

THE ATLANTIC COUNCIL
OF THE UNITED STATES

CLEAN AIR FOR ASIA:

Quadripartite U.S.-Japanese-Chinese-Indian Cooperation to Promote Energy Policies to Reduce Air Pollution in China & India

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The following comments represent observations from a series of consultations in December 2000 with over fifty energy experts in China and India. This work is conducted with the guidance of an advisory committee comprised of co-chairmen and rapporteurs from the four countries participating in the cooperative project: Prof. Yang Jike, Mr. Tarun Das, Mr. Shinji Fukukawa, and Gen. Richard L. Lawson (co-chairs); Mr. Chen Qing, Mr. V. Raghuraman, and Mr. Akinobu Yasumoto (rapporteurs). Mr. Lyman is the U.S. rapporteur.

Policymakers in China and India are increasingly aware of the complex linkages between economic development, growing energy requirements and environmental pollution. There is now broad recognition of the need to promote a cleaner environment in conjunction with economic growth through a more efficient and effective development of energy. These countries (which together represent over one-third of the world's population) have an extremely low per capita energy usage today. In China, the level is one-sixth that in OECD countries, and in India it is one-twelfth. In both countries policy makers know that the availability, affordability, and accessibility of energy is critical to improving individual incomes and overall economic growth.

Energy demand is expected to more than double over the next twenty years in both countries, even with an improvement in energy efficiencies. This growth in demand and potential pollution has to be placed in context: a high percentage of the current population lives on only a few dollars a day, and energy efficiencies are low versus international standards. In both countries, it is critical that commercial energy be expanded to serve rural areas and the poor. This is necessary to improve health, income levels and national productivity as well as to reduce pressures from urbanization.

Additional factors are inefficient management of industries and protection from global market forces. The result has been industries relying on outdated technologies to produce products that often do not meet world competitive standards. Global market forces are increasingly being brought to bear on these economies as tariffs are gradually reduced and domestic markets are gradually deregulated. As these pressures increase, the energy component of production costs must be restrained. In order to modernize and become competitive most industries will need to install new machinery that will rapidly increase the demand for electric power even as efficiency is improved. Hence, policy planners see the availability, affordability and accessibility of power as the top priority.

Today, many energy companies in China and India are not commercially viable owing to pricing policies that do not allow them to cover the cost of operations, much less that of capital. Restructuring of the power industry through privatization or corporatization of state enterprises is viewed as essential. Through this process government subsidy and revenue decisions can be separated from company decisions. Simultaneously, there is a need to move to market pricing and more efficient management practices.

Unfortunately, both China and India have limited domestic energy supply options. Both accept that there will be a continuing high dependence on coal (55 to 65 percent of total supply) for at least the next twenty or more years. All economic energy sources, including hydro, will need to be developed. Petroleum and natural gas will be used as near-term options to reduce coal pollution in urban areas and as transportation fuel. While domestic exploration for oil and natural gas will continue, imports are expected to grow.

Today, renewable energy sources, including mini-hydro, account for less than 2-3 percent of total primary energy supplies. Major efforts are being made to encourage the use of renewables in the rural areas where it is cost effective and can make a major change in the local economy. However, renewables are expected to remain a small percentage of total commercial energy supplies for the next 10-20 years (3-6 percent in the next ten years).

In both countries, government and public concern over environmental and health matters is significant and growing, and there is interest in developing cleaner and more convenient energy sources. In China, monitoring and reporting on air quality is regularly available to the public and is becoming more prevalent in India. However, even the environmental laws in place are not effectively enforced. This reflects limited monitoring and enforcement resources as well as ineffective administration. Implementing energy and environmental policy reforms requires an understanding of technical and economic issues. The communication of such issues is particularly difficult because of the lack of technical and economic education in both countries and, in India, language barriers arising from a multiplicity of dialects.

Despite these difficulties, both countries are passing legislation and regulations to restructure their electric power sectors. In addition, transportation vehicles and fuels are being regulated to reduce air pollution. Compressed natural gas (CNG) and liquefied petroleum gas (LPG) vehicles are now required in some of the more polluted major cities. Furthermore, markets are now being allowed to determine prices for most if not all petroleum products, and the “polluter

pays” principle is under discussion or gradually being applied to a wider range of fuels.

Massive capital inflows will be required if an efficient, less polluting, growing energy industry is to develop. Domestic governmental resources are severely limited, especially at the central level, and adequate private domestic and foreign capital will not be forthcoming with current industry structures and pricing policies.

In short, the challenges to providing less polluting, adequate supplies of energy to meet the growing needs of both countries are daunting. While the similarity of issues between the countries are more striking than the differences, it is useful to recognize the situation in each country before exploring areas that would provide the greatest leverage to joint cooperation among China, India, Japan and the United States.

China

China faces many challenges in balancing economic growth, energy use and environmental concerns in the coming decades. Maintaining a balanced approach is recognized to require the development of more efficient and effective energy systems as well as the availability of a wide range of energy sources. While China’s energy markets are, and will remain, dominated by coal, policies and programs are being undertaken to address energy demand and supply, including diversification of supply. Besides expanding the use of traditional energy sources such as petroleum, natural gas, hydro and nuclear, resources being considered range from clean coal technology to renewable energy technologies and to new technologies such as fuel cells and micro-turbines for distributed power. The current lack of a complex national energy infrastructure increases the opportunities for China to integrate such new and alternative energy technologies into its economy. Nevertheless, the rate at which new technologies will become economic and have an opportunity to penetrate China’s markets remains uncertain.

Thus, China’s energy markets are believed likely to remain dominated by coal for many decades. Improvements in efficiencies and the greater use of

petroleum products have resulted in coal now accounting for 65 percent of total commercial energy consumption versus 75 percent in the mid-1990s. Since the mid-1990s, coal production has fallen from 1.4 billion tons to 1.0 billion tons as inefficient and unsafe mines were closed, and demand shifted to other fuels with structural adjustments in the industrial sector and a drive to reduce urban air pollution. However, even with a major increase in the use of other fuels, it is unlikely that coal consumption will fall below 60 percent of total demand during the next several decades. Throughout this period coal will also remain the major source of electric power generation.

In spite of this dominance, coal technology is currently underdeveloped, and there is a desire to improve the efficiency with which it is used. There are many sub-issues related to this objective. With the recent short-term oversupply in coal and electricity, the Chinese government has closed down 18,000 small coal mines as well as a large number of small inefficient and polluting power plants. At the same time, mine-mouth power plants and transmission of the electric power produced (“coal-by-wire”) are being developed, as is a coal slurry pipeline. Chinese coal tends to be high in sulfur, which creates SO₂ problems in addition to the particulate fallout. Clean coal technologies – coal washing, scrubbing, and coal gasification and liquefaction – are needed. Although it should be noted that over 30 percent of coal is currently washed in China, water resources are scarce and a major bottleneck. The railways are highly dependent on coal as a revenue source. Rail tariffs are based on straight mileage charges that do not reflect the cost of haulage over differing terrain. This reduces the incentives for “coal by wire” and also encourages uneconomic direct burning of coal in areas that would be better served by other energy sources.

Throughout the economy there is a need to modernize plants and equipment to improve efficiencies and to reduce pollution. In urban areas, coal-fired central heating plants are being replaced by gas and oil plants. SO₂ levels in the major cities are closely monitored and regularly published. In industry, direct burning of coal is being reduced, and since September 1, 2000, more stringent controls are in place on total emissions. The new air pollution law also requires “total

emissions control” (TEC) on the total volume of pollutants entering an airshed or water body in TEC zones. Priority cities may prohibit all burning of coal in designated zones, and in all large and medium cities burning of crude lump coal is to be phased out. In many locations new or expanded SO₂ emitting power plants and large and medium-sized industrial plants must install desulfurization and dust-removal equipment or take other measures to reduce emissions.

At the same time, electric power usage is expected to grow by at least seven percent a year over the next decade. As the inefficient and highly polluting uses of coal in the industrial and residential sectors are reduced, the percentage of coal utilized for electricity generation will increase dramatically. Currently, there remains a large number of thermal power plants under 100 MW capacity that tend to be inefficient and highly polluting. Investments in clean coal technology have been minimal. In addition, major improvements in transmission systems are needed to connect grids, to expand service, and to improve the match with generating capacity.

In Beijing, it is generally accepted that the investments required will not be forthcoming without a major restructuring of the electric power sector. Power generation and distribution are run by state enterprises that are controlled by regional governments which give priority to employment and low tariff rates rather than to the long-term viability of the electric power sector. The desire to ensure employment and subsidized electricity prices results in pricing and operating cost that do not provide sufficient cash flow for new investments. Asset and capital cost are often ignored in pricing decisions. In some instances, the state’s desire to maintain revenue from plants has caused cheaper sources of power, like hydro, to be underutilized.

Structural reforms are being discussed to unbundle generation, transmission and distribution. As there is recognition that most investment will ultimately have to come from the private sector and not the central or regional governments, privatization is being considered. However, there is concern over how to price and distribute assets so that China does not run into the same problems as Russia.

Financial reform and structural reforms are linked and are equally critical to adequate capital formation throughout the energy sector. For example, in the natural gas industry, the proper structure and regulation of gas pipelines and LNG terminals will determine whether or not major projects will be financed. In the power industry, it will probably be necessary to break down the regional state-run monopolies, which serve as a source of government revenues, while still maintaining state ownership, as complete privatization of existing assets appears unlikely in the near term.

The percentage of energy consumed as transportation fuel is about one-third the level in the OECD countries. However, vehicle traffic is a major contributor to urban pollution in the major cities. Current laws require all new or imported vehicles to meet basic European emission standards, and existing cars are to be retrofitted to meet these standards. In some cities, like Beijing, more advanced emission standards are being applied. The sale of leaded gasoline has been prohibited, and the production and sale of clean-fuel vehicles is being encouraged. Old taxis are being retrofitted to LPG in some cities, and fuel cells are being discussed as longer-term alternatives.

In summary, China appears to be committed to accelerating reforms. Concerns remain over unemployment and the price instability that could result from market mechanisms, especially with increased reliance on imports of energy. The Chinese are looking for practical answers as to how to undertake structural reforms. In the electric power sector there are concerns over how to separate generation, transmission and distribution. Policymakers have consulted with many advisors and organizations, but still do not feel they have all the answers.

India

India's per capita consumption of energy is about half that in China, consistent with India's lower level of GDP per capita. However, the energy patterns mirror those in China. Today, coal provides almost 60 percent of commercial primary energy and will continue to be the major source of energy for many years. Coal thermal plants provide over 60 percent of

the country's electricity and consume 70 percent of coal produced. Petroleum provides almost 30 percent of primary demand and natural gas another 7 percent. Hydro, nuclear and renewables provide the balance. Indigenous sources of oil and gas are limited, and maintaining existing domestic production levels will require a significant increase in successful exploration activities. However, the expectation is that even with exploration success most of the growth in petroleum and natural gas supply will come from imports.

India's future economic development is seen to be critically dependent on the long-term availability, affordability and accessibility of energy. A secondary, but by no means insignificant, concern is to ensure that this is done with less pollution. It is recognized that cleaner air will cost more, but this cost cannot jeopardize the supply of affordable energy.

India's limited availability of domestic commercial energy supplies makes energy security a major issue. More than 20 percent of India's energy needs are met through imports, mainly in the form of crude oil. Concerns over energy security are exacerbated by concerns over crude oil price volatility in international markets.

Throughout the economy there is a crucial need to improve operating efficiencies and product quality. In the industrial sector, trade restrictions have allowed manufacturers to operate inefficiently and to sell price-protected, energy-inefficient products. The World Bank has estimated that Indian industry has the potential to save 20 to 30 percent of its energy consumption, and some estimate that the potential may be twice as high for small industrial concerns. In the agricultural sector, the low utilization of commercial energy continues to inhibit productivity improvements. Also, the low electricity tariffs to this sector not only encourage the use of inefficient equipment, but also leads to the over-utilization of scarce water resources. At the same time, only limited supplies of electricity are available in rural areas, where 70 percent of the people live. The burning of non-commercial fuels along with poor ventilation systems causes a serious health problem from the high levels of indoor air pollution – a problem both in urban and rural areas. It has been estimated that over eighty percent of SO₂, volatile compounds and

particulate matter emissions may come from the household sector.

In the electric power sector a non-commercial tariff structure and huge distribution losses have exacerbated problems. Sales to the agricultural sector are made at a fraction of costs, and a substantial percentage of the power supplied is stolen. High industrial tariffs are used to subsidize agricultural and domestic rates. Many industries have captive power stations to provide cheaper and more reliable power. While the National Power Corporation, which produces 25 percent of India's electricity, is financially viable, all but a few of the state-run power companies are running financial losses. In short, approximately 60 percent of power generation is not commercially viable owing to three problem areas: low consumer tariffs, ineffective metering and billing, and the need for more efficient management. The latter includes poor operating efficiencies as plant load factors are well under international standards. The under-investment in generation and distribution facilities is so significant that in three regions shortages in generating capacity cause consumers to face daily power outages. Transmission and distribution is primarily the responsibility of the state electricity boards. The Power Grid Corporation, which manages and controls interstate linkages, recognizes that the national grid system needs to be extended and interstate movements need to be increased if generation and distribution are to be more efficiently managed.

Restructuring of the power sector is a top priority. While still under review, capacity additions of 125,000 MW may be needed to meet requirements by 2012. At the same time, a large portion of the existing thermal generating capacity is in need of modernization. Almost half the addition in capacity is to be met by coal. Large-scale hydro projects, gas, 10,000 MW of nuclear and renewables are expected to provide the balance. Indian energy policy has laid down an ambitious target for renewables: 12,000 MW (10 percent of capacity additions) by the end of the 11th Plan (2011-2012), almost half from wind, 3,500 MW from biomass, and 2,000 MW from small hydro.

Currently, there is an inclination to privatize, or corporatize, first in order to establish financial viability. The unbundling of generation, transmission and distribution would then follow. However, the rules for privatization are not well understood. All twenty-five Indian states have made the decision to reform the power sector, but the status of progress varies widely. It may be necessary to see success in one or two of the more progressive states before the others follow, and the process could take as long as 10 to 15 years. National electricity legislation is now being drafted that will set the ground rules for this process.

The restructuring of the power industry must be accompanied by major changes in the handling and utilization of coal. Both coal mining and coal power plants are using outdated technology. In addition, while relatively low in sulfur, domestic coal has a very high ash content, 40 percent plus, which makes movement of coal and coal-fired power plants inefficient. Coal washing at the mine is now required if the coal is to be transported more than 1,000 kilometers, but even after cleaning ash content remains at 34 percent at the power plants. The mines are reluctant to invest in coal washing, and a greater use of coal-fired mine mouth power plants is contemplated. Numerous clean coal technologies are being considered, but there is a desire to undertake the simplest, least costly solutions first. Many of the solutions that have been considered represent high cost, commercially untested technology.

Other fuel sources such as natural gas and nuclear are very capital intensive. Natural gas has to be imported either as LNG or through pipelines from Iran or Oman. Bangladesh could also supply gas, but has not yet agreed to export. Nuclear power is viewed as a long-term option. Today, 2,430 MW are in operation and a further 5,320 MW are under construction or approved. The needs for new technologies, standardized designs and training are recognized. There is concern over the worldwide lack of major research and development initiatives at a time when the need for such initiatives is critical if the technologies and training are to be in place in the foreseeable future.

In the urban areas, transportation use is a significant contributor to the high levels of air pollution, especially of particulate, CO, NO_x and volatile organic compounds. Lead is now prohibited in fuels, and sulfur levels are being reduced. In some cities, like New Delhi, CNG buses and LPG cars are now being used. But supplies are limited and better engine technologies for petrol and diesel vehicles are needed. Today, many vehicles within the cities run on inefficient two stroke engines that are highly polluting. In Delhi, eighty percent of the vehicle pollution is coming from twenty percent of the vehicles that are old. New regulations will restrict the use of older vehicles, and European emission standards are to be applied at both the basic and advanced levels.

In India, the energy sector will be affected by major regulatory and structural reforms that have recently been enacted or are actively under consideration. The urgency of action was recently emphasized by Prime Minister Shri Atal Bihari Vajpayee in his inaugural address at the Chief Ministers' Conference on Power Sector Reforms on March 3, 2001. However, implementation will be difficult owing to resource constraints, enforcement limitations and political opposition at the state level. Historically, India has relied heavily on command and control techniques that have only been partially effective.

Recommendations for Quadripartite Cooperation

The challenges facing governmental energy and environmental policymakers in China and India are complex and daunting. Besides the multiplicity of issues and interactions between subjects, there are literally hundreds of organizations providing advice on what needs to be done to provide growing energy supplies that are less polluting. Much of this advice is product or technology specific. Investment projects are often accompanied with recommendations and/or requirements for policy and regulatory changes. While international organizations like the World Bank have provided valuable insights into many of the key issues, they have tended to focus on China and India as individual countries. Few, if any, broad policy discussions have taken place between China and India.

Developments in both countries have reached the stage where major reforms and regulatory changes are seen as necessary to ensure the long-term availability of growing energy supplies that are dependable, affordable, less polluting, and used more efficiently. Both China and India are actively in the process of establishing the legal and regulatory framework for increasing the supply of less polluting energy. In each country major concerns remain over the precise mechanisms to be used and implementation issues abound. Japan and the United States have experimented with and faced most of the same issues and are in a position to provide useful insights that could assist China and India in their deliberations. Recent discussions in China and India indicate that a cooperative project to facilitate a collegial dialogue on broad energy issues of mutual interest would be especially beneficial to both countries at this time.

In reviewing the host of potential subjects, it appears that the top priority in both countries is the restructuring and reform of the electric power sector. This also happens to be an area where Japan and the United States have a wide range of experience. Market pricing and the establishment of tariffs for generation, transmission and distribution to meet a variety of objectives are understood. Similarly, both China and India have experienced a combination of command and control, and economic incentives to direct and enforce industrial policies. All four countries are finding it necessary to increase generating and transmission capacity to meet growing demand for electricity.

Other areas where cooperative dialogue among the four countries could prove highly useful include a review of transportation fuels and environmental protection regulation and enforcement. However, the policy implementation and regulatory issues related to electricity tend to be more universal and more readily explored from an overall perspective. In contrast, many of the transportation and environmental regulatory issues are more location specific.

Quadripartite cooperation to promote electric power-related policies to reduce air pollution in China and India would require a wide range of topics to be discussed that would have applicability to other industries. Moreover, economic and social

development in both China and India is critically dependent upon these issues being handled efficiently and effectively in as short a time frame as possible.

Conclusion

China and India are at a critical stage in their efforts to meet growing energy requirements with cleaner fuels. A cooperative discussion among China, India, Japan and the United States would uncover many topics of

mutual interest. The identification of areas where Japan and the United States could cooperate in providing assistance and/or technology to China and India could prove very beneficial in enabling these countries to improve per capita incomes with less pollution. Simultaneously, Japan and the United States will benefit from stronger trading and political relationships with more stable and economically successful China and India.

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