

Energy Security

Insights



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Editor
Deepti Mahajan



The Energy and Resources Institute

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India's energy security: impact of developments in West Asia and North Africa

That India is not blessed with adequate domestic energy resources is a proposition that few will contest. When India was a closed economy until two decades ago, it seemed relatively easy to manage the import dependence by cultivating special relationships with a few hydrocarbon suppliers like Russia and Iraq. Yet the First Gulf War in 1990 triggered a balance of payments crisis and compelled a root and branch overhaul of India's national economic strategy. Today, as a globalizing India grows by leaps and bounds, its energy dependence on the rest of the world has acquired staggering proportions. Further, India's import dependence is no longer limited to hydrocarbons, but also high quality coal. As R K Pachauri reminds us in this issue of *Energy Security Insights*, India is expected to import nearly 600 million tonnes (MT) of oil and 1300 MT of coal by 2031. India's plans to dramatically expand its generation of nuclear power would also involve significant imports of uranium—both naturally occurring uranium and the low enriched version.

If energy security is defined as reliable access to energy resources at a reasonable price, India's economic welfare will increasingly rely on the political circumstances in resource surplus areas and the impact of great power competition for influence in these areas. C Uday Bhaskar and Shebonti Ray Dadwal offer insights on the potential impact of the current unrest in the Middle East on India's energy security. Meanwhile, the conflict between the United States and Iran has resulted in Washington squeezing India's oil imports from Tehran, which accounts for nearly 12% of the current annual consumption. Many coal producing countries are beginning to face domestic pressures to limit the exports of "black gold". China's massive international hunt for energy resources and a new naval dynamic involving China, the United States, and India, cast a dark shadow over India's energy security. Above all, the international concerns about global warming have begun to complicate India's energy calculus.

To be sure, India is investing in equity oil and coal mines in distant lands. The government has also embarked on creating a national oil reserve. Delhi has talked about investing in green and alternative energy technologies. These half-hearted measures are utterly inadequate in addressing the grave challenge of energy security confronting the nation. The Indian political classes as well as the economic and national security managers are a long way from defining what Dr Pachauri calls a "central philosophy for attaining higher energy security." This would involve a number of measures, including the stepping up of the exploration and production of energy resources at home, intensifying energy diplomacy, reducing the use of hydrocarbons in the transportation sector through the massive development of public transportation, and a war-like focus on the development of renewable energy resources.

Given the fact that energy security involves so many different government agencies and private sector corporations, efficient coordination between them is a task that Delhi must immediately focus on. As a first step towards the development of an integrated energy security strategy, the Prime Minister must consider setting up of a "Council on Energy Security" that will work in tandem with the PM's Council on Climate Change. Further complacency would have incalculable costs for India's economic and social well-being in the coming years. It will also be a recipe for an energy security crisis that could shake the nation to the core in the not so distant future.

C Raja Mohan
Senior Fellow, Centre for Policy Research
New Delhi

Middle East unrest: need for an energy policy review

Shebonti Ray Dadwal

Institute for Defence Studies and Analyses

When a young Tunisian hawkler immolated himself on 17 December 2010, after the police beat him up and seized his wares, few thought that it would set off a contagion that would unseat many of the well-ensconced regimes in the West Asian–North African (hereafter referred to as the MENA) region. Within a few months, protests that spread across the region saw Tunisian President Zine El Abidine Ben Ali fleeing the country after a quarter of a century in power, and Egyptian President Hosni Mubarak being forced to hand over interim charge of the government to the army after a 30-year rule. Currently, Libyan strongman Muammar Gaddafi and Yemeni President Ali Abdullah Saleh are locked in combat with opposition members, while sporadic protests and violence have erupted in Algeria, Bahrain, Djibouti, Kuwait, Oman, Morocco, Saudi Arabia, Jordan, Sudan, and in the Palestinian territories.

While the spreading unrest is a matter of deep concern for the regimes and could change the complexion of the entire region, it has deep implications for the global oil market as well. Given the MENA region's position as the world's largest and, more importantly, residual producer of oil, concerns regarding supplies of crude to the oil market have arisen, particularly after Libyan oil supplies to the tune of 1.6 million barrels a day (mbd) were taken off the market due to the ongoing conflict in the country. It also caused the price of North Sea Brent crude to rise to over \$120 a barrel—an increase by about 28% since end-2010. Now, with reports of unrest spreading in other countries in the oil-rich Gulf region, there is deep concern that this may cause crude prices to rise to heights last seen in July 2008 or higher.

Member countries of the Organization of Petroleum Exporting Countries (OPEC) announced that this was a temporary factor, that the market had plenty of supply, and that they had acted quickly to fill in the gap caused by Libyan lost barrels. After all,

Libya accounts for only 2% of global oil production, and this was easily made up by the spare production capacity maintained by other cartel members. They also stated that the rise in prices had nothing to do with shortage in supply but was driven by speculation in the oil exchanges.

However, while speculation in the futures market could be one of the factors leading to the current price rise, it does not explain why oil prices have been volatile over the last decade. In fact, from the early 2000s, oil production has not risen in tandem with demand from the Asian developing countries, causing prices to soar. Given the long gestation period between the discovery of oil and bringing supplies online, the period of low prices during the late 1990s saw the oil companies slowing down their exploration and production (E&P) activities. Therefore, as prices began to rise, despite an increase in E&P activity, the process took time, causing supply to tighten.

Furthermore, during the 1990s, the OPEC oil producers maintained quite a large amount of production as spare capacity, close to 11 mbd, which could be brought online if demand spurted, or to settle the market if prices rose over a comfortable margin. But as demand outweighed supply 2000 onward, this spare capacity gradually diminished. Currently, it is believed to be about 3.6 mbd, all of it coming from OPEC producers as production from non-OPEC countries is falling. Moreover, more than three-fourths of this spare capacity belongs to the Saudis. In fact, this is the reason the al Sauds have succeeded in gaining clout in the oil market. However, some oil market analysts are of the opinion that, in reality, OPEC has less than 2 mbd of spare capacity, and that Saudi Arabia has been producing a million barrels per day over and above their official production quota since November.

The problem is that despite assurances from Saudi Arabia and other OPEC members that they will do all they can to stabilize the market, the recent unrest has

Note: While the title of this issue of *Energy Security Insights* refers to the region under focus as 'West Asia and North Africa', it carries references to 'Middle East and North Africa'. The editor has chosen not to alter authors' use of these phrases.

prompted these regimes to unveil a series of packages for their citizens, with the Saudis alone announcing that they would be spending about \$130 billion in social benefits such as the construction of 500,000 new houses, more attractive interest-free mortgages, as well as education and medical facilities. Since most of these countries' economies depend on oil revenue, the recent slew of socio-economic benefits could very well see these regimes opt for oil prices in the range of \$100 plus a barrel. In that case, the Saudis may not be as eager or enthusiastic to increase their production and cause a drop in prices. Neither will increased output from Iraq be able to fill the gap as rapidly as some reports have optimistically predicted. Though Iraq is believed to have about 173 billion barrels of untapped proven reserves, production is expected to be ramped up from the current 2.68 mbd by only another 1 mbd by 2015.

Moreover, following the uprisings and particularly after President Mubarak's ouster, the special relationship between the Saudi regime states and the US has come under some stress. The Saudis have made known their displeasure at Washington's handling of long-time ally Mubarak's ouster, and have sent a clear signal to the US that they would not tolerate the same in Bahrain, by sending in troops to quell the protests in that country in order to prevent any possibility of the protests spreading to their crucial oil-rich and Shia-dominant eastern sector. While the US has refrained from openly criticizing Saudi action, it has put the White House, which has been advocating the spread of democracy, in an awkward position. As a result, how the US–Saudi relations play out in the future will be important for the oil market. Already, following the spurt in consumption by Asian economies, many of the Gulf oil producers have been forging closer ties, both economic and political, with these countries which are gradually emerging as important markets for them.

However, if the unrest in the Middle East escalates, the consequences could range from a tightening of the oil supply, a substantial hike in prices, and even a supply disruption, with some

analysts even predicting that prices could cross the \$200 a barrel mark. Given that the developed countries, particularly Europe, have been consuming less oil for some time, the impact of a tighter oil market will affect the larger Asian consumers like China and India (the US will continue to be the largest oil consumer, but its dependence on the Middle East is comparatively less). Moreover, following the fallout of the Fukushima Daiichi nuclear disaster in Japan and the subsequent review of nuclear energy policy by several countries, the possibility of a rise in demand for oil by Japan and other developed countries in the future cannot be ruled out.

Under these circumstances, should India review its energy policy, given that its crude oil imports will be around 90% by 2015, most of it coming from the Middle East region?

India has, for some time, been pursuing an oil source diversification policy, and trying, though not very successfully, to lessen its dependence on the Middle East. India has also recently accelerated its hunt for acquiring hydrocarbon assets with some success. Though the diversification policy may ensure assured supplies, it will not resolve the problem of higher prices, given the fungibility of the oil market. Nor will its acquisition policy substantially enhance its energy security.

While India should continue to pursue the policy of strengthening energy ties with all producing countries, both in the MENA region, and especially outside (in Latin America, the Central Asian countries, and Russia) in the short term, in the medium and long term it should lower its overall dependence on hydrocarbons, particularly oil and coal, and increase its natural gas and alternative energy basket. However, this would require a substantial increase in partnerships and investment in R&D in renewable and emerging energy technologies across the board, as well as a renewed focus on developing hydropower. If India continues to traverse its current path of dependence on imported fossil fuels, then its energy future looks bleak.

Developments in North Africa and West Asia: strategic implications

Comde C Uday Bhaskar
National Maritime Foundation

The current turmoil in North Africa and West Asia (referred to as the WANA desk in the Indian Ministry of External Affairs) has its genesis in the tragic self-immolation of the 26-year-old Tunisian computer graduate-turned-fruit vendor—Mohamed Bouazizi—on 17 December 2010. And, more than four months after the tumultuous events that rocked Tunisia (this comment was written on 1 May 2011), the extended region is in a state of bloody turmoil and contested stalemate—as for instance in Libya and Syria, or sullen stability—as for example in Bahrain. The major regional states, who also happen to be the biggest oil producing members—Saudi Arabia, Iran, and Iraq—have also been differently drawn into this domain of turbulence and complex contestation. And, the global community, as represented by some members of the UN Security Council, has also entered the fray through the robust (and perhaps hasty?) military intervention in Libya, ostensibly to save civilian lives.

At the time of writing this comment, there are reports from the Libyan government that the Libyan leader's son, Saif al-Arab Gaddafi, and three of Col Gaddafi's grandchildren, had died in a NATO attack on a villa in Tripoli. The socio-political and diplomatic fall-out of this event will be far-reaching and will fuel the deep anti-western/anti-US sentiment that permeates the region all the way upto the Afghanistan-Pakistan theatre. In West Asia, the simmering discontent among the majority Shia community in Bahrain will be further exacerbated with the award of death penalty to four anti-government protesters. In short, the socio-political texture of the extended WANA region will be one of turbulence, violence, and an attempt by the regime in power to maintain the status quo in their own favour. As the empirical experience of the last few months reveals, the role of the individual militaries—the army in each state—will be critical to the final outcome.

However, the impact of this socio-political turbulence in the region on the oil supply to the global economy will be marginal in quantitative terms—but the non-linear linkage to the skittish oil market has been relatively considerable. As rankings go, Libya (exports 1.5 million bpd before the crisis)

is 18th among the oil suppliers, while the other affected states are as follows: Oman (25th); Egypt (29th); Yemen (37th); Tunisia (54th); and finally, Bahrain (63rd). Despite the fact that Saudi Arabia has sought to assuage fears about oil supply, the market has reacted with some sharp volatility and it is instructive that the price of Brent crude oil has surged from \$96.3 per barrel (25 January 2011), to close to \$125.9 per barrel on 30 April 2011. According to oil market analysts, the reason for this 30.7% rise in crude prices, in a span of just over months, is a political risk premium. The rise has little to do with altered supply-demand fundamentals or levels of economic activity that typically drive price movements. Market participants have 'priced-in' the risk of disruptions stemming from the Arab Spring uprising, and the possibility of a significant disruption of oil supplies from Saudi Arabia.

Thus while the actual supply of oil in the global market will be determined by the normalcy index associated with the big five oil producing nations—Russia, Saudi Arabia, USA, China, and Iran—price volatility cannot be ruled out. The current \$125 per barrel level could well spike towards \$150, and then the global amber lights will begin to flicker with shrill rapidity.

Major economies that are heavily dependent on oil imports would have to ensure that the uncertainty about the availability of oil due to any kind of disruption is managed with appropriate Plan Bs as it were. Here, the relevance of strategic crude oil reserves for the major Asian economies comes into focus. Based on the lessons learnt from the first oil shock of the 1970s, the developed economies created such reserves and these are now estimated to cater for disruptions of up to 90 days. China and India would have to review their existing strategic reserves policy, and according to a report in the Financial Times (28 February 2011): "China's strategic oil reserve plan calls for a depot of 500 m barrels, enough for about 100 days of oil imports, although by the time the storage is finished in 2020 it will probably cover only 75–85 days of imports. So far the country has filled a little more than 110 m barrels a day under the first

phase of the three of the country's reserve. Another 40 m barrels could be added this year and in 2012 under the second phase." India's Integrated Energy Policy (IEP) envisions the creation of a strategic reserve equivalent of 90 days imports by 2013, but this will be a formidable task with considerable fiscal outflow. As per the same FT report: "The country (India) is targeting a reserve of about 40 m barrels – equal to little more than two weeks of imports – by the end of 2012. So far, it has only filled depots holding 9.8 m barrels of crude. If India were to create a reserve similar in size as a share of oil imports to the one in China, the US, Japan or Europe, the country would need at least 200 m–250 m barrels of oil."

India would have to evolve innovative strategic oil reserves policies and some degree of private sector partnership is called for. One option that merits consideration is using the location of the Andaman and Nicobar islands in the Bay of Bengal to create

an oil reserve with private sector participation. As opposed to investing large amounts of Government money (almost Rs 1,000 crores for one day's consumption) for creating such reserves, which would then be deemed to be locked up capital, the innovative policy that one is proposing would involve the private sector to use market forces and exploit the location of the islands for creating a regional oil reserve.

The current unrest in West Asia and North Africa, which does not show any sign of speedy resolution, has the potential to add to the oil uncertainty factor, which in turn manifests in the price spikes that the world has witnessed. While no immediate disruption is foreseen as long as the major oil producers are not affected, preparing for worst case scenarios would be prudent, and here the role of strategic oil reserves warrants a policy review.

The imperatives of energy security in India: pursuing an ambitious renewable energy agenda

R K Pachauri

The Energy and Resources Institute

India and the emerging global scenario

On 30 October 2010, more than 400 investors and leaders of the solar industry from around the world converged on the town of Upington in South Africa's arid northern Cape province, for a two day conference aimed at generating investor interest in plans for a 5,000-MW solar park at the edge of the Kalahari desert. This park, whose estimated price tag is in the range of Rand 150 billion (approximately \$27.7 billion), is expected to provide one eighth of South Africa's current generation capacity. On 30 June this year, it would be three years since Prime Minister Manmohan Singh announced the National Action Plan on Climate Change (NAPCC). In these three years, some modest progress has been achieved, but we are nowhere close to the trajectory that is required for establishing 20,000 MW of solar capacity approximately in the next ten years. As a short term target, the Jawaharlal Nehru National Solar Mission targets creation of 1,100 MW of grid connected solar power and 200 MW of off-grid solar power generation by the year 2030. These targets could possibly be met through current actions, but it is questionable whether they would lead to technology development and cost reductions that would facilitate achievement of the long term 2021-2022 target of 20,000 MW.

Another important development took place in May 2011, when the Intergovernmental Panel on Climate Change (IPCC) released its Special Report on Renewable Energy Sources and Climate Change Mitigation. Apart from other dimensions of renewable energy (RE) development and use worldwide, the report also assessed 164 scenarios with a range of global outcomes, which are expected to be achieved in the next few decades. For instance, more than half the scenarios that were examined show a contribution from RE in excess of 17% share of primary energy supply in 2030 rising to more than 27% in 2050. Scenarios with the highest RE share reach approximately 43% in 2030 and 77% in 2050. It is ironic that India would be overwhelmingly below this extent of contribution by RE, even though:

1. This country has had a separate department dealing with RE for almost 30 years now and, more recently, a full fledged ministry dealing with the subject.
2. The resources of RE in India are substantially higher than what is found in most other parts of the world. However, as the IPCC Special Report clearly determined, government policies play a crucial role in accelerating the deployment of renewable technologies.

The focus of policies worldwide has broadened from concentration primarily on RE electricity to include RE heating, cooling, and transportation, RE specific policies for research, development, and demonstration to level the playing field for RE. The most effective policies used in this arena include regulations, such as feed-in tariffs, quotas, priority grid access, building mandates, biofuels blending requirement (which should be enforced effectively), and bioenergy sustainability criteria. Other policy actions include fiscal incentives such as tax policy, and direct government payments such as rebates and grants, and public finance mechanisms such as loans and guarantees. Carbon pricing mechanisms are also expected to support RE. However, in this country we continue with measures that if anything deviate from a level playing field for RE and actually favour fossil fuels, as is the case with subsidies on kerosene and LPG. These continue even though it is well known that in the case of the former, almost 50% of the subsidized kerosene goes into the black market for adulteration of other petroleum products, and in the case of the latter, the major beneficiaries are urban dwellers who have the ability to pay higher prices which would be rational.

The relative contribution of RE in different countries is shown in Figure 1, with China clearly in the lead.

Our energy insecure future

Why do we need a more enlightened treatment of RE policies? Quite apart from the environmental benefits of greater use of RE, the most important

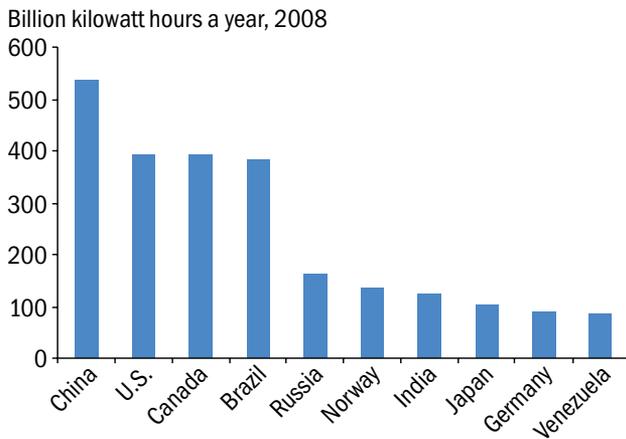


Figure 1 Electricity production from renewable sources
Sources: McKinsey & Company; Population Reference Bureau; U.S. Energy Information Administration

considerations for India to promote this area of development are those related to future security of energy supply. In a paper prepared by TERI in June 2009, the whole area of energy security was analyzed, both in respect of current supply and use as well as in respect of future projections. It was shown that if India follows the business as usual path in what was labelled as the reference energy scenario, India could be importing 1,300 million tonnes (MT) of coal in 2031 and crude oil imports would rise to 660 MT in the same year. This would be clearly unsustainable and fraught with risks, which would make the country extremely vulnerable to price fluctuations and even physical restrictions of supply of fossil fuels. In another publication brought out by TERI in March 2011, it was shown that India's coal resources are constrained to an extent that would not allow production at levels that are currently being assumed. For instance, at a modest growth rate of production of 5.5%, the production of coal and lignite by 2031–32 will be close to 1,400 MT. Coal India Ltd has targeted a maximum production of 839 MT by 2025 in its “Vision 2025” document.

Under various scenarios, coal requirement in 2031–32 is projected within a range of 1,580 MT to 2,555 MT. A mere 5% deterioration in quality over the next 25 years would raise coal requirement to 2,689 MT. Hence, high quality coal import needs at 6,000 Kcal per kilogram would range from 120 MT to 770 MT by 2031. However, the total international trade today is only in the range of 700–800 MT. We also need to be aware of the fact that in some countries there is a great deal of pressure by local groups to limit coal exports, because they believe that

exports of this commodity essentially imply export of greenhouse gas and carbon dioxide emissions. The recent unfortunate developments in the Fukushima nuclear power plant in Japan certainly spotlight concerns about nuclear energy and its potential for meeting energy needs in a country like India, but it is unlikely that there would be a serious repercussion in the form of lower growth of nuclear energy capacity vis-à-vis what is being planned. At any rate, even with the most optimistic projections related to this source, nuclear energy will meet only a small share of power generating capacity by 2031–32. The most plausible scenario for nuclear power capacity is pegged at 63,000 MW by 2031–32.

Learning by Looking Elsewhere

What is happening with RE in other parts of the world? In October 2010, Korea announced a bold plan to invest approximately \$ 36 billion over the next five years for developing RE sources and nurturing them into new economic growth engines. On this basis, the Government of the Republic of Korea forecasts the country's export of clean energy reaching a level of \$36.2 billion in 2015, and if this plan is implemented successfully, it would be creating some 110,000 jobs in that country. India has had some success in exports of RE products in the form of photovoltaic modules being exported largely to the Federal Republic of Germany as well as wind energy equipment to other parts of the world. However, we lack a vision in defining ambitious export scenarios that would place India in an advantageous position and as a serious player in the global RE market.

Arguments against rapid development of RE are advanced on the grounds of high costs and the fact that in a number of forms of RE, supply fluctuates simply because the resources available fluctuate during 24 hours of the day and different seasons of the year, such as in the case of wind and solar. However, storage technologies have now improved the viability of these sources to an extent where they may be able to compete effectively against conventional sources. Economies of scale are another factor in reducing costs per unit. For instance, if we were to implement the two solar parks under consideration in Rajasthan and Gujarat, each with a capacity of 3,000 MW and more, we would not only be able to bring down costs substantially, but also develop a manufacturing base which would help in mounting a major expansion of this technology in India and a large scale export effort in the future. Since the proposed solar parks, both of

which TERI has been associated with, would be based largely on solar thermal power generating technologies, most of the equipment would be fabricated and manufactured in India. Given our competitive costs of labour, the capital cost of equipment produced in the country would have a lower cost per unit than similar equipment manufactured in developed countries.

The challenge of energy security is a serious one, and its implications for healthy rates of economic growth in India cannot be ignored. If the Indian economy is to grow at rates between 8% to 10%, then within a space of the next five to ten years a major transition to alternative sources of energy would become imperative. This will not happen by itself, but would have to be driven by a clearly defined vision as embodied in the Jawaharlal Nehru National Solar Mission. However, the wherewithal for achieving this mission is clearly not in place. A typical departmental approach to managing such an ambitious programme would just not work. The mission has to be implemented within the context and framework of overall energy policy and on the foundation of:

1. A clear and enhanced research and development policy
2. A set of fiscal measures that provide incentives and disincentives for greater use of RE, which is not just short term in nature but a clearly articulated pathway which targets the next 15 years or so in terms of desired outcomes, and
3. Very clear legislative and regulatory measures, such as laying down targets for the share of RE, benchmarks for several sectors of the economy, including old as well as new buildings and their usage patterns of energy, as well as for household appliances, automobiles, and industrial processes.

An important element of policy would have to be the rationalization of price for conventional sources of energy. We are certainly off the mark in this respect as the current pattern of pricing clearly reveals.

Managing demand

The attainment of higher levels of energy security would require a multiplicity of initiatives on both the demand as well as supply sides. On the demand

side, there is substantial scope for bringing about improvements in the efficiency of energy use in the buildings sector. High rates of economic growth have led to a boom in construction activity all over the country, and the need to provide appropriate shelter to all sections of society is bound to lead to a continuation of growth in this sector at rates similar to what we have witnessed in recent years. Given the fact that buildings lock a society into a pattern of energy consumption that cannot easily be changed (since buildings have a long physical and economic life), it is essential that regulations, established practices, and consumer preferences drive building activity in the direction of higher levels of energy efficiency.

TERI has been at the forefront of developments in this respect, not only setting up buildings that provide a benchmark for very high levels of energy efficiency, but also devising a rating system known as the Green Rating for Integrated Habitat Assessment (GRIHA), which has now been adopted by the Government of India for all central government buildings. There is a need to extend the application of this system to states as well as towns and cities, such that all new construction is subjected to careful evaluation of implications for energy and natural resource use. In the case of new buildings, an improvement in efficiency of 40% to 45% can be achieved on an economically viable basis with measures that are now well established. In the case of existing buildings, retrofit can bring about an improvement in energy efficiency of 15% to 20%¹. Energy efficiency measures are essential in several sectors of the economy including industry, transport as well as agriculture. In the case of industry, the Bureau of Energy Efficiency has come up with a set of measures and policies that are showing significant progress.

In the case of transport, however, there is need for a major effort to increase public transport infrastructure, and modernization of the Indian Railways so that its share of passenger and freight traffic increases over time as opposed to the trend in recent decades of perceptible decline. One projection of ownership of personal vehicles in India is a total of 708 million units by 2030 based on the growth of GDP of 6% per year. Consequently, the share

¹ TERI has constructed buildings for its own use which are iconic in the levels of energy efficiency and responsibility to the environment. The RETREAT building at TERI's campus in Gual Pahari, District Gurgaon, uses no power from the grid and has developed the technology of earth air tunnels which use the thermal property of the earth (often referred to as geothermal energy) for providing cooling and heating in the living quarters of this complex. Similarly, the TERI University has set a benchmark for energy and water use efficiency through a combination of technological innovations, all of which can be replicated on a large scale.

of public transport is projected to decline from the current level of about 60% to 45%. The level of ownership of personal vehicles in India was 67 per thousand in 2006 as compared to a little over 500 per thousand in the developed world (Figure 2). Aspiring to those levels of ownership would be detrimental to the efficiency of energy use in this sector. Even if personal vehicle ownership keeps increasing steadily, the kilometres driven per annum should go down if the consumption of petroleum products is to be kept in check. Over a period of time, a major improvement in fuel efficiency of automobiles would also become imperative, with a further gradual shift to hybrid and electric vehicles. Reduction in the usage of personal automobiles would come about only if consumers are confronted with choices of public transport. A major effort in this direction is long overdue at the national, state, and local levels. Essentially, public transport would require the creation of local capability to devise appropriate public transport systems and access to financing given the fact that public transport requires lumpy investments.

In the case of agriculture, the biggest barrier to efficient use of energy lies in totally irrational pricing mechanisms, both for groundwater use and electricity. Highly subsidized rates of electricity not only lead to excessive use of water with serious environmental problems but also the installation of energy inefficient pumpsets which may have low capital costs but high costs of electricity use. Since the consumer pays at subsidized rates for electricity, there is no incentive for installation of energy efficient

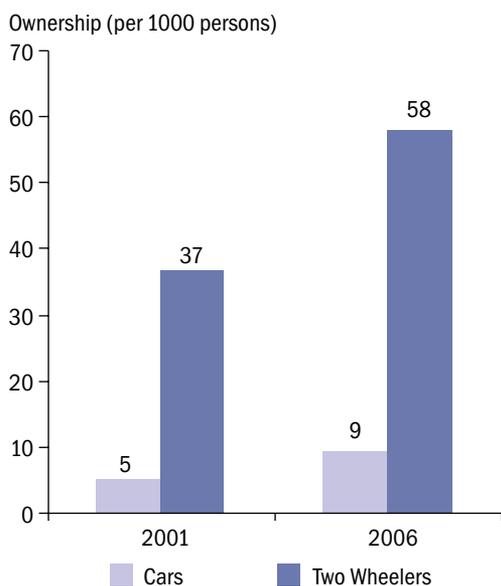


Figure 2 Ownership of personal vehicles in India

pumpsets thereby perpetuating inefficient use of energy over the life of the pumpset. The regulatory mechanism in the state governments has to be strengthened whereby irrational pricing of power and benefits of subsidy which largely accrue to rich farmers, are done away with. While independent regulation has been established in the country through the institution of State Electricity Regulatory Commissions, their evolution into effective, independent, and professionally strong organizations is still overdue.

Departure from business as usual

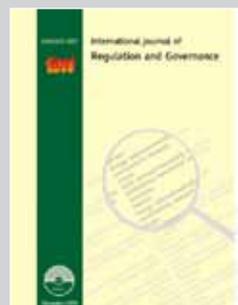
On the supply side, Indian investors including public sector organizations have been making significant investments in hydrocarbons in other parts of the world. This trend would certainly provide relief to the country by enlarging the geographical diversity and magnitude of sources of supply. However, given the emerging developments in the global fossil fuel market, such an approach can only provide temporary relief. India would have to come to grips with enhancing its own indigenous production of energy as rapidly as possible.

While a multiplicity of actions is required to enhance the security of supply of energy to India, clear areas of emphasis needs to be articulated and followed as part of a long term strategy, the implementation of which cannot be delayed much longer. If we are to view developments in those countries which have taken adequate and timely measures towards energy security in recent years, there is evidence of clear areas of emphasis which have formed the central core of energy policy. In the case of France, after the first oil price shock of 1973–74, the government went aggressively in favour of enhancing the supply of nuclear energy while at the same time strengthening and modernizing its transport sector, such as the French railways. Much the same happened in the case of Japan which shifted a large part of its energy supply in favour of natural gas and shut down energy intensive industries, allowing these to be located in other parts of the world where energy resources were abundant. Even a small but prosperous country like Denmark moved away from dependence on oil imports. It not only used the mid-1970s as a period to discover some oil in the North Sea but also pursued the imposition of taxes on petroleum products, laying down of building and efficiency standards, and later imposition of CO₂ taxes. Denmark also provided support and carefully

planned subsidies for utilization of wind energy. The result was that Denmark was able to revolutionize wind energy technology to a point where it became the world leader in this field. Today, Denmark has developed and produces 7-MW wind energy machines for which there is a growing global demand. Even the current UK government, in an effort to reduce emission of greenhouse gases, has provided substantial incentives for the expansion of off-shore wind energy capacity. Given the shallow continental shelf surrounding parts of UK, a large number of wind energy machines are being installed by the country.

In the case of India, there is a need to define a central philosophy for attaining higher energy security. While as an interim measure, both on the supply as well as demand sides, conventional actions have to be an essential part of energy policy, the country has to define and pursue an ambitious programme of expansion of supply from renewable energy sources. In this area as well, a large number of options would need to be pursued with seriousness, but the greatest gains would come from

the development and expansion of supply from solar, wind, and biomass. Institutionally, such a plan must build on the NAPCC, but perhaps what is missing at the moment is integration of policies and actions involving ministries and departments that handle various elements of energy policy. Such integration would go beyond merely the supply sector but would include ministries dealing with transport (including the railways), buildings, urban development, industry, and agriculture. There may be a need to establish an organization similar to the Advisory Board on Energy, which was established by Prime Minister Indira Gandhi in 1983. What could be established now is the Prime Minister's Council on Energy Security, with significant overlaps with the Prime Minister's Council on Climate Change. The interests of Indian society today, and generations yet to come, lie in accepting and pursuing the centrality of energy security as part of India's efforts to emerge as a vigorous and dynamic country, self-assured in the belief that not only would adequate and affordable energy be available to all its citizens, but that energy will not, in any way, become a constraint on healthy economic growth.



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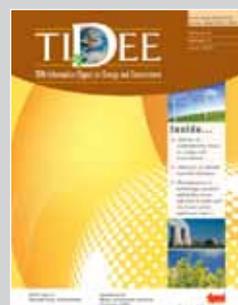
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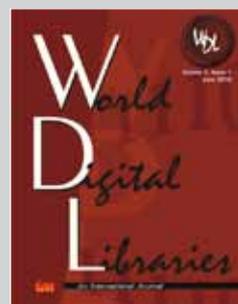
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The Energy and Resources Institute
 Attn: Kakali Ghosh, TERI Press
 Darbari Seth Block
 IHC Complex, Lodhi Road
 New Delhi – 110 003 / India

Tel. 2468 2100 or 4150 4900
 Fax: 2468 2144 or 2468 2145
 India +91 • Delhi (0) 11
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Tel. 2468 2100 or 4150 4900

Fax 2468 2144 or 2468 2145

India +91 • Delhi (0)11

E-mail bineesan@teri.res.in

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