

(1997) INDIA

REPORT ON INDIA ENERGY SCENE By Sujay Basu

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1. Introduction

India being one of the fastest growing economies in the world has a fast growing energy demand fueled by an ever increasing rate of industrialisation and urbanisation. And India should urgently increase investments in the energy sector because economic growth has to take place at an expected level of over 6% per annum for planned development. There has been a global interest in India's energy sector ever since the process of liberalisation to invite foreign investment was initiated by the Government of India in 1991. India's enormous potential for energy production and consumption has enhanced investment prospects in this field. Opportunities have widened rapidly with the opening up of this area to power developers globally. On the other hand there are related apprehensions being voiced by several NGOs relating to the inevitable increase of environmental problems including population displacements. Future expansion in energy sector would depend on the emergence of appropriate capital markets. This is true for new production capacity, both conventional and renewable, as well as measures directed at improving energy efficiency in various user sections and in the energy sector itself. India is still in the process of evolving a sustainable and equitable energy policy for itself.

2. Energy Intensity

The Indian economy characterised largely as an agrarian economy is presently going through a transition towards industrialisation and commercialisation. The energy intensity defined as energy consumption per unit of GNP is shown below:

Table-1: Energy intensity over five years

Year	1990-91	1991-92	1992-93	1993-94	1994-95
Energy consumption (MTOE)	189.17	199.97	206.83	212.72	219.24
GNP (billion Rs.)	2084.8	2096.2	2201.1	2300.8	2456.0
Energy intensity (MTOE/ b Rs.)	0.0907	0.0954	0.0940	0.0925	0.0893

source: (i) Economic Survey, GOI (ii) India's Energy Sector, CMIE

There is a marginal fall in energy-GNP ratio and the downward trend is most likely to continue. In some areas of the industrial sector improvements have been witnessed, but, the production of energy-intensive raw materials like steel and aluminium is on the increase and larger volumes have been exported for earning foreign exchange. The shift of energy-intensive raw material production from developed to developing countries is also affecting India's energy-GNP ratio.

Although traditional energy fuels are estimated to account for over 50% of the total final energy consumption in the country, the available information is very sparse. It is for this reason alone that information presented on energy supply does not cover the traditional sources of energy.

The industrial sector continues to be the single largest commercial energy consuming sector using up about 50% of the total commercial energy in the country, although its share is declining gradually. Indian industry is highly energy-intensive and its energy-GDP elasticity is around 1.5 compared to less than unity for the developed nations. But its commercial energy-intensity has also declined over the past due largely to a relatively rapid expansion of non-energy-intensive industries, adoption of modern energy efficient technologies and successful implementation of energy conservation measures. Sufficient energy savings are being achieved in energy intensive aluminium, iron & steel, textiles, chemicals and paper & pulp industries through better house-keeping, improved capacity utilisation, development of cogeneration facilities, industrial heat & waste management and arrangements for improving the quality of electric supply.

Transport infrastructure has expanded considerably and its energy-intensity has grown gradually. Rapid urbanisation along with the conglomeration of industrial and commercial activities has consequently increased the transport demand. Uncontrolled expansion of cities coupled with inadequate public transport has contributed to a phenomenal growth in the number of mechanised energy-intensive private modes leading to energy inefficiency and severe pollution problem.

The domestic sector is the largest consumer of energy in India accounting for 40-50% of the total energy consumption but the bulk of it consists of traditional fuels in the rural household. Rapid urbanisation and diverse urban growth patterns involved many basic structural changes in the economy that have important ramifications for energy use. Growth in income is leading to an increased demand for energy - particularly electricity end use - and energy-intensive products and services. The increased per capita energy use is a consequence. The growing demand for modern household fuels such as LPG and kerosene adds greatly to the already burden on scarce resources of capital and foreign exchange.

The commercial sector is not a major energy consumer. Its energy-intensity has however increased from 0.548 MTOE per hundred billion rupees in 1991-92 to 0.55 in 1992-93 and 0.58 in 1993-94 (all at 1980-81 prices). It is possibly due to the growth of the commercial sector and the increased requirement of energy by the sector. It is also probable that the increased use of gensets over the last few years has resulted in slightly higher energy intensities since efficiency of electricity use is higher than that of oil products and coal/soft coke.

3. Commercial Energy Supply

The primary commercial energy in India has experienced a relatively slow growth in the 1990-95 period from 189.17 to 219.24 MTOE or an annual average growth rate of only 3.2%. The table below gives the figures:

Table-2: Primary sources of commercial energy (MTOE)
[The figure in parentheses shows the % share]

Year	Lignite	Coal	Oil	N. gas	Hydro	Nuclear	Total
1990-91	6.91 (3.65)	106.63 (56.37)	53.73 (28.40)	15.42 (8.15)	5.96 (3.15)	0.52 (0.28)	189.17 (100)
1991-92	7.83 (3.91)	115.29 (57.65)	54.37 (27.19)	15.98 (7.99)	6.05 (3.03)	0.46 (0.23)	199.97 (100)
1992-93	8.14 (3.94)	119.86 (58.05)	56.37 (27.25)	15.98 (7.73)	5.82 (2.82)	0.46 (0.22)	206.83 (100)
1993-94	8.87 (4.17)	124.02 (58.30)	57.52 (27.04)	15.98 (7.51)	5.86 (2.76)	0.46 (0.22)	212.72 (100)
1994-95	9.41 (4.29)	128.52 (58.62)	58.00 (26.45)	15.98 (7.29)	6.88 (3.10)	0.46 (0.21)	219.24 (100)

It is evident that the share of coal and lignite has increased marginally while that of oil & gas has a likewise decline. There is hardly any effect of the slight changes in hydro & nuclear - their share is around 3.25%. Coal & Lignite thus account for nearly 63% of total primary energy. Production has increased from 211.73 MT in 1990-91 to 253.81 MT in 1994-95. The gross reserve of coal is 200 BT of which one-third or about 70 BT will be economically recoverable. The electric power stations consume nearly 65% of the product and steel industry roughly 15%. Cement & Brick industry is the other major consumer. The production of coal is required to be increased to reduce the pressure on oil but the low productivity (0.55 Tonne output per man-shift) and the lack of mechanisation for want of investment has considerably impeded the production rise. Government of India has just (February, 1997) announced de-nationalisation of the coal industry after 25 years of nationalisation experience to invite private investment. An increase in productivity is expected. Oil and gas together provide nearly 34% of the total primary energy. The domestic production being inadequate, nearly 40% of the country's consumption is imported. The table below gives the volume of import and production of crude:

Table-3: Crude oil: import and production (MT)

Year	Import	Production	Total
1990-91	20.70	33.02	53.72
1991-92	23.99	30.35	54.34
1992-93	29.25	26.95	56.20
1993-94	30.82	27.03	57.85
1994-95	27.35	31.23	59.58

source:CMIE

(India also exports small amount of oil to neighboring countries)

The production of oil is picking up after a fall in 1992-93 due to ethnic troubles in the oil field region in eastern India. The country's self sufficiency in oil had declined considerably from the mid-eighties when it reached 70%. The domestic refinery capacity is insufficient and

petroleum products like kerosene, diesel and LPG are imported. The recent years are witnessing a phenomenal growth in automobiles (around 24%) and the fast increasing traffic on city roads is resulting in slow movements and high pollution. All the international automobile giants are now targeting India. The disproportionate demand of the middle distillates is being discouraged, with little effect, through hiking of petroleum prices. The price structure is administered by the government for providing heavy subsidies to kerosene used extensively by rural people for lighting and cooking and diesel for mass transport and agriculture. The oil import bill is becoming uncomfortably high - it was US \$ 5 billion last year. With increasing demand and rise in international oil price it may shoot to US \$ 10 billion per year within 2/3 years. The estimated demand is variously placed between 94 to 120 MT in 2000-01. Oil conservation efforts are there but the impact is not very significant. The total oil reserve in the country now stands at 765 MT only. Oil production has been privatised but the expected growth is yet to be seen. Decontrol of prices by withdrawing the administered price mechanism is also being considered to curb both demand and import.

Natural gas production had both fall and rise in the first half of the nineties and was around 20 BCM. The country's estimated reserve is 707 BCM. Compressed natural gas and also a mixture of petrol and alcohol ('gasohol') are being tried in vehicles on a purely experimental basis to reduce pollution in cities.

The electric power situation in the country appears dismal. The annual growth rate in the eighties was more than 7% but it has declined to 5% in the nineties. The installed capacity is shown in the table:

Table-4: Electricity generation - Installed capacity (MW)

Year	Hydel	Thermal	Nuclear	Total
1990-91	18,753	45,768	1565	66,086
1991-92	19,194	48,086	1785	69,065
1992-93	19,574	50,749	2005	72,330
1993-94	20,366	54,347	2005	76,718
1994-95	20,829 (25.67%)	58,110 (71.60%)	2225 (2.74%)	81,164 (100)%

In the 8th Five Year Plan (1992-97) the capacity addition has been only 18,000 MW against a downsized target of 26,000 MW. There is shortage both in peak power and also in energy reaching 23% and 7% respectively last year. The demand in evening peak hours can not be met because of low hydro installation - its share steadily falling over the years. The next plan has a priority on hydel. The Central and State sectors are failing to secure loans from international funding agencies, because of their financial weaknesses - the State Electricity Boards incurring heavy losses for almost free distribution to agricultural loads and Central Sector (accounting for more than 30% of installation) failing to collect payments from SEBs for the electricity sold. The government's invitation to foreign investors on very liberal terms has not met good response. Electrification of villages has been taken up through the creation of Rural Electrification Corporation in 1969 and by end 1995 more than 85% of the 0.579 million villages has been electrified. But only 30% of rural households have electricity connection. The demand for electricity is estimated to grow at an annual average rate of 8.3% upto 2010-11 with domestic sector's highest rate of 12.8%, agriculture's 12%, commercial's 9.8% and industry's 6.7%. Industrial electricity consumption has declined over the years to current 40%.

The country has a large hydroelectric potential estimated at 84,000 MW at 60% load factor. Less than one-fourth of that has been tapped. Large hydro projects are also being stiffly opposed by environmentalists all over the country. Nuclear power is again being encouraged by the government with invitation of full ownership of nuclear plants to other countries and Russia is showing interest to set up a 1000 MW plant in the South. Electrical energy conservation measures are being adapted and energy audit is being enforced. However, independent experts are of the opinion that the power scene will not brighten up unless the government expresses a strong political will.

Renewable energy, the only sustainable form of energy in this country blessed with abundant sunshine, has started receiving attention. The fund allocation in this field, after the Department of Nonconventional Energy Sources (DNES) got elevated to a Ministry (MNES) in 1992, is as follows:

Table-5: Energy Sector Outlay (Million Rs.)

Year	Power	Petroleum	Coal&Lignite	Nonconv.	Total
1993-94	62.8	106.6	24.2	2.0	195.6
1994-95	70.5	105.1	25.4	2.5	203.5
1995-96 (estimate)	74.0 (36.5%)	106.2 (52.4%)	18.5 (9.1%)	4.0 (2.0%)	202.7 (100%)

The Plan funding for Nonconventional Energy Sources has been around 0.1% of total Plan expenditure in the 6th Plan (1980-85) and 0.3% in both 7th Plan (1985-90) and 8th Plan (1992-97). While the 7th Plan had a target of 200 MW of electricity from renewable sources the next Plan set it at 2000 MW of which about 1200 MW has been achieved. The estimated potential of renewable energy sources and the progress in harnessing these upto September, 1995 are given in table:

Table-6: Renewable energy sources and installations in India

Source	Potential	Harnessed
Biogas plants	12 million nos.	2.2 million nos.
Biomass	17,000 MW	38 MW
Improved cookstoves	120 million nos.	20.1 million nos.
Solar energy	5×10^{15} KWh/yr	825 KWp (solar PV) 0.3 million m ² (solar thermal)
Small hydro	10,000 MW	122 MW
Wind energy	20,000 MW	557 MW
Ocean thermal	50,000 MW	-
Sea Wave	20,000 MW	-
Tidal	9,000 MW	-

source: MNES

For sustainability in the area of energy supply the following policy changes are desired :

1. Dependence on imported oil should be decreased through effective oil conservation programmes and inter-fuel substitution. Public mass transport systems should be improved in every possible way to discourage energy-intensive private modes of transport. Railway transportation should, both passenger and goods, be improved and encouraged through attractive fare structures. Administered price mechanism should be withdrawn.

2. Coal production is to be increased through mechanisation. Benefaction of coal is to be taken up and clean coal technologies including coal gasification are to be adopted. Privatisation of coal industry is also welcome.

3. Rural energy supply should receive priority for overall improvement of rural economy. Rural electrification programmes have failed to achieve the desired results. Energy supply through integration of renewable energy sources in an effective manner is to be worked out by the experts and implemented by local bodies to ensure better participation of people. Both conventional and nonconventional sources are to be used for the time being, whenever conventional sources are available and a judicious mix of the two should be promoted.

4. Renewable energy should be allotted a higher share of the total allocation of power starting with 10% with the Ninth Plan and increasing appropriately from the next Plans. A separate Solar Energy Commission is to be created in line with Atomic Energy Commission with identical terms of reference to adopt Solar energy to the maximum possible extent in every sector of consumption.

5. Massive education awareness programmes for people in every walk of life for efficient utilisation of energy through supply and demand management. Everybody is to be informed that energy is a really precious commodity.