

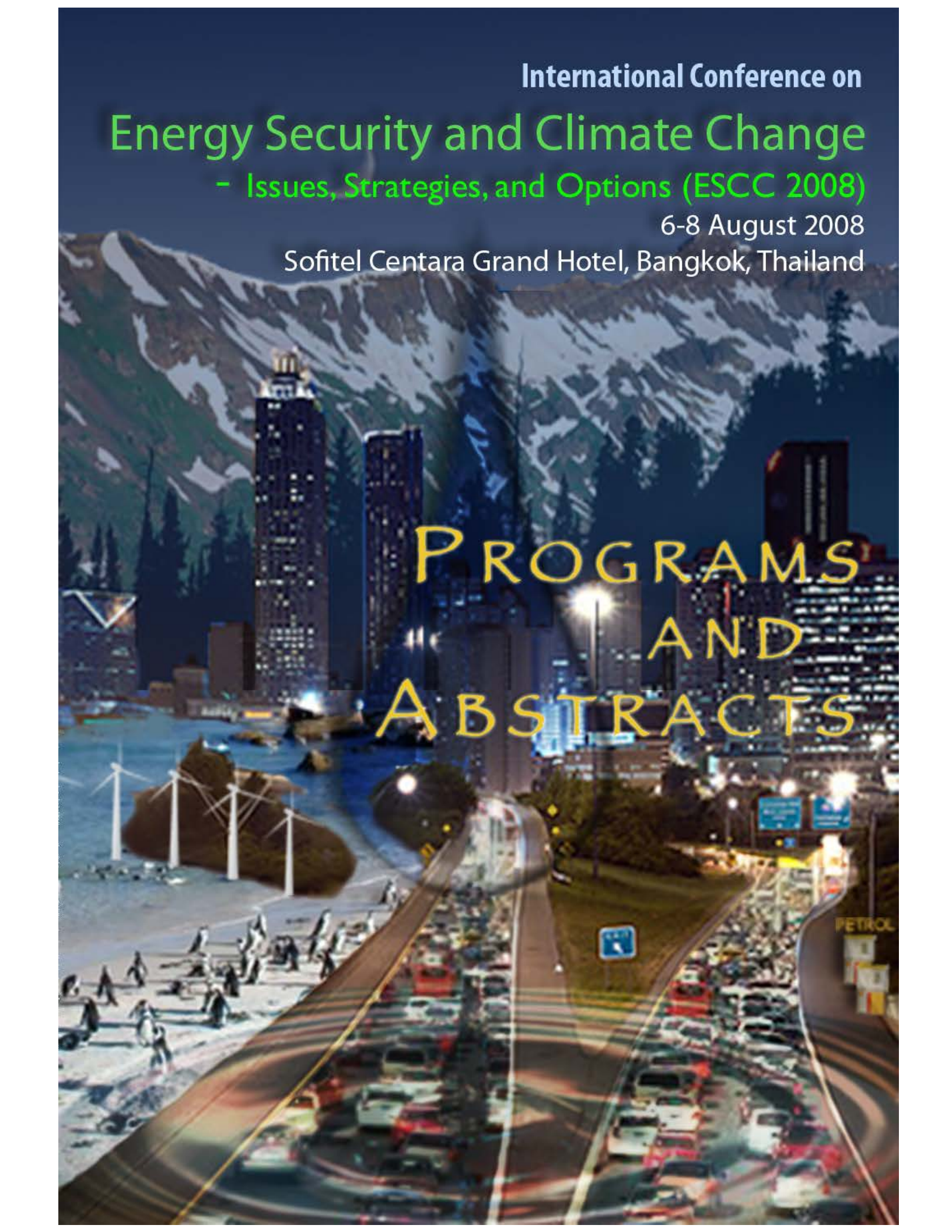
International Conference on

Energy Security and Climate Change

- Issues, Strategies, and Options (ESCC 2008)

6-8 August 2008

Sofitel Centara Grand Hotel, Bangkok, Thailand



PROGRAMS AND ABSTRACTS

CONTENTS

ORGANIZERS	2
PARTNER	2
ORGANIZING COMMITTEE	2
MESSAGE FROM THE CHAIRMAN OF THE ORGANIZING COMMITTEE	3
INTERNATIONAL ADVISORY PANEL	4
ABOUT RERIC	5
VENUE	6
ROOM ASSIGNMENTS	7
PROGRAM AT A GLANCE	8
KEYNOTE ADDRESS	10
KEYNOTE ADDRESS	11
PRESENTATION SCHEDULES	12
DETAILED ABSTRACTS	24
IGES POLICY FORUM RATIONALE	57
TECHNICAL TOURS	58
PARTICIPANTS	60
NOTES	65

ORGANIZERS

Regional Energy Resources and Information Center (RERIC)
Energy Field of Study, Asian Institute of Technology (AIT)

PARTNER

Institute for Global Environmental Strategies (IGES)
2108-11 Kamiyamaguchi, Hayama, Kanagawa
Japan 240-0115

ORGANIZING COMMITTEE

Chair: Prof. Said Irandoust
President
Asian Institute of Technology, Thailand

Members:

Prof. S. Kumar
Dean, SERD, Asian Institute of Technology

Dr. Mithulananthan Nadarajah
Conference Coordinator

Prof. Ram Shrestha
Technical Program Organizer

Dr. Weerakorn Ongsakul
Technical Program Co-Organizer

Maria Kathrina B. Gratuito
Information Professional, RERIC

Parichart Khammeerak
Member, ESCC 2008 Secretariat

MESSAGE FROM THE CHAIRMAN OF THE ORGANIZING COMMITTEE



It is my great pleasure to chair the “International Conference on Energy Security and Climate Change: Issues, Strategies, and Options (ESCC 2008)”. On behalf of the organizing committee, I take this opportunity to welcome you all to this very relevant international conference that addresses important issues the whole world is currently facing.

As energy is essential to all activities for development, more countries are in need of vital energy resources. From developing necessary infrastructures down to providing sustainable human development, energy is very indispensable and crucial. However, fact remains that distribution of energy resources, particularly oil and gas, is very uneven and creates unbalanced progress throughout the world. As countries need to have a secured energy supply for its growth, energy-disadvantaged countries are often at the mercy of power-playing energy-rich countries creating economic troubles, conflicts, and tensions. Therefore, national policies, regional energy strategies, and technologies should be focused on efforts to efficiently utilize the available resources, with a governing principle that considers the environment. The environment should never be sacrificed for development if sustainability is our goal. Fuelling the development of energy-hungry countries puts a toll on the environment as the use of fossil-based energy resources increases global warming leading to climate change. As climate change is the greatest environmental challenge facing the world today, it is therefore essential to bridge energy gaps that create supply and environmental insecurities. A steady and secured supply of sustainable energy can be achieved through energy diversification, greater focus on promotion of cleaner, more efficient and less-polluting technologies, along with greater use of indigenous forms of renewable energy.

This timely conference is organized by the Regional Energy Resources Information Center (RERIC) based in the Energy Field of Study, School of Environment, Resources, and Development, Asian Institute of Technology in partnership with the Institute for Global Environmental Strategies (IGES), Japan and with guidance from the International Advisory Committee. This is a venue to share experiences, report latest developments, showcase new ideas and technologies, and highlight related programs and policies on energy security and climate change. This dynamic international intellectual exchange in which all stakeholders can coordinate, promote and contribute solutions to pressing issues the whole world is confronting will be particularly useful to the members of the academe, research institutions, multilateral and bilateral funding agencies, and government agencies.

I take this great honor to thank the members of the organizing committee, partner, and the sponsors for their esteemed support and cooperation. Finally, I would like to thank the participants for taking this as an opportunity to be part of this timely event to show that we can be part of the solution to our generation’s problems.

Wishing you all a pleasant stay here in Thailand!

Prof. Said Irandoust
President
Asian Institute of Technology

INTERNATIONAL ADVISORY COMMITTEE

David Wood	The University of Newcastle	Australia
Deepak Sharma	University of Technology Sydney	Australia
Binu Parthan	Renewable Energy and Energy Efficiency Partnership	Austria
Gilberto Jannuzzi	Universidade Estadual de Campinas	Brazil
Ibrahim Dincer	University of Ontario Institute of Technology	Canada
John Grace	The University of British Columbia	Canada
Kirsten Halsnæs	Risø National Laboratory	Denmark
Hans-Jürgen Haubrich	RWTH-Aachen University	Germany
S.C. Srivastava	Indian Institute of Technology Kanpur	India
Naoya Tsukamoto	Ministry of the Environment	Japan
Yasuhiro Sasano	Center for Global Environmental Research	Japan
Ancha Srinivasan	Institute for Global Environmental Strategies	Japan
Joo-Sok Suh	Ajou University	South Korea
Won-Woo Lee	Korea Energy Economics Institute	South Korea
Wil L. Kling	Technical University of Eindhoven	The Netherlands
Ferdinand Banks	Uppsala University	Sweden
R.H.B. Exell	King Mongkut Institute of Technology Thonburi	Thailand
Janusz W. Bialek	The University of Edinburgh	United Kingdom
Surabi Menon	Lawrence Berkeley National Laboratory	United States of America
Govinda Timilsina	The World Bank	United States of America
Wesley Foell	Resources Management Associates, Madison	United States of America

ABOUT RERIC

The Regional Energy Resources Information Center (RERIC) was established in 1978 as a result of recommendations made at various meetings held in Asia, and particularly those made at a meeting of experts in solar and wind energy utilization held in 1976 under the energy program of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

RERIC collects, repackages, and disseminates information on energy and environmental issues related to energy. The Center's wide range of activities include publishing, networking, consulting, and other information services for energy conservation and renewable energy promotion.

The current RERIC staff are:

Director:	Dr. Weerakorn Ongsakul
Editor:	Prof. Ram M. Shrestha
Research/Information Professional:	Maria Kathrina B. Gratuito
Secretary:	Parichart Khammeerak

RERIC regularly publishes the International Energy Journal (IEJ) since 1979. It is a journal dedicated to the advancement of knowledge in energy by the vigorous examination and analysis of theories and good practices, and by encouraging innovations needed to establish a successful approach to solve identified problems. IEJ is a quarterly journal that publishes peer-reviewed papers on technical, socio-economic and environmental aspects of energy planning, energy conservation, renewable sources of energy, and electric power transmission, generation and management. The papers are reviewed by world renowned referees. IEJ also maintains an online journal system wherein not only current volumes are available but also archives containing past volumes and past special issues.

RERIC's occasional publications include conference/seminar/workshop proceedings, research reports, directories, environment systems reviewa, and do-it-yourself manuals. For more information about RERIC's publications, please visit www.serd.ait.ac.th/eric. Annual membership fees to RERIC entitles the members to hard copies of the International Energy Journal (IEJ) as well as access to the online journal system at www.ericjournal.ait.ac.th. Members also get 20% discount on other RERIC publications and a discounted rate to trainings/workshops/conference it organizes. Annual membership fees for year 2008 are as follows: USA, Canada, European countries, Australia, New Zealand, Japan, and Middle East (*Individual: US\$ 130, Institutional: US\$ 275*); Thailand (*Individual: THB 1,500, Institutional: THB 5,000*); all other countries not mentioned above (*Individual: US\$ 85, Institutional: US\$ 160*).

VENUE

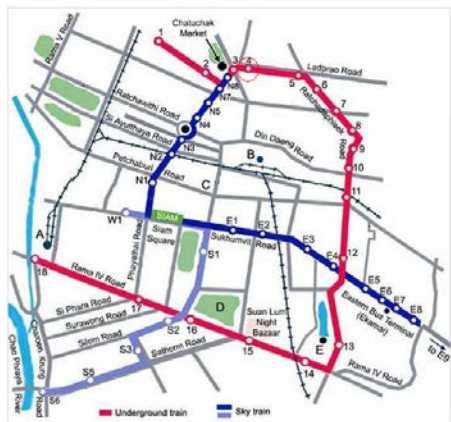
The International Conference on “Energy Security and Climate Change: Issues, Strategies, and Options (ESCC 2008)” will be held in Vibhavadee Ballroom, Sofitel Centara Grand Bangkok, 1695 Paholyothin Road, Chatuchak, Bangkok, Thailand.

Sofitel Centara Grand Bangkok is ideally situated on Vibhavadee Rangsit Highway, amidst the booming business district of Bangkok. It stands adjacent to the renowned Central Plaza Shopping Mall & Bangkok Convention Centre (over 200 shops, boutiques, and multiples cinema combined with ample parking facilities, all under one roof) with the famous Chatuchak Park and Market opposite. It is also linked to the rest of the city by MRT (underground train service) at Phaholyothin Station.

SOFITEL CENTARA GRAND BANGKOK



Train routes showing the linkages between the BTS Skytrain (Siam and Sukhumvit line) and the MRT Subway Train



Another map showing the train routes and the linkages between the BTS Skytrain and the MRT Subway Train

ROOM ASSIGNMENTS

Venue for:

C = Panel Sessions
 = Geopolitical Energy and Climate Policy Issues 1
 = Geopolitical Energy and Climate Policy Issues 2
 = Energy Security
 = IGES Policy Forums

A = Lunch breaks on August 7 and 8
 = Welcome Banquet

Pre-function Area = Coffee and Tea Breaks

Vibhavadee Ballroom
 Level: Lobby

Rangsit – Lad Prao A
 = Renewable Energy
 = Energy Efficiency
 = Power Plants and Energy Industry
 = Emerging Technologies 1
 = Emerging Technologies 2
 = Climate Change Monitoring and Modeling
 = Emerging Technologies 3

Horvang – Lad Prao B
 = Biofuels and Applications 1
 = Biofuels and Applications 2
 = Clean Energy for the Environment
 = Wind Energy Systems
 = Electric Power System Management
 = Energy in Transportation Sector

Sofitel Meeting Rooms
 Level: Mezzanine

Note: As welcome treat of the Sofitel Centara Grand Hotel, the buffet lunch on the first day (6 August) will be at its Suan Bua Restaurant.

PROGRAM AT A GLANCE

KEYNOTE ADDRESS

New paradigm of Low Carbon Society

Rae-Kwon Chung

Ambassador for Climate Change, Ministry of Foreign Affairs and Trade, Republic of Korea

Climate change is pressing us to shift towards a new paradigm of low carbon society from current cheap carbon paradigm. We have to shift from quantity of GDP paradigm towards the quality of GDP based on ecological efficiency. Low carbon paradigm based on high energy efficiency and low fossil fuel and low fossil fuel dependency will improve our economic vulnerability against high oil price and improve energy security while reducing CO₂ emissions which will improve ecological vulnerability against climate change.

Climate action is now increasingly more compatible with energy security as oil prices rise. We have to seize the opportunity to make climate actions to be an integral part of our economic performance by harnessing market mechanism.

Negotiation for Bali Roadmap is now hitting a serious deadlock. While Annex 1 is expecting Non-Annex 1 to accept a certain commitment, Non-Annex 1 is insisting that satisfactory transfer of finance and technology in advance is a condition for any action of Non-Annex 1. We urgently need a breakthrough if we are to save a deal by the end of next year.

Fundamental reason for the deadlock is the idea of imposing a target approach on developing countries. Current debate on climate regime is focusing only on top-down command and control approach emphasizing the role of government while not fully engaging the dynamics of market. CDM is still playing a very limited role in providing market incentives for mitigation investment in developing countries. Major players of global carbon market are developed countries and developing countries are still remaining as bystander. It is not realistic to expect that governments of Annex 1 could play a key role in transferring finance and technology while the private sectors are the major players of technology and finance transfer.

Instead of trying to impose targets on developing countries, it is much more realistic to use incentives for their mitigation in the form of carbon credit. If their Nationally Appropriate Mitigation Actions (NAMA) implemented in a MRV fashion could get carbon credit, then investment for mitigation in developing countries will increase as the commercial viability improves.

Critical factor in up-scaling investment for mitigation is commercial viability. If investment for mitigation in developing countries could generate profit, then investment will increase driven by market dynamism. What is lacking is not money and technology. In fact we have more than enough money and technology. What we are lacking is the mechanism which could improve the commercial viability of investment for mitigation. Giving carbon credit for the verifiable mitigations of developing countries could improve the commercial viability of mitigation investment, thus allowing market dynamism to drive climate action and the private sector could play a primary role.

* Rae-Kwon Chung is currently the Ambassador for Climate Change of the Ministry of Foreign Affairs and Trade (MOFAT), Republic of Korea. Having studied Economics at Sung Kyun Kwan University in Korea, he completed his masters at Georgetown University in Washington DC in 1981. Since the early nineties he has been working in the international political arena, focusing mainly on environmental issues. In his various roles within the Korean Ministry of Foreign Affairs, he has been a part of a number of key global meetings on the environment, including the Rio Earth Summit in 1992. In 1996 he became part of the Permanent Mission of Korea to the United Nations, and was the coordinator for technology transfer of the first Conference of the Parties (COP) of the UN Climate Change Convention (UNCCC). He was also a member of the Global Environment Facility (GEF), and a lead author for an Inter-governmental Panel on Climate Change (IPCC) special report on technology transfer. Prior to his current post, he served as the director of the environment and sustainable division of the United Nations Economics and Social Commission for Asia and the Pacific (UNESCAP).

KEYNOTE ADDRESS

Prof. Ram Manohar Shrestha[†]

[†] Professor Ram M. Shrestha, joined AIT in 1986, and is now a leading expert in the energy economics and environmental policy. His professional experience include having conducted: a comparative study of energy policies in Asian countries; economic analysis of biocoal production; energy cum electricity supply and demand analysis in China; electric utility demand-side management in developing countries; assessment of environmental implications and economics of utility planning in selected Asian countries. His recent research involvements are in the areas of energy, economics, and environmental modeling, environmental and pricing implications of privatization in power sector, greenhouse gas mitigation and energy efficiency improvements, acid rain and emission reduction in Asia, the perspective energy planning of Nepal, performance of electric utilities, independent power producers and electricity pricing, and integrated resource planning and environmental implications.

PRESENTATION SCHEDULES

Day 1: 06 August 2008

S 01: Geopolitical Energy and Policy Issues 1

Time: 10:30 – 12:00

Room Assignment: Vibhavadee Ballroom C

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 01.1	The Security of the Oil Market in Three Northeast Asian Countries Il Hwan Ahn and Suduk Kim <i>Ajou University</i>	Korea
S 01.2	CO₂ Reduction Potential of Biofuels in Asia: Issues and Policy Implications SVRK. Prabhakar and Mark Elders <i>Institute for Global Environmental Strategies (IGES)</i>	Japan
S 01.3	Strengthening ASEAN+3 Renewable Energy Strategies Jane Romero, Mark Elder, Anindya Bhattacharya <i>Institute for Global Environmental Strategies (IGES)</i>	Japan
S 01.4	Impacts of European Emissions Trading Scheme on Italian Power Sector Anula Abeygunawardana, Alberto Berizzi, Cristian Bovo, Mario Innorta <i>Politecnico di Milano</i>	Italy
S 01.5	Oil-Price Vulnerability Index (OPVI) for the Developing Countries of Asia and the Pacific and Policy Application Nandita Mongia UNDP Regional Centre in Bangkok	Thailand

S 02: Renewable Energy

Time: 10:30 – 12:00

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 02.1	Renewable Energy Options for an Island Community Napaporn Phuangpornpitak <i>Kasetsart University Chalermphrakiat Sakonnakhon Province</i>	Thailand
S 02.2	A Sustainable Energy Source for Small Community: Solar Updraft Tower Yuttachai Keawsuntia, Sanguan Patamatamkul, Thamrong Prempridi <i>Vongchavalitkul University</i>	Thailand
S 02.3	An Assessment of Vietnam's Renewable Energy Policy Anindya Bhattacharya, Nguyen Thi Anh Tuyet, Mark Elder <i>Institute for Global Environmental Strategies (IGES)</i>	Japan
S 02.4	Bagasse Energy Cogeneration Potential in the South African Sugar Industry Mashoko Livison, Mbohwa Charles, Kekana M. <i>University of Johannesburg</i>	South Africa
S 02.5	Study of Direct Energy Consumption in Iranian Agricultural Sector Mohammad Esmaeil Asadi, Mohammad Hassan Razzaghi, Hamid Reza Sadeghnezhad <i>Agricultural and Natural Research Center of Golesta</i>	Iran

- | | | |
|--------|---|----------------|
| S 02.6 | Organic Waste Treatment for Power Production and Energy Supply
<i>Abdeen Omer</i> | United Kingdom |
| S 02.7 | The Environmental and Economical Advantages of Agricultural Wastes for Sustainable Development
<i>Abdeen Omer</i> | United Kingdom |

S 03: Biofuels and Applications 1

Time: 10:30 – 12:00

Room Assignment: Horvang – Lad Prao B

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 03.1	Mesua Ferrea Oil: An Environmental Friendly Alternative Fuel For Diesel Engine Biplab Das, S. Deb Barma, Sumita Deb Barma, P. Linghfa <i>North Eastern Regional Institute of Science and Technology</i>	India
S 03.2	Effect of Bioinoculants on Jatropha Curcas (Energy Crop) Under Na₂CO₃ Induced Stress Ashwani Kumar, Satyawati Sharma, Saroj Mishra <i>Indian Institute of Technology Delhi</i>	India
S 03.3	Some Physical Properties of Jatropha Seed (Jatropha curcas L.): In Indian Context Rama Chandra Pradhan, Satya Narayan Naik, Subha Laxmi Pradhan, Naresh Bhatnagar, Virendra Vijay <i>Indian Institute of Technology Delhi</i>	India
S 03.4	Feasibility Study of Jatropha Curcas Oil as a Diesel Substitute in a Single Cylinder Compression Ignition Engine Poonam Gera and Mithilesh Kumar Jha <i>Dr. B.R. Ambedkar National Institute of Technology</i>	India

S 04: Geopolitical Energy and Policy Issues 2

Time: 13:00 – 14:30

Room Assignment: Vibhavadee Ballroom C

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 04.1	Changing Energy Production Structures and CO₂ Emissions in the ASEAN Countries: Decomposition Analysis of Drivers Behind the Changes Jarmo Vehmas, Jyrki Luukkanen, Suvisanna Mustonen, Jari Kaivo-oja, Juha-Pekka Snäkin, Sari Jusi <i>Finland Futures Research Centre</i>	Finland
S 04.2	Regional Energy Resource Development and Energy Security in the Greater Mekong Subregion Countries under CO₂ Mitigation Policy Mayurachat Watcharejyothin and Ram M. Shrestha <i>Asian Institute of Technology</i>	Thailand
S 04.3	Institutional Dimensions of the Emerging Schism between Energy-Environmental Interface in Australia Deepak Sharma <i>University of Technology, Sydney</i>	Australia
S 04.4	A Comprehensive Framework for the Analysis of Long-term Energy Policy Issues in Thailand	Australia

- S 04.5 **Srichattra Chaivongvilan and Deepak Sharma**
University of Technology, Sydney
Electricity Industry Reforms in Thailand: An Analysis of Productivity Australia
 Supannika Wattana and Deepak Sharma
University of Technology, Sydney

S 05: Energy Efficiency

Time: 13:00 – 14:30

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 05.1	Lesson from Vernacular Architecture for Energy Conservation in Buildings Barnabas Nawangwe <i>Makerere University</i>	Uganda
S 05.2	Parameter Improvement for Cooling Load Calculation by the Radiant Time Series Method for Thailand Nisakorn Somsuk and Teerapot Wessapan <i>Eastern Asia University</i>	Thailand
S 05.3	Effectiveness of the Revised Energy Efficiency Standard for a Room Air Condition Unit in Thailand Sarawoot Watechagit, Bunyongvut Chullabodhi, Supphachai Nathaphan, Wichien Ueasomsakul Supphachai <i>Mahidol University</i>	Thailand
S 05.4	Energy Efficiency Standard Revision for Electric Thermo Pot in Thailand Suwat Trutassanwin, Supphachai Nathaphan, Bunyongvut Chullabodhi, Wichien Ueasomsakul, and Sayan Attawan <i>Mahidol University</i>	Thailand
S 05.5	Energy Efficiency in Buildings and Appliances: Key Barriers and Promotional Initiatives Binu Parthan* and Udo Bachhiesl [†] <i>*Renewable Energy and Energy Efficiency Partnership (REEEP)</i> <i>[†]IEE, Graz University of Technology</i>	Austria

S 06: Biofuels and Applications 2

Time: 13:00 – 14:30

Room Assignment: Horvang – Lad Prao B

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 06.1	Experimental Investigations of Particulate Emitted by an Alcohol Fuelled HCCI/CAI Combustion Engine Rakesh Kumar Maurya, Dhananjay Kumar Srivastava, Avinash Kumar Agarwal <i>Indian Institute of Technology Kanpur</i>	India
S 06.2	Effect of Biodiesel Un-saturation on Combustion, Performance and Emission Characteristics of a DI Diesel Engine Sukumar Puhan, Annatha Gopinath, Govinda Nagarajan <i>Anna University</i>	India
S 06.3	Experimental Investigations to Reduce the Smoke Emission of a Rubber Seed Oil Fuelled Diesel Engine through DEE Port	India

Injection

V. Edwin Geo, J. Kamalakannan, G. Nagarajan, B. Nagalingam*

Anna University

*KCG College of Technology**

S 06.4 **Numerical Modeling of Biodiesel Properties from Their Fatty Acid Composition** India

Sukumar Puhan, Annatha Gopinath, Govinda Nagarajan

Anna University

S 06.5 **Usage of Biodiesel in Diesel Engines and its Effect** India

B. Rajendra Prasath, P. Tamil Porai, Mohd F. Shabir

Anna University

S 07: Energy Security

Time: 14:45 – 16:15

Room Assignment: Vibhavadee Ballroom C

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 07.1	External Costs of Energy Security and Climate Change Dalia Streimikiene <i>Lithuanian Energy Institute</i>	Lithuania
S 07.2	Security of Supply Concerns and Environmental Impacts of Electricity Capacity Expansion in Thailand Thanawat Nakawiro and Subhes Bhattacharyya <i>University of Dundee</i>	United Kingdom
S 07.3	Assessment of Nuclear Energy Production in Brazil: Looking for Energy Security Miguel Edgar Morales Udaeta, Jonathas Luiz de Oliveira Bernal, Paulo Hélio Kanayama, Luiz Claudio Ribeiro Galvão <i>University of Sao Paulo</i>	Brazil
S 07.4	Energy Security and the Developing Country: Issues, Strategies and Options Javed Anwar <i>International Islamic University</i>	Pakistan
S 07.5	A Real-Option Approach on Energy Security Appraisal Shih-Mo Lin*, Yuan-Chin Chen [†] , and Chih-Hsiung Tzeng* *Chung Yuan Christian University [†] Kainan University	Taiwan

S 08: Power Plants and Energy Industry

Time: 14:45 – 16:15

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 08.1	Contribution of Decentralized Energy System as Climate Change Mitigation Option – an Analysis of District Cooling System and Power Plant (DCAP) at Suvarnabhumi Airport, Thailand Wantana Somcharoenwattana [#] , Christoph Menke [#] , Darunporn Kamolpus*, Dusan Gvozdenac ⁺ <i>JGSEE, King Mongkut's University of Technology Thonburi[#], District Cooling System and Power Plant Co., Ltd. (Thailand)*, University of Novi Sad (Serbia)⁺</i>	Thailand

S 08.2	Technical and Policy Assessment for Energy Efficiency Improvements and Greenhouse Gas Emission Reductions in Thailand's Cement Industry Ali Hasanbeigi and Christoph Menke <i>Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi</i>	Thailand
S 08.3	Cost Model of a Small Generator as a Resource of Virtual Power Plant Petri Trygg, Sami Repo, Pertti Järventausta <i>Tampere University of Technology</i>	Finland
S 08.4	Life Cycle Analysis of a 300 MW Coal-Fired Plant In Malaysia P.N. Panjaitan, Prof. Madya, Dr. Mohd. Hariffin Bin Boosroh <i>Universiti Tenaga Nasional</i>	Malaysia
S 08.5	Exergy Analysis of a Steam Power Plant in Iran Mofid Gorji-bandpy, Sajad Soleimani pour, Niki Molana <i>Babol University of Technology</i>	Iran

S 09: Clean Energy for the Environment

Time: 14:45 – 16:15

Room Assignment: Horvang – Lad Prao B

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 09.1	Development of Absorbent for Separating Carbon Dioxide from Power Plant Flue Gases Ho-Jun Song, Joon-Ho Lee, Jong-Jin Park, Ankur Gaur, Jin-Won Park, Kyung-Ryong Jang*, Jae-Goo Shim*, Jun-Han Kim* <i>Yonsei University Korea Electric Power Research Institute*</i>	Korea
S 09.2	Nanoscale Investigations for Resource Development of Clean, Green and Renewable Energy Packages R.B. Choudhary and M.K. Jha <i>National Institute of Technology, Jalandhar</i>	India
S 09.3	Life Cycle Energy Analysis of a Natural Gas Refinery Ali Akbari, E. Mousavai, F. Mhdizadeh, Mehrmoosh Sarcheshmehpoor, Shiva Tatina <i>University of Tehran</i>	Iran
S 09.4	Water Pollution Impact Assessment on Environment of Cachar Paper Mill - A Case Study Sanjoy Kumar Dey and Rajat Gupta <i>National Institute of Technology Silchar</i>	India

Day 2: 07 August 2008

S 10: IGES Policy Forum – Enhancing Energy Security in Asia (through energy efficiency and energy diversification) and Implications for the Post-2012 regime

Time: 09:45 – 12:15

Room Assignment: Vibhavadee Ballroom C

Chairperson: Prof. Hironori Hamanaka, Chair of the Board of Directors, IGES

Opening Remarks

Prof. Hironori Hamanaka

Institute for Global Environmental Strategies

Scope/Overview of IGES Consultations on the Post-2012 Climate Regime

Dr. Ancha Srinivasan

Institute for Global Environmental Strategies

Framing Presentation Thailand

Prof. Ram M. Shrestha

Asian Institute of Technology

Energy Security, Rural Electrification, and Market based UK

Climate Change Intervention by the Global Environmental (Germany)

Facility in India

Dr. Ruediger Haum

University of Sussex, and Free University of Berlin

Policy Options for India's Energy Security vis-à-vis Climate India

Change: The Gaps and the Way Forward

Dr. Rupanwita Dash and Dr. Neha Pahuja

Emergent Ventures India

Energy Efficiency and Renewable Energy Policies in Korea: Korea

Implications for the Post-2012 Climate Regime

Dr. Myung-Kyoon Lee

Keimyung University

Next Steps in the Chinese Iron and Steel Power Sectors? Sectoral United

CDM and Joint Commitments Kingdom

Dr. Christian Ellermann

Oxford University

General Discussion

S 11: Emerging Technologies 1

Time: 09:45 – 11:15

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 11.1	Analytical Modeling of Partial Shading of Photovoltaic Modules in a Solar Power Generation System Yaw-Juen Wang and Po-Chun Hsu <i>National Yunlin University of Science and Technology</i>	Taiwan
S 11.2	Development of a Piecewise Linear Parallel Branches Model for Solar Cell Module Yaw-Juen Wang and Po-Chun Hsu <i>National Yunlin University of Science and Technology</i>	Taiwan
S 11.3	Utilizing Sea Pressure as a Source of Power for Autonomous Underwater Vehicles - An Approach Harsha Vardhan, Sukanta Roy, Gagan Kumar Deka, Prasenjit Paul <i>National Institute of Technology Karnataka</i>	India
S 11.4	A Study of Fuel Cell CHP-Technology using LEAP-Model Seung-bok Shin, Jung-Hwa Jang, Sooyoung Jun, Jaehoon Lee, Dal Chand Spah, Jin-won Park <i>Yonsei University</i>	Korea

S 12: Wind Energy Systems

Time: 09:45 – 11:15

Room Assignment: Horvang – Lad Prao B

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 12.1	Comparative Study of a Three-bladed H-Darrieus Rotor With a Two-Bladed H-Darrieus Rotor With Various H/D Ratios	India

	Biplab Das and Rajat Gupta <i>National Institute of Technology, Silchar</i>	
S 12.2	Control of Grid-Side Voltage Source Converter Using Active and Reactive Current Components for Wind Energy System Suksan Wangsathitwong, Somporn Sirisumrannukul, Somchai Chatratana*, Werner Deleroi ⁺ <i>King Mongkut's University of Technology North Bangkok National Science and Technology Development Agency (NSTDA), Thailand*</i>	Thailand
S 12.3	Field Oriented Controlled Cage Rotor Induction Generator for Optimal Wind Energy System Watthana Seubkinorn, Bunlung Neammanee, Somporn Sirisumrannukul <i>King Mongkut's University of Technology North Bangkok</i>	Thailand
S 12.4	Wind Energy in Thailand to Enhance Energy Security: Potential, Status and Barriers Devbratta Thakur and Mithulananthan Nadarajah <i>Asian Institute of Technology</i>	Thailand

S 13: IGES Policy Forum – Sectoral Approaches in Post-2012 Regime: Linking Energy Security and Climate Change in Asia

Time: 13:15 – 15:15

Room Assignment: Vibhavadee Ballroom C

Chairperson: Dr. Myung-Kyoon Lee, Keimyung University, Republic of Korea

	Framing Presentation	Japan
	Dr. Kentaro Tamura <i>Institute for Global and Environmental Strategies (IGES)</i>	
	Japan's View on Sectoral Approaches	Japan
	Mr. Hiroaki Takiguchi Ministry of Environment	
	Connecting Climate Protection and Energy Security – The Asia-Pacific Partnership on Clean Development and Climate and its Influence on the Post-2012 Climate Change Regime	Germany
	Dr. Christopher Holtwisch <i>Hagen University and Fraunhofer Institute UMSICHT</i>	
	A Preliminary Analysis of Prospects for Application of Sectoral Approaches in Transportation	Japan
	Dr. Atit Tippichai and Dr. Atsushi Fukuda <i>Nihon University</i>	
	Energy Security and GHG mitigation in Asia	Indonesia
	Dr. Joseph Hwang <i>PT Gikoko Kogyo Indonesia</i>	
	General Discussion	

S 14: Emerging Technologies 2

Time: 13:15 – 14:45

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 14.1	Effects of Temperature and Methanol Concentration to the Yield of Bagasse to Gasoline at Two Stages Fixed Bed Reactor Using	Indonesia

	Iron Sulfate as the Catalyst Sri Haryati, Erfina Oktariani, Sri Rizki PP <i>Sriwijaya University</i>	
S 14.2	Effects of the Strength of Electromagnetic Field and Temperature on the Inherent Moisture of Brown Coal in Electrothermal Dewatering Brown Coal (EDBC) Process Muhammad D. Bustan and Triana Prihatin <i>Sriwijaya University</i>	Indonesia
S 14.3	Termokinetic Parameters of Pulverised Coal Michal Zidek and Jiri Horak <i>VSB-Technical University</i>	Czech Republic
S 14.4	Thermochemical Study of Biogas Autothermal Reforming Sompop Jarungthammachote* and Maria Kathrina B. Gratuito ⁺ <i>Kasetsart University Si Racha Campus*</i> <i>Asian Institute of Technology⁺</i>	Thailand

S 15: Electric Power System Management

Time: 13:15 – 14:45

Room Assignment: Horvang – Lad Prao B

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 15.1	The Interconnection in Active Distribution Networks Phuong H. Nguyen, Wil L. Kling, Johanna M.A. Myrzik <i>Eindhoven University of Technology</i>	The Netherlands
S 15.2	ANN Application for Identifying the Suitable Location for Installation of Unified Power Flow Controller P.S. Venkataramu, Minyraj Modi, C.S.Veena, T. Ananthapadmanabha <i>GyanGanga Institute of Technology and Management</i>	India
S 15.3	Harmonics-Constrained Optimal Placement and Sizing of Capacitor Banks for Loss Reduction by a Particle Swarm Technique Suwit Auchariyamet, Tawat Sirisangas, Somporn Sirsumrannukul <i>King Mongkut's University of Technology North Bangkok</i>	Thailand
S 15.4	Maximizing Reliability Benefit from Distributed Generation in Distribution Systems by Tabu Search Nattachote Rugthaicharoencheep, Yuttana Eamsomboon, Somporn Sirsumrannukul <i>King Mongkut's University of Technology North Bangkok</i>	Thailand
S 15.5	Captive Power Wheeling for Peak Load Management C. A. Babu and S. Ashok <i>National Institute of Technology Calicut</i>	India
S 15.6	Development of New Tools to Target Power Requirement in a Power Utilization Network Zalina Mat Nawi and Zainuddin Abdul Manan* <i>Universiti Malaysia Terengganu</i> <i>Universiti Teknologi Malaysia*</i>	Malaysia
S 15.7	Contributions of Individual Generators to Power Flows and Losses Using Modified Proportional Tree Method Mohd Herwan Sulaiman, Mohd Wazir Mustafa*, Omar Aliman, Ismail Daut, Mohamad Suhaizal Abu Hassan <i>Universiti Malaysia Perlis (UniMAP)</i> <i>Universiti Teknologi Malaysia (UTM)*</i>	Malaysia

S 16: IGES Policy Forum – Panel Discussion on Enabling Conditions (Technology, Finance and Capacity Building)

Time: 15:30 – 18:00

Room Assignment: Vibhavadee Ballroom C

Chairperson: Dr. Ancha Srinivasan, Institute for Global Environmental Strategies

Framing Presentation	Japan
Ms. Maricor Muzones <i>Institute for Global Environmental Strategies (IGES)</i>	
Carbon Taxation in China –Possible and Potential Choice	China
Prof. Mao Xianqiang and Dr. Xing Youkai <i>Beijing Normal University</i>	
Navigating the Marketplace Towards a Pro-Poor, Community-based Climate Strategy in an Era of Global and Regional Energy Insecurity	USA
Dr. Jacob Park <i>Green Mountain College</i>	
Stakeholders’ Perspective: China	China
Dr. Fu Jiafeng <i>Ministry of Environmental Protection</i>	
Stakeholders’ Perspective: India	India
Dr. Laxman Prasad <i>Ministry of Science and Technology</i>	
Stakeholders’ Perspective: Germany	Germany
<i>GTZ Office Thailand</i>	
Stakeholders’ Perspective: Philippines	Philippines
Ms. Leisl C. Lim <i>Presidential Task Force on Climate Change</i>	
Stakeholders’ Perspective: Thailand	Thailand
Mr. Somkiat Sutiratana <i>Ministry of Energy</i>	
International Organization Perspective: UNESCAP	Thailand
Masakazu Ichimura <i>United Nations Economic and Social Commission for Asia and the Pacific</i>	
General Discussion	

S 17: Climate Change Monitoring and Modeling

Time: 15:30 – 17:00

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 17.1	Mathematical Model Simulation for Climatic Factors Based on GMS-6 Satellite Image Sequence Analysis Chairote Yaiprasert, Krisanadej Jaroensutasinee, Mullica Jaroensutasinee <i>Walailak University</i>	Thailand
S 17.2	Wind Power and Climate Change in the UK Lucy Cradden, Gareth Harrison, John Chick <i>University of Edinburgh</i>	United Kingdom
S 17.3	A Web-based Weather Monitoring Network in the City of Palermo Giorgio Beccali, Maurizio Cellura, Simona Culotta, Valerio Lo	Italy

	Brano, Antonino Marvuglia <i>University of Palermo</i>	
S 17.4	Sensitivity Experiments of Two Convection Parameterization Schemes in Regional Climate Model RegCM3 for Part of Southeast Asia Mega Octaviani and Kasemsan Manomaiphiboon <i>Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi</i>	Thailand
S 17.5	Comparison of Carbon Emission Factors from Ox and Buffalo Farms and Slaughterhouses in Meat Production Nathawut Thanee, Wut Dankittikul, and Prayong Keeratiurai <i>Suranaree University of Technology</i>	Thailand
S 17.6	Life Cycle Inventory of Carbon in Rubber Tree Plantation and Utilization in Thailand: Potential Carbon Sequestration in Soil and Rubber Tree Supawan Petsri and Amnat Chidthaisong <i>Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi Thailand</i>	Thailand
S 17.7	Modeling of Least Cost Climate Mitigation: Does it Work on the Ground? Experiences from Asia and the Pacific Region Nandita Mongia <i>UNDP Regional Centre in Bangkok</i>	Thailand

S 18: Energy in Transportation Sector

Time: 15:30 – 17:00

Room Assignment: Horvang – Lad Prao B

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 18.1	Present Status of the Vehicle Fuel Economy Standards Development in Thailand Sarawoot Watechagit, Wichien Ueasomsakul, Bunyongvut Chullabodhi, Suppachai Duangthoughpol, Supphachai Nathaphan <i>Mahidol University</i>	Thailand
S 18.2	Energy Saving Lighting Design of Haul Roads Mangalpady Aruna <i>National Institute of Technology Karnataka</i>	India
S 18.3	Energy Efficiency Analysis on Malaysian Transportation Sector Anwar Al-mofleh, Soib Taib*, Hamzea Algulman ⁺ , Wael Salah <i>University Sains Malaysia</i> <i>CETREE USM, Malaysia*</i> <i>Umm AL-Qura University, Saudi Arabia⁺</i>	Malaysia

Day 3: 08 August 2008

S 19: IGES Policy Forum – Panel Discussion on Bio-energy (including Biofuels)

Time: 08:45 – 10:15

Room Assignment: Vibhavadee Ballroom C

Chairperson:

Framing Presentation Dr. Prabhakar Sivapuram <i>Institute for Global Environmental Strategies (IGES)</i>	Japan
Stakeholders' Perspective: China	China

Dr. Guiyang Zhuang <i>Chinese Academy of Social Sciences</i>	India
Stakeholders' Perspective: India	
Dr. H.L. Sharma <i>Ministry of New and Renewable Energy</i>	
Stakeholders' Perspective: Indonesia	Indonesia
Dr. Teguh Wikan Widodo <i>Indonesian Center for Agricultural Engineering Research and Development</i>	
Stakeholders' Perspective: Sweden	Sweden
Prof. Anders Granlund <i>Swedish Environmental Secretariat for Asia</i>	
Stakeholders' Perspective: Thailand	Thailand
Mr. Amnuay Thongsathity <i>Ministry of Energy</i>	
International Organization's Perspective: UNDP	Thailand
Mr. Thiagarajan Velumail <i>Regional Energy Programme for Poverty Reduction, UNDP</i> <i>Regional Center in Bangkok</i>	
General Discussion	

S 20: Emerging Technologies 3

Time: 08:45 – 10:15

Room Assignment: Rangsit – Lad Prao A

Ref. No.	Title, Authors, Affiliation	Country of Origin
S 20.1	Computational Fluid Dynamics Analysis on Suspension Tower Insulators K. M. Munisamy, N.H. Shuaib, M. Z. Yusoff, H. Hasini, S. Balachandran <i>Universiti Tenaga Nasional</i>	Malaysia
S 20.2	Studies on Bed to Wall Heat Transfer in the Cyclone Separators of Circulating Fluidized Beds Ranjit S. Patil, Pinakeshwar Mahanta, Manmohan Pandey, K.L. Meena, Y.V. Singh, P. Sharma <i>Indian Institute of Technology Guwahati</i>	India
S 20.3	A New Design of Domestic Gases Storage Water Heater to Increase Heat Efficiency Mofid Gorji-bandpy, Saeed Khezri, Tahere Gorji-Bandpy <i>Babol University of Technology</i>	Iran
S 20.4	Study of Performance Improvement Window Air Conditioning Using Water Spray Poonpong Swatdepan, Umphisak Teeboonma, Chawalit Thinongpituak <i>Ubon Ratchathani University</i>	Thailand

S 21: IGES Policy Forum – Panel Discussion on Bali Action Plan

Time: 10:30 – 12:00

Room Assignment: Vibhavadee Ballroom C

Chairperson: Prof. Hironori Hamanaka, Chair of the Board of Directors (IGES)

Framing Presentation	Japan
Eric Zusman <i>Institute for Global Environmental Strategies (IGES)</i>	

Stakeholders' Perspective: Australia Ms. Penny Morton <i>Department of Climate Change</i>	Australia
Stakeholders' Perspective: China Dr. Can Wang <i>Tsinghua University</i>	China
Stakeholders' Perspective: Korea Dr. Kyungsik Choi <i>Korea Environmental Management Corporation</i>	Korea
Stakeholders' Perspective: Indonesia Ms. Maritje Hutapea <i>Ministry of Energy and Mineral Resource</i>	Indonesia
Stakeholders' Perspective: Japan Mr. Hiroaki Takiguchi <i>Ministry of the Environment</i>	Japan
Stakeholders' Perspective: Thailand Aree Wattana Tummakird <i>Ministry of Natural Resources and Environment</i>	Thailand
Stakeholders' Perspective: USA <i>United States Agency for International Development</i>	USA
General Discussion	

Field Trip

DETAILED ABSTRACTS

S 01: Geopolitical Energy and Policy Issues 1

Time: 10:30 – 12:00

Room Assignment: Vibhavadee Ballroom C

S 01.1 **The Security of the Oil Market in Three Northeast Asian Countries**

Il Hwan Ahn¹, Suduk Kim¹

Department of Energy Studies, Graduate School, Ajou University, San 5, Wonchun-dong, Yeongtong-gu, Suwon, Korea, 443-749.

¹ suduk@ajou.ac.kr

This study revisits the question of energy security by examining the supply and demand conditions of the petroleum products market and the refinery capacity of three Northeast Asian countries. (Korea, China, Japan). In 2006, an excess oil demand of 10.6 million b/d (Barrels per day) was observed, and this excess demand is expected to reach 15-22 million b/d by the year 2030 in this regional oil market. This is mainly due to different demand patterns for various petroleum products in each country. Ranking the demand in different markets according to the type of petroleum product, it can be listed as gasoil>gasoline>fuel oil>LPG>naphtha>Kero/jet in Chinese market, gasoil>gasoline>naphtha>Kero/jet>fuel oil>LPG in Japanese market, and naphtha>gasoil>fuel oil>LPG>Kero/jet>gasoline in Korean market. The total CDU (Crude Distillation Unit) capacity of these three Northeast Asian countries has been examined in this respect, too. This study highlights the importance of information on oil demand and supply, on the petroleum products and on refinery capacities of the three northeastern countries to enhance the security of the oil markets in this region.

S 01.2 **CO₂ Reduction Potential of Biofuels in Asia: Issues and Policy Implications**

S.V.R.K. Prabhakar¹ and Mark Elders

Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hayama, Kanagawa, 240 0115, Japan.

¹ sivapuram.prabhakar@gmail.com

Biofuels have attracted significant interest because of their potential to reduce CO₂ emissions, but the extent to which they can actually do so has not been clearly determined. Nevertheless, many countries in the region have either started producing or have plans to produce bioethanol and biodiesel, and have set long term targets for them to replace considerable amounts of fossil fuels. These policies mainly motivated by a desire to enhance energy security and promote rural development, as CO₂ emissions reduction is not a high priority for many Asian countries.

The current paper addresses the question of whether the biofuel promotion strategies of the countries in the region are likely to achieve CO₂ reductions. In order to do this, it will analyze existing life cycle analysis (LCA) studies, mainly conducted outside of Asia and comparing the parameters with conditions in the Asian region in order to determine how the results obtained for Asia would differ from the results obtained outside of Asia. In Asia, biofuels are produced from a wide variety of feedstocks, including some that are also cultivated in western countries, such as corn and spent cooking oil, but also several that are not, such as sugarcane, palm oil, jatropha, cassava, and coconut.

There are very few LCA studies carried out in the Asian context. However, the relevant conditions are different in Asian region, for example in terms of input use efficiency and productivity. Since fertilizer, water and energy input use efficiency and crop productivity are important determinants of CO₂ emissions and net energy values of biofuels, we argue that, there is a possibility that the countries in the region may not be able to achieve the CO₂ reduction potential of biofuels reported in the literature.

Inputs such as water, fertilizers, energy and labor would have to be managed more carefully than it has been done in the region if countries want to achieve the full potential of biofuels, not only CO₂ emissions reduction but also energy security, economic development, in a cost effective manner. The current level of energy efficiency in agriculture (unit amount of energy used to produce unit amount of output) in the region is still below world standards. In addition, fertilizer use, which has been one of the important contributors to CO₂ emissions in biofuel production, would have to be strictly managed.

Policy options those promote high input use efficiency would have to be put in place. Any certification system to be put in place should consider the amount of inputs used and their efficiency to produce biofuels. There is a need to promote thorough life cycle analysis of all important feedstocks in the region covering all agro-ecological zones in the region to arrive at realistic estimates of CO2 reduction potential of biofuels.

S 01.3

Strengthening ASEAN+3 Renewable Energy Strategies

Jane Romero¹, Mark Elder, and Anindya Bhattacharya

Institute for Global Environmental Strategies, 2108-11 Kamiyamaguchi, Hayama, Kanagawa 240-0115
Japan.

¹ romero@iges.or.jp.

ASEAN+3 countries have committed to promote renewable energy through regional cooperation (for example, the June 2004 Ministerial Statement "Forging Closer ASEAN+3 Energy Partnership and the January 2007 Cebu Declaration on East Asian Energy Security), and many have also established national renewable energy promotion policies. Despite these good intentions, renewable energy utilization in the region remains very low, and the region's enormous physical potential is largely unused. In many cases policies are weaker than they appear or suffer from inadequate funding or implementation.

This is surprising since East Asian countries have very strong incentives to prioritize and invest in renewable energy, as well has vast untapped physical potential. Renewable energy would be enormously helpful in helping East Asian countries achieve urgent policy goals such as enhancing energy security, economic growth, poverty reduction, rural electrification, not to mention reducing GHG emissions. This study will examine why various national policies are less effective than expected, focusing on the ASEAN+3 countries, and why regional cooperation, which was already agreed on, has not been fully implemented. Based on this analysis, this study will make policy recommendations for how national and regional renewable energy policies in East Asia can be made more effective.

S 01.4

Impacts of the European Union Emissions Trading Scheme on the Italian Power Sector

*A.M.A.K. Abeygunawardana*¹, A. Berizzi*¹, C. Bovo* and M. Innorta**

Department of Energy, Politecnico di Milano, Bovisa Campus, 34, Via La Masa, 20156 Milan, Italy.

¹ anula.abeygunawardana@polimi.it.

This paper assesses the impacts of the European Union Emissions Trading Scheme (EU ETS) on the Italian power sector using a detailed electricity market model. The proposed model for the Italian electricity market is formulated in a realistic and flexible framework. This model is more realistic than the models proposed for the Italian market by other studies, as it can be used when price elasticity of electricity demand is zero (the electricity demand in Italy is price inelastic) and it includes Italy's large transmission network with its constraints. The proposed model can also be used to analyze the level of competitive development in Italy's recently liberalized electricity market.

S 02: Renewable Energy

Time: 10:30 – 12:00

Room Assignment: Rangsit – Lad Prao A

S 02.1

Renewable Energy Options for an Island Community

N. Phuangpornpitak

Faculty of Science and Engineering, Kasetsart University, Chalermphrakiat Sakonnakhon Province
Campus, Sakonnakhon 47000, Thailand.

napaporn.ph@ku.ac.th

With rising price of oil and other conventional fuels, the world is turning towards renewable energy to enable it to meet the growing demand for electrical power. As an option, solar photovoltaic (PV) is

gaining popularity, though its high initial cost is a major barrier for its widespread use. Moreover, an island that has high potentiality for wind energy, wind turbine to generate electricity can be considered as another option. Wind turbines can supply electricity, both as grid connected and isolated PV/wind/diesel hybrid energy systems. This paper discusses the renewable energy options for a rural (island) village. The system includes PV array, wind turbine, diesel generator, bi-directional inverter and battery storage. The detailed analysis of the system arrangements for provision of electricity and accompanying problems are considered. The paper also analyzes an optimized hybrid energy system that would make use of available resources (solar photovoltaic, wind sites and diesel generators, etc.) to improve electricity service and lower costs to end-users.

The results of the analysis show that there are potential niche markets for hybrid power supply system for application in an island community. Their attractiveness is enhanced due to the rising cost of fossil fuel-based transportation and the difficulty in extending the distribution system over the island. The renewable energy fraction of the designed hybrid system was found to be 40% which would reduce diesel consumption at 113,332 liters/year as compared to the diesel generating system. The power from the renewable source can be a significant contribution to the supply. In addition using one large diesel generator that take place far from the village center has reduced the environmental impact such as oil spill and loud noise from the earlier power supply system of using individual 94 set of small diesel generators.

S 02.2 **A Sustainable Energy Source for Small Community: Solar Updraft Tower**
Yuttachai Keawsuntia^{*1}, Sanguan Patamatamkul^{*}, and Thamrong Prempridi^{*}

^{*}Department of Engineering Management, Faculty of Engineering, Vongchavalitkul University 30000, Thailand.

¹keawsa2000@yahoo.com

Solar updraft tower is an alternative technology for energy production that does not cause pollution. A principle of operation is that air underneath a solar collector is heated by solar radiation so that it rises through a tower. The current of rising warm air can be used to drive a turbine and an electrical generator. A computer simulation of the solar updraft tower with 40 meter diameters of solar collector, 0.5 meter above the ground, a tower of 20 meter high and 0.8 meter diameter, utilizing 400 W/m² of solar radiation input, was undertaken. The simulation results showed that with the entrance air velocity input of 0.1 m/s and the ambient air temperature input of 298 Kelvin, the hot air velocity in the tower increased to 23 m/s and the temperature increased to about 350 Kelvin while the pressure and the density of the hot air decreased slightly. If a 16 blades wind turbine with a maximum power coefficient of 0.3 at a tip speed ratio of 1.2 is to be installed in the tower, this air velocity could generate about 1082 Watts, enough to supply electricity for up to 10 families of small community in the rural area.

S 02.3 **An Assessment of Vietnam's Renewable Energy Policy**

Anindya Bhattacharya^{*1}, Nguyen Thi Anh Tuyet⁺, Mark Elder^{*}

^{*}Energy Policy Specialist, Institute for Global Environmental Strategies, Japan.

⁺Dept. of Environmental Management, INEST, Hanoi University of Technology, Vietnam.

¹bhattacharya@iges.or.jp

Introduction - The energy demand in Vietnam in the coming years is expected to increase significantly (14% per year) due to high economic growth (EVN,2006). Vietnam has significant amount of hydro power in the total power mix (around 38%) [1] and potential too. However, the major problem of hydro power generation is the decreasing rain fall and heavy silting in the reservoirs which is affecting the plant load factor and the production of electricity. The immediate effect is increasing amount of expensive imported power from China, and also increased use of natural gas which are the easy and quick substitute for the country. Nevertheless, growth rate of renewable energy (RE) generation is far below the expected level, reaching only around 4% by end of 2025, even though Vietnam has the technical potential for more than 3000 MW of RE power which is around 10% of the expected total installed capacity by 2025.

The purpose of this paper is to analyze Vietnam's current RE policies and to demonstrate a feasible way of achieving a significantly higher share of RE in future to combat the problem of increasing supply deficit, increasing power import and soaring costs of electricity supply. Existing majority of the literatures on energy crisis in Vietnam lack in analysing the impacts of high cost power import on the economy and also how to utilize the available potential of small and mini hydro to its fullest extent to achieve a better level of energy self sufficiency. This study shows a new direction of thinking on how Vietnam can tackle the energy security issue in a cost competitive manner by integrating their renewable energy especially small hydro power development policy with their national energy policy.

S 02.4 Bagasse Energy Cogeneration Potential in the South African Sugar Industry

*Mashoko, L.**, *Mbohwa, C.*, *Kekana, M.*

Department of Quality and Operations Management, University of Johannesburg, Auckland Park
Bunting Road Campus, P. O. Box 524, Auckland Park 2006, Johannesburg, South Africa.

¹ cmbohwa@uj.ac.za

The paper explores the potential energy cogeneration effect of bagasse in the South African sugar industry. At the present moment very few sugar mills are exporting surplus electricity generated to the national grid. There is a need to take advantage of the abundant bagasse that is produced from the sugar industry through more efficient combustion processes to co-generate process steam and electricity for the supply to the grid. The industry also needs to take advantage of available technologies to efficiently generate electricity from bagasse using high pressure steam boilers. Using the current available technology the industry has a potential to produce about 3000 GWh per year and this is about 1.3% of the current generating capacity in South Africa. This translates to a generating capacity of 343 MW. Application of Integrated gasification combined cycle can result in 11000 GWh and this is about 5% of the current generating capacity at Eskom. In terms of MW this is equivalent to a generating capacity of 1255 MW. The other benefit derived from cogeneration is the 1.619 kilo tonnes reduction in the use of coal which also translates to 2.84Mt of carbon dioxide. The cogeneration project will also improve the competitiveness of the sugar industry provided a viable price per KWh of electricity is agreed upon.

S 02.5 Study of Direct Energy Consumption in Iranian Agricultural Sector

*Mohammad E. Asadi*¹*, *Mohammad H. Razzaghi**, and *Hamid R. Sadeghnejad**,

*Department of Agricultural Engineering Research, Agricultural and Natural Resources Research Center
of Golestan Province, Gorgan, Iran

¹ iwc977127@yahoo.com

Agricultural sector is the greatest Iranian economic part after government agencies. Many factors can affect on agricultural products such as water, soil, climate, labor, energy and funds. Among these factors, labor, energy and capital can be substituted. In this research, regression between energy consumption and some factors was estimated by using regression analysis and time series data. Results showed that there are significant positive relation between agricultural sector value added (GDP) and direct energy consumption. There are decreasing trend in direct energy intensity during 1992-2002, but direct energy productivity had increase in mentioned years.

S 02.6 Organic Waste Treatment for Power Production and Energy Supply

Abdeen Mustafa Omer

17 Juniper Court, Forest Road West, Nottingham NG7 4EU, UK
abdeenomer2@yahoo.co.uk

Sudan is enjoyed with abundant solar, wind, hydro, and biomass resources. Like many tropical countries, Sudan has ample biomass resources that can be efficiently exploited in a manner that is both profitable and sustainable. Fuel-wood farming offers cost-effective and environmentally friendly energy solutions for Sudan, with the added benefit of providing sustainable livelihoods in rural areas. Biogas from biomass appears to have potential as an alternative energy in Sudan, which is potentially rich in biomass

resources. This is an overview of some salient points and perspectives of biomass technology in Sudan. This current literature is reviewed regarding the ecological, social, cultural and economic impacts of biomass technology. This article provides an overview of biomass energy activities and highlights future plans concerning optimum technical and economical utilisation of biomass energy available in Sudan.

S 02.7 **The Environmental and Economical Advantages of Agricultural Wastes for Sustainable Development**

Abdeen Mustafa Omer

17 Juniper Court, Forest Road West, Nottingham NG7 4EU, UK
abdeenomer2@yahoo.co.uk

There is strong scientific evidence that the average temperature of the earth's surface is rising. This was a result of the increased concentration of carbon dioxide (CO₂), and other greenhouse gases (GHGs) in the atmosphere as released by burning fossil fuels. This global warming will eventually lead to substantial changes in the world's climate, which will, in turn, have a major impact on human life and the environment. Energy use reductions can be achieved by minimising the energy demand, by rational energy use, by recovering heat and the use of more green energies. This study was a step towards achieving this goal. The adoption of green or sustainable approaches to the way in which society is run is seen as an important strategy in finding a solution to the energy problem. The key factors to reducing and controlling CO₂, which is the major contributor to global warming, are the use of alternative approaches to energy generation and the exploration of how these alternatives are used today and may be used in the future as green energy sources. Even with modest assumptions about the availability of land, comprehensive fuel-wood farming programmes offer significant energy, economic and environmental benefits. These benefits would be dispersed in rural areas where they are greatly needed and can serve as linkages for further rural economic development. The nations as a whole would benefit from savings in foreign exchange, improved energy security, and socio-economic improvements. With a nine-fold increase in forest – plantation cover, the nation's resource base would be greatly improved. The international community would benefit from pollution reduction, climate mitigation, and the increased trading opportunities that arise from new income sources. The non-technical issues, which have recently gained attention, include: (1) Environmental and ecological factors e.g., carbon sequestration, reforestation and revegetation. (2) Renewables as a CO₂ neutral replacement for fossil fuels. (3) Greater recognition of the importance of renewable energy, particularly modern biomass energy carriers, at the policy and planning levels. (4) Greater recognition of the difficulties of gathering good and reliable biomass energy data, and efforts to improve it. (5) Studies on the detrimental health effects of biomass energy particularly from traditional energy users. This article discusses a comprehensive review of biomass energy sources, environment and sustainable development. This includes all the biomass energy technologies, energy efficiency systems, energy conservation scenarios, energy savings and other mitigation measures necessary to reduce climate change.

S 03: Biofuels and Applications 1

Time: 10:30 – 12:00

Room Assignment: Horvang – Lad Prao B

S 03.1 **Mesua Ferrea Oil: An Environmental Friendly Alternative Fuel For Diesel Engine**

*Biplab Das^{*1}, S. Deb Barma[#], Sumita Deb Barma*, and P. Lingfa*

^{*} Department of Mechanical Engineering, North Eastern Regional Institute of Science and Technology, Itanagar, India-791109.

[#] Department of Agricultural Engineering, North Eastern Regional Institute of Science and Technology, Itanagar, India-791109.

¹ biplab.2kmech@gmail.com.

Rapid industrialization and motorization of the world has led to the steep increase in the demand for

petroleum products, which are limited in natural reserves. These finite resources are highly concentrated in certain regions of the world. Therefore, developing nations like India is facing foreign exchange crisis due to import of crude oil. This has led to the search for alternative fuel to meet the requirement of development activities on a sustainable basis. One such alternative fuel is *Mesua ferrea* oil.

In the light of the above points, biodiesel was prepared from *Mesua ferrea* oil and tests were carried out in laboratories of NERIST and Tezpur University, India. Tests were conducted to find the properties like density, viscosity, pour point, flashpoint, and calorific value of biodiesel, which was prepared from fresh *Mesua ferrea* oil and its blend with petroleum diesel. From the investigation, it has been observed that density and viscosity were higher than petroleum diesel. To overcome these disadvantages, *Mesua ferrea* oil was blended with petroleum diesel at different ratios like B5, B10, B15, B20 and B25 (e.g. B25 means 25% biodiesel and 75% petroleum diesel). Engine (Kirloskar 4 stroke diesel engine) performance and exhaust gases (CO and NO) analysis were carried out at different load conditions. Out of all the above five blends B10 showed the best performance that can be used as an alternative to petroleum diesel thereby mitigating the foreign import.

S 03.2 **Effect of Bioinoculants on *Jatropha curcas* (Energy Crop) under Na₂CO₃ Induced Stress**

Ashwani Kumar*, Satyawati Sharma*¹ and Saroj Mishra⁺

*Centre for Rural Development and Technology, Indian Institute of Technology, Delhi, Hauz Khas New Delhi-110016, India.

¹Department of Biochemical Engineering and Biotechnology, Indian Institute of Technology, Delhi, Hauz Khas New Delhi-110016, India.

¹satyawatis@hotmail.com.

The current study is an effort to utilize the potential of bioinoculants (*Azotobacter*, *Microfoss* and endomycorrhizal fungi i.e. AMF) individually and in combinations to increase the germination, survival and plant biomass of *Jatropha curcas* on alkaline wasteland. A pot experiment was conducted by using different concentration of Na₂CO₃ i.e. (0.1%, 0.2%, 0.3%, 0.4%, and 0.5%) at Micromodel, IIT Delhi. The data pertaining to the effect of bioinoculants on different parameters of *Jatropha curcas* were collected and analyzed statistically. The effect of bioinoculants on seed germination (%) at 0.4 % of Na₂CO₃ was found to be in order of; *Azotobacter* + AMF > *Azotobacter* + *Microfoss* ≥ *Azotobacter* > AMF > *Microfoss* > control (no germination) while at 0.5 % Na₂CO₃ germination was almost nil with all treatments. The survival percentage at 0.4 % Na₂CO₃ was maximum with *Azotobacter* + AMF and no survival was observed in case of AMF, *Microfoss* and control at this salt concentrations. The combination of AM fungi and *Azotobacter* significantly improved plant height, shoot diameter, shoot dry weight and leaf relative water content at 0.4 % of Na₂CO₃ over other treatments. This co-inoculation also helped *Jatropha* to tolerate 0.4%, Na₂CO₃ by accumulating soluble sugar and total soluble protein content. For all parameters, the combinations of *Azotobacter* and AMF performed best. However after certain levels of alkalinity, these bioinoculants could not function efficiently and hence resulted in retarded growth of the plants.

S 03.3 **Some Physical Properties of *Jatropha* Seed (*Jatropha curcas* L.): In Indian Context**

Rama C. Pradhan *, Satya N. Naik *¹, Subha Laxmi Pradhan*, Naresh Bhatnagar⁺, and V. K. Vijay*

*Centre for Rural Development and Technology, Indian Institute of Technology, Delhi, Hauz Khas, New Delhi, 110016, India.

⁺ Mechanical Engineering Department, Indian Institute of Technology, Delhi, Hauz Khas, New Delhi, 110016, India

¹ snn@rdat.iitd.ac.in.

Bio-diesel can be produced from oil bearing seeds of many plants grown in the wild like *Jatropha curcas*, and blended with high speed diesel for transport vehicles, generators, railway engines, irrigation pumps, etc. In the process of extracting the *jatropha* seed oil and its derivatives, the seeds undergo a series of unit

operations. Knowledge of the physical properties of seed is essential to facilitate and improve the design of the equipment for harvesting, processing and storage of the seeds. The study was conducted to investigate some physical properties of jatropha seed collected from different states of India. The physical properties studied include oil content, moisture content, seed dimension, thousand seed mass, surface area, sphericity, bulk density, true density, porosity and angle of repose. The oil content of jatropha seed in India is varies between 32% to 39% in different region. Among all the states the average length was highest in Madhya Pradesh and lowest was in Orissa. The average width 11.58 mm was highest for Gujarat and for average thickness it was highest in Madhya Pradesh. The sphericity shows a much closed range among all states and it was highest in case of Orissa. The seeds belong to Madhya Pradesh are highest in surface area (506.21 mm²), true density (790.04 kg/m³) and thousand seed mass (728.72g) as compared to other domains. The bulk density of seed was highest in case of Gujarat where as the porosity was highest for Tamilnadu's seeds. The angle of repose was highest for Rajasthan and lowest in case of Orissa seeds.

S 03.4 **Feasibility Study of Jatropha Curcas Oil as a Diesel Substitute in a Single Cylinder Compression Ignition Engine**

Poonam Chadha Gera*¹, Mithilesh Kumar Jha*

*Department of Chemical Engineering, Dr. B.R.Ambedkar National Institute of Technology, Jalandhar
144011, India

¹ chadhap@nitj.ac.in

Edible and non-edible vegetable oils have been considered as substitutes for, or blends in, diesel fuel. One source of bio-diesel is Jatropha Curcas oil. Characterization of Jatropha Curcas oil sample is essentially important to obtain quality of the product. In this work a few important parameters such as moisture content, acid value and viscosity has been considered and they are determined by experimental methods in the laboratory. Transesterification of Jatropha oil with methanol to obtain bio-diesel was carried out using potassium hydroxide (KOH) catalyst. ASTM standard fuel test performed on the bio-diesel showed encouraging result and thus this bio-diesel can be one of the promising alternative fuels. In the present study an attempt is made to find the effect of reaction parameters on bio-diesel such as effect of moisture and free fatty acids, effect of catalyst type and concentration, effect of reaction temperature etc.

Further the possibility of using bio-diesel without any further treatment, as a fuel for single cylinder compression ignition (diesel) engine is also explored. Various fuel blends were tested from pure diesel to pure bio-diesel. The result shows that emission characteristics are improved while efficiency is to some extent affected. It is also found that NOx emission is increased slightly and amount of hydrocarbon emission is reduced. The study reveals that this fuel has reduced thermal efficiency.

Thus it may be concluded that this bio-diesel may be used as an alternative fuel in diesel engines especially as dilute blends in diesel. This work has shown that bio-diesel has significant potential as an alternative fuel for diesel engines, and deserves more serious consideration as a diesel blend.

S 04: Geopolitical Energy and Policy Issues 2

Time: 13:00 – 14:30

Room Assignment: Vibhavadee Ballroom C

S 04.1 **Changing Energy Production Structures and CO₂ Emissions in the ASEAN Countries: Decomposition Analysis of Drivers Behind the Changes**

Jarmo Vehmas*¹, Jyrki Luukkanen*, Suvisanna Mustonen*, Jari Kaivo-oja[†], Juha-Pekka Snäkin*, Sari Jusi*

*Turku School of Economics, Finland Futures Research Centre, Pinninkatu 47, FI-33100 Tampere, Finland

[†]Turku School of Economics, Finland Futures Research Centre Rehtorinpellonkatu 3, FI-20500 Turku, Finland.

¹ jarmo.vehmas@tse.fi

This study is a comparative analysis of the development of energy intensity and CO₂ emission intensity in the selected ASEAN countries in the years 1980-2005. The reasons and driving forces behind the changes are studied in the article using a complete decomposition methodology. The decomposition analysis explains the changes in energy use or CO₂ emissions with different factors. Traditionally the changes are explained by activity effect, structural effect and intensity effect. The authors provide an analysis of dynamic changes of CO₂ emissions using five different components. The CO₂ emissions per capita are considerable low in many ASEAN countries (except Singapore), but the emissions are increasing fast due to the rapid economic growth and increased reliance on fossil fuels. The emission intensities in the countries have been increasing in the industrialization process, but with shift to more service sector oriented production and higher level of GDP per capita, the intensities can decrease.

S 04.2

Regional Energy Resource Development And Energy Security In The Greater Mekong Subregion Countries Under CO₂ Emission Mitigation Policy

M. Watcharejyothin¹ and Ram M. Shrestha

Energy Field of Study, School of Environment Resources and Development,
Asian Institute of Technology P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand.

¹mayurachat.watcharejyothin@ait.ac.th.

This paper examines the effects of trans-boundary energy trade and the CO₂ emission mitigation policies after 2010 within the Greater Mekong Subregion (GMS). In particular, it is analyzed on energy resource mix, power generation capacity mix, energy system cost, the environment such as CO₂ and NO_x and local emissions (e.g. SO₂) as well as the energy security in the case of the GMS countries during the planning horizon of 2000 – 2035. A MARKAL based integrated energy system model of the subregion including Cambodia, Laos, Myanmar, Thailand and Vietnam is developed to assess the effects of regional energy resource development and trade for meeting the energy demand of these countries. Further, five separated national level MARKAL based energy system models of the five countries are formulated to assess the effects of regional energy resource development under 10 % reduction of CO₂ emission target with four cases i.e. i) restricted trade (base case), ii) unrestricted trade, iii) restricted trade with 10 % reduction of the emission and iv) unrestricted trade with 10% reduction of the emission cases. The study found that the expansion of trade would actively affect to the decreasing of energy systems cost by 17 % and CO₂ emission 3 % less than that of the base case. The cross-border trade policy would greatly provide greater diversification of energy sources for Myanmar and Thailand but it would induce the lower diversification in the energy systems of Cambodia, Laos, and Vietnam. Further, the openness of trade within the region would abate the energy import dependency of the five GMS countries. The study also addresses that the effects of the CO₂ emission target would not significantly affect to the changes of the integrated and individual energy systems costs of them but it tends to cause the lower diversification of energy resources of the countries. In addition, under the condition of unrestricted of energy trade, we found that the abatement of CO₂ by 10 % would against the openness of energy trade and the energy systems of the five GMS countries would not the significant effects in terms of diversification of energy resources and energy import dependency.

S 04.4

A Comprehensive Framework for the Analysis of Long-term Energy Policy Issues in Thailand

Srichattra Chaivongvilan¹ and Deepak Sharma

Energy Planning and Policy Program, University of Technology Sydney (UTS), P.O. Box 123,
Broadway, NSW 2007, Australia.

¹Srichattra.Chaivongvilan@eng.uts.edu.au

Energy is one of the most critical ingredients for economic development and prosperity of any nation, especially for a developing country like Thailand – the country of focus in this paper. The task of providing adequate and reliable energy has however emerged as a challenging policy issue for Thailand, particularly when viewed in the context of the evolving socio-economic dynamics of the country, typified by an energy sector that is in the throes of reform, resource scarcity, energy dependence, industrial

development and economic growth. In order, therefore, to satisfy the expected energy requirements and sustain economic prosperity, effective national energy policies would be needed. A review of the existing energy policies suggests that these policies somewhat narrow, fragmented and insular. They therefore are unlikely to be able to satisfactorily meet the energy needs of Thailand. This deficiency could however – this paper contends – be overcome by taking a fresher perspective on the nature of policy challenges and strategies to redress them. Such a perspective, this paper further argues, could be assisted by adopting a comprehensive framework that would accommodate the specificities of Thailand while integrating the technical, economic, environmental and political dimensions of the energy sector in a cohesive and consistent manner. This paper is an early attempt at developing such a framework.

S 04.5 **Electricity Industry Reforms in Thailand: An Analysis of Productivity**

Supannika Wattana¹ and Deepak Sharma

Energy Planning and Policy Program, University of Technology Sydney (UTS), P.O. Box 123,
Broadway, NSW 2007, Australia.

¹ supannika.wattana@eng.uts.edu.au

Prompted by concerns about poor industry performance, the Thai government initiated a process of reform of the electricity industry in 1992. The first step in the process was the introduction of Independent Power Producer (IPP) and Small Power Producer (SPP) programs, aimed at meeting increasing electricity demand. This was followed by, in the mid-to-late 1990s, a proposal to introduce a market-oriented reform program. This program envisioned significant changes in the industry structure, ownership and regulation. Such changes, argued its proponents, will improve the productivity of the industry and contribute to enhancing the overall economic prosperity. This paper examines the veracity of this argument. A Data Envelopment Analysis (DEA) – based methodology – is employed to measure the productivity of the entire Thai electricity industry and its segments for the period 1980-2006. This method enables the decomposition of productivity changes into technical and efficiency changes, and hence enables one to determine if changes in productivity are due to electricity reform (efficiency gains) or due to autonomous technological improvements. The analysis reveals that the increase in the productivity of the Thai electricity industry over the period 1980-2006 was mainly driven by technological improvements and that industry reform has had insignificant impact on productivity.

S 05: Energy Efficiency

Time: 13:00 – 14:30

Room Assignment: Rangsit – Lad Prao A

S 05.1 **Lessons From Vernacular Architecture For Energy Conservation In Buildings**

Barnabas Nawangwe
Makerere University, Uganda.
nawangwe@tech.mak.ac.ug

Vernacular Architecture is increasingly becoming a subject of major interest not only to architecture theorists, but also to designers and technologists for very many good reasons.

It has now become very apparent, that although technological advancement brings modern civilization to our communities, it also accelerates the disappearance from among our people not only the style of life which has been developed over a span of many centuries but also the very veins of cultural identity which are so vital for the survival of any society.

The onslaught of modern technology has robbed our communities of the construction skills and environmentally sensitive design of their dwellings. “Modern Architecture” is becoming more and more environmentally unfriendly not only to people, but also to the surrounding natural environment, including the excessive use of energy in cooling buildings.

However, the study of vernacular architecture of Uganda is revealing that the use of industrial materials for construction can produce environmentally friendly shelter, responsive to our climate and conserving our dear cultural heritage and the scarce energy resources available.

This paper discusses the problem of inadequate research into environmental issues of modern tropical architecture, analyses results of research done on the environmental qualities of vernacular residential buildings with particular emphasis on efficient energy use, the methodology applied during the study and ends with some conclusions and recommendations.

S 05.2 **Parameter Improvement for Cooling Load Calculation by the Radiant Time Series Method for Thailand**

*Nisakorn Somsuk*¹ and Teerapot Wessapan**

Faculty of Engineering, Eastern Asia University, 200 Rangsit-Nakhon Nayok Rd., Rangsit, Thanyaburi, Pathumthani 12110, Thailand

¹ nisakorn@eau.ac.th

The radiant time series method (RTSM) is a new cooling load calculation method introduced by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE). The method is simpler than the heat balance method (exact solution) and well suited for use in a spreadsheet program. The ASHRAE has a clear sky model for use with the RTSM. The model is used to estimate the solar radiation, which is a major contributor to the heat gain of a building, on a clear sky day. Since the model was initially developed for the atmospheric conditions in the USA, which are quite different from the conditions in Thailand. Therefore, it is appropriate for calculating the cooling loads for the United States. However, it cannot give acceptable results for Thailand. The measured solar radiation data in the United States are used to determine the value of the model parameters; the atmospheric extinction coefficient (B) and the diffuse radiation factor (C). These values are the main references used in an air-conditioning system design. Therefore, the objectives of this study is to find an appropriate atmospheric extinction coefficient and diffuse radiation factor of the ASHRAE clear sky model for Thailand, a tropical country and to increase the accuracy of cooling load calculation to design an air-conditioner used in Thailand. The least square method is used to fit the meteorological solar data and to determine the appropriate parameters. The results found that the model with the revised parameters gives a smaller error of the solar radiations than the model with the unrevised parameters. In other words, the estimated radiations obtained from the revised parameters are much more accurate than the unrevised ones. The model with revised parameters is used with the RTSM to calculate the cooling load of a sample building. An error of the cooling load with the revised parameters is less than 2% compared to 10% for the unrevised parameters, i.e. less approximately 8%, so the efficiency for calculating the cooling load for Thailand will be improved. A consequence of the parameter improvement is that the local solar radiation references are provided for designing air-conditioning system for Thailand. This approach can be applied for other locations, by adjusting these model parameters according to their local sky conditions

S 05.3 **Effectiveness of the Revised Energy Efficiency Standard for A Room Air Condition Unit in Thailand**

Sarawoot Watechagit, Bunyongvut Chullabodhi, Supphachai Nathaphan, Wichien UeasomsakulSupphachai

Office of the Engineering Consultant, Mahidol University, 25/25 Phuthamonthon 4 Road
Salaya, Phuthamonthon 73170, Thailand

egswg@mahidol.ac.th

The energy efficiency standard for a room air condition is one of the first energy efficiency standards for energy usage equipments in Thailand. The program has been established since 1995 by the Electricity Generating Authority of Thailand (EGAT) through the Demand Side Management Program (DSM). The program has been implemented via a voluntary scheme by issuing an energy label, so called label No.5, to the air condition units which pass the required levels of efficiency. Since the starting of the program, the efficiency levels were rescaled 2 times. The current levels were adjusted at the beginning of 2007 (so called a 2006 version). This paper presents the reviewing results of the current efficiency levels. The

main considerations include the comparison of the efficiency levels to the averaged efficiency of the room air condition units in the market, and the feasibility study to strengthening the efficiency levels in the near future. Due to the limitation of necessary technical data, the modified engineering analysis method is developed in order to establish a relationship between the efficiency and the cost of the room air condition unit. Based on the findings, the current No.5 efficiency level is lower than that is of the market by at least 5%. An estimated life-cycle cost analysis shows that the current No.5 efficiency level could be increased up to 20%.

S 05.4

Energy Efficiency Standard Revision for Electric Pot in Thailand

Suwat Trutassanawin*, Bunyongvut Chullabodhi*, Suphachai Nathaphan[†],
Wichien Ueasomsakul*, Sayan Attawan*

*Mechanical Engineering, Faculty of Engineering, Mahidol University, 25/25, Phutthamonthon 4 Rd.,
Salaya, Phutthamonthon, Nakorn Pathom 73170, Thailand

[†]Industrial Engineering, Faculty of Engineering, Mahidol University, 25/25, Phutthamonthon 4 Rd.,
Salaya, Phutthamonthon, Nakorn Pathom 73170, Thailand.

egsts@mahidol.ac.th, egsnh@mahidol.ac.th, egbch@mahidol.ac.th, egwus@mahidol.ac.th

This paper presented the suitable testing conditions and procedures to determine the heating efficiency of electric thermo pots. The electric thermo pots were classified to three ranges according to the water rated volume: less than 2.4 dm³, between 2.4 and 3.0 dm³, and greater than 3.0 dm³. The efficiency testing method was set to comply with conditions of Thailand for the ambient temperature of 25±2 °C and relative humidity of 60±15%. The water temperature measuring positions between one point at the middle of the water and three points (at the center of the 10 cm below the water surface, the middle of the water, and the center of the 10 cm above the bottom) were examined. The energy consumption and time necessary to boil water from the initial temperature of 35 °C to the final temperature of 90 °C (time to the operation of the control if it operated below 90 °C) were recorded for the heating efficiency calculation. Experiments were conducted to evaluate the heating efficiency from total of 85 electric pots. The minimum energy performance standard (MEPS) and high efficiency performance standard (HEPS) values of electric thermo pots equal to 87.82% and 92.74% were proposed for all three rated volumes, respectively.

S 05.5

Energy Efficiency in Buildings and Appliances: Key Barriers and Promotional Initiatives

Binu Parthan^{*1}, and Udo Bachhiesl[†]

*Renewable Energy and Energy Efficiency Partnership (REEEP), VIC D1732, Wagramerstrasse 5,
Vienna, A-1400, Austria.

[†] IEE, Graz University of Technology, Inffeldgasse, 18, Graz, A-8010 – Austria.

¹ bp@reecp.org

Energy efficiency in buildings and appliances is an important issue which needs to be addressed for global energy security. The paper highlights the importance of this sector and identifies the key barriers to development of this opportunity. It also lists the key approaches to promote the development of this market and lists some of the key initiatives in this space. The paper concludes that energy efficiency in buildings and appliances have a key role in curbing energy demand and contributing to energy security and climate change mitigation. Thereafter conclusions are drawn based on the overview provided.

S 06: Biofuels and Applications 2

Time: 13:00 – 14:30

Room Assignment: Horvang – Lad Prao B

S 06.1 Experimental Investigations of Particulate Emitted by an Alcohol Fuelled HCCI/CAI Combustion Engine

Rakesh Kumar Maurya*, Dhananjay Kumar Srivastava*, and Avinash Kumar Agarwal*¹

*Engine Research Laboratory, Indian Institute of Technology Kanpur, Kanpur – 208 016, India.

¹akag@iitk.ac.in.

Environmental concerns have increased significantly world over in the past decade. To fulfill the simultaneous emission requirements for near zero pollutant and low CO₂ levels, which are the challenges of future power-trains, many research studies are currently carried out world over on new engine combustion process, such as Controlled Auto Ignition (CAI) for gasoline engines and the Homogeneous Charge Compression Ignition (HCCI) for diesel engine. These combustion processes have potential of ultra low NO_x and particulate matter (PM) emission in comparison with a conventional gasoline or diesel engine. Regulatory agencies are becoming increasingly concerned with particulate emissions as the health and environmental effects are getting understood better due the rapid development in instrumentation. In this paper, combustion and emission characteristics of an HCCI engine fuelled with methanol were investigated on a modified two-cylinder, four strokes engine. In the investigation, port injection technique is used for preparing homogeneous charge. The experiment is conducted with varying intake air temperature of 120, 130 and 150 °C at different air-fuel ratios, for which stable HCCI combustion is achieved. The experimental results indicate that the engine load or air-fuel ratio has significant effect on the maximum cylinder pressure and its position relative to TDC, the shape of the pressure rise curve and the heat release rate.

The engine exhaust particle sizer (EEPS) was used for size, surface area and mass distributions of soot particles emitted under different operating conditions under different combustion modes. EEPS measures particle size ranging from 5.6 to 560 nanometers with a sizing resolution of 16 channels per decade (a total of 32 channels). Resolving the size distribution 10 times per second allows for the particle size and number distribution measurement in transient conditions. It was found that number and size distribution of soot particles depends on engine load and the width of the size distribution increased with increasing engine load. The number distributions were found to obey log-normal assumption.

S 06.2 Effect of Biodiesel Un-saturation on Combustion, Performance and Emission Characteristics of a DI Diesel Engine

Sukumar Puhan¹, Gopinath. A, Nagarajan. G.

I.C.E Division, Faculty of Mechanical Engineering, Anna University, Guindy, Chennai

¹ sp_anna2006@yahoo.co.in

Many studies have reported that exhaust from biodiesel fuel gives higher oxides of nitrogen or lower, while HC and smoke emissions are significantly lower than that of diesel fuel. Possible explanations are: the physical properties and fatty acid composition of biodiesel affecting the spray and the mixture formation with reduced heat losses. The aim of the present investigation is to study the effect of unsaturated fatty acid composition of biodiesel on combustion, performance and emissions characteristics of a diesel engine. For this experiment thirteen different biodiesel fuels with different fatty acid compositions were selected. The performance and emissions tests on a single cylinder DI diesel engine were conducted using same biodiesel fuels. The results showed that biodiesel having more unsaturated fatty acids emit more oxides of nitrogen and exhibit lower thermal efficiency compared to biodiesel having more saturated acids. Combustion analysis showed that increase in unsaturation tend to reduce the combustion duration and peak cylinder pressure.

S 06.3

Experiment Investigations to Reduce the Smoke Emission of a Rubber Seed Oil Fuelled Diesel Engine Through Dee Port Injection

V. Edwin Geo^{*1}, J. Kamalakannan*, G. Nagarajan*, and B. Nagalingam[†]

^{*}Department of Mechanical Engineering, Anna University, Chennai 600025, India.

[†]Department of Mechanical Engineering, KCG College of Technology, OMR, Karapakkam, Chennai
¹ve_geo@yahoo.com.

Producing and using renewable fuels for transportation is one approach for sustainable energy future for the world. A renewable fuel contributes lesser global climate change. High smoke emission and lower thermal efficiency are the main problems with the use of neat vegetable oils in diesel engines. The present work reports on the utilization of rubber seed oil (RSO) as a primary fuel with Diethyl ether (DEE) as a combustion enhancer in a diesel engine. DEE is recently reported as a renewable fuel and to be a low emission high quality combustion improver. A single cylinder, four stroke, air cooled DI diesel engine having rated output of 4.4 kW at 1500 rpm was used for the experiments. DEE was injected in to the intake port during suction stroke, while Rubber seed oil was injected directly inside the cylinder at the end of compression stroke (23°bTDC). The parameters such as injection timing, duration and quantity of DEE were optimized for different loads. The brake thermal efficiency improves from 26.5 % with neat RSO to a maximum of 28.5 % with DEE injected at the rate of 200 g/h. Results are also indicated a reduction in emissions except NOx level for all loads. Smoke is reduced drastically from 6.1 to 4 BSU with DEE injection. The combustion duration decreases with DEE injection, which will contribute to higher heat release rate in the initial stages of combustion. On the whole it is concluded that DEE can be injected in the inlet port in order to reduce emissions and improve the thermal efficiency of vegetable oil fuelled diesel.

S 06.4

Numerical Modeling of Biodiesel Properties from Their Fatty Acid Composition

Gopinath. A*, Sukumar Puhan^{*1}, Nagarajan. G.*

Internal Combustion Engineering Division, Department of Mechanical Engineering, Anna University, India, Tamil Nadu, Chennai-6000 25.

¹sp_anna2006@yahoo.co.in

Biodiesel fuel is a mixture of mono-alkyl esters of long chain fatty acid derived from vegetable oils. The properties of various individual fatty esters those form a biodiesel determine the overall fuel properties of biodiesel. Recently, there has been a considerable worldwide research on biodiesel qualities, with emphasis on finding the vital fuel properties that influence engine combustion and emissions. In order to understand the fundamental characteristics of biodiesel combustion and emissions, studies of biodiesel properties are required. The objective of the present work is to derive mathematical models to calculate the biodiesel properties (density, viscosity, cetane number, heating value, iodine value, and saponification value) using fatty acid composition. The density, viscosity, cetane number, heating value, iodine value, and saponification value of thirteen different biodiesel fuels (including different blends) were experimentally measured. Six different multiple linear regression models were developed to predict six different properties. The properties and fatty acid composition of eight biodiesel fuels were given as inputs to develop the regression models. The models have yielded R² values between 0.858 and 0.999. The maximum prediction error observed was 0.08 % for density, 2.67 % for viscosity, 5.29 % for cetane number, 2.78 % for heating value, 6.15 % for iodine value, and 7.46 % for saponification value. The models developed in the present work compared with the existing models available in the literature exhibit a close agreement with the experimentally measured values as compared to available literature models.

S 06.5

Usage of Biodiesel in Diesel Engines and its Effect

B.Rajendra Prasath*¹, P. Tamil Porai*, Mohd.F. Shabir*

*Department of Mechanical Engineering, Anna University, Chennai, India.

¹ br_prasath@rediffmail.com

Use of biodiesel in diesel engine is becoming popular due to its advantages such as eco friendly, green fuel, low cost and most importantly the renewable fuel. In the recent scenario of increased diesel fuel cost and environmental issues, the use of biodiesel in internal combustion engines in transport sector provides the energy security along with environmental protection. The chemically treated vegetable oil called biodiesel can be produced from either edible or non edible oils through commonly known transesterification process. In this investigation, biodiesel produced from non edible jatropha oil has been used in a single cylinder water cooled stationary diesel engine to assess the performance and emission characteristics of the engine. The performance characteristics of biodiesel are similar to that of diesel fuel operation and emission levels are lower than the diesel fuel. The effect of automotive emission levels are explicit and have a major role in climatic changes such as ozone layer depletion, acid rain and photochemical smog etc. The use of low cost biodiesel in diesel engines leads to same power output with lower emission levels which in turn leads to global revolution in renewable fuel and also assures the energy security and environmental cleanliness.

S 07: Energy Security

Time: 14:45 – 16:15

Room Assignment: Vibhavadee Ballroom C

S 07.1

External Costs of Energy Security and Climate Change

Dalia Streimikiene

Lithuanian Energy Institute, Breslaujos 3, LT-44403, Kaunas, Lithuania

dalia@mail.lei.lt

This paper presents the external costs of electricity due to climate change and security of energy supply derived during EU Framework 6 project “Cases”. The cost of green house gases emissions is an important component of the total external cost of electricity production. In the framework of the CASES project two approaches were followed to assess global warming. With the first methodology the quantifiable marginal damage costs of climate change were estimated, while with the second one the marginal avoidance costs of GHG emissions based on Meta analysis. The paper will focus on the power sector therefore for external cost of energy security the Value Of Lost Load (VOLL) will be applied. The aggregate value of security of electricity supply can be expressed by multiplying the probability of the intensity, frequency and duration of supply disruptions, i. e. expectation value of the amount of electricity not served by VOLL. The paper discusses external energy cost evaluation methodologies, results of external costs of climate change and energy security assessments provided in CASES project and develop recommendations for the integration of these external costs in decision making in energy sector.

S 07.2

Security of Supply Concerns and Environmental Impacts of Electricity Capacity Expansion in Thailand

Thanawat Nakawiro¹ and Subhes C. Bhattacharyya

Centre for Energy Petroleum and Mineral Law and Policy (CEPMLP), University of Dundee, Dundee DD1 4HN, Scotland, United Kingdom.

¹ t.nakawiro@dundee.ac.uk.

Purpose

To meet its growing electricity demand Thailand needs an extensive expansion of its electricity capacity in the foreseeable future. The country faces twin challenges in this respect:

a) Continued dependence on gas for power generation adversely affects the security of electricity supply by deteriorating fuel diversity and raising vulnerability to the Thai economy.

b) A diversification to other fossil fuels could in turn impose additional environmental degradation.

Therefore, the objective of this paper is to explore an acceptable solution balancing these two concerns.

Methodology/ Approach:

The paper employs the electricity capacity expansion planning approach and simulates alternative capacity expansion paths for Thailand between 2011 and 2025. The analysis contains four scenarios, each of which is also subjected to two fuel price assumptions. The paper also discusses policy options to mitigate supply, price, and environmental risk.

Findings:

It is found from the simulation results that natural gas is likely to remain the major fuel for electricity generation during the planning horizon and consequently the impact from gas dependence to security of supply will continue in the near future. An addition of new coal-fired power plants could improve security of supply but its environmental impact remains a crucial concern. Nuclear power could offer the least cost solution for electricity generation while appreciably reducing environmental emissions but a large scale penetration of this technology within the planning horizon is unlikely.

Note: A part of this paper is based on the previous work of the authors, which has also been accepted for a publication with Energy Policy Journal.

S 07.3

Assessment of Nuclear Energy Production in Brazil Looking for Energy Security

Miguel Edgar Morales Udaeta^{*+1}, Jonathas Luiz de Oliveira Bernal^{*}, Paulo Hélio Kanayama⁺ and Luiz Claudio Ribeiro Galvão⁺

^{*} Energy and Electrotechnical Institute (IEE), University of Sao Paulo (USP), Avenida Professor Luciano Gualberto, 1289 - Cidade Universitária CEP 05508-010 - Butantã - São Paulo, Brazil.

⁺ GEPEA/EPUSP, Brazil.

¹ udaeta@iee.usp.br

Nuclear power stations generate about 17% (PNUD, 2007) of the world's electricity and when carrying out a financial and economic analysis, it is always important to attain equilibrium between favorable and unfavorable positions regarding nuclear stations and, from the economic point of view, weigh the costs and benefits between GHG (Greenhouse Gases) emissions and the safety of the nuclear installations. In the Brazilian case, the costs of Nuclear plant "Angra 3" due to exposure to the short-term market prices, that can severely compromise the financial "health" of any generation project whose probability of long breaks is obvious, like the nuclear stations, there is need to have back-up stations that can supply hired energy in case of "out of service" nuclear stations that are not considered here. Regarding to the R\$ 138.20/MWh tariff, for a level of sales tariff to be used in this degree, the remuneration of the obtained capital, with 10% TIR per annum, it is very low, even when the standards of a state company are considered. For example, if the calculations were done considering an internal return rate of 12% for the project as a whole, the necessary tariff would be R\$ 152/MWh.

S 07.4

Energy Security and the Developing Country: Issues, Strategies and Options

Javed Anwar

Doctoral Student at Energy Field of Study, Asian Institute of Technology, P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand.

International Institute of Islamic Economics, International Islamic University, Islamabad, Pakistan.
javed.anwar@iiu.edu.pk and javed.anwar@ait.ac.th

Reliable and adequate energy supply at reasonable prices is a basic requirement for human and economic growth. The world has enough energy resources to fulfill energy demand but the extraction and delivery cost to consumer is a hurdle for developing countries. Pakistan a developing country is also facing very severe energy deficit, heavily dependent on oil imports. This import dependency can be reduced by exploiting domestic fossil fuel resources, developing new alternative energy resources, adopting energy efficiency and conservation measures and through regional cooperation in power and other type of energy resources. The regional cooperation will also help in reducing the environmental degradation.

S 07.5

A Real-Option Approach on Energy Security Appraisal

*Shih-Mo Lin**, *Yuan-Chin Chen*⁺, and *Chih-Hsiung Tzeng**

*Chung-Yuan Christian University, 200, Chung Pei Road, Chung Li, Taiwan 32023, Republic of China

⁺ Kainan University, 1, Kainan Rd., Luzhu, Taoyuan County, Taiwan 33857, Republic of China

shihmo@cycu.edu.tw

The traditional energy portfolio decision-making depends greatly on the costs of energies. However, the cost-based view of energy security would incur huge risks when the volatility of energy price dramatically increases. In addition, many scholars have dealt the risk-return problem with CAPM model. The mean-variance model considered the tradeoff between risk and return in energy portfolios and treated the energy sources such as nuclear and wind power as risk-free. Different from the previous research, in this paper we adopted a real-option approach on energy security appraisal. Beyond the risk-return tradeoff, this research takes time and price factors into consideration and thus can evaluate the effect of new energy R&D on energy security.

S 08: Power Plants and Energy Industry

Time: 14:45 – 16:15

Room Assignment: Rangsit – Lad Prao A

S 08.1

Contribution of Decentralized Energy System as Climate Change Mitigation Option – an Analysis of District Cooling System and Power Plant (DCAP) at Suvarnabhumi Airport, Thailand

*Wantana Somcharoenwattana**, *Christoph Menke**, *Darunporn Kamolpus*⁺, and *Dušan Gvozdenac*[#]

*Energy Division, The Joint Graduate School of Energy and Environment, KMUTT, 126 Pracha-Uthit Road, Tungkrui, Bangkok 10140, Thailand.

⁺ District Cooling System and Power Plant Co., Ltd., 222 Moo 1, Nong Prue, Bangplee, Samutprakarn, 10540, Thailand.

[#] Faculty of Energy and Process Engineering, University of Novi Sad. Trg Dositeja Obradovica 6, 2100 Novi Sad, Serbia.

¹swantanas@yahoo.com.

The district cooling system and power plant (DCAP) is a system supplying power, steam and cooling to the new international airport of Bangkok in Thailand. DCAP is a natural gas based combined cycle cogeneration system with a total capacity of 52.5 MWe and 25,240 RT. The system consists of 2x20 MW gas turbines for major electricity generation and 1x12.5MW steam turbine for additional electricity production. Presently, DCAP has an average overall efficiency of around 48%. DCAP management is planning to improve the system efficiency in order to achieve more primary energy saving and CO₂ emission reduction and to improve the economical base for the operation of DCAP. In this study the technical factors concerning the operation efficiency have been determined and analyzed using a simulation model (Thermoflex). To improve the operation of DCAP two options are considered: first replacing the gas turbines (GT) with better performance gas turbines and secondly the gas turbines are replaced together with GT inlet air cooling as options. The results of the improvement would yield in an increase of the overall efficiency to 60% which results in a 26% increase in primary energy saving and 27% of CO₂ emission reduction. Significant amount of primary energy is saved after replacing new gas turbines is 843 TJ/a and when replacing new gas turbines with inlet air cooling is 1,092 TJ/a. The amount of CO₂ emission reduction through the replacements are 96,187 tCO₂/a, and 113,833 tCO₂/a, respectively.

S 08.2

Technical and Policy Assessment for Energy Efficiency Improvements and Greenhouse Gas Emission Reductions in Thailand's Cement Industry

Ali Hasanbeigi*¹ and Christoph Menke[†]

*The Joint Graduate School of Energy and Environment, 126 Pracha-uthit Rd, Bangmod, Tungkru, Bangkok, Thailand 10140.

¹hasanbeigi@jgsee.kmutt.ac.th

In 2005, industrial sector in Thailand accounted for 36.7% of primary energy consumption. Cement industry is one of the main energy consumer sectors in Thai industry which, in 2001, consumed about 16 % of the overall manufacturing energy consumption. Cement sector also accounted for more than 21 million ton of CO₂ emission in 2005. Given the importance of cement industry in Thailand, this study attempts to capture potentials for energy efficiency and CO₂ emission reduction in this sector. Using the bottom-up Energy Conservation Supply Curve model, the cost effective energy efficiency potential for Thai cement industry in 2005 is estimated which is equal to 14,648 TJ that is about 10% of total cement industry energy use in 2005. Total technical energy saving potential is 21,222 TJ accounting for 15% of total cement industry's energy consumption. Cost effective carbon emission reduction potential is 1,397 ktC, while total potential for carbon emission reduction is 1,538 ktC. We also propose that a portfolio of energy efficiency policy in the framework of Voluntary Agreement is necessary to enhance energy efficiency in Thai cement industry and remove the fiscal as well as non monetary barriers.

S 08.3

Cost Model for a Small Generator as a Resource of Virtual Power Plant

Petri Trygg*¹, Sami Repo*, and Pertti Järventausta*

* Department of Electrical Energy Engineering, Tampere University of Technology, P.O. Box 692, 33101 Tampere, Finland.

¹petri.trygg@tut.fi

In Scandinavia Finland, Sweden and Norway are interconnected as one market area. Peak loads mean higher price for electricity in Nordic electricity exchange NordPool. There are cases when Finnish transmission grid company has given a warning of possible power shortage to take place if power plants or transmission connections fail.

As an alternative to building new connections or power plants a model called virtual power plant (VPP) has been introduced. It is a electricity market actor that has control over separate loads and small generation units and energy storages. It could sell these resources to electricity markets to lower power peaks during high price period and reduce loads in failure situations. This paper describes a case study cost analysis of a small reserve power generator in a Finnish farm and cost comparison to regulating power price. Additionally possibilities in developing required automation for VPP usage is discussed.

S 08.4

Life Cycle Analysis of a 300 MW Coal-Fired Plant In Malaysia

P.N. Panjaitan*¹, Madya, Mohd. Hariffin Bin Boosroh *

*Universiti Tenaga Nasional, Km 7, Jalan Kajang-Puchong, 43009 Kajang, Selangor, Malaysia

¹yusalmi@uniten.edu.my

Life Cycle Analysis (LCA) is a systematic analytical method that helps identify, evaluate, and minimize the environmental impacts of a specific process. The results are then used to evaluate the environmental impacts of the process so that efforts can be focused on mitigating possible effects. In this study, a life cycle assessment (LCA) on the production of electricity from a 300 MW coal-fired power plant in Malaysia was performed in order to examine the environmental aspects of pulverized coal boiler systems. The approach looked at the total green house gas emission during the construction, operational and decommissioning phases of the plant. Taking the average net efficiency of 30% and load factor of 65%, it was found that the total green house gases (GHG) emission is about 798 g CO₂/kWh. Out of this, about 93% of GHG is generated in the coal combustion process, while construction, transportation and decommissioning activities contribute to 0.8%, 5.5% and 0.6% respectively. Other sources of GHG emission are from coal mining and preparation. It was also observed that the life cycle analysis is influenced by the plant net efficiency and type of coals used in the power plant. The study shows that a

10% increase in net efficiency results in a decrease of GHG by about 9%. This allows a direct correlation to estimate GHG emissions from power plant net efficiency to be established. The LCA model developed in this study therefore can be used by power utility planners and operators to estimate the GHG emission from the plant throughout its life cycle, i.e. from construction, operation and decommissioning.

S 08.5

Exergy Analysis of a Steam Power Plant in Iran

Mofid Gorji-Bandpy^{*1}, Zeynab Esmaeil pour^{*}, Niki Molana^{*}

Faculty of Mechanical Engineering, Babol University of Technology, P.O. Box 484, Babol, Iran.

¹ gorji@nit.ac.ir

In this paper the details of the power plant cycle with two kinds of gas and diesel fuels have been analyzed. The losses and exergy efficiency that are the main factors, have been investigated. The results show that the most effective part in elimination of the exergy is the boiler of the power plant whereas in energy analysis, condenser losses the most of heat transfer. The effect of changes in the inner condition and the effect of environmental condition of the process of the boiler on the efficiency were also studied. The results show that heat transfer process losses more exergy than the combustion process.

S 09: Clean Energy for the Environment

Time: 14:45 – 16:15

Room Assignment: Rangsit

S 09.1 Development of Absorbent for Separating Carbon Dioxide from Power Plant Flue Gases

Ho-Jun Song^{*}, Joon-ho Lee^{*}, Jong-Jin Park^{*}, Ankur Gaur^{*}, Jin-Won Park^{*1}, Kyung-Ryong Jang[†], Jae-Goo Shim[†], Jun-Han Kim[†]

^{*}Department of Chemical Engineering, Yonsei University, 134 Shinchon-dong Seodaemun-gu, Seoul 120-749, Korea.

[†] Environment & Assessment Group, Korea Electric Power Research Institute, 103-16 Munji-dong Yuseong-gu, Daejeon 305-380, Korea.

¹ jwpark@yonsei.ac.kr

In this study, an absorbent for capturing carbon dioxide from power plant flue gas has been developed. To achieve low operating and management cost associated with CO₂ capture in industrial process such as power plant, rate of reaction, CO₂ absorption capacity, durability, corrosion characteristics are important parameters to be kept in mind. According to these parameters some candidate CO₂ absorbents were proposed and screened. Finally, the most efficient CO₂ solvent was selected. Some basic physicochemical properties such as density, viscosity, surface tension, heat capacity, vapor pressure were measured. After compilation of these properties different kinetics and vapor-liquid equilibrium between CO₂ and absorbent were investigated. Economic feasibility of the absorbent was also assessed.

S 09.2 Nanoscale Investigations for Resource Development of Clean, Green and Renewable Energy Packages

R. B. Choudhary^{*} and M. K. Jha[†]

^{*}Center for Advanced Technology (CAT), Haryana Engineering College (HEC) Jagadhri, District-Yamunanagar, Haryana - 135 003, India.

[†]Department of Chemical & Bio Engineering, National Institute of Technology (NIT), G.T. Bye Pass Road Jalandhar, Punjab - 140008 India.

¹ jhamkin@yahoo.co.in

Energy is one of the single largest techno-economical issue that has been haunting over, hankering on, and hammering to the national and international energy professionals since last couple of decades. The issue took crucial turn when the severe environmental regulations were imposed thereby leaving no substitute other than redesigning the energy formulation protocol with reconfiguration of technological

dimensions. In such a critical situation, energy experts are bound to stake their promises with novel technological approaches and opted for quasi-relief endeavors so as to overcome the energy revolution. Nanotechnology helps make possible the curative search for new package of energy with cute characteristics, probably leading to the new ways for designing, developing, storing and utilizing energy appropriately and adequately. Since the introduction of non-polluting energy materials heavily depend on the successful utilization of the energy sources such as electrochemical energy, geothermal energy, thermoelectric energy, photovoltaic energy (solar energy), bio mass energy, wind energy and tidal energy. The current trends set in investigating the functional energy, environmental species and advanced tools based on the nanomaterials like nano zinc oxide particles, nano lithium ions, nano gold tubes, nano fibers, nano membranes and the relevant nano phenomena such as nano ionics, nano assemblies, nano clusters, nano surface, nano structures, and nano modelling and simulation. Non-polluting energy materials' characterization is another important feature that separates the utility mode of nano energy materials from that of the conventional energy materials. Therefore, characterization techniques seek marked range of utility modes for wide range of nano investigations. In the present communication, the authors aim to emphasize the nanoscale endeavors for exploring the resource development of nano energy packages of clean, green and renewable origin so as to meet the energy crisis at global scale.

S 09.3

Life Cycle Energy Analysis of a Natural Gas Refinery

A. Akbari^{*}, E. Mousavi[†], F. Mhdizade^{*}, M. Sarcheshmehpoor[†], and S. Tatina[†]

^{*}Faculty of Environment, University of Tehran, Iran

[†]HSEQ Department, Petropars Co. Tehran, Iran

¹akbariali@ut.ac.ir

Environmental quality has been increasingly affected by the oil & gas industries. In order optimization of energy consumption in a specific natural gas refinery in design stage, this work focuses mainly on estimating the energy required for producing sour gas, Propane, Butane and Condensate. Life Cycle Energy Analysis (LCEA) is an approach in which energy inputs to a product are accounted for. The applied approach leads to some strategies that improve performance of the refinery. Indeed these improvements are highly dependent on technologies studied in Life Cycle Assessment. This paper aims to present the life cycle energy for design stage of a natural gas refinery of 6,7 & 8 phases in the South Pars field, located onshore of Persian gulf.

The work is a part of a greater project during which life cycle assessment procedure will be employed. Among different variants of LCA, gate to gate has been selected inasmuch as the design of the refinery is going to be assessed. Steam, electrical power, fuel gas and cooling tower are major energy sources in the refinery. Allocation of each product contribution from the energy used in each unit is controversial due to complex and joint production systems of gas refining. This subject is the heart of net energy calculation for refined fuels. Here we found the ratio of the energy content of refined products to the energy required to refine them in the refinery, 12.2, 60.6, 7.03, and 6.97 for sour gas, condensate, propane and butane respectively. Sour gas would be injected to the resource wells, condensate would be used as a very valuable feedstock in petrochemical industries and the mixture of two products, usually is called LPG, more recently, has been used in spark ignition or diesel engines. The calculated ratio for LPG is considerably higher in this specific configuration in comparison with previous reported data. This is the result of some parameters like, the sour nature of feed, desalination of sea water by evaporation and etc. Considering the energy consumption, in different units, some modifying recommendations are also discussed through a complete life cycle which can even decrease precombustion energy requirement of LPG.

S 09.4

Water Pollution Impact Assessment on Environment of Cachar Paper Mill – A Case Study

Sanjoy Kumar Dey^{†} and Rajat Gupta **

Department of Mechanical Engineering, National Institute of Technology, Silchar – 788 010, Assam, India

[†] sanjoy.deyl@gmail.com

*The Hindustan Paper Corporation Ltd (HPCL) is one of the paper-manufacturing giants in India. The Cachar Paper Mill (CPM) was established by the HPCL in 1988 in the Hailakandi district of Assam, India, for the manufacture of writing and printing paper with a designed capacity of 100,000 MT per year. The pulp and paper industry is one of the most heavily polluting industries in our country. The impact of this type of industry on environment is a matter of great concern. During the manufacture of paper, wastes of solids, liquids and gases in large volumes are discharged, thus polluting the environment. Keeping these points in mind, a case study was conducted at CPM to assess the impact of water pollution on the river Barak, the main recipient of the liquid effluents discharged from the mill. Impact analysis was done using Matrix method. For this purpose, samples were collected from the river Barak at three locations namely, (i) Barak up stream (u/s) 3 km at Bagmara, (ii) Barak at effluent discharge point and (iii) Barak down stream (d/s) 3 km at Siddeswar. The pollution parameters investigated were pH, Suspended solids (S.S), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Dissolved oxygen (DO) and Turbidity. The effects of above parameters on different environmental parameters such as health, flora, fauna and economics were analyzed using Risk matrix method. Matrix methods are generalized checklists where one dimension of a matrix is a list of environmental, social and economic factors likely to be affected by a proposal and the other dimension is a list of actions associated with the development. Magnitude ranking as well as Importance ranking of an interaction were considered on a 1 to 5 scale, 1 being negligible and 5 being severe. Risk matrix impact significance (Product of magnitude ranking and importance ranking of an interaction) was also considered on a 1 to 5 scale. From the present analysis, it was observed that for locations (ii) and (iii), the impact of only COD was high; others were within permissible limit, whereas for location (i) the impacts of all the parameters were within the permissible limits. However, COD reduction up to 79% was possible by adding a bacterial stain called *Pseudomonas fluorescens* in a continuous inlet- outlet flow of liquid effluent at the rate of 25ml/h in a sequential bioreactor.*

S 11: Emerging Technologies 1

Time: 09:45 – 11:15

Room Assignment: Rangsit – Lad Prao A

S 11.1

Analytical Modeling of Partial Shading of Photovoltaic Modules in a Solar Power Generation System

Yaw-Juen Wang^{†}, Member, RERIC and Po-Chun Hsu**

*Doctoral Program, Graduate School of Engineering Science and Technology, National Yunlin University of Science & Technology, 123 Sec. 3, University Rd., Tou-Liu, 64002 Yunlin, Taiwan.

[†] wangyj@ait.ac.th

This paper presents an analytical modeling of partial shading phenomenon of PV modules based on the commonly used single-diode equivalent circuit of PV cells. The proposed analytical model, though limited to the case of two series PV modules and composed of complicated nonlinear implicit functions, allows the global picture of the problem to be presented and the effect of partial shading to be interpreted in a better way. Several electrical characteristics of a PV system such as I-V curves, open-circuit voltage, short-circuit current, maximum power output and reverse voltages, can be presented in two-dimensional and three-dimensional graphs to provide in-depth physical interpretation of the issue.

S 11.2 **Development of a Piecewise Linear Parallel Branches Model for Solar Cell Module**

Yaw-Juen Wang*¹ and Po-Chun Hsu *

*Graduate School of Engineering Science and Technology Doctoral Program, National Yunlin University of Science & Technology, 123 Sec. 3, University Rd., Tou-Liu, 64002 Yunlin, Taiwan.

¹wangyj@ait.ac.th

Photovoltaic (PV) generators exhibit a nonlinear i-v characteristic, the operating points of which are strongly influenced by solar irradiance and temperature. Hence, researchers have developed various methods to simulate the behavior of PV generator, such as iterative numerical methods and circuit-oriented models. This paper proposes a piecewise linear parallel branches model for PV module. The proposed model can easily be applied in electric circuit simulation tools such as ElectroMagnetic Transients Program (EMTP). To verify the proposed model, i-v and P-v characteristics of a PV array have been generated by EMTP simulation for different conditions of solar irradiance, temperature, load and partial shading phenomenon. The simulation results were compared with those obtained from equation-oriented model, and good agreements between simulation and equation-oriented model have been achieved.

S 11.3 **Utilizing Sea Pressure as a Source of Power for Autonomous Underwater Vehicles – an Approach**

Harsha Vardhan*¹, Sukanta Roy⁺, Gagan Kumar Deka*, and Prasenjit Paul*

*Department of Mining Engineering, National Institute of Technology Karnataka (N.I.T.K), Surathkal, Mangalore, Karnataka State, 575025, India.

⁺Department of Mechanical Engineering, N.I.T.K Surathkal, Mangalore, Karnataka State, 575025, India.

¹har7323@rediffmail.com

Autonomous Underwater Vehicles (AUV's) finds application in deep sea bed mining apart from a variety of other utilities in different sectors. When the AUV's are deployed for deep seabed mining or for any other purpose at a depth of 3 to 4 Kms below sea level, it experiences a significant water pressure of the order of 30 MPa or even more. In this paper, an approach for utilizing this pressure for the functioning of the Autonomous Underwater Vehicles has been presented. Further, the various considerations and challenges which may be associated in designing such a system have been discussed. It is important to mention here that this is just an idea and there are no laboratory/field studies conducted by the authors to check the suitability of the system.

S 11.4 **A Study of Fuel Cell CHP-Technology using LEAP-Model**

Seungbok Shin*, Jung-Hwa Jang*, Sooyoung Jun*, Jaehoon Lee*, Dal Chand Spah⁺ and Jin-Won Park*¹

*Department of Chemical Engineering, Yonsei University, 134 Sinchon-dong, Seodaemun-ku, Souel 120 749, Republic of Korea.

⁺ Department of Chemistry Government College, Gohana Sonepat, Haryana, India.

¹jwpark@yonsei.ac.kr

This study introduces the use of fossil fuel and building of infrastructure for hydrogen based technology should go side by side. The object of our study is to develop a small sized Fuel Cell Combined Heat and Power (CHP) technology. And we quantitatively analyzed the change of amount of energy consumption along with the change of GHGs emission using Long-range Energy Alternative Planning System (LEAP) as energy economy model by introducing Fuel Cell CHP that is a hydrogen based technology.

S 12: Wind Energy Systems

Time: 09:45 – 11:15

Room Assignment: Horvang – Lad Prao B

S 12.1 **Comparative Study of a Three-bladed-H-Darrieus Rotor with a Two-Bladed-H-Darrieus Rotor with Various H/D Ratios**

*Biplab Das*¹ and Rajat Gupta**

*Department of Mechanical Engineering, National Institute of Technology Silchar, Assam-788010, India.

¹ r_guptanitsil@yahoo.com

The vertical axis wind turbine (VAWT) is expected to be a viable proposition for rural electrification and many household applications in developing countries including India. This is due to the fact that VAWT has got many advantages over Horizontal axis wind turbines (HAWT), like simple in construction, economical, acceptance of wind from any direction, self-starting. In spite of these advantages, VAWT is not gaining popularity mainly because of its low efficiency. However, few works were reported in the available literature. Thus, the authors strongly feel that there is a need of research work in this area.

Keeping the above points in view, performance study of H-Darrieus rotor, which is a vertical axis wind turbine, was carried out. In this paper, a comparative study was made between a two-bladed H-Darrieus rotor and a three-bladed H-Darrieus rotor with various H/D ratios ranging from 1.25 to 2.00. The blade material used was aluminum. From the experiments, power-coefficients (C_p) was calculated and it has been observed that C_p increases with increase of H/D ratio up to a certain limit, thereafter; it starts decreasing even though the H/D ratio is increased. Thus it can be concluded that there is an optimum value of H/D ratio for which C_p is maximum. And from the present study, the optimum value of H/D ratio is found to be 1.43 for both the rotors. Further, while comparing the power-coefficients between these two rotors, it is found that the maximum C_p obtained for the two-bladed H-Darrieus rotor is 0.58 whereas for the three-bladed H-Darrieus rotor, it is 0.52. Thus it can further be concluded that the power coefficient for two-bladed H-Darrieus rotor is higher than that of a three-bladed H-Darrieus under the same test conditions.

S 12.2 **Control of Grid-Side Voltage Source Converter Using Active and Reactive Current Components for Wind Energy System**

*Suksan Wangsathitwong*¹, Somporn Sirisumrannukul*, Somchai Chatratana[#] and Werner Deleroi⁺*

*King Mongkut's University of Technology North Bangkok (KMUTNB), Bangkok, Thailand.

[#]Technology Management Center, National Science and Technology Development Agency (NSTDA), 111 Thailand Science Park, Paholyothin Rd., Pathumthani, Thailand.

⁺Delft University of Technology, Delft, Netherlands.

¹ ssww@kmitnb.ac.th

This paper presents a technique to control a grid-side voltage source converter of the wind energy system. The converter comprises three single phase voltage source converters connected to a common dc link capacitor. Three single phase converters are connected to the grid through a three phase transformer. The control method for each converter is based on the active and reactive current components on the synchronously rotating reference frame. The dc link voltage and power factor are decoupling controlled by active and reactive current components, respectively. The results show that the converter with proposed control method can operate both in rectifying mode and inverting mode. The dc link voltage can be effectively regulated under unbalanced voltage condition.

S 12.3

Field Oriented Controlled Cage Rotor Induction Generator for Variable Speed Wind Turbine Systems

Wathana Seubkinorn*, Bunlung Neammanee*, Member RERIC, and Somporn Sirisumrannukul*

Department of Electrical Engineering, King Mongkut's University of Technology North Bangkok 1518 Bangsue, Bangkok 10800, Thailand.

¹ bln@kmutnb.ac.th

Cage rotor induction machines are well known and have long been considered as a good choice for the electrical generator in variable speed wind energy conversion systems (VS-WECS) because of their high dynamic torque, robustness, low maintenance and relative cheapness. The stator of a squirrel cage induction generator (SCIG) is connected with a machine side converter and a front-end converter with a DC bus in between. The SCIG can be efficiently vector-controlled by the q-axis stator current in the machine side for maximum energy capture. The power from the machine side is transferred to the DC bus, then to the front-end converter, and finally to the grid. The front-end converter employs a vector-control technique to regulate the DC bus at a specified reference voltage. In addition, the front-end converter controls the output current near sinusoidal at unity power factor. The paper presents a simulation of a grid connected SCIG driven by a back-to-back PWM voltage source converter in VS-WECS. The simulation result verifies the main control objective in tracking the maximum energy capture for step and variable wind speeds with high quality performance.

S 12.4

Wind Energy in Thailand to Enhance Energy Security: Potential, Status and Barriers

Devbratta Thakur¹ and Nadarajah Mithulananthan

Energy Field of Study, School of Environment, Resource and Development,

Asian Institute of Technology, P.O. Box 4, Klong Luang, Pathumthani, Thailand 12120

¹ devbratta@ait.ac.th, devbratta_thakur@hotmail.com

The paper reveals the potential, status and barriers of wind energy in Thailand. With the growing concerns on energy security, green house gas (GHG) emission and consequent climate change, renewable energy sources have become attractive option for electricity generation around the world. The current power generation pattern in Thailand is not secured and sustainable as a result of country's heavy dependency on imported fossil fuels. Unlike conventional fossil fuels, wind energy is by large an indigenous power source with no fuel cost, no geo-political risk and no supply dependency that come with dependence on imported fuels. And also the decreasing cost of wind energy makes Thailand to think up its energy strategy and to include wind energy as one of the promising alternatives. The paper concludes that Thailand has not utilized wind energy resources anywhere near to its potential and there are potentials and possibilities for electricity generation from wind energy.

S 14: Emerging Technologies 2

Time: 13:00 – 14:30

Room Assignment: Rangsit – Lad Prao A

S 14.1

Effects of Temperature and Natural Zeolite/Spirituos Ratio to the Yield of Gasoline from Spirituous at Two Stages Fixed Bed Reactor Using Iron Sulfate as the Catalyst

Sri Haryati¹, Erfina Oktariani, and Sri Rizki PP

Chemical Engineering Department, Graduate School of Srwijaya University, Jl. Padang Selasa No. 524 Bukit Besar Palembang, Sumatera Selatan 30139, Indonesia.

¹ haryati_djoni@yahoo.co.id

Generally, gasoline is produced abundantly from crude petroleum refinery. Its compound contains paraffins, naphthenes, olefins and aromatics which the amount of carbon atoms from C4 to C11. The decreasing of petroleum reservoirs will influence the gasoline reservoirs as the famous fuel so the

synthetic gasoline with high quality is needed to obstruct the rate of crude petroleum exploration in Indonesia. The objective of this research is how to produce gasoline from bagasse as the alternative fuel using iron sulfate as the catalyst at proper temperature. Reaction process occurred in the fixed bed reactor with two zones, first zone was thermal cracking and the second one is catalytic cracking. The effect of various temperatures from 2000C to 3000C and effect of methanol concentration as the solvent varied from 10% to 30% were observed in this research while it occurred at constant solvent volume, mass of bagasse, and mass of catalyst. The gasoline product of this research has better characteristic than conventional gasoline from Pertamina with octane number 90 and heating value 19,872 Btu/lb while the highest yield was obtained at temperature 2500C, solvent concentration 20% for 100 minutes. The gasoline was analyzed in Laboratory of Pertamina UP III Plaju, Palembang – South Sumatera, Indonesia.

S 14.2 **Effects the Strength of Electromagnetic Field and Temperature on the Inherent Moisture of Brown Coal in Electrothermal Dewatering Brown Coal (EDBC) Process**

Muhammad D. Bustan¹ and Triana Prihatin

Department of Chemical Engineering, Graduate School, University of Sriwijaya, Padang Selasa Street No.524, Bukit Besar, Palembang, South Sumatera, 30139, Indonesia.

¹djajashanta@yahoo.co.id

The most utilization of coal low rank which is the reservoir is abundant is as mixture with other high qualified coal. Then, there is a consideration to use it as fuel at power plants to ensure the world's energy security. But the inherent moisture contents inside the coal make it become less economical. It has encouraged experts to find the technology to eliminate the moisture contents. This work used a new technology termed as Electromagnetic Dewatering Brown Coal (EDBC). The objective of this work is to study the effects of the strength of electromagnetic field and the temperature for the enhancement of coal product qualities. The indication is there will be the reduction of the inherent moisture contents and the increase of the value heating. The operating conditions are varying the voltage of 0, 4, 8, and 12, and the temperature of 50 °C, 60 °C, and 70 °C. The results of this study show the increasing of heating value from 6,477 kcal/kg to 7,902 kcal/kg and the reduction of the inherent moisture content from 12.09 % (adb) to 2.64 % (adb).

S 14.3 **Termokinetic Parameters of Pulverised Coal**

*Michal Zidek, Jiri Horak*¹*

** Energy Research Center, VSB - Technical University of Ostrava, 17. listopadu 15, Ostrava – Poruba, 708 33, Czech Republic*

jiri.horak2@vsb.cz, michal.zidek@vsb.cz

The paper deals particularly with gained experience in building of the experimental unit “drop tube” which serves to determination of quality parameters of coal powder currently combusted in most coal sources in the Czech Republic. The aim of the research works in this unit is to define experimentally border conditions for a mathematic model for calculation of a combustion chamber of a boiler which should contribute in practice to the electric power production efficiency in coal sources. Currently, this also seems to be one of realistic possibilities hot to reduce the emission load to the environment. The research works regarding the efficiency improvement are addressed within the “Power Progressive Technologies and Systems” Project, which solution is participated by the Energy Research Center as one of five chosen solving business units. Our task is to determine and prepare a summary of quality parameter of Czech coal kinds for new power station blocks. In order to meet the defined objectives, it was necessary to build an experimental unit “drop tube”, by the means of which we will be able, based on achieved results, to specify more precisely a mathematic model of a high efficient powder boiler furnace. The quality parameters of the pulverized coal comprise thermokinetic properties of the coal powder which can be determined based on data gained from a designed experimental unit.

S 14.4

Thermochemical Study of Biogas Autothermal Reforming

Sompop Jarungthammachote ^{*1}, Maria Kathrina B. Gratuito ^{*}

^{*} Mechanical Engineering Program, Faculty of Engineering at Si Racha, Kasetsart University,
Sukhumvit Road, Si Racha, Chonburi, Thailand 20230

⁺ Regional Energy Resources Information Center (RERIC), School of Environment, Resource and
Development, Asian Institute of Technology, Pathumthani, Thailand 12120
sompop@src.ku.ac.th, st103485@ait.ac.th

Autothermal reforming (ATR) is the combination of steam reforming and partial oxidation processes. In this study, the autothermal reforming of biogas was investigated. The study identified the optimum operating range based on hydrogen yield. It is O₂/B of 0.43-0.47 and S/B of 4.0-5.0 at inlet temperature and pressure of 25 °C, 1 atm, respectively, for biogas and oxygen and 150°C, 1 atm, respectively, for steam. The solid carbon formation was observed when this process is carried out at S/B lower than 1.5 with low O₂/B value. The effect of preheat temperature of reactant can cause two events. The first is that the peak of hydrogen production shifts to lower O₂/C when preheat temperature increases. Another event is that the peak of hydrogen production at higher preheat temperature is higher than that one at lower temperature. The results confirm that higher preheat temperature of reactants gives the benefit on hydrogen yield.

S 15: Electric Power System Management

Time: 12:45 – 14:15

Room Assignment: Horvang – Lad Prao B

S 15.1

The Interconnection in Active Distribution Networks

Phuong H. Nguyen ^{*1}, Wil L. Kling ^{*}, Johanna M.A. Myrzik ^{*}

^{*}Department of Electrical Engineering, Eindhoven University of Technology, 5600MB Eindhoven, the Netherlands.

¹p.nguyen.hong@tue.nl.

The active distribution network (AN) has been mentioned recently to adapt with a large-scale implementation of distributed generators. One of its enhancements is increasing interconnections to provide more than one power flow path among local control areas. These parallel physical connections might cause several problems for the network such as congestion and loop flow. Considering the characteristics of the AN, this paper proposes a decentralized approach to control power flow which has some analogies to the telephone networks. The implementation of this control mechanism is based on a multi-agent system (MAS) technology. A simulation of the power system and MAS is created to illustrate the possibility of the proposed method.

S 15.2

ANN Application for Identifying the Suitable Location for Installation of Unified Power Flow Controller

P.S. Venkataramu ^{*1}, Minyraj Modi ^{*}, C.S. Veena ^{*}, and T. Ananthapadmanabha [#]

^{*} Department of Electrical Engineering, GGITM, Bhopal, 462021, India.

[#] Department of Electrical Engineering, NIE, Mysore, India.

¹venkataramu_ps@yahoo.com.

This paper presents an Artificial Neural Network (ANN) based approach for identifying the suitable location for installation of Unified Power Flow Controller (UPFC). Neural network is trained off-line to capture the non linear relationship between the systems' loading condition without UPFC and the location (line section) of UPFC at which the overall system wide voltage profile is improved and the Voltage Stability Margin (VSM) is enhanced due to the installation of UPFC. ANN architecture is trained using back propagation algorithm and an efficient input feature selection technique based on mutual information index is adopted. The performance of the ANN is demonstrated through identification of UPFC location in a 22 bus real life EHV equivalent power network.

S 15.3 **Harmonics-Constrained Optimal Placement and Sizing of Capacitor Banks for Loss Reduction by a Particle Swarm Technique**

Suwit Aucharinyamet¹, Tawat Sirisangas, and Somporn Sirisumrannukul
Department of Electrical Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, 1518, Pibulsongkram Rd., Bangsue, Bangkok, 10800, Thailand.
¹sw287@hotmail.com.

The presence of nonlinear loads in the distribution system introduces considerable harmonic currents, which could result in undesired harmonic parallel resonance. The capacitor placement problem should be, therefore, formulated by including a harmonic constraint to determine the optimal locations and sizes of capacitor. In this paper, the objective function of the problem is to minimize the total cost comprising the costs of capacitor investment and energy loss and peak demand loss, while retaining the voltage magnitudes of all the load points within prescribed allowable limits for different load levels. The capacitor installation problem is solved by a particle swarm method, whereas the system power loss and voltages of the load points are calculated from a distribution power flow algorithm based on a backward-forward sweep technique. A radial distribution system of Provincial Electricity Authority (PEA), Thailand, which consists of 29 buses and 20 load points, is studied. The obtained optimal solutions reveal that all bus voltages and their associated total harmonic distortion (THD) of voltages are maintained within permissible limits, while keeping the system loss at minimum.

S 15.4 **Maximizing Reliability Benefit from Distributed Generation in Distribution Systems by Tabu Search**

Nattachote Rugthaicharoencheep, Yuttana Eamsomboon, and Somporn Sirisumrannukul¹
Department of Electrical Engineering, Faculty of Engineering King Mongkut's University of Technology North Bangkok 1518, Pibulsongkram Rd., Bangsue, Bangkok, 10800, Thailand.
¹spss@kmutnb.ac.th

A distributed generator is a small-scaled active generating unit located on or near the site where it is to be used. Several benefits have been realized by installing distributed generators in a distribution network. Among them is reliability improvement if their locations and sizes are appropriately determined. For this reason, reliability benefit is investigated in this paper with the main objective for the optimal placement and sizing of distributed generators in a distribution system to minimize the customer interruption cost subject to the maximum number of distributed generators, total capacity of distributed generators, bus voltage limits, current transfer capability of the feeders and only one distributed generator for one installation position. The technique employed to solve the minimization problem is based on a developed Tabu search algorithm and reliability worth analysis. The Tabu search algorithm is a local search that uses memory to avoid being trapped around a local neighborhood and help to move away from a local optimum solution. The reliability worth analysis provides an indirect measure for cost implication associated with power failure. The developed methodology is tested with a distribution system of Provincial Electricity Authority (PEA). Numerical results from the tests demonstrate that distributed generators can be used to promote the reliability of the distribution system.

S 15.5 **Captive Power Wheeling for Peak Load Management**

C. A. Babu*, and S. Ashok
Department of Electrical Engineering, National Institute of Technology, Calicut, 673 601, India.
¹p050005ee@nitc.ac.in.

Captive power plants installed in large industrial plants in India are intended mainly as a stand by supply source, or to cater some portion of critical electrical load, and hence remain under utilized. In this paper, an optimization model for captive power wheeling for peak demand management is proposed in the context of power system deregulation. The formulation utilizes non linear programming technique for minimizing the electricity cost and reducing the peak demand, by wheeling the captive power, satisfying the system constraints. The case study of a typical industrial belt shows that, significant reduction in peak

demand (about 39%) and electricity cost (about 11%) can be achieved, by captive power wheeling among the industries.

S 15.6 **Development of New Tools to Target Power Requirement in a Power Utilisation Network**

Zalina Mat Nawi*, Zainuddin Abdul Manan[†]

*Universiti Malaysia Terengganu

[†] Universiti Teknologi Malaysia, Johor

[‡] zalina@umt.edu.my

Power generation and power consumption are inherent for a chemical process involves a wide range of temperatures and pressures, particularly for processes involving operations from sub-ambient to above ambient conditions. A classic example of such heavy chemical processes is ethylene complex. This study using a combination of techniques is pinch and exergy analysis. Pinch analysis is an established systematic tool for the optimal design and retrofit of energy recovery systems. Unfortunately, pinch analysis has one of the main limitations in optimizing the energy recovery systems that is can only deal with heat transfer processes, not processes involving power utilization. Otherwise, exergy analysis guidance cannot indicate clearly the maximum power recovery potential and the minimum utility power. Thus, by using the modification of pinch concept and exergy analysis as a new tool to target power requirement, a systematic technique which can target the maximum power generation and minimum power consumption is essential. This paper presents the first step towards a systematic utilization of power resources in such processes to target the minimum power consumption by taking into account the power generation and power demand capacities. The new developed graphical tool named as Power Composite Curves (PCCs) is used for targeting the minimum power consumption in such process. An ethylene complex is selected as a case study to illustrate the strength of the new developed technique. By using the Power Composite Curves, it allows an engineer to visualize the overall potential to maximize the power generation from a series of turbines and power consumption, and hence, the maximum power recovery and minimum power consumption from the national grid can be targeted. From the results of the potential of power savings is 12.83 MW and the minimum utility power requirement is 17.606 MW.

S 15.7 **Contributions of Individual Generators to Power Flows and Losses Using Proportional Tree Method**

Mohd Herwan Sulaiman*[‡], Mohd Wazir Mustafa[†], Omar Aliman*, Member, RERIC, Ismail Daut*, Surya Hardi Amin*, and Mohamad Suhaizal Abu Hassan[#]

*School of Electrical System Engineering, Universiti Malaysia Perlis (UniMAP) 01000 Kangar, Perlis, Malaysia.

[†] Faculty of Electrical Engineering, Universiti Teknologi Malaysia, Johor 81310, Malaysia.

[#] School of Computer and Communication Engineering, Universiti Malaysia Perlis (UniMAP) 01000 Kangar, Perlis, Malaysia.

[‡] mherwan@unimap.edu.my

Tracing power flows and losses becomes an important issue under deregulation system. Due to the complexity of electrical transmission system, it is not straightforward to map out the contribution of particular generator to a particular lines or loads. Thus there are several algorithms proposed to trace the power flow and loss through the literatures. This paper will discuss the power flow and loss allocation using Proportional Tree Method (PTM). The method is based on proportional sharing principle. After power flow solution is obtained, the test system is modeled like a tree, where the power flow tracing is started from a particular generator to a particular line or load through the routes that connected between them. It is also possible to appoint the losses at each transmission to which generators. In this paper, the 4-bus and IEEE-30 bus test systems were used to illustrate the effectiveness of the method. Comparison with other method is also discussed.

S 17: Climate Change Monitoring and Modeling

Time: 14:30 – 16:00

Room Assignment: Rangsit – Lad Prao A

S 17.1 Mathematical Model for Climatic Factors Based on GMS-6 Satellite Image Sequence Analysis

Chairote Yaiprasert^{*†}, *Krisanadej Jaroensutasinee*^{*}, and *Mullica Jaroensutasinee*^{*}
Complex System Research Unit and Computational Science Graduate Program, Walailak University,
Thaiburi, Thasala, Nakhon Si Thammarat, Thailand, 80161
[†]a.cirrus@gmail.com

Solar radiation data were not always available particularly in isolated sites due to the non-availability of the meteorological stations in these sites. Fortunately, the GMS-6 satellite images were always available because we could automatically download the vapor maps satellite image at half an hour intervals. This paper was introduces a new approach for modeling of solar radiation data from pixel value of satellite images by using mathematical model. The pixel value was positively associated with solar radiation. The methodology could be applied to any geographical area in the world.

S 17.2 Wind Power and Climate Change in the UK

*Lucy C. Cradden*¹, *Gareth P. Harrison*, and *John Chick*
Institute for Energy Systems, University of Edinburgh, Mayfield Road, Edinburgh EH9 3JL
¹lucy.cradden@ed.ac.uk

The increasing use of wind power as an alternative to fossil-fuel based electricity generation will contribute to the reduction of carbon dioxide emissions and thus help tackle the issue of climate change. However, the impacts that a changing climate may have on the output of wind power generators is currently unclear. This paper presents a technique for extracting useful surface wind information from General Circulation Models (GCMs) of the global climate system. The models are currently limited by computing resources to producing output at resolutions of 2 to 3 degrees latitude and longitude. This is not suitable for analysing surface winds which vary at much smaller scales, and thus a downscaling method is required. Regional Climate Models in which a higher resolution model is nested inside the GCM over a small area have been developed but these are expensive and difficult to run. Empirical-statistical downscaling is a cheaper and simpler alternative for climate impacts studies and a method has been developed to use the large-scale pressure gradients from a GCM to derive surface wind speeds at various sites in the United Kingdom.

S 17.3 A Web-based Weather Monitoring Network in the City of Palermo

Giorgio Beccali^{*}, *Maurizio Cellura*^{*}, *Simona Culotta*^{*}, *Valerio Lo Brano*^{*†}, *Antonino Marvuglia*^{*}

^{*}Dipartimento di Ricerche Energetiche ed Ambientali (DREAM), University of Palermo, Viale delle Scienze, edificio 9, 90128 Palermo, Italy.

[†]lbrano@dream.unipa.it

Weather data are crucial to correctly design buildings and their heating and cooling systems and to assess their energy performances. As a consequence, nowadays climate changes are drawing the attention of the scientists on the effects that weather parameters exert on heat exchanges between buildings and environment and, consequently, on the cooling load necessary to maintain comfort conditions in indoor environments. In the urban environment the effects of micro-climatic changes are more intense. In fact, in densely built towns, the impact of the global climate change is enhanced by the effect of the local “urban heat island”, i.e. the increase in the air temperature of urban areas, mainly due to urban geometry, low-albedo urban materials and heat emissions due to human activities.

The comparison between weather data collected within the most densely urbanized area of a town and data referred to the extra-urban areas nearby it allows a qualitative and quantitative analysis of the heat

island. The city of Palermo was lacking of a monitoring system suitable for this kind of analysis and for this reason the Dipartimento di Ricerche Energetiche ed Ambientali (DREAM) of the University of Palermo has built a weather monitoring network composed of different weather stations displaced in different parts of the town and a comparison weather station installed in a rural location in the surrounding area. The monitoring system has been designed for a continuous observation 24 hours per day. The data are immediately available in the web site: <http://www.dream.unipa.it/meteo> and can be read in real time from any remote location by using a web browser. Furthermore, data plots are automatically created every thirty minutes. The current weather situation, the fluctuations (daily, monthly and yearly) of the main weather parameters and a statistical analysis of the weather data are also showed in real time.

S 17.4 **Sensitivity Experiments of Two Convection Parameterization Schemes in Regional Climate Model RegCM3 for Part of Southeast Asia**

Mega Octaviani*, Kasemsan Manomaiphiboon*¹

Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi, Bangkok, Thailand.

kasemsan_m@jgsee.kmutt.ac.th

Regional climate models (RCMs) have become a useful and more accessible tool for use to generate regional climate information of interest. Regional climate is a complex system that is influenced by numerous physical processes, e.g., land-related processes, radiation processes, atmospheric processes, etc. Physical parameterizations in an RCM should be representative to produce realistic climatic conditions. Different physical parameterizations generally result in different predictions, i.e., uncertainties in modeling. Convective process is known to be one of important physical processes in climate modeling since it strongly influences radiation and precipitation. In this work, a sensitivity study of two convection parameterization schemes (CPSs) in regional climate model RegCM3 was conducted, which are 1) Grell with Arakawa-Schubert closure (shortly, Grell-AS) and 2) Grell with Fritsch-Chappell closure (shortly, Grell-FC). Effects of two different sea surface temperature (SST) datasets were also included, which are weekly-average OISST and monthly-average GISST. RegCM3 was run over a three-year period (1997-1999), covering the entire Indochina Peninsula (which is most part of Southeast Asia) at a grid size of 60 km for four designed experiments (i.e., 2 CPSs x 2 SST datasets). Seasonal near-surface temperature (shortly, temperature) and precipitation are the climate variables of interest here. Model results were compared to observation data of the Climate Research Unit (CRU). Mean bias (MB) and root mean square error (RMSE) were used to evaluate the model performance. For temperature, simulated results show systematic underestimation (-2.0 °C to -2.8 °C for MB and 2.6 °C to 3.0 °C for RMSE) in both dry and wet seasons for all experiments with larger magnitude in Grell-FC than Grell-AS, but the results improves in wet season. For precipitation, Grell-FC performs better in wet season but it is not conclusive for dry season. Distinct differences in precipitation between dry and wet seasons are well captured. Nevertheless, both Grell-AS and Grell-FC overestimate precipitation in dry season while only Grell-AS underestimates precipitation in wet season. RMSE appears comparable in all experiments for dry season (2.5-2.7 mm/day) and also wet season (3.5-4.4 mm/day). Sensitivity of simulated results to different SST dataset was found to be not significant.

S 17.5 **Comparison of Carbon Emission Factors from Ox and Buffalo Farms and Slaughterhouses in Meat Production**

Nathawut Thanee*¹, Wut Dankittikul⁺, and Prayong Keeratiurai⁺

* School of Biology, Institute of Science, Suranaree University of Technology, 111 University Avenue, Suranaree, Muang, Nakhon Ratchasima Province 30000, Thailand.

⁺ School of Environmental Engineering, Institute of Engineering, Suranaree University of Technology, 111 University Avenue, Suranaree, Muang, Nakhon Ratchasima Province 30000, Thailand.

¹ biology@sut.ac.th

The carbon budget of oxen and buffaloes during meat production were studied to develop carbon emission factors from ox and buffalo farms, to investigate the rate of carbon fixation and their transfer to

oxen and buffaloes in food chain and to study the carbon content changing in energy patterns from electric energy and petrol that were used in meat production in Nakhon Ratchasima province. The study showed that the carbon emission factors per unit from ox and buffalo farms and slaughterhouses in ox and buffalo meat production were 2.00 and 2.32 kg.C/head/day, respectively. The carbon fixation factor in meat and organs, of oxen and buffaloes were 3.09 and 4.72 kg.C/head/day, respectively and the rate of carbon massflow from grass and energy used for electricity, and petroleum of oxen and buffaloes were 5.15 and 7.10 kg.C/head/day, respectively. This study also showed the ratio of the carbon fixation in ox or buffalo meat and organs to the sum of carbon contents in grass, humans cannot use the carbon in grass but herbivores can, and carbon contents from electric energy and petrol used in ox and buffalo meat production were 0.60 and 0.66, respectively. The ratio of total carbon emitted per unit to total carbon contents per unit in grass and energy used in ox and buffalo meat production were 0.39 and 0.33, respectively. The ratio of total carbon emitted per day to carbon fixation per day in meat and organs of an ox and a buffalo was 0.65 and 0.49, respectively. Ox production produced more environmentally harmful carbon than buffalo production. The carbon contents changing emitted in meat production in ton C. per year from ox and buffalo farms and slaughterhouses in Nakhon Ratchasima province can be predicted by using the equation as follow; $C\text{-emission}_{\text{oxen}} = 10054(\text{year})^2 - 4 \times 10^7(\text{year}) + 4 \times 10^{10}$ ($R^2 = 0.9528$) and $C\text{-emission}_{\text{buffaloes}} = 72.357(\text{year})^2 - 288350(\text{year}) + 3 \times 10^8$ ($R^2 = 0.9522$). The results also showed that the ratio of $\text{CH}_4 : \text{CO}_2$ emitted from faeces, enteric fermentation and respiration of ox was 1.48 times higher than the value from buffalo. For the same quantity of meat production it can be suggested that decreasing ox meat production and increasing buffalo meat production can decrease of the environmental problems.

S 17.6 Life Cycle Inventory of Carbon in Rubber Tree Plantation and Utilization in Thailand: Potential Carbon Sequestration in Soil and Rubber Tree

Supawan Petsri*, Amnat Chidthaisong[†], and Nathsuda Pumijumnong[†]

*The Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi, Bangkok 10140.

[†]Faculty of Environment and Resource Studies, Mahidol University, Nakhon Pathom, 73170.

[†]amnat_c@jgsee.kmutt.ac.th

Managing carbon stocks in the rubber tree plantation may potentially provide important opportunities to mitigate the net exchange of carbon with the atmosphere at a national scale. In order to assess the possibility of these mitigation benefits, detailed study and understanding carbon dynamics within rubber tree plantation system is required. This study aims to establish methodology for carbon stock estimation and to give the estimate of, based on the method developed, the amount of carbon stock in the rubber tree plantation system in Thailand during 1990- 2004. Soil organic carbon (SOC) was estimated by using GIS spatial analysis, soil series map and rubber tree plantation database map. Meanwhile, biomass of stem and branches (W_{S+B}), of leaves (W_L) and of roots (W_R) were estimated from the following equations; $\log W_{S+B} = 0.9254 \log(D^2H) - 1.2218$, $r^2 = 0.97$; $\log W_L = 0.6958 \log(D^2H) - 1.5986$, $r^2 = 0.95$ and $\log W_R = 0.6648 \log(D^2H) - 0.9340$, $r^2 = 0.98$, where D = diameter at breast height (cm) and H = height of rubber tree (m). The carbon content of the rubber tree plantation at various ages was predicted from the relationship between the mean total carbon content per area and the age of the rubber tree plantation by using logistic growth model. The results show that Thailand's 2004 rubber tree plantation area was 3,672,831 ha. Carbon stock in soil in rubber tree plantations varied greatly between ecoclimatic provinces. The national average was 495.64 million tC (0-100 cm soil depth). The highest total soil organic carbon content in rubber tree plantation at 0-100 cm soil depth was found in the southern (452.83 million tC), followed by the eastern (33.87 million tC), the northeast (7.32 million tC), the central (1.63 million tC), and the northern (0.20 million tC), respectively. This represents about 8% (495.64 million tC or 495,640 GgC) of the total soil carbon stock in Thailand (6,211,706 GgC). Aboveground and belowground carbon stock in biomass increased from about 12, to 23, 48, 81 and 128 tC ha⁻¹ when age increased from 1 to 5, 10, 15 and 25 year, respectively. On the other hand, the yearly average of total carbon stock in rubber tree plantation of Thailand during 1990 and 2004 was fairly constant at 95.2±2.4 million tC. This value is quite high when compared to other types of plantation, including the 25-year-old teak (30.72 tC ha⁻¹), 19-year-old *Dipterocarpus alatus* (70.71 tC ha⁻¹), 7-year-old *Acacia mangium* (47.90 tC ha⁻¹), and 4-year-old *Eucalyptus camaldulensis* (13.59 tC ha⁻¹). Most of the carbon in rubber tree plantation were found in soils (495.64 million tC), followed by in the stem and branches (68.51 million

tC), root (12.43 million tC), leaves (3.56 million tC) and in natural rubber (2.63 million tC), respectively. Thus, there is indeed significant amount of carbon stored in rubber tree plantation besides other direct and indirect benefits of wood and rubber utilization.

S 18: Energy in Transportation Sector

Time: 14:30 – 16:00

Room Assignment: Horvang – Lad Prao B

S 18.1 Present Status of the Vehicle Fuel Economy Standards Development in Thailand

Sarawoot Watechagit, Wichien Ueasomsakul, Bunyongvut Chullabodhi, Suppachai Duangthoughpol, Supphachai Nathaphan

Office of the Engineering Consultant, Mahidol University, 25/25 Phutthamonthon 4 Road
Salaya, Phutthamonthon 73170 Thailand
egswg@mahidol.ac.th

The increasing of demand and price of petroleum fuel has led policy makers in Thailand to evaluate the need of having fuel economy standards for motor vehicles. There have been currently at least 3 governmental organizations those have reported and set related regulations or programs. The oldest and the most vital program is the mandatory regulations set by Thai Industrial Standards Institute (TISI) regarding to the maximum allowable levels of emission from passenger cars and light-duty trucks. These regulations prohibit the vehicles producing over-limit emission (currently at EURO-3 limits) to be sold in the market and they have long been implemented for more than 10 years. The Pollution Control Department (PCD) have also attempted to set up a voluntary program related to fuel economy by announcing the future target level of CO₂ emission for passenger cars and light-duty trucks. The National Energy Policy Office (NEPO) developed a direct voluntary fuel economy standard program by introducing a fuel economy label for passenger cars. Besides TISI's regulations, other programs have not been successfully implemented. The report presented here shows some results from the feasibility study to setting up implementable fuel economy standards for passenger cars and light-duty trucks. The difficulties of implementing the aforementioned standards are shown via the comparative study with the existing fuel economy standards around the world. The study results reveal that the problems can be classified into 3 categories related to the vehicle classification scheme, the testing standard, and the establishment of the standardized levels for fuel consumption. Based on the findings, the revised models of the fuel economy standards for passenger cars and light-duty trucks are proposed.

S 18.2 Energy Saving Lighting Design of Haul Road

Mangalpady Aruna

Department of Mining Engineering, National Institute of Technology Karnataka (N.I.T.K), Surathkal,
Mangalore, Karnataka State, 575025, India.
mangalpady@yahoo.com

Haul roads are one of the critical areas in surface mine lighting, where lighting installations are provided by single sided arrangement of poles. Proper arrangements of these poles are very important so as to fulfill the required lighting standards, as specified by various regulatory bodies and to assure better visual perfection. But any improvement in the lighting quality is an economic decision. In this paper a 1.0 km stretch of haul road is designed for eight different types of sources (80, 125 & 250 W high pressure mercury vapor, 70, 100, 150, 250 & 400 W high pressure sodium vapor), at varied pole heights (8, 10, 12, 14 & 16 m) using developed software SURLux, by the authors. The results of the study show that 150 W high pressure sodium vapor lamps at 16 m height pole offer optimum energy consumption with minimum annual cost. No doubt, energy efficient design has a tremendous impact on cost. But the final decision on which lighting system is to be installed should be based on total annual cost. Where shortage of power supply exists, saving in power consumption in lighting system through optimization in illumination design would help the mine management.

S 18.3

Energy Efficiency Analysis on Malaysian Transportation Sector

A. Al-Mofleh^{*1}, S. Taib⁺, H. Al-Gulman³, W. Salah^{*}

^{*}School of Electrical & Electronic Engineering, University Sains Malaysia, Pulau Pinang, Malaysia.
⁺CETREE USM, 11800 Pulau Pinang Malaysia.

[#]Hamza A. Ghulman, Mechanical Engineering Department, Umm AL-Qura University, Saudi Arabia.
¹anwar1971@yahoo.com

Road transport represents one of the greatest areas of challenge for energy efficiency. A study shows that the growing percentage of petrol usage is due to the consumption in transportation sector and also the transportation is the one sector where petrol usage has not been effectively substituted. Various forms of fuel substitutes have been developed, such as ethanol liquefied petroleum gas (LPG) or compressed natural gas (CNG), and each of these suffers from various disadvantages drawbacks or inconveniences. In the long term wise, hydrogen may prove to be the ideal substitute fuel, but even ardent proponents of Hydrogen economy concedes that this will not occur in the near future. The need for worldwide action to achieve energy efficiency in the transportation sector has been recognized by United Nations agencies and other international governmental and non-governmental organizations. In this paper the amount of energy consumes in Malaysia transportation is compared and it is found that more than 80% of the primary energy consumption based on fossil fuels. It is proven also even if technology developments eventually able to reduce the specific consumption, the world energy demand is likely to increase in line with its population. This sector also accounts for a substantial amount of air pollution in cities and contributes significantly to greenhouse gases emissions. This paper aims to analyze factors influencing energy consumption pattern and emission level in the transportation sector of Malaysia, and extrapolates total energy demand and the vehicular emissions.

S 20: Emerging Technologies 3

Time: 08:45 – 10:00

Room Assignment: Rangsit – Lad Prao A

S 20.1

Computational Fluid Dynamics Analysis on Suspension Tower Insulators

K. M. Munisamy, H. Hasini, N.H. Shuaib, M. Z. Yusoff, S. Balachandran,
and S. K. Thangaraju

Kannan M.Munisamy, Mechanical Department, Universiti Tenaga Nasional, Km 7 Jalan Kajang-
Puchong 43009 Kajang, Selangor, Malaysia
kannan@uniten.edu.my, sharish00@yahoo.com

This paper is devoted to CFD analysis on the suspension tower insulator. Detail CFD analysis on different suspension tower insulators under various wind velocities were carried out using commercial CFD code FLUENT 6.2. The investigation aims to simulate the flow around different types of insulators and predict the sensitive area that prone to particle accumulation. Detail computational grid of the glass and porcelain insulators arrangements were created, with each of the geometric mesh contain approximately 1 million cells. The computational model consists of Reynolds Averaged Navier-Stokes (RANS) equations coupled with other related models using the properties of the fluids under investigation. The same calculation was also applied to other cases involving various air flow velocities around the two types of insulator. On top of that, another multi-inlet boundary conditions computation was also carried out. Highly re-circulating zone is predicted within the circumferential gaps for both insulator types. The re-circulation zone indicates dead flow region which cause any particle to settle and accumulate. High re-circulation zones are predicted at the inner circumferential ring gaps under the insulator cup. The very low velocity region is at the most bottom pin area followed by the next pin between the most bottom and adjacent insulator behind velocity flow direction. This phenomenon is more dominant for the porcelain insulator due to the cup shape the number of inner rings. In conclusion, the objective of the project work is fulfilled completely. The prediction of particle accumulation shows that high re-circulation area at the inner gaps of both insulators. These recirculation zones indicate dead flow regions, within which the tendency of particle settling is very high. The recirculation zone is more evident at the most bottom pin area followed by the next upper pin between the most bottom and adjacent insulator behind velocity flow direction. This phenomenon is more dominant for the porcelain insulator as compared to glass insulator

due to the cup shape the number of inner rings.

S 20.2 Studies on Bed to Wall Heat Transfer in the Cyclone Separators of Circulating Fluidized Beds

R.S. Patil*, M.Pandey*, P.Mahanta*, K.L. Meena*, Y.V. Singh*, and P.Sharma*

*Indian Institute of Technology, Guwahati 781039, India

¹ pinak@iitg.ernet.in

The present paper describes heat transfer behaviour in the cyclone separators of different cross sections of two different cold Circulating Fluidized Beds (CFBs). In the present study, steady state experiments have been carried out by providing heat in the riser of a CFB and consequently examining bed to wall heat transfer in the cyclone separator. Axial distribution of local heat transfer coefficients have been examined at the axis of cyclone along its height (length). Also local heat transfer coefficients across the cyclone width have been examined taking two sections along the cyclone length and providing several thermocouples for each section in the radial direction. The trends observed at the same operating conditions and the same locations for two cyclones of different diameters have been compared with each other and also with the findings reported in the literature. In this way, effect of diameter on the heat transfer coefficient has been predicted and scale effect study has been completed.

S 20.3 A New Design of Domestic Gases Storage Water Heater to Increase Heat Efficiency

Mofid Gorji-Bandpy*¹, Saeed Khezri*, and Tahere Gorji-Bandpy*

Faculty of Mechanical Engineering, Babol University of Technology, P.O. Box 484, Babol, Iran.

¹ gorji@nit.ac.ir

In this paper heat transfer in new designing of storage water heater is numerically analyzed. Heat gases passes across the annular channel which is divided into sector channels by axial fin, instead of passing through the round pipe that is existed in the traditional storage water heater. Heat transfer and pressure losses depends on the ratio of internal and external cylinders diameters, angle of axial fin, inlet heat gases temperature and the mass flow rate of the gasses. The result shows that for equal gas flow intensity, new water heater has better efficiency.

S 20.4 Study of Performance Improvement Window Air Conditioning using Water Spray

P. Swasdipan*¹, U. Teeboonma*, and C. Thinvongpituk*

Department of Mechanical Engineering, Faculty of Engineering, Ubon Ratchathani University, Ubon Ratchathani, 34190, Thailand

¹ luechai36@hotmail.com

The objective of this paper was to comparatively study the performance of a window air conditioning between the conventional window air conditioning and the conventional window air conditioning with using water spray at the same external condition have been performed. A window air conditioner with using water spray is used to test by putting the fan for built water to spray with high revolution and low power input for motor. The purpose of water spray was expected to absorb heat from air by evaporation before it passes over the condenser coil. The cooling substance then increases condensation can absorb more heat from evaporator and low power input compressor. The criteria for evaluating the performance of air conditioning unit were energy consumption, coefficient of performance, and energy efficiency ratio. From experimental results, It was found that the conventional window air conditioning with using water spray improved the coefficient of performance (COP) and energy efficiency ratio (EER). The conventional window air conditioning with using water spray has the coefficient of performance improved 19.4 % and energy efficiency ratio improved 12.9 %. The economical analysis showed that the break even point and internal rate of return are 3 years and 30 %, respectively.

IGES POLICY FORUM RATIONALE

The Institute for Global Environmental Strategies (IGES) Policy Forum on
Integrating Asia's Concerns on Energy Security into the Post-2012 Climate Regime
Sofitel Centara Grand, Bangkok, Thailand
7-8 August 2008

In recent years, energy security and climate change have drawn growing interest from policy makers. This interest has led to the realization that both issues are closely linked. Nowhere are these linkages more important than Asia. Asia not only consumes a large and increasing proportion of the world's energy, but offers considerable potential to alter its energy-use patterns and thereby bend its carbon trajectory with a view to achieve a low carbon society. Indeed escalating oil prices in the past one year has led to a considerable interest in several Asian countries to enhance energy efficiency and promote renewable sources of energy, including biofuels, which in turn can have positive benefits in mitigation of climate change. Yet, while there is an emerging interest in integrating energy and climate concerns in Asia, there is no consensus on how the post-2012 climate change regime will support this integration. Reconciling Asia's energy security needs and global climate concerns will be one the key challenges encountered during negotiations over the post-2012 climate regime. This policy forum is designed to make that challenge more manageable.

In line with this overarching goal, the forum will include two technical sessions and three panel discussions focusing on the below themes:

- **Energy Efficiency/ Renewables:** It is widely acknowledged that improving energy efficiency and exploiting renewable sources of energy can reduce Asia's carbon emissions and dependence on energy imports. At the same time, there exist several barriers to taking advantage of these opportunities in Asia. This session will analyze these barriers and examine how the post-2012 climate regime can help overcome them.
- **Sectoral Approaches:** The limited success of Kyoto-style economy-wide targets has led to an interest in approaches focusing on specific carbon-intensive sectors. Developing countries in Asia have nevertheless voiced growing concerns about sectoral approaches. This session will outline these concerns as well as how effectively different sectoral approaches could potentially address them in the post-2012 regime.
- **Enabling Conditions (Technology, Finance, and Capacity Building):** If Asia is to shift to a low-carbon development path it will need greater technological, financial, and capacity building assistance than it currently receives. This panel will examine how post-2012 climate regime can facilitate the transfer of climate-friendly technologies, investment, and capacity building.
- **Biofuels:** Many countries in Asia have begun to harvest biofuels in response to rising fossil fuel prices. The increase in use of biofuels has sparked debates about their implications on food costs and downstream impacts on carbon emissions. This panel will focus on the costs and benefits of biofuels and how post-2012 regime negotiations can help in designing policy interventions needed to minimize the former and maximize the latter in Asia.
- **The Bali Action Plan:** There are several provisions in the Bali Action Plan that will be critical to determine how successfully Asia can enhance its energy security and confront climate change without undermining economic growth. The panel will discuss how key provisions in the Bali Action Plan can facilitate an effective integration of energy security concerns in climate negotiations.

Note: This policy forum is co-sponsored by Keimyung University, Republic of Korea and Asian Institute of Technology, Thailand

TECHNICAL TOURS



Side view of the bio-solar house designed and occupied by Soontorn Boonyatikarm, professor of architecture at Chulalongkorn University in Bangkok. Photo: Soontorn Boonyatikarm

Bio-Solar House in Thailand - a self-reliant house that produces its own electricity, water, and cooking gas. Built by a research team from Chulalongkorn University, the house is the country's first "bio-solar".

The bio-solar house is a high-tech, ecology-friendly version of what Le Corbusier called "a machine for living." Yet at first sight, the house hardly stands out among the other homes in a gated residential community. But the roof of this 1900-square-foot (180-square-meter), three-bedroom house are installed with 670 square feet (62 square meters) of solar cells capable of generating 22 kilowatts. Buried in the garden are biogas generation unit (adapted from research from Kasetsart University and the Department of Alternative Energy Development and Efficiency in Thailand's Ministry of Energy), condensation collection unit, water recycling equipment, filtering units, and storage tanks. Nothing in this home-cum-ecosystem goes to waste. Garden clippings (grass and leaves) and wet kitchen waste fertilize the small, organic vegetable garden.

The designer and occupant of this self-reliant bio-solar house is Soontorn Boonyatikarm, professor of architecture at Chulalongkorn University who had long had an interest in ecologically responsible architecture. Basic economics was also an integral reason for this project and Prof. Soontorn wanted a self-sustaining house so that he doesn't have to worry about utility bills.

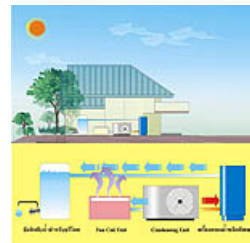
Prof. Soontorn claims the house is 14 times more energy-efficient than a conventional house. Moreover, he says, the house embodies a "philosophy of modern living," based on economy, technology, environmental preservation, and social values without sacrificing comfort. This comfort extends to air quality, cooling, lighting, and acoustics despite the reduced load on the environment. He is convinced that Thailand could benefit enormously if the technology were applied on a large scale. Without the swimming pool, his house would have come within the normal price range of new houses in Thailand today. He estimates that if Thailand built 300,000 such houses, the country would not need any additional power stations.



The solar cells generate 22 kilowatt-hours, and can store energy for three days. Surplus energy can be sold to the power company or used to drive an electric car. Image: Chulalongkorn University



Water from the house is recycled and used to irrigate the garden. The system features are (left to right): car wash, storage tank, household plumbing units, a pipe to send water to the garden, water from the washing machine, and the garden being watered. Image: Chulalongkorn University



Condensation from the air conditioning system supplies 8 gallons (30 liters) of water per day. The unit at the left is the drinking water storage tank; the unit at the right is the water purification unit. Image: Chulalongkorn University

This article is extracted from an article by Jan Krikke (a journalist from the Netherlands, currently based in Thailand) published at http://www.architectureweek.com/2003/0514/environment_1-1.html

Bang Khun Tien – a land swallowed by the sea.

Like lost sentinels, the telephone poles stand in neat rows out at sea, the brown waters of the Gulf of Thailand roiling about them. There are several electricity poles as well, with their cables removed. Occasionally, the roof of a water tank protrudes from the waves. A stone structure stands almost a kilometre out to sea, announcing to boat passengers that they have arrived in Bangkok.

Twenty years ago, this area was on dry land. Just like the telephone and electricity poles. This lost land in Bang Khun Tien district faces a hungry sea from behind double barriers of concrete slabs and a rock-pile embankment.



Telephone poles stand in neat rows out at sea, the brown waters of the Gulf of Thailand roiling about them. ST PHOTO: NIRMAL GHOSH



A few new buildings are under construction in the Wat Khun Samut's compound, resting on wooden and concrete pillars grouted into concrete slabs sunk into the mud beneath, which is under inches of water on a normal high tide. ST PHOTO: NIRMAL GHOSH

The process of inundation is already well under way. Land subsidence is a fairly common natural process in countries across the world prone to it for geological reasons. But it can also be said that it is affected by global warming and climate change as land subsidence in low-lying gulf areas (such as Bangkok) is severely exacerbated by sea-level rise and storms.

The throbbing heart of downtown Bangkok is only about 20km north-east of this lost land in Bang Khun Tien. In a few years, the Thai capital city of Bangkok may well be in an alarming state. Bangkok is subsiding partly because ground water is being drained from underground aquifers. And as the sea level rises, things can only become more perilous.

Global warming induces a rise in sea level worldwide while temperature changes affect climate and often weather as well, producing more violent storms. Across Thailand, global warming is expected to affect weather patterns. Climate models predicted that the country would experience shorter rainy season but with a little bit more precipitation on the average.

Article and photos are extracted from a published article by Nirmal Ghosh (Thailand correspondent of The Straits Times, Singapore) at http://www.straitstimes.com/Photo%2BEssays/STImageReference_2172.html

PARTICIPANTS

Country	Name	Organization
Australia	Deepak Sharma	University of Technology Sydney
	Srichattra Chaivongvilan	University of Technology Sydney
	Supannika Wattana	University of Technology Sydney
	Penny Morton	Multilateral Section (UNFCCC), International Division, Department of Climate Change
Austria	Binu Parthan	Renewable Energy and Energy Efficiency Partnership (REEEP) International Secretariat
Brazil	Prof. Miguel Edgar Morales Udaeta	University of Sao Paulo
Canada	Mr. Christian Martin	Office of Energy Research and Development, Natural Resources
China	Mao Xianqiang	School of Environment, Beijing Normal University
	Xing Youkai	School of Environment, Beijing Normal University
	Fu Jiafeng	Center for Climate Impact Research, Ministry of Environmental Protection
	Wang Can	Tsinghua University
	Zhuang Guiyang	Research Center for Sustainable Development
Czech Republic	Michal Zidek	VSB-Technical University
	Jiri Horak	VSB-Technical University
Finland	Petri Trygg	Tampere University of Technology
	Jari Kaivo-oja	Finland Futures Research Centre
Germany	Christopher Holtwisch	Hagen University and Fraunhofer Institute UMSICHT (Germany)
India	Biplab Das	North Eastern Regional Institute of Science and Technology, Itanagar, India
	Ashwani Kumar	Indian Institute of Technology, Delhi
	Rama Chandra Pradhan	Indian Institute of Technology, Delhi
	Poonam Gera	Dr. B.R.Ambedkar National Institute of Technology
	P.S. Venkataramu	GyanGanga Institute of Technology and Management
	Mangalpaday Aruna	National Institute of Technology Karnataka
	Dr. Harsha Vardhan	National Institute of Technology Karnataka
Sukanta Roy	National Institute of Technology Karnataka	

	Gagan Kumar Deka	National Institute of Technology Karnataka
	Prasenjit Paul	National Institute of Technology Karnataka
	C. A. Babu	National Institute of Technology Calicut
	Pinakeswar Mahanta	Indian Institute of Technology, Guwahati
	Rakesh Kumar Maurya	Indian Institute of Technology Kanpur
	Avinash Kumar Agarwal	Indian Institute of Technology Kanpur
	R.B. Choudhary	National Institute of Technology, Jalandhar
	Rupanwita Dash	Centre for Development Finance, IFMR, Chennai
	Neha Pahuja	Emergent Ventures India
	Laxman Prasad	National Science & Technology Management Information System, Department of Science and Technology
	H. L. Sharma	Ministry of New and Renewable Energy
Indonesia	Sri Haryati	Sriwijaya University
	Muhammad D. Bustan	Sriwijaya University
	Joseph Hwang	PT Gikoko Kogyo Indonesia
	Maritje Hutapea	Ministry of Energy and Mineral Resource
	Teguh Wikan Widodo	Indonesian Center for Agricultural Engineering Research and Development (ICAERD)
Iran	Mohammad Esmaeil Asadi	Agricultural and Natural Research Center of Golesta
Israel	Ms. Michal Blat	Blat – Lapidot
Italy	Anula Abeygunawardana	Politecnico di Milano
	Prof. Valerio Lo Brano	University of Palermo
Japan	Hironori Hamanaka	Chairman, Board of Directors, Institute for Global Environmental Strategies
	Ancha Srinivasan	Climate Policy, Institute for Global Environmental Strategies
	Kentaro Tamura	Climate Policy, Institute for Global Environmental Strategies
	Eric Zusman	Climate Policy, Institute for Global Environmental Strategies
	Maricor Muzones	Climate Policy, Institute for Global Environmental Strategies
	Anindya Bhattacharya	Economic Analysis Team, Institute for Global Environmental Strategies
	Jane Romero	Institute for Global Environmental Strategies (IGES)
	Sivapuram Prabhakar	Institute for Global Environmental Strategies (IGES)
	Hiroaki Takiguchi	Ministry of the Environment, Japan
	Atit Tippichai	Nihon University

Korea	Seung-Bok Shin	Yonsei University
	Prof. Jin-won Park	Yonsei University
	Ho-Jun Song	Yonsei University
	Il Hwan Ahn	Ajou University
	Rae Kwon Chung	Ambassador for Climate Change, Ministry of Foreign Affairs and Trade
	Myung-Kyoon Lee Kyoungsik Choi	Keimyung University Korea Environmental Management Corporation
Lithuania	Dalia Streimikiene	Lithuanian Energy Institute
Malaysia	Dr. Mohd. Hariffin Bin Boosroh	Universiti Tenaga Nasional
	Sujundran Balachandran	Universiti Tenaga Nasional
	Zalina Mat Nawi	Universiti Malaysia Terengganu
Malta	Mr. Nicholas J. Zarb	University of Malta
New Zealand	Mr. Roger Baars	University of Auckland
Pakistan	Javed Anwar	International Islamic University
Philippines	Liesl C. Lim	Presidential Task Force on Climate Change, Department of Energy, Philippines
Singapore	Ms. Fanny Lie	Ginga Petroleum PTE, Ltd.
South Africa	Mashoko Livison	University of Johannesburg
Sweden	Anders Granlund	Swedish Environmental Secretariat for Asia
Switzerland	Georg Steiner	Swiss Ministry for Foreign Affairs
Taiwan	Prof. Yaw-Juen Wang	National Yunlin University of Science and Technology/Asian Institute of Technology
	Po-Chun Hsu	National Yunlin University of Science and Technology
	Shih-Mo Lin	Chung Yuan Christian University
	Chih-Hsiung Tseng	Chung Yuan Christian University
Thailand	Prof. Said Irandoust	President, Asian Institute of Technology
	Dr. Nadarajah Mithulananthan	Asian Institute of Technology
	Prof. S. Kumar	Asian Institute of Technology
	Prof. Ram Shrestha	Asian Institute of Technology
	Dr. Weerakorn Ongsakul Maria Kathrina B. Grautoito	Asian Institute of Technology Information Professional, RERIC, Asian Institute of Technology

Teerapot Wessapan	Eastern Asia University
Yuttachai Keawsuntia	Vongchavalitkul University
Wantana Somcharoenwattana	JGSEE, King Mongkut's University of Technology Thonburi
Prayong Keeratiurai	Suranaree University of Technology
Supawan Petsri	JGSEE, King Mongkut's University of Technology Thonburi
Ali Hasanbeigi	JGSEE, King Mongkut's University of Technology Thonburi
Sarawoot Watechagit	Mahidol University
Mega Octaviani	JGSEE, King Mongkut's University of Technology Thonburi
Suwat Trutassanawin	Mahidol University
Napaporn Phuangsornpitak	Kasetsart University, Chalermphrakiat Sakonnakhon Province Campus
Suksan Wangsathitwong	King Mongkut's University of Technology North Bangkok
Suwit Auchariyamet	King Mongkut's University of Technology North Bangkok
Nattachote	King Mongkut's University of Technology North Bangkok
Rugthaicharoencheep	King Mongkut's University of Technology North Bangkok
Watthana Seubkinorn	King Mongkut's University of Technology North Bangkok
Chairote Yaiprasert	Walailak University
Sompop Jarungthammachote	Kasetsart University Si Racha Campus
Kitipong Jaojaruek	Kasetsart University Kamphaeng Saen Campus
Devbratta Thakur	Asian Institute of Technology
Mayurachat Watcharejyothin	Asian Institute of Technology
Austin Arensberg	Nollen Group Company Limited
Chumnong Sorapipatana	JGSEE, King Mongkut's University of Technology Thonburi
Masakazu Ichimura	Environmental and Natural Resources Development Division, United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP)
Somkiat Sutiratana	Department of Alternative Energy Development and Efficiency
Amnuay Thongsathity	Department of Alternative Energy Development and Efficiency
Aree Wattana Tummakird	Office of Natural Resources and Environmental Policy and Planning (ONEP)
Thiyagarajan Velumail	Regional Energy Programme for Poverty Reduction, UNDP Regional Center in Bangkok
Jeremie Duthel	Embassy of France in Thailand
Prasertsuk Chamornmarn	Climate Change Cooperation Center, Office of Natural Resources and Environmental Policy and Planning
Sitanon Jesdapipat	Center for Natural Resources and Environmental Management, NREM Center,

	Thierry Lefevre	Mae Fah Luang University Center for Energy-Environment Research and Development (CEERD)
	Kanin Eklaknarat	Siam Cement Group
	Narongrit Pinyotrakool	Siam Cement Group
	Panya Sopasriphan	Siam Cement Group
	Chanwut Limpichai	Siam Cement Group
	Nusorn Pangsapa	Siam Cement Group
	Sasiluksana Khamsiri	Electricity Generating Authority of Thailand
	Nilapha Paemaneer	Electricity Generating Authority of Thailand
	Phongnat Tuaycharoen	Electricity Generating Authority of Thailand
	Nithima Lojai	Electricity Generating Authority of Thailand
	Parichart Khameerak	RERIC, Asian Institute of Technology
	Sukanya Nhooma	Energy FoS, Asian Institute of Technology
	Albert Pedrajas	Energy FoS, Asian Institute of Technology
The Netherlands	Prof. Peter Van Krieken	Webster University
	Phuong H. Nguyen	Eindhoven University of Technology
Uganda	Barnabas Nawangwe	Makerere University
United Kingdom	Thanawat Nakawiro	University of Dundee
	Lucy Cradden	University of Edinburgh
	Christian Ellermann	Oxford University
	Ruediger Haum	University of Sussex, and Free University of Berlyn
	Mike Stairmand	
USA	Jacob Park	Business Strategy and Sustainability, Green Mountain College

NOTES

NOTES

NOTES

NOTES

ESCC 2008

A venue to report latest developments, showcase new ideas and technologies, share meaningful experiences, and highlight related programs and policies on issues energy security and climate change. Be part of this dynamic international intellectual exchange in which all stakeholders should be involved in to coordinate, promote, and contribute solutions to these pressing issues the whole world at present is confronting.

Our world we borrowed from future generations is irreplaceable. Be part of the solution, be a positive part of the global change!

Organized by:



Regional Energy Resource; Information Center (RERIC)



Asian Institute of Technology (AIT)

In partnership with:



Institute for Global Environmental Strategies (IGES)

Platinum Sponsors:



Electricity Generating Authority of Thailand



Metropolitan Electricity Authority



Siam Cement Group

Silver Sponsor:



RERIC

Asian Institute of Technology
P.O. Box 4, Klong Luang
Pathumthani 12120
Thailand

Tel: +66 2 524 6216 and +66 2 524 5413

Fax: +66 2 524 5439

E-mail: enreric@ait.ac.th