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Choosing a Post-Kyoto Course for China

Although the dust has hardly settled from the Kyoto Conference, people all over the world are already wondering what to do next. Thirty-six industrialized countries made promises to cut their greenhouse gas emissions by up to 8 percent of 1990 levels by 2012. Developing nations maintained a vigilant stance throughout the conference demanding that developed countries take action first before laying out plans for their own possible commitments. China, already the second largest greenhouse emitter, is on top of the list of resistors.

Media coverage, especially that from the west, has painted a picture of a very resistant China. What is lingering on many participants' minds about China is its chief negotiators' statement -- that Beijing would reject "the introduction of any new commitments for developing countries," as well as "launching of any negotiating process" for such an introduction. What is missing from this picture, perhaps, is the fact that China, and other large developing countries, has been making solid progress in improving energy efficiency over the past two decades. China alone has average 5 percent annual reductions in energy intensity over the past decade and its income elasticity of energy demand is now approximately 0.5, meaning that energy growth is occurring only half as quickly as economic growth.

China's Achievements

A recent World Resources Institute study concluded that developing countries are already doing a great deal to limit emissions -- a fact largely overlooked in the current debate. The most significant carbon savings over the past decade have occurred in China, which accounts for 12 percent of total world energy-related CO2 emissions, second only to the United States, the study noted. China's energy-related carbon emissions tripled between 1971 and 1993, largely due to growth in coal consumption, which accounted for 83 percent of its emissions. Beginning in the 1980s, however, China substantially reformed energy pricing, with coal subsidies falling from 37 percent in 1984 to 29 percent in 1995, and petroleum subsidies falling from 55 percent in 1990 to 2 percent in 1995. Although annual carbon emissions grew by 228 MtC between 1980 and 1990, emissions would have been 155 MtC higher in 1990 without the energy efficiency gains achieved over this period.

China, already the second largest emitter of greenhouse gases, will likely exceed those of the United States by 2020, while total developing country emissions will exceed total developed country emissions by around 2015. Though with or without China's active involvement, the climate negotiation process will move ahead. Two additional points are clear. First, the goal of protecting the global climate won't be achieved without continued efforts from China and other major developing countries. Second, the developing country group wherein China plays an important role could become fragmented as some nations support JI and other forms of trading and others resist these "cooperative" reductions.

The concerns China and other developing countries share today are that the developed countries largely failed to fulfill their promise at the Rio conference to take the lead in reducing emissions and to provide financial and technological support for developing countries to improve energy efficiency and reduce their emissions. During its rapid transition from a centralized, command economy to a market-based one, China has been concerned that the United States and other developed countries may use the opportunity to check the economic growth rate it hopes to achieve during the next few decades. Paranoid or not, China believes these developing countries may be trying to prevent it from becoming the largest economy in the world sometime next century.

Target or No Target?

PACE members have been addressing some interesting questions on their e-mail discussion group. The discussions have focused on what China should do domestically and internationally after Kyoto. No single solution could solve this very complicated issue, but it has been agreed that China should take a more active role in international negotiations. As Germany and England have claimed credit for reducing GHG emissions, China should do the same for improving its energy efficiency. It should also try to take the lead among developing countries in initiating practical and workable solutions that not only suit local conditions but also contribute to the global climate protection.

On the domestic front, one contributor suggested that China develop a three-pronged strategy to slow the growth of greenhouse gas emissions, lower energy bills, protect human health, and minimize ecosystem damage. Under the strategy, China should first establish a long-term R&D program in partnership with other countries to develop low energy-intensity technologies. The partnerships would aim to develop and commercialize technologies appropriate for China's conditions. Examples would include advanced conventional and hybrid vehicles, industrial boilers, fuel cells, industrial catalysts, turbines, and gasification processes.

Second, China should develop a financial fund (uni-, bi-, or multi-laterally) to promote existing energy efficient and renewable energy technologies. The fund would be used to overcome barriers that prevent greater penetration of these technologies. And third, China should build institutional capacity in the government to improve policies, regulation and training.

Under this plan, China could request partnerships with other countries in exchange for agreeing to reduce emissions from an agreed upon baseline by an agreed upon amount. Naturally, questions

arose of how to define the baseline and to what degree reductions from it could be achieved.

Per Capita vs. GNP-Based

Several ways have been identified to define the baseline. One is the "1990 baseline," which is what has been used for industrialized countries in the Kyoto negotiations. Participants generally agreed, however, that it would be very difficult for China to reduce its emissions to below that baseline. While Robert Williams from Princeton University and a few other bold researchers have developed plans for China to do just this, concern over costs and bureaucratic resistance kept the plans on hold (see "The Potential for Reducing CO2 Emissions with Modern Energy Technology: An Illustrative Scenario for the Power Sector in China," November 1991, draft).

Another baseline for greenhouse gas emissions is that projected to exist at some point in the future (for example, 2010), if the business-as-usual practice continues. The Global Environment Facility (GEF) has been using this type method to evaluate projects to reduce emissions. This baseline is then compared to the "with-project scenario" to determine what the potential is for the proposed measures to reduce emissions if approved and adopted. There have been quite a number of greenhouse gas emissions reduction projects proposed, either in development or in implementation for China.

What, then, should be the basis to make the baseline in order to set a target? Some noted that GHG/GNP might be a good option. The baseline of the 2010 "business-as-usual" emission level might be appealing to China. But the concerns are whether the United Sates and other industrialized countries would accept it, and the level itself, a moving target, could be very controversial too. The following table lists some carbon, GNP and population indicators for selected countries on the basis of 1994 figures. The "carbon/GNP" column gives the Carbon emissions in tons per thousand US dollars. China and Russia have the highest values, 1.13 and 1.33 respectively. Japan and Germany have the lowest, 0.06 and 0.10 respectively. The higher the ratio, the poorer the efficiency for carbon emissions control.

Country	**Carbon (10^3 tons)**	**Population (10^6)**	**GNP/Capita ($)**	**Carbon/capita (tons)**	**Carbon/GNP (tons/$)**
US	1,387,256	260.8	26,980	5.3	0.2
China	828,436	1183.5	620	0.7	1.13
Russia	440,979	147.5	2,240	3	1.33
Japan	303,267	124.8	39,640	2.4	0.06
Germany	220,000	81.5	27,510	2.7	0.1
India	236,448	909.4	340	0.3	0.76

(Source: ORNL and World Bank, 1996)

The beauty of GNP-based greenhouse gas measures is that they clearly identify the fundamental problem of developing countries: their inefficient economies, according to those who are in favor of this measure. The GHG/GNP measure also serves as a great equalizer, by-passing the population factor. In reality, it turns the population-based ranking upside down, which might be a good measure for developed countries as well.

The GHG/GNP measure also combines economic development and pollution control into a single equation. What matters is the change rates of the two measures: annual economic growth rate (EGR) and GHG growth rate (GGR). Assuming that the reduction target for GHG/GNP ratio is X% over N years, we can thus calculate the increase of GHG (Y%) during the same period of time by the following equation:

$$(1+Y\%) * GHG/(1+EGR)^N * GNP = (1-X\%) * (GHG/GNP)$$

To rearrange the equation, we have the GHG increase (Y%) to be determined as:

$$Y\% = (1-X\%)*(1+EGR)^N - 1$$

Assuming that the reduction target for GHG/GNP ratio X% = 30 % and N = 10 years, thus we have the reduction of GHG as:

$$Y\% = 0.7*(1+EGR)^{10} - 1$$

Y% could be either positive or negative, depending on the value of annual economic growth rate EGR. The following table provides results of some sample calculations:

GHG Growth (%)	**EGR (%)**	**Total Economic Growth (%)**
15	2	22
6	3	34
4	4	48
14	5	63
51	8	116

The table shows that over a ten year span, if the annual economic growth rate is under 3%, you will have a total reduction in GHG of more than 6%. This is the case of many developed countries. If the annual growth rate is more than 4%, you will have a gain in total GHG emissions, which is the case of many developing countries.

It is suggested that a reduction target be set up in total GHG emission, e.g. 10%. This is to protect countries which have low or negative economic growth rate. And a reduction target should also be set up for GHG/GNP ration, e.g., 30%. This can be country-specific.

Energy Structure and Economic Indicators

The argument against the above methodology occurs in 2 areas. First, it is insensitive to the energy use structure of a country and therefore, unfair to the countries which have to rely heavily on coal and other types of primary energy. And second, it provides no upper limit for total emissions control, which in turn may jeopardize the overall efforts to protect the global climate.

Since economic activity is the most important determinant of GHG emissions, it is noted, using

targets based on GDP (or any other economic indicator), however, introduces a host of difficulties that may divert attention from the true target of negotiations -- controlling GHG emissions. Physical energy (or carbon) intensities may be more appropriate indicators to use as targets. Such targets could be tied more closely to specific technical measures, and therefore to specific actions, than targets for economic energy intensities.

Also, the cross-national comparisons of economic efficiency are very sensitive to the metric used to measure GDP. GDP is a very broad measure, and can hide more than it reveals in comparisons. Comparisons of GDP and economic intensity measures are heavily influenced by economic structure, exchange rates, geography, demography, and financial markets and other institutions, not to mention idiosyncrasies in reporting and accounting. These problems are particularly acute for a country like China, in which recent trends in GDP have been so strongly linked with lifting of price controls and phenomenal growth in the non-state sector. Exchange rates were also held at artificially low levels for many years.

One way to rectify this problem is to use purchasing power parity (PPP). It is believed that, if purchasing power parity is used to make cross-national energy and carbon intensities, China is not as inefficient as suggested by the above table. Sometimes, it is also useful to make cross-national comparisons of energy and carbon intensities on the basis of physical output of various sectors of the economy, like carbon/steel production (t).

The following table is based on FY94 PPP values:

Country	**Carbon (10^3 tons)**	**Carbon/Capita (tons)**	**PPP/cap ($)**	**Carbon/PPP (tons/$)**
US	1,387,256	5.3	24,396	0.22
China	828,436	0.7	2026	0.35
Russia	440,979	3.0	7925	0.38
Japan	303,267	2.4	21545	0.11
Germany	220,000	2.7	21013	0.13
India	236,448	0.3	1800	0.14
Brazil	64,417	0.4	5141	0.08

From the table, the carbon/PPP values are much closer among different countries. But this does not overcome structural issues, and reliable and consistent time series of PPP estimates are hard to find. Using 1993 PPP estimates gives China an energy intensity lower than the US -- a result clearly at odds with a multitude of comparisons of physical intensities. The carbon/PPP values are strongly dominated by the economic structures of individual countries. What needs to be done next is to compare the historical trend of carbon and PPP growth rate for each country and come up with reasonable projection for the future.

Within countries, analyses show contradictory trends among economic indicators, and these trends also differ from those shown by physical indicators. For example, comparisons of energy intensities based on three economic indicators (energy use per unit of value added, per unit of

gross output, and per value of shipments) to a physical indicator (energy use per ton of crude steel produced) for the US iron and steel industry between 1980 and 1991 shows little correlation between the economic and physical indicators. Other analysts who have looked at a variety of industrial products have also concluded that it is difficult to measure energy intensity trends using value-based indicators.

No Agreement on Indicators

There is no doubt that no single indicator is flawlessly suited to be the target indicator in a climate-change agreement. However, GHG emission targets need to be established based on a combination of indicators. This is a very complicated process, but that is exactly what happens during a multilateral negotiation. After agreement is reached that restrictions should be applied, each country puts forth its arguments for what those restrictions should be linked to, based at least in part on each country's own specific situation. For example, in the negotiations completed in Kyoto, the EU was willing to offer a large percentage reduction from 1990 levels in large part because achieving that reduction would be significantly easier due to Europe's recession and to the large amount of easy and inexpensive CO2 reductions which were available in East Germany. If a different base year had been selected, the EU would probably not have offered such deep reductions. Conversely, the EU resisted inclusion of other greenhouse gases because those reductions would be harder for the EU to attain than CO2 emissions reductions.

In China's case, a measure based on population would obviously be greatly to China's advantage, and this is an issue that must be taken into account when setting GHG reduction targets, as a few participants pointed out. In the meantime, China's tremendous efforts in population control should be considered as a contributing factor to global climate protection. One of China's strongest arguments is that the country still has one-seventh the per capita emissions as that of the US. On the basis that all humans are born equal, China and other developing countries should be allowed to enjoy an equivalent level of per capita energy consumption, though it may not have to be as high as the current level enjoyed by industrialized countries.

China Will Continue Its Efforts

No matter how international negotiations play out, China will continue its efforts in improving energy efficiency and slowing its GHG emissions. Still with an energy intensity three to ten times that of the major industrialized countries, China has a huge potential to lower the current level of 2 t coal per $1,000 GDP (1995). China is aiming to reduce it to 0.9 t coal by 2020, which is equivalent to twice the world average in 1990.

To slow GHG emissions demands increasing spending. The options China has in order to achieve its own goals include energy efficiency improvements, development of alternative energy, reforestation and aforestation, and changes of some agricultural practice. If China can achieve energy efficiency of its key manufactured products closer to that of the advanced countries by 2020, China can save up to 460 million tons of coal, which means 330 million tons of carbon emissions, according to the estimates of Chinese experts.

China also has rich renewable and other alternative energy resources. It is expected that China may avoid 237 million tons of carbon emissions by the year 2020 if appropriate policies and technologies are adopted. That is if nuclear, solar, and hydro power, by 2020, provide 16 percent of the country's total energy supply, then they can substitute 75 million tons of coal, with 55 millions tons of carbon reduced; and if coal-bed methane provides energy equivalent to that by 40 million tons, then 42 millions of carbon emissions can be avoided.

Planting more trees has been another alternative for China to reduce its GHG emissions through carbon sequestration. China plans to plant and manage five million hectares of trees each year (a rate at 1989-90) from now on, then by 2020, 221 million tons of carbon are expected to be sequestered. From the agricultural sector, China will try to reduce the GHG, especially methane, emissions through reforms and improvement of animal feeds and paddy rice.

Besides its continued efforts, Chinese decision and policy makers may take a more active attitude in developing a better strategy of communication. Saying "NO" should not be the final option. Rather, China should spend more effort in conveying to the developed world its achievements in protecting the global climate and also searching for the better policy alternatives that fit China's situation -- a win-win strategy that won't severely affect China's economic growth and in the meantime, gain China more leverage at the international negotiating table.

This article is just a beginning of many more to come from PACE members on this very important issue of global climate protection.