Global Climate Change
Bangladesh episode

SUMMARY

5.1 Summary and Conclusions

The synthesis report has brought together the three components of the study together. The three components are (i) an emission inventory, (ii) a vulnerability analysis and (iii) an analysis of possible mitigation options and strategies.

5.1.1 Emission inventory

As required under international conventions the base year for these estimates is 1990. The estimates indicate the following:

- The total carbon dioxide release from all primary fossil fuel use in Bangladesh amounted to 13,443 Gg in 1990. The corresponding quantity of carbon, (in oxidised form) is 3,666 Gg. The per capita emissions were just about 123.3 and 33.6 KGs of CO_2 and carbon, respectively.
- Bio-mass combustion caused an annual release of 61,283.7 Gg of CO_2 in 1990. This emission is thought to be counter-balanced by annual regeneration and therefore, is not considered in the inventory. Open bio-mass burning releases other greenhouse gases like methane (189.5 Gg), CO (2340 Gg) and a little of various oxides of nitrogen.
- Methane is released in the process of production and distribution of natural gas. This amounted to an annual release of 6.1 Gg. Municipal landfills appears to release 73.6 Gg of methane per year. Emission from waste water is difficult to estimate due to non-availability of data and was of attempted.
- By far one of the largest sources of methane is wet rice cultivation. Became of various uncertainties regarding the relevant parameters, only a range has been estimated. The emission of CH_4 is estimated to range from 257 Gg to 622 Gg with a median value of 468 Gg. Livestocks emit CH_4 as a result of enteric fermentation and manure management. Here again there are large uncertainties. Enteric fermentation is estimated to contribute 446.8 Gg and manure management another 73.07 Gg of CH_4 making it a total of 519.67 Gg from livestock.
- Land use changes indicate a net sink effect of 6859 Gg of carbon (or 21,151 Gg carbon di-oxide).

Collecting all the results together and converting the release of various gases into a common unit of global warming potential, it is found that Bangladesh released 44,541 Gg of CO_2 equivalent in 1990 of this roughly 30% was due to the emission of carbon dioxide from fossil fuels. Practically the whole of the rest was from CH_4 with livestock mid rice fields as major contributors. The forestry sector acts as a net sink of carbon.

5.1.2 Vulnerability analysis

Vulnerability analysis followed a three-step procedure. As a first step an attempt was made to model the possible future climate change. The second step involved an analysis of the physical vulnerabilities that the country may face. The focus has been on water, salinity and beach erosion. The third step involved examining the effect of the physical impacts of climate change or human activity, particularly rice production. The effect on fisheries and forestry sector has been only cursorily looked at.

- The modelling exercise indicates that there is a general increasing trend of temperature which is more pronounced during winter months by 2030 but more so during post winter months by 2075. Precipitation increases are pronounced during the monsoon months by 2075.

- The water sector vulnerability has been investigated mainly in relation to inundation risks. Modelling exercises indicate that by 2030, there is likely to be an increased risk of flooding than at present. On the other hand, by 2075, due to infrastructure development, flood free area would be somewhat more extensive than at present while the over-all susceptibility to food may increase.

- Coastal zone changes have been investigated in relation to salinity effects and beach erosion. Soil salinity changes are likely to be extensive, particularly under a severe climate change scenario. Many of the present thanas not much prone to salinity would be severely affected.

- Beach erosion has been studied more as a case study along the south-east coast. It is indicated that an average recession of the short land by 0.89 cm per 1 cm rise in sea level for a 30 cm rise in the latter. The average rate of recession appears invariant with respect to higher levels of rise of the sea. These rates translate into a loss of 5.8 km^2 of land due to a 30 cm rise in the level of the sea.

- Effect on rice output due to changes in yield has been considered again through a modelling exercise. These estimates indicate that the results are sensitive to the climate change scenarios, temperature changes, moisture stress and atmospheric concentration of carbon. On the whole, carbon concentration increases yields of all types of rice but at higher temperature change of 4°C, such stimulating effect gets outweighed. Wheat yields behaved similarly for concentration of CO_2 with adverse effects of temperature rise.

Moisture stress is detrimental to rice yields particularly during the boro, season rice. Higher CO_2 concentration does not have any unidirectlonal impact in the presence of moisture stress. Taking various factors into account the output of HYV rice will fall with a rise in temperature and increase due to CO_2 fertilisation. The net effect may depend on the relative strengths of the two.

Salinity increase will also hamper rice production. At present about 196,000 mt of aman rice is lost annually dire to salinity. The losses would be 1.4 to 3.3 times higher depending on the future salinity change.

5.1.3 Mitigation strategy for climate change

Principles of mitigation: Mitigation implies a set of actions, which prevent an outcome. One of the major causes of greenhouse gas emission is inefficiency in fossil fuel and energy production distribution and consumption.

The findings of the mitigation analysis indicate the following:

- Of the fossil fuels, Bangladesh has a fair reserve only of natural gas and other fossil fuels like coal and petroleum products are practically all imported.

- Electricity generation depends mainly on relatively inefficient technologies while the efficient combined cycle is used in only one plant.

- Energy intensity (energy use per unit of sectoral GDP) is the highest in case of industry followed by transport sectors owing to very large degrees of inefficiencies.

- The top-down and bottom-up data for energy consumption do not match. The mismatch is the highest in case of industry. Such mismatches occur in all other sectors.

- In future the demand for all fossil fuels and electricity may increase. While gas reserve may dwindle the pressure on the national exchequer for foreign exchange to buy fuel abroad for transport, electricity generation and other purpose will increase. One general way to ease the pressure is to increase efficiency in energy production, distribution and use in all sectors.

- On a priority basis, generation of power, industrial and residential use of energy and energy use in transport should be the main areas of focus for mitigation. In industry major savings potential exists in boiler maintenance, use of efficient motors add also in house keeping. In the domestic sector, major efficiencies lie in lighting.

In evalueing and operationalising a mitigation strategy, with emphasis on energy efficiency, attention has to be given to the following: pricing energy on the basis of economic cost of its supply and to technology and its cost.

There is also the international aspect of mitigation. Particularly the government should, urgently focus on generation of funds for mitigation activities through active policy on AIJ (activities implemented jointly).

5.2 Future Research Needs

Very large gaps in our understanding of the climate change, its causes and consequences and appropriate mitigation measures have been observed. The gaps are due to nonavailability or rather absence of information at the microlevel on energy use and other activities that release greenhouse gases. Industrial use of energy is particularly not known with any certainty. Major gaps also lie in estimation of methane emission from various sources as Bangladesh specific parameters are non-existent.

The vulnerability analysis that have been attempted are only preliminary and needs to be carried out for firming up the results and also extending them to other areas of vulnerability. The mitigation analysis has shown how important it is to estimate a firm bottom-up inventory of energy use given major sources of inefficiency by sector and by type energy. It has underscored the need for finding out the pros and cons of international fund transfers under AIJ for a firm policy position of the government.

On the whole therefore there are several areas where future research may be directed to. These are as follows:

i. Survey of industrial, commercial, residential and transport sector energy use by type of technology and type of energy-use devices and scopes for energy conservation through housekeeping, retrofitting and technological changes;

ii. Firming up methane emission estimates from various sources, particularly rice fields and livestock and finding ways and means for their mitigation;

iii. A proper inventory of forestry resources, establishing country specific carbon fixation characteristics of various species of plants throughout their life cycle and estimation of role of forestry as a sink giving due attention to use of wood as timber and firewood;

iv. Firming up of climate change parameters through country specific purpose built modelling;

v. Utilising the results of (iv), analysis and further fine tuning of physical impacts particularly water, sea-shore changes, salinity intrusion, changes in natural vegetation including mangroves;

vi. Research on other areas of vulnerability in relation to livestock, water borne and vector borne diseases in the modelling of their future possible spread;

vii. Analysis of energy pricing and related policies and their effect on energy use by sector;

viii. An analysis of AIJ and its applicability in the Bangladesh context, giving due attention to the costs and benefits and the barriers.