TDRI Quarterly Review
Published in *TDRI Quarterly Review*
Vol. 6 No. 3 September 1991, pp. 7-12
Editor: Anne Johnson

The Basis for Thailand's Response Strategies to Global Warming*

Somthawin Sungsuwan-Patanavanich

Despite the uncertainties concerning global climate change, most recent international conferences on this issue have agreed to support the Intergovernmental Panel on Climate Change (IPCC) as the principal forum for its scientific assessment. This implies a basic recognition that climate change is a global problem, and that all countries should share common but different responsibilities. Industrialized countries are expected to take the lead and commit themselves to immediate action and also to cooperate with the developing countries in addressing climate change without obstructing national development goals. All countries should base their responses on the precautionary principle that environmental measures must anticipate, prevent, and attack the causes of environmental degradation. Lack of certainty should not be used as an excuse for postponing preventive measures.

There have been many debates over what should be the basis for deciding how responsibility for reducing emissions should be allocated—current levels of emission, accumulative emissions (stock), emission/Gross Domestic Product, or emission/person basis. The general consensus seems to favor responsibility on a per capita basis as this represents the most practical way of deciding a country's fossil carbon budget. If this method were adopted, some of the industrialized countries would face difficulty because they would not be allowed further burning of fossil fuel unless compensation mechanisms, with a certain degree of flexibility, were adopted. This is why economic mechanisms, tradable emissions rights, taxation systems and a climate protection fund were introduced as tools for emissions management.

Thailand has indicated its commitment to protecting the global climate by participating in many international forums. The country has been a contracting party to the Vienna Convention for the Protection of the Ozone Layer, as well as to the Montreal Protocol on Substances that Deplete the Ozone Layer (chlorofluorocarbon [CFC] control). As to carbon emission reduction, Thailand has also hosted international meetings including the Meeting of the Preparatory Committee: the Technical Workshop to Explore Options for Global Forest Management, the Technical Workshop on Legal Aspects of Global Warming, and the International Conference on Global Warming and Sustainable Development: An Agenda for the '90s. However, it is not clear, at least to the public, what Thailand's position should be. Although identified as a nation highly vulnerable to the ill effects of climate change, Thailand is less able than the industrialized countries to mobilize the technical and financial resources needed to respond. The country must, however, design policies and preventive strategies to minimize its own emissions without hindering growth. In implementing such policies, the Thai government must also make sure that the benefits of development reach the nation's poor, i.e., the vast majority of its people. Key considerations determining Thailand's position are as follows:

THAILAND'S SHARE OF GLOBAL GREENHOUSE GAS EMISSIONS

World Resources Institute estimates show that Thailand emits 1.13 percent of the world's net increase of atmospheric greenhouse gases, 67 million of 5.9 billion tons of carbon, or about 6.7 percent of U.S. emissions. In emissions per capita, Thailand emits 1.3 tons per head, slightly above the world average of 1.2 tons. Per capita emissions for the U.S., the U.K., Japan, Malaysia, and South Korea are 4.1, 2.7, 1.8, 1.6 and 0.7 tons, respectively.

STRUCTURAL CHANGE IN THE ECONOMY

The GDP shares of Thailand's nonagricultural sectors, particularly the industrial and service sectors, have grown at an accelerated rate. In 1970, the shares of industry, services, and agriculture were 26 percent, 47 percent and 27 percent respectively. In 1989, the share of agriculture dropped to 16 percent, while the industrial share rose to 36 percent. The share of services has been steady at 47 percent to 48 percent, but is expected to grow with the expansion of the industrial sector. The expansion of industry and services has become a driving force of the economy's growth, and has created a growing demand for fossil energy, thus increasing CO_2 (carbon dioxide) emissions. Thailand's recent economic performance has propelled the country into one of the world's most rapidly industrializing nations, with an average annual growth rate of 6.8 percent from 1970-80, and 7.5 percent from 1980-89.

This economic growth has meant more energy consumption and hence higher emissions of CO_2. Rough estimates indicate that the emissions elasticity of GDP is about 0.9, meaning that a one percent increase in the GDP induces a roughly 0.9 percent increase in CO_2 emissions.

CHANGES IN LAND-USE PATTERNS

Deforestation cannot continue to be the major method of opening up new crop lands. Additional crop land must be made available through reducing the amount of land now under rice. Thailand's paddy planted area is, therefore, expected to decrease as farmers switch from rice to crops such as fruit trees or to livestock or aquaculture—all of which offer considerably higher profit margins than rice. These land-use patterns should at least restrain increases of CO_2 and methane emissions and directly reduce the CO_2 released by cutting down trees.

ENERGY USE EFFICIENCY

According to the National Energy Administration (NEA), the efficient use of energy in the industrial, commercial, and residential sectors could save up to 607 megawatts of electricity. This accounts for 10 percent of EGAT's (the Electricity Generating Authority of Thailand) total capacity.

Thailand stands to loose considerably if the international community agrees to freeze the level of fossil carbon emissions by country. In contrast, Thailand would benefit from allocation on a per capita basis. If there were an agreement to set the level of CO_2 emissions per capita at the current world average of 1.2 tons, Thailand would not exceed its present emission quota for at least fifteen years. Clearly, Thailand should give strong support to the per capita basis, with allowance for emissions rights trading. Beyond national interest, Thailand as a member of the global community has tried to identify possible measures that can be implemented at the national level. This is reflected in the country's preparation for the United Nations Conference on Environment and Development (UNCED) in 1992.

PREPARATION FOR THE UNCED IN 1992

In preparation for the UNCED, Thailand plans to draft a comprehensive national development report which includes information on the state of its natural resources. It also assesses the environmental and development situation within the country. This requires broad-based independent sector participation. To facilitate such participation, in 1990 the National Environmental Board (NEB) established a National Committee on Long-term Global Environmental Issues which brought in representatives from both governmental and non-governmental agencies working in the environment/development area. Under this committee, a sub-committee, chaired by the Director of Natural Resources and Environment Program of TDRI, was established. The Sub-Committee, through TDRI, has now initiated work to complete the national report draft.

The national report will address the various linkages between environmental problems and the

development process, including how the transformation from a subsistence agricultural economy into a rapidly industrializing country has affected natural resources and thus the country's environment. This will include present and potential conflicts over the use of natural resources, particularly land, water, and forests. The main emphasis will be on identifying options to lessen pressure on natural resources.

Equal importance will also be given to balancing national development with global environment protection measures, especially Thailand's contribution to greenhouse gas emissions. In this regard, the national report will cover the country's status and position on global warming. Two central issues will be: how global warming policy will affect the interests of the poor, and to what extent and under what conditions can Thailand contribute to arresting the global warming problem. To ensure the participation of all sectors, and to obtain public comments, the draft report will be discussed at a national symposium scheduled for November 4, 1991.

RESEARCH EFFORTS AND PRELIMINARY FINDINGS

To formulate the country's response strategies in international negotiations regarding the global warming issue, TDRI conducted a research project in 1990 linking greenhouse gas emissions to changes in patterns of land use and energy consumption. The policy implications of greenhouse gas reduction on the economy were discussed. The findings from this project will serve as a basis to formulate the country's response strategy to UNCED in 1992. Meanwhile, TDRI is working in collaboration with the Environment and Policy Institute of the East-West Center and the Environmental Assessment and Information Science Division of the Argonne National Laboratory to identify energy technology problems and measures needed to reduce carbon dioxide emissions. A research project relating greenhouse gas emissions to changes in land-use patterns is under way, using a common framework developed at the Lawrence Berkeley Laboratories. Preliminary findings from TDRI's study include:

Thailand's Greenhouse Gas Emissions: Sources and Trends

The major sources of Thailand's greenhouse gas emissions arise from changing land-use patterns and from increased energy consumption, including both fossil and renewable fuels. Clearing of forest land for other use has led to a drastic drop in the amount of carbon stored in standing biomass and soils. The amount of carbon lost adds to the atmosphere in the form of CO_2 through oxidation. In 1988, deforestation in Thailand released a total of 35 million tons of carbon, or 69 percent of the country's total carbon release. Growing rice is another source, particularly wet rice. Rice paddy fields release methane which is also an important greenhouse gas. In Thailand, a large portion of the country's land is devoted to rice production, i.e., about 18-20 percent in the 1980s, with wet rice accounting for 90 percent of the total rice-planted area. TDRI 1990 estimates of released methane during the same period were some 10-12 million tons of carbon equivalent annually. A final main source of greenhouse gas emissions is in energy conversion and consumption processes which produce a large amount of CO_2. CO_2 emissions in carbon from this source were estimated at 9, 9, 12, and 16 million tons of carbon in 1979, 1981, 1986, and 1988, respectively. An increasing rate of fossil carbon emissions and a slowed rate of deforestation resulted in fossil carbon emissions exceeding emissions by deforestation in 1991. It should be noted that Thailand is considered a small user of CFCs. Thailand's consumption per capita in 1988 was 0.07 kilograms. The corresponding figures for the U.S., Europe, Japan, and Malaysia were 1.2, 0.9, 0.9, and 0.2, respectively.

CO_2 Released through Deforestation

Deforestation has been the major contributor of CO_2 to the atmosphere in Thailand. If CO_2 emissions from deforestation and fossil fuel burning were combined, Thailand, in 1987, ranked as the thirteenth largest CO_2 emitter in the world after Mexico, number 12. These top 13 countries were responsible for 70 percent of the world net carbon released into the atmosphere.

Thailand lost forest area very rapidly during the 1960s and 1970s—fully 3 percent annually. Although the

deforestation rate was down to 2 percent in the early 1980s, the annual loss was still high at 240,000-480,000 hectares (1.5-3.0 million rai). The rate dropped to approximately one percent during 1987-88, and during 1988-89 it declined further to 0.3 percent (about 39,000 hectares), due to the logging ban which took effect in February, 1988.

According to a 1989 study on the relationship between tropical deforestation and atmospheric carbon by the International Project for Sustainable Energy Paths (IPSEP 1989), during the 1960s and 1970s Thailand's deforestation contributed more than 100 million tons of carbon to the atmosphere annually. This dropped to approximately 60 million tons during 1983-86, becoming much lower (approximately 35 million tons) in 1988. In 1989, it was estimated to be as low as 10 million tons. This downward trend shows a slowed rate of deforestation. The most recent study by TDRI, which applies the COPATH model, indicates that emissions of CO_2 from deforestation are expected to be 30, 33, 20, 8, and 2 million tons of carbon in 1991, 1996, 2001, 2006, and 2011, respectively.

CO_2 Released through Energy Consumption

Thailand's energy consumption, including renewable energy, increased at the rate of 4.6 percent per annum during 1981-86, and rose sharply to 8.4 percent during 1986-88. In 1988, total primary energy demand was 23 million tons of crude oil equivalent. The CO_2 emission caused by such high consumption was estimated at 58 million tons (16 million tons of carbon).

TDRI's projections to the year 2011 indicate that the country's energy consumption will grow at an annual compound rate of about 6 percent, implying an increasing amount of CO_2 emissions. From the beginning of the Eighth National Development Plan (1996), emission rates should be higher because of increasing proportions of coal and lignite in the future energy mix for utilities and the industrial sector's growing energy demands.

CO_2 emissions vary according to economic sector. Since the end of the Fifth Plan (1986), the transportation sector has been the dominant source of CO_2. Its share of emissions was 47 percent during 1986-88. Estimates for 2011 show increasing emissions for the transportation sector with an annual compound growth rate of about 6.6 percent. The power sector holds the second largest share because of the high levels of lignite used in generating electricity. This sector's emission share is expected to be as large as 33 percent in 1991, and 34 percent in 1996. By 1996, the power sector's share should become very close to that of the transportation sector, and may even surpass it shortly thereafter, unless major shifts in fuel mix and effective emissions control systems are adopted.

The U-shape Curve of CO_2 Emissions

The ratios of emissions from deforestation to emissions from fossil fuel burning were roughly 13.7, 12.4, 5, and 2.2 in 1979, 1981, 1986, and 1988, respectively (Figure 1). These decreasing ratios are the result of increased fossil fuel combustion and the slowing down of deforestation. In the foreseeable future (during the Seventh to the Tenth Plans), the carbon added to the atmosphere will come mainly from the burning of fuel by the power, industrial and transportation sectors. This implies a growing significance of fossil fuel consumption as a source of the country's carbon production during the next two decades. It is worth noting that the sum of carbon emissions by both sources form a U-shape curve, possibly a common pattern for many countries with formerly abundant forest resources.

CO_2 Reduction and Thailand's Energy Systems

As the most serious current proposals concern strategies for reducing CO_2 emissions, it is crucial for Thailand to understand how these strategies would effect the country's energy system if adopted as measures to reduce CO_2 . TDRI's 1990 study concludes that for the country to ensure a sufficient supply of

electricity to achieve its targeted growth and industrialization, while keeping the level of CO_2 emissions low, the government should take immediate action to accelerate the implementation of energy conservation programs. Incentives in various forms should be offered to electricity users, with EGAT taking a leading role. In the medium-run (five to ten years) when increased electricity generation might be inevitable, switching to different fuel mixes, basically toward extensive use of natural gas, liquefied natural gas (LNG), and imported hydroelectric power, will be required. The possibility of adopting unconventional sources of energy (wind, solar) should be explored. Along with other policy actions, effective measures to increase forest areas should be designed, and proper management of forest areas should be made a long-term goal.

Reforestation as a Carbon Sink

Emission reductions could also be achieved via changing the pattern of land use. Reforestation, in particular, represents an attractive strategy. Although there are some uncertainties in quantifying the relationship between tropical reforestation and carbon absorption, some rough estimates could be made based on the statistics reviewed by the International Project for Sustainable Energy Paths (1989) and the most recent statistics reported by the IPCC working group II. Assuming that the CO_2 absorptive capacity of one hectare of forest is 2.5 tons per year, and that the government's forest policy is able to reforest an area of 0.16 million hectares, or one million rai, per year, Thailand would have an additional 30 million rai of forested area by the end of the year 2020. This would absorb approximately 186 million tons by the year 2020 and would be enough to stabilize the level of the country's CO_2 emission without disturbing energy consumption in other sectors. Reforestation brings many other benefits as well and should therefore be taken into serious consideration by decision makers. Many might argue that past reforestation programs have proved unsuccessful. This is because not enough attention was paid to the trade-off between land for food crops and forest area or to ensuring that local people benefited from these programs. An additional complication is that more than 7.8 million people currently live in encroached forest areas which the government hopes to reforest.

POLICY IMPLICATIONS: A COOPERATIVE STRATEGY

There are two primary implications for policy to be drawn from the data and information presented in this paper.

The first implication is that Thailand will need to reduce its emissions of CO_2 through fuel switching and conservation measures if it wishes to reduce greenhouse gases. Although the combined potential to effect emissions of CO_2 through these two measures is small compared to global emissions levels, they nevertheless warrant exploration. Thailand's task in reducing emissions will be greatly facilitated through cooperative efforts with neighboring countries who have excess supplies of natural gas and hydropower. Currently, Thailand has small and diminishing natural gas resources and will need to rely even more on lignite to fuel its industrialization. An acceleration of the Joint-Development Area project between Malaysia and Thailand is one concrete way to ensure that more natural gas is available to the Kingdom. Similarly, implementation of the international hydropower project between Laos and Thailand can speed up access to electricity generated by sources other than lignite. Finally, continued negotiations with the Burmese government for trade in natural gas represents a third viable cooperative strategy to reducing CO_2 emissions.

The second primary implication is the potential for reforestation. The encroached forest reserves, some of which have been rented to private firms, cannot be considered a promising supply of land for tree plantings due to the complication of dealing with some 7.8 million settlers. Although there is some identified unused land, it is not necessarily true that it will be available for reforestation. The opportunity cost of converting the land into plantations must also be taken into account. The financial and technological problems facing Thailand are similar to those facing other developing countries. These factors will significantly determine the rate of change in forests. A national effort is necessary to implement a successful reforestation program, yet not really sufficient. Therefore, external funds will be needed to assist this effort. Specifying

the amount of funds needed to cover the costs of planting trees must be done at the national and not simply at the site level. At present, there has been no effort to do so in Thailand. Equally as important as financial and technological factors is the institutional capacity to implement large reforestation programs. The tasks include not only the preparation of land, if available, planting and maintaining but also the overall management of forest-related systems such as agricultural and forest product trading systems. This, too, will require the assistance and cooperation of other and wealthier nations.

REFERENCES

Chongpeerapien, T., S. Sungsuwan, P. Kritiporn, S. Buranasajja, and Resource Management Associates. 1990. *Energy and Environment: Choosing the Right Mix*. Bangkok: Thailand Development Research Institute.

Forest Statistics Sub-division. *Forestry Statistics of Thailand 1989*. Bangkok: Royal Forest Department.

Krause, Florentine, Wilfrid Bach and Jon Koomey. 1989. *Energy Policy in the Greenhouse Vol. 1, From Warming Fate to Warming Limit: Benchmarks for a Global Climate Convention*. International Project for Sustainable Energy Paths, September.

Kumpanon, A. *Present and Future Plans for Electricity Generation*. Bangkok: Electricity Generating Authority of Thailand, 24 May 1991 (in Thai).

Panayotou, T., and C. Parasuk. 1990. *Land and Forest: Projecting Demand and Managing Encroachment*. Bangkok: Thailand Development Research Institute.

The World Resources Institute. 1990. *World Resources 1990-91*. Oxford University.
