CO_2 Reduction in Transport Sector in Thailand: Some Insights

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Abstract: In this presentation, an attempt is made to highlight the importance of having a fundamental shift in planning and policies for public infrastructure development in the transport sector and alternative energy resources development in a developing country like Thailand if a substantial reduction in CO_2 emission is to be achieved. It is argued that climate change related economic instruments like carbon tax may not achieve their full potential to reduce greenhouse gases in the absence of such shift in plans and policies. Results from a study on Thailand are presented to that end.

Thailand is the second largest economy in the ASEAN region. It is also the second largest in CO_2 emission in the region. Thailand's total CO_2 emission was 206 million tons in 2004, which was 2.62 times the corresponding figure in 1990. Thailand's share in the global total CO_2 emission increased from 0.4% in year 1990 to 0.8% in 2004. The total CO_2 emission increased by 162% during 1990-2004 in the country, which shows a much higher growth rate than that of the global CO_2 emission (28% during the period). The annual growth rate of the country's CO_2 emission per capita during 1990-2004 was 5.99%, which is substantially higher than that of OECD (0.32%) and Asia excluding China (3.06%). The transport sector accounts for 29.5% of the total CO_2 emission in Thailand due to its heavy reliance on fossil fuels. The figure is not only substantially higher than that of major emerging developing countries like China (6.3%) and India (8.8%) but is also higher than the corresponding figures of the developed countries (27.1% in OECD and 20.8% in Japan). The transport sector in Thailand is predominantly road based. This is evident from the fact that at present the total length of highway is 64,000 km and the total length of railway is less than 4,070 km. The transport sector is heavily based on fossil fuels and accounts for more than one third of final energy demand.

The Thai Government has some environment-friendly strategies and plans in the transport sector, which include substitution of existing diesel-run trains with electric trains, developing mass rapid transit to substitute private vehicles (813 km long double track trains) and intercity trains to reduce private vehicles within city area. The government has developed a very ambitious plan for biofuels promotion in the transport sector, which aims at substituting 10% of diesel use with bio-diesel by 2012. This plan requires the utilization of 85 million liters of blended biodiesel per day and production of 8.5 million liter per day of pure biodiesel production by 2012. The production will be based on palm oil and Jatropha. Also the government has a Gasohol Strategic Plan which would increase the utilization of E10 Gasohol from one million liters per day in 2006 to 3 million liters of ethanol per day by 2011.

Our study on CO_2 reduction potential in Thailand shows that increasing the use of biofuels in the base case during the planning horizon of 2000-2050 (i.e., increasing the use of biodiesel from 500 ktoe in 2005 to 30,000 ktoe by 2020 and to 40,000 ktoe

by 2050 and similarly increasing the use of Gasohol from 500 ktoe in 2005 to 10,000 ktoe in 2030 and to 20,000 ktoe by 2050) would reduce the cumulative CO_2 emission during the period by 0.8% from the total emission during the period in the absence of biofuels[1]. Also, it was found that increasing the availability of biofuels during 2020-2050 (i.e., biodiesel availability increasing from by 30,000 ktoe in 2020 to 80,000 ktoe in 2050 and Gasohol increasing from 10,000 ktoe in 2030 to 40,000 ktoe in 2050) would reduce the cumulative CO_2 emission during 2005-2050 by only 0.27%. This demonstrates that without a massive biofuels production/procurement program, that is far bigger in scale than conceived presently, biofuels cannot contribute significantly to total national CO_2 emission reduction. On the other hand, a program for a substantial increase in biofuels production would face the standard conflict of having to use the agricultural land for fuel production instead of food production.

Our study (Shrestha et al., 2008) shows that if passenger travel demand based on cars, vans and pickups is shifted to that based on electrified MRTS and railways by 10% in 2015 with the shift increasing up to 30% by 2050, there would be a reduction in cumulative CO_2 emission during 2015-2050 by about 1.87% as compared to the CO2 emission in the base case. This shows that shifting the passenger transport demand away from the low occupancy road based personal transport system to MRTS and railways would have a significantly large CO_2 reduction potential.

How large could be the effect of carbon tax in reducing CO_2 emission from a country like Thailand? Our study shows that introducing a uniform (i.e., constant) tax of \$100/tCO_2 during 2013-2050 would reduce total CO_2 emission by about 16.4% from that in the base case (i.e., without both carbon tax and modal shift to MRTS and railways and with limited hydropower availability and with a limited nuclear power generation capacity). If the carbon tax is applied along with the modal shift (as stated in the previous paragraph), the study shows that CO_2 emission would fall by additional 2.2% (i.e., the total emission would be reduced by about 18.6%). This clearly shows that climate policy related economic instruments like carbon tax would be more effective, when there is an option for investment in public transport systems like MRTS and electric railways. This, however, requires a major shift in the government's policies and plans to favor the development of MRTS and railway based public transport infrastructure.

Furthermore, the options of additional hydropower import (up to 93,040 GWh by 2050) from neighboring countries, enhanced nuclear power generation capacity (up to 40,000 MW by 2050) and the modal shift (as described earlier) are considered along with a carbon tax of US\$100/tCO_2, our study shows that the total CO_2 emission would be reduced by an additional 6.3% as compared to the case with the carbon tax alone. In other words, the total emission in such a case (with modal shift, additional hydropower import and nuclear power generation combined) would be about 22.7% less than that in the base case. These results show that the carbon tax would be much more effective in CO_2 reduction if the wider options of investments in non-road public transport infrastructures, regional hydropower development and nuclear power generation are considered.

[1] The study used a bottom-up energy system model of Thailand, which we developed using the Asia Pacific Integrated Assessment Model (AIM)/Enduse framework.

Thus, if a developing country like Thailand is to pursue a development path towards a low carbon economy, it is important to orient the public policies toward those favoring climate friendly infrastructure developments (e.g., electrified MRTS and railways, regional transboundary hydropower development) besides programs to improve energy efficiency and promote greater use of renewable energy.

Reference:

Shrestha, R. M., S. Pradhan and M. Liyanage, 2008, Effects of Carbon Tax on Greenhouse Gas Mitigation in Thailand, Climate Policy (accepted for publication).