

Transition towards Low Carbon Societies in Thailand and Asia

Dialogue between Policy-makers and Researchers and
Cross-sectoral Approach

Synthesis Report
-Key findings from the dialogue-

17-18 November 2010
Bangkok, Thailand

Key Findings

1. LCS vision and commitment of Thailand

- Strong signal in the form of policy incentives has already been introduced to the nation, as evident in the Thai government's National Plan, Climate Action Plan, and Science and Technology Policy.
- The Thailand government has set up a strategic plan on climate change (2008-2012) which will be implemented through local authorities and will support transition toward LCS.
- LCS vision of Thailand is guided by the philosophy of 'sufficiency economy' that focuses on the community and the management of human and natural resources with sustainable manner.

2. Multi-level approach toward LCS

- The philosophy of "sufficiency economy" is expected to promote citizen awareness and grass roots action; This indicates an effective combination of top-down and bottom-up approaches to gain public support for the LCS policies.
- Thailand's traditional focus on natural resource management is a good example of an effective approach for the LCS.
- LCS for better life is one of the Thai approaches to promote LCS particularly in the big city.
- Innovative political and economic incentives and institutional arrangements, including inter-ministerial arrangements, are called for to induce transition toward LCS.

3. Specific characteristics of Thailand that guide its LCS policy

- Thai experience with CDM provides a good basis of city-based LCS approach –which is now developed as a national mechanism named "Crown standard" to identify low carbon cities.
- Thailand's LCS policy needs to align with national development goals – sustainable natural resource management, better urban life, improved local environment, energy security, food security, better health, and growth in tourism industry.
- Both adaptation and mitigation are important policy concerns because agriculture, forests and natural resources are major sectors of the Thai economy.

4. Collaborations to facilitate LCS process

- External collaborations are needed for technology transfer, gaining technical knowhow to support localization of such technology, as well as infrastructure changes for LCS.
- International mechanisms for financing the investments required under above mentioned collaborations, as already being witnessed in various multilateral and bilateral mechanisms, are crucial.
- Involvement of private sector for financing LCS in Thailand can be attained by risk management schemes such as public private partnerships (PPP)¹.

¹ Public-private partnership (PPP), in this context, is a funding model for public infrastructure and/or service project such as a new telecommunications system, airport, etc. or private business venture which is funded and operated through a partnership of government and one or more private sector companies.

5. Focus areas for promoting LCS

- Agriculture, natural resources and land use: LCS policies should meet both adaptation and mitigation goals by utilizing local community knowledge for adaptation.
- Energy and transportation: Priority areas are energy efficiency, demand side management, renewable energy, high speed, multi-modal and low carbon transport systems, and poly-centric type urban land use planning.
- Waste management: Waste sector can be a good model for public participation in national mitigation actions.
- Inter-sector coordination: Mechanisms for inter-sector coordination are urgently required to allocate limited financial resources among multiple options, resolve possible inter-sector conflicts around land use policies, and facilitate integrated assessment approach.

6. Role of research

- Strengthening research and coordination among researchers and with policy makers is urgently required.
- Climate change researchers must communicate with researchers from other fields to promote integrated, multi-sector research.
- Holistic, multi-disciplinary research including use of integrated assessment models, new indicators to measure effects of low carbon policies, new institutions design and analysis, and so on, needs to be promoted.
- LCS research should be strengthened by providing greater financial and human resources for scientific support to policy makers.
- Researches need to develop economic tools that help policy makers understand and assess mitigation options.

Preface

Emphasizing the active role in climate change abatement, Thailand has implemented the National Strategic Plan of Climate Change (2008-2012) since 2008. In addition, the current direction of the 11th National development plan (in preparation) has integrated the issues of global warming and its impacts into the core content. Long term planning of Thailand Power Development Plan and 20 years planning of National Energy Conservation Plan has also focused on enhancing renewable resources. These policies indicated that Thailand is moving towards a low-carbon society.

Transition to a low-carbon society needs collaborative understanding of the vision and pathway as well as information sharing among stakeholders, particularly academia, researchers and policy-makers. Clear communication can reduce barriers and gaps, and therefore enhance sustainable growth and development.

The meeting on ‘Transition towards Low Carbon Societies in Thailand and Asia - a dialogue between policy-makers and researchers and cross cutting approach’ co-hosted by Thailand Greenhouse Gas Management Organization (TGO, Public Organization) and the Joint Graduate School of Energy and Environment (JGSEE), and supported by Institute for Global Environmental Strategies (IGES) / Secretariat of the International Research Network for Low Carbon Societies (LCS-RNet Secretariat) was held to create momentum for transition towards low-carbon societies (LCSs) in national and local policies and actions in Thailand as well as other Asian countries. Enhancing LCS policy research and strengthening collaboration among researchers and policy-makers are the keys to accomplishing sustainable LCS.

This report indicates the approaches to LCS from the viewpoint of policy-makers and researchers on multilevel drivers from the technology to philosophy of the sufficiency economy which is a unique approach by Thailand.

Discussions initiated in this workshop are take-home messages and can be carried forward to demonstrate sustainable low-carbon development for Thailand in the future. These efforts will be not only benefit for Thailand, but also Japan and other Asian countries.

Bundit Fungtammasan
Director,
The Joint Graduate School of
Energy and Environment,
King Mongkut’s University of
Technology Thonburi and the
Center of Excellence of Energy
Technology and Environment
Thailand

Sunthud Somchivita
Chair of the Board of Directors,
Thailand Greenhouse Gas
Management Organization
Thailand

Hironori Hamanaka
Chair of the Board of Directors,
Institute for Global
Environmental Strategies
Japan

Acknowledgement

This Synthesis Report draws together findings from the dialogue between policy-makers and researchers in Thailand and neighbouring countries who are taking actions to realise low-carbon, sustainable development in Thailand and Asia. The dialogue took place as a meeting, entitled Transition towards Low-Carbon Societies in Thailand and Asia, on 17-18 November 2010, co-hosted by Thailand Greenhouse Gas Management Organization (TGO, Public Organization) and the Joint Graduate School of Energy and Environment (JGSEE), supported by Institute for Global Environmental Strategies (IGES) / Secretariat of the International Research Network for Low Carbon Societies (LCS-RNet Secretariat), at Pullman Bangkok King Power Hotel, Bangkok, Thailand.

The objective of the meeting is to create momentum for transition towards low carbon societies (LCSs) in national and local policies and actions in Thailand and other Asian countries by enhancing LCS policy –research relations. The first day was for a dialogue between policy makers and researchers to identify roles of researchers on sustainable low-carbon development from policy perspective. The second day focused on policies and actions in each sector (e.g. energy, industry, waste, agriculture and forestry, urban infrastructure and building) and coordination amongst them.

The issues covered in this report are the following, which would be of great interest to policy-makers and researchers in making the transition towards sustainable low-carbon development;

- LCS vision and commitment of Thailand
- Multi-level approach toward LCS
- Specific characteristics of Thailand that guide its LCS policy
- Collaborations to facilitate LCS process
- Focus areas for promoting LCS
- Role of research

I would like to take this opportunity to express our profound gratitude to all speakers and participants from the government of Thailand and academia for their contributions to the meeting. I would also like to add our sincere appreciation to Mr. Sirithan Pairoj-Boriboon, Executive Director, TGO and the JGSEE for their guidance and support to materialise this dialogue. Special gratitude goes to Prof. Dr. Bundit Fungtammasan and Prof. Dr. Sirintornthep Towprayoon in JGSEE for their guidance in planning this dialogue, since they made a considerable effort to coordinate this meeting.



Shuzo Nishioka
Secretary General / LCS-RNet Secretariat

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Agenda

Day 1 - Dialogue between Policy Makers and Researchers: Demands and Roles of Sustainable Low Carbon Development Researches from Policy Perspective

Welcome Addresses

Bundit Fungtammasan, Joint Graduate School of Energy and Environment (JGSEE) and CHE Center for Energy Technology and Environment (CEE)-KMUTT, Thailand

Opening Addresses

Sunthud Somchivita, Thailand Greenhouse Gas Management Organization (TGO), Thailand

Keynote Speech

Chair: Sirintornthep Towprayoon/ Rapporteur: Sebastien Bonnet

Session Summary

KP_1	<i>Carbon Reduction as a National Co-benefit, A better life in Low-Carbon City</i> Sirithan Pairoj-Boriboon, Thailand Greenhouse Gas Management Organization (TGO), Thailand
KP_2	<i>How to Reach a Low-Carbon Society?</i> Shuzo Nishioka, International Low Carbon Society Research Network (LCS-RNet)/ Institute for Global Environmental Strategies (IGES), Japan

Session 1: Low Carbon Society (LCS) Policies and Research Demands from Policy Makers

Chair: Bundit Fungtammasan/ Rapporteur: Komsilp Wangyao

Session Summary

S1_1	<i>Low-Carbon Society in the 11th National Plan</i> Montree Boonpanit, National Economics Science and Development Board (NESDB), Thailand
S1_2	<i>Provincial Policies and Action Plans towards Low-Carbon Society</i> Sunee Piyapanpong, Office of Natural Resources and Environmental Planning (ONEP), Thailand
S1_3	<i>Science, Technology and Innovation Policies for Development of Low-Carbon Society</i> Yada Mukdapitak, National Science, Technology and Innovation Policy Office, Thailand
S1_4	<i>Japan's Policy for Low-Carbon Societies</i> Midori Sasaki, Global Environment Bureau, Ministry of Environment (MOEJ), Japan

Session 2: Low Carbon Society (LCS) Scenario and Roadmaps with Policy Options to Frame Sustainable Low Carbon Development

Chair: Dr. Shuzo Nishioka/ Rapporteur: Dr. Junichi Fujino

Session Summary

S2_1	<i>Low-Carbon Society: A Green Roadmap for India</i> Aashish Deshpande, National Institute of Technology, Bhopal, India
S2_2	<i>Low-Carbon Society Vision 2030 Thailand</i> Bundit Limmeechokechai, Sirindhorn International Institute of Technology Thammasat University (SIIT-TU), Thailand
S2_3	<i>A Low Carbon Society Scenario Study for Ratchaburi Province, Thailand</i> Savitri Garivait, Joint Graduate School of Energy and Environment (JGSEE)-KMUTT, Thailand

Session 3: Multi-Level Approaches to Achieve Sustainable Low Carbon Development**Chair: Nares Damrongchai/ Rapporteur: Sebastien Bonnet**

Session Summary

S3_1	<i>Low Carbon Target and Activity in Bangkok</i> Suwanna Jungrungrueng, Department of Environment, Bangkok Metropolitan Administration (BMA), Thailand
S3_2	<i>Low Carbon Activities in a Small City : Case of Muang Klang Municipality</i> Somchai. Chariyacharoen, Muang Klang Municipality, Thailand
S3_3	<i>Low Carbon Society and Sufficiency Economy</i> Sirintornthep Towprayoon, Joint Graduate School of Energy and Environment (JGSEE)-KMUTT, Thailand
S3_3	<i>A Green-focused Agenda for Iskandar, Malaysia: Towards a Low Carbon Society</i> Boyd Dionysius Joeman, Integrated Planning, Iskandar Regional Development Authority (IRDA), Malaysia

Session 4: Research Infrastructure Supporting Low Carbon Society (LCS)**Chair: Prasertsuk Chamornmarn/ Rapporteur: Komsilp Wangyao**

Session Summary

S4_1	<i>Research Activity Supporting Low Carbon Society by the Thailand Research Fund</i> Amnat Chidthaisong, JGSEE and Thailand Research Fund's Center for Research Developments (Thai-GLOB), Thailand
S4_2	<i>National Research Strategy</i> Chetphong Butthep, Office of International Affairs, National Research Council of Thailand (NRCT), Thailand
S4_3	<i>Research Infrastructure Supporting LCS: Energy Sector</i> Sittichod Wantawin, Energy Conservation and Renewable Energy Policy Bureau, Energy Policy and Planning Office (EPPO), Ministry of Energy, Thailand
S4_4	<i>Towards Low-Carbon Society Research Infrastructure Supporting LCS</i> Togo Uchida, Japan International Cooperation Agency (JICA), Thailand Office, Japan

Day 1 Panel Discussion**Moderator: Sirintornthep Towprayoon/ Rapporteur: Ms. Kyoko Miwa**

Session Summary

PD_1	<i>Future Scenarios of Low Carbon Society Beyond 2050: An Asia-Pacific's Aspiration</i> Nares Damrongchai, APEC Center for Technology Foresight, Thailand
PD_2	<i>Development of Low Carbon Society Scenarios for Iskandar Malaysia and Putrajaya</i> Ho Chin Siong, Universiti Teknologi Malaysia
PD_3	<i>Future of Sustainable Low Carbon Development in Asia and How to Approach LCS</i> Mikiko Kainuma, National Institute for Environmental Studies (NIES), Japan

Day 2 - Opportunities and Challenges in Sectors
Cross-Sectoral Approach towards Low Carbon Societies

Session 5: Approach towards Low Carbon Society (LCS) and Cross-Sectoral Approach

Chair: Shuzo Nishioka

Session Summary

S5_1	<i>Summary of Day 1</i> Kyoko Miwa, International Low Carbon Society Research Network (LCS-RNet)/ Institute for Global Environmental Strategies (IGES), Japan
S5_2	<i>Green Growth Roadmap</i> Rae Kwon Chung, Environment and Development Division, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)

Session 6: Sectoral Issues - Energy

Chair : Eric Zusman/ Rapporteur: Rahul Pandey

Session Summary

S6_1	<i>Low Carbon Energy Transitions: An Institutional Perspective</i> Eric Zusman, Institute for Global Environmental Strategies (IGES), Japan
S6_2	<i>Efforts Towards a Lower Carbon Energy System in Thailand</i> Bundit Fungtammasan, Joint Graduate School of Energy and Environment (JGSEE) and CHE Center for Energy Technology and Environment (CEE)-KMUTT, Thailand
S6_3	<i>Opportunities and Challenges towards low carbon transportation</i> Chamroon Tangpaisalkit, Deputy permanent secretary, Ministry of Transport, Thailand

Session 7: Sectoral Issues - Industry and Waste

Chair: Junichi Fujino/ Rapporteur: Sebastien Bonnet

Session Summary

S7_1	<i>Sectoral Issues-Opportunities and Challenges: Industry</i> Bongkoch Kittisompun, Department of industrial Work (DIW), Ministry of Industry, Thailand
S7_2	<i>Mitigation of GHG Emission from Solid Waste Disposal in Thailand</i> Chart Chiemchaisri, Kasetsart University, Thailand
S7_3	<i>Sectoral Issues:Opportunities and Challenges: Waste</i> Rangsan Pinthong, Wastes and hazardous Substances Management Bureau, Pollution Control Department, Thailand

Session 8: Sectoral Issues - Agriculture and Forestry

Chair: Savitri Garivait/ Rapporteur: Eric Zusman

Session Summary

S8_1	<i>ภาคเกษตรกรรมกับการเปลี่ยนแปลงภูมิอากาศ...: โอกาส&ความท้าทาย</i> Ratchanee Sonkranok, Office of Agriculture Economics, Thailand
S8_2	<i>Transition towards Low Carbon Societies in Agricultural Sector</i> Pitayakon Limtong, Land Development Department, Ministry of Agriculture and Cooperatives, Thailand
S8_3	<i>Forest Land Management in Thailand</i> Korn Manassrisuksi, Forest Land management Bureau, Royal Forest Department, Thailand

Session 9: Sectoral Issues - Urban Infrastructure and Building
Chair: Boyd Dionysius Joeman/ Rapporteur: Komsilp Wangyao

Session Summary

S9_1	<i>Green Design & Planning of Urban Infrastructure in Asian Cities</i> Ariya Aruninth, Chulalongkorn University, Thailand
S9_2	<i>Sustainable Building Design and Education</i> Acharawan Chutarat, School of Architecture and Design-KMUTT, Thailand
S8_3	<i>New Building Energy Code & Government Policies of Thailand</i> Pattana Rakkwamsuk, School of Energy, Environment and Materials, KMUTT, Thailand

Session 10: Low Carbon Societies (LCS) Modelling and Scenarios Development

Chair: Mikiko Kainuma/ Rapporteur: Rahul Pandey

Session Summary

S10_1	<i>Sustainable Transport for Low Carbon Society in Nepal: Institutional and Other Challenges</i> Ram Manohar Shrestha, Asian Institute of Technology (AIT), Thailand
S10_2	<i>Japan and Asian Low-Carbon Society Scenarios and Actions</i> Junichi Fujino, National Institute for Environmental Studies (NIES), Japan

Wrap-up Session of the Whole Meeting

Co-Moderator: Sirintornthep Towprayoon and Shuzo Nishioka/ Rapporteur: Komsilp Wangyao

Session Summary

WU	<i>Prompt Report of the Meeting with Key Messages</i> Rahul Pandey (IIM Lucknow), India and Kyoko Miwa (LCS-RNet Secretariat/ IGES), Japan
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Closing ceremony

:Sirithan Pairoj-Boriboon, Thailand Greenhouse Gas Management Organization (TGO), Thailand

Synthesis of Findings

1. LCS vision and commitment of Thailand

Thai government is showing a strong signal of its commitment to realize LCS with policy incentives, backed by a multilevel, as well as a combination of top-down and bottom-up approaches, as evident in the Thai government's National Plan, Climate Action Plan, and Science Technology and Innovation Policy.

The Thai government has set up a national strategic plan on climate change (2008-2012) which will be implemented through local authorities and will support transition toward LCS. The 11th National Plan of Thailand is focused on sufficiency economy concept and integrates multiple goals – sustainable management of natural resources, security of food and energy, fostering creative economy, and low carbon society.

The example of Thailand demonstrates that strong domestic LCS and related policies and measures undertaken by the national government, combined with appropriate co-benefits, can send a clear signal to both internal and international stakeholders. This is evident in Thai government's plans mentioned earlier in this section. While some of these plans are not directly focused on climate change or LCS, they aim toward goals synergistic with LCS like sustainable development, conservation of natural resources, environment friendly production and consumption, and sufficiency economy.

Philosophy of 'sufficiency economy for better life' provides a fundamental basis for LCS policy and shaping people's mindset to develop LCS vision of Thailand.

The role of leadership, as demonstrated in case of Thailand, is critical to provide a LCS vision and a guiding force to the people to move towards the desired development path. In Thailand the King's philosophy of 'sufficiency economy' that focuses on the community and the management of human and natural resources in a sustainable manner is integrated with the goal of 'better life' for the people. This philosophy is assumed to balance morality and knowledge that helps to develop LCS visions and a self-sufficient path towards it. It provides

assurance and reduces apprehension of people about future uncertainties inherent in climate change and encourages them to move towards low carbon life style. This is expected to create bottom-up movement that can help LCS policies become more effective in their implementation. In this way it could be possible to achieve decoupling of development from carbon emissions.

2. Multi-level approach toward LCS

A combination of top-down and bottom-up approaches is in place.

The concept of sufficiency economy is simultaneously guiding national policies and promoting awareness among citizens and communities. This is an effective combination of top-down and bottom-up approach in policy making, and is useful to gain public support for LCS policies. This approach is also reflected in the several plans that Thai government has proposed at different levels – national and sub-national.

Specific low carbon policies and standards need to be designed for cities.

LCS for better life is one of the Thai approaches to promote LCS particularly in the big city. The Crown Standard of Thailand is an incentive mechanism to identify and reward low carbon cities. This is derived from Thailand's experience with CDM. In implementation, different policies and measures need to be designed for each different city taking into account specific conditions of each city. For instance, for a large and growing city like Bangkok the effective options include expansion of mass transit transportation system, growing of trees in large spaces, improving efficiency of electricity use in buildings, and solid waste management. For a small city like Muang Klang municipality the appropriate options include local waste management methods, local waste-to-energy generation, and natural resource management.

Cooperation between policy-making and research community is important to support local efforts.

A key challenge is to ensure active involvement of local authorities in implementation of low carbon and related actions. This can be facilitated by local level

LCS studies. For instance a LCS study of Ratchaburi province of Thailand indicated the possibility of achieving a synergy between low carbon and local economic development goals by integrating agriculture, land use, natural resource management, energy, and low carbon measures. Another study of Muang Klang municipality in Thailand showed existence of several low carbon practices like green public spaces, public transportation, local technology for solid waste management and waste-to-energy projects.

Country specific elements of policy need to consider domestic resources and development priorities.

LCS policies designed to integrate with dominant resources of domestic economy can demonstrate co-benefits and gain wider internal acceptance. Thailand's traditional focus on natural resource management to prevent excessive exploitation is a good example of effective approach and that could be a good example for other countries.

Both political and economic incentives are crucial.

Not only economic but also political incentives and institutions are required to induce transition toward LCS. Innovative political incentives need to be designed for sub-national and city level governing authorities, for example the Crown Standard for cities in Thailand. This is important for the effective implementation of policies with efficient use of limited resources as they are directly linked with local communities for both adaptation and mitigation.

Institutions to promote necessary inter-ministerial and inter-sector coordination play an important role.

Inter-ministerial institutions with support of appropriate legal frameworks are useful to resolve conflicts and design integrated LCS policies and mechanisms. While the Thai government has proposed several plans at national and sub-national levels, it will be a challenge to achieve coherence of policies across different sectors and transition to LCS.

3. Specific characteristics of Thailand that guide its LCS policy

LCS Vision is translated into sector level elements.

Vision of LCS 2050 has several elements relevant to important sectors of the Thai economy: climate change impact; migration, rural life and natural resources;

housing, construction, urban life and transportation; society and health; tourism; and trade of goods and services. Harnessing the traditional focus of natural resource management and integrating it with LCS vision is an example of country specific strategy.

LCS policy needs to align with national development goals.

Thailand's LCS and adaptation policy is being aligned with national development goals – sustainable natural resource management, better urban life, improved local environment, energy security, food security, better health, and growth in tourism industry. Early implementation of such policies can yield significant co-benefits. For instance, if the introduction of crop varieties for the adaptation purpose in agriculture achieves early success, it will pave the way for Thai agriculture to boost exports.

Policies for natural resources need to include knowledge base of communities and combine adaptation and mitigation objectives.

The Thai tradition focuses on the community and the management of human and natural resources. LCS policies need to include these aspects. This is reflected in Thailand's vision of self-sufficiency and inclusion of natural resources and forests among the major sectors in LCS strategy.

Thailand is also emphasizing the importance of both adaptation and mitigation policies. This reflects the dominance of agriculture, forests and natural resources in the Thai economy. As adaptation is of paramount concern to local communities and local authorities, combining mitigation with adaptation strategies also helps to gain wider support for LCS.

4. Collaborations to facilitate LCS process

External collaborative arrangements are required to support desired research, technology, and infrastructure changes.

Transition to LCS requires transfer and localization of desired technology and knowhow, and infrastructure changes. Examples of technology and infrastructure changes that could be the options for Thailand include mass transport, electric train and high speed train. Improving adaptation capability requires advanced research in agriculture and forestry. As Thailand and many other Asian countries are in growth phase, international assistance for such technology transfer

and infrastructure change is required to prevent lock in. Mechanisms for external collaboration with other countries and R&D agencies are therefore critical.

International mechanisms are needed to provide financial support to low carbon interventions.

Multilateral and bilateral mechanisms are needed for financing the desired low carbon investments. This is already being witnessed in the form of programs like those of JICA, STI, World Bank, UNEP, and WWF. Some of these programs are built on co-benefits approach while supporting tangible development or research projects. For instance, JICA provides multi-pronged support in the form of financing mass transit system in Bangkok, technical assistance for capacity building for climate change adaptation and mitigation, and support for science and technology research partnership for sustainable development.

Innovative schemes for financing and for managing risk to promote private sector to invest in LCS is necessary.

As LCS will require huge investment to support infrastructure changes, low carbon technology and research, and the public resource available from bilateral and multilateral arrangements is limited, it is important to promote private investment to support low carbon transition. It is also crucially important to design innovative schemes with specific mechanisms to manage risks for investors. Public private partnerships (PPP) can play a crucial role to both finance and implement low carbon projects. Appropriately designed PPP schemes, with incentives for risk mitigation of private investors, can make a significant contribution.

5. Focus areas for promoting LCS

Agriculture, natural resources and land use:

Agriculture is the second largest sector as a source of emission in Thailand (22.6% in 2000). Low carbon and adaptation policies in the agriculture and natural resources sector need to integrate with local communities and draw from their traditional knowledge base. Raising awareness among farmers is important to enhance acceptance of LCS measures. Greening agriculture could be the area that communities could contribute to by adopting organic fertilizer, animal feed, etc. A key challenge is to design strategies for disseminating knowledge among

farmers and local communities for implementing low carbon and adaptation measures via local governance institutions and for coordinating land use policies. Thai Land Use Change and Forestry sector was a net carbon sink (-3.5%) in 2000, and the government is promoting the expansion of urban forest and public parks. This can be good example of policy coordination and multiple co-benefits, as such measures improve living environment of urban areas, promote tourism, protect erosion, reduce dust, as they are promoted under the Crown Standard.

Energy and transportation:

Energy sector is the largest source of emission (69.6% in 2000) in Thailand, stationary source of power industries is the largest in the energy sector that is followed by the transportation, manufacturing industries and construction. Major low carbon options in energy sector lie in the areas of energy efficiency, demand side management, and renewable energy. There is a large potential of energy efficiency improvement in residential, commercial, industrial and transportation sectors. Energy strategies need to incorporate multiple objectives like sustaining economic growth, reducing energy intensity, reducing import dependence, mitigating energy price impacts, and improving access of people to modern and clean energy services.

Transport sector options include high speed, multi-modal and low carbon transport systems, integrated rail and road network, and regional integration of transport network. Thailand's transport sector strategies include interventions with three distinct objectives – 'avoid', 'shift', 'improve'. 'Avoid' strategies aim at preventing high energy and emission intensive transport infrastructure. For instance, Change of urban land-use from mono-centric to poly-centric structure and internalizing costs at early development stages are examples of 'Avoid' strategies. 'Shift' strategies aim at inducing shift towards low carbon modes, for example, extension of road links to neighbouring countries, building rail-road integrated network across Thailand, and enhancing multi-modal transport systems. 'Improve' strategies aim at improving energy efficiency and other performance indicators, for example, introduction of high speed trains, double track logistics, upgrade of mass rapid transit (MRT) system, and improvement of safety features.

One of the targets in transport sector is to achieve 60% mass transit ridership. It is necessary to define relevant

indicators to measure low carbon transport. Low carbon transport strategy needs to integrate with low carbon city design.

Waste management:

Waste sector can be a good model as it directly encourages public participation in the national mitigation action, and promotes awareness of people to the sustainable low carbon living environment. Under the goal of sustainable development there are plans in Thailand to construct new wastewater treatment projects, enhance waste collection systems, and waste-to-energy conversion projects. With the combination of management policy implementation to decrease generation rate with the promotion of 3Rs and the technologies such as biological treatment of waste and recovery of landfill gas, future increase of emissions could be avoided.

Low carbon cities:

City is an important unit for LCS. The Thai government's Crown Standard recognizes this. A low carbon city needs to focus on several main aspects – energy saving, green urban transportation, waste management, urban forest, and urban land use. This involves actions like changing lifestyle and behaviour of people, promoting non-car transportation and bicycle lanes, combining waste management with recycling and energy generation, growing more trees to improve local environment, and moving toward poly-centric type urban land use planning. Clearly, these require changes in technologies, infrastructure, and lifestyles.

Coordination and networking:

Mechanisms for inter-sector coordination are required to allocate limited financial resources among multiple options, resolve possible inter-sector conflicts around land use policies, and facilitate integrated assessment approach. For instance, policies in different sectors, like renewable energy, transportation and urban planning, impact land use. Therefore land use policies will require coordination among relevant governmental agencies in order to resolve possible conflicts, for example, between food and energy crops. Recommendations from research community can help toward better coordination among different ministries and policy makers.

Information and knowledge networking is important for educating the people about LCS. Special financial support for this initiative is required, especially in

the agriculture and natural resources sector as it is connected with the goals of food security and poverty eradication. Initiatives like NRCT that provide such support for knowledge networking and dissemination need to be strengthened and scaled up.

6. Role of research

Strengthening research and coordination among researchers and with policy makers is urgently required to promote integrated, multi-disciplinary analyses.

Researchers need to develop economic tools that help policy makers understand and assess mitigation options. Such tools should permit evaluation of practical options and their impacts. For instance, integration of institutional analysis in models and scenarios will permit evaluation of desirable institutions and political incentives to induce LCS transition. Similarly, researchers need to develop indicators to measure impacts of low carbon policies. There is an urgent need to assess specific policy options for decoupling GDP growth and mitigation objectives, especially for the developing countries. Such efforts will help to remove apprehensions about LCS. Holistic, multi-disciplinary research including use of integrated assessment models, new indicators to measure effects of low carbon policies, new institutions design and analysis, and so on, are called for to assist policy-making process for long-term.

Coordination between research and policy communities is necessary to make the research and its output policy relevant.

Coordination amongst different climate change researchers and those from other fields is necessary to carry out integrated, multi-sector assessment. For instance, such coordination can permit research in critical areas like analysis of inter-sector benefits and conflicts, total cross-sector material flow assessment of GHG emissions, like impact of LCS implementation on competitive advantage of industries, decoupling between GDP growth and mitigation objectives, analysis of alternate institutional designs.

Research for improving adaptation capability, besides mitigation, is required.

As agriculture, forestry and natural resources are important sectors of the Thai economy and society, building capability to adapt to climate change impacts

is critical. Therefore, besides promoting research in the key areas for mitigation, research for improving adaptation capability is required. An example of such a research subject in agriculture is to strengthen crop resistance to climate change.

Greater financial and human resource support is needed for LCS research.

LCS research should be strengthened by providing greater financial and human resources for scientific support to policy makers. LCS focus areas need to be identified and resource support needs to be directed to those areas. A good example is the NRCT supported research for LCS in Thailand. It covers several areas like creation of knowledge on climate change, capacity building of stakeholders, networking and knowledge dissemination. High priority research areas have been identified and supported in this program.

Participant List

Thailand

ARPAC, Leyla Thailand GHG Management Organization (TGO)	CHIDTHAISONG, Amnat The Joint Graduate School of Energy and Environment	ICHIMURA, Masakazu United Nations Economic and Social Commission for Asia and Pacific
ARUNINTH, Ariya Chulalongkorn University	CHOEYPUN, Krisana Regional Energy Coordination Office 8-Ratchaburi	JAROONGKIAT, Nopporn Office of Transport and Traffic Policy and Planning, Ministry of Transport
BONNET, Sebastien The Joint Graduate School of Energy and Environment	CHOOCHUEN, Chinnawat Thailand GHG Management Organization (TGO)	JIAPASUANAN, Thasanee The Joint Graduate School of Energy and Environment
BOONMAN, Thannonpat The Joint Graduate School of Energy and Environment	CHOUYKERD, Prateep Energy Research Institute	JONGPUKDEE, Sukumaporn National Housing Authority
BOONPANICH, Montree Office of National Economic and Social Development Board	CHUANGCHOTE, Chomphoonut Office of National Economic and Social Development Board	JONGSANONGSUB, Piyawat Bureau of Fuel Quality Ministry of Energy
BRECHTER, Manden Thailand GHG Management Organization (TGO)	CHUKAMNERD, Peeraphat Bureau of Policy and Strategy	JUNGRUNGRUENG, Suwanna Bangkok Metropolitan Administration
BUNYAGIDJ, Chaiyod Thailand Environment Institute	CHUNG, Rae Kwon Environment and Development Division, ESCAP	KAEWKUNYA, Tanatchoke Provincial Energy Office Pichsanuloke
BUTTHEP, Chetphong Office of the National Research Council of	CHUTARAT, Acharawan King Mongkut's University of Technology Thonburi	KAJONWATTAKUL, Sumana Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment
CHAMOMMAN, Prasertsuk Thailand GHG Management Organization (TGO)	DAMRONGCHAI, Nares APEC Center for Technology Foresight	KAMESUK, Solos Regional Energy Coordination Office
CHANTANAVAT, Jaruwan King Mongkut's University of Technology Thonburi	FELIX, Mweurw The Joint Graduate School of Energy and Environment	KANANURAK, Jakkanit Thailand GHG Management Organization (TGO)
CHARIYACHAROEN, Somchai Klang Municipality	FUNGTAMMASAN, Bundit The Joint Graduate School of Energy and Environment	KANOKKANCHANA, Kanittha The Joint Graduate School of Energy and Environment
CHARRASSRIVISIST, Theerasak Office of Academic Energy Region 10	FUSUWANKAYA, Kallayanee The Joint Graduate School of Energy and Environment	KATTIYAVONG, Suvit Regional Energy Coordination Office 2-Lampang
CHATEPHON, Thiraphan Lumluka Municipality	GARIVAIT, Savitri The Joint Graduate School of Energy and Environment	KETPHAN, Terapol Abacus Renewable Energy Corp
CHEEWAPHONGPHAN, Penwadee The Joint Graduate School of Energy and Environment	GHEEWALA, Shabbir The Joint Graduate School of Energy and Environment	Khongsaenkhaw, Ananya Ministry of Natural Resources and Environment
CHERDCHUCHAI, Supattra Office of National Economic and Social Development Board	HANKAEW, Charoenwitt Rangsit University	KITTISOMPUN, Bongkoch Department of Industrial Works, Ministry of Industry
CHIAMCHAISRI, Chart Kasetsart University	HOMENAN, Wanakae Bangkok Metropolitan Administration	KLADNIEAM, Rojjana Office of Academic Energy Region 2

KONGDUB, Suthasinee Fiscal Policy office	MALAI, Pimnahathai The Joint Graduate School of Energy and Environment	PANWAI, Sakda Expressway Authority of Thailand
KONGRITTI, Nirun Expressway Authority of Thailand	MANEEROJ, Charuwat The Hotels Association	PATON, Carina The Joint Graduate School of Energy and Environment
KOOMSIN, Surachai Office of National Economic and Social Development Board	MANUSSRISUKSI, Korn Royal forest department	PATTHANA, Jariya Department of Energy Business, Ministry of Energy
KOTOKOTRN, Ton Thai consultance	MARUKATAT, Thanan Petroleum Institute of	PETCHCHART, Kamonravee Kasetsart university
KRABISRI, Suphat The Joint Graduate School of Energy and Environment	MEESOMBOON, Jaron Department of Civil Aviation	PHADUNGSRI, Darnp Thailand GHG Management Organization
KUNARAK, Apiwat Regional Energy Coordination Office	MUENGPOTHONG, Chatetha The Joint Graduate School of Energy and Environment	PHUEAKNANG, Chinna Department of National Parks, Wildlife and Plant Conservation
LEE, Hyunju LERDMAHAKUL, Natcha Environment Unit, United Nations Development Programme	MUKDAPITAK, Yada Technology and Innovation Office	PHUPHUAKRAT, Thana State Railway of Thailand
LI, Lailai Stockholm Environment Institute	MUNCHAROEN, Supnita Kasetsart university	PINTHONG, Rangson Pollution Control Department, Ministry of Natural Resources and Environment
LIENGSIRI, Chaiyasit Royal Forest Department	NAKAVIDHAYA, Sutipong Thai Industrial Standards	PIYAPHANPONG, Sunee Office of Natural Resources and Environmental Policy and Planning
LIMJIRAKON, Sangchai Chulalongkorn University	NAKAMEE, Narumon Regional Energy Coordination Office	PONGSUK, Phankeat Environment Unit, United Nations Development Programme
LIMMEECHOKECHAI, Bundit Sirindhorn International Institute of Technology, Thammasat University	NANA, Prince The Joint Graduate School of Energy and Environment	PONGTHANISAWAN, Jakkapong The Joint Graduate School of Energy and Environment
LIMPHODAN, Raviphak The National Municipal League of Thailand	NANTHASITANGWUL, Chadavat Ministry of Natural Resources and Environment	POONKAEW, Saipin The Joint Graduate School of Energy and Environment
LIMTHONG, Pittayakorn Land Development Department, Ministry of Agricultural and Cooperatives	NERAPORN, Parnita Rangsit University	POOWACHIRANON, Thongchai Regional Energy Coordination Office 15-Phuket
LUTRAGASAURE, Kieattipat Forest hide Organization	NIDHIRITDHAIKRAI, Raksana Energy Research Institute	PORNPENPARN, Suthisa Bangkok Metropolitan Administration
MAHAKOTE, Panya The Joint Graduate School of Energy and Environment	OCTAVIANI, Mega The Joint Graduate School of Energy and Environment	PRADITPHET, Chutinthon Office of Transport and Traffic Policy and Planning, Ministry of Transport
MAHITTHIBURIN, Sivarak Electricity Generating Authority of Thailand, Ministry of Energy	ONGLA, Suranid Chiengrai Municipality	PRAKOBCHAT, Sukamon Department of Alternative Energy Development and Efficiency
MALAI, Attapole Rajamangala University of Technology Rattanakosin	PAIROJ-BORIBOON, Sirithan Thailand GHG Management Organization	PRAKOBCHAT, Sukamon Department of Alternative Energy Development and Efficiency
	PAISANDTEERADEG, Supat Department of Lands, Ministry of Interior	RAKKWAMSUK, Pattana King Mongkut's University of Technology Thonburi
	PANPOOM, Tuangphorn Regional Energy Coordination Office 6-Nonthaburi	

RATAJEEN, Puttamon Office of Transport and Traffic Policy and Planning, Ministry of Transport	Su-Ngathani, Thittaya Department of Civil Aviation	TUNSARAVIRAT, Jinna Office of National Economic and Social Development Board
RUANGRUNGCHAIKUL, Tanit Thammasat University	SUNGPRADIT, Noppadol Office of Academic Energy Region 2	UNLUMBERT, Wipada Office of Transport and Traffic Policy and Planning, Ministry of Transport
SAEUNG, Orapin National Housing Authority	SUNGSAWANG, Nontapat Rangsit University	UTHAIJAROON, Kornchid Central Pattana
SAITUN, Armkaew Rangsit University	SUPNITHADNAPORN, Anupit Office of National Economic and Social Development Board	VAYUPARB, Natarika Thailand GHG Management Organization
SANGDOW, Seksan Pollution Control Department, Ministry of Natural Resources and Environment	SUTTHIVAIYAKIT, Komgris National Housing Authority	VISALVANICH, Kitisak TPI Polene Public Company Limited
SANGJAROEN, Khanatta Rangsit University	SUWANAPON, Chodchai Petroleum Institute of Thailand	VITSAVAKUL, Naphaporn Regional Energy Coordination Office 6-Nonthaburi
SANGTAKSIN, Surachai Regional Energy Coordination Office 13-Chunburi	SUWANNACHOT, Lerpong Regional Energy Coordination Office	WAKANAKAWEE, Pornpawee Rangsit University
SAROCHAWIKASIT, Rangan Department of Alternative Energy Development and Efficiency	SWANGPANYAGKOON, Teerapong Maejo University	WANGKIAT, Arpa Rangsit University
SHRESTHA, Ram Manohar Asian Institute of Technology	TAMEERUKS, Ruongthong National Housing Authority	WANGYAO, Komsilp The Joint Graduate School of Energy and Environment
SINLAPAPROMMARD, Jintamard Regional Energy Coordination Office 14-Surat thani	TANGPAISALKIT, Chamroon Office of Transport and Traffic Policy and Planning, Ministry of Transport	WANNASOOK, Tananchai Regional Energy Coordination Office 11-Nakornratchasrim
SIRISWASDI, Jumpol Regional Energy Coordination Office 14-Surat thani	TANSUBHAPOL, Kanyasorn British Embassy Bangkok	WANTAWIN, Sittichod Energy Policy and Planning Office, Ministry of Energy
SITTICHOK, Pawitra Rangsit University	TAUTIPAIBULRUT, Chaiporn Petroleum Institute of Thailand	WATHANACHINDA, Natchanon Thailand GHG Management Organization
SOMNAM, Thawatchai Thailand GHG Management Organization	TEERAWATTANAKITTI, Soraya Mass Rapid Transit Authority of Thailand	WATTANAPUTI, Nattapol Hua Hin Municipality
SONKRANOK, Ratchanee Office of Agricultural Economics, Ministry of Agriculture and Cooperatives	TEPAKORN, Kanapong Regional Energy Coordination Office 7-Saraburi	YAMADA, Kazuhito JICA -Thailand GHG Management Organization
SRITAKHET, Sawitree Bangkok Metropolitan Administration	THAICHAROENDEE, Veera Bangkok Mass Transit Authority	YOOHOON, Areerat Department of Alternative Energy Development and Efficiency
SUKKASI, Sittha National Metal and Materials Technology Center	THARAWATCHARASART, Phattira Department of Energy Business Ministry of Energy	
SUKNIYOM, Thiti Provincial Energy Office Prachuapkirikun	TIPPICHAJ, Atit The Joint Graduate School of Energy and Environment	
SUKSOMBOON, Preyarat Rangsit University	TIVASURADEJ, Weerada Thailand GHG Management Organization	
	TOWPRAYOON, Sirintornthep The Joint Graduate School of Energy and Environment	

Other countries

BINTISYEDAHMAD, Sharifah
Shahidah
Iskandar Regional Development Authority
Malaysia

CHIENGSRI, Panadda
Rangsit University

CHINSIONG, Ho
Universiti Technology
Malaysia

DESHPANDE, Aashish
National Institute of Technology, Bhopal,
India

JOEMAN, Boyd Dionysius
Iskandar Regional Development Authority
Malaysia

LIU, Wenman
Stockholm Environment Institute
Sweden

MAO, Hak
Ministry of Environment
Cambodia

PANDEY, Rahul
IIM - Lucknow
India

Japan

KAINUMA, Mikiko
National Institute for Environmental
Studies

FUJIMORI, Mariko
JICA -Thailand GHG Management
Organization (TGO)

FUJINO, Junichi
National Institute for Environmental
Studies

MATSUOKA, Yuzuru,
Kyoto University

SASAKI, Midori
Global Environment Bureau Ministry of
Environment

SUDA, Maiko
National Institute for Environmental
Studies

UCHIDA, Togo
Japan International Cooperation Agency

YANO, Masahito
Japan Science and Technology Agency

LCS-RNet Secretariat/
Institute for Global Environmental
Strategies (IGES)
NISHIOKA, Shuzo, Secretary General
MACHIDA, Wataru
MIWA, Kyoko
WAKIYAMA, Takako

Published by the Institute for Global Environmental Strategies (IGES)
© Institute for Global Environmental Strategies (IGES), 2011

Referencing this report:

IGES 2011, Synthesis Report of Transition towards Low Carbon Societies in Thailand and Asia –Dialogue between Policy-makers and Researchers and Cross-sectoral Approach, Institute for Global Environmental Strategies (IGES), Japan

Prepared by the LCS-RNet Secretariat (eds). Published: IGES, Japan

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LCS-RNet Secretariat

c/o Institute for Global Environmental Strategies (IGES)
2108-11, Kamiyamaguchi, Hayama, Kanagawa, Japan, 240-0115
Website: <http://lcs-rnet.org> Email: lcs-rnet@iges.or.jp

Whilst advice and information in this report is believed to be true and accurate at the date of going to press, neither the authors nor publisher can accept any legal responsibility or liability for any errors or omissions that may be made.

Printed in Japan



International Research Network
for Low Carbon Societies
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