



SEA-EU-NET

National Metal and Materials
Technology Center (MTEC), Thailand

National Science and Technology
Development Agency (NSTDA), Thailand

British High Commission, Singapore

European Commission

British Embassy, Thailand



EU-Southeast Asia Expert Meeting on 2nd Generation Biofuels: Identifying Opportunities for Collaboration

Bangkok, Thailand

8-9 September 2009

Final Report





+ Contents

- 03 Programme
- 08 Forward
- 10 Description and Objectives
- 11 SEA-EU-NET
- 13 Biofuels in FP7
- 17 Proceedings
 - 17 Opening Session
 - 18 Speaker Session
 - 28 Panel Discussion
 - 31 Roundtable Discussion
 - 35 Laboratory Tour
- 36 Feedback and Potential Collaborations
- 38 Participants
- 42 Organizing Committee

Tuesday 8 September 2009

Opening Session

Sirindhorn Science Home, Thailand Science Park, Pathumthani, Thailand

8:30-9:00	Registration
9:00-9:15	Welcome Remarks Assoc. Prof. Dr. Werasak Udomkichdecha Executive Director National Metal and Materials Technology Center (MTEC), Thailand
9:15-9:30	Opening Address Mr. Jean-Michel Sers Directorate-General for Research, International Dimension of the Framework Programme European Commission, Brussels
9:30-9:40	Group photos with all speakers
9:40-10:00	FP7 Briefing Mr. Jurgen Saunders Directorate-General for Research, International Cooperation European Commission, Brussels
10:00-10:20	Networking break

Programme

Tuesday 8 September 2009

Plenary Session I

2nd generation biofuels feedstock

10:20-10:45	Agriculture beyond food Dr. Huub J.M. Loffler Agriculture beyond Food Programme Wageningen University and Research centre, Plant Research International Netherlands
10:45-11:10	2 nd Generation biofuel feedstock assessment: Land use management and availability Dr. Sylvia Prieler REFUEL Programme International Institute for Applied Systems Analysis Austria
11:10-11:35	Microalgae for biofuel production Dr. Aparat Mahakhant Microbiological Resources Center (MIRCEN) Thailand Institute of Scientific and Technological Research (TISTR) Thailand
11:35-12:00	Bio hydrofined diesel from catfish fat Dr. Le Kim Dien National Key Laboratory for Petrochemical & Refinery Technologies Vietnam Institute of Industrial Chemistry Vietnam
12:00-13:30	Networking lunch

Programme

Tuesday 8 September 2009

Plenary Session II

Biological and thermo-chemical processes in
2nd generation biofuels production

13:30-13:55	Second generation, sustainable, bacterial biofuels (Butanol) Prof. Nigel Peter Minton Biotechnology and Biological Sciences Research Council (BBSRC): Second Generation, Sustainable, Bacterial Biofuels Programme University of Nottingham United Kingdom
13:55-14:20	Lignocellulosic conversion to bioethanol Prof. Ed Louis Biotechnology and Biological Sciences Research Council (BBSRC): Lignocellulosic Conversion to Bioethanol (LACE) Programme University of Nottingham United Kingdom
14:20-14:45	Marine wood borer enzyme Dr. Leonardo Gomez Biotechnology and Biological Sciences Research Council (BBSRC): Marine Wood Borer Enzyme Discovery Programme University of York United Kingdom
14:45-15:10	Catalytic vegetable oils transformations: Biofuels and fine chemistry application Dr. Jean-Marc Clacens Laboratoire de Catalyse en Chimie Organique (LACCO), CNRS Université de Poitiers France

Programme

Tuesday 8 September 2009

Plenary Session II (Continued)

Biological and thermo-chemical processes in 2nd generation biofuels production

15:10-15:35	Advances in gasification/pyrolysis of palm oil wastes for 2 nd generation biofuel production Dr. Lee Dongho Advanced Clean Energy Centre The Institute of Environmental Science and Engineering (IESE) Singapore
15:35-15:55	Networking break

Closing Session

15:55-16:55	Panel discussion Chairman: Prof. Sudip K. Rakshit Vice President – Research Asian Institute of Technology Thailand
16:55-17:00	Concluding remarks

Programme

Wednesday 9 September 2009

Discussion and Exploration of Potential Collaboration with Local Researchers

NSTDA, Thailand Science Park, Pathumthani, Thailand

9:00-9:15	Introduction of NSTDA Alternative Energy Cluster Assoc. Prof. Dr. Paritud Bhandhubanyong Chairman of Alternative Energy Cluster, National Science and Technology Development Agency (NSTDA) Thailand
9:15-9:30	Introduction of MTEC Bioenergy Lab Dr. Nuwong Chollacoop Researcher , Bioenergy Laboratory National Metal and Materials Technology Center (MTEC) Thailand
9:30-10:00	Self-introduction of all researcher participants' interests and areas of expertise in 2 nd generation biofuels research
10:00-10:20	Networking break
10:20-11:00	EU funding experiences: Tips and Tricks
11:00-12:00	NSTDA lab tour
12:00-13:30	Networking lunch



Forward

The foreseeable depletion of fossil fuels and the necessity to curb greenhouse gas emissions has led to a sharpened focus on alternative, environmentally friendly energy sources such as biofuels.

However, there has been mounting concern that conventional or 1st generation biofuels, such as those derived from sugar cane, corn and oil palm, may in fact contribute to higher food prices due to their competition with food crops, and that their production may in fact contribute to energy price volatility. It is increasingly accepted that 1st generation biofuels are limited in their ability to achieve targets of oil product substitution, climate change mitigation and sustainable economic growth.

There is, as a result, a growing interest in developing biofuels produced from agricultural and forest residues as well as non-food biomass, and these include cellulosic ethanol, biomass-to-liquid (BTL), and algae oil. These so-

called 2nd generation biofuels are in the emerging stages commercially but hold great promise in avoiding many of the concerns of 1st generation biofuels. And though many of the conversion pathways have been known for some time, there are still a number of technical and economic challenges to overcome.

Since the potential benefits of biofuels are global, international collaboration on research and development (R&D) is essential. Southeast Asia has abundant biomass resources, while the EU has state-of-the-art biomass-to-biofuel conversion technologies. Partnerships between SEA and EU researchers can lead to sustainable development of 2nd generation biofuels.

Initiating an internationally collaborative R&D effort is, however, challenging, particularly at the beginning steps of bringing researchers from different places together and setting a stage explicitly to brainstorm possible collaborations. Thanks to the support of SEA-EU-NET,

those difficult initial steps were successfully taken in 2008 at a workshop in Bangkok, titled “*EU-Southeast Asia Workshop on Biofuels Development: Opportunities for Collaboration*,” in Bangkok.

Building on the success of last year’s broad-scoped workshop, this year’s workshop, titled “*EU-Southeast Asia Expert Meeting on 2nd Generation Biofuels: Identifying Opportunities for Collaboration*,” had a sharper focus: sustainable development of 2nd generation biofuels. The invited participants were also a more focused group, comprising experts, researchers and enthusiasts in the fields related to 2nd generation biofuels from European and Southeast Asian countries. Nearly 100 people registered, and over 80 people participated over the 2-day course of the Meeting.

As anticipated, the invited speakers offered impressively comprehensive presentations on a broad spectrum of 2nd generation biofuels research, showcasing the state-of-the-art development from both the EU and SEA. The panel discussion at the end of the first day produced insightful comments from the panelists on the hot topics of 2nd generation biofuels, along with thoughtful comments from the participants. Moreover, the roundtable discussion on the second day was very lively and productive. The invited EU and SEA experts, as well as many local researchers, exchanged ideas and personal views on the current development in the different regions.

A number of participants seized the networking opportunities, started forming partnerships, and brainstormed collaborative research projects with one another.

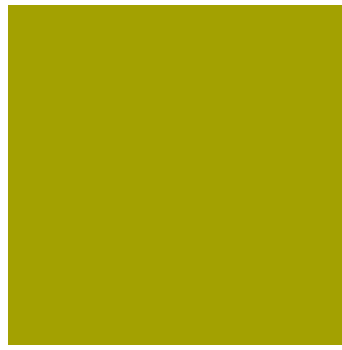
On behalf of the organizing committee, we would like to take this opportunity to express our highest appreciations to the supporters of this Meeting, especially the SEA-EU-NET, the British High Commission (Singapore), the European Commission, the British Embassy (Thailand), Thailand’s National Science and Technology Development Agency (NSTDA) and National Metal and Materials Technology Center (MTEC).

We hope that the successful first steps toward international collaboration initiated during this Meeting will lead to sustainable 2nd generation biofuels as alternative pathways toward global sustainability.

Sittha Sukkasi
Nuwong Chollacoop
Simon Grimley

National Science and Technology Development Agency
(NSTDA), Thailand

Coordinators of the Workshop



Description and Objectives +

This Expert Meeting strived to foster partnerships between SEA and EU researchers in the sustainable development of 2nd generation biofuels.

It aimed to bring together European and Southeast Asian scientific experts to identify opportunities for collaboration and to form consortia to bid into the upcoming EU FP7 calls on 2nd generation biofuels.

The highlights of the meeting included ample opportunities for researchers to network and brainstorm potential collaborations, as well as presentations by leading EU and SEA researchers on the current status of 2nd generation biomass utilization, conversion technologies, and adaptation into existing transportation framework. A panel of distinguished speakers provided thought-provoking insights on the future direction of research on 2nd generation biofuels. In addition, a roundtable discussion was facilitated, allowing local researchers to further explore collaborations with other SEA and EU researchers.

Details of funding under the Seventh Framework Programme (FP7) were also presented.

The Workshop was sponsored by SEA-EU-NET and the British High Commission (Singapore), supported by the European Commission and the British Embassy (Thailand), and organized by the National Science and Technology Development Agency (NSTDA) and the National Metal and Materials Technology Center (MTEC) of Thailand. It was part of the workshop series organized by the British High Commission.



SEA-EU-NET

Partners in Science



There are many examples of fruitful scientific collaborations and linkages between researchers in the EU and South East Asia. Such partnerships are beneficial to all parties involved, and the resulting advancements in research deliver improved quality of living, life saving medicines and economic returns to both regions.

The "SEA-EU-NET" project has been set up to expand scientific collaboration between Europe and South East Asia in a more strategic and coherent manner. The project was launched in January 2008 and involves 17 key institutions from the two regions. It will adopt an evidence-based approach to increase the quality, quantity, profile and impact of Science and Technology (S&T) cooperation between the ten member countries of the Association of Southeast Asian Nations (ASEAN) and the Member- and Associated States of the European Union (EU). This is in support of the international strategy of the EU, and in particular the specific objectives of the Seventh Framework Programme for Research and Technological Development (FP7) - the EU's primary funding opportunity for collaborative scientific research. "SEA-EU-NET" funding runs through to the end of 2011 although the outcomes will be designed so they are sustained beyond this point.

The project will identify, promote and deliver a wide range of measures to increase mutually beneficial SEA-EU cooperation amongst academic, industrial and government stakeholders.

Objectives

1. Dialogue: To strengthen bi-regional and bi-lateral dialogue in scientific cooperation and to jointly identify

priority strategic topics for collaboration under FP7 thematic programmes.

2. Decision-Making: To reach consensus on areas which will yield the greatest benefits from improved cooperation, and to increase the flow and availability of resources available to these areas.

3. Networking: To network Universities, industry, Government, charities and S&T related institutions in order to strengthen research capacity.

4. Partnership: To develop and implement a coherent European-level approach towards international S&T cooperation with South East Asia.

5. Sustainability: All activities will be underpinned by a focus on sustainability, and designed to deliver impact beyond the lifespan of the four year funding stream in order to develop long-lasting partnership.

Description of work

The SEA-EU-NET project will identify examples of best practice and barriers to the formation and success of collaborations. Existing support mechanisms will be analysed, networked and expanded where necessary to ensure a more coherent strategic approach. Funding streams - in particular the EU's 7th Framework Programme for Research (FP7) - will be analysed to identify further opportunities for stimulating collaboration. Participation in such schemes will be increased through the dissemination of information in a targeted manner to researchers in South East Asia, and support will be provided in accessing the funds. Action will be driven forward to deliver increased partnership.



Scientific conferences will be held to bring together expert researchers from the EU and SE Asia, to provide a platform for sharing research, overcoming technical barriers, and stimulating long term collaborative projects for funding by national research bodies, the EU Framework Programme 7 and other sources.

Each year stakeholders will be brought together through a 'week of cooperation' to foster knowledge transfer, policy coordination and develop joint action plans for delivering closer bi-regional partnership.

Partners

The SEA-EU-NET consortium has been engineered to bring together a diverse range of S&T policy expertise from academia, the private sector, and government. The consortium currently comprises 17 partners although this shall be expanded over the course of the four years (2008-2011):

- *The International Bureau of the German Federal Ministry of Education and Research, (PT-DLR), Germany (Coordinator) www.internationales-buero.de*
- *Royal Netherlands Academy of Arts and Sciences (KNAW), The Netherlands www.knaw.nl*
- *The British High Commission, Singapore (BHC), Singapore/United Kingdom www.britishhighcommission.gov.uk/singapore*
- *Collegium Budapest, Institute for Advanced Study (COLBUD), Hungary <http://www.colbud.hu/>*
- *The Scientific & Technological Research Council of Turkey - TUBITAK, Turkey www.tubitak.gov.tr*
- *National Science and Technology Development Agency (NSTDA), Thailand www.nstda.or.th*
- *Zentrum für Soziale Innovation (ZSI), Austria www.zsi.at*
- *Ministry of State for Research and Technology (RISTEK) Indonesia www.ristek.go.id*
- *National Centre for Scientific and Technological Information (NACESTI), Vietnam www.nacesti.vn*
- *Institute of Asian Studies GIGA German Institute of Global and Area Studies (GIGA) Germany www.giga-hamburg.de*
- *Centre de coopération internationale en recherche agronomique pour le développement CIRAD, France www.cirad.fr*
- *DEMOS - Think tank for everyday democracy (DEMOS) United Kingdom www.demos.uk*
- *Centre National de Recherche Scientifique (CNRS), Réseau Asie, France www.reseau-asie.com*
- *The Scientific & Technological Research Council of Turkey - TUBITAK UME Turkey www.ume.tubitak.gov.tr*
- *Polska Akademia Nauk (PAN) Poland www.pan.pl*
- *National Metrology Laboratory - SIRIM Berhad (NML-SIRIM), Malaysia www.sirim.my*
- *Ministry of Science, Technology and Innovation (MOSTI) Malaysia www.mosti.gov.my*

Information about SEA-EU-NET obtained from:
<http://ukinsingapore.fco.gov.uk/en/working-with-singapore/science-innovation/sea-eu>



Biofuels in FP7

A Presentation by Mr. Jurgen Sanders
Directorate-General for Research, International Cooperation
European Commission, Brussels



Biofuels in FP7



Bangkok, 8 September 2009

jurgen.sanders@ec.europa.eu

FP7 Thematic priorities: Biofuels

- Health
- **Food, Agriculture and Biotechnology**
- Information and Communication Technologies
- Nanosciences, Nanotechnologies, Materials and new Production Technologies
- **Energy**
- **Environment (including Climate Change)**
- **Transport (including Aeronautics)**
- Socio-Economic Sciences and the Humanities
- Security and Space
- Nuclear Fission and Radiation Protection

FP7 Work Programme 2010 Energy: Biofuels

- Biofuels from Energy Crops
 - Industrial biofuels from algae (demonstration), 3 projects, total ca. 15 M€, deadline 4.3.2010
- Liquid or gaseous fuels using direct biological conversion of solar radiation
 - ca. 5 – 8 M€, deadline: 15.10.2009 (not 1st or 2nd generation biofuel)
- Biomass: demonstration of new generation of boilers and stoves
 - up to 3 projects, ca. 14 M€, deadline: 4.3.2010

FP7 Work Programme 2010 Environment: Biofuels

- Long- term carbon sequestration (100 year perspective)
 - 3 projects, incl. pilot plant demonstration, ca. 2.5 M€ each, deadline: 5.1.2020



EUROPEAN COMMISSION
FP7 Work Programme 2010 Food: Biofuels

- Modification of algae to better suit industrial applications (bioplastics, biofuels, pharmaceuticals,...)
 – Ca. 6 M€, deadline 14.1.2010
- Biorefinery (call probably next year)

EUROPEAN COMMISSION
FP7 Work Programme 2010 Transport: Biofuels

- Aeronautics propulsion with new generation biofuels or "green" synthetic fuels
 – ca. 3 M€, deadline: 14.1.2010
- Alternative fuels in transport
 – Coordination and Support Action, strongly encouraging international partners, deadline: 14.1.2010, contact the European Biofuels Technology Platform

EUROPEAN COMMISSION
A typical FP7 project

- 10 or more research partners from many countries
- 4 years duration
- 3 to 30 million Euro project budget
- one partner is the project coordinator

EUROPEAN COMMISSION
FP7

Collaboration
 < - >
 Competition
 (proposal based)

EUROPEAN COMMISSION
FP7

Make it simple

EUROPEAN COMMISSION
Joining Projects in FP7

- Two steps for joining a proposal:
- Step 1. Find a European proposal coordinator
 - Step 2. Help preparing the proposal as a "partner"

No Application Forms (almost)

Step 1: Find a European Proposal Coordinator

Find a good proposal coordinator though:

- scientific friends
- European Technology Platforms
- www.cordis.lu -> partner search
- Internet
- conferences
- SEA-EU-NET (Simon Gimley)
- FP7 information events
(Dr. Junpen Meka-apiruk from the Thai Embassy goes to most FP7 information events in Brussels)

Step 1: Find a European Proposal Coordinator

Present yourself with simple text:

- who you are : your competence, your institution
- your research idea
- your cooperation idea
- required or available funding (if you know)
- the intended FP7 call (if you know)
- your name and address

2 pages max

Step 2: Help preparing the proposal

A Partner's text contributions :

- your research contribution
- description of your institution
- CVs of key researchers
- importance of the project in your country
- economic and social impact of the project
- how to exploit the results
- list of references and related projects
- illustrations
- your required budget

1 page for each

Best advice : Act Fast

FP7 Evaluation Criteria

- Scientific Quality
- Relevance
- Management

FP7 Fellowships, Grants

- Marie Curie Fellowships *incoming or outgoing*
– for experienced scientists (with PhD)
- ERC Starting Grants
– For highly qualified starting researchers (2 to 10 years after PhD) *for establishing a research team in Europe*
- ERC Advanced Grants
– For advanced researchers with track record of significant achievements *for establishing a research team in Europe*
- See also Training Networks:
<http://ec.europa.eu/euraxess/> (FP7)
http://mc-opportunities.cordis.lu/home_vac.cfm (FP7)
(also possible institutional applications)

Individual application together with the host institution

More Information

- www.cordis.lu
 - call for proposals
 - search for partners
 - register as expert to the EU
 - subscriptions (RTD info, email alerts)
 - registration of research organisations
 - documents, news, project information,...
- see also
 - www.SEA-EU.NET
 - www.thaiscience.eu



FP7 Contacts

Simon Grimley
Coordinator
NSTDA / SEA-EU-NET
simon@nstda.or.th
www.sea-eu.net

Dr. Junpen Meka-apiruk
Minister Counsellor
Thai Embassy, Brussels
junpen@most.go.th
www.thaiscience.eu

Somboonsub Nopmanee
EU Delegation, Bangkok
nopmanee.somboonsub@ec.europa.eu
www.deltha.ec.europa.eu



FP7

Wish you success!



+ Proceedings

Opening Session



The first day of the Meeting was on Tuesday September 8, 2009. A day-long series of sessions started with welcoming remarks from **Assoc. Prof. Dr. Werusak Udomkichdecha, the Executive Director of the National Metal and Materials Technology Center (MTEC)**. He officially opened the Meeting by warmly welcoming all the distinguished speakers and participants. He then outlined the objectives and expected outcomes of the Meeting to the audience, and reported on the number of participants and the diversity of their affiliations. Lastly, he wished all participants successful exchange of ideas and identification of potential collaborations.

Mr. Jean-Michel Sers, Directorate-General for Research, International Dimension of the Framework Programme and Mr. Jurgen Saunders, Directorate-General for Research, International Cooperation, both from the **European Commission**, also honored the Meeting with their presence and opening addresses. They described the Seventh Framework Programme, its funding schemes, budgets, specific programmes, and opportunities. Thematic priorities that were related to biofuels were highlighted. Furthermore, a typical FP7 project and the processes of application and collaboration were illustrated. Finally, contact information of FP7 contact persons in Thailand was provided.

Speaker Session



From left to right: Prof. Sudip K. Rakshit, Dr. Sittha Sukkasi, Mr. Christopher Tan, Dr. Aparat Mahakhat, Mr. Simon Grimley, Dr. Junpen Meka-Apiruk, Assoc. Prof. Dr. Werasak Udomkichdecha, Mr. Mads Korn, Mr. Jean-Michel Sers, Dr. Huub J.M. Loffler, Dr. Sylvia Prieler, Mr. Jürgen Sanders, Dr. Jean-Marc Clacens, Dr. Le Kim Dien, Dr. Lee Dongho, Prof. Ed Louis, Prof. Nigel Peter Minton, Dr. Leonardo Gomez, and Dr. Nuwong Chollacoop

Speaker Session



Agriculture beyond food

Dr. Huub J.M. Loffler

Agriculture beyond Food Programme

Wageningen University and Research centre, Plant Research International, Netherland

Dr. Huub Loffler started the presentation with the historical data for food production and human growths in the past four decades. World average food availability is higher than the nutritious requirement but there are great variations from countries to countries, with much larger fraction of under-nourished populations in developing countries. It is estimated that double the plant-production is required for food and feed by 2050, not to mention future energy demand. One of the proposed approaches is “Biobased Economy” as solution to world demands for food, feed and energy in the future. In this regard, Consultative Group on International Agricultural Research (CGIAR) has discussed on the Biobased Economy concept in Science Forum 2009 (The Netherlands, 16-17 June 2009). The recommendation for 1st generation biofuels is focused on the small scale for small community; whereas, that for 2nd generation biofuels may still adversely compete for scarce resources (e.g. labor, land water and nutrients). Five recommendations for sustainable Biobased Economy are the following, with the emphasized preconditions on People, Planet and Profit: i) to explore new scientific avenues, e.g. photosynthesis, non-land use and micro-organisms; ii) to stimulate the use of biomaterials; iii) stimulate bio-refineries; iv) start with social and economics; and v) pre-processing as an innovative option

As a result, a scientific cooperation on Biobased Economy was initiated between Indonesia and the Netherlands, with the following objectives: i) to obtain a solid, scientifically well funded, innovative program for the development of biofuels and bioproducts focusing on both education and research; ii) to address technical, socio-economic and legal aspects in a consorted way to the benefit of society, economy and environment of both countries; and iii) to obtain a program under joint responsibility of both countries.

Speaker Session



2nd Generation biofuel feedstock assessment: Land use management and availability

Dr. Sylvia Prieler

REFUEL Programme

International Institute for Applied Systems Analysis (IIASA), Austria

Dr. Sylvia Prieler presented her work from REFUEL (Renewable fuels for a sustainable Europe) and OFID (OPEC Fund for International Development) Programs, focusing on land use assessment for 2nd generation biofuels feedstock. The contribution of 2nd generation biofuels in transport is strongly encouraged due to its lower competition for land/water in term of food security, and better sustainability performance in term of GHG savings. In US policy on ethanol production, one study has predicted 1st generation contribution would reach plateau after 2014 with contribution of 2nd generation starting in 2008 with rapid growth to over 20 billion gallons by 2022. In EU policy, binding target of 10% share of renewable energy in transport was set by 2020, with biofuels being subjected to sustainability criteria on GHG savings and protected land use. FAO (Food and Agriculture Organization) and IIASA has developed a spatial analysis system that enables rational land-use planning on the basis of an inventory of land resources, together with evaluation of biophysical limitations and production potentials of land. Europe and global mapping of potential energy yield, suitable feedstock and unprotected land suitability are generated.

From 13.1 billion hectares of global land (excluding Antarctic and Greenland), 4.6 billion hectares are for grassland, shrubs and woodland, of which 1.7 billion hectares are for livestock and bioenergy. Taken into account of animal feeding land, approximately 600-800 million hectares are potentially available for bioenergy production, of which approximately 330 million hectares are located in developed countries while about 450 million hectares are located in developing countries (mainly Africa and Latin America). However, practical availability of this land is also affected by future food/feed demand, infrastructure-accessibility-economic feasibility, biodiversity and socio-cultural concerns (e.g. indigenous people). Hence, land use model has been employed with scenario analyses to assess potential land use for bioenergy feedstock. No-land requirement for agricultural residues and marginal-land situation for energy crops like jatropha/cassava have also been incorporated.

Speaker Session



Microalgae for biofuel production

Dr. Aparat Mahakhant

Microbiological Resources Center (MIRCEN)

Thailand Institute of Scientific and Technological Research (TISTR), Thailand

Dr. Aparat Mahakhant presented her research activities on microalgae, which was popular as potential biofuels feedstock during the oil crises in 1970s and recently in 2007. The attractiveness of microalgae lies in its high productivity (mass, starch or oil), high biodiversity, small footprint and non-arable land requirement, presence in various kind of water (fresh/brackish/sea/waste). In term of biological processing, microalgae yields co-products of protein, pigment and biomass for food/feed/fertilizer; and can be co-processed with waste utilization, e.g. CO₂ fixation in flue gas, eutrophication in waste water with inexpensive and intensive cultivation systems. Within the context of biofuels feedstock, microalgae strain needs to contain high oil/starch, grow at fast rate and be able to grow in waste.

At TISTR Culture Collection, there are over 1,000 strains under investigation in three research aspects: i) Convention on Biological Diversity (CBD): e.g. situ conversion & sustainable utilization of strains; ii) Convention on Climate Change (CCC): e.g. CO₂ fixation/wastewater treatment/biofuels production; and iii) Convention to Combat Desertification: e.g. soil conditioner/bio-fertilizer. Various research topics and results were presented with most activities still on the screening stages for various interests and applications. Nostoc and Hapalosiphon strains have been identified as suitable for ethanol production with 30% dry-weight starch content; whereas, Nostoc strain is for biodiesels production with 30% dry-weight oil content. Researches on productions of both ethanol and biodiesel will commence next year.

Speaker Session



Bio hydrofined diesel from catfish fat

Dr. Le Kim Dien

National Key Laboratory for Petrochemical & Refinery Technologies
Vietnam Institute of Industrial Chemistry, Vietnam

Dr. Le Kim Dien presented his work on Bio-Hydrotreated (BHD) vegetable oil, which is non-oxygenated hydrocarbon fuel with closer properties to mineral diesel than biodiesel. Catalysts for BHD process were synthesized and characterized to illustrate promising potentials. Final remark on the biofuels situation in Vietnam was also presented with the following three periods:

- 2006-2010: This period mainly focuses on raising public awareness while identifying appropriate production technologies. Zoning of raw material and production of new high yield breeds are planned with trial utilization of E5 and B5 in selected cities.
- 2011-2015: Production, distribution and necessary infrastructure of biofuel will be expanded with a target of 5% from E5 and B5. Genetic engineering and modern fermentation technology will be introduced.
- 2015-2025: Production of ethanol and biodiesel will reach 5 and 0.5-1 billion liters/year, respectively, which are accounted for 10-15% of petro-fuel.



Speaker Session



Second generation, sustainable, bacterial biofuels (Butanol)

Prof. Nigel Peter Minton

Biotechnology and Biological Sciences Research Council (BBSRC):
Second Generation, Sustainable, Bacterial Biofuels Programme
University of Nottingham, UK

Prof. Minton presented his research on cellulosic biobutanol, which is a work under BBSRC. He heads the Clostridia Research Group at the Centre of Biomolecular Sciences (CBS), The University of Nottingham. His research group has many collaboration projects with governmental institutes and private companies. One of his focuses is on Acetone-Butanol-Ethanol (ABE) Process via *Clostridium acetobutylicum*, which is harmless, nonpathogenic, widespread in soil, and produces chemical solvents (acetone and butanol) via fermentation process. The ABE process was discovered in 1914 but became less popular after the alcohol production from yeast and competition from petroleum industry. Brief interest was paid following 1970s oil crisis and recent crisis in 2007. Biobutanol has superior properties to bioethanol such as higher energy content, lower vapor pressure, higher tolerance to water contamination and better fuel economy. These attractive characteristics make biobutanol more suitable for gasoline with possible higher blend for existing engine without modification, as well as simple adaptation to existing gasoline supply and distribution channels. Finally, butanol could be used as aviation fuel.

However, butanol economy competitiveness could be uplifted via strain development to improve product yield and reduce downstream distillation cost. BBSRC has undertaken key enabling technology in genetic bioengineering. Many patents have been filed for process and technology. Final remark focused on ample opportunities to have collaboration with his research center with already many on-going international research cooperations.

Speaker Session



Lignocellulosic conversion to bioethanol

Prof. Ed Louis

Biotechnology and Biological Sciences Research Council (BBSRC):
Lignocellulosic Conversion to Bioethanol (LACE) Programme
University of Nottingham, UK

Prof. Louis presented the research work on lignocellulosic biomass conversion to biofuel. Under BBSRC, Lignocellulosic Conversion to Bioethanol (LACE) Programme focuses on three kinds of biomass resources, namely wood residues, municipal paper waste and agricultural residues, with emphasis on conversion technology with optimized fermentation. Furthermore, sustainability issue among social, environment and economic must be addressed.

The second part of the talk was an introduction of new centre for bioenergy at The University of Nottingham, which will expand scientific base and launch new development collaboration.



Speaker Session



Marine wood borer enzyme

Dr. Leonardo Gomez

Biotechnology and Biological Sciences Research Council (BBSRC):

Marine Wood Borer Enzyme Discovery Programme

University of York, UK

Dr. Gomez presented his research work on developing enzyme to overcome the cell wall challenge in biofuel process, within Centre for Novel Agricultural Products (CNAP), University of York. CNAP analysis shows that transport sector relies on liquid fuels and accounts for 30% of total GHG emissions. Biomass is currently the most cost-effective, large scale, renewable feedstock that can be converted into fuels that are well suited for transportation. Success of lignocellulosic ethanol greatly depends on how to overcome the cell wall since downstream process of fermentation is already well established with conventional sugar/starch feedstock. Over 17 institutions from all over the world has joined effort of RENEWALL, aiming to i) engineer plant feedstock for enhanced saccharification; ii) identify the molecular basis of recalcitrance to saccharification; and iii) identify and optimize novel biochemical pretreatments.

Detailed work plans of each sub group were presented. Final remarks on marine wood borer enzyme discovery were presented.



Speaker Session



Catalytic vegetable oils transformations: Biofuels and fine chemistry application

Dr. Jean-Marc Clacens

Laboratoire de Catalyse en Chimie Organique (LACCO), CNRS

Université de Poitiers, France

Dr. Clacens presented his research work on how vegetable oils can be transformed for biofuels and fine chemistry applications. First, conventional biodiesel process from vegetable oil via transesterification was described, with introduction of solid catalyst Esterfip-H (IFP) process as an alternative to reduce waste water and improve by-product glycerin quality. However, with 2nd generational biofuels, new oils, e.g. from Jatropha or Algae, would pose a problem to currently available basic solid catalyst due to the high free fatty acid. Hence, a flexibility of the catalytic system is desired for diversity of future oils of interest. Hydrotreatment is another option to produce closer fuel with conventional fuel but with higher cost.

Apart from biofuels, vegetable oils have many applications in fine chemistry via catalysis. For instances, valorization of glycerol, by-product of biodiesel process, to polyglycerols for lubricants, and monoglycerides/polyglycerol esters for safe emulsifiers. Details of various catalysts (homogeneous and heterogeneous) were discussed and compared. For fatty esters and acids transformation, modification of the ester or acid group could be used for preparation of fatty alcohols while modification of the fatty chain could be used for epoxidation of fatty esters. In conclusion, vegetable oils from either 1st or 2nd generation feedstock can be valorized for biofuel and other fine chemistry, with potential for value-added by-product for profitability. Brief introduction of LACCO was presented at the end.

Speaker Session



Advances in gasification/pyrolysis of palm oil wastes for 2nd generation biofuel production

Dr. Lee Dongho

Advanced Clean Energy Centre

The Institute of Environmental Science and Engineering (IESE), Singapore

Dr. Dongho presented his research work in the gasification and pyrolysis of palm oil wastes at IESE. Every year, about 30 million tons from Malaysia and 8.8 million tons from Indonesia of palm oil wastes (e.g. fruit shell, empty fruit bunch, and fiber) are generated. Since these wastes contain high volatile matters (about 75%), their calorific values are quite high (about 20 MJ/kg), which could be recovered as energy source. Among many conversion technologies, IESE has focused on gasification and pyrolysis of palm shell, empty fruit bunch (EFB) and fiber. Fixed- and fluidized-bed reactors were developed to investigate the kinetics, reactivity, fundamentals and mechanisms of palm waste pyrolysis. New catalyst in biomass gasification was developed for tar removal, with modeling and simulation tools as a guideline. Furthermore, torrefaction of palm oil waste was investigated since the final product of torrefied biomass is pellet of 1.3 more energy density. Lab-scale torrefactors have been built to study various characteristics and effects of temperature and time.



Panel Discussion



Chairman: Prof. Sudip K. Rakshit
 Vice President – Research
 Asian Institute of Technology, Thailand

Prof. Rakshit honored the Meeting by chairing the panel discussion at the end of the first day. The panelists were the distinguished speakers who had presented earlier in the morning and afternoon.

The chairman started the discussion by sharing his experience in biofuels research. He stressed the importance of the issue of land use and its relation to other issues including socio-economics, appropriate technology, and climate change.

He then opened the floor for discussions between the panelists and the audience. The following are highlights from the ensuing discussion.

Panel Discussion: Highlights



The benefits of the 1st and 2nd generation biofuels over conventional fuels, particularly in developing countries

- There is a range of biofuels and there is no clear winner. The diversity of feedstock options can help raise the possibility of success.
- In the case of developing countries, it is not guaranteed that biofuels will always lead to lower greenhouse gas emissions than conventional fuels, due to other factors such as those concerning raw material transportation with fossil fuels.
- The 2nd generation of biofuels indeed stands on the shoulders of the 1st generation. There is no clear distinction between the two.
- Life-cycle analyses of biofuels have been done relatively well. The results of those studies can be referred.
- The issue of indirect land use change is important. For example, biofuels land may replace food land, forcing the food land move or expand.
- Developing countries have to rely on food more than fuels. The focus of the development should be finding solutions from non-edible oil, biomass, and byproducts. Only then can biofuels be considered to be clearly better than conventional fuels.
- Higher oil price is expected. Biofuels from biomass waste will have bright future.
- Classification of biofuels generations matters only when the solutions are sustainable.



Feedstock choices, land use, and food security

- Nature makes biomass to be very tough. Biofuels production processes have to work against nature's intention.
- Farmers might convert from food crops, such as rice, to biofuels crops, such as oil palms, without proper reasons or knowledge.
- The issues of food security and land leasing are connected.



Panel Discussion: Highlights



- Different feedstock solutions work differently for different parts of the world. For instance, sugar cane works for Brazil because of its land abundance. India, on the other hand, is not going with sugar cane but choosing to grow Jatropha on marginal land instead.
- The food security is an important issue, but other uses of agriculture also need to be considered.
- Only a couple-percent increase in the downstream use of solar energy through biomass will be significant.



Overcoming the bottleneck in bioethanol technology

- There is confidence that pre-treatment technology will improve bioethanol production.
- There will be multiple solutions, such as mixed fermentation.
- Changing cell walls of biomass allows bigger possibility without changing the biomass properties. There have been substantial advances in only a few years.



Glycerol from biodiesel production

- There are many applications and the list is growing.
- It opens new pathways for the oleochemical industry.

Butanol issues

- Butanol tolerance is still a difficult problem that needs R&D.
- Processing cost has been substantially decreased with promising potential for commercial applications in the future.



Ionic liquid to break down cell walls

- Ionic liquid technology to release polymer from the cell walls exists.
- There is a consortium that has a large library of ionic liquid, which has been narrowed down to a few promising ones.

Roundtable Discussion

Exploration of potential collaboration with local researchers



The second day of the Meeting started with a roundtable discussion to explore potential research collaboration between the invited EU and SEA experts and the local researchers.



Introduction of NSTDA Alternative Energy Cluster

Assoc. Prof. Dr. Paritud Bhandhubanyong

Chairman of Alternative Energy Cluster

National Science and Technology Development Agency (NSTDA), Thailand

Prof. Bhandhubanyong kicked off the roundtable discussion by welcoming all participants to NSTDA and introducing the overall structure, missions, and strategies of NSTDA. Then, he gave a presentation on the NSTDA Alternative Energy Cluster, in which he outlined the research activities in the areas of solar cell, fuel cell, biofuels, biogas, biomass CHP, biomass-to-liquid, and energy efficiency. He highlighted the key achievements in each research area. Finally, he described the Cluster's research collaboration, listing both domestic and international research partners.

Roundtable Discussion: Highlights



Introduction of MTEC Bioenergy Lab

Dr. Nuwong Chollacoop

National Metal and Materials Technology Center (MTEC), Thailand

Before starting the discussion, Dr. Chollacoop gave an introduction to the MTEC Bioenergy Lab, where the participants will be given a tour after the roundtable discussion. He outlined the Lab's research areas and activities and gave examples of projects in which the Lab has collaborated with international organizations.



Prior to the discussion, all participants were given an opportunity to introduce themselves and their research areas of interest, so that they could identify potential partners among themselves. The ensuing discussion was very lively and touched upon many fields of biofuels. Here are some highlights.

Ethanol

- The main research and development goals in Thailand now are i) to move away from molasses to cassava as feedstock, and ii) to achieve quicker processes, such as by replacing batch-wise with continuous processes.
- Yeast strains in Thailand are developed by Kasetsart University. The fermentation time is about 72 hours. It was suggested that now there is a strain that uses only 12 hours.
- Cocktail enzymes are used in ethanol production with byproducts from milling plants.



Biodiesel

- The ratio of diesel to gasoline used in Thailand is about 2:1.
- There is a push for Fischer-Tropsch technology, but it is a very demanding technology.

Roundtable Discussion: Highlights



- Many feedstock options for biodiesel exist, but not many of them are feasible.
- CO₂ balance of palm oil industry is an issue. One solution is biogas technology, which is quite established in Thailand.
- B10 (diesel with 10% blend of biodiesel) is a target, but growing area for oil palms is a challenge.

Diesohol



- Blending diesel with only little ethanol will make the flash point drop dramatically. That leads to an infrastructure problem.

Oil Palm



- Empty fruit bunches of oil palm are used in gasification, and in Fischer-Tropsch for 2nd generation biofuels.
- Currently, the industry uses incineration and recovers heat for in-house use. Since the energy generated from incineration is already enough to meet the in-house demand, the practice of recovering methane to produce more energy is generally not in place. Also, electricity production from methane is only economically feasible for factories with certain feedstock. For example, it works for pig farms, but not oil palm farms.
- Efforts should be put into finding ways to support small palm holders to get green credits
- Only 1% of Malaysia's palm oil goes into biodiesel production. But this is due to only 2% biodiesel blending target.

Jatropha



- If the toxins are removed from Jatropha, it could be food, too. Then, it will be subjected to the food-fuel debate as well.
- Growing Jatropha on wasteland actually produces only marginal results and may not be economically feasible.

Roundtable Discussion: Highlights



Feedstock breeding

- Jatropha is not an attractive option to breed. Rubber trees and castor beans are more attractive. While, Jatropha takes only one year to fully grow, but the yield might not be high. In contrary, oil palm and rubber may take 3-5 years to fully grow, but the yields are more certain.



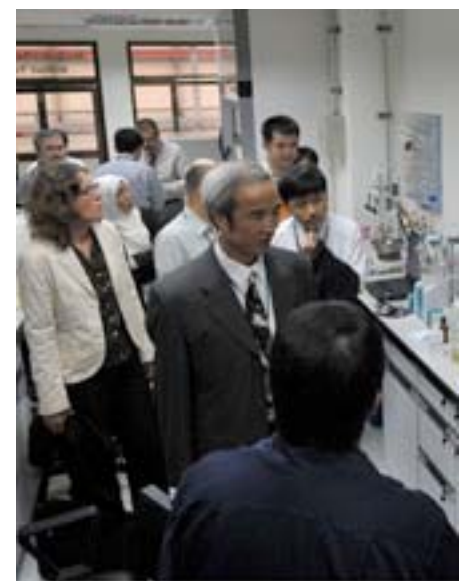
Tips for EU funding application

Besides discussing various biofuels research areas, the participants, especially those from the EU, also talked about the process of applying for EU funding and provided tips for successful application. Here are some highlights.

- There are 3 steps to a successful international collaboration: networking, good ideas, and funding.
- To develop a good proposal, there need to be a good coordinator. The regional balance of consortium is important. The stakeholders should be involved. There should be a good outreach program as part of the project. Gender balance and private sector's involvement are also important.
- The same application can be resubmitted many times, with improvement, of course.
- National contact persons of the EU are helpful.
- The calls are becoming more descriptive. Specific calls require specific regional involvement. Applicants should contact the EU to find out exactly what they want beyond what is written in the calls.
- Successful proposals must meet all specific requirements.



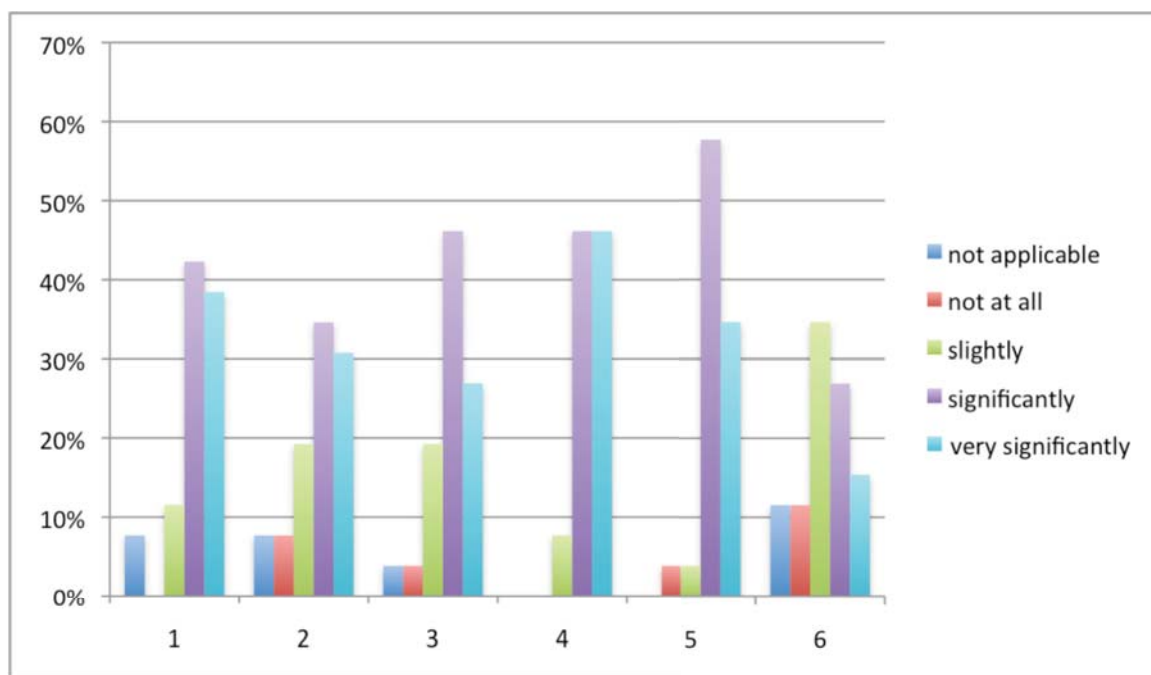
Laboratory Tour



After the roundtable discussion, the participants were given a tour of biofuels laboratories at the National Metal and Materials Technology Center. The participants first visited the Biofuels Testing Laboratory, which conducts research on alternative fuels and catalysts for biofuels production, as well as biofuels quality control. Next, they visited the Automotive and Alternative Fuels Laboratory, where biofuels are tested with various types of engines to study mechanical and emission performances. The participants also visited a pilot-scale gasifier, which is used for research on biomass gasification. After the tour, the participants had an opportunity to further network and brainstorm future collaboration over lunch.

Feedback +

In terms of the overall feedback from the general participants, the results from the questionnaires that were handed out at the Meeting are plotted below.



The six questions in the questionnaires were:

1. To what extent has this event enabled you to access international expertise, resources and/or facilities?
2. To what extent has this event enabled you to initiate or expand an international collaboration leading to one or more joint research projects?
3. To what extent has this event enabled you to increase your understanding of EU Funding, science and innovation priorities?
4. To what extent did this event provide you better understanding about the state of the art research in 2nd-generation biofuels?
5. To what extent did this event meet your objectives for attending it?
6. To what extent did the event lead to significant new proposal to be submitted under FP7?

Potential Collaborations

Over the course of the Meeting, many of the speakers started to talk about potential collaboration among themselves as well as with local participants. The following are examples of which the organizers are aware:

- Dr. Suzana Yusup and Prof. Yoshimitsu Uemura from Universiti Teknologi PETRONAS, Malaysia, discussed collaboration with Dr. Aparat Mahakhant from Thailand Institute of Scientific and Technological Research (TISTR), Thailand. Dr. Yusup and Prof. Uemura also went to visit Dr. Aparat's laboratory after the second day of the Meeting.
- Thai researchers who work on cellulosic ethanol were introduced to Prof. Nigel Minton and Prof. Ed Louis from the University of Nottingham, UK.
- Dr. Sittha Sukkasi and Dr. Nuwong Chollacoop from National Metal and Materials Technology Center (MTEC), Thailand, started brainstorming collaboration with Dr. Sylvia Prieler from International Institute for Applied Systems Analysis, Austria, and Dr. Huub Loffler from Wageningen University and Research Centre, Plant Research International, Netherland.
- Dr. Leonardo Gomez from University of York, UK, discussed research collaboration with professors from Kasetsart University, Thailand.
- Dr. Lee Dongho from the Institute of Environmental Science and Engineering, Singapore, connected with Dr. Suzana Yusup from Universiti Teknologi PETRONAS, Malaysia.

Surely, there have been many more discussions of potential collaborations between the speakers and the general participants, as well as among the general participants themselves, that stemmed from this Meeting.

In general, the participants provided very positive feedback to the organizers. Many of the guests, especially the invited speakers and the international guests, were very pleased with the overall Meeting.



Participants

Apanee Luangnaruemitchai
Chulalongkorn University
apanee@hotmail.com, apanee.l@chula.ac.th

Aparat Mahakhat
Thailand Institute of Scientific and Technological Research
aparat@tist.or.th

Arif Satria
Bogor Agricultural University
arifsatria@gmail.com

Arunee Supasinsatrit
King Mongkut's University of Technology
arunee_pom@yahoo.com

Bonlue Sripodok
Pure Biodiesel Co., Ltd
bus@pbcthai.com

Boonyarach Kitiyanun
Chulalongkorn University
boonyarach.k@chula.ac.th

Buppa Puttasawat
National Metal and Materials Technology Center (MTEC)
buppap@mtec.or.th

Chanakan Assasujarit
Thailand Institute of Scientific and Technological Research
chanakan@tist.or.th

Chantaraporn Phalakornkul
King Mongkut's University of Technology North
Bangkokcpthalak21@yahoo.com, cpk@kmitnb.ac.th

Charn Saralertsophon
The Federation of Thai Industries
charn888@off.fti.or.th

Cheerawan Banyenprasobsuk
Technical and International Affairs Division
cheerawanbb@dit.go.th

Chinnatad Sinpasertchock
Kasetsart University
chinnatad_s@hotmail.com

Christopher Tan
British High Commission
Christopher.Tan@fco.gov.uk

Chuladit Chunekamral
Thai Oil Palm and Plam Oil Association
chuladitc@yahoo.com

Daiyana Keerasomboon
The Customer Department
daiyana.k@gmail.com

Ed Louis
University of Nottingham
Ed.Louis@nottingham.ac.u

Francois LEFEVRE
Centre for Energy Environment Resources Development
(CEERD)
f.lefevre@ceerd.net

Hamdan Mokhtar
SIRIM Berhad
Hamdan_mokhtar@sirim.my

Harnporn Phunggrassami
Thammasat University
pharnpon@engr.tu.ac.th

Huub J.M. Loffler
Wageningen University and Research centre, Plant Research
International, Netherland
huub.loffler@wur.nl

Jean-Marc Clacens
Université de Poitiers
jean-marc.clacens@univ-poitiers.fr

Jean-Michel SERS
European Commission
jean-michel.sers@ec.europa.eu

Jürgen Sanders
European Commission
jurgensanders@ec.europa.eu

Junpen Meka-Apiruk
Royal Thai Embassy, Belgium
junpen@most.go.th

Kairawee Bhaopichitr
TriPetch Isuzu Sales Co.,LTD.
cop@tripetch-isuzu.co.th

Kiatkong Suwannakij
National Metal and Materials Technology Center (MTEC)
kiatkons@mtec.or.th

Klaus Herzog
German Embassy Singapore
science@sing.diplo.de

Participants

Kosin Watticharoenwong
PTT Chemical Public Co., Ltd
Kosin.w@pttchemgroup.com

Kriengsak Wongpromrat
Petroleum Institute of Thailand
kriengsak@ptit.org

Kunn Kangvansaichol
PTT Research and Technology Institute
kunn.k@pttplc.com

Kunvara Chotiphansophon
Agricultural Research Development Agency (Public
Organization)
kunvara@arda.or.th

Le Kim Dien
National Key Laboratory for Petrochemical & Refinery
Technologies, Vietnam Institute of Industrial Chemistry,
Vietnam
lekimdienpt@yahoo.com

Lee Dongho
The Institute of Environmental Science and Engineering
DHLee@ntu.edu.sg

Leonardo Gomez
University of York
ldg3@york.ac.uk

Mads KORN
European Union, Delegation of the European Commission to
Thailand

Malinee Leethochawalit
National Center for Genetic Engineering and Biotechnology
malinee.lee@biotec.or.th

Maythinee Sirikulbodee
Bangkok Renewable Energy Co.,Ltd
maythinee@bkkre.com

Mongkon Kananont
Thailand Advanced Institute of Science and Technology
ducaty_jack@hotmail.com

Nigel Peter Minton
University of Nottingham
nigel.minton@nottingham.ac.uk

Nipat Srirakul
Kasetsart University
srirakul@hotmail.com

Nipon Pisutpaisal
King Mongkut's University of Technology North Bangkok
phn@kmitnb.ac.th

Nuthapong Dumrongrat
TriPetch Isuzu Sales Co.,LTD.

Nuwong Chollacoop
National Metal and Materials Technology Center (MTEC)
nuwongc@mtec.or.th

Paritud Bhandhubanyong
National Sciences and Technology Development Agency
paritud@nstda.or.th

Parncheewa Udomsap
National Metal and Materials Technology Center (MTEC)
parncheu@mtec.or.th

Pattamas Bintachit
Srinakharintarawiroth University
patamas_pum99@hotmail.com

Pawnprapa Krasae
National Metal and Materials Technology Center (MTEC)
pawnpak@mtec.or.th

Penjit Srinophakhun
Kasetsart University
penjit2004@yahoo.com

Phongsakdi Chaknuvej
B.Grimm Joint Venture Holding Ltd.
phengsakid@bgrimmgroup.com

Pramoch Rangsunvigit
Chulalongkorn University
pramoch.r@chula.ac.th

Pramuk Parakulsuksatid
Kasetsart University
fagipmp@ku.ac.th

Prang Kiatkumjai
PTT Chemical Public Co., Ltd
prang.k@pttchemgroup.com

Praveena In-Yim
Agricultural Research Development Agency (Public
Organization)
kunvara@arda.or.th

Prayoon Enmak
Kasetsart University
biochema@gmail.com

Participants

Precha Jantarasarsophon
Center for Ecological Economics
tsiajao@lycos.com

Ratiya Eiampinyo
B.Grimm Joint Venture Holding Ltd.
ratiya@bgrimmgroup.com

Rattanaporn Leesing
Khon Kaen University
ratlee@kku.ac.th

Ruengsak Thitiratsakul
Petroleum Institute of Thailand
ruengsak@ptit.org

Rungroj Maolanon
National Nanotechnology Center
rungroj@nanotec.or.th

Sanitra Jarupaiboon
Perkinelmer
Sanitra.jarupaiboon@pekinelmer.com

Sappinandana Akamphan
Thammasat University
sup@engr.tu.ac.th

Siamnat Panassorn
TriPetch Isuzu Sales Co.,LTD.

Simon Grimley
National Sciences and Technology Development Agency
simon@nstda.or.th

Sittha Sukkasi
National Metal and Materials Technology Center (MTEC)
sitthas@mtec.or.th

Sivawan Phoolphundh
King Mongkut's University of Technology
sivawanp@yahoo.com

Somsak Apisitwanich
Kasetsart University
fscissa@ku.ac.th

Sudip K. Rakshit
Asian Institute of Technology
rakshit@ait.ac.th

Sumaeth Chavadej
Chulalongkorn University
sumaeth.c@chula.ac.th

Supachai Vuttipongchaikij
Kasetsart University
fsciscv@ku.ac.th

Supagarn Wongpanich
Defence Energy Department

Suriya Ayachanan
Chumporn Palm Oil Industry Public Co.,LTD
suriya.ayachanan@gmail.com

Suzana Yusup
Universiti Teknologi PETRONAS
drsuzana_yusuf@petronas.com.my

Sylvia Prieler
International Institute for Applied Systems Analysis, Austria
prieler@iiasa.ac.at

Tanakorn Dingmukpanao
National Metal and Materials Technology Center (MTEC)
tanakrnd@mtec.or.th

Tawan Kongvattananon
Pure Biodiesel Co., Ltd
twk@pbcthai.com

Teerapatr Srinorakutara
Thailand Institute of Scientific and Technological Research
teerapatr_tist@yahoo.com

Teerapong Sitayoung
PTT Public Co., Ltd
teerapong.s@pttplc.com

Thammanoon Sreethawang
Chulalongkorn University
thammanoon.s@chula.ac.th

Thanita Sonthisawate
Thailand Institute of Scientific and Technological Research
thanita@tist.or.th

Thapat Silalertuksa
The Joint Graduate School of Energy and Environment
(JGSEE)
thapatws@hotmail.com

Thierry LEFEVRE
Centre for Energy Environment Resources Development
(CEERD)
t.lefevre@ceerd.net

Ukrit Sahapatsombut
National Metal and Materials Technology Center (MTEC)
ukrits@mtec.or.th

Participants

Veerapat Tantayakom
PTT Chemical Public Co., Ltd
veerpat.t@pttchemgroup.com

Viroj Ketsoi
Perkinelmer
viroj.ketsoi@pekinelmer.com

Vorakan Burapatana
PTT Research and Technology Institute
vorakan.b@pttplc.com

Voravit Muenthong
Department of foreign Trade
v_muenthong@hotmail.com

Vorawan Asadatorn
Thai Rong Rung Energy Co.,Ltd
vorawan@trrsugar.com

Waret Veerasai
Mahidol University
scwr@mahidol.ac.th

Weerawish Buranasajjawaraporn
The Shell Company of Thailand Ltd.

Werasak Udomkichdecha
National Metal and Materials Technology Center (MTEC)
werasak@mtec.or.th

Wimonwan Wattanawitchit
Kasetsart University
pwimonwan@hotmail.com

Woranee Paengjuntuek
Thammasat University
pworanee@engr.tu.ac.th

Yoshimitsu Uemura
Universiti Teknologi PETRONAS
yoshimitsu_uemura@petronas.com.my

Yuttanant Boonyongmaneerat
Metallurgy and Materials Science Research Institute
yuttanant.b@chula.ac.th

Report designed and written by:
Sittha Sukkasi
Nuwong Chollacoop

Photo credits:

page 8:
adelie penguin antarctica by *christopher* (flickr.com)
Jukwa Village & Palm Oil Production, Ghana by oneVillage Initiative (flickr.com)
Kurkas (in Turkish) by dinesh_valke (flickr.com)

page 42:
Jumping into the new dimension (DSC_4769) by Shutterhack (flickr.com)

other pages:
MTEC Training Group
Sittha Sukkasi



+ Organizing Committee

Coordinators

Dr. Nuwong Chollacoop
MTEC
nuwongc@mtec.or.th

Dr. Sittha Sukkasi
MTEC
sitthas@mtec.or.th

Simon Grimley
NSTDA
simon@nstda.or.th

Advisors

Assoc. Prof. Dr. Werasak Udomkichdecha
MTEC

Assoc. Prof. Dr. Paritud Bhandhubanyong
NSTDA

Assoc. Prof. Siriluck Nivitchanyong
MTEC

Christoph Elineau
SEA-EU-NET

Christopher Tan
British High Commission, Singapore

Staff

Wanngam Weeraphasuk
MTEC

Thanakorn Chaipotar
MTEC

Supicha Kerdnark
MTEC

Sirorat Boonrattanakul
MTEC

Kobkul Amonmongkul
MTEC

Ponlathorn Wenunun
MTEC