Energy efficiency initiatives: Indian experience

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Abstract
India, with a population of over 1.10 billion is one of the fastest growing economies of the world. As domestic sources of different conventional commercial energy are drying up, dependence on foreign energy sources is increasing. There exists a huge potential for saving energy in India. After the first 'oil shock' (1973), the government of India realized the need for conservation of energy and a 'Petroleum Conservation Action Group' was formed in 1976. Since then many initiatives aiming at energy conservation and improving energy efficiency, have been undertaken (the establishment of Petroleum Conservation Research Association in 1978; the notification of Eco labelling scheme in 1991; the formation of Bureau of Energy Efficiency in 2002). But no such initiative was successful. In this paper an attempt has been made to analyze the changing importance of energy conservation/efficiency measures which have been initiated in India between 1970 and 2005.

The present study tries to analyze the limitations and the reasons of failure of those initiatives. The probable reasons are: fuel pricing mechanism (including subsidies), political factors, corruption and unethical practices, influence of oil and related industry lobbies – both internal and external, the economic situation and the prolonged protection of domestic industries. Further, as India is opening its economy, the study explores the opportunities that the globally competitive market would offer to improve the overall energy efficiency of the economy.

The study suggests that the Bureau of Energy Efficiency (BEE) - the newly formed nodal agency for improving energy efficiency of the economy— may be made an autonomous institution where intervention from the politicians would be very low. For proper implementation of different initiatives to improve energy efficiency, BEE should involve more the civil societies (NGO) from the inception to the implementation stage of the programs. The paper also highlights a few challenges that the government of India is likely to face in the near future.

Introduction
India with a population of over one billion inhabitants, more than one quarter of which are unable to meet their basic requirement, faces a formidable challenge in meeting its energy needs in a sustainable manner and at a reasonable price. To eradicate poverty and meet the basic requirement of the citizens, it is estimated that the economy must grow at a rate of 8 to 9 percent in the next 25 years. To meet the energy requirements for such a fast growing economy, India will require an assured supply of 3 to 4 times more energy than the total energy consumed today.[1] By 2031 – 32, the power generation capacity must increase to nearly 800,000 megawatt (MW) from the current capacity of 160,000 MW. There is huge potential for saving energy through different mechanisms. It is estimated that nearly 25,000 MW of energy could be saved through energy efficiency measures. The

1. Per capita consumption of energy in India is one of the lowest of the world and Indian citizen consumed only 439 kg of oil equivalent (kgoe) per person of primary energy in 2003. The corresponding world average and the consumption figures for China were 1,688 kgoe and 1090 kgoe respectively. In 2003-04 India consumed a total of 470 MTOE primary energy of which the amount of commercial energy was 327 MTOE (69.57 %). Rest 143 MTOE (30.43 %) was met through non-commercial sources like fuel wood, agro west, dung cake, biogas etc. Compared to this, India consumed a total of 132 MTOE and 246 MTOE energy in 1970 and 1990 respectively

Report of the Expert Committee on Integrated Energy Policy (2006), has stated that over the next 25 years, 'energy efficiency and conservation are the most important virtual energy supply sources that India possesses'2. Another study estimated that the economy has an energy saving potential up to 23 % as a whole and the key sectors like agriculture, industry, transport and domestic and commercial have the energy saving potential of 30 %, 25 %, 20 % and 20 % respectively3.

'Energy Conservation/efficiency' is no more a fancy term used by energy planners as it has been the case during the last four decades. Now, it has become an integral part of India's future energy planning strategies. We suggest that, the main focus of Indian energy planners were more on 'conservation' at least until the early nineties (phase one). The focus got shifted to achieving 'energy efficiency' only recently (explicitly after the formation of BEE), when environmental issues also got linked to India's energy planning.

In this paper, an attempt has been made to analyze this changing importance of energy conservation/efficiency measures initiated in India between 1970 and 2005. The paper has been organised in three sections: First, the major initiatives; then the reasons of failures; and finally future challenges and recommendations.

The major initiatives

Energy Conservation and Energy Efficiency are related but separate concepts. Energy conservation is achieved when growth of energy consumption is reduced, measured in physical terms. Energy efficiency may be defined as a practice of judicious use of energy with an aim to reduce its economic cost and environmental impact. Although, energy efficiency has been in practice ever since the first oil crisis in 1973, now, it has assumed even more importance because of being the most cost-effective and reliable means of mitigating the global climate change. Recognition of that potential has led to high expectations for the control of carbon emissions through even more energy efficiency improvements than have occurred in the past. The Inter-Ministerial Working Group on Energy Conservation (IMWGEC) is their report (1983) stated, 'energy conservation requires lesser energy inputs for the same level of economic growth. In other words, an increase in energy productivity is the hallmark of energy conservation. Energy conservation also implies the substitution of costly imported energy by cheap energy; the harnessing of non-conventional energy resources to supplement conventional resources etc. In the hierarchy of importance, substitution of oil by coal occupies the major importance and challenge'[4].

Between 1970 and 1990, India's energy intensity of primary modern energy use had increased by 38 percent. Thereafter, it started to decline.[5] The above period has been divided into two phases: during the first phase, between 1970 and 1990, the economy was controlled to a large extent by the state and the energy intensity of the economy was growing. During the second phase between 1991 and 2005, the economic liberalization process was in force and the energy intensity of the economy has been declining.

PHASE I: 1970-1990

(a) The Fuel Policy Committee was set up in 1970 and a comprehensive final report was submitted in 1974. It emphasized the necessity of substitution of oil by coal and that higher efficiency in electricity generation and transmission with special attention to hydel power developments. It also provided an outline for the energy policy of the country and suggested the setting up of an Energy Board to ensure the integration of the energy plan with the national plan.

(b) In 1976, the Ministry of Oil and Petroleum, Government of India formed the Petroleum Conservation Action Group to promote the conservation of oil. It was reconstituted as the Petroleum Conservation Research Association in 1978 with the objectives of creating awareness on the importance, methods and benefits of conserving petroleum products; to promote research & development in the field, especially in fuel efficient technologies; to provide training and technical assistance for better economy and increased efficiency in use of energy and also to promote the substitution of petroleum products by a1ternative sources of energy.

(c) The Working Group on Energy Policy (1979) was constituted by an order of the Planning Commission on 6th December, 1977, with a view to "carry out a comprehensive review of the present situation in the light of recent developments both within the country and outside, to develop a perspective for the next five to fifteen years and to recommend appropriate policy measures for optimal utilization of available energy resources including non-conventional sources of energy". Some of the important recommendations of the Committee were:

- Demand Management should form the most important element of oil policy in the future,
- To develop coordination among rail, road and water ways including coastal shipping for optimum use of transportation options,
- To set up standards of fuel efficiency for electrical and diesel pumps, lighting and cooking appliances etc[6].

(d) The Inter-Ministerial Working Group on Energy Conservation was instituted by the Government of India in August 1981 to recommend policies and programmes for achieving the targets of energy saving. It came up with the first concrete proposal for reduction in energy consumption in India. In its very well researched and properly documented report (1983), the Group proposed the creation of an apex body to initiate, coordinate and monitor the progress and implementation of various energy conservation measures in India. The report showed that in the three major economic sectors of India, viz. industry, transportation and agriculture, there were immense scopes of saving energy. Studies as mentioned in the report revealed that with 1/20th to 1/10th of the investment required for new energy supplies, it would be possible to save an equal amount of energy that would have been produced[7].

2. Planning Commission 2006
3. Hindustan Chronicle, 2006
4. IMWGEC , 1983
5. Sathaye and Reddy, 1993
6. Planning Commission, 2006
7. IMWGEC,1983

(e) The Advisory Board on Energy (set up in 1980) commissioned the Indian Law Institute in 1987 to prepare a draft of the Energy Conservation Bill for enactment by the Parliament. The draft was completed in 1988 (Draft Bill, 1988). The main objective of the bill was to empower the government to take such measures as deemed necessary and expedient for the purpose of conserving energy in the country and making appropriate and rational use of energy resources. It provided for establishment of a Nodal Energy Conservation Organization (NECO) whose observations and recommendations would be binding on all Central and State government agencies as well as on the prescribed authorities. In place of the NECO, a more appropriately named Energy Management Centre came into existence in 1989 as a registered body under the Department of Power, Government of India. With assistance from the United Nations and various agencies of the United States, the Energy Management Centre coordinated energy auditing of consumers both in industrial and commercial sector in different regions of the country with the National Productivity Council as the local lead agency[8].

PHASE II: 1991-2005

(a) The Government of India had declared that the 14th of December (every year) is the National Energy Conservation Day. For the first time in 1991, the *National Energy Conservation Award* was introduced by the Ministry of Power for industrial units who have taken exceptional initiatives on Energy Conservation[9].

(b) In February 1991, the Indian Parliament initiated a voluntary eco-labelling programme known as the Eco-Mark. The Ministry of Environment and Forests (MoEF), with the technical advice of the Central Pollution Control Board (CPCB), manages the programme. Unlike many other international eco-labelling programmes that are independent, India's Eco-Mark is tied with the BIS' (Bureau of Indian Standards) product quality standards[10]. It has some product specific requirements that include clauses on energy conservation in the production process. Though the government had notified standards for 16 different categories of products – mostly consumer goods, Indian industry did not respond to initiative. No Eco-mark product is available in the market, though a few companies have taken Eco-mark license for their products from BIS. Consumer awareness about Eco-mark is low as there was hardly any initiative to generate awareness among them[11].

(c) In 1997, a voluntary programme on energy efficiency standard was initiated in India. Standards had been developed for refrigerators and room air-conditioners. But there was no taker. Few Indian organizations had taken memberships of the World Energy Efficiency Association (WEEA) which was founded in 1993[12].

(d) Two Indian states, viz. Kerala (1992) and West Bengal (1995) at their own initiatives had introduced mandatory Energy Audit for large consumers, by issuing orders from their respective Departments of Power to this effect[13].

(e) Centre for Science and Environment (CSE) a Delhi based NGO initiated their Green Rating Project (GRP) in 1997 to present a market oriented framework by which environmental impacts of industrialization could be monitored and influenced. (For details, see Annex I)

(f) The Energy Conservation Bill, introduced in the year 2000, did not differ much in form and content from the Bill of 1988 except the notable change of the introduction of a new body in the name of the *Bureau of Energy Efficiency (BEE)* which would inherit all the rights and liabilities of the Energy Management Centre as the later would cease to exist thereafter. The Bill finally became an Act in September, 2001. The Energy Conservation Act, 2001 would strive and act to facilitate and enforce the efficient use of energy and its conservation. The Act has introduced the concept of a class called the Designated Consumers, i.e. the energy intensive industries and other establishments notified so by the government. The Act also makes provisions for penalties and adjudication. BEE was established in March 2002.

(g) On June 10, 2003, the Government of India notified the Electricity Act, 2003. Among others, it also has provisions for promotion of efficient and environmentally benign policies.

(h) Complying with the Electricity Act 2003, on February 12, 2005, the Central government notified a National Electricity Policy to address various issues relating to electricity. This policy laid great emphasis on energy conservation. Following are few relevant policy issues

1. Bureau of Energy Efficiency (BEE) shall initiate action in energy efficiency;
2. Periodic energy audits have been made compulsory for power intensive industries under the Energy Conservation Act.
3. In the field of energy conservation, initial approach would be voluntary and self-regulating with emphasis on labelling of appliances. Gradually as awareness increases, a more regulatory approach of setting standards would be followed.
4. In the agriculture sector, the pump sets and the water delivery system-engineered for high efficiency would be promoted. In the industrial sector, energy efficient technologies should be used and energy audits carried out to indicate scope for energy conservation measures.
5. For effective implementation of energy conservation measures, the role of energy service companies (ESCOs) would be enlarged.
6. A national campaign for bringing about awareness about energy conservation would be essential to achieve efficient consumption of electricity.

8. Nandi and Basu 2006

9. Chatruvedi, P 'Energy Conservation India', http://www.worldenergy.org/wec-geis/publications/default/tech_papers/17th_congress/1_1_26.asp#Heading10.

10. CUTS-International,2005

11. Sudhir K Ghosh, former Member Secretary of the Ecomark Technical committee, speaking on Ecolabels and Energy efficiency labels in the Indian context said that ecolabels and energy efficiency labels at a Side –Event on *Impact of Unsustainable Production and Consumption Patterns on Climate Change: The Role of Consumers Groups, organized by Cuts-Centre for Sustainable Production and Consumption*, October 24, New Delhi, during CoP 8, UNFCC, 2002

12.Ghosh, ibid

13.Nandi and Basu, 2006

7. A National Action Plan has been developed. Progress on all the proposed measures will be monitored with reference to the specific plans of action14.

(i) Various promotional provisions in support of the EC Act have been initiated by the *Bureau of Energy Efficiency (BEE)* and the following *four* are vigorously pursued by it.

Indian Industry Programme for Energy Conservation (IIPEC): Task forces have been formed in seven designated consumers, namely: Aluminium industry, cement industry, pulp & paper industry, textile industry, fertilizer industry, chlro-alkali industry and petrochemicals industry.

Small group activities on energy conservation: BEE supports designated consumers in improving their energy efficiency through launch of voluntary programmes. Experts are invited from Japan for establishing small group activity focused on energy conservation

National Energy Conservation Awards: The individual industrial units are being motivated through National Energy Conservation Award Scheme. 14 major industrial sectors have set ambitious targets to save upto 40 % energy through implementing different conservation measures.

Energy efficiency improvement in government buildings: BEE has undertaken energy audit studies in nine government buildings to set up an example for private buildings to pursue similar efforts[15].

(j) Three-Country Energy Efficiency (3CEE) project (since 2002): To strengthen An Energy Service Company (ESCO[16]) business model. United Nations Environment programme (UNEP) and the World Bank, with funding from UN Foundation, have been implementing a technical assistance project since 2002 for developing financial intermediation mechanisms for energy efficiency investments in India, China and Brazil. A significant achievement for the 3CEE project is that three of the participating commercial banks have designed, and launched schemes specifically targeted at energy efficiency projects (EE). State Bank of India, Canara Bank and Union Bank of India have launched and are implementing different EE loan schemes targeted at small and medium enterprises[17].

(k) The LEED (Leadership in Energy and Environmental Design) focuses on sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. Indian Green Building Council (IGBC) founded in 2001 has asked the Government in September, 2006 to make it mandatory for buildings above 20,000 square feet to incorporate minimum green features. In India, audit and certification of green buildings are currently conducted by the US Green Building Council, while the entire process is facilitated by the Indian Green Building Council[18].

(l) TERI-GRIHA (TERI- Green Rating for Integrated Habitat Assessment) - the green building rating system devised by TERI is a voluntary scheme. It has derived useful inputs from the upcoming mandatory voluntary building codes/guidelines being developed by the Bureau of Energy Efficiency, the Ministry of Non-conventional Energy Sources, the Ministry of Environment and Forests, the Government of India, and the Bureau of Indian Standards. The rating system launched around 2005 and being administered by TERI-BCSD (Business Council for Sustainable Development, India), aims to achieve efficient resource utilization, enhanced resource efficiency, and an improved quality of life in buildings[19].

Important Findings

(a) The elasticity (% change in commercial energy use for one % change in GDP) for per capita primary commercial energy supply with respect to per capital GDP has improved to 0.82 between 1990 – 91 and 2002-03 from the estimated figures of 1.08 between 1980 – 81 and 2002 – 03. India's energy intensity (energy consumption/GDP) has been falling and is about half of what it used to be in the early seventies. In 2003, India consumed 0.19 kgoe per dollar of GDP expressed in PPP. The corresponding figures for OECD, China, US and World average are 0.19 kgoe, 0.21 kgoe, 0.22 kgoe and 0.21 kgoe respectively[20]. Though the statistics indicate about some improvement in the energy usage but in terms of huge potential, the achievements are insignificant.

From our analysis, it becomes clear that neither the implementing agencies, nor the consumers, did exhibit serious intention in saving energy despite the fact that huge potential for saving existed. To quote the Report of the Expert Committee on Integrated Energy Planning[21], 'despite these potential studies, actual implementation has been sluggish'. The 8th Five Year Plan (1992 – 1997) made a provision of $ 0.22 billion for energy efficiency to provide targeted energy savings of 5,000 MW and 6 Million Tones in the electricity and petroleum sectors respectively. There is no clear quantification of the actual costs and savings achieved.' The target for energy savings in the 10th Plan (2002 – 2007) is 95 billion kWh which is about 13 % of the estimated demand of 7,19 billion kWh in the terminal year of the 10th Plan. However, there is no specific resources that have been allocated to meet the energy saving targets.

(b) The Bureau of Energy Efficiency (BEE) has just made a beginning after a very slow start. Due to administrative red tapes, BEE did not have a fulltime head and, till September 2005, had only 4 professionals on staff![22]. But BEE has, among others, initiated few important initiates: the National Energy Conservation Award for small scale industries, for shopping mall buildings, hotel and hospital buildings, office buildings, and also large and medium scale industries. They have also come out with a detailed scheme of energy efficiency labels in May 2006[23]. Moreover, BEE has also drafted a model energy performance contract for ESCOS (energy service compa-

14. *Government Approach to Energy Conservation, Survey of Energy Conservation in India – 2006 p, 69*

15. Verma, 2006

16. An Energy Service Company (ESCO) is a company that provides integrated energy services (technical and financial) to its customers, mainly large energy users, but also utilities, which may include implementing energy-efficiency improvement projects, on a turnkey basis),

17. Cherail , 2006

18. The Hindu Business Line: Sops sought for Green Buildings, September 16, 2006

19. http://www.bee-india.nic.in/sidelinks/Announcement/11TERIGriha.pdf

20. Planning Commission,2006

21. Planning Commission 2005

22. ibid

23. www.bee-india.nic.in

nies)[24]. The most important initiative taken by BEE during last few years so far was the organization, on a regular basis, of the National Certificate Examination for Energy Managers and Energy Auditors. A vast country like India needs substantial numbers of such energy experts without whom, no conservation measures will be successful.

(c) Persistence of 'dual fuel' society: Since nearly one third of total energy is used for domestic cooking, efficiency of the cooking process should have been given a high priority, particularly since this process is currently marked by poor level of efficiency and dependence on fire wood is very high especially in the rural sector. A focused program to increase the efficiency of traditional wood stoves is urgently required. But report revealed that successes in disseminating information on improved wood stoves have been limited. They penetrated only 15 percent of Indian's homes between early 1982 and 1992. A survey showed that one-third of the ICs (improved cooking stoves) installed became non-functional within the first year of installation. During the same period, China covered 70 % of the rural household under a similar type of program[25]. In the early 1990s, priority on wood stove research was reduced and the effort was put on solar energy. It was a world wide phenomenon. Restricting the efforts to improve fuel wood stoves implied the acceptance of a 'dual-fuel' society, i.e. a society in which the poor cooked with messy solid fuels in relatively inefficient stoves and the rich enjoyed clean gaseous fuels like LPG in efficient stoves. There was also little consciousness of the strong gender bias against women in this shift of priorities[26]. A 'dual fuel' society –an out come of economic dualism is still very strong in India. For example, in 2002-03, 80 % of the energy needs of rural India (75 % of the total population) was met from traditional renewable energy sources like fuel woods etc. (65 %), animal and human energy (15 %)[27]. Even towards the end of 1990s, more than 55 % of the total cultivated area was managed by using draught animals as against 20 % by tractors[28]. In 1991, the percentages of electrified rural and urban household were 30.5 % and 75.8 % respectively. The corresponding figures in 2001 were 43.5 % and 87.6 % respectively. A study based on an integrated survey by Parikh et al, 2005 as quoted in the India Development Report (2004-05) covering 15,293 rural households from 148 villages estimated that 96 % of households used biomass energy, 11 % used kerosene and 5 % used LPG for cooking. Most of them used multiple fuels. Respiratory symptoms were prevalent among 24 million adults of whom 17 million had serious symptoms; 5 % of adults suffered from Bronchial asthma, 16 % from Bronchitis, 8.2 % from Pulmonary TB and 7 % from Chest infection; Risk of contracting respiratory diseases increased with longer duration of use of bio-fuels[29].

(d) This duality becomes more pronounced when we find that whatever plans for energy conservation/ efficiency improvement have been made so far, no attention has been paid to another major and most benign component of traditional energy sources – namely animal and human energy. The increasing in energy intensity during 1970 and 1990 was explained by the researchers[30] as a reflection of the replacement of human and animal draught power by mechanical and electrical devices. The INFORSE indicate that even in the early 21st century share of animal and human energy in the total primary energy of rural India was substantial (15 %). Though due to paucity of data on this area it is difficult to measure the actual contribution of human and animal energy; the practical experience indicates that the share could be much higher. A research study published in 1999 revealed that little information on draught -ability on all the major Indian breeds of cattle, buffaloes and pack animals including cross breeds is available[31]. Draught animals in different regions vary greatly in sizes but matrix of distribution of weight, which helps in design of the farm machinery as per source of power available, was not available[32].

(e) The Eco-labelling scheme (Eco-Mark) which was launched in 1991 just before the earth summit (1992) was a total failure. No Eco-mark product is available in the market. One reason for this could be numerous regulatory requirements and cost involved in implementing them[33].

(f) The only silver lining was the success of the Green Rating Project (GRP) initiated by an NGO (for details please refer to Annex I). The success of this project indicates that industry responses positively if a program is designed, giving due respect to all the stakeholders' views by involving them in every stage of it from inception to implementation. Probably NGOs are more equipped and philosophically more attached to this kind of program delivery process then the bureaucrats.

Possible reasons of failure of the energy conservation initiatives

(i) *Lack of seriousness and leadership*: All these initiatives towards conservation measures taken by the government remained as an appendix to the long term energy policy (if there was any!). All the measures taken were reactive to certain events, not proactive by nature. This was the case for the establishment of the Petroleum Conservation Action Group in 1976 (as a reaction to oil shock of 1973 – 74), the Inter-Ministerial Working Group for Energy Conservation (IMWGEC) in 1981 (again as a reaction to second oil shock of 1979), the Eco-labelling initiatives in 1991 (as part of the preparation for the Earth Summit 1992[34]). Even the most recent initiative, the establishment of the BEE in March 2002, coincided with the Rio+10 summits at Johannesburg. Moreover, even after three years of its formation, BEE remained almost non operational. Until September 2005, it did not even have a full time head!

24. Ramaswamy S, 2006

25. Parikh, 1999

26. Reddy, 1999

27. INFORSE

28. Sing,1999

29. Planning Commission,2006

30. Sathaye and Reddy, 1993

31. With a view to increase the annual utilization and over all efficiency of draught animals, an ad-hoc project from Agricultural Produce fund in the name of "Co-ordinated Research Programme on Increased Utilization of Animal Energy with Enhanced System Efficiency" was started in January 1985 by the Indian Council of Agricultural Engineering, Bhopal, India which was later converted into a regular all India coordinated research project from 1st July 1987

32. Singh, 1999

33. CUTS-International, 2005

34. It was alleged that most of Eco-Mark standards were copied from other countries and were not applicable to the Indian condition.

(ii) *Technical backwardness*: In the early fifties, India -then a newly independent state could not mobilize fund or develop appropriate technology for its nascent industry. Indian industry had to accept obsolete technology from whatever source it could get it. Replacement of those old fashioned, inefficient power technologies in industries and transport sector is a prerequisite for improving the energy intensity of the economy. Until the early 1990s, the shortage of adequate foreign exchange was the major constraints for the entrepreneurs who wanted to import better technology to improve their efficiency. Appropriate indigenous technology could not be developed also for various reasons. Signs of improvement in the energy intensity figures were only observed with the opening up of the economy during the last one and half decades. Increased competition both at home and abroad, has compelled the business leaders to look into alternative options to save energy cost.

(iii) *Limited exposure to global trade*: Indian economy during the first fifty years of its independence relied mostly on protected domestic market. In 1980, India's share in the global trade was 0.57 %. This share increased only at a snail's pace as the figures indicate: 0.60 % (1990); 0.71 % (2000) and 0.80 % (2002). In this new century, when most of the industries were gearing up to boost exports, they realized that the cost of energy was robbing off their competitive edge in the international market. The World Economic Forum study on competitiveness of countries for the year of 2001 ranked, India 57th on the Growth Competitiveness Index (GCI); down by 9 points from the GCI ranking of 48 in the previous year. The high cost of energy, was the main reason identified for the poor competitiveness of Indian industry. In India, the cost of power has escalated three fold in the last ten years[35]. This probably explains why various new initiatives on improving energy efficiency have been taken recently.

(iv) *Wrong pricing policy and high subsidies*: Through cross subsidisation between different products oil PSUs (public sector units) tried to persuade targeted customers to switch from other competitive energy sources and to use more petroleum products. The main objective of cross subsidisation between products was to attain distributional equity and social welfare. In reality, it helped to popularise different petroleum products in the targeted markets. Between 1975-76 and 1989-90 subsidised HSD (high speed diesel) and kerosene consumption increased by 300 % and 250 % respectively. The Kerosene subsidy was mainly given to the poorer section of the population[36]. In September 1997, the government announced its intension to dismantle Administrative Pricing Mechanism (APM) in phased manner. It was decided that April, 2002 it would be fully dismantled and prices of petroleum products would be determined on the basis of import parity system. The APM- a complicated pricing formula had two important components: 'retention' and cross subsidization'. The 'retention concept' (a variant of the World Bank suggested 'cost plus' pricing model introduced to Shipping Corporation of India in the early 1970s) was introduced to crude and petroleum products pricing system in 1976. Accordingly, the price of indigenous crude was based on operating cost plus 15 % post tax return on capital employed. And oil refineries and marketing companies calculated the price of their products on the basis of operating cost plus 12 % post tax on net worth. Natural gas was kept out of this pricing mechanism

The other important component of APM is 'cross subsidization mechanism' which has enabled the Indian oil industry to establish its dominance in the energy sector in the last few decades. Cross subsidized petroleum products competed with other energy sources like coal, and penetrated into their domain. Thus low priced kerosene has replaced vegetable oil and coal for illuminating lamps and cooking respectively. Subsidized LPG has become an essential household fuel making coal gas uncompetitive, long distance trucks fed with cheap diesel easily competed with the railways in freight movement and subsidized naphtha made the indigenous coal technology unviable for fertilizer production. This pricing policy backed with elaborate distribution system has made the entire economy almost completely dependent on petroleum products. The 'retention concept' on the other hand did not allow the public sector oil companies to become sick. Thus investors' (mainly multilateral funding agencies like World Bank, ADB etc.) funds were safe[37].

In April, 2002, the Government of India dismantled the Administered Pricing Mechanism (APM). Domestic price of petroleum products has been linked to global price fluctuations ('import parity'). But the government continues with the controlling mechanism through exercising various fiscal measures like taxes and subsidies. As of January 2006, subsidies on PDS kerosene (distributed through public distribution system) and domestic LPG rose to $ 3.33 billion and $ 2.44 billion[38]. In 2003/04, central subsidy on petroleum products was $ 1.44 billion. This was a 26 % increase from the previous year. Under pressure from diesel lobby, in February 2007, the price of diesel has been reduced by cutting excise duty on diesel. (1 US$ is approx 45 INR)

Subsidies on both kerosene and LPG do not target a specific segment of the population. According to Census 2001, biomass accounts for about 90 % of the total primary fuel consumption for cooking in rural areas. LPG is the primary fuel consumed by the urban households. While traditional fuels are also consumed in these areas, their usage is restricted to the lowest expenditure classes. Subsidies have not been able to change the pattern of consumption in rural areas, and the dominance of traditional fuels still continues. Subsidized kerosene is used by rural households to meet their lighting needs. The consumption pattern of LPG is highly skewed towards the higher expenditure classes in the rural areas. Even in the urban areas, LPG consumption increases significantly with the increase in income but the quantities consumed are much larger, and therefore, the subsidy benefits in urban areas are also much larger. It has been observed that 76 % of the LPG subsidy goes to urban areas with 25 % of total population. Nearly 40 % of the LPG subsidy is enjoyed by the top 6.75 % of the population. TERI estimated that around 26 % of the total kerosene consumed in the coun-

35. Energy Saving Potential in Indian Industry, Survey of Energy Consumption in India – 2006 p.77

36. Dey, 1999

37. Dey D 2001

38. GoI,2006

try could not be accounted for[39]. It is believed that the kerosene that is siphoned off is used for adulterating diesel, used as a transportation fuel, and in pump sets /gensets in rural areas. A key reason for adulteration is the price difference between diesel and kerosene. At present diesel is priced at $ 0.68/litres[40] and PDS kerosene is priced at just $ 0.20/litre. This differential is a big incentive for retail sellers to adulterate[41].

(iv) *Wrong priority on road transportation*: In 1950-51, railways accounted for 89 percent of total freight movement which fell to 66 percent in 1970-71 and further to 46 percent in 1988-89. Contrary to this, freight movement by road went up from below 30 % of total freight in 1970 to 54 % in 1988-89. Most importantly, 88 % of the total diesel consumption in India in 1986-87 for freight haulage was utilized by trucks in carrying 59 % of the total diesel hauled freight. The railways in the same year, accounted for only 12 percent of total diesel consumption to move 41 percent of total diesel freight. This clearly indicates the relative energy efficiency of rail movement. But, transportation through road had overtaken the railways mainly because of the availability of cheap diesel[42]. The share of railways in total tonne kilometer of goods traffic came down from 70 % in 1970-71 to 39 % in 2003-04. Had the railway carried 70 percent of the goods traffic, it would have carried 300 btkm of additional traffic. Assuming that Railways using diesel would have carried all of this goods traffic, the diesel saved in year 2003-04 is around 5 MMT (million metric ton) out of a total consumption of 40 MMT in the country that year. Thus a significant saving of diesel is possible, if railways operations can be upgraded to win back the haulage lost to road traffic[43].

In 1980, the *National Transport Policy Committee* recognised the cost and energy efficiencies of the rail mode and recommended measures to increase its share in total traffic. However, the road mode in India had continued to grow at the expense of the rail mode. The national modal split between rail and road (in percentage terms) in 2000-01 is estimated at 26:74 for freight movement and 18:82 for passenger movement. The shares of rail are projected to decline still further. Between 1970 and 2002, negligible kilometres were added to the railway system, while the highways and vehicles grew by over 125 %[44]. The massive 'The Golden Quadrilateral' highway project is a case in point. Golden Quadrilateral is a major initiative in this road to progress initiative. Dedicated to the nation in December 2003 (pre-poned by a whole year) this mammoth project has given a major fillip to the quest for connectivity. Combined with the North-South, East-West corridors (completion in December 2007) the project, christened the National Highways Development Project (NHDP) will extend 13,151 km[45]. Studies have also revealed that for almost all green house gases, rail exhibited a lower emission rate. Moreover, rail movement is safer compared to movement by road where incidence of accidents are much higher[46].

(v) *Easy availability of energy sources*: In addition to the easy availability of petroleum products due to wrong pricing and subsidy policy, other factors like power theft (Ref to India's Corruption Perception Index: 2005; 2.9, Rank 88, CPI 2004; 2.8, Rank 90)[47], illegal mining, high percentage of disguised unemployed people in the rural economy and usage of more fertilizer in cultivation, allowed the availability of electrical power, coal, fire wood and dung cakes at a lower rate than the market price. This acted as a disincentive to the consumers both domestic and industrial to make any investment in energy saving technology.

(a) Power theft: According to the Planning Commission figures, the transmission and distribution losses in the State Electricity Boards (SEBs) have grown over time, from 21 % in 1992-93 to about 28 % in 2004-05. The practice of the SEBs in later years was to hide the T&D losses under agriculture and irrigation supplies, which are subsidized[48]. The Electricity Act 2003 has introduced the term ATC loss (aggregate technical and commercial loss) which also includes loss due to pilferage. Recent data indicates that the ATC losses of few SEBs were as high as over 70 %. The average ATC losses to the SEBs were around 50 %. This indicates the extent to which pilferage takes place in India[49]. Distinguished scientist and parliamentarian Raja Ramanna said in an interview that "politicians have ignored power thefts in their constituencies because they feared to take action that could affect their votes". Voluntary groups like the Pune-based PRAYAS have also pointed to high-level collusion involving big industrialists and politicians, leaving utility managers helpless to prevent large-scale thefts for fear of vindictive action. Independent studies of the phenomenon of large-scale theft have shown that the perpetrators tend to be well-to-do citizens who maintain air conditioned homes rather than poor people who live in the slums and may tap power off overhead cables to light up their shanties. India has the reputation of having the highest transmission and distribution losses in the world, ranking above the Dominican Republic with its 38 percent losses, Burma 36 percent and Bangladesh at 33 percent[50]. There are no hard figures, but the best estimate is that somewhere between a third and half of the country's electricity supply is unpaid for. No other country suffers revenue losses on this scale. In China, Asia's other emerging economic giant, no more than 3 % of the nation's power supply is lost to theft[51]. The commercial loss of India's SEBs' has gone up from

39. In a recent study NCAER (National Council of Applied Economic Research) has put this figure at 40 %.

40. Delhi prices (as on 20September 2005) Source: www.iocl.com accessed on 20 September 2005.

41. Mishra et al ,2005

42. Dey,1999

43. Planning Commission, 2005

44. Dey,2006

45. Dey,2006

46. ibid

47. Transparency International Corruption Perception Index 2005, *CPI score relates to perceptions of the degree of corruption as seen by business people and country analysts. It ranges between 10 (highly clean) and 0 (highly corrupt).

48. The agricultural sector is being wrongly blamed for large subsidies(see end note). As its supply is largely un-metered, it is easy to pass off theft and other losses as agricultural consumption. It may be mentioned that upto 1974-75, irrigation pump sets were also metered. Un-metered supply introduces distortions as it allows pilferage and does not promote efficiency. The rate of electricity for agriculture needs to be pegged lower than the average rate of electricity as agricultural sector is given off-peak power, generating much needed base demand on the system. http://www.eefi.org/final%20interim%20report.pdf.

49. The Electricity Sector: A Note, http://www.eefi.org/final%20interim%20report.pdf.

50. Devraj, 2004

51. Mark 2006

$ 5.01 billion in 2004-05 to $ 5.02 billion in 2005-06[52] (1 US$ is approx. 45 INR).

(b) Coal: India has a fairly good reserve of coal which is distributed all over the country. Commercial exploitation of coal was started almost two hundred years ago. Hundreds of such abandoned mines have become the hunting grounds of coal mafias who, in collaboration with local administration, run an illegal and highly risky coal mining activity. News papers occasionally reports on the death of poor miners due to explosions, flooding, roof collapse etc.[53] Official coal supply statistics is an underestimation of actual supply of coal. Illegally mined coal is always cheaper.

(c) Fire woods: The total fire wood consumption in 1970 was 2,345 Petajoules By 1990; the figure reached 3,210 Petajoules and is projected to reach 5,722 Petajoules in 2010[54]. The opportunity and health cost of collecting and using fire wood as fuel has been estimated to be $ 6.64 billion using a wage rate(in 2004-05) of $ 1.33 per day[55], the actual opportunity cost of collecting fire wood could be less due to the presence of large number of disguised unemployed persons.

(d) The total consumption of crop residue and animal dung as fuel has also increased in the above period. The corresponding figures in Petajoules are: 1,286; 1,568; 1,764; 3,101[56].The main reason for this could be increased availability of crop residue due to increased production of food grains. And in this 'green revolution' phase of cultivation, chemical fertilizer had replaced organic manures. This has definitely reduced the opportunity cost of animal dung. It was available in huge quantities for consumption as fuel. With the increased demand for organic manures in cultivation, the opportunity cost of animal dung as a primary fuel is likely to increase in the future[57].

Future challenges and Few Recommendations

The analysis indicates that initiatives, including the most current ones, are mostly aimed at increasing the energy efficiency of the sectors which use modern form of energy. However the presence of traditional form of energy (including animal and human) is still substantial. No effective measure has been taken to improve the efficiency of traditional form of energy system. Given the existence of a dual energy economy where there exists a very clear division between urban and rural energy usage, the energy planners faces an uphill task to improve the efficiency of the traditional energy usage and simultaneously increase the supply of modern form of energy to billions of energy starved population.

Second, the most formidable challenge would be to curb the non essential energy demand in the urban sector. For example, as developed countries are taking measures to restrict the usage of automobiles the global automobile industry is focusing their attentions to India with active support from the Government. India is being considered as a potential global automobile manufacturing and export hub (refer to the 10-year Automotive Mission Plan)[58]. Initiatives have been taken to produce smaller cars suitable for congested Indian lanes. The controversial small car project initiated by the Tatas (one of the largest business groups in India) in West Bengal is a case in point. All these would increase the future demand for energy. Again, to solve the increased demand for energy, construction of large scale nuclear plants (instead of cheaper energy options) have been suggested in the name of restricting carbon emission. It is heartening to note that already different civil societies and common citizens have started protesting against this kind of initiatives and the government is also trying to find the solution in new and renewable energy sources. India is one of the few countries which has separate ministry to look after the renewable energy sources. The Ministry of Non Conventional Energy Sources which has a very poor performance record, has been renamed (with effect from October 2006), as the Ministry of New and Renewable Energy. After a long wait, India's energy planners might have found their proper direction.

RECOMMENDATIONS

(i) Change in the Electricity Act, 2003: To control AT&C losses, the Report of the Expert Committee on Integrated Energy Policy [59] recommends that the existing Accelerated Power Development and Reform Programme (APDRP) be restructured to ensure energy flow auditing at the distribution transformer level. The revised APDRP should provide performance linked incentives to State Electricity Boards (SEBs). It should also include incentives to staff for reduction in AT&C losses.

(ii) Redeployment of subsidies: subsidy schemes should be devised targeting the specific group/sector only.

(iii) Proper pricing of energy sources: The price of the energy sources should reflect the scarcity value and social costs. All subsidy elements should be kept out of the pricing model Subsidies may be provided to the target group (say families with less than subsistence level of income or small scale manufacturers catering to a priority sector) in the form of 'energy voucher'.

(iv) The experience of the failure of the Indian Eco-labelling program (managed by the bureaucrats) vis a vis the success of the 'Green Rating project' initiated and managed by CSE –a NGO— highlights the importance of 'passion' and 'involvement' required to make such schemes acceptable to different stake holders). For handling projects like energy efficiency level, BEE should rely more on NGO which are not nudged into line with grant and assistance from 'foundations'[60] managed by mega corporations.

52. The Economic Times, 28.2.2006

53. see report on 'Illegal mining caused cave-in', The Times of India, 17.1.07

54. Mitra, 2003

55. A study based on an integrated survey by Parikh et al, 2005 as quoted in the India Development Report (2004-05) covering 15,293 rural households from 148 villages estimated the total economic burden comprising of the opportunity cost of gathering fuel, loss of wages due to illness caused by the 'dirty' fuel and cost of associated medical services of the biomass fuel.

56. Mitra, 2003

57. ibid

58. CSE Press release December, 19, 2006. See CSE website.

59.Planning Commission, 2006

60.Roelofs 2003

Conclusion

India – an energy starved developing country with very high dependence on imported petroleum crude, has failed to take any serious initiative towards conservation of energy. Easy availability, faulty pricing and subsidy policy, limited competitive pressure on industry are some of the possible reasons behind such lacklustre attitude of the major stake holders. Increased competitive pressure after the opening up of the economy and steep rise in the price of petroleum products in the recent past has elevated the importance of energy management. Few initiatives in the form of establishing a nodal institution in BEE to improve energy efficiency of different sectors of the economy have been taken. To make it more effective and accountable, BEE may be made an autonomous institution and encouraged to involve more NGOs from inception to implementation stages of different programs it undertakes.

Annex I: CSE's Green Rating Project (GRP)

Centre for Science and Environment (CSE) a Delhi based NGO initiated their Green Rating Project (GRP) in 1997 to present a market oriented framework by which environmental impacts of industrialization could be monitored and influenced. CSE's green rating project is a civil society initiative to develop an alternative form of governance to control industrial pollution in India. It collects information on the environmental performance of industries, rates them using scientific methodology and puts them in the public domain to put pressure on the polluting industries. To avoid embarrassment, industries are taking proactive action voluntarily to improve their environmental performance. A study by the Delhi School of Economics showed that companies rated poorly by GRP suffered in the share market[61]. In 1999, the first industry that CSE had chosen for rating under GRP was pulp and paper industry. Then in 2001, CSE rated the Indian automobile industry. It was followed by the rating of the Indian Caustic Chlorine Industry in 2002. In 2003, CSE rated the cement industry and in 2004 they re-rated the pulp and paper industry again. For GRP, CSE uses different environmental (including energy) parameters which are assigned with some points. The total points add up to 100. Any firm scoring less than 50 is disqualified for rating. And firms scoring 50-60 are awarded with one leaf rating (the lowest grade). Firms scoring between 60-70, 70-80, 80-90, 90-100 are awarded with two, three, four and five leafs respectively[62].

When pulp and paper industry was re-rated in 2004, after a gap of five years, the result showed striking improvement. For examples, in 1999 only one company had a clearly documented environmental policy and by 2004 the numbers of such firms reached to sixteen and twenty five companies which participated in the rating process, had a separate environment department in their organization in 2004. The average water consumption of mills during the first rating was 200 tones per ton of paper produced which came down to 135 tones in 2004. At least one company of the industry totally eliminated the use of toxic chloride during that period and others have cut down their consumption from 65 tones of chlorine used for each ton of bleached pulp to 40 tones by 2002. After the publication of the report on Caustic Chloride industry rating, the concerned industry had put pressure on the government to offer tax incentives to those firms which avoided using mercury and instead opted for cleaner technology for chlorine. Due to CSE's sustained campaign, government had to frame a strict guideline to phase out mercury by 2012[63].

These improvement got reflected in the ratings also. In 2004 six companies were eligible to receive three leafs rating as compared to only three companies in 1999[64]. Asia Week judged CSE's GRP as the best green audit project in the Asia during the last twenty-five years[65].

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Glossary

Abbreviations

ATC	Aggregate Technical and Commercial
GOI	Government of India
INR	Indian Rupees
koe	Kg. of Oil Equivalent
MTOE	Million Tone of Oil Equivalent

Conversion Factors

1 Bk Wh Hydro or Wind Electricity	0.0866 MTOE

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