

# Technology Transfer and Assessment of Technology Need

Enabling the Kingdom of Thailand to Prepare its First National Communication  
in Response to its Commitment to the UNFCCC (Phase II)



Ministry of Natural Resources and Environment

# Technology Transfer and Assessment of Technology Need

## Executive Summary

Study on Thailand's needs for climate change technology is part of the activities to maintain and enhance national capacity of non-Annex I parties in implementing their commitments under the United Nations Framework Convention on Climate Change (UNFCCC).

Ministry of Natural Resources and Environment of Thailand, under the financial support of the Global Environment Facility (GEF) implemented the "Enabling Activities II" project. One of the main objectives of this project is to study Thailand's needs for development and transfer of climate change technology, under Article 4 paragraph 5 of the Convention. The study covers the status of technology development, especially on the adaptation to climate change impact.

Article 4 paragraph 5 of the UNFCCC states that developed country Parties and other developed Parties included in Annex II to take "all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties", and to "support the development and enhancement of endogenous capacities and

technologies of developing country Parties”, and calls on other Parties and organizations to assist in facilitating the transfer of such technologies.

Under the convention, developing countries such as Thailand have certain commitments in climate change activities. The extent of the implementation is subject to financial and technical supports especially on technology transfer issue. The environmentally sound technology (EST) covers wide ranges of technologies. Technologies directly relate to climate change are:

- Technologies that reduce GHGs or enhance sink
- Technologies that adapt to climate change impact.



## **The Implementation of the Secretariat to the Convention**

The Secretariat of the Convention has synthesized and disseminated information related to the environmental-sound technologies and basic knowledge about technologies to mitigate and adaptation to the impact of climate change. In addition, the Conference of the Parties also requested the Chairman of the Subsidiary Body for Science and Technological Advice (SBSTA) to organize a consultation process on framework to effectively implement Article 4 paragraph 5. Several consultations were organized and three technical workshops on technology transfer were conducted in three regions (Africa, Latin America and the Caribbean and Asia and the Pacific).

Six areas under the framework to effectively implement Article 4 paragraph 5 have been identified based the information from consultations and technical workshops. They are technology needs, barriers to development and transfer of technology, capability building, technology information, mechanism for technology transfer and the roles of private sector.



## **The Implementation of IPCC**

The Intergovernmental Panel on Climate Change (IPCC) has been established by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP). It has the main objectives of providing scientific assessment of climate change, its potential economic and social impact, as well as the mitigation and adaptation options. IPCC also prepares special report and technical papers on related issues. In addition, the IPCC is also mandated to provide technical support per request of the United Nations Framework Convention on Climate Change.

IPCC defines technology transfer as the process covering the flow of know-how, experiences, software and hardware on mitigation of GHGs and adaptation to climate change among stakeholders including public, private, financial institution, non-governmental organizations and academic and research institutes.

IPCC completed its Third Assessment Report (on climate change) in 2000. Following the request of SBSTA, the working group III of IPCC also completed and disseminated the special report on technology transfer (Methodological and Technological Issues in Technology Transfer). The report is to promote the transfer of environmental-sound technologies. The report found that the trend of climate change technology transfer cannot be clearly observed and foreign investment is important factor for technology transfer. The case studies reviewed also indicated that technology transfer had been bias toward GHG mitigation technologies. Technologies related to adaptation to climate change impact had been neglected.

Review of technology transfer suggests the needs to carefully consider technology transfer under Article 4 paragraph 5 and the existing development, especially on 1) trend and direction of existing technology transfer and the needs of developing countries 2) the financial mechanism on technology transfer and 3) the technology transfer under the UNFCCC and the Kyoto Protocol.

The IPCC report indicates that most technologies have been transferred through market mechanism, particularly as direct investment. Technology transfer through loan and private sector are on increasing trends while that through international financial institutions and bilateral cooperation are either stagnant or declining. Technology transfer, so far, has not been in line with the demand of developing countries, particularly on technologies

for adaptation to climate change impact. The IPCC report indicates that the market mechanism does not induce the transfer of such technologies. Case studies also confirm that developed countries have emphasized the transfer of GHG mitigation technologies.

At present, GEF is the only multi-lateral financial mechanism on technology transfer under the Convention. GEF is the international institute supporting the transfer of environmental-sound technologies, especially in promoting energy efficiency and renewable energy technologies, by reducing barriers to investment and long-term expenses. However, since GEF provides financial supports through various international agreements, its contribution specifically to the Convention is difficult to assess.

Technology transfer under Kyoto Protocol is channeled through the Clean Development Mechanism (CDM). This is separated from such transfer under Article 4 paragraph 5 of the Convention. The technology transfer under Kyoto Protocol is in addition to the existing commitments. Through the mutual beneficial mechanism, the developed countries will cost less in meeting the agreed targets while developing countries receive assistance to further enhance their sustainable development process. The Conference of the Party has agreed that developed countries cannot use technology transfer under the Protocol as part of the implementation under Article 4 paragraph 5.



## **Development of Thailand on Technology Transfer**

As developing countries, Thailand has certain commitments in climate change activities, especially on submission of national inventory of GHGs. The Convention requests the parties to report GHG inventory in their National Communications. Parties should also report development and transfer of technology under Article 4 paragraph 5 in their National Communications.

In preparing national GHG inventory, there is certain transfer of technology in estimating the GHG emissions from several sectors. However, the technology of GHG inventory is not the priority need of developing countries. Thailand also participated in the Activities Implemented Jointly (AIJ) with the aim of more understanding of technology transfer process as well as the related transaction costs.

### ***GHG Inventory Technology***

Thailand prepared its first national inventory of GHG emissions for 1990 by employing the estimation method developed by the Organization of Economic Cooperation and Development (OECD) and the IPCC. The GHG inventory was updated to 1994 by using the revised methods of the IPCC. The 1994 GHG inventory of Thailand is reported in the National Communication in 2000.

There are few important factors in the preparation of the national GHG inventory i.e. the GHG emission coefficients and their activity data, and 5 sectors are included: energy, industrial process, land use, land use change and forestry, agriculture and wastes.

In estimation of Thailand's GHG emission inventory, it was found that the technologies related to development of GHG emission coefficient, especially for rice cultivation and forestry can contribute greatly to the quality of the estimates. Development of methods to project GHG emission is going on slowly.

### ***GHG Emission Reduction***

Thailand, as a developing country, has no commitment in GHG reduction and has the policy to assist global GHG emission reduction under the common but differentiated responsibility principle and following its policy of "No-regret Options". In the other word, the GHG emission reduction should not affect the economic and social development of the country.

#### *GHG mitigation options in energy sector*

The GHG mitigation options in the energy sector can be classified into 4 groups: regulation, fiscal incentive, public relation, and research, development and demonstration, covering improvement of energy efficiency and fuel switching from those of high to low carbon contents. Options to reduce emission in energy sector include fuel switching, renewable energy,

energy conservation in industry and business demand-side management and fuel switching in transportation and mass transit management. In addition, a least-cost analysis model called EFORM-ENV was employed to prioritize several options according to costs.

*GHG mitigation options in forestry sector*

The GHG mitigation options in the forestry sector were analyzed by using the Comprehensive Mitigation Assessment Process (COMAP). Two CO<sub>2</sub> emission mitigation options, following the forestry master plan, were investigated: forestry protection and afforestation. GHG mitigation in forestry does not require complicated technology. Thailand has capability and sufficient technology for such development. The main problem in CO<sub>2</sub> mitigation in the forestry sector is the forestry management and administration.

*GHG mitigation options in agriculture (rice paddy)*

Rice cultivation in flooded land, especially in irrigated areas is major source of methane emissions. Hence, major methane reduction options in the agricultural sector are in rice cultivation in the flooded area. The major mitigation options are changing water management and chemical fertilizer uses to reduce emissions. This requires extensive research on potential impact on rice farmers.

Development of technology in reducing methane emissions from rice sector is important to enhance research knowledge for national development, but not for the reduction of emission per se. The rice production involves more than one-half of the people in Thailand, especially those poor farmers. Food security is one of the main objectives of the Convention and Thailand, as developing country, has no commitment in reduction target, implementing mitigation option is highly social and economic sensitive and careful analysis is needed.

For raising domestic animals in limited areas, application of ionophores such as monensin to reduce methane emission in conjunction with enhance the feed efficiency could be an option. In addition, reduction on methane from animal wastes should emphasize wastewater management in large swine farms. Central treatment plants may be needed for small and medium farms. GHG mitigation options in swine farms directly correspond to the development of biogas energy in Thailand. Thailand is promoting renewable energy, especially biogas. High cost of biogas development is the main issue and need technical support under Article 4, paragraph 5 of the Convention.

#### *GHG mitigation options in waste sector*

GHG reduction options in the waste sector can be classified into 2 strategies: waste management and waste conversion to energy form. Measures in waste management are waste reduction, recycling or both. In the waste conversion to energy form, especially in producing electricity reduces methane

emission. Methane production from waste conversion, similar to biogas production process, involves technology transfer under Article 4 paragraph 5 of the Convention.

In general, GHG mitigation of Thailand is not the urgent policy in the climate change activities. Several alternatives in GHG mitigation in some sectors involve technology transfer under Article 4 paragraph 5 of the Convention. Such transfer could play important roles in development of basic knowledge of Thai researchers as well as energy and environmental management for sustainable development of the country. These are the potential areas of climate change policy priorities of Thailand.



## **Adaptation to Climate Change Impact**

Developing countries, like Thailand are vulnerable to but lack of capacity to adapt to climate change impact. Development and transfer of adaptation technologies are relatively slow. Studies on vulnerable and adaptation in Thailand are only at preliminary stages, although several sectors including forestry, agriculture, water resources, coastal areas and health were covered. Several techniques applied were weak, especially the application of climate change scenarios from Global Circulation Models. At present, there is no sub-regional climate model such as for Southeast Asian region for adaptation studies. This resulted in errors and high certainties in analysis of climate change impact and hence adaptation. For

instance, the average yields of crops generated

from crop models based on different climate scenarios varied widely.

The limitation of technologies and know-how in research and development in impact and adaptation to climate change resulted in high uncertain results and lack of usefulness in adaptation policy analysis.



## **Technology Transfer Needs Assessment for Thailand**

Implementation on development and transfer of technologies of developed countries under the UNFCCC has concentrated on those for emission reduction. In contrast, the principles and circumstances of developing countries give priorities to adaptation technologies.

Several studies have proposed the approach to transfer of technologies such as those of Climate Change Initiative and IPCC. The approach covers the steps of assessment the technology needs, the process of transfer of technologies and the evaluation of such transfer. Differences in development and transfer of emission and adaptation technologies were due partly to the political policies of developed countries and partly to the nature of complexity of the studies on adaptation. In addition, adaptation technologies have no commercial attractive as emission technologies.



## Assessment of Technological Needs

Technology need assessment is part of the technology transfer process. Several studies have proposed the approach to assess technology needs such as UNDP/NCSP, UNEP, CTI and other self-developed approaches of some countries. It was found that the approaches have similar basic principle i.e. the criteria to prioritize sectors and technologies are based on the national sustainable development policy and planning priorities. The same approach is applied for technology need assessment in this study.

Assessment of technology needs in Thailand follows the components to form the steps as follows: 1) Study the circumstance on implementation of climate change related to transfer of technology 2) Conditions and criteria determining the importance of related sectors 3) rank of sectors and technologies according to the conditions and criteria 4) Brainstorming and 5) prioritize the need for development and transfer of technologies

The analysis of national circumstances and principles of the Convention form the status of development of climate change technologies in Thailand. Conditions and criteria, based on the principles and the need of the countries in economic and social development, following the national policy and development plans set up the scope to identify sectors and related technologies.

brainstorming process employed and the preliminary identified needed technologies are finalized.

### ***Technology for Local Emission Factor Development***

From the review of assessment of emission factor development for Thailand and based on the trend of the negotiation process of the UNFCCC, it is recommended that Thailand should develop local emission factors for rice and forest sectors, especially in expanding experimental sites to different regions.

Thailand may not need hard ware for development and transfer of technology for local emission factors. The research work can be conducted by local experts and researchers. The main important technology needs are the financial and technical supports from developed countries.

### ***GHG Mitigation Technology***

Thailand gives high priority to renewable energy development especially biogas energy and energy conservation. The national energy policy also emphasizes renewable energy development by accelerating technology development for renewable energy and energy conservation.

### ***Biogas Technology***

The master plan of renewable energy development in Thailand supports the studies of using biogas from pig farms and industries to substitute liquefied petroleum gas (LPG) in household's cooking, and fuel oil in electricity production. Biogas is composed of methane 65%, carbon dioxide 33%, and the other gases 2%. The assessment of biogas potentials in Thailand includes:

1. Biogas from pig farms
2. Biogas from agro-based industries
3. Biogas from domestic waste management .

Approaches to promote biogas energy includes 1) support biogas installation in the livestock farms, 2) demonstration of biogas installation in the industries to prove the reliability of biogas production system, 3) demonstration of biogas production from domestic wastes, 4) research and development to improve efficiency of biogas system, and 5) biogas collection and storage, and waste treatment in the pig farms.

### *Biomass Energy Technology*

Thailand is an agricultural based country. There are agricultural wastes generated from the production and processing of agricultural products. Some wastes have been used for energy generation such as rice husk in rice mills, bargas and oilpalm waste in generation of steams and electricity and wates of parawood in drying process. Thailand still has bargas rice husk and oilpalm waste that can produce about 202, 406,

and 75 megawatt of electricity. The main problems

of development of biomass energy technology in Thailand are 1) source and management of raw materials 2) cost management in acquiring raw materials.

### *Solar Energy Technology*

Conversion of solar energy to the ready-for-use forms includes solar electricity production and solar thermal energy. The main barrier is the high initial investment cost since solar cell production requires advanced technology. Solar thermal energy for hot water production, industrial product heating, and agricultural post harvest processing as well as pesticide production is economically competitive to the conventional energy form but requires high initial investment, which is the main barrier in the promotion of solar thermal energy.

The main problems and barriers of renewable energy development in Thailand are 1) development of renewable energy has its own limitation and the research capability of Thailand is still low, 2) renewable energy technology requires proofs of system reliability and stability such as biogas and biomass production, and 3) the average energy cost of renewable energy technology such as solar cell is still higher than that of the conventional energy.

### *Climate Change Adaptation Technology*

The review of research and development on adaptation technologies in Thailand indicates that research work on impact of climate change and adaptation potential has been limited. This is mainly due to the fact that to identify the potentials of adaptation requires a comprehensive analysis of potential impact of climate change. The needs for technologies related to adaptation options include:

- 1) analytical techniques on climate change at sub-regional level, especially the climate change scenarios at sub-regional scales.
- 2) analytical techniques on potential impacts on agriculture, especially on analysis of potential impacts on yields of economic crops in different regions of the country and the impacts on pest and disease.
- 3) analytical techniques on the impact on water resources, coastal resources and present and future surface run-off.
- 4) analytical techniques on coastal resources, especially on impact of ecological system and coastal resource utilization. and
- 5) analytical techniques on potential health impact, particularly on the spread of climate change related diseases.

## **Human Resource Needs**



Demand for human resources in development and transfer of climate change technologies are not critical for Thailand. For local emission factor development, Thailand can utilize the research stations and experts from academic institutes. Similarly, development of emission reduction technologies has been part of the national economic and social development policies and plans. The main issue here is to enhance the capacities of the existing researchers to improve efficiencies of different technologies to be commercially viable. As far as climate model is concerned, Thailand needs to develop researchers to conduct the research. For impact part, the country has experts in different areas who merely need capacity building on climate change aspects. In total, Thailand has sufficient local experts and researchers to carry out development and transfer of technologies. The more important area is the enhance, the capacities of these researchers, especially in joint-research with experts in developed countries, so that they can applied the technologies to local conditions.



## **Conclusions**

Executive Summary:

*Technology Transfer and Assessment of Technology Need*

This report indicates that Thailand needs technology development and capacity enhancement on development of emission factors for agriculture and forestry. For mitigation technologies, biogas, solar and energy conservation related technologies are of priority. Capacity building on research development on vulnerability and adaptation is highly important and more urgent than other areas. Particular important development needs are subregional climate change model, analytical techniques on potential impacts on agriculture, water resources, coastal resources and health.