The e-ASIA JRP International Workshop
on
Renewable Energy

Proceedings

Jointly organized by
Ministry of Science and Technology of Lao P.D.R.
and
Japan Science and Technology Agency
and
hosted by
Renewable Energy and New Materials Institute

31 July – 1 August 2013,
Lane Xang Hotel, Lao P.D.R.

The e-ASIA JRP International Workshop on Renewable Energy
Vientiane Capital, Lao's People Democratic Republic.
from 31 July to 01 August 2013

Jointly-organized by:

Ministry of Science and Technology (MOST), Lao PDR

Japan Science and Technology Agency (JST)

Hosted by:

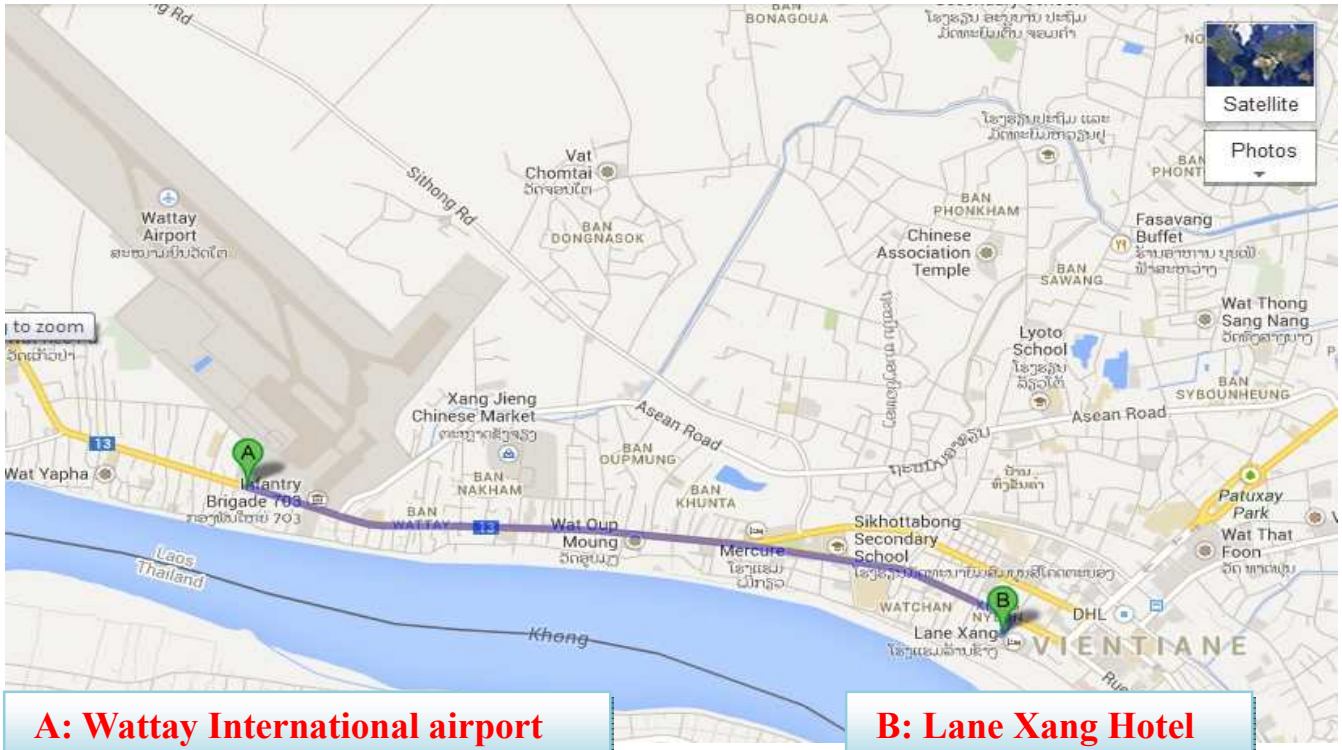
Renewable Energy and New Materials Institute (REMI

Venues

Date: 31 July – 1 August 2013

Venues: Forum: Lane Xang Hotel, Vientiane Capital, Lao P.D.R
(Dokkhoun Meeting Room, Luang Prabang Meeting Room)

The e-ASIA JRP International Workshop on "Renewable Energy"
31 July-1 August 2013



A: Wattay International airport

B: Lane Xang Hotel

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Workshop Theme

Theme

Opening up unlimited opportunities in a Renewable Energy.

Description

The theme of this workshop: "Renewable Energy", is considered not only by the e-ASIA JRP Member States but also by many other countries worldwide to be a vital area of technological development for the achievement of sustainable society and the pursuit of sustainable development. The promotion of research related to renewable energy technologies and the application of those technologies among the e-ASIA JRP Member States will lead to sustainable future development in Asian countries.

In that context, we have elected to concentrate on "renewable energy" in this workshop. We will especially focus on photovoltaics and biomass power generation, which have already been put to significant practical use and on which considerable research has been carried out to achieve both reductions to manufacturing costs and increased power generation efficiency.

The purpose of this workshop is to explore potential future collaborative research areas in the field of renewable energy and also to create potential international joint research teams through active discussion among participating researchers. Through this workshop, we sincerely hope that we can develop ways to promote sustainable lifestyles around the world, as well as future scientific collaboration in the field of renewable energy to achieve comprehensive development among e-ASIA JRP member states and advancements which will spread throughout our society.

The Workshop had attracted close to 21 submissions, and the Scientific Committee had the onerous task of selecting a subset for presentation. The rigorous selection process has ensured a very high quality event. To meet the stringent standards set by the Scientific Committee, more than 96% of submissions will be presented.

The Workshop brings together policy makers, leading academic thinkers, influential research institutional representatives, researchers from academia, government agencies, research institutions and universities to discuss and debate topics of current importance aimed at identifying present trends and future directions of collaborative joint research. Lessons learnt from this Workshop will undoubtedly find application in e-ASIA Joint Research Program settings and, in particular, aid developing countries to benefit from government, research institution and academic interactions, to achieve sustainable economic growth and to develop a culture of continuous innovation. We have an engaging technical programme with a of keynote presentations by the e-ASIA JRP's leading experts, and a large number of excellent presentations in the technical concurrent sessions.

The Ministry of Science and technology is proud to jointly organize the e-ASIA Joint Research Program International Workshop on Renewable Energy with Japan Science and Technology Agency without which the Workshop would simply not have happened. The Workshop will discuss on the following topics:

- Solar Energy and Photovoltaic;
- Biomass Utilization (Power Generation, Fuels and Materials).

Activities	
First day: Tuesday 30th July 2013	
00:00 00:00	Arrival of Delegates at Wattay International Airport Check in at the Lane Xang Hotel
From 00:00	Free time
Second day: Wednesday 31st July 2013	
08:30-09:00	**Registration**
09:00-11:35: Inauguration ceremony *(Venue Ballroom at the 1st Floor of the Lane Xang Hotel)*	
09:00-09:20	**Organizer's Remarks** *Mr.Toshihiko OGURU, Director of Department of International Affairs, JST*
09:20-0940	**Enzymatic Saccharification and Fermentation Technology for Ethanol Production from Lignocelluloses Biomass (Using waste of Jatropha as substrate)** *Mr. Houmpheng THEUAMBOUNMY, Director of Alternative Energy Divisions, REMI ,MOST*
09:40-10:00	**Presentation on Renewable Energy and New Materials Institute (REMI)** *Mr. Phaychit SENGMANY, Deputy Director of REMI*
10:00-10:20	**Opening Remarks** *H.E. Houmphanh INTHARATH, Vice Minister of MOST*
10:20-10:35	**Taking Group Photos**
10:35-10:50	**Coffee Break**
10:50-11:30	**Introduction of e-ASIA JRP Activities** *Mr. Osamu Kobayashi, Director of Singapore Office, JST*
11:30-11:45	Q&A and Discussions on **e-ASIA JRP Activities**
12:00-13:00: **Working Lunch** *(venue: Near lobby at the 1st Floor of the Lane Xang Hotel)*	
13:00-18:50: **Working Group Sessions**	
Two Working Groups sessions will be established to prepare observations and recommendations of the Workshop *Presentation: *Session1 Solar Energy Session* 20 minutes + 5 minutes for Q&A and comments for each.* **Session2 Biomass* **Utilization** *Session* 15 minutes + 5 minutes for Q&A and comments for each.* *Presentation help participants to share your research background and encourage the following discussion, by presenting:* *(1) Social background of your research such as a social problem(s) or social challenge(s) faced by your country* *(2) Research project which your team is conducting to solve the social problem(s)* *(3) Solution for the social problem which your research team aims to find out through the said project* *(4) Competence which you expect of your future foreign research partners to achieve the goal* *Discussion may include:* *(1) Importance of research in this field,* *(2) Potential research areas or topics for future joint research and possible multilateral joint research projects* *(3) Necessity of international collaboration and expected synergistic effects, and* *(4) Possible composition of research teams and scientific contribution from each country*	
Concurrent Group Sessions	

NOTE Solar Energy Session ONLY	**Session1:** **Solar Energy and Photovoltaic** *Chair & Moderator: Dr.Masaya ICHIMURA* *(Venue: Room A at the 1st floor of Lane Xang Hotel)*	*NOTE* Biomass Session ONLY	**Session2:** **Biomass Utilization (Power Generation, Fuels and Materials)** *Chair & Moderator: Dr. Akio NISHIJIMA, Japan* *(Venue: Room B at the 1st floor of Lane Xang Hotel)*
13:00-13:10		13:00-13:10	
13:10-13:35	**PV activities at NECTEC, Thailand** *Dr. Kobsak SRIPRAPHA, Researcher, Solar Energy Technology Laboratory (STL), National Electronics and Computer Technology Center (NECTEC), Thailand*	13:10-13:30	**Biomass Asia Prospect (a region wide collaborative framework)** *Dr. Akio NISHIJIMA, Professor, Waseda University, Japan.*
13:35-14:00	**Solar Energy Utilization and Development in Yunnan, China and integrated with building in practice** *Dr. LI Ming, Professor, Solar Energy Research Institute, Yunnan Normal University, China*	13:30-13:50	**Current Activities of Renewable Energy in Myanmar** *Dr. May Myat KHINE, Lecturer, Mandalay Technological University, Myanmar*
14:00-14:25	**Simple Chemical Techniques of Thin Film Deposition for Solar Cell Application** *Dr. Masaya ICHIMURA, Professor, Nagoya Institute of Technology, Japan*	13:50-14:10	**Reuse Agriculture and Organic Waste from Agro-Processing in Viet Nam** *Dr. Luong Huu THANH, Head of Environmental Biology Department, Institute for Agricultural Environment , Vietnam*
14:25-14:35	**Coffee Break**	14:10-14:20	**Coffee Break**
14:35-15:00	**Dependent of Solar Cell Efficiency on the Characteristics of Nanostructured CuI Thin Films as a Hole Conductor** *Dr. Mohamad Rusop MAHMOOD, Professor / Head of Center, NANO-SciTech Centre (NST), Institute of Science, Universiti Teknologi MARA (UiTM), Malaysia*	14:20-14:40	**Alcohol-tolerant bacteria isolated from Laos** *Ms. Toulaphone KEOKENE, Head of Microbiology Unit, Department of Biology, Faculty of Science, National University of Laos, Lao P.D.R.*
15:00-15:25	**Renewable System Utilizing Photovoltaic Cell or Solar Thermal Energy and Thermoelectric Converter Combining Biomass Energy** *Dr. Toshikazu YANO, Project Advisor, Japan Aerospace Technology Foundation (JAST), Japan*	14:40-15:00	**New fermentation technology: High-temperature fermentation with thermotolerant microbes** *Dr. Mamoru YAMADA, Professor / Dean of Faculty of Agriculture, Yamaguchi University, Japan*
		15:00-15:20	**Geographical distribution of**

			Thermotolerant acetic acid bacteria in Lao PDR *Mr. Chanhom LOINHEUANG, Lecturer, Biology Department, Faculty of Science, National University of Laos, Lao P.D.R.*
15:25-15:35	**Coffee Break**	15:20-15:30	**Coffee Break**
15:35-16:00	**Utilization of carbon dioxide using solar light: photocatalytic reduction** *Dr. Osamu ISHITANI, Professor, Tokyo institute of Technology, Japan*	15:30-15:50	**Bio-Ethanol Production by Simultaneous Cassava Starch Hydrolysis and fermentation Using Screened Microorganisms** *Mr. Boualy VONGVISITH, Deputy Director of Bio-energy Division, Renewable Energy and New Materials Institute, Ministry of Science and Technology, Lao P.D.R.*
16:00-16:25	**Experimental Research of Solar Collector with Copper Tube over Steel Plate of U Shape and Solar Boosted Heat Pump** *Mr. Sengratry Kythavon, Department of mechanical Engineering, Faculty of Engineering, National University of Laos, Lao PDR*	15:50-16:10	**Development of the Generation Technology by Mixed Combustion of Biomass Fuel** *Dr. Sopheak REY, Researcher / Lecturer, Department of Industrial and Mechanical Engineering, Institute of Technology of Cambodia, Cambodia*
		16:10-16:30	**Compatibility of Ethanol-Gasoline Blends with the In-used Engines** *Dr. LE ANH Tuan, Associate Professor / Deputy Director, School of Transportation Engineering / Head of the Internal Combustion Engine Department, Hanoi University of Science and Technology (HUST), Vietnam*
		16:30-16:50	**The relationship between compositions, fuel properties, combustion and emission characteristics of biodiesel fuels** *Dr. Deuansavanh PHOMMAVONGSA, Lecturer, the mechanical engineering department, faculty of engineering, the National University of Laos (NUOL), Lao P.D.R.*
		16:50-17:10	**Quality Control and Standardization of Biodiesel** *Mr. Syvang XAYYAVONG, Deputy Director at Renewable Energy Development Division (REDD), Institute of Renewable Energy*

			Promotion (IREP), Ministry of Energy and Mines (MEM), Lao P.D.R.
16:25-16:35	**Coffee Break**	17:10-17:20	**Coffee Break**
16:35-18:50	**Free Discussion** *Chair & Moderator: Dr. Masaya ICHIMURA, Japan*	17:20-18:50	**Free Discussion** *Chair & Moderator: Dr. Akio NISHIJIMA, Japan*
19:00-20:45	**Welcome and Networking Dinner hosted by MOST** *(Venue: Near the Lobby at 1st floor of Lane Xang Hotel)*		
Day 2: Working Group Meeting			
09:00-10:00	**Free Discussion and Wrap up** *Chair & Moderator: Dr. Akio NISHIJIMA, Japan*		
10:00-10:15	**Coffee break**		
10:15-11:00	**Panel Discussion (Joint Session): Presentation of Working Group Observation and Recommendations** *(by chairs of Working Groups)* *Co-Chair: Dr. Akio NISHIJIMA, Japan* *Co-Chair: Dr. Masaya ICHIMURA, Japan*		
11:00-11:30	*Free discussion based on co-chairs' reports. Possible topics would include, but not limited to:* *(1) priority themes (or topics) for collaboration* *(2) comments on the other session or the workshop.* *Co-Chair: Dr. Akio NISHIJIMA, Japan* *Co-Chair: Dr. Dr. Masaya ICHIMURA, Japan*		
11:30-12:00: Closing Session			
11:30-12:00	**Closing Remarks:** **Renewable Energy and New Materials Institute (REMI)** *Mr. Phaychit SENGMANY, Deputy Director, REMI* **Japan Science and Technology Agency (JST)** *Mr. Toshihiko OGURU, Director of Department of International Affairs, JST* **Ministry of Science and Technology (MOST)** *H.E. Houmphanh INTHARATH, Vice Minister of MOST*		
12:00-13:15	**Working Lunch** *(Venue: Near the Lobby at 1st Floor of Lane Xang Hotel)*		
14:00-17:00	**Site Visit** *. Science Natural Faculty, Lao National University;* *. Engineering Faculty (Renewable Energy at 3km from Vientiane Capital);* *. Sunlabob Company (Solar Energy);* *. Renewable Energy and New Materials Institute (REMI).*		
18:00-20:00	**Farewell and Networking Dinner hosted by JST** *(Venue: Near the Lobby at 1st floor of Lane Xang Hotel)*		
Day 3: Thursday 2nd August 2013			
00:00	Check out from Lane Xang Hotel		
00:00	Departure of Delegates		

ABSTRACTS and BIOGRAPHIES

Opening Speech

Houmphanh INTHARATH
Vice Minister, Ministry of Science and Technology, Lao P.D.R.

Biography

Name and Family: Houmphanh INTHARATH
Date of Birth: 17/12/1954
Place of Birth: Ban Xieng Thong, Luang Prabang District/Province
Family Status: Married
Working Date: 1/7/1977
Present Government Occupation: Vice Minister, Ministry of Sciences and Technology
Graduated
1966 Primary Certificate of Pongkham Primary School, Luang Prabang Province
1972 Technical Certificate of Pakpasack Polytechnic College, Vientiane
1975 Technical Certificate of Post and Telecommunication Centre, Vientiane
1977 Technical Superior Certificate of Post and Telecommunication Centre, Vientiane
1985 Master of Science of Odessa Polytechnic institute, former of Soviet Union

Occupation
1992-1994 Deputy Director of Project Division, Enterprise of Post and Telecommunication Lao (EPTL)
1995-1996 Director of Project Division, Enterprise of Post and Telecommunication Lao (EPTL)
1997-2000 Deputy Director General, Lao Telecommunication Company (LTC)
2001-2008 Director General, Lao Telecommunication Company (LTC)
16/7/2008 – 10/10/2001 Vice President, National Authority for Sciences and Technology (NAST)
11/10/2011 up to now Vice Minister, Ministry of Sciences and Technology (MOST)

Organizer's Speech

Toshihiko Oguru
Director of Department of International Affairs,
Japan Science and Technology

Biography

Educational Background:
Master of Engineering, Kyoto University

Work Experience:
19981-84: Science and Technology Agency (STA), Government of Japan
1996: Counselor (Economic, Science and Technology), Embassy of Japan in Sweden
1999: Director, Europe Division, Trade Policy Bureau, Ministry of External Trade and Industry (MITI)
2000: Director, Research Promotion Division, National Institute for Materials Science (NIMS)
2002: Director, Elementary and Secondary Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
2004: Deputy Director, International Science and Technology Center (ISTC) in Moscow
2006: Director, Brain Science Promotion Division, the National Institute of Physical and Chemical Research (RIKEN)
2012.9: Director, Department of International Affairs, JST

REMI's Representative

Mr. Phaychit SENGMANY
Deputy Director General of Renewable Energy and New Materials Institute (REMI)

Biography

Name and Family: Phaychit SENGMANY
Date of Birth: 04/07/1952
Place of Birth: Ban Nongdouang, Sikhottabong District, Vientiane Capital.
Family Status: Married
Present Government Occupation: Deputy Director General of Renewable Energy and New Materials Institute (REMI), Ministry of Sciences and Technology
Education: Primary & Secondary School
Bachelor Degree: (French Bachelor)
Mining Engineer concerning on Exploration Minerals(Czechoslovakia)

Occupation
1980-1982 Chief of Exploration Sapphire Team, Bokeo Province;
1982-1988 Chief Project for Tin Prospect ion and Exploration in Nam Pathem Basin (Khammouane Province); 1989-1992 Director of Technical Management Division, Department of Geology and Mines (DGM), Ministry of Industry and Handicraft (MIH)
1990-1993 Director of Licensing & Minerals Management Division, Department of Geology & Mines;
1992-1994 Director of Licensing Management Division, DGM, MIH
1994-2000 Deputy Director General of Geology & Mines Department, Ministry of Industry & Handicraft;
1995-1999 Deputy Director General of DGM, MIH
1996-1997 National member Committee for drafting mining Law
2000-2001 Senior Mining Engineer (Senior officer of Environment), Environmental Research Institute, STEA, Prime Ministers' Office
2001-2007 Deputy-General Secretary of the Lao Union of Science & Engineering Associations and Deputy Director-General of Cabinet of the National Council of Sciences, Prime Minister's Office.
2002-20012 Deputy Director General of Cabinet, National Science Council, Prime Ministry's Office;
2005 ASEAN Engineer has been awarded by the ASEAN Federation of Engineering Organizations (AFEO) Governing Board
2012 up to now Deputy Director General of Renewable Energy & New Materials Institute.

Solar Energy:

Dr. Kobsak Sriprapha is Researcher, (Acting) Head of Solar Energy Technology Laboratory (STL) National Electronics and Computer Technology Center (NECTEC).

Major Field: Solar Energy (PV Fabrication, PV system design, installation and evaluation)

Presentation Title: PV activities at NECTEC, Thailand

Abstract :

Solar Energy Technology Laboratory (STL) was established by the National Electronics and Computer Technology Center (NECTEC), National Science and Technology Development Agency (NSTDA) in order to support, coordination and conducting research and development in the area of solar cell technology. We focus on the development of silicon-based solar cells, pv system application and performance evaluation. In the area of solar cell development, the wide bandgapthin film silicon solar cells and Hetero-junction (HJ) solar cell were developed in order to obtain solar cells with high conversion efficiency (η) and low temperature coefficient which suitable for the use in high temperature environment, i.e. tropical climate region. The project highlights of PV fabrication, PV system and application will be presented and discussed in this presentation.

Prof. Dr. LI Ming Directorfor Solar Energy Institute, Yunnan Normal University. China.

Major Field: Solar energy and biomass energy.

Presentation Title: Solar Energy Utilization and Development in Yunnan, China and integrated with building in practice

Abstract :

The presentation will give the utilization of solar energy in Yunnan province of China include the resources in Yunnan, the Photovoltaic Utilization, the Solar Thermal Utilization, the Sino-Germany Joint RE Program, the Non-electrification situation in Yunnan. Furthermore, the application demonstrations inferred with solar building will be introduced too. A building included with solar PV, solar thermo-engineering, will be constructed in Yunnan Normal University this year for synthetical demonstration of solar energy. The cooperation will be need for further utilization for solar energy.

Prof. Dr. Masaya Ichimura, Professor of Department of Engineering Physics, Electronics and Mechanics (Graduate) Nagoya Institute of Technology, Japan.

Major Field: semiconductor science and technology

Presentation Title: Simple Chemical Techniques of Thin Film Deposition for Solar Cell Application.

Abstract :

To drastically reduce cost of photovoltaic power generation, both material and fabrication costs of solar cells should be reduced. To this end, we selected oxides and sulfides of abundant metals as the solar cell materials, and adopted chemical techniques for the thin film deposition. In this paper, we review results of our attempt to deposit three solar cell materials (Cu_2O, SnS, and CdS), each by a different chemical method.

Cu_2O is a p-type semiconductor with a band gap of 2.1 eV. We deposited Cu_2O thin films by the simple chemical bath deposition (CBD). An aqueous solution containing $CuSO_4$ and Na_2SO_3 was heated to 70 - 80 °C. Then, with spontaneous reactions in the solution, Cu_2O was synthesized and a film was deposited on the substrate placed at the bottom of the container.

SnSis another p-type material with a band gap of 1.0 - 1.4 eV. SnS films were deposited by using the pulsed electrochemical deposition (ECD) method. In ECD, ions in the solution are reduced at the cathode, and a film is deposited there. The deposition solution for SnS contained $SnSO_4$ and $Na_2S_2O_3$, which acts as the sulfur source. The film became much more compact and dense with pulse biasing than with DC biasing.

We have developed another novel chemical deposition method, that is, photochemical deposition (PCD). In PCD, ions in the solution are excited by UV light, and chemical reactions are induced.CdS thin films were deposited from an aqueous solution containing $CdSO_4$and $Na_2S_2O_3$. $S_2O_3^{2-}$ ions absorb the UV light, and release S atoms and electrons. The substrate was immersed at a depth of 2 - 3mm inside the solution and was irradiated with an ultrahigh-pressure mercury arc lamp of 500 W.

In these deposition processes, a thin film was formed in an aqueous solution within a glass beaker. The apparatus is very simple and inexpensive: big expensive machines such as a vacuum chamber and a high-temperature furnace are not needed. Thus, one can easily start deposition experiments, and try a new recipe, a modified apparatus or condition, and even a novel method based on a new principle. On the other hand, some advanced facilities may be needed for material and device characterizations. Material scientists in various countries can make efforts to develop those chemical deposition techniques further in their own place, while the characterization should be carried out with a suitable international collaboration scheme.

Prof. Dr. Mohamad RusopMahmood is Professor/ Head of NANO-SciTech Centre, Institute of Science, UiTM,Malaysia.

Major Field: Opto-Electronic Devices and Technology.

Presentation Title: Dependent of Solar Cell Efficiency on the Characteristics of Nanostructured CuI Thin Films as a Hole Conductor.

Abstract :

The improvement of solid-state dye sensitized solar cells requires identification and understanding of hole transport material properties at various deposition process that limit the energy conversion efficiency. A well-studied of this hole conductor (eg. CuI) properties, a high efficiency ss-DSSC is highly achievable. This research demonstrated the effect of solution concentration of copper (I) iodide (CuI) to the thin films properties and photovoltaic performance. The thin films characteristics of surface morphology and electrical properties and its effect to the photovoltaic performance were investigated. The CuI concentration was varied from 0.01M to 0.09M. The CuI solution was prepared by mixing the CuI powder with 50 ml of acetonitrile as a solvent. A novel method of mist atomization technique has been used for the deposition of CuI materials. For the thin film properties, the surface morphology and electrical properties of CuI thin films which was deposited on the glass substrates were investigated. The result shows the CuI thin film properties strongly depends on its precursor concentration. The nano size CuI particles were observed for all thin films. The electrical properties indicates the increased of conductivity until optimum point of 0.05M concentration. The highest device efficiency obtained in this research is 1.05% for samples deposited at 0.05M concentration. The pore filling issues and electrical conductivity of hole conductor were the main factors contributed to the overall performance of solar cells.

Prof. Dr. Toshikazu Yano, Project Adviser of Foundation for Promotion of Japanese Aerospace Technology (JAST), Japan.

Major Field: Solar Engineering, Biomass Engineering, Thermal-hydraulics, Renewable Energy, Environmental Engineering, Nuclear Safety and Radioactive Engineering.

Presentation Title: Renewable System Utilizing Photovoltaic Cell or Solar Thermal Energy and Thermoelectric Converter Combining Biomass Energy.

Abstract :

Renewable energy system is now expected to realize the sustainable society utilizing the natural energy resources, such as solar, wind, hydraulic, biomass, geo-thermal and etc. The sun is the most general and fundamental energy resource to human beings, therefore, the advantage and disadvantage of solar energy is discussed and the method to fully utilize the performance of solar power by combining biomass energy.

Firstly, various methods of solar energy utilization are discussed from the viewpoint of thermal efficiency among photovoltaic cell, solar thermal energy such as thermal engine and other methods.

Secondly, the specialusage of solar thermal energy is described that the thermoelectric converter is utilized by the solar heat, which was performed under the JST (Japan Science and Technology Agency) program on“Material Technology for Environmental Conservation and Advanced Utilization of Energy” from 2009 to 2011. The fundamental investigation of thermoelectric module was performed and the experimental data was also evaluated.

Thirdly, in the recent study, the combination system between solar and biomass energies is developed to overcome the non-sunshine and unsteady energy characteristics of the sun such as rainy or cloudy weather, the day and night. The biomass system is able to compensate the unsteady energy consumption by applying thermal storage system to the combination system of solar and other renewable energy such as biomass utilization. In the result, the application systems of renewable energy are described concerning the desalination by membrane distillation and disaster prevention of energy source.

Finally, we would like to make the research corporation program among the e-ASIA JRP International Workshop Group especially in the thermal and electric storage system development by utilizing renewable energy combination such as solar and biomass, because thermal storage system is very low cost and it is possible to generate again both the electric power and the heat by utilizing electric power generation system by heat.

Prof. Dr. Osamu Ishitani, Professor of Tokyo Institute of Technology, Japan.

Major Field: Photochemistry.

Presentation Title: Utilization of carbon dioxide using solar light: photo catalytic reduction.

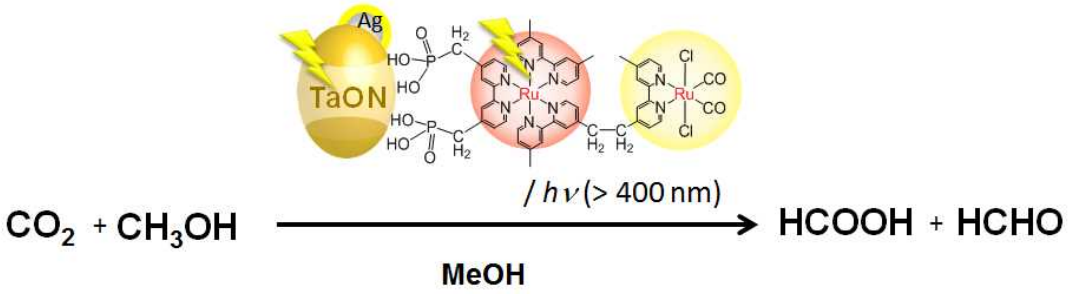
Abstract :

Both the problems of the global warming and shortage of the fossil resources have brought about great interest in photochemical utilization of CO_2 with solar energy. Efficient photo catalysts for CO_2 reduction must be necessary for development of such an important technology.

We have developed novel types of photo catalytic systems using metal complexes and/or semiconductors as a photo catalyst. I will focus on the following systems in my presentation.

(1) Architecture of supramolecular photo catalysts driven with visible light, which can efficiently reduce CO_2 selectively to CO or HCOOH.[1-5]

(2) Z-scheme type photo catalysts by using hybrids composed with the supramolecular photo catalyst and a semiconductor, which can reduce CO_2 with methanol as an electron donor.[6]



Associate Professor Sengratry Kythavone, Department of mechanical Engineering, Faculty of Engineering, National University of Laos

Presentation Title: Experimental Research of Solar Collector with Copper Tube over Steel Plate of U Shape and Solar Boosted Heat Pump

Abstract:

This research conducted on experimental of solar collector with copper tube over steel plate of U shape and solar boosted heat pump.Solar collector is one of the systems of to use solar energy. In general the solar collector almost is put copper tube to collect heat on flat steel plate. In this research new solar collector that has copper tube is put over steel plate with U shape and combination of solar boosted heat pump was proposed. Area of solar collector is 1.56 m^2 with 8 copper tubes. The copper tubes are placed over galvanized steel. Solar radiation can be reflected from U shape galvanized steel or the flat plate to the copper tube. Diameter and length of tube are 15.8 mm and 1.88 m respectively. The solar collector is placed with inclined angle of 18° toward horizon and oriented to the south. Water tank is made of stainless steel with capacity of 125 L. The solar boosted heat pump consists of condenser coil with heat rejected of 1.75 kW, hermetic reciprocating compressor with capacity of 0.35 kW and Evaporating coil absorbed heat of 1.4 kW. From experiment we found that the maximum temperature of water in the tank reaches to 58°C with flow rate of water through the collector of 1 L/min with maximum of solar collector of 48% in case of using solar collector only, and the temperature of water in the tank can reach to 55°C, and the maximum coefficient of performance of heat pump reaches to 4.8.

Keyword: Solar collector, Solar energy, Copper tube, Heat pump

Biomass Energy:

Prof. Dr.Akio Nishijima, professor of Waseda University, Japan.

Major Field: Environment and Energy, Advanced Characterization.

Presentation Title: Biomass Asia Prospect (a region wide collaborative framework)

Abstract :

Since the ASEAN region is rich in biomass resources, collaboration and human development in the field of biomass utilization seems to be one of the most feasible approach toward sustainable development of the region.

We proposed “Biomass Asia Strategy” as a collaborative subject among East Asia to establish equal partnership (2001), and arranged “1st Biomass Asia Workshop” in Tokyo (2003). Based on discussions at 1st workshop and 2nd workshop in Bangkok, bilateral collaboration has been established between Thailand and Japan. Characteristics of the collaboration are “High quality BDF production using partial hydrogenation“, “Feedstock of non-food biomass” and “Practical application to society”. This project (bench scale test) was supported by NEDO and ERIA. Then we moved onto JST/JICA project (SATREPS,) 4years ago. Similar bilateral collaboration has been also carried out with Vietnam and Indonesia, although multilateral (region wide) collaboration is not yet successfully carried out.

Currently, lots of studies on biomass utilization, including many SATREPS projects, have been performed, But real application is not going well due to insufficient understanding and wrong strategy. Integrated process from the inlet (biomass feedstock) to the outlet (end product) will be essential. New approach toward more environmentally friendly biofuels and biomaterial is also necessary for us.

It is now required to establish a region wide collaborative framework for promoting real application of biomass resources. We are planning to collaborate among ASEAN countries for biofuel and biomaterial. We need to consider the benefit of stakeholders as well as total economic principle and social significance.

Based on the above-mentioned idea, we held in Tokyo “the International Policy Dialogue (Regional Collaboration in Science and Technology in East Asia) (2011, 2012) and discussed regional development of human resources and regional collaboration such as nanotechnology and biomass utilization. Last year we proposed to establish “Biomass Open Research Center” (BORC) in ASEAN. Kick-off meeting targeting BORC and “Biomass Asia Consortium” (ABC) will be held in Bangkok on August 30.

Dr. May MyatKhine is Current Activities of Renewable Energy in Myanmar, Ministry of Science and Technology, Myanmar.

Major Field: Biofuels.

Presentation Title: Current Activities of Renewable Energy in Myanmar.

Abstract :

Ministry of Science and Technology (MOST) and other ministries in Republic of Union of Myanmar has been undertaking the activities of renewable energy particularly in the research and development. Micro-hydropower project group designed and constructed 3 kW and 7 kW low head propeller turbines for village-hydropower research in 2009. Under the MOST, three wind turbine projects had been constructed. In the field of solar energy, 3 kW-GTI and 3 KW-GTHS solar modules were installed in Kachin State and Sagaing Region. There are 183 biogas plants which had already developed in the whole country. Many gasfiers that gave mostly 50 kW output had been constructed since 2004. The productions of biodiesel and bioethanol in laboratory scale have been investigating with various methods and raw materials. The biodiesel pilot plant (150 liters/day) had been scaled up. Moreover, 500 gal/day and 3000 gal/day capacity anhydrous ethanol plant had been constructed in 2004. For agricultural development, natural fertilizer, biofertilizer, biopesticide, and natural liquid fertilizer are being produced to reduce the chemical fertilizer used.

Dr. Luong Huu Thanh , Head of Department of Environmental Biology, Institute for Agricultural Environment, Me Tri – Dai Mo -TuLiem- Ha Noi, Viet Nam.

Research on the fields of:

- Microoganism.
- Organic manure and biofertilizer, N-fixation for legume and nonleague crops, P-solubilizing and plan growth promoting microorganisms.
- Composting.
- Water waste treatment, biogas.

Presentation Title: Reuse Agriculture Waste and Organic Waste from Agro-Processing in Vietnam.

Abstract :

Agricultural production and agro-processing in Vietnam has been discharging big amounts of organic waste include crop residues, animal wastes, waste after agro- processing. The waste was not controlled will be causing environmental pollution and waste of organic material. Reuses of agriculture waste and waste from agro-processing are very important in saving materials and protecting the environment. Organic fertilizer from waste can help us save a significant amount of chemical fertilizer as N, P. Biogas system helps us to created new sources of energy for cooking, lighting and protecting the environment.

Ms. Toulaphone KEOKENE, Lecture on Biology, Department of Biology, Faculty of Science, National University of Laos.

Major Field: Plant Physiology, Microbiology.

Presentation Title: Alcohol-tolerant bacteria isolated from Laos.

Abstract :

Recently, butanol has been regarded as one of the most potential alternative liquid transportation fuels. Bioproduction of butanol is the process of great industrial interest, but the application is limited by the toxicity of butanol to bacterial strain. Therefore, solvent tolerance trait of bacteria plays an important role in cost-effective bioproduction processes. In this study, the aim was to isolate and characterize alcohol-tolerant bacteria, focusing on butanol. Organic-solvent tolerant bacteria were screened from different sources such as sledge, waste of starch fermented and soil contaminated with gasoline. All samples were enriched by exposure to various types of solvent: butanol, xylene and benzene. Three organic solvent-tolerant bacterial isolates were obtained using butanol enriched conditions (5%, v/v). The identification of the isolate S1-N1, S1-N3, and S2-N by 16s rRNA sequence analysis revealed that they are *Bacillus altitudinis*, *Staphylococcus* sp.and *Staphylococcussa-prophyticus*, respectively. The alcohol-tolerance test using various concentrations (1.2, 1.4, 1.6, 1.8, 2%, v/v) of short-chain and long-chain length alcohols showed that these isolates could tolerate short-chain alcohols (ethanol, isopropanol and butanol), while the tolerance to long chain alcohols (pentanol, *n*-heptanol and *n*-decyl alcohol) was low. The thermo-tolerant test showed that the three isolates grow optimally at 37ºC than at 45ºC and 60ºC.

Prof. Dr. Mamoru Yamada, Dean for Faculty of Agriculture Yamaguchi University, Japan.

Major Field: Molecular Biology, Applied Microbiology.

Presentation Title: New fermentation technology: High-temperature fermentation with thermotolerant microbes.

Abstract :

Concerning the issues of global warming and increase in running cost, fermentation industries also require new technologies that reduce energy utilized or more efficiently and economically produce useful materials including alternative fuels. With a number of scientists of Thai, Vietnam and Lao, we have achieved the Core University Program (CUP, 1998-2007) on "Development of Thermotolerant Microbial Resources and Their Application" and the Asian Core Program (ACP, 2008-2012) on "Capacity Building and Development of Microbial Potential and Fermentation Technology towards New Era" to isolate and characterize several hundred useful, thermotolerant microbes, develop their application and clarify molecular mechanisms of their fundamental feature of thermotolerance. The further trials have been made by one program of Strategic Funds for the Promotion of Science and Technology, as the MEXT-ARDA project on "High-temperature fermentation technologies (HTFT) with thermotolerant microbes isolated from tropical environments" (2010-2012), which focused on fermentation tests of bio-ethanol, bio-gas, acetic acid and L-lactate production from various biomass in Thailand. HTFT providing various advantages including reduction of cooling cost is expected to become economical next-generation fermentation technologies.

Here, introduced are a part of HTFT developed in the MEXT-ARDA project and the bio-ethanol production at high temperature with *Kluyveromycesmarxianus* and other microbes. HTFT is also very useful for tropical countries because of their stable producibility of useful materials under conditions without a temperature control and thus simple fermentation systems. Further collaborative researches with ASEAN countries will lead the development of various HTFT since there are many different kinds of potential, thermotolerant microbes in tropical environments.

Mr. Chanhom Loinheuang, Lecture on Biology, Department of Biology, Faculty of Science, National University of Laos.

Major Field: Plant Tissue Culture and Microbiology.

Presentation Title: Geographical distribution of Thermo tolerant acetic acid bacteria in Lao PDR.

Abstract :

Lao PDR, Xiengkhuang Province, Luang Prabang Province, Vientiane Province, Bolikhamxay Province and Vientiane Capital. These AAB were isolated by the enrichment culture, which were performed at 37°C in the presence of 1% acetic acid or 4% ethanol. 113 isolates were obtained and characterized. The 77 isolates could grow at 37°C on YPGD with 1% acetic acid and 4% ethanol, 22 isolates with 4% ethanol and 34 isolates with 1% acetic acid. Of these isolates, 13 isolates (SNL81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 52 and SNL65) were selected and examined for their growth at higher temperature (Table 1). Acetic acid production was examined with the 13 isolates, all of which produced 3.0-3.5% of acetic acid from 4% ethanol after 72 hrs incubation at 37°C, whereas Acetobacterpasterianus SKU1108 could produce 3.2% acetic acid (Fig. 3). Of these 13 strains, SNL90 exhibited the highest productivity (~3.5%) and SNL81 produced acetic acid more rapidly. 17 isolates of AAB were identified based on the 16S rDNA analysis. As shown in Table 1, SNL65 and 87 were most closely to Acetobactercibinongenis and Acetobacterpasteurianus, respectively, while all others seemed to be Acetobactertropicalis. Another 4 isolates (SN06, SN21, SN57, and SN66) were also identified with 16S rDNA to be Acetobaterpasteurianus, Acetobacterpasteurianus, Acetobactermalorum, and Gluconobacteroxydans, respectively.

Mr. Boualy VONGVISITH, Deputy Director of Bio-energy Division,
Renewable Energy and New Materials Institute, Ministry of Science and Technology, Lao PDR.

Major Field: Food Engineering and Bioprocess Technology especially bio-ethanol, biodiesel and organic fertilizer production.

Presentation Title: Bio-Ethanol Production by Simultaneous Cassava Starch Hydrolysis and Fermentation Using Screened Microorganisms.

Abstract:

In the present study, the main aim was to select and characterize microorganisms capable of simultaneous cassava starch digestion and ethanol production. Eight samples were collected from waste water treatment areas of the Siam Modified Starch Co. Ltd., Pathumthani in Thailand. There were thirty seven strains which were able to hydrolyze cassava starch. Eight of these strains were able to produce ethanol simultaneously. The strain of $SMS_{1/1}$ gave highest ethanol among screened strains and gave higher level of ethanol production compared to these of standard strain (*Saccharomyces diastaticus*TISTR 5221 and Saccharomyces cerevisiaeTISTR 5049) under the test conditions. Ethanol concentration of 46.5 and 44.66g/l was obtained in modified MRS added with 2% precooked cassava starch at 37°C and 42°C respectively obtained. Ethanol concentration of 44.5 and 43.45 g/l was obtained in modified MRS added with non-cooked cassava starch at 37 °C and 42 °C respectively. The ethanol production was found to be growth associated. Ethanol accumulation was observed during the whole period, with an increased accumulation among the logarithmic growth stage in all tested conditions. The strain $SMS_{1/1}$ was also able to grow and produce ethanol in non-cooked starch. This is of great significance as there is considerable energy saving possible.

Keywords: Bio-ethanol production; simultaneous; cassava starch hydrolysis; fermentation; screened microorganisms.

Dr. Sopheak Rey ,Researcher/lecturer at Department of Industrial and Mechanical Engineering, Institute of Technology of Cambodia.

Major Field: Energy science/Internal combustion engine.

Presentation Title: Development of the Generation Technology by Mixed Combustion of Biomass Fuel.

Abstract :

In Cambodia, electricity access is about 30% at the present and mostly covers in the cities. Therefore, electrification for rural area is in urgent need and early realization is expected. At the present, most of Rural Electrification Enterprise (REE) is the main power producers in the rural area, and is operated by using fossil fuel. The utilization of biomass especially from non-food and wastes for these REEs is not introduced yet. In this research, the development of generation technology was conducted by using mixed combustion of biomass fuel (JatrophaCurcas L. Oil and its derivative waste). The developments of technology are included the fuel oil processing from Jatropha seed, the phosphorous removal from oil, the electric generation by diesel engine using Jatropha oil, the gasification of Jatropha seed cake and wastes and the monitoring toxic substances in the handling processes. The results show that the squeezed oil can meet the standard by the developed phosphorus removal process (up to 10ppm), the performance and exhaust gas emission (NOx and CO) are comparable to that of diesel fuel in medium size engine, the cold gas efficiency is up to 48.7% and toxic substances such as phorbol esters (PEs) from Jatropha oil are not detected in the exhaust gas due to the effect of combustion.

Prof. Dr. Le Anh Tuan, Lecturer of Hanoi University of Science and Technology, Vietnam.

Major Field: Internal Combustion Engine.

Presentation Title: Compatibility of Ethanol-Gasoline Blends with the In-used Engines.

Abstract :

Gasohol E5 has officially introduced in Vietnam market since the beginning of August, 2010. According the national biofuels road map, gasohol E5 and E10 will be mandated in turn in 7 cities from 01/12/2014 and from 01/12/2016; and in the whole country from 01/12/2015 and from 01/12/2017, respectively. With the high potential of ethanol production of an agricultural country as Vietnam, the higher ethanol rate of the blends such as E20 and E85 are expected to be provided to the market in a due course.

Because the major in-used gasoline engines are with high ages and not really compatible with such biofuels, the compatibility of these engines with ethanol-gasoline blends must be investigated. The paper summarizes results of plenty research activities conducted on two wheeler's and four wheeler's engines which were fueled with ethanol-gasoline blends at the rates of ethanol from 5% to 85%. Performance, exhaust emissions and materials/components compatibility of the test engines were investigated and compared with the original ones.

Dr. Deuansavanh PHOMMAVONGSA , Lecturer in the Mechanical Engineering Department, Faculty of Engineering at the National University of Laos (NUOL), Lao PDR.

Major Field: Mechanical engineering: Internal Combustion Engine; Automotive Systems; Fuel and Bio-fuels (bio-diesel).

Presentation Title: The Relationship Between Composition, Fuel properties, Combustion and Emission Characteristics of Biodiesel Fuel.

Abstract :

As the biodiesel fuel (BDF) industries mature, more raw materials becoming available, BDF producers will probably move towards making BDF from blends of fatty oils, in order to minimize raw material cost while precisely complying with the qualities demanded by intended BDF standards. Prerequisite to this is the existence of an adequately accurate method to predict fuel properties of BDFs based on their fatty acids composition and an assurance that the predicted fuel properties will be compatible with real combustion, performance and emission in engines. The BDF blends (JCME, JPME and SPME), and pure (PME, JME, CME and SME) were used as test fuels. This work first developed the correlations to

predict BDF properties from pure FAME component properties and the fatty acid composition, by "mixing rule" (linear and logarithm). Result: the linear (and sometimes logarithmic mixing rules) prove to be a simple way to predict BDF properties. The comparison between predicted and measured values: BDF properties have the errors within 8% for viscosities, 4% for cetane number (CN) and iodine values and 2% for densities (ρ) and heating values (HV). Second work, to gain understanding on the compatibility of performance, combustion, and emissions in real engines with predicted fuel properties. It was found that the properties of BDFs have a substantial impact on engine performance and emissions. The properties of ρ, CN, HV and oxygen content (O2) were found to be highly linear function correlated with brake thermal efficiency (BTE); BTE ≈ flinear[(ρ)/(CN).(O2)] , brake specific fuel consumption (BSFC); BSFC ≈ flinear[(ρ).(HV)] and emissions; NOx, THC, CO and Smoke ≈ flinear[(CN).(O2)/ (ρ)]. Furthermore, the blended BDFs JCME, JPME and SPME are the solution of better BTE, BSFC and emissions than pure JME, CME (for BSFC) and SME.
Keywords: Blended biodiesel; properties; composition; prediction; performance; combustion; emissions; diesel engine.

Mr. Syvang Xayyavong, Deputy Director of Renewable Energy Development Division (REDD), Institute of Renewable Energy Promotion (IREP), Ministry of Energy and Mines (MEM), Lao PDR.

Major Field: Biomass.

Presentation Title: Quality Control and Standardization of Biodiesel.

Abstract :

There are several advantages and disadvantages from production and utilization of biodiesel. The advantage of biodiesel as a diesel engine fuel are its portable, renewable, higher combustion efficiency, lower sulfur, higher cetane value, biodegradable and higher flash point and inherent lubricity. Less carbon monoxide, particulate matters, smoke and less hydrocarbons emission and more oxygen content. Another advantage it is domestic origin and it potential to reduce economic dependent on imported petroleum, and also reducing slash and burn and poverty reduction. Biodiesel leads to the easiest and most crucial solution for environmental problems and reduce greenhouse gas emission substantially as well as improve lubricity. Furthermore biodiesel also share for energy security and job creation for local people. However, it has some drawback itself when using biodiesel with diesel engines. The inherent biodiesel characteristics have been found to cause a number of operational problems including severe engine deposits, injector coking, filter plugging, piston ring sticking. Several biodiesel characteristics such as thermal instability, oxidation, polymerization, high viscosity, water absorption, increasing acid are the prime concern to ensure stable fuel properties during its utilization.
Quality is a needed for the long-term successful use, without any technical problems. The final biodiesel quality depends on several factors that reflect its chemical and physical characteristics. The quality of biodiesel can be influenced by a number of factors: the quality of the feedstock; the fatty acid composition of the parent vegetable oil or animal fat; the production process and the other materials used in the process; and the handling and storage. Biodiesel quality can be provided efficiently if its entire manufacturing process is monitored: from monitoring feedstock acidity, assuring complete separation of biodiesel from glycerin, to removing the excess of alcohol and contaminants before its marketing. In addition, storage, testing, blending and distribution should include in regulation on quality control and standardization.

Key word: Quality, standardization of biodiesel

Mr. Houmpheng THEUAMBOUNMY , Director of Alternative Energy Divisions, Renewable Energy and New Material Institute, Ministry of Science and Technology, Lao PDR.

Major Field: Renewable Energy Technologies.

Presentation Title 1: Enzymatic Saccharification and Fermentation Technology for Ethanol Production from Lignocelluloses Biomass (Using waste of Jatropha as substrate).

Abstract 1 :

In Research, enzymatic saccharification was used instead of using sulfuric acid to hydrolyses cellulose in biomass to free glucose sugar for further ethanol fermentation. The effective of substrate size and enzyme dose to hydrolyse glucose yield were studied. The waste from Jatrophacurcas (stem and fruit husk) were used as substrate. The substrate was first pretreated by cutter milling and then ball milling for 30 mins and 120 mins. Enzyme saccharification with enzyme mixture containing cellulase, β-glucosidase, and hemicellulase, and subsequent ethanol fermentation by *saccharomyces cerevisiae* were evaluated for all substrates form 10% to 15% of substrate concentration, Enzymatic saccharification with 15% substrate concentration resulted glucose yield 89.2% from jatropha stem and ethanol yield 0.2 liter of ethanol per kilogram of dry jatropha stem, with fermentation of jatropha husk given 87.5 % of ethanol yield or 0.14 liter of ethanol per kilogram of dry jatropha husk.

Presentation Title 2: Studies on Biodiesel Production Using Freshwater Algae.

Abstract 2:

Biofuel development is currently a national issue of Laos for reduction of import fuel oil, sustainable supply of fuels, and reduction of greenhouse gas emission. Oil crop plantation has resulted in low yields of oil. Therefore, biofuel development using freshwater algae in Laos seemed critical. Tobe acquainted with skills for isolation oil-producing algae from natural environments, algae cultivation, oil content measurement, and oil extraction, here I conducted studies on oil-producing micro-algae. The research consisted of in two main parts. In Part 1, new oil-producing algal strainswere isolated from natural environments. Five oil-producing algae species (3 species from freshwater including *Botryococcusbraunii* and 2 species from brackish water) were isolated from Atsumi peninsula, Japan.In Part 2, effects of various environmental factors on oil productivity of *B. braunii*were evaluated.It was firstly found that the oil productivity of *B. braunii* is dependent on temperature. Low temperature treatments (10 ^{o}C and 15 ^{o}C) diminished the oil content by 30% compared to 25 ^{o}C. Secondly, it was found that supplemental ultraviolet-B (UVB) radiation increases the oil accumulation. The oil content of *B.braunii* was doubled after a 1-month supplemental UVB irradiation at 0.02 wm^{-2}.

Mr. Ludovic Branlant, Project Manager Bio-Energy of Lao Institute For Renewable Energy(LIRE).

Major Field: Economics And Specialization: Economy and Law of Energy.

Presentation Title: Detailed Viability Study of Small-Scale Biodiesel Production in Lao PDR and First Pilot Implementation- Key Findings.

Abstract:

The objective of the presentation is to present the key finding of LIRE's biodiesel pilot project that has been developed for 2 years, but also our whole research on biofuel since LIRE's creation with emphasis on Jatropha.

Indeed it is almost 7 years that LIRE investigates the different options for producing biofuels in sustainable way in Lao PDR while benefitting to a wide range of people. LIRE focus its research on a diverse range of feedstock crops.

LIRE's activities in general will be presented following by the presentation of LIRE's pilot project for the establishment of a small-scale biodiesel production (Project background, Project Summary…).

More time will be spending on feedstock itself and its related issues. To conclude a brief economic overview of the biodiesel production will be presented as well as some recommendations for the development of the biofuel sector in Lao PDR.

Mr. Souphavanh KEOVILAY, Director of Livestock Management Division, Department of Livestock and Fisheries, Ministry of Agriculture and Forestry, Lao PDR.

Major Field: Veterinary.

Presentation Title: Lessons from promoting household biogas technology in Lao PDR.

Abstract :

The term 'biogas' is commonly used to refer to a gas which has been produced by the biological breakdown of organic matter in the absence of oxygen. Biogas burns very clean with a flame comparable to that of liquefied petroleum gas (LPG) and can be used directly in a simple low-pressure gas burner.The benefits of biogas are many and tangible. They have been well documented in the areas of energy supply, agriculture, health, sanitation, enterprise improvement, gender and environment.

Biogas is a relatively new technology for Lao PDR with the first digesters having been installed during the period 1995-1999. The Lao Biogas Pilot Project (BBP) was established with the signing of a Program Agreement by the Ministry of Agriculture and Forestry and SNV in November 2006. The Lao BPP is funded by the Dutch government as part of the Asia Biogas Program. Through the implementation of BPP for 6 years, it was found that household biogas technology is well-accepted by farmers in Laos PDR and this helps to improve living standard of rural families. So the BPP is considered as a successful project and household biogas technology should be expanded in a wide range across the country. However, biogas promotion activities are paralyzed because there is no supporting budget. Therefore, searching for new potential donors is in front of the agenda.