+, CD44+ and CD45- were unaltered, but changed under hyperoxic culture, indicated by the down-regulation of CD90+ and CD44+, and up-regulation of CD45-. Meanwhile, immunocytochemical and immunofluorescence analysis showed that under hypoxic preconditioning, r-ASCs culture expressed quiescent cells with p63 as marker, but the latter remained unexpressed in hyperoxic culture. In conclusion, hypoxic preconditioning with 3% O_2 concentration supported r-ASCs in sustaining viability before transplantation in rabbit. (**Author's abstract**)

Keywords: *hyperoxia, hypoxic preconditioning, rabbit, r-ASCs, viability, Veterinary medicine*

Philippine Journal of Veterinary Medicine, Volume No. 55 Issue No. 1, 1-8
2018 Special issue,
(Filipiniana Analytics)
NP

ZOOLOGY

0626

Anthelmintic efficacy of lagundi (*Vitex negundo* Linn.) and banaba (*Langrostroemia speciosa* Linn.) extracts on the gastro-intestinal parasites of goat

Tadeo, Norbe

The study sought to test and evaluate the efficacy of lagundi and banaba fresh leaves extracts against gastro-intestinal parasites of goat and compare it with the commercial dewormer. The data collected includes species of gastro-intestinal parasites, parasitic loads, efficacy of the test extracts, hatchability of parasitic eggs, and return above dewormer costs. The treatments used were as follows: GT1 (Control)-Grower goats administered with Valbazen (Albendazole); GT2-Grower goats administered with Banaba leaves extract (BLE); GT3-Grower goats administered with Lagundi leaves extract (LLE); MT1 (Control)-Matured goats administered with Valbazen (Albendazole); MT2-Matured goats administered with BLE; and MT3-Matured goats administered with LLE. There were five (5) species of gastro-intestinal parasites identified in both stages of goat, the *Cooperia* spp., which is the most abundant, followed by *Strongyloides* spp., *Haemonchus* spp., *Monieza* spp., and *Trichuris* spp. The parasitic loads of the experimental animals were rated as heavily parasitized. In terms of efficiency of the leaves extracts and commercial dewormer against *Haemonchus* spp., the Treatments GT2, GT3, and MT2 were rated effective and Treatment MT1 was rated highly effective. In *Cooperia* spp., the efficacy of Treatment GT1 was effective, Treatments MT2, MT3 and GT3 moderate effective and Treatment GT2 highly effective. Lastly, in *Monieza* spp. Treatments GT1 and GT3 were rated as highly effective and GT2 effective. In larval culture, there were no ovicidal and larvicidal effects of the test extracts and commercial dewormer in parasitic eggs. It is recommended that immediate anti-parasitic treatment should be administered to the test animals to control or eliminate parasitism. To reduce the development of dewormer resistant parasites, interval use of dewormers should be adopted. To prolong the effects of the test extracts and commercial dewormer, short intervals or frequency of administration should be applied to the test animals and studies on the different doses, frequency, combination of lagundi and banaba leaves extracts as dewormer and the use of different species of experimental animals should be conducted to identify the effects of test extracts. (**Author's abstract**)

Keywords: *Anthelmintic, Dewormer, Leaves extract, Gastro-intestinal parasites, Efficacy, Zoology*

Cabagan Journal of Research, Volume No. 20 Issue No. 1, 1-13
2011/06,
(Filipiniana Analytics)
NP

0627

Epipenaeon latifrons (Isopoda: Bopyridae) and *Pandarus rhincodonicus* (Copepoda: Pandaridae), new records of parasitic crustacea for the Philippines

Eduardo, Salc

Two species of parasitic crustacean namely *Epipenaeon latifrons* Bourdon, 1979 (Isopoda: Bopyridae) and *Pandarus rhincodonicus* Norman, Newbound and Knott, 2000 (Copepoda: Pandaridae) were identified from recent collections. The former species was recovered from the branchial chambers of the Indian white prawn, *Fenneropenaeus indicus* (Decapoda: Penaeidae) caught from the waters off Matnog port, Sorsogon and Lucena, Quezon. The latter species was found on the edges of the fins and lips, and gills of the whale shark, *Rhincodon typus* (Orectoloboformes: Rhincodontidae) on necropsy stranded off the coast off Jagna, Bohol, Philippines. Prawns infected with *E. latifrons* exhibited characteristic bulge of the carapace on the side of the infected gill chamber. Specimens were preserved and kept in 80% ethyl alcohol. Whole and dissected parts of specimens were studied by clearing in lacto-phenol and mounted temporarily or gradually dehydrated in increasing grades of ethyl alcohol, some stained, and mounted in Canada balsam on glass slides for microscopic examination. Based on the Philippine materials, the two species are described and measurements of both males and females are given; drawings and photographs of them are also provided. *Epipenaeon latifrons* and *Pandarus rhincodonicus* are reported for the first time in the Philippines, constituting new locality records. (**Author's abstract**)

Keywords: *Epipenaeon latifrons, Copepoda, Isopoda, Pandarus rhincodonicus, Philippines, Zoology*

Philippine Journal of Veterinary Medicine, Volume No. 54 Issue No. 2, 1-10
2017,
(Filipiniana Analytics)
NP

0628

Evaluation of frozen semen stored in provincial and field stations in Bicol Region, Philippines

Llanto, Lourd

This study described the storage, handling, and quality of frozen semen samples used in artificial insemination (AI) in cattle and Philippine water buffalo at provincial and field stations in Albay, Camarines Sur, and Sorsogon in Bicol region, Philippines. Frozen semen straw samples were analyzed for motility, viability, and morphology at the Philippine Carabao Center, Carranglan, Nueva Ecija. Interviewed were three Provincial AI coordinators and 26 AI technicians involved in AI. Frozen semen straws from the National Artificial Breeding Center and Philippine Carabao Center were stored in center tanks at the regional station in Camarines Sur where these are distributed to the different municipalities of Camarines Sur, and the provincial stations (Albay and Sorsogon). In Albay and Sorsogon, center tanks served as storage tanks and "station thawing" was commonly practiced during conduct of AI. In Camarines Sur, AI technicians used field tanks as storage tank. Storage rooms for center and field tanks were spare rooms without air condition or corners inside offices. Number of handlers of frozen semen who were also trained AI technicians ranged from one to four. Storage of frozen semen samples ranged from few days to one year. Percent post-thaw motility (PTM) did not deteriorate based on subjective evaluation. However, computer-assisted sperm analysis showed 23.53% of samples had <70% PTM. There was highly significant reduction ($p \leq 0.01$) in percent live and normal sperm when data from source was compared with results of laboratory analysis. Percentage abnormal sperm was higher in semen from cattle bulls. (**Author's abstract**)

Keywords: *artificial insemination, cattle semen, thawing, water buffalo, Zoology*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-10
2017,
(Filipiniana Analytics)
NP

0629

Performance and carcass traits of broiler chickens fed diets supplemented with aged garlic extractor humates with probiotics at different growth stages

Nicolas, Honey

This study was conducted to determine the effects of supplementing aged garlic extract (AGE) and humates with probiotics (HWP) at varying growth stages on the performance and carcass traits of broilers. The experimental study used 4x4 factorial in Completely Randomized Design, where the type of feed supplement as factor A (negative control, with AGE, with HWP, and positive control or antibacterial) and growth stage as factor B (brooder stage/0-12 d, starter stage/13-21 d, grower stage/22-28 d, and brooder to grower stages/0-28 d). A total of 320 male day-old Cobb broiler chicks were randomly distributed to 16 groups with four replicates. The supplements were given at 1g/kg inclusion rate. Significant interaction effects were observed between feed supplements and growth stages in terms of body weight, ADG and FCE. Results indicated that supplementation with either aged garlic extract (AGE) or humates with probiotics (HWP) was best done continuously at 0-28 d of age (brooder to grower stages). Supplementation with AGE or HWP at any stage of growth had no significant effect on carcass traits. (**Author's abstract**)

Keywords: *aged garlic extract (AGE), broiler, humates, probiotics, Zoology*

Philippine Journal of Veterinary and Animal Sciences, Volume No. 43 Issue No. 2, 1-7
2017,
(Filipiniana Analytics)
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Philippine Journal of Veterinary Medicine
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Renewable Energy Topics in East Asia
Science Diliman: A Philippine Journal of Pure and Applied Science