INDIA'S ENERGY CRISIS AND SECURITY: THE CHALLENGE HEAD FOR SUSTAINABILITY

Sneh Gangwar*

Abstract

Energy is an essential need for human existence besides national development. For many years in past, per capita energy consumption was in use as an index to measure the health of economic condition of a nation. Recently, the cost of the energy as a share of GNP is considered a better norm. Therefore, this is more widely used in measuring the energy efficiency of a nation. India is a developing country facing the critical challenge of meeting its rapidly increasing demand for energy. With over billion people, India ranks sixth in the world in terms of energy demand. Its economy is projected to grow seven to eight percent over the next two decades, spurring a substantial increase in demand for oil to fuel land, sea, and air transportation. Lack of energy supply and interruption in energy supply is causing serious financial, economic and social losses. Energy must be available at all times, in sufficient quantities and at affordable prices, to support the goals of sustainable development. So there is an urgent need to thing about the energy security for India's future sustainable development.

Key words: Energy, Distribution, Potential, Demand, Crisis, Security, Sustainable Development

* Assistant Professor, Aditi Mahavidyalaya, University of Delhi

Introduction

Energy is a vital input for economy and social development in our society. Presently, the global primary energy needs are met largely from oil, natural gas, coal, nuclear energy and hydro electric. In some of the developing countries, various other fuels, such as, wood and animal wastes are also used for meeting the energy requirement. It however, appears that there will not be adequate supplies from the existing energy resources if the earth's population keep on increasing at its present rates.

Objective and Methodology

The main objective of the paper is to give a snapshot of energy resource of India and to provide a vision about the energy crisis and security for India's sustainable energy efficient scenario. The paper is based on the secondary data and sources collected from Ministries, Department, Institutions, Library and newspapers.

Energy resource of India

Coal and hydroelectric power resources are the mainstay for India's primary resource support for secondary energy purposes. Oil and natural gas resources of the country are limited. Within a proved amount in place of 1,652 million tonnes, the amount of proved recoverable reserves in 2005 was 786 million tonnes, of which 410 million tonnes is located offshore. Onshore reserves have risen by 13.3 percent from 332 million tonnes to 376 million tonnes, whereas offshore reserves have remained virtually unchanged. Oil account for about one third of India's commercial energy consumption, and its share has been growing gradually in recent years. Nuclear resources on the other hand, are modest. The coal resources are of poor quality having high ash content. India is the world's third largest producer of coal. Chhattisgarh, Jharkhand, Orissa and West Bengal together account for about 77 percent of india's coal reserve. Besides, the distribution of the primary resources in the various regions is rather skewed. While the eastern region accounts for 70 percent of the total coal resource, the western region accounts for over 70 percent of the hydrocarbon reserves, and over 70 percent of the total hydro potential of the country is concentrated in the northern and north eastern region of India. The southern region which has only 6 percent of the total coal reserves and 10 percent of the hydroelectric potential, possesses most of the lignite deposits, tidal energy and ocean currents wave energy of the country (Table 1).

Table 1: Primary Commercial Energy Resources

Regional	Coal (BMT)	Lignite (BMT)	Crude oil (MMT)	Natural Gas (BCM)	Hydro Electricity	
					Capacity (x) MW	Energy TWh
Northern	1.1	1.1	-	4	30135	225.00
Western	48.2	0.5	584	497	5679	31.40
Southern	13.1	25.9	-	-	10763	61.80
Eastern	141.4	-	-	-	5590	42.50
North-	0.9	-	148	159	31857	239.30
All India	204.7	27.5	732	660	84044	600.00

Source: Planning Commission, Government of India

Notes: BMT- Billion Metric Tonnes; MMT- Million Metric Tonnes; BCM- Billion Cubic Meter

According to an estimate India has a non-conventional energy potential of 195,000 MW. Wind energy generation in India was started in 1950. At present there are over 400 wind pump sets generating wind energy. The largest wind farm of Asia is located in Gujarat (920 MW capacity). Tamilnadu has the largest installed capacity in the country in Muppandai-Erungudi near Kanyakumari (320 MW). As India is located near the Tropic of Cancer passes through the central part of the country. Most part of the country has over 300 clear sunny days in year. India receives a good level of solar radiation, energy equivalent of 5000 trillion KWh/year. The solar energy programme, implemented by MNRE, one of the largest in the world, plans to utilize India's estimated solar power potential of 20 MW/km^2, and 35 MW/km^2 solar thermals. The country has also developed substantial manufacturing capabilities, becoming a lead producer in the developing world.

Other than this biomass energy (a clean and cheap energy) is available in India from agricultural and domestic garbage. Some important centres of bio energy production are Gausaba, Sunderban Island, Koonoor (Tamilnadu) and Tumkur (Karnataka). Ocean tides and waves both are very suitable energy for India, as India has 6100 km long coast line, but the favorable sites for tidal are in Gulf of Khambat, Gulf of Kutch and estuary of Hugli. Chennai has installed plant at Thiruvanantapuram which generates electricity through sea waves. The Indian Wave Energy Programme started in 1983 at the Indian Institute of Technology under the sponsorship of Indian Department of Ocean Development. West Himalayan range, Manikaran,

Narmada Son valley, Damodar Valley and western coast generates geothermal energy in India. It has been estimated by the Geological Survey of India that the geothermal potential is in the region of 10,000 MWe, widely distributed between seven geothermal provinces.

Energy Crisis and Future Vision

In the recent years, India's energy consumption has been increasing at one of the fastest rates in the world owing to population growth and economic development. Primary commercial energy demand grew at the rate of 6 percent between 1981 and 2001 (Planning Commercial, 2002). India ranks fifth in the world in terms of primary energy consumption, accounting for about 3.5 percent of the world commercial energy demand in the year 2003.

Figure 1: Figure and Fact about Energy Security:-

- **India is suffering from huge estimated shortage of nearly 10 percent in energy terms and almost 17 percent in peak demand.**
- **Less than 30 percent of India's population is able to use LPG for meeting its cooking energy needs.**
- **India's coal resources have been downgraded to provide secure access for just about 40 years.**
- **Climate change considerations are putting under more immediate and intense pressure to reduce dependence on coal.**
- **It is possible for Indian to drastically reduce its non cooking coal import needs while reducing its crude oil import level form 666 MT TO 260 MT.**
- **Substituting petrol and diesel driven vehicles with hybrid and battery operated vehicles is one of the key transformations that defines the GES scenario with respect to the oil sector.**

Despite the increasing dependency on commercial fuels, a sizable quantum of energy requirement (40 percent of the total energy requirement), especially in the rural households sector, is met by non-commercial energy sources, which includes fuelwood, crop residue, and animal waste, including human and draught animal power. However, other forms of commercial energy of a much higher quality and efficiency are steadily replacing the traditional energy resources being consumed in the rural sector. Resource augmentation and growth in the energy supply has not kept pace with the increasing demand and, therefore, India continues to face

serious energy shortage. This has led to increased reliance on imports to meet the energy demand (Table 2).

India's energy requirements met from traditional as well as modern forms of energy. The share of traditional forms of fuels is diminishing and 1996-97 these contributed to over 34 percent of the annual energy consumption. The usage is largely restricted to domestic fuels in semi-urban and rural areas at very low efficiencies.

Table 2: Trends in Indigenous Production of Total Commercial Primary Energy from 1953 to 1998

Coal	23.62	35.64	36.48	56.96	94.68	122.79	125.79
Lignite	-	0.01	0.81	1.23	3.34	5.04	5.20
Crude Oil	0.19	0.46	7.01	10.79	33.92	33.87	33.86
Natural Gas	-	-	0.60	1.41	11.73	20.05	24.70
Hydro Power	0.24	0.67	2.17	4.00	6.16	5.90	6.45
Nuclear Power	-	-	0.63	0.78	1.60	2.35	2.50
Wind Power	-	-	-	-	-	0.07	0.10
Total	24.05	36.78	47.67	75.19	151.43	190.30	198.60
Net Imorts	2.20	6.04	12.66	24.63	31.69	61.63	61.63
St. Changes	(-)0.24	2.87	0.69	3.80	5.37	2.38	2.38
Intl. Bunkers	(-)0.53	2.50	0.24	0.21	0.14	0.17	0.17
Total Commercial	25.48	39.45	59.40	95.81	117.61	249.38	262.7
Non-Commercial	64.13	74.38	86.72	108.48	122.07	127.51	127.5
Total Primary	**89.61**	**103.83**	**143.12**	**204.29**	**299.68**	**376.89**	**390.12**

Source: Planning Commission, Government of India

Total supply of energy (both for commercial and non commercial forms excluding draught animal power) increased from 89.6 mtoe in 1953-54 to about 377 mtoe in 1996-97. Share of non-commercial fuels declined from 74 percent in 1950-51 to about 34 percent in 1996-97 and 42 percent in 2010-11. Fuel wood continues to maintain its primacy in the non-commercial energy supply (largely in the household sector). Share of commercial energy in the final energy consumption increased from 28.4 percent to 71.9 percent during 1953 to 2010. While that of non-commercial energy sources has declined from 71.6 percent to 34.1 percent in same period. The long term demand for the end of Eleventh Five Year Plan (2011-12) has been

calculated. This demand corresponds to 6.5 percent growth rate of GDP during the Ninth Plan (1997-2002). 7.7 percent growth rate of GDP during the Tenth Plan (2002-07) and 8 percent growth rate of GDP during the Eleventh Five Year Plan. Table 3 gives the energy projection for the coming future of India.

Table 3: India's Energy Requirement from 1991 to 2021

Source	Unit	1991-92	1996-97	2009-10	2020-21
Electricity	TWH	231	336	725	1350
Coal	Mt	229	311	690	1400
Petroleum	Mt	57	91.2	16.5	335
Natural Gas	Bcum	18.6	30.2	65	130

Source: Planning Commission, Government of India

Various projections indicate that by 2013, India's energy requirements may increase to about 5 to 7 times that of 2001 levels. The integrated Energy Policy report brought out by the Planning Commission estimates that in an 8 percent GDP growth scenario. India's total commercial energy requirements would be in the range of 1514 mtoe to 1856 mtoe by 2013 under alternative scenarios. The Energy and Resources Institute estimate indicate that 8 percent GDP growth scenario commercial energy requirements would increases to about 2150 mtoe in year 2031. Coal is the mainstay of the Indian economy and its dominance is expected to continue even in the future under a Business-As-Usual scenario with coal consumption expected to increase by as much as 8 times from around 350 million tonnes to 2050 million tonnes during 2001 to 2013 as per TERI estimates. The electricity sector is especially heavily dependent on coal with 53 percent of the generation capacity being coal based. Petroleum consumption is also expected to increase rapidly, mainly on account of the transport sector, and is estimated to increase by around 8 times over the period 2001-2031.

Putting India's likely energy demand in 2031-32 in a global perspective, one sees that China's current energy consumption is 1100-1200 mtoe and USA's current consumption is 2400-2500 mtoe. In comparison, India consumed about 421 mtoe of commercial energy in 2007-08. With a projected population of just under 1.47 billion in 2031-32, India's per capita energy consumption will be marginally above China's current per capita consumption or be about one seventh of the current US per capita consumption. What this is means that India on per capita basis, currently consumes under 6 percent of what US consumes and under 41 percent of what China consumes and will, by 2031-32, consumes just under 15 percent of current US

consumption levels and equal China's current per capita consumption. The major issue of major concern that will dictate future courses of the sustainable energy supply is the population explosion. India touched a population of 1 billion on May 11, 2000, i.e. 16 percent of the world's population on 2.4 percentage of the globe's land area. If the current trend continues then India may overtake China in 2045, to become the most populous country of the world. It is estimated that by the year 2020, almost 50 percent of the population will be in the urban area. This simple means that by the year 2020, the urban population would have jumped from the present 310 million to over 1675 million and the rural population would have reduced from 675 million to 600 million. The major issue of concern, therefore, will be to ensure higher levels of electricity availability to the urban population. Since they will be able to afford to buy electricity, it will be an issue of electricity or energy availability to them. Out of 600,000 villages of India more than 85,000 villages are not electrified. Of these 18,000 villages may never be electrified from grid. It is estimated that about 500 million people in India are without access to commercial forms of energy. This reflects the situation of energy poverty in India (Table 4).

Table 4: Projection for the Electricity Requirement for India

Years	**Billion kWh**				**Projected Peak**		**Installed Capacity**	
	Total energy @GDP Growth		Energy required at @GDP Growth		@GDP Growth Rate		@ GDP Growth Rate	
	8%	9%	8%	9%	8%	9%	8%	9%
2003	633	633	592	592	89	89	131	131
2006	761	774	712	724	107	109	153	155
2011	1097	1167	1026	1091	158	168	220	233
2016	1524	1687	1425	1577	226	250	306	337
2021	2118	2438	1980	2280	323	372	425	488
2026	4866	3423	2680	3201	437	522	575	685
2031	3880	4806	3628	4493	592	733	778	960

Source: Geography and You, 2009

India's total primary energy consumption or energy consumption from all commercial sources, in the year 2010-12 was about 530 million tonnes of oil equivalent. This is equivalent to about 22 exa joules of total primary energy consumed. On per capita, per year basis this consumption is about 0.48 mtoe, which is quite low when compared to many other developed countries wherein it is 10 times more than India. Data on share of various energy sources as of 2011 shows that 90 percent of the primary energy comes from fossil fuels. Together with this the impact of the use of fossil fuel on climate change should be noted. Quality of a person in a

country is presented by Human Development Index having a value between zeros to one. The HDI incorporates parameter like literacy level, health condition and income level. The index of India is just above 0.54 which indicates below average quality of life. The HDI is strongly related to per capita energy consumption of a country in order to increase our index from current value of 0.54 to above 0.75 for an average quality of life our per capita energy consumption must increase from current level of 0.48 mtoe to about 2.0 mtoe.

The data says that 'NO' we are not energy secure, and we should remember that energy security of a country very strongly affects the national security.

Need for an Integrated and Multiple Energy Policy

Major initiatives undertaken by the government of India in terms of regional cooperation; integrated transport policy; development of environment friendly renewable sources including the hydro, and energy efficiency and conservation measures on supply and demand side can lead to sustainable energy supply in the country. The prime challenge before the country is to provide the minimum energy services to allow the poor people to achieve a decent standard of living. By 2020, which is also the target goal for the vision statement, the provision of modern energy services can be ensured either as a connection to a reliable, sustainable electricity grid supply, or as standalone electricity supply system. It is necessary that the Energy Vision 2020 focuses on the following three issues. First, overcome energy poverty wherever it occurs; second is to enhance the quality and reliability of delivered energy at affordable price; and third and last is to minimize the indicative environmental and health impacts of energy development.

"We are energy secure when we can supply lifeline energy to all our citizen irrespective of their ability to pay for it as well as meet their effective demand for safe and convenient energy to satisfy their various needs at competitive prices, at all times and with a prescribed confidence level considering shocks and disruption that can be reasonably expected"

-Integrated Energy Policy (2006)

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