

# **Asia's Changing Role in Global Climate Change**

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## ***Introduction***

Global Climate Change has been an important item on the Agenda of policymakers around the world for at least the last two decades. After considerable worldwide discussion and negotiations, the United Nations Framework Convention on Climate Change (UNFCCC) was signed at the World Summit in Rio de Janeiro in 1992. The Kyoto Protocol, which spells out the actions to be taken under the Convention, was opened for signatures in 1998. The Protocol came into force in February 2005, and requires the industrialized countries that have ratified it to reduce the emissions of the greenhouse gases that contribute to global climate change (UNFCCC, 2006). The majority of the European countries, and Japan, have ratified the Protocol, whereas the United States and Australia had not (The new Government in Australia has recently ratified the Protocol). The developing countries, including those in Asia and the Pacific, were not required to reduce their emissions, since economic development requires energy as an important input, and energy sources such as coal, oil, and firewood are large emitters of carbon dioxide, the major contributor to global climate change.

The publication of the latest Reports of the Intergovernmental Panel on Climate Change (IPCC, 2007), prepared by scientists from dozens of countries, has helped to give climate change concerns high visibility and acceptance in the developing world as well as in the United States and other industrialized countries. They have shown with a very high level of confidence that human

activities are contributing substantially to global climate change, and that the adverse effects of such change are already visible and likely to increase, and that there is a greater urgency for action to first stabilize and then reduce the emissions of greenhouse gases. The session of the UNFCCC starting in December, 2007 thus takes place in an atmosphere of greatly heightened concern and expectation of action to address the problem. Asia's role in shaping the outcome will need to be much larger than it was when the Kyoto Protocol was being negotiated.

### ***A Historic Perspective on Asia's Contribution to Climate Change***

Asia is home to some of the oldest civilizations in the world. Changes in land use, for example from forests to agriculture, did contribute to the emissions of carbon dioxide. This gas stays in the atmosphere for more than 200 years, so the emissions that occurred during the initial growth of agriculture several centuries ago would have been absorbed by now, but much of the change in land use has occurred during the past 100 years, and thus still contributes to the buildup of carbon dioxide in the atmosphere.

Carbon dioxide contributes just over half to global climate change, but it is not the only greenhouse gas. Methane is a much more powerful greenhouse gas per molecule, but its lifetime in the atmosphere is much shorter (IPCC, 2007), about 15 years. Rice paddies are a major source of methane emissions, and rice is the

principal staple food in Asia. Cattle and organic wastes are also large significant contributors to methane emissions in Asia.

The industrial revolution that started in England during the 17<sup>th</sup> century, and rapidly expanded to Western Europe and the United States, was powered largely by coal. Carbon dioxide emissions from the use of coal, and later of oil, grew rapidly and are now the largest source of the increase that has taken place during the last two centuries.

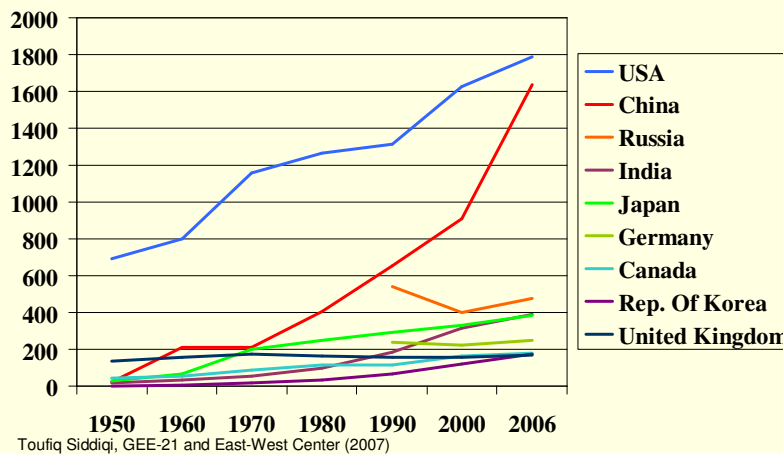
In Asia, large-scale industrialization started in Japan during the last decades of the 19th century, and in many other countries only during the last thirty years. Thus Asia's historic contribution to the present level of carbon dioxide in the atmosphere is relatively low. One could claim that during the past two centuries, Asia was more of an "Impactee" than a large "Impactor" contributing to global climate change. However its annual greenhouse gas emissions now are growing rapidly (Siddiqi, 1995a) and the implications of this increase are substantial.

### ***Asia's current contribution to Carbon Dioxide Emissions***

In the limited time available here, we shall focus only on the emissions of carbon dioxide due to energy use. This is not only because CO<sub>2</sub> emissions are the largest contributor to global climate change, but also because these emissions can be measured more accurately than those of methane or the other greenhouse gases.

During the past 30 years or so, CO<sub>2</sub> emissions from Asian countries have been increasing rapidly, due to industrialization as well as population growth. Figure 1 shows how rapidly the emissions of the large Asian countries have increased compared to some of the highly industrialized countries in North America and Europe.

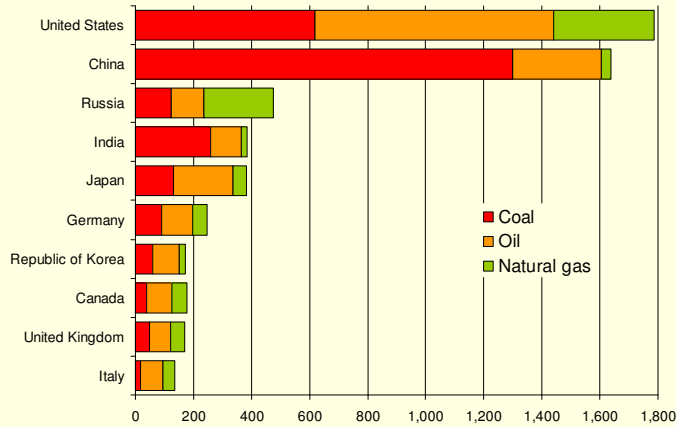
Figure 1. Trends in Carbon Dioxide Emissions from Fossil Fuels, Large Emitting Countries, 1950-2006



Please note that in Figure 1, the data for Russia and Germany are given only since 1990, when the Soviet Union was dissolved, and the two Germanys were unified. The data in all the Figures in this paper for 1950-2000 are from Marland et al (2007), but for 2006 have been calculated by the present author, using coal, oil, and natural gas consumption numbers from BP (2007).

At present, four of the ten countries in the world with the highest CO<sub>2</sub> emissions from fossil-fuel use are located in Asia (Figure 2). China ranks second, but is expected to overtake the United States as the largest emitter by 2008. India (fourth), Japan (fifth), and South Korea (seventh) also rank amongst the top 10 emitters.

Figure 2. Total Carbon Dioxide Emissions from Fossil Fuels, Top 10 Emitting Countries, 2006

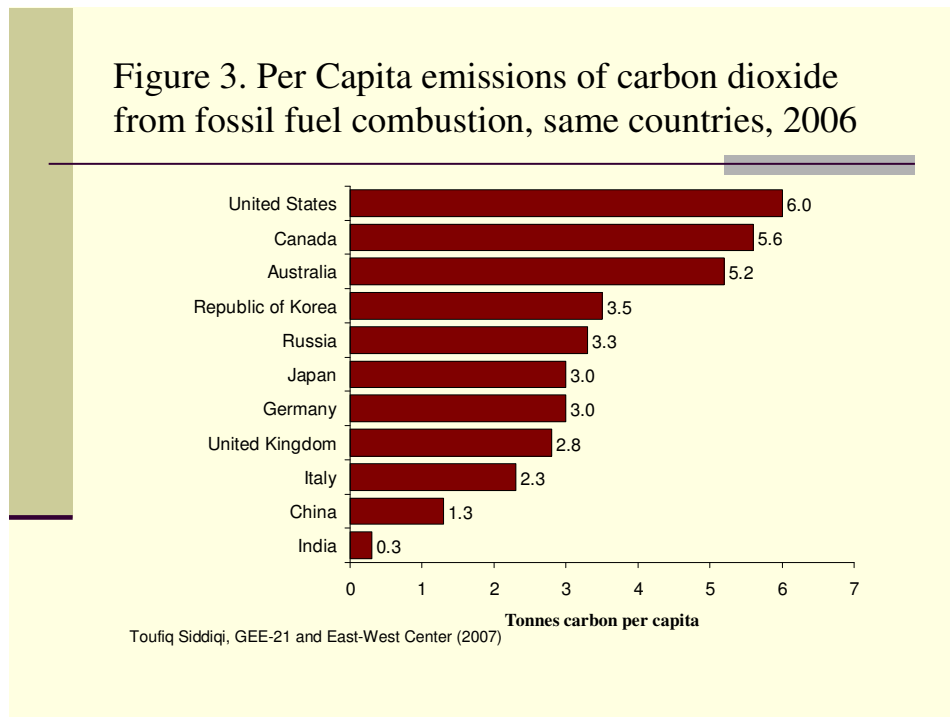


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The numbers shown in Figure 2 do not include the carbon dioxide emissions from the burning of firewood and other biomass, which are large sources of energy in many countries of Asia. Further, ongoing changes in land use, particularly from forests to agriculture and urban development, are also

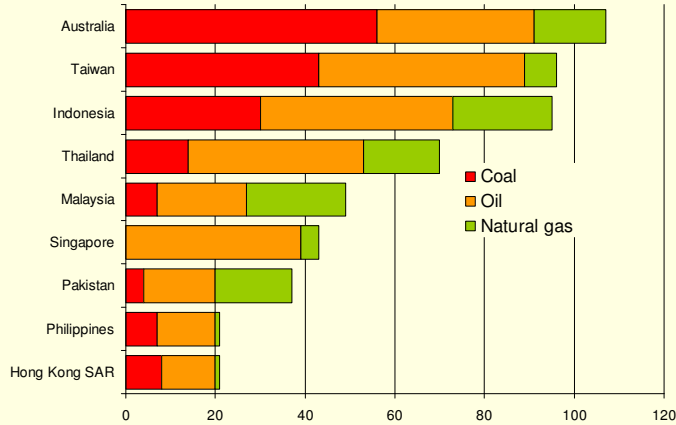
significant contributors to carbon dioxide emissions in many of the larger Asian countries such as Indonesia and the Philippines.

Although high in absolute terms, greenhouse-gas emissions from most Asian countries are much lower on a per-capita basis than emissions from the world's industrialized nations. On average, each American emits more than four times as much carbon dioxide from energy use as a Chinese, and as much as 20 Indians (Figure 3). This difference in per-capita CO<sub>2</sub> emissions has important implications for reaching a binding international agreement on global climate change.



Other countries in the Asia-Pacific region that have large total emissions of carbon dioxide due to energy use are shown in Figure 4.

Figure 4. Other Major Carbon Dioxide Emitters from Fossil Fuel use in Asia and the Pacific, 2006



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## ***Equity Issues in Global Climate Change***

There are important equity issues that have to be resolved, if the countries of the world are to reach an agreement to limit future emissions of greenhouse gases.

We briefly discuss three types of equity issues:

### ***Equity between countries***

There are large variations amongst countries in terms of size, populations, and levels of industrialization. What, then, are good measures of equity? One indicator that is frequently used is the average income of people in countries, i.e.

the per capita gross domestic product (GDP) or gross national income (GNI). It is an internationally accepted goal to bridge the gap between the incomes in the industrialized and the developing countries.

There is a fairly good correlation between the average GDP of a country (measured in terms of purchasing power parity) and its per capita energy use (Siddiqi, 1994), and the resulting impact on the environment. The developing countries around the world, including China and India, point to the per capita GDP of their countries, and the need to catch up with the industrialized countries such as the United States, Japan, and Germany. They maintain that this cannot be achieved without increased use of energy and other resources, and thus their emissions of greenhouse gases will have to increase for a long time.

The United States during recent years has looked at the issue of equity between countries in a different way. Many in the U.S. Senate, as well as the Administration (White House, 2001) claimed that placing limits on total emissions from the United States, while not requiring similar limits from the large rapidly developing countries such as China and India, will put it at an economic disadvantage, while not really helping to mitigate global climate change. The atmosphere does not care which country the greenhouse gases come from or the disparities in per capita income and emissions. Thus each country with large total emissions should agree to reduce them, and countries with large emissions, such as China, should no longer be considered “developing” countries.

## **Equity *within* countries**

One of the characteristics of the industrialized countries is that there is relatively little disparity in energy use between the urban or rural areas or between different parts of the country. Those living in the rural areas use as much energy for transportation, heating, cooling, and appliances, as their urban counterparts. This is rarely the case in the developing countries of Asia. The urban middle class has its own automobile and its use of electricity for lighting and running a TV set, refrigerator, computer, and other appliances would be comparable to that in Europe or Japan (Siddiqi, 1995b). In contrast, the rural population may use bicycles or animals-based transportation, and only a small amount of electricity is used due to its high cost. There are still over one hundred million people in Asia with no access to electricity.

Reducing the inequities within countries is one of the major goals of the developing countries of Asia. This would require more energy use in the rural areas, and the way this energy is supplied would have a great impact on the emissions of greenhouse gases. A focus on renewable energy for electricity, combined with natural gas for most other uses, could go a long way on keeping emissions of greenhouse gases low.

## **Equity between Generations**

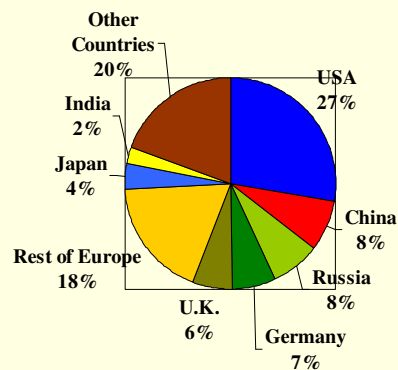
Human activities have been contributing to the buildup of greenhouse gases in the atmosphere for many centuries, but the rate of emissions has increased dramatically since the industrial revolution. Levels of carbon dioxide, for example, are about 30% higher today than they were in pre-industrial times (IPCC, 2007). Most of this increase has come from energy use in Europe, the United States, and to a smaller extent, Japan. These countries did not set out to damage the global environment, but the results of their industrialization did not become evident until the twentieth century.

The developing countries of Asia are demanding that the industrialized countries accept responsibility for the emissions contributed by preceding generations in their countries, which have been quite substantial (Figure 5). The developed countries have been asked to reduce their emissions first, before asking the developing countries to do likewise. As seen in Figure 5, the United States has contributed more than a quarter of all greenhouse gas emissions from the burning of fossil fuels since 1850. A slightly larger total amount was contributed by Germany, the United Kingdom, and other European countries.

The industrialized countries, with the notable exception of the United States, have generally accepted this argument, and the Kyoto Protocol is a reflection of this responsibility, which requires that industrialized nations as a whole reduce greenhouse-gas emissions to about 5 percent below 1990 levels over a five-year

period from 2008 to 2012. Targets for reductions by individual countries are provided. Developing countries are not required to reduce their emission levels, but encouraged to do so through financial and technological incentives.

Figure 5. Accumulated Emissions of Carbon Dioxide from fossil fuels, 1850-2005

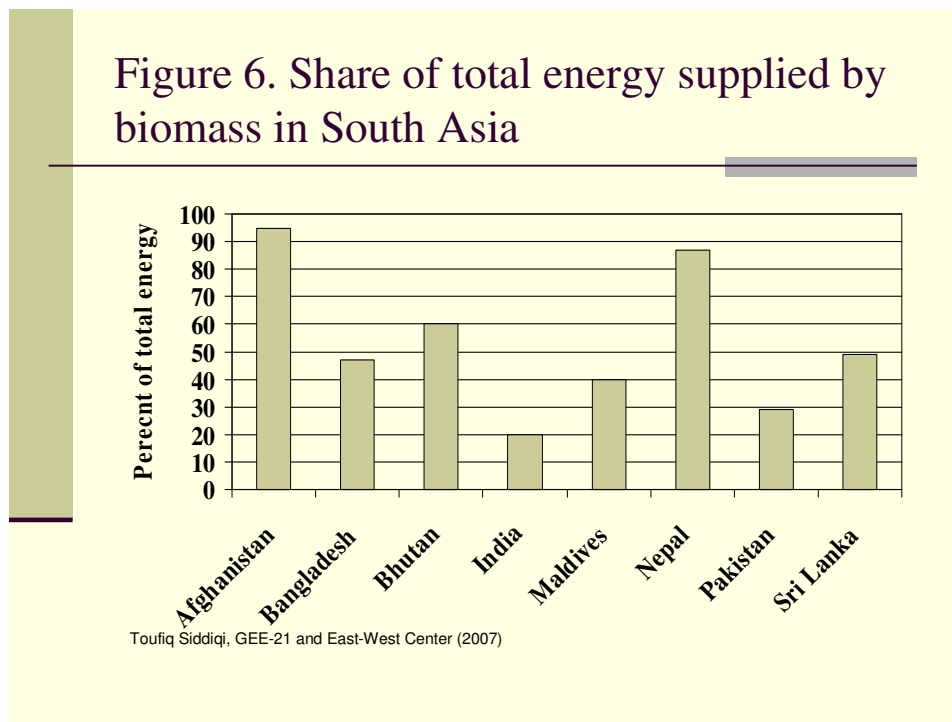


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### ***Other Anthropogenic Sources of Greenhouse Gas Emissions***

In this paper, we have focused on emissions of carbon dioxide from fossil fuels, which is the largest single contributor to global climate change. In this section, we briefly mention the other significant contributions to the buildup of greenhouse gases in the atmosphere due to human activities.

Substantial emissions of CO<sub>2</sub> arise from land use changes, primarily the conversion of forests to agricultural land and urban development. Further, the burning of firewood and other biomass, including agricultural and animal wastes, also leads to significant emissions of CO<sub>2</sub>. Biomass still supplies a large share of energy in many Asian countries, as shown in Figure 6, based on data from the World Development Indicators (World Bank, 2006).



After carbon dioxide, methane is the largest contributor to the radiative forcing of the climate system. The larger Asian countries also contribute to anthropogenic methane emissions, primary from rice paddies and through livestock. The estimated emissions for some of these countries are shown in Figure 7. Although

the data are for 2000 (Yamaji, accessed 2007), methane emissions, unlike carbon dioxide, are not growing rapidly.

### Figure 7. Major Sources of Methane Emissions in Selected Asian Countries

- Emissions from rice paddies
  - China: ca. 7
  - India: ca. 6
  - Indonesia: ca. 3
  - Thailand: ca. 2
- Emissions from livestock
  - India: ca. 12
  - China: ca. 11
  - Pakistan: ca. 2

Data are for 2000 in teragrams (Tg) of methane per year; Source (Yamaji, 2007)

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Other gases such as halocarbons, nitrous oxide, tropospheric ozone, as well as sulfates and black carbon also affect the world climate, but their contributions are smaller, and less well understood (IPCC, 2007). It is beyond the scope of this paper to discuss these sources.

### **Conclusions**

Most of the industrialized countries, while acknowledging responsibility for the actions of past generations, are also accepting responsibility for safeguarding the interests of future generations. Reducing greenhouse gas emissions *now* will have some economic costs associated with it, but not taking action will inflict

*even larger* costs on our children and grandchildren, as has been shown in the Stern Report (UK Treasury, 2006) and many other assessments.

Pointing to the disparity in the living standards between them and the industrialized nations, the developing countries of Asia have resisted attempts to limit their emissions of greenhouse gases until they have reached a comparable level of affluence. This approach is consistent with having equity between countries and within countries (if the development is designed to help the rural areas and other poor persons in developing societies). However, it presents a dilemma in terms of responsibility to future generations. As mentioned earlier, the atmosphere does not care whether the greenhouse gases entering it come from the industrialized countries or the developing ones. The changes to the global climate will affect all countries, rich and poor.

A rise in sea level would result not only in the gradual submergence of the small island states such as the Atolls in the Pacific and Maldives, but also create major problems for many of Asia's largest cities, such as Jakarta, Kolkata, Manila, and Shanghai, which lie on the coast. Tens of millions of people in Asia may have to be resettled, and massive expenditures incurred to protect the coastal cities from sea level rise, which under various scenarios, may range from about 20 centimeters to about 70 centimeters (about 8 inches to 2 feet) by the end of this century (IPCC, 2007).

Further, the expected greater intensity (but not necessarily the frequency) of hurricanes could have a larger impact than before on countries in Asia that are frequently affected by hurricanes, such as Bangladesh, China, India, the Philippines, and Japan. Also, parts of many countries in Asia, including Northwestern India, and almost all of Pakistan are already suffering from shortages of water. A rise in global temperature would accelerate the melting of glaciers in the Himalayas that feed the rivers in Northern India and throughout Pakistan, leading subsequently to even greater water shortages.

The Intergovernmental Panel on Climate Change reports (IPCC, 2007) show that the world has until about 2020 to reverse the trend of rising greenhouse gas emissions to avoid the worst effects of climate change. A joint statement issued in May 2007 by the national science academies of all G8 nations and Brazil, China, India, Mexico and South Africa drew attention to the IPCC findings and urged a goal of confining global warming to two degrees above pre-industrial levels. The academies said: "Our present energy course is not sustainable . . . The problem is not yet insoluble, but becomes more difficult with each passing day."

While it is too early to require that countries such as China and India reduce their emissions from their present levels, it should be possible to come to an agreement that would require all countries to limit their emissions once they reach a certain per capita level. Looking again at Figure 2, we see the great

disparities between the countries in terms of per capita emissions. Let us, for example, pick a limit of 2.0 tonnes of carbon per capita as a limit that no country should exceed in 2025.

China would continue its rapid economic growth during the next decade, but then reach its limit. This would require that it begin to implement plans to make much greater use of other energy sources such as hydropower, nuclear energy, solar and wind power once it reaches this limit, probably before 2020. India would likely reach a similar limit by 2030. The Western European countries and Japan have been quite efficient in their energy use already, and would thus face some hardship in reducing their per capita emissions by about 30%, but those countries have been at the forefront of addressing global climate change and have the political will to continue further reductions there.

The greatest challenge will be faced by the standouts in Figure 2, i.e. the United States, Canada, and Australia. Given the high levels of per capita emissions from which these three countries are starting, it may be realistic to give them an additional 10 years to reach the 2.0 tonnes of carbon annually per person (tCap). They could have intermediate goals for 2020 and 2030. While the target may require some modest lifestyle changes, such as smaller homes and more efficient automobiles, much of the reduction can be achieved by using more efficient appliances and lighting, and greater use of renewable energy sources and possibly nuclear power.

Even a limit of 2.0 tCap may not be enough to reach the goal of keeping the temperature increase on earth below the recommended 2°C above pre-industrial times, beyond which unacceptable adverse consequences might result. The scientific community believes that greenhouse gas emissions will have to be reduced by at least 50% from present levels by 2050 to keep within this temperature limit. Such a goal would imply a per capita emission limit of 0.5 tons of carbon equivalent per year. In such a scenario, most of the countries presently considered “Developing”, and all developed countries, would need to move to very low greenhouse gas emitting energy sources. To some extent, many of the countries of Asia have an advantage in that their per capita emissions are likely to be less than one ton of carbon per year by 2025, and thus the reduction required from them will not be as stringent. They could start on a low carbon path, emphasizing renewable energy and, in a few cases, nuclear power, during the next decade, and not have to make very much of a reduction at all.

A main objective of the climate change negotiations currently under way in Bali (December 2007) should be on starting action now, and refining targets later, rather than finding reasons for delaying action. This would require a major re-thinking of the nature and development, and what cooperation between nations means in the twenty-first century. We constantly discuss how interrelated the world has become, and global climate change provides an outstanding example

of our mutual interdependence. Inequities in resource use have always existed, but they would need to be greatly reduced, if we are to overcome the enormous challenge the world confronts today. There are hopeful signs that the global community increasingly realizes this, and will take the necessary steps to meet the goal of passing on a world to future generations that is not in much worse shape than the one we live in today.

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