

Trends of Production and Consumption of Energy as Per Conventional Sources in India

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ABSTRACT

India is the second most populous country in the world, with population 1210 million by census 2011. This causes substantial burden on the environment and on energy resources. Fossil fuels are the major sources of conventional energy. At present, many countries, including India are overly dependent on fossil fuels to meet their requirement for power. The known reserves of fossil fuels have depleted to a large extent due to its continued use and if it continues, there is risk of complete exhaustion of these sources of energy. The present paper is an attempt to study the pattern of production and consumption of chief conventional sources of energy in India from the year 2005-06 to 2013-14. Data for the purpose is taken from Energy Statistics-2015 published by the Central Statistics Office, Ministry of statistics and programme implementation. It is evident from the analysis of data that the production of Energy by primary Sources has increased by 3.28 % from the year 2005 to 2014. At the same time the Consumption of conventional energy in the country has risen from 15146 to 24071 Peta joules in this period showing an increase of 5.28%. This clearly reflects the demand–supply imbalance of energy and emphasizes on energy conservation.

Keywords: conservation, conventional source, energy, trends

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INTRODUCTION

India is one of the fastest growing countries in the world and the Indian economy has experienced remarkable economic growth over the last decade. Today, India is the ninth largest economy in the world, having a real GDP growth of 8.7%. This high degree of sustained economic growth is placing massive demand on its energy resources. Energy production and consumption are among the key inputs in attaining such growth. Energy sector in India is one of the most challenging sectors. Energy industry is considered as the primary driver of Indian economy as it is the major fuel for various industries like power sector, steel, chemical, fertilizers, paper, cement, transport and thousands of burgeoning Small and Medium Enterprises (SME) in

India. Energy is critical, directly or indirectly, in the entire process of evolution, growth and survival of all living beings and it plays a vital role in the socio-economic development and human welfare of a country. According to recent IBEF estimates this sector contributes about 64% of gross revenues of Government (both Central and State together) through Taxes and Duties. The energy sector comprises of oil, natural gas, coal, petroleum, refined products, electricity and others. The empirical literature for electricity consumption and economic growth relationship is analyzed in detail in the studies of Ozturk and Payne [1, 2].

Besides this, the growing population also adding substantial burden on the environment and on energy resources.

Fossil fuels are the major sources of conventional energy. At present, many countries, including India are overly dependent on fossil fuels to meet their requirement for power. The known reserves of fossil fuels have depleted to a large extent due to its continued use and if it continues, there is risk of complete exhaustion of these sources of energy. Studies have shown that there is a huge gap in the production and consumption of energy in the country [3, 4]. The demand and supply imbalance in energy is pervasive across all sources requiring serious efforts by Government of India to augment energy supplies as India faces possible severe energy supply constraints.

Offshore Research and consultant firm Zinnov reported that the supply is not expected to catch up with the demand in near future or even later. With the supply demand gap widening there would be tremendous opportunities for all global and local investors and meet these challenges. The present paper is an attempt to study the trends of production and consumption of conventional sources and energy in India for a period of one decade.

OBJECTIVES

- (1) To study the trends in production and consumption of conventional energy in India from 2005 to 2014.
- (2) To access the production and consumption of various sources of conventional energy for the same period.

Methodology:

India's energy bin has an assortment of all the resources available including renewables. India's coal dependence is borne out from the fact that 54 % of the total installed electricity generation capacity is coal based.⁶

For the purpose of the study we have resorted to various issues of Energy Statistics for data on energy production, consumption and primary sources of energy. Last nine years of data (2005-06 to 2013-14) on both production and consumption and conventional sources of energy was taken.

The Energy Statistics is published by the Central Statistics Office, Ministry of statistics and programme implementation, Government of India [7, 8]. Percentage increase and decrease of energy for the two variables was calculated (Tables 1–5).

Table 1. Trends in production of energy in India by primary sources (in Peta Joules).

Year	Coal and lignite	Crude petroleum	Natural gas	Electricity (hydro & nuclear)	Total
2005-06	7008.97	1348.00	1240.00	427.74	10024.72
2006-07	7458.57	1423.00	1223.00	476.29	10580.86
2007-08	7925.74	1429.00	1249.00	494.44	11098.18
2008-09	8476.37	1402.90	1265.34	513.27	11657.89
2009-10	9137.06	1410.64	1830.09	451.14	12828.93
2010-11	9206.69	1578.00	2011.00	505.89	13301.58
2011-12	9398.03	1595.00	1832.00	589.67	13414.70
2012-13	9730.08	1585.00	1567.00	527.39	13409.47
2013-14	9846.00	1582.00	1364.00	608.15	13400.15
Growth rate of 2013-14 over 2012-13(%)	1.19	-0.19	-12.95	15.31	-0.07
CAGR* 2005-06 to 2013-14(%)	3.85	1.79	1.06	3.99	3.28

* Compound annual growth rate.

Table 2. Trends in production of primary sources of conventional energy in India.

Year	Coal (million tons)	Lignite (million tons)	Crude petroleum	Natural gas (billion cubic meters)	Electricity* hydro and nuclear (GWh)
(Million tons)					
2005-06	407.04	30.23	32.19	32.20	118,818
2006-07	430.83	31.29	33.99	31.75	132,304
2007-08	457.08	33.98	34.12	32.42	137,344
2008-09	492.76	32.42	33.51	32.85	142,576
2009-10	532.04	34.07	33.69	47.50	125,316
2010-11	532.69	37.73	37.68	52.22	140,524
2011-12	539.95	42.33	38.09	47.56	163,796
2012-13	556.40	46.45	37.86	40.68	146,497
2013-14	565.77	44.27	37.79	35.41	168,931
Growth rate of 2013-14 over 2012-13(%)	1.68	-4.70	-0.18	-12.95	15.31
CAGR 2005-06 to 2013-14(%)	3.73	4.33	1.80	1.06	3.99

Table 3. Trends in production of coal and lignite in India (in million tons).

Year	Coal				Grand
	Coking	Non-coking	Total	Lignite	
1	2	3	4=(2)+(3)	5	6=(4)+(5)
2005-06	31.51	375.53	407.04	30.23	437.27
2006-07	32.10	398.74	430.83	31.29	462.12
2007-08	34.46	422.63	457.08	33.98	491.06
2008-09	33.81	457.95	491.76	32.42	524.18
2009-10	44.41	487.63	532.04	34.07	566.11
2010-11	49.55	483.15	532.69	37.73	570.43
2011-12	51.65	488.29	539.94	42.33	582.27
2012-13	51.58	504.82	556.40	46.45	602.86
2013-14(p)	56.82	508.95	565.77	44.27	610
Growth rate of 2013-14 over 2012-13(%)	10.15	0.82	1.68	-4.70	1.19
CAGR 2005-06 to 2013-14(%)	6.77	3.44	3.73	4.33	3.77

Table 4. Trends in domestic production of petroleum products in India (in million tons).

Year	Light distillates			Middle distillates			
	Liquefied Petroleum Gas	Motor Gasoline	Naphtha	Kerosene	Aviation Turbine Fuel	High Speed Diesel Oil	Light Diesel Oil
2005-06	7.71	10.50	16.09	9.24	6.20	47.59	0.92
2006-07	8.41	12.54	18.14	8.63	7.81	53.48	0.80
2007-08	8.79	14.17	17.96	7.97	9.11	58.38	0.67
2008-09	9.16	16.02	16.45	8.39	8.07	62.91	0.61
2009-10	10.33	22.54	18.79	8.70	9.30	73.30	0.47
2010-11	9.71	26.14	19.20	7.81	9.59	78.06	0.59
2011-12	9.55	27.19	18.83	7.86	10.06	82.88	0.50
2012-13	9.82	30.12	17.35	7.87	10.08	91.08	0.40
2013-14(p)	10.03	30.28	18.51	7.42	11.22	93.76	0.42
Growth rate of 2013-14 over 2012-13(%)	2.09	0.54	6.66	-5.69	11.34	2.94	5.11
CAGR 2005-06 to 2013-14(%)	2.97	12.49	1.57	-2.41	6.82	7.83	-8.38

Table 5. Trends in gross and net production of natural gas in India (in billion cubic meters).

Year	Gross production	Re-injected	Flared	Net production
2005-06	32.20	4.47	0.88	31.33
2006-07	31.75	4.37	0.96	30.79
2007-08	32.42	4.50	0.94	31.48
2008-09	32.85	4.68	1.09	31.75
2009-10	47.50	5.66	0.98	46.52
2010-11	52.22	5.21	0.97	51.25
2011-2012	47.56	5.31	1.08	46.48
2012-13	40.68	5.43	0.90	39.78
2013-14(p)	35.41	5.65	0.77	34.64
Growth rate of 2013-14 over 2012-13(%)	-12.95	4.08	-14.44	-12.92
CAGR 2005-06 to 2013-14(%)	1.06	2.65	-1.44	1.12

Production of Conventional Energy Sources

Production of Coal, Lignite, Crude Petroleum, Natural Gas, and Electricity

It is clear from Tables 1–5 that coal production in the country during the year 2013-14 was 565.77 million tons (MTs) as compared to 556.40 MTs during 2012-13, registering a growth of 1.68%. The lignite production during the same period decreased by 4.70%. Considering the trend of production from 2005-06 to 2013-14, it was observed that coal production in India was about 407.04 MTs during 2005-06, which increased to 565.77 MTs during 2013-14 with a CAGR of 3.73%. During the same period the CAGR of Lignite was about 4.33% with production increasing from 30.23 MTs in 2005-06 to 44.27 MTs in 2013-14.

Production of crude petroleum increased from 32.19 MTs during 2005-06 to 37.79 MTs during 2013-14, a CAGR of about 1.80%. The CAGRs for natural gas and electricity were 1.06% and 3.99% respectively. Lignite has experienced the highest CAGR i.e. 4.33% among all the conventional sources of energy since 2005. For more meaningful comparison in the trends and patterns of growth of different energy resources.

The total production of energy from conventional sources decreased from

13409.47 Peta joules during 2012-13 to 13400.15 Peta joules during 2013-14, showing a decrease of 0.07%.

The production of energy in Peta joules by primary sources (Table 1) shown that Coal and Lignite were the major sources of energy, accounting for about 73.48% of the total production during 2013-14. Crude Petroleum was second (11.81%), while Natural Gas (10.18%) was third.

Production of Petroleum Products and Natural Gas

In the year 2013-14, the production of Petroleum Products in the country was 220.78 MTs as against 217.74 during 2012-13, an increase of 1.40%. In the total production of Petroleum products during 2013-14, High speed diesel oil accounted for the maximum share (42.47%), followed by Motor Gasoline (13.72%), Naptha (8.38%), Fuel Oil (6.07%), Petroleum Coke (5.47%) and Aviation Turbine Fuel (5.08%) (Table 4).

Production of Natural Gas decreased from 39.78 billion cubic meters (BCM) in 2012-13 to 34.64 BCM in 2013-14 registering a negative growth of 12.92% and a CAGR of 1.12% from 2005-06 to 2013-14 (Tables 5–9).

Table 6. Trends in consumption of conventional energy in India (in Peta Joules).

Year	Coal and lignite	Crude petroleum	Natural gas	Electricity	Total
1	2	3	4	5	6= 2 to 5
2005-06	7,009	5,448	1,207	1,483	15,146
2006-07	7,459	6,136	1,186	1,641	16,421
2007-08	7,926	6,536	1,213	1,839	17,514
2008-09	8,476	6,732	1,223	2,026	18,457
2009-10	9,137	8,071	1,792	2,233	21,233
2010-11	9,207	8,248	1,974	2,464	21,892
2011-12	9,325	8,547	1,790	2,721	22,383
2012-13	9,909	9,178	1,532	3,283	23,903
2013-14(p)	9,939	9,316	1,334	3,482	24,071
Growth rate of 2013-14 over 2012-13(%)	0.31	1.50	-12.93	6.04	0.70
CAGR 2005-06 to 2013-14(%)	3.96	6.14	1.12	9.95	5.28

Table 7. Trends in consumption of conventional sources of energy in India.

Year	Coal	Lignite	Crude oil	Natural gas (billion cubic meters)	Electricity (GWh)
2005-06	407.04	30.23	130.11	31.33	411,887
2006-07	430.83	31.29	146.55	30.79	455,748
2007-08	457.08	33.98	156.10	31.48	510,899
2008-09	492.76	32.42	160.77	31.75	562,888
2009-10	532.04	34.07	192.77	46.52	620,251
2010-11	532.69	37.73	196.99	51.25	684,324
2011-12	535.88	41.88	204.12	46.48	755,847
2012-13	567.60	46.31	219.21	39.78	912,057
2013-14(p)	571.89	43.90	222.50	34.64	967,150
Growth rate of 2013-14 over 2012-13(%)	0.76	-5.22	1.50	-12.93	6.04
CAGR 2005-06 to 2013-14(%)	3.85	4.23	6.14	1.12	9.95

Table 8. Trends in consumption of petroleum products in India (in million tons).

Year	Light distillates			Middle distillates			
	LPG	Petrol	Naphtha	Kerosene	ATF	HSDO	LDO
2005-06	10.46	8.65	12.19	9.54	3.30	40.19	0.88
2006-07	10.85	9.29	13.89	9.51	3.98	42.90	0.72
2007-08	12.17	10.33	13.29	9.37	4.54	47.67	0.67
2008-09	12.34	11.26	13.91	9.30	4.42	51.71	0.55
2009-10	13.14	12.82	10.13	9.30	4.63	56.24	0.46
2010-11	14.33	14.19	10.68	8.93	5.08	60.07	0.46
2011-12	15.35	14.99	11.22	8.23	5.54	64.75	0.42
2012-13	15.60	15.74	12.29	7.50	5.27	69.08	0.40
2013-14	16.34	17.13	11.45	7.17	5.51	68.37	0.39
Growth rate of 2013-14 over 2012-13(%)	4.71	8.79	-6.79	-4.49	4.44	-1.03	-3.26
CAGR 2005-06 to 2013-14(%)	5.08	7.89	-0.69	-3.13	5.86	6.08	-8.78

Table 9. Trends in consumption of petroleum products in India (in million tons).

Year	Heavy Ends				Refinery	Others	Total
	Fuel Oils	Lubricants	Bitumen	Petroleum			
2005-06	Coke	2.08	3.51	4.93	9.14	4.66	122.36
2006-07	12.62	1.90	3.83	5.44	10.92	5.83	131.67
2007-08	12.72	2.29	4.51	5.95	11.75	5.45	140.70
2008-09	12.59	2.00	4.75	6.17	11.91	4.60	145.51
2009-10	11.63	2.54	4.93	6.59	14.58	5.40	152.39
2010-11	10.79	2.43	4.54	4.98	16.38	4.57	157.42
2011-12	9.31	2.63	4.64	6.14	17.29	4.92	165.43
2012-13	7.66	3.20	4.68	10.14	18.35	5.51	175.40
2013-14	6.19	2.89	4.94	11.65	17.87	6.18	176.06
Growth rate of 2013-14 over 2012-13(%)	-19.11	-9.54	5.60	14.96	-2.61	12.22	0.38
CAGR 2005-06 to 2013-14(%)	-7.77	3.72	3.87	10.03	7.73	3.19	4.13

Consumption of Energy Resources

Consumption of Coal and Lignite

The above consumption tables reflect that the estimated total consumption of raw coal by industry has increased from 407.04 MTs during 2005-06 to 571.89 MTs during 2013-14 with a CAGR of 3.85% (Table 7). The annual growth rate from 2012-13 to 2013-14 was 0.76%. Consumption of Lignite increased from 30.23 MTs in 2005-06 to 43.90 MTs in 2013-14 registering a compound growth of 4.23%.

Consumption of Crude Oil and Natural Gas

The estimated consumption of crude oil has a steady increase, from 130.11 MMTs during 2005-06 to 222.50 MMTs during 2013-14 with CAGR of 6.14%. It increased from 219.21 MMTs in 2012-13 to 222.50 MMTs in 2013-14 (Table 7).

Consumption of Petroleum Products

High speed diesel oil accounted for 38.83% of total consumption of all types of petroleum products in 2013-14. This was followed by Refinery (10.15%), Petrol (9.73%), LPG (9.28%) and Naphtha (6.50%). Consumption of Light Diesel oil continuously decreased from 2005-06 (0.88 MTs) to 2013-14 (0.39 MTs) (Tables 8 and 9).

CONCLUSION

The major sources for commercial energy in India are coal, oil products, natural gas and electricity. Coal is used as a final product as well as intermediate product for power generation. Similarly, natural gas is also used directly or as an intermediate in power generation. Many petroleum products, such as HSDO, Naphtha etc. are used as a final product by the non-energy producing sectors and also used for power generation. This indicates that the same energy source can be used in various forms at various stages of consumption. This creates a possibility of over-estimation or under-estimation of energy consumption in totality as well as for different sources.

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