

# **CARBON MANAGEMENT AND GLOBAL ENERGY NEEDS**

**Remarks by**

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## I. Setting the Scene: International Agreements on Carbon Management

Carbon management has received increased international attention since the late 1980s. Some brief highlights on the international agreements relating to carbon management over this period follow:

- The UN General Assembly mandated the formation of an Intergovernmental Committee to draft a climate convention in the late 1980s. This was set up to address concerns about global warming associated with greenhouse gases. Carbon dioxide, related to energy use, accounted for 84% of total greenhouse gas emissions in developed and transition economies in 1990.
- The UN Framework Convention on Climate Change was opened for signature in June 1992.
- The Convention came into force in March 1994. 180 countries have now acceded to the Convention.
- The Kyoto Protocol, which specifies particular commitments to reduce greenhouse gases, was agreed to in December 1997. No developing countries have agreed to specific commitments.

## II. A Major Challenge

These agreements have resulted in discussions on how developed countries should reduce carbon emissions, with emphasis on the economic/environmental impacts of reducing these emissions. The major challenge in meeting the economic-energy needs of developing countries, though reducing carbon emissions has, in my view however, not received sufficient attention.

According to the IEA, 68% of the increase in energy demand (1997-2020) will come from developing countries, emphasizing the importance of these nations.

On the other hand, it is easy to forget how desperately low income countries need energy, and that these countries have gravely serious economic problems

- 2.8 billion –about half the people in the world– live on less than 2 dollars a day.
- 1.2 billion live on less than 1 dollar a day.
- 2 billion have no electricity.
- 2 billion are unemployed or underemployed.
- Low income countries (\$410 GNP/capita) use about 10% per capita level of energy of high income countries (\$25,730 GNP/capita).

[Low income ~ 600 kg/oil equivalent/capita]

[High income ~ 5000 kg/ oil equivalent/capita]

The world's geographic distribution of low incomes is broadly based, as illustrated in the table below.

### **Geographical Distribution of People Living on Less Than \$1 per Day**

*(in millions)*

|                     |         |
|---------------------|---------|
| East Asia & Pacific | 278.3   |
| South Asia          | 522.0   |
| Sub-Saharan Africa  | 290.9   |
| Other               | 197.7   |
| Millions of People  | 1,198.9 |

*Source: World Development Project 2000/2001*

Almost 800 million are in Asia and the Pacific area, and 300 million in Sub-Saharan Africa. In East Asia, this number is about 65 million if China is excluded. Of the remaining 200 million, about 24 million are in Europe and Central Asia, 78 million are in Latin America and the Caribbean, and 55 million are in the Middle East and North Africa.

### III. Comparison of US, Chinese and Indian Energy Use

A focus on Asia will illustrate more specifically the huge difference in energy use and carbon emissions between the United States, China, and India.

#### Comparison of the United States to China and India

|                      | <i>Population<br/>In Millions<br/>(1999)</i> | <i>GNP/Capita<br/>Dollars<br/>(1999)</i> | <i>Energy Use<br/>Kgoe/Capita<br/>(1997)</i> | <i>Metric tons CO2<br/>Emissions/Capita<br/>(1996)</i> |
|----------------------|--|--|--|--|
| <b>United States</b> | 273  | 30,600                                   | 8,076  | 20.0   |
| <b>China</b>         | 1,250  | 780                                      | 907  | 2.8  |
| <b>India</b>         | 998  | 450                                      | 479  | 1.1  |

*Source: World Bank, World Development Report 2000/2001*

The GNP/capita of the United States is about 40 times that of China and 68 times that of India. The United States uses about nine times the amount of energy per capita of China, and 17 times that of India. Per capita CO<sub>2</sub> emissions are about seven times those of China and 18 times those of India.

### IV. Asian Energy Outlook

It is generally agreed that world energy consumption is going to increase dramatically in the coming century. These projections and scenarios are not meant to be taken as absolute forecasts, but rather to be used as tools better to understand possible futures, and probable impacts of various policy approaches.

#### Future Scenarios: World

| <i>Year</i>                     | <i>2000</i> | <i>2050</i> | <i>2100</i> |
|---------------------------------|-------------|-------------|-------------|
| <b>Population<br/>(Billion)</b> | 6.2         | 10.1        | 11.7        |

|  |        |        |         |
|--|--------|--------|---------|
| <b>GNP</b><br><i>(Billion \$US -1990)</i>  | 26,189 | 72,810 | 201,600 |
| <b>Energy consumption</b><br><i>(Mtoe)</i> | 10,110 | 19,831 | 34,688  |

*Source: International Institute for Applied Systems Analysis/World Energy Council Mid-range Scenario*

The scenario noted above (IIASA/WEC) shows global population growing to over 11 billion by 2100, GNP growing by a factor of about 8, and energy consumption growing by a factor of about 3.4.

In the major growth area (Asia-Pacific-exOECD Pacific), there is dramatic growth in population, and overall GNP grows by a factor of about 28.

### **Future Scenarios: Asia and Pacific (ex OECD Pacific)**

| <i>Year</i>                                | <i>2000</i> | <i>2050</i> | <i>2100</i> |
|--|-------------|-------------|-------------|
| <b>Population</b><br><i>(Billions)</i>     | 3.3         | 4.1         | 5.5         |
| <b>GNP</b><br><i>(Billion US\$-1990)</i>   | 2,486       | 15,588      | 68,538      |
| <b>Energy Consumption</b><br><i>(Mtoe)</i> | 2,519       | 6,966       | 14,043      |
| <b>Carbon Emmissions</b><br><i>(MtC)</i>   | 1,625       | 3,325       | 5,416       |

*Source: IIASA/WEC Mid-Range Scenario*

Energy consumption also grows dramatically from about 2,519 million tons oil equivalent to 14,043 million tons oil equivalent with accompanying growth in carbon emissions. It is important to keep in mind that in China and India the major population centers now use coal to meet 70-75% of their energy needs. While having vast coal deposits, they do not have comparable oil and gas resources. Both countries are making major efforts to increase the use of renewables, particularly in rural areas. In the next few decades it is unlikely that renewables will meet more than 6-10% of energy needs. This will be primarily through the use of mini-hydro.

Providing the energy for the Asia-Pacific area (ex OCED) will require enormous efforts. The table below illustrates the amount of investment that might be required to meet Asia-Pacific (ex OECD) energy needs in the period 1990-2100. In the period 2020-2050, this could amount to 6.4 trillion dollars, or 29% of worldwide investment in the energy sector.

### **Cumulative Investment Asia and Pacific (Ex OECD Pacific) *(in trillions of dollars)***

|                  | <b>Asia-Pacific</b> | <b>World</b> | <b>%Asia-Pacific</b> |
|------------------|---------------------|--------------|----------------------|
| <b>1990-2000</b> | 2.31                | 12.38        | 19                   |

|                  |       |       |    |
|------------------|-------|-------|----|
| <b>2020-2050</b> | 6.41  | 22.27 | 29 |
| <b>2050-2100</b> | 30.15 | 82.25 | 37 |

*Source: International Institute for Applied Systems Analysis/World Energy Council Mid-range Scenario*

## V. Chinese and Indian Perspectives

Chinese and Indian perspectives provide some insights as to how energy experts in these countries view their energy futures in the next few decades.

The table below highlights perspectives resulting from interviews conducted by American and Japanese experts in conjunction with an Atlantic Council cooperative quadripartite project on promoting clean air in China and India.

| <b>Perspectives on Outlook: China–India</b>   |
|---|
| <ul style="list-style-type: none"> <li>• Energy must be available, accessible, and affordable.</li> <li>• Demand will grow significantly even with increased efficiency.</li> <li>• Coal will continue as key energy source (55-65%).</li> <li>• Renewables (mainly mini-hydro) expected to meet 6-10% of need.</li> <li>• Health and environment impacts of increased concern.</li> <li>• Initiating policies to increase effectiveness and efficiency of energy systems.</li> </ul> |

*Source: Atlantic Council Discussions, December 2000.*

## VI. Actions to Reduce Carbon

A range of actions are needed to contribute to reducing carbon pollutants globally. Such policies are now being legislated and implemented in China, India, and other low income countries.

They include:

- Market-oriented pricing policies to provide economic incentives to help in decision-making, and generate funds to cover operating and capital costs.
- Policies to foster increased domestic and foreign investment, which is critical to modernization, and the introduction of more effective and efficient energy technologies.
- Particular focus on the electric power sector, which is critical for development.
- More effective and efficient utilization of *all* energy resources: oil, gas, coal, nuclear, and renewables.

In addition, it is important to increase R & D on technologies to remove carbon from the atmosphere.

## **VII. Obstacles to Overcome**

There are major obstacles to overcome as such policies are introduced and implemented. They include:

- Major adjustments to enterprises and employment associated with movement to market systems
- Capital shortages
- Absorption and management of more effective and efficient technologies.

## **VIII. Conclusions**

The road ahead, while posing many challenges in high income countries, is orders of magnitude far more difficult for low income countries –which represent about one half of the people in the world.

Efforts to manage carbon emissions must take into account the critical needs for energy of these countries to improve living standards to contribute to meeting the basic requirements and the aspirations of half the population of the world.