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Need for a Paradigm Shift – Opportunities for Indo-Canadian Dialog in Energy

By Daljit Singh, Girish Sant,
Prayas Energy Group, Athawale Corner, Karve Road, Deccan Gymkhana, Pune, India.

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Abstract

As India is growing economically, it is caught in a difficult situation. On one hand it needs to dramatically increase energy services for a large section of its population to meet Millennium Development Goals (MDG). On the other hand, such a rapid increase in energy consumption will lead to severe resource and environmental constraints. A radical shift in approach in providing energy services is needed, so that the needs of the people, particularly the poor, are met in a less energy-intensive manner. Specifically, Indian energy policy needs to focus on solutions that are economically efficient, environmentally friendly, and equitable. Energy security can be further assured through the following ways: (1) reducing energy requirements; (2) reducing dependence on imports; (3) enhancing the use of domestic resources; and (4) expanding the domestic resource base and finding alternative sources of energy. For Indo-Canadian collaboration the following areas are good options to be considered: (1) low energy building materials; (2) clean coal technologies; and (3) recovery of oil from oily sands.

Introduction

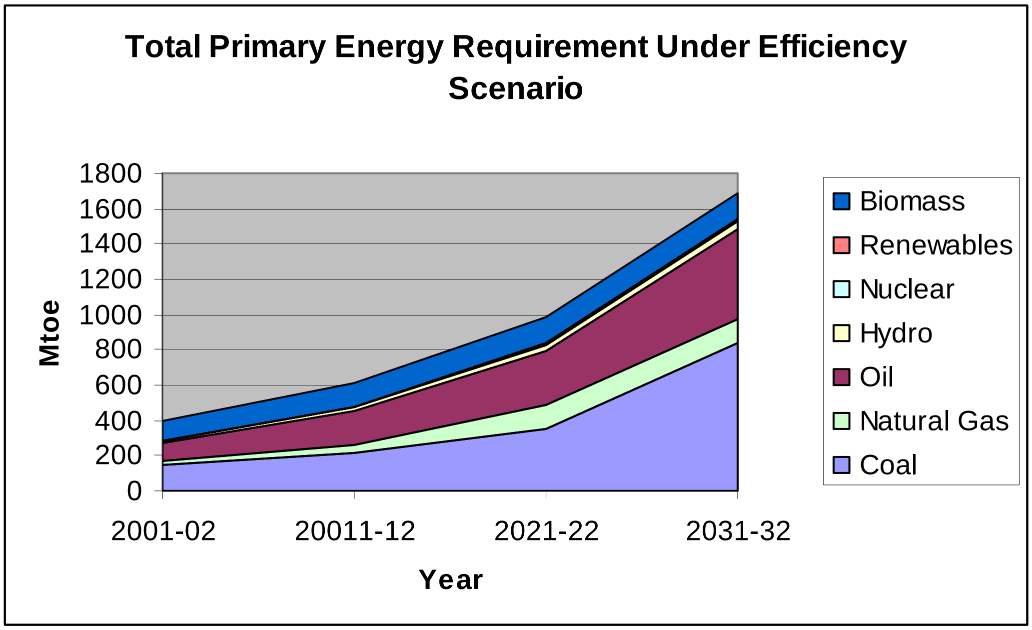
India's commercial energy consumption was 365 Mtoe in 2005-06, which was about 4% of global commercial energy supply.[1] India's per capita commercial energy consumption is about one fifth of the world average. With the Indian economy growing rapidly in the recent past, constricting effects of energy shortages have become more pronounced. These shortages are one factor that has put the development of a robust energy policy at centre-stage. The challenge for the energy policy of India is two-fold – remove bottlenecks in economic development and attend to the energy needs of the poor on a priority basis.

India has a long way to go to meet the Millennium Development Goals (MDGs). Even basic services of water connections and toilets are not available in many houses. To meet MDG goals, India will also need to raise the income of the bottom third of the population that lives at an income less than US $ 1 a day. Doing this is bound to put upward pressure on the use of materials and energy resources. Access to efficient forms of energy sources is also a key indicator of well-being. Over 60% of the population depends on traditional biomass for cooking. About 400 million people do not have access to electricity: while 25% of electricity is used in households, the per capita domestic consumption is only 108 kWh per year. This is equivalent to running one 60 W light bulb for five hours a day! Less than half of the population lives in *pucca* houses (defined as houses built with steel, concrete, bricks or wood). On the other hand the

[1] Biomass energy consumption would add about 160 Mtoe to the commercial energy consumption.

relatively recent rapid economic growth is also resulting in growth in demand for energy. Economic growth at 8% is expected to be accompanied by a growth in energy consumption of more than 4.3% per year.

Part I. Energy Scenario in India



Source: National Energy Map for India by TERI, 2006, and Integrated Energy Policy, 2006.

Figure 1 shows the primary energy requirements for the country as projected under a high efficiency scenario. As can be seen, India's energy demand is expected to grow dramatically, by about four times between now and 2030. Industry and transport are the two major consumers of commercial energy. Over the period until 2032, industry's share of consumption is likely to remain at a little over half of the commercial energy. The share of transport is likely to increase from about 18% now to 31% in 2032.

Coal plays a dominant role in India's energy mix and is expected to continue to do so for the next few decades. It provides about 50% of the country's energy needs. Coal production is carried out almost exclusively by government companies although recently some coal blocks have been allocated to private players. Productivity of Indian coal mines is very low compared to other countries. Further, known extractable resources are estimated to be about 42 Bt and if no further reserves are added are expected to last for about 40 years, assuming production increases at 5% per year. Because only about 45% of the potentially coal bearing area has been systematically explored, there is considerable uncertainty about the actual reserves of coal in the country.

Oil is the second largest fuel consumed in India after coal and accounts for about 35% (145 Mtoe) of the total commercial energy consumed in India, while gas accounts for about 10% (43 Mtoe).[2] The established hydrocarbon reserves in India are about 7.5 Btoe. After having been completely controlled and run by the government, the oil and gas sector has recently been opened up for private participation. In the upstream segment, the New Licensing and Exploration Policy (NELP)

[2] National Energy Map for India, 2007, TERI

introduced in 1997-98 has attracted many national and international players to explore large unexplored area of India.

Problems with Conventional Approach to Planning

Such a growth in energy requirements is unsustainable for several reasons. First, it would exceed by a large amount the domestic production capacity for all the fuels, greatly increasing India's dependence on imports. Even for the country's most abundant resource, coal, import dependence would increase. For oil, India already depends on imports for about 70% of its requirements. By 2031 this would increase to 90% of the requirement. Increased imports of fuels would be a drain on the country's foreign exchange reserves.

Second, this level of growth would exceed the capability to add energy infrastructure. At current levels of growth projections, by 2031 India would need to add over 40,000 MW of electric generating capacity every year – add a 1,000 MW power plant every ten days or so. The country is already facing difficulties with siting of power plants due to local opposition, environmental concerns, and issues with displacement of people, and these difficulties are likely to multiply.

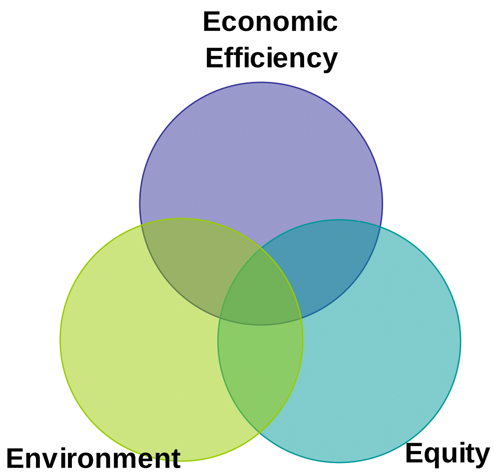
The third reason for unsustainability of the current approach is the environmental effect of such growth in energy use. While India's current carbon dioxide emissions at 1.6 tonnes per capita are a quarter of the world average, the country cannot keep increasing its carbon emissions indefinitely.

A Way Out

Clearly India cannot keep planning its energy infrastructure in this way. The need for an alternative becomes more urgent when it is realized that 70% of the infrastructure that will be there in 2030 is still to be built. The way cities and transportation networks are organized and whatever is built now – power plants, buildings, roads, industries, etc. -- will be with us for a long time. Furthermore, as experience in other countries has shown, when the segment of the population that earns more than $3,000 per year increases, there is likely to be a dramatic increase in electricity usage as these people start buying high-energy-use appliances such as air-conditioners, washing machines etc.

Most often options are selected based on considerations of cost (economic efficiency). However, we believe that environmental considerations and equity must also be factored into the selection of a particular option or energy path. Unfortunately, because many more environment-friendly solutions cost more, and equity considerations imply additional costs (or subsidies), economic, environmental and equity considerations are seen to be in opposition. But it does not have to be so. There are choices that satisfy all three considerations (3-E criteria). As the figure below illustrates, given the challenges faced by India, we must apply our creativity to find solutions that lie in the overlapping space of economic efficiency, environment-friendliness and equity.

One good example of such an option is the promotion of public transportation. Increased public transport instead of personal transport, has tremendous positive impact on local air quality, reduces personal expenditures while reducing energy consumption, and benefits the poor the most. Another example is promotion of solar PV based LED home lighting systems for the 40% of unconnected houses, rather than subsidization of grid connected MW size PV plants. The first route would promote PV technology and immediately offer lighting to 10 million houses while the second route would only put in place a couple of hundred MW of PV power plants – which would be too small for the grid to have any impact. Similar such examples can be seen in rural electrification, agricultural energy use etc.



The equity considerations in the 3-E approach require the country's energy policy to be designed to provide lifeline energy to all citizens. In addition, the energy policy should fulfill the following conditions to ensure energy security in a more conventional sense:

- Supply energy at competitive prices;
- Supply at all times with a given level of confidence taking into consideration disruptions that can reasonably be expected.

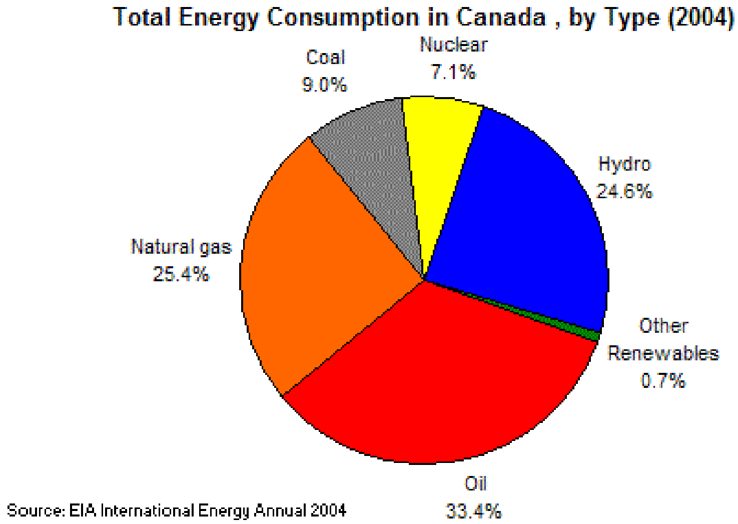
These requirements including the 3-E criteria would lead to the following sequence for selecting options: (1) reduce energy requirements; (2) reduce dependence on imports of fuels; (3) diversify fuel choices and supply sources; and (4) expand resource base and maximize the use of current resource base.

Canada's Energy Scenario[3]

Canada is richly endowed with natural resources. In 2004 it produced 470 Mtoe of energy. Its exports form a large part of the energy used in the US; with 11%, 16%, and 1% of US oil, gas and electricity respectively coming from Canada. At 180 billion barrels, Canada's oil reserves are second only to those of Saudi Arabia. However, about 95% of these reserves are in oil sands deposits which are difficult to extract and process. Canada is the largest producer of natural gas in the Western Hemisphere after the US. Canada is also endowed with extensive hydro resources and is one of the world's largest producers of hydro-electricity. About 58% of its electricity comes from hydro, about 25% from thermal, 15% from nuclear power, and about 2% from renewables.

Canada's commercial energy consumption is about 240 Mtoe. Canada's per capita CO_2 emissions were 17 tonnes in 2004, which was more than three times the world average, and they are increasing by 0.7% per year.

[3] Canada Country Brief, Energy Information Administration, Department of Energy, Washington DC, USA, April 2007, www.eia.doe.gov .



Opportunities to Collaborate with Canada

Given the framework discussed above, there are many areas in which India could benefit from collaboration with other countries. These include soft as well as hard technologies. Some examples are end-use energy efficiency, building materials, coal mining and utilization technology, diversification of fuel sources, planning and development of low-energy-use urban centres. Equally important is identification and implementation of innovative options in governance and institutions to implement sustainable and equitable policies and measures. With respect to Canada, five potential candidates for collaboration are discussed below.

Development of Low-Energy Building Materials

Infrastructure creation consumes the largest share of energy in India when one considers both direct and indirect energy use. As half the population in India is yet to have robust homes and as over 60% of the infrastructure that will be in use in 2030 is yet to be built, energy consumption due to buildings and other infrastructure is going to remain high in the coming decades. This feature of economic growth is common for many developing countries. Therefore, any effort to reduce energy use cannot ignore development of low-energy building materials and building technology. Biomass-based advanced building materials offer a ray of hope. Use of biomass as materials saves three to four times more energy than the energy generated from it by direct combustion or through the bio-fuels route.

Indo-Canadian collaboration can facilitate development of improved biomass materials and construction techniques, and adapt Canada's building standards for buildings using wood. Efforts should be targeted at construction of houses, small bridges and roads. Collaborative research would have to factor in that India can use only small timber-based materials, unlike Canada.

Oil Sands

Indo-Canadian collaboration should consider India investing in Canada's oil sand resources, while Canada could offer India the technology for extracting oil from oil sands. India may not be able to directly use the generated oil and technology – but will have large spin offs for India.

Hydropower

The two countries could collaborate on forecasting potential impact of global warming on river runoffs. This is important for both countries for their own reasons: 58% of Canada's electricity comes from hydropower and India is planning to build nearly 100,000 MW of new dams in Northern India, which are largely fed by runoff from melting glaciers of the Himalayas. India can benefit from learning techniques of hydropower management, especially scheduling.

Clean Coal Technologies

Coal is India's most abundant resource. However, there are concerns about the environmental impacts of using coal for electricity generation, and an interest in increasing efficiency in order to make the most of the coal resource. Therefore it is natural that India looks for development of cleaner coal technologies (CCT) for electricity generation.

It is critical that India creates a strategic technology plan, or road map, to evaluate the plethora of technology options in CCTs available, and to select and invest in appropriate options. Because of uncertainties in development of technologies, it should be emphasized that the road-mapping process needs to be dynamic and iterative.

Does development of CCTs present a good opportunity for Indo-Canadian collaboration? Canada has already developed a road map and it would be very useful for India to learn from Canada's experience in bringing together diverse stakeholders. The road map for any technology has to be country-specific because selection of a technology or pathway depends on the geographical, economic and institutional context in which that technology is used. The Indian context for CCT development differs considerably from the Canadian context in terms of: (1) quality of coal; (2) economic considerations and availability of alternative fuels; and (3) CO_2 emission reduction requirements. Further India may not be willing to pay substantially for the CCT technology while its emissions remain far below the world average.

Given all these considerations, we think that on the issue of CCT development, first India needs to develop its own technology development road map. India can then consider where partnerships and collaborations with other countries would be most appropriate.

Civil Society Collaboration

A solution to the present energy challenge and climate change mitigation issues certainly requires many technology innovations. But this is going to be woefully inadequate. We are going to need radical changes in the way the society is operating. These changes are unlikely to come from business and commerce, in fact, may even be opposed by businesses and commerce, as they may be against their interests. Initiatives within the broader civil society will be of great importance in facilitating the required changes. If we have to solve the energy and climate problem in an equitable and humane manner then the two countries should encourage strong ties between think tanks, academics (in non-science/non-technical fields) and civil society groups. These collaborations should be to identify, promote, and highlight 3-E options, and the institutional and governance innovations required to transition toward a sustainable and equitable path.