# Energy Security Insights

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## Oil and energy security: a commentary

Oil prices have increased on several occasions in the past, and in the first and second oil price shocks of 1973/74 and 1979/80 respectively, the economic impacts across the world proved to be disruptive. However, while the sudden oil price increase of 1990/91, triggered by the first Gulf War, had somewhat similar – though smaller – effects, the short duration of operations allowed the balance to be restored relatively soon. Quite in contrast, although the price increase that we are witnessing today is quite momentous in sheer magnitude, the nervousness that accompanied past increases appears to be missing this time. A recent article in *The Wall Street Journal* in fact carried the title *Oil Shock isn't a Jolt to Global Economy*. The reason for such a situation as provided in this news analysis was that, in contrast with past episodes, the current surge in oil prices stems from global economic vigour mainly in the form of strong demand for oil from China and the US (United States) rather than any curtailment in supply. In other words, the current price increase is driven by a robust increase in demand, which has not produced an adequate supply response in the short run.

The question, therefore, arises whether, given adequate time, would oil supply increase to temper the current upward trend in prices! Under normal circumstances, this would be inevitable. The 1985 collapse of global oil prices was the result of a major expansion of exploration and production stimulated by high oil prices since 1973 and by major conservation efforts on the demand side, creating a substantial gap between quantity demanded and supply capacity, which expanded considerably due to high oil prices in the previous 12 years. Can we predict a similar response this time around? There appear to be doubts whether a repeat of 1985 is likely even to a small degree.

One important study published recently is the book by Matthew R Simmons, titled *Twilight in the Desert*, with the subtitle *The Coming Saudi Oil Shock and the World Economy*. Simmons' thesis is very simple. His contention is that the bulk of Saudi Arabian production comes from a small number of rapidly aging giant and super-giant fields. The author asks, 'as a matter of greatest urgency, whether Saudi Arabia will be able to deliver over the next several decades the oil supplies that the world's consuming nations have come to depend on!' He believes that, given the lack of accurate information on the real state of Saudi reserves and the lack of any major new finds, 'the twilight of Saudi Arabian oil as explained in the book is not a remote fantasy'. He believes that, given the bulk of Saudi production coming from seven giant fields, which have now all matured and grown old, there is little likelihood of major increases in production in the future. The kingdom's three most important fields have been producing at very high rates for over 50 years. There is no getting away from the fact that the state of Saudi oil production would remain the dominant factor in defining the state of the global oil market.

If we look at the projections of the IEA (International Energy Agency), oil demand in 2030 is expected to be 121.3 MBD (million barrels per day) as against 77 MBD in 2002. With this large increase, dependence on OPEC (Organization of Petroleum Exporting Countries) nations of the Middle-East would grow dramatically, such that this group of exporters would have to increase supply from around 19 MBD in 2002 to 51.8 MBD in 2030. This necessarily means that a large part of the increase will have to come from Saudi Arabia. Would this really come about, and can the world bet safely on such an increase?

As far as India is concerned, the response on the demand side that should have been in evidence is completely missing, mainly because the government has been pursuing an illogical and questionable policy of protecting consumers from price increases and bleeding the oil companies who for the first time have started moving into the red. It would be impossible to hold off increases in petroleum product prices, and when this does happen, inflationary impacts could be serious. The demand-side response that should really have taken place over a period of time would now have to be more sudden and fitted into a much shorter time period. In an era of increasing oil prices, the economy cannot be insulated from this reality, and the sooner that price increases are passed on to the consumer the earlier would actions be taken for moving towards greater use of substitute sources of energy, including renewables, and bringing about improvements in energy efficiency. In other words, the best means to ensure energy security in the future would be to adopt rational energy prices by facing reality rather than ignoring it.

The government also needs to look at the future scenario of supply options, and the evolution of new technologies and measures by which demand could be kept within check without jeopardizing economic growth and development. Much of the infrastructure to be put in place today needs to incorporate future energy price expectations and scarcity, so that the Indian economy does not get locked in to inefficient use of scarce energy resources. If we do not accept this principle, we would clearly be ignoring the objectives of a secure energy future for the citizens of this country.

A clear indication of the importance of charting out a more energy-efficient, less oil-dependant future is provided by the recent initiative undertaken by the IEA. This organization came into existence in the mid-1970s as a counter to the perceived threat of cartelized actions by the OPEC nations, which were likely to go against the interests of the major oil consumers who at that stage were essentially the OECD (Organisation for Economic Co-operation and Development) nations. The IEA has been very conservative in looking at policy-driven reduction in energy demand and anything but a business-as-usual future for oil consumption. Recently, however, the IEA has developed an alternative scenario that is characterized by carbon dioxide emissions lower than the business-as-usual case and much higher levels of energy efficiency. Undoubtedly, one concern underlying this exercise is the growing uncertainty of oil supply to meet unrestrained levels of demand in the future.

All oil-importing countries, including India, need to now develop strategies and chart out pathways by which they improve the efficiency of energy use—by setting up, where necessary, totally new infrastructure, such as for public transport. Energy policy would also need to favour, through proper pricing and other fiscal measures, a greater use of renewable forms of energy. A secure energy future for India and the world would clearly require a major shift in the mix of energy consumption and a diversification of energy supply sources, that would collectively reduce the upward pressure on global oil prices.

R K Pachauri
Director-General, TERI

# Building partnerships

## Gulf Research Center and TERI sign MoU

The GRC (Gulf Research Center) and TERI signed a wide-ranging cooperation agreement on 10 April 2005. Based in Dubai and driven by a challenging vision – knowledge for all – the GRC is an independent research institute, think tank, education provider and consultant. The objectives of this partnership are to collaborate and support each other in the areas of research, policy facilitation, and implementation in pursuit of creating greater national, regional, and international awareness on issues pertaining to security and stability in the Arabian Gulf region, the greater Middle-East, and South Asia. The partnership aims to strengthen interactions between civil society and government and inter-governmental institutions in the Arabian Gulf region and South Asia, and between these countries and the wider international community.

## TERI and International Energy Forum Secretariat signed an MoU on energy security

TERI and the IEFS (International Energy Forum Secretariat), based in Riyadh, signed an MoU (memorandum of understanding) on energy security in New Delhi on 27 July 2005. Mr Mani Shankar Aiyar, Hon'ble Minister of Petroleum and Natural Gas and Panchayati Raj, presided over the MoU-signing ceremony. The mission of the IEFS is to support and enhance global dialogue between energy-consuming and -producing countries at the ministers' level within the framework of the IFS. Under the agreement, the two institutions will specially focus on issues and activities related to energy security, efficient energy use, and the links between energy, environment, and economic development, mainly in the Asian context.

# Launch of the Centre for Research on Energy Security

The Centre for Research on Energy Security at TERI was launched on 31 May 2005 by Mr Mani Shankar Aiyar, Hon'ble Minister of Petroleum and Natural Gas, and Panchayati Raj, Government of India. The occasion was marked by the presence of several distinguished experts in the field of energy security.

In his opening remarks, Dr R K Pachauri, Director-General of TERI, presented the following key policy issues that are needed to address energy security concerns in India.

*Adopting scenario-based approaches in planning for the future* Scenario-based approaches are needed in place of the current focus on a unique time path of demand and supply. There is a need to look at multiple trajectories, that is, different types of scenarios that are likely to emerge. A multi-level approach should be adopted, and development at the global, regional, and national levels needs to be evaluated.

*Taking pricing and demand management trends in long-term energy plans* This includes policy initiatives being taken to bring down the demand for oil in future as well as the pricing trend in the oil and gas sector. With the current high prices, there is much greater incentive for people to invest in exploration and production. Further, there are also greater incentives in expanding and improving the commercial viability of the existing reserves.

*Envisaging energy supply companies as building blocks for energy supply* Energy companies need to have a broader view of the security issues. They also need to look at the diversification of both geographic and energy sources, and whether they should promote efficiency in consumption.

*Government and pricing* It is necessary for the government to distance itself from pricing. Although the administered pricing mechanism was dismantled in 2002, not much has been really done about it. The political establishment is still saddled with the problem of taking what are seen today as unpopular decisions on energy pricing.

*Adopting an integrated energy framework and strategy* A shortfall in one energy sub-sector can create an unwarranted increase in dependence on another sub-sector. For instance, a shortfall in power supply results in an increase in captive power generation and diesel pump sets. This, in turn, increases the dependence on oil. Further, there is a need to evaluate energy policy. This is particularly relevant, as, despite considerable work being done on the subject, the country does not have any institutional memory of this. There is a need for continuity in the framework of analysis adopted. The Hydrocarbon Vision 2025 has highlighted the need for acquisition of equity oil abroad to enchance oil security of the country. At current prices, supply options such as bio-diesel seem attractive.

*Structuring and managing energy demand* There is a need for a complete restructuring of the demand side and the structure of the economy itself so as to bring about higher efficiency in the use of energy. In this context, transport is an important sector, which uses liquid fuel to a large extent. In India, there has been an unfortunate shift from the railways to road transport, which is not in the interest of the country.

*Promoting energy efficiency in buildings* This area requires urgent attention. At present, no efforts are being directed at bringing about awareness and increasing the knowledge base or devising regulatory measures that would ensure that buildings are built in an energy-efficient manner.

Mr Satish Chandra, former Deputy National Security Adviser, initiated the open discussion. He cautioned against the tendency to view energy overwhelmingly through the hydrocarbon prism. He pointed out that the increasing dependence on hydrocarbons would pose a severe burden on the economy and also create serious security concerns. Hence, to ensure long-term energy security, it is essential to wean the economy away from hydrocarbons gradually. He briefed the gathering on the six key plans of the National Security Council Secretariat to address the energy security issues.

1 *Energy conservation and efficiency* Large savings are possible through energy-efficient systems, which need to be introduced and promoted in all sectors of the economy, particularly in the industrial, agricultural, transport sectors.
2 *Generating alternative: emphasis on green fuels* There is a need to lay emphasis on increasing the use of green fuels such as nuclear, hydro, and renewables as also new energy sources such as hydrates, fuel-cell technology, and coal-bed methane.
3 *Energy pricing policy* An energy pricing policy needs to emerge, which encourages efficiency of energy used and also promotes substitution of fossil fuels by green fuels.
4 *Maximization of domestic hydrocarbon production* A much greater effort at increasing the research and development of domestic hydrocarbon resources is required.
5 *Diversification in external sources of hydrocarbon supplies* This plan requires a search for hydrocarbons outside the country to increase supply sources.
6 *Safeguard energy infrastructure* This involves protection against any security threats.

Besides the above six plans, the *need for international cooperation* was emphasized as a means to achieve energy security. It was felt that if energy security is pursued in a constructive manner, it could provide important linkages to China, as well as to the Gulf. Cooperation on the energy front could serve as a vehicle for greater integration within both our immediate and extended neighbourhoods.

The need to *launch a major research initiative for solving technological problems* in utilizing various alternative resources that are available domestically was highlighted; for instance, in implementing clean coal technologies. In this context, it was pointed out that it is necessary to recognize that the *supply of coal is not infinite*. Also, the transportation of coal with high ash content at high costs does not make sense. Instead, the option of imported coal being used in western and southern parts of the country should be made more viable and investments should be considered to ensure long-term availability of coal from international resources.

Dr Anil Kakodkar, Chairman, Atomic Energy Commission, emphasized that energy security and national security are inseparable in the context of nuclear power. The linkage between these two objectives needs to be realized. He elaborated on the classical three-stage programme of the nuclear sector, which focuses on using the abundantly available thorium reserves relative to the limited uranium reserves. Although India has very advanced thorium-based technologies, the right path needs to be followed to fully exploit them.

Ms Preety Bhandari, Director, Policy Analysis Division, TERI, referred to the need to adopt a holistic approach for energy policy in the context of an 'energy security policy' for the country. This energy policy should look at trade-offs between different forms of fuel, and issues related to energy access, efficiency, and the environment. The need for a technology vision for the country was felt imperative in which assessments are made both from the energy supply and demand sides.

Concerns over securing *energy access* for remote villages were discussed. Mr A M Gokhale, Secretary, Ministry of Non-conventional Energy Sources, Government of India, pointed out that these villages are un-gridable. These remote villages and those that form the large domain of captive power generation, which is based on diesel alone, need to be covered by decentralized stand-alone distributive generation systems. In this context, the use of plant oil provides an opportunity for maximizing the use of the available domestic resources. It was pointed out that there are about 400 indigenous species of plants waiting to be investigated for oil content. Unfortunately, the emphasis has only been on Jatropha, which is not an indigenous species. This narrow approach needs to be broadened to look at other species as well.

Mr Hamid Ansari, Distinguished Fellow, Observer Research Foundation, felt that, given the increasing import dependency, *foreign policy, trade policy, and security policy would find a convergenc*e on the subject of the country's requirement over the next 20–30 years. For the same reason, the issue of stability in sources of supply needs to be studied carefully.

Mr Talmiz Ahmad, Additional Secretary, Ministry of Petroleum and Natural Gas, Government of India, talked of a 'fear premium' index, which can be used to assess the unstable supply. Oil prices, he suggested, are being driven up by geopolitical reasons rather than market dynamics. The fear premium on the crude prices has gone up from 40 cents in 2003 to 20.65 dollars in the first quarter of 2005. It is projected to go up to 22 dollars in the next two to three years. He highlighted the need for a greater understanding of these factors from India's perspective and how India can influence it.

On the issue of energy conservation, the need for *massive public awareness campaigns* was felt. Significant progress has been made in standards and labelling; the draft energy-efficient building codes and energy consumption norms are ready to be implemented, once notifications from the government are out.

Prof. Indira Rajaraman, RBI (Reserve Bank of India) Chair, National Institute of Public Finance and Policy, further emphasized the need for energy conservation, suitable pricing, and energy auditing. The main reason for wastage in use of electricity is the distorted prices of electricity. There is also a need for a compulsory energy audit among large energy consumers, failing which their licence to operate should be withdrawn. This might breed a possibility of corruption at the monitoring level, but something needs to be done urgently. It was suggested that India should speed up the negotiations with other countries in the areas in which possibility of generating electricity from renewable sources exists.

The need for studies to *analyse Indian perspectives and a vision for the energy sector* was highlighted. Most of the existing literature on energy-related issues focuses on the West, which does not give an Indian perspective. Moreover, India lacks complete knowledge of its own resources. Specifically, the need to address vital sectors such as electricity, which lack adequate research, was felt.

With regard to rural energy, the lack of modern forms of energy was discussed. Also an anomaly was highlighted in the context of kerosene subsidization. Although kerosene is being subsidized for meeting cooking requirements in rural areas, almost 90% of this oil is being used for lighting purposes. At the same time, the kind of devices that are used are highly inefficient. A suggestion was made that instead of subsidizing kerosene, the funds could instead have been invested on R&D (research and development) on kerosene devices to improve efficiency and also introduce modern fuels along with conventional technologies.

Mr Mani Shankar Aiyar highlighted the need for having a single ministry of energy sources. He also laid stress on the importance of multiple trajectories for energy security analysis. He specified that any energy security policy based on a single trajectory is likely to be unrealistic due to uncertainty of parameters operating in the future.

The key points of Mr Aiyar speech were as follows.

- *Preparation of the Energy Security Vision 2025 and Revision of the Hydrocarbon Vision 2025* He called upon TERI to contribute in preparing an Energy Security Vision 2025 as a complement to the Hydrocarbon Vision. This document along with a revised Hydrocarbon Vision could be used to produce an integrated document.
- *Need for a sound knowledge base* Mr Aiyar pointed out that there was a need to coordinate with all possible stakeholders to develop a sound knowledge base. He felt that TERI's Centre for Research on Energy Security could contribute in this regard. Further, he suggested networking with organizations such as Cambridge Energy Research Associates, Moscow Petroleum Institute, and King Fahd Petroleum University in Dhahran in finding Indian solutions for domestic problems.

  He also elaborated upon his plans of setting up an Institute of Petroleum Technology, which would provide a base for research in this sector. The minister sought suggestions on how to restructure the PCRA (Petroleum Conservation

Research Association) so as to make it a nodal point for networking, nationally as well as globally, on all issues that would fall under the general rubric of conserving petroleum.

- *International cooperation* The minister discussed the success of setting up the Round Table of Asian Oil Ministers, which works on the principle of reinforcing mutual trade by mutual investment for sustaining economic relations between buyers and suppliers. He emphasized the need for creating a sense of Asian-ness in the continent.
- *NELP for coal* Drawing from the success India has had in the NELP (New Exploration Licensing Policy) for oil, the minister suggested exploring this policy in the coal sector as well.
- *Working towards an integrated energy policy* The minister expressed his hope on having an integrated energy policy—to start with, in the hydrocarbon sector with involvement and cooperation of other sectors.
- *Issue of bio-diesel and Jatropha* On the subject of Jatropha, Mr Aiyar discussed an idea from D1, the world's most significant bio-diesel producer. Given that bio-diesel is more expensive than fossil fuels in the country and would pose problems in selling in the domestic markets, India could export its Jatropha oil. The returns in such a case would be much higher. In exchange of this, India could comfortably import, at good prices, palm oil waste from Malaysia, called Palmolane, which could be immediately processed to bio-diesel. He felt that, to increase the growth of Jatropha, the support of *Gram Panchayats* all over the country should be taken. He felt that as far as rural India is concerned, one should not talk of just public–private partnership; rather look at the public–private–panchayat partnership.
- *Tapping markets and foreign trade policy* Mr Aiyar talked of the importance of organizing an Asian oil and oil products market. He thought that it would be good to work along with Oman, a key market, and see how their existing markets can be upgraded. This could be done if the Russian oil (North Asian oil), which will become available on the Pacific Coast as soon as the East Siberian fields are developed, could be tapped. In this context, he discussed a proposal that the ministry is working on in which the plan is to extend the Baku–Tbilisi–Ceyhan pipeline alongside the eastern Mediterranean through Egypt and bring this into the Gulf of Aqaba or the Red Sea. And if this can be combined with the Egyptian project, which is to lay a parallel pipeline to the one which now exists from the Red Sea to the Mediterranean with one from the Mediterranean to Red Sea, all of the North African and West African oil can also get pumped into Asia. This would completely alter the geo-politics plus the availability to India.
- *De-linking ourselves from others and turning into main consumer from residual consumer* Mr Aiyar highlighted the need for the Asian continent to de-link itself from others and stop being a residual consumer when it is actually one of the main consumers of its own Asian oil. He felt that India really has the potential to become a significant hydrocarbon power and should focus more on the same.
- *Pricing and distribution issues* In response to the question of kerosene, the minister informed that a big project for distribution of kerosene from oil depots to village panchayats to finally the ration shops is in place, and invited TERI to join hands and fine-tune the exercise.

# Energy security: an international perspective*

Mr John Manzoni, Group Managing Director, BP Plc, here focuses on some fresh approaches to energy security in addition to the traditional way of securing equity barrels. He also touches upon some of the initiatives that BP has been taking in this area in the global market.

BP (British Petroleum Plc) has been a significant investor in India for more than 50 years, with a business led by the Castrol brand, which caters to several million customers every

***** Talk by John Manzoni organized by TERI on 20 April 2005 day. It also has significant activities in solar energy, digital business, shipping, and accounting services.

Energy security has become an important issue over the past few years, not just here in India but right across the world. The primary reason is the shift in oil prices, which has occurred over the past two years. The concern also extends to worries about import dependence and the reliability of supplies, to the efficiency of energy use and its impact on competitiveness, and to environmental effects of increased energy consumption.

**Why is the oil price so high, and will it stay high?**

The price of oil in the international market has risen from 25 dollars a barrel two years ago to 33 dollars a barrel in April 2004 to over 50 dollars a barrel today. To understand the reasons for this shift, we should look back over the events of the last five years. Until the end of the 1990s, we were all accustomed to an oil price, which averaged a reasonably stable 18 dollars a barrel.

During the 1990s, technological advances – such as those in seismic imaging and reservoir management – had opened the range of new possibilities. Political changes had also opened new doors. International companies were able to invest, for the first time, in areas such as Russia and the Caspian. So, supplies were growing and prices were moderate.

The factor, which changed the outcome, was the decision in April 2000 by the OPEC (Organization of the Petroleum Exporting Countries) member-states to set a price framework for oil at around 25 dollars a barrel. That was driven by the need for revenue in countries, which had seen their population rise by over 75% in less than 20 years. OPEC's successful management of their production kept prices at around 25 dollars for the next three years.

The next fundamental change came on the demand side. In the last two years, world oil demand has grown by almost 5 MBD (million barrels a day). Chinese imports alone grew by 1.4 MBD and demand here has risen by seven per cent, thanks to economic growth and increased prosperity. Along with the growing demand, the last two years have seen an increasing concern about the security of energy supplies.

For most of the last two decades, the market has operated with around 3 MBD of spare capacity. Last year that spare capacity fell to around 1 MBD, an amount less than what is produced in a number of areas where continuity of supply has been threatened by disruptions, including in Iraq, Nigeria, and Venezuela.

There has been no physical shortage, but there has been a fear that a shortage could develop. It was this reduction in spare capacity, which precipitated the increase in the price during last year, and has held it there since.

Supply is beginning to grow, partly in response to the increased price, but demand is also still growing. China will need at least another half a million barrels of oil per day this year and India perhaps an additional 100 000 barrels per day or more.

So, although it is impossible to predict what will happen to prices, the tension of supply and demand will remain in the short to medium term and there is very little immediate prospect of a return to the calm of the 1990s.

So, in the short term, the high prices are one cause of insecurity. But there are other longer-term factors at work. If you look ahead over the next decade, it is clear that the demand for oil will increase further. On the most recent forecast from the International Energy Agency, oil demand is set to grow by almost 150% between 2000 and 2020. Natural gas demand could grow by 300%.

In the transport sector in particular, there are as yet no obvious commercially viable substitutes for oil. Vehicle numbers are increasing—on some estimates, by 250 million over the next 10 years.

But there is no shortage of oil. The best estimates say that there are at least 40 years of supply remaining at current rates of consumption, and that is just conventional oil. There are also heavy oil supplies in places such as Canada and Venezuela and at least 65 years of natural gas supplies.

We believe that non-OPEC supplies of oil will continue to grow as industry continues to explore existing and new basins, and applies new technology to existing fields and new exploration. Over time, and depending of course on other factors including demand and OPEC production policy, this should lead to a more comfortable level of spare capacity and moderation of today's very high prices.

The challenge is that supplies are not in the same places as the demand. America, China, Europe, Japan, and increasingly India will be importing oil in significant volumes. The most recent study by the International Energy Agency suggests that, on quite modest forecasts of economic growth, India will be importing over 80% of its needs by 2020. The same independent study says that almost 80% of all the traded oil will come from just three areas—the Middle East, Russia, and West Africa.

Then there is a concern about the efficiency of energy use. That concern affects energy users everywhere around the world. Developed, industrialized countries still have a lot to learn. But energy efficiency has a particular importance for countries such as India and China where the development of the economy will draw in increased volumes of both oil and natural gas at a rapid pace.

**Are economies, which are in the process of transition, equipped to use the energy they need effectively in vehicles, in power stations, in the cities, and in the rural areas? Can they improve on the mixed track record of the industrialized world?**

To use huge additional amounts of new energy in old plant could be very inefficient and costly. It could be very damaging to the competitiveness of the businesses for which energy is a major input. It could be very damaging to the fragile infrastructure of cities, which have not been designed for use by millions of vehicles every day.

The other concern is about the environmental impact. In part, it is about the long-term effect on the world's climate of using hydrocarbons and increasing the concentration of carbon in the earth's atmosphere. But also and more immediately – especially in rapidly developing countries – it is about the effect of increasing energy consumption on low-level pollution—on air quality in the cities in particular and, therefore, on the health of everyone who lives and works in those cities. It would be ironic if the process of development, which is doing so much to improve health standards in such countries, were to bring with it new and perhaps even more serious health problems. Because of these reasons, there is such a sense of insecurity about energy at the moment.

There is no single, magical solution for this problem. We are not about to move to a hydrogen economy or to find a way of securing economic development without using energy. One day, alternative and renewable fuels will play a significant role in the world's energy balance, but that day is a long way off.

We have to be realistic to find practical solutions to each of the challenges. The first part of the answer to energy insecurity is to diversify the available sources of supply and the infrastructure, linking that supply to the customer. There is no need, in a global market, to be dependent on any single source.

That's why BP has invested in Russia—a major 8-billion-dollar long-term investment in partnership with the Russian company TNK to re-develop existing fields and to find new ones. Historically, the largest single oil field in Russia is called Samatlor, which is in West Sibera. That is part of the company of which BP is now the joint owner. That field has been producing for decades and production has been falling. BP applied some of the technology in the North Sea and Alaska. Below the field, there was another field, previously completely undiscovered. This is an example of what the transfer of knowledge and technology can achieve.

Russia is very important for the world's energy future. But it isn't the only place. BP is also investing in Angola, and Algeria and Egypt, in partnership with the local companies.

Then the company is investing in Indonesia in the development of one of the world's largest natural gas fields—Tannguh. This field holds an estimated 14 TCF (trillion cubic feet) of recoverable gas that is being developed as LNG (liquefied natural gas), taking it to China, Japan, and Korea. One very interesting element of this is the direct investment in the development by the Japanese and Chinese buyers of the gas. They will hold a direct share in the resources.

BP is also investing in the development of a major terminal to receive the LNG in China and to distribute it to local business users. That investment is undertaken jointly with the CNOOC (China National Offshore Oil Corporation)—one of the major Chinese state companies.

So, diversity and the development of infrastructure brings consumers and suppliers together. This is a very effective way of protecting energy security.

Diversity is also a way of limiting price volatility. If you are reliant on a single fuel and a single supplier, you are trapped if that supplier increases the prices for whatever reason.

But with flexibility, supply sources can be switched. That is why natural gas is so important. I agree with the comment of Dr Vijay Kelkar, which was quoted in a recent speech by Mr Mani Shankar Aiyar: 'What petroleum was to the 20th century, natural gas will be to the 21st.'

The technological advances of the past 20 years have made natural gas an ideal source of energy for power generation. The natural gas we supply worldwide goes increasingly into the power sector. That means that countries such as Japan, the UK, and the US can limit their reliance on oil, or coal, and can retain the ability to move some of their consumption between one fuel and another.

The global trading market, for both oil and natural gas, is now huge and very efficient. Over the past three years, despite the conflict in Iraq and numerous other incidents, the market has worked remarkably effectively and has been instrumental in ensuring that there has been no physical shortage of supply. Although prices have increased, the trading market has been one of the restraining factors. Trading helps to keep prices down. As a major participant in that market, BP has begun to create partnerships – for instance, in China – so that those who need secure and reliable sources of supply can use the trading market to enhance that security.

These markets operate on a global basis, but they have a particular potential in Asia; linking the resources of West Asia (Saudi Arabia, Iran, and other Persian Gulf states) and North Asia (Russia and South-East Asia, in particular, Indonesia) with the energy consumers of India and China.

The ability to trade, with confidence, in an open and fungible market provides a real alternative and complement to direct equity ownership of resources.

Both efficiency and the environmental impact of energy are crucially dependent on the quality of products used and the ways in which they are used. Let us just focus on vehicles. We have begun to improve fuel quality: cleaning up the fuels so that the emissions produced are minimized. We have eliminated lead; we produce no leaded petrol anywhere in the world. And we are supplying both gasoline and diesel to higher specifications by improving our refinery operations. Clean fuel is now becoming the norm in the industrialized world—we see no reason why it should not be the norm in the rest of world as well.

But efficiency and environmental impact also depend on the quality of the equipment, which uses the energy we and others provide.

That is why we have been working in partnership with car manufacturers to produce a new generation of engines, which combine the very best technology in their field with clean fuels and crucially with the best technology in lubricants. That is work in progress, but it is hoped that it will produce vehicles that can match the needs of countries such as India, not by following the old path, but by designing something that suits the circumstances these countries face.

It would be tremendous to produce a vehicle at a very low cost, which could provide millions of people in India and other countries access to mobility for the first time. But vehicles do not just mean car or motorcycles. Buses are important as well. BP has been experimenting in many European cities, using the latest technology to produce buses, which are economically and environmentally efficient. Those buses can work in an urban environment but they can be just as valuable in the rural environment.

Not that all the development will take place in Indian cities. The rural economy is crucial and effective transport systems – affordable, clean and accessible to all – could be very important in ensuring a balanced process of development which does not force everyone to migrate into the towns and cities.

And there are other things, which can be done. Alternative and renewable fuels are not going to make a big difference for some time to come. At the macro level, that is true; but in particular areas, they can make an enormous difference. BP is developing in partnership with Tata a solar power business using photovoltaics. That business is beginning to have an impact in a segment of the energy market largely untouched by conventional business. Solar can provide power in the forms of lamps and generators to small communities who live well away from the normal supply lines.

BP's solar power business supplies to communities in Australian desert, farming villages in Angola, and a series of schools in rural Zambia. Through the Tata joint venture, it supplies to 30 000 villagers in India (in Rajasthan and Uttar Pradesh).

Solar is not going to provide the energy on the scale needed to power great cities such as Delhi and Mumbai for some time to come, but it can provide energy for villages and small towns; and can provide a local power source to improve the living standards of the people who live there.

BP is also looking at ways to create cleaner, more efficient household energy sources and is hoping to develop an alternative so that those who currently rely on wood-burning stoves can switch to something that is safer and cleaner—something that does not damage people's health or pollute their homes. LPG (liquefied petroleum gas) seems to be one very interesting possibility. BP has a team working out how to make this possible in rural India.

BP is experimenting with the technology of converting coal into other forms of energy in an efficient and an environmentally positive way. That work is in progress, including some very interesting work that the company is undertaking in partnership with the Chinese Academy of Science.

No analysis of energy security can be complete if it neglects the large local resources, which are in place and which could, with the benefit of advances in technology, begin to provide significant volumes of clean energy in usable forms. It is a long-term process but worth pursuing, not least because if the technology could be developed commercially, it would enable indigenous resources to be used to meet local needs with all the economic benefits that it could offer.

The possible answers to the challenge of energy insecurity are very different and their application varies in detail from one country to another, because the needs of each country are so different. The striking common feature is that they are all about partnership. The concept of privatization – the concept of publicly owned assets being sold off to private interests – is outdated.

There is a public interest in energy, because energy is so central to a modern integrated economy. The challenge for private companies is to work with that public interest and to develop ideas and solutions in partnership with state enterprises and nationally owned companies. The example mentioned shows that partnerships are proving to be very successful. Partnership, based on alignment and mutual advantage, is the way forward.

Energy security is a very important topic. Countries such as India and China are entering a new phase in the process of economic growth and development. It is very exciting to be part of that process, not least because growth is the way in which poverty will be removed, and living standards for everyone rises to a decent level. Energy is crucial to that development process, and the absence of energy or extreme volatility in prices, could stall the progress that is being made.

There are good reasons why so many people are concerned about energy security. But there is no reason to be fatalistic. There are things that can be done to maintain security. And BP believes its role is to be part of that process—working with each country, in genuine partnership with local companies.

# Forecasting of oil supply and demand: what went wrong in 2004?*

Dr A F Alhajji, in a stimulating talk, analysed why the continuous rise in oil prices since 2002 and contemporaneous high demand for oil was not foreseen. He argued that forecasting models failed to take account of certain important aspects of oil demand and supply, which led to wrong forecasts. Four main reasons were put forward.

1 Failure to incorporate the impact of monetary policies
2 Failure to incorporate the impact of fiscal policies
3 Failure to capture the impact of information technology on the demand for oil
4 Failure to model OPEC (Organization of Petroleum Exporting Countries) behaviour

Dr Alhajji pointed out that the current situation was different from the past as the past two years is the only period in OECD (Organisation for Economic Co-operation and Development) history when oil prices, economic growth, government expenditures, and military spending have all increased at a time when interest rates and the value of the dollar continued to decrease. He made the case that forecasters assumed the same historical responses of GDP (gross domestic product) to price, and failed to understand the insensitivity of GDP to oil price rise. This insensitivity, he argued, arose firstly from the impact of monetary policies, which combined a depreciating dollar and low interest rates. This depreciation meant that the oil price (marked in dollars) resulted in the high oil prices being transmitted to the US and to those countries pegged to the dollar, but has actually gone down for countries using the Euro and Yen. This has pushed up global demand for oil.

Second, there was a failure to consider the impact of fiscal policy variables. There has been a massive increase in OECD government expenditure after 11 September. For instance, in case of the US, the percentage increase in government expenditures has been 182 times higher than the percentage increase in oil. Both this factor and the US tax breaks have propelled economic growth and mitigated the effect of high oil prices on economic activity. Also, he pointed out that in the US, Europe, and Japan, petroleum consumption as a percentage of total energy consumption in many sectors has gone down significantly. The role of oil is limited mostly to the transport sector, where its share in sectoral energy consumption has remained almost the same. The reason that oil price rise did not affect oil consumption was also because the rise in real income was greater than rise in real oil prices, and so the income effect was greater than the price effect. The income effect explains why Americans have not changed their behaviour despite the increase in oil and gasoline prices in recent months.

Third, Dr Alhajji pointed out that forecasting models failed to note the oil intensity of information technology, and as these migrated from the West to countries such as China and India, they created a large increase in oil demand, while reducing oil consumption in the US. He said that an average desktop computer and monitor consumes 10 times its weight in fossil fuels and chemicals, while cars and refrigerators consume only one to two times their weight in fossil fuels. This relocation and its implications for oil demand projections for China and India were not factored in by the forecasters.

Fourth, the supply behaviour of the OPEC was not modelled properly. In the standard models, OPEC supply was estimated as a

* Summary of Dr A F Alhajji's talk on 27 July 2005 at TERI. Dr A F Alhajji is an Associate Professor of Economics at the College of Business Administration at Ohio Northern University. He was recently appointed to the George Patton Chair of Economics and Business at the same university. He is also the Moderator of the Gulf Energy Program at the Gulf Research Center in Dubai, United Arab Emirates.

residual, that is, estimated world demand, less estimated non-OPEC supply. The OPEC supply has not been based on behavioural patterns. OPEC actually has no excess capacity in terms of marketable oil. As capacity declines, prices rise. Economic sanctions or the threat of them in many OPEC countries have helped to lower excess capacity. He added that the US foreign policy and sanctions were also one of the main reasons for the lowered investment in oil producing countries.

Dr Alhajji concluded his lecture with the following points.

- If the current macro trends continue, then rising oil prices should not adversely affect the economy.
- Forecasting models should take account of the effects of fiscal and monetary policies, especially the effect of exchange rates.
- Forecasting models should start modelling OPEC behaviour.
- If the policies of the 1970s are repeated, high oil prices may strike back.
- The impact of technological change and migration of technology should be considered.
- As interest rates start to rise and public expenditure fall, the economy may be negatively affected.
- Since in the past, all wars and episodes of rising oil prices have been followed by recessions, a recession might follow this time if the war in Iraq has not really ended.

# Energy security in India: key issues, multiple strategies*

In the past 50 years, India has seen considerable development and progress wherein abundant and cheap sources of energy have played a crucial role. However, India still faces an enormous energy challenge, with a large part of the one-billion-plus population still without access to modern fuels, overall low income and consumption levels, and the urgency of accelerating economic growth. With India targeting ambitious growth rates of seven to eight per cent over the next two decades, its energy consumption is likely to rise substantially. It is expected to more than double by 2020 to meet development aspirations. Further, India's energy intensity is much higher than that of the developed countries. Hence, continuous supply of energy is going to be critical.

Energy security of a nation can be defined as 'the continuous availability of fuel and energy services to meet the needs of the people and minimization of the risks associated with the supply and use of energy'. India is a net importer of energy and, therefore, energy security is critical. The growing uncertainties about the stability and security that exist in the global energy market have fuelled the need for a comprehensive energy strategy for India for addressing security concerns.

An assessment of the demand–supply situation in India shows that, over the years, energy supply in the country has not been able to keep pace with the demand. As a result, there is high dependence on energy imports. The energy demand and supply projections (Table 1) imply that the import dependence is going to increase further.

More than 70% of the country's crude oil requirement is imported. This is projected to increase to as high as 90% in the next couple of decades. In the case of natural gas, which is seen as an emerging alternative fuel, again India would have to rely on imports to meet the requirements. The coal import market in the country is also increasingly coming into sharper focus especially with the demand–supply gap expected to be 55 MT (million tonnes) by 2006/07 and 105 MT by 2011/12 (Planning Commission 2002). The demand–supply gap will be more acute for coking coal.

* This paper is prepared by researchers at TERI's Centre for Research on Energy Security.

**Table 1** Energy demand and supply projections for India

| Sector | Unit | 2002/03 | | | 2006/07 | | | 2024/25 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *Demand* | *Supply* | *Gap* | *Demand* | *Supply* | *Gap* | *Demand* | *Supply* | *Gap* |
| Coal | Million tonnes | 340.10[1] | 341.30[1] | 1.20 | 460.50[2] | 405.00[2] | –55.5 | 669.00[3] | 450.00[3] | –219.00 |
| | MTOE (million tonnes of oil equivalent) | 150.04 | 150.57 | 0.53 | 203.16 | 178.68 | –24.49 | 295.15 | 198.52 | –96.66 |
| Gas | BCM (billion cubic metres) | 28.20[4] | 31.40[4] | 3.20 | 84.31[5] | 54.32[2*] | –29.99 | 131.92[6] | 29.53[3*] | –102.39 |
| | MTOE | 24.14 | 26.88 | –2.74 | 72.17 | 46.5 | –25.67 | 112.93 | 25.28 | –87.65 |
| Oil | Million tonnes | 97.70[4] | 33.00[4] | –64.7 | 134.50[2] | 33.97[2] | –100.53 | 256.68[6] | 80.00[3] | –176.68 |

**Source** [1] MoC 2004, [2] Planning Commission 2002, [3] Pachauri and Batra 2001, [4] TERI 2003, [5] Planning Commission, [6] Planning Commission 1999, * Including the KG basin discoveries

## Sources of energy insecurity

Energy resources are not evenly distributed across the world. The concentration of oil and gas reserves in the Middle-East region brings with it a concern of supply disruptions. The various sources of insecurity of energy supply include international sanctions/disputes, ethnic tensions, domestic security concerns, political environment, and economic structures. Regions harbouring substantial potential for domestic and geopolitical risks are currently home to 85% of the proven oil reserves, while 70% is located in the so-called 'strategic ellipse', which stretches from Persian Gulf to Central Asia. In addition, about 68% of gas reserves can be found in the strategic ellipse. The domestic environment concerns in producing countries that India faces are highlighted in Table 2.

The security of fuel transport infrastructure can also pose a significant concern for a continued supply. Several transit points have been identified in major oil supply routes (Figure 1), the choking of which can cause hardening of oil and gas prices. The most critical from India's security point of view is the Strait of Hormuz as all our imports through the Persian Gulf (which are about 60%–70% of our total imports) have to pass through this.

**Table 2** Domestic environment concerns

| Import category | *Country* | *Domestic environment status* |
|---|---|---|
| Oil imports | Iran | ▪ *Sanctions* under Iran Libya Sanctions Act of 1996 of the United States (Reicher 1999)<br>▪ *Dispute* with Azerbaijan over Caspian Sea |
| | Iraq | ▪ *International sanction* till May 2003 limiting oil supplies only under the Oil-for-Food Programme implemented by the United Nations Office of the Iraq Programme (United Nations 2003)<br>▪ Oil fields and supply routes subject to threat from *terrorist groups and arsonists* (Fisk 2003) |
| | Nigeria, Indonesia, Venezuela | ▪ Ethnic tensions/domestic political unrest |
| Coal | Australia | ▪ Limited exports due to strike in mine |
| | China | ▪ Prospective exporter but tight domestic supply situation |
| Hydropower | Nepal | ▪ Concerns in Nepal regarding fairness of Indo-Nepal Treaty of Peace and Friendship of 1950 (Ramesh 2001)<br>▪ Concerns about Maoist insurgency |

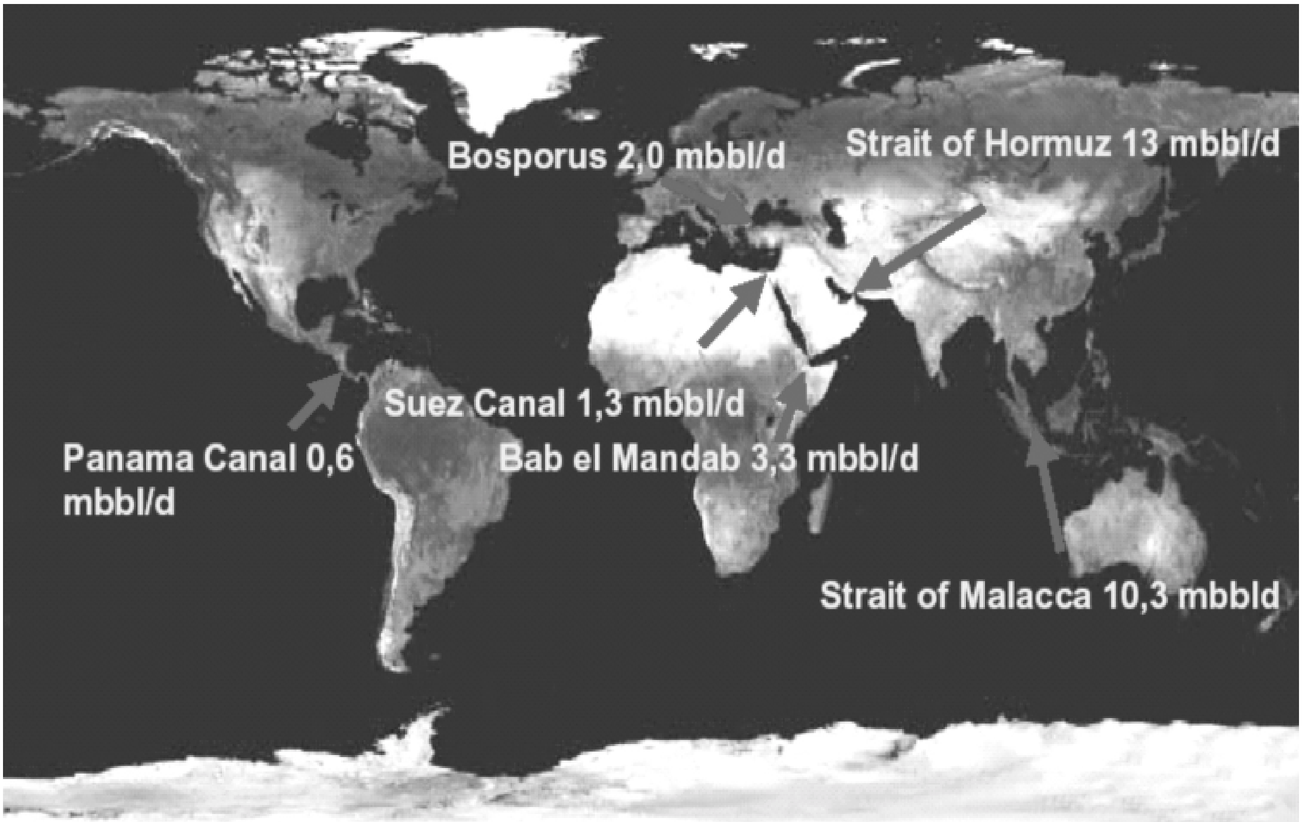


**Figure 1** Major oil supply routes in the world
**Source** IIRC (2004)

Inland security of the fuel transport and other infrastructure is also a significant concern in energy security. As far as petroleum and petroleum products are concerned, bulk transportation is through either pipelines or rail wagons. For coal, security is an issue, given that long-distance transportation is integral as the coal is produced in eastern and south-eastern parts of the country while the consumption centres are located in West and North India.

### *Price fluctuations*

While physical disruptions are an important security concern, more significant is the harmful economic impacts of sudden and large oil price increase. This is because physical disruptions can still be countered to a certain extent by maintaining strategic reserves, as any such disruption is not likely to last longer than a few days. On the other hand, the economic impacts of sudden oil price increases can be disastrous.

For energy pricing across the world, the price of oil is the market leader. In India as well, oil prices are crucial in the context of energy security. The volatility of oil prices had earlier created a greater insecurity for India because of low foreign exchange reserves, a situation slightly less constrained now because of higher foreign exchange reserves.

### *Multilateral and bilateral agreements*

Multilateral and bilateral agreements that impede or facilitate trade are also important issues that affect stable energy supplies. For instance, in the case of nuclear power, there are restrictions on import of the fuel for use in a power plant for countries that are not signatories of the safeguards under the NPT (Treaty on Non-proliferation of Nuclear Weapons). Since India has not signed the NPT, import of nuclear power technology, even for peaceful purposes, from countries that are signatories to the Treaty is not permitted.

However, recently, India has signed a pact with the US on civilian nuclear cooperation, which will allow India to import nuclear fuel and technology for its civil operations subject to India placing its civil nuclear programme under international monitoring (Latham 2005).

Given the growing energy demand, the increasing mismatch between energy demand and supply, and the geopolitics around energy supply, it is critical to identify strategies for addressing India's energy security concerns. In this regard, TERI is planning to work towards developing an Energy Security Vision for India and carrying out research on the various policy tools and options available to address energy security issues that may arise under various scenarios.

## Strategies for addressing energy security concerns of the country

### *Long-term strategies*

The level of risk in energy supply that a country is exposed to is a function of the flexibility of its energy system and its economy to accommodate supply shocks. For long-term security of energy supply, a mixture of both market and a strategic approach is required. Some of these strategies are elaborated below.

#### Integrated resource planning

Over the years, the Indian energy sector has been regulated and owned by government agencies and organizations. The Indian Constitution provides legislative control of the energy sector to the central government, with the exception of power, which is a concurrent subject—the authority to legislate on power lies with both Parliament and state legislatures. However, there is no overarching ministry that deals with all the issues related to energy. The government's legislative control is exercised through five different ministries or departments.

As a result of the large number of agencies, the system suffers from lack of coordination and integration. For the smooth operation of the energy sector, integration is essential. This is because the success of reform in one energy sector is intricately linked to the level of reforms in the other sector. A well-established institutional framework – consisting of regulatory agencies, rules and regulations of the sector, and policy guidelines – is necessary for adopting an integrated approach to energy planning.

Very recently, the inter-ministerial ECC (Energy Coordination Committee) – under the chairmanship of Prime Minister, Dr Manmohan Singh – to guide government policies in the energy sector, has been set up (Times Foundation 2005). The mandate of the ECC is to formulate a coordinated policy response, cutting across ministries so as to improve the overall energy scenario in the country while addressing energy security concerns. The committee will consist of the union ministers of finance, power, petroleum and natural gas, coal, and non-conventional energy sources; the Deputy Chairman, Planning Commission; Member [Energy], Planning Commission; Chairman, Economic Advisory Council to the Prime Minister; the National Security Adviser; and the Cabinet Secretary and the Principal Secretary to the Prime Minister, who will be the Convener of the Committee.

#### Deregulation and domestic market structures

With the deregulation of prices in coal, oil, and electricity industries, domestic market structure imply that market forces will increasingly govern the supply of energy. Despite some efforts (deregulation of coal prices, reform measures taken by state electricity boards, etc.), cross-subsidization of energy prices still continues. This subsidization of energy prices has led to wasteful and unsustainable usage patterns of natural resources. As per an IEA (International Energy Agency) study, by reducing price subsidies, India stands to increase GDP by one per cent through higher economic efficiency, reduce primary energy consumption by 13%, and reduce carbon dioxide emissions as well as local air pollution. However, while moving towards market orientation, there would be a need to consider the issues of subsidy and cross-subsidy to achieve universal energy access with private energy suppliers. Private players are unlikely to be driven by security considerations, thereby achieving diversity in supplies may be limited if a larger set of sources is more expensive. Ensuring diversity in supplies and stability in prices, and meeting the targets for universal access to energy is a challenge.

### Ensuring adequate domestic supply

One of the key strategies for enhancing energy security is to intensify the exploration and production activities in the country. Assuring energy security by achieving self-reliance through increased indigenous production and investment in equity oil abroad is one of the objectives of the Hydrocarbon Vision 2025. Increased private sector participation has raised investments for oil and gas exploration and the development of proven reserves with joint venture partners. However, a large part of the remaining sedimentary basin will require deep-sea exploration.[1] At the existing speed of exploration, the process of giving out all the sedimentary basins would continue till 2025. There is a need to accelerate the process.

### Diversification

With the increasing concern for easy and cheap availability of oil, there is an increasing emphasis worldwide in diversification of energy sources in the context of energy security in countries with high import dependency. Learning from the experience of the oil shocks of 1970s, countries like Japan have successfully enhanced energy security through diversifying, which entailed a shift to natural gas and nuclear energy.

In India, fossil fuels will continue to dominate in the years to come. Given the abundant coal reserves, coal will continue to be the dominant fuel in power generation. In order to maximize the benefits of using coal, a three-pronged approach needs to be followed: (1) improving the thermodynamic efficiency of the coal-based power plants; (2) minimizing the environmental impact; and (3) cost-effective utilization of high-ash Indian coal. The technological options for achieving these would include super and ultra-super critical combustion technologies, IGCC (integrated gasification combined cycles), fluidized bed combustion, and underground coal gasification. In the transportation sector, oil is expected to be the dominant fuel in the absence of any significant alternative energy source.

India is abundantly endowed with renewable energy sources in the form of solar, wind, biomass, and small hydro. In terms of feasibility, several renewable energy technologies are not only commercially available, but are also economically viable in comparison with fossil fuels (particularly in the remote, far-flung areas since they are not economically viable to connect through a conventional grid system). With a strong industrial base and successful commercialization of technologies in wind, solar photovoltaics, solar thermal, small hydro, and bio-energy, India can aggressively pursue renewable energy sources to reduce reliance on petroleum products.

The huge potential in the fields of solar, wind, hydro, and nuclear energy needs to be tapped aggressively. In addition, a lot of emphasis needs to be given to R&D of other non-conventional energy sources like ocean energy, fuel cells, and hydrogen energy. Theoretically, the estimated potential of wave energy in India is about 40 000 MW (megawatts) (TERI 2004). The National Institute of Ocean Technology, Chennai, is in the final stages of commissioning a 1-MW ocean thermal energy conversion plant. India also has immense potential of harnessing tidal energy. The identified economic tidal power potential in India is of the order of 8000–9000 MW. There are also a number of initiatives for developing fuel-cell technology and hydrogen energy. Recognizing hydrogen as an alternative fuel led to the creation of the National Hydrogen Energy Board. The mandate of the Board is to cover all aspects related to hydrogen energy production, storage, delivery, applications, codes and standards, public awareness, and capacity building.

### Diversifying geographical sources

One of the main concerns of countries with high import dependency for energy supply is the potential of disruption in supply from the exporting countries, which implies that energy

[1] http://www.indiacore.com/oil&gas.html as on 15 April 2005, statement by Mr B K Chaturvedi when he was the Secretary, Ministry of Petroleum and Natural Gas, Government of India

supply is not available during a crisis situation. Hence, increasing the diversity of supply sources and giving the country access to crude oil reserves of other countries can be a good strategy for enhancing energy security for the country.

Sourcing oil from other countries adds to the diversity in supply sources and, hence, enhances energy security. Also domestic companies can go in for long-term supply contracts with source countries, as these help in moderating risks. Another option available to domestic oil companies is to use financial instruments like futures. Futures are price agreements, which can be bought and sold. For instance, power sector can hedge the risks in the fuel that it uses. At the international level, future markets are being used increasingly as risk management instruments. The Ministry of Petroleum and Natural Gas, in the past few years, has been encouraging oil PSUs (public sector units) of the country to participate in futures trading to cope with the crude price volatility (Bose 2005). Another option to diversify and enhance energy security is to encourage companies to explore in other countries and increase equity energy reserves. The main issues of consideration here include the net return on investment, the stability in supply, and the kind of relationship with the source countries.

The Government of India aims to produce 20 million tonnes a year of equity oil and gas abroad by 2010, with a long-term target of acquiring 60 million tonnes per annum of equity oil and gas overseas by 2025. The OVL (ONGC [Oil and Natural Gas Commission] Videsh Ltd), the overseas arm of ONGC Ltd, along with other national oil companies, such as the OIL (Oil India Ltd), the IOC (Indian Oil Corporation) Ltd, and GAIL (India) Ltd are pursuing this objective. The OVL has acquired discovered properties in Vietnam (gas field, 45% share), Russia (oil and gas field, 20% share), and Sudan (oil field, 25% share). Production from Vietnam and Sudan is around 7.54 MSCMD (million standard cubic metres per day) of gas and 250 000 barrels of oil per day. The first consignment of crude oil from Sudan was received in mid-2003. The Sakhlain-1 project in Russia is under development. In addition, the OVL has participating interests in one exploration block each in Iran (40% share), Myanmar (20% share), Iran (100% share), Libya (49% share), Angola (50% share), and Syria (60% share). The OIL and the IOC have a participating interest in exploration blocks in Iran while GAIL has in Myanmar.*

The government is also considering equity in coal mines abroad. According to the Planning Commission, coal may be the most cost-effective and abundantly available energy source, particularly for thermal power generation (*The Hindu Business Line* 2003). However, this will have to be evaluated in the context of imported coal. India could consider coal mines in Australia, Indonesia, and South Africa for investment. However, there is a need to take into account the security of investments abroad itself while evaluating the option of equity investments for addressing energy security of India. The option needs to be evaluated against investing in developing alternative domestic options.

Besides, trading and cooperating with each other also enhances energy security of the entire region. There is ample evidence of this from India's experience with Nepal and Bhutan. However, regional trade is not only a techno-economic issue, there is a political side to it also and, for such trade to be successful, it requires high political will on both sides. The domestic environment in the trading partner also needs to be taken into account.

One attempt towards developing an integrated South Asia energy market is the establishment of the SAREC (South Asia Regional Energy Coalition). It was established by the US Chamber of Commerce, through a cooperative agreement with the USAID (United States Agency for International Development) in April of 2001. India, Bangladesh, Nepal, and Sri Lanka are the members of the coalition. The coalition is an organization and networking mechanism through which public and private sector stakeholders can influence regional energy policy and reform throughout South Asia (ICPL 2005). Furthermore, India is considering

* Based on information from the Ministry of Petroleum and Natural Gas, Government of India

signing the Energy Charter Treaty (*India Daily* 2005) that may obviate the need for separate multilateral agreements for various projects.

#### Managing demand

India's oil intensity rose from 5.33 KGOE (kilograms of oil equivalent) per thousand rupees in 1965 to 8.50 KGOE per thousand rupees in 1989 after which it stabilized and has dropped marginally since (TERI 2003). Reducing intensity of usage through demand management measures would strengthen security. Most IEA countries have statutory powers to initiate demand-restraint measures in sub-crisis and emergency situations. The measures to achieve demand restraint fall into three main classes: (1) advocacy and persuasion; (2) administrative and compulsory measures; and (3) allocation and rationing schemes.

The effectiveness of any demand-restraint measures is dependent on the fuel-switching capability of the country while simultaneously moving to more energy-efficient technologies. Since a substantial proportion of oil is used in the transport sector where substitution possibilities are marginal, technology development in the sector becomes important. In the transport sector, for instance, the options available are to improve fuel efficiencies of automobiles and promote a shift to more efficient modes of transportation. In India, over the past decades, there has been a move towards road transport systems for freight movement. This has implications on energy consumption as well as the environment as road transport is much less energy efficient in comparison to railways. There is a strong case for encouraging a shift to railways in case of trans-national movement and public transport systems in urban settings. In the case of power sector, there are substantial efficiency gains in moving to natural-gas-based power generation. However, in this context, one will need to compare the gains from moving to natural gas with that of using the abundant coal reserves, if clean coal technologies can be developed.

In the residential sector, energy demand has been increasing significantly as a result of higher disposable incomes, changing lifestyles, and patterns of energy consumption. Setting energy consumption standards along with energy labelling in these gadgets and appliances proposed in the Energy Conservation Act would save significant amount of energy.

### *Short-term strategies*

Disruptions in short-term supplies translate into higher prices of crude oil and petroleum products. Strategic reserves are regarded as a vital element in the crisis management strategy of the IEA countries. According to the International Emergency Programme norms, net oil importers have a stock-holding obligation equivalent to 90 days of net oil imports in the preceding year. In about one-third of the IEA countries, stock draw is considered to be the main response in the early stages of crisis. India has been considering setting up strategic oil reserves for some time now. However, the government has not yet taken a decision on strategic reserves.

Another option for crisis management in case of disruption is using pricing policy and regulation. For instance, if there is a sudden hike in oil prices, the government has the option of either varying the taxes/subsidies, or reducing the margins of oil companies so as to prevent an immediate impact on the consumers by raising product prices. However, if the government decides to insulate the domestic economy from price rise in the international market, it would imply a large budgetary deficit, which ultimately will have to be borne by the tax payers. The policy options are politically and economically challenging, given the differential distributional impacts they can create. Further, in an era of liberalized markets, administering prices can become an issue of debate. To deal with this, the implementation of energy price policy should be subject to a strict and transparent definition of when this instrument is employed to prevent unnecessary uncertainty for the market players.

## Conclusions

Given the growing energy demand in the country and increasing import dependency, developing a comprehensive energy security policy is critical for India. However, energy security is a complex issue, which, as discussed, needs to involve an integrated approach that takes into account the future prospects, and requirements of each of the energy sub-sectors. Another issue to be considered is developing a technology policy for the energy sector that needs to take into account the kind of energy supply and consumption desired in the context of security and other issues. Institutional and regulatory stability in the energy sector is also a critical element in energy security. Macro policies and market-based instruments can be used effectively for ensuring high levels of energy security. One should also keep in view that energy security is an issue, which essentially has geopolitical and international dimensions. Given the globalization that is taking place, any region/country cannot remain isolated from the impacts of crises/disruptions in supply. As competition among consuming countries becomes more intense than in the past, energy relations are likely to become much more politicized. The changed circumstance will necessarily have an impact on the international economic and political relations in the world. Hence, energy security issues have to be understood in the wider context of foreign and trade policies.

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# The Centre for Research on Energy Security

CeRES (Centre for Research on Energy Security) was set up on 31 May 2005. The Centre will conduct research and provide analysis, information, and direction on issues that relate to energy security in India. It will track global energy demands, supply, prices, and technological research/breakthroughs – both in the present and for the future – and analyse their implications for global as well as India's energy security, and in relation to the energy needs of the poor. It will engage in international, regional, and national dialogues on energy security issues, and form strategic partnerships with various countries and initiatives that would be in India and the region's long-term energy interest. *Energy Security Insights* is a quarterly bulletin of CeRES that seeks to establish a multi-stakeholder dialogue on these issues.

## Steering Committee

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**Dr Vijay Kelkar**, former Adviser to the Finance Minister

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- **Mr Talmiz Ahmad**, Additional Secretary, Ministry of Petroleum and Natural Gas, Government of India
- **Mr Mukesh D Ambani**, Chairman and Managing Director, Reliance Industries Ltd
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- **Dr Leena Srivastava**, Executive Director, TERI
- **Mr S Sundar**, Distinguished Fellow, TERI
- **Mr R Vasudevan**, former Secretary, Ministry of Power, Government of India

**For further details, contact**

Pragya Jaswal
Centre for Research on Energy Security
TERI
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003

*Tel.* 2468 2100 or 2468 2111
*Fax* 2468 2144 or 2468 2145
India +91 • Delhi (0) 11
*E-mail* pragyaj@teri.res.in
*Web* www.teriin.org



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