Energy in India and the world: 2012–13

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A number of publications have been recently available from international and national agencies in the field of energy statistics. Analysis of data from these publications shows that per capita energy consumption remains low; simply because 40–50% of the population does not have access to electricity and other commercial fuels. To achieve good standard of living for everyone, consumption of electricity and other sources has to rise substantially. India is depending heavily on imported oil, coal and gas. To achieve energy security, improve balance of payment and reduce emissions, energy efficiency offers the most cost-effective solutions. Energy policy has to shift drastically from supply side to demand side management. Organizations like BEE, PCRA, GEDA, MEDA have to be given significantly large human and financial resources. Importance has to be given to residential sector and small and medium industries. Public transport and railways need heavy investment compared to private vehicles and expressways.

Keywords: Climate change, energy efficiency, energy policy, international comparison.

International comparison

THE International Energy Agency (IEA; iea.org) has recently released Key Energy Statistics 2012 (ref. 1). Tables 1–3 give some information from these statistics.

It can be seen that India's per capita energy consumption, electricity consumption and CO_2 emission are much lower than the world average. China's indicators are at the world average level. This is due to the fact that nearly 50% of the people in India do not have access to electricity and modern fuels. For good standard of living for everyone, India's energy consumption has to increase substantially.

From Table 3 it can be seen that energy efficiency in terms of GDP at actual exchange rate (not purchasing power parity (PPP) dollars) is quite low. We have to substantially invest in energy efficiency in all sectors of economy.

CO_2 concentration in the atmosphere has already reached 400 ppm. While India's per capita emissions are low, total emissions are third in the world after China and USA. This is creating a pressure on India in climate change negotiation to reduce emissions. Energy efficiency improvement and low carbon intensity development model offer good economic solutions. Renewable energy solutions remain expensive.

Energy in India

Table 4 shows India's energy consumption for the last three years[2,3].

We are importing 80% of oil and 15–20% of coal and gas. Such import dependence leads to severe balance of payment problems and sliding value of rupee. Such heavy import dependence also affects energy security. The Government is trying to control gold demand. It is the oil demand which should be controlled.

Improving energy efficiency

It can be seen from Table 5 that significant share of passenger and freight traffic has shifted from railways to roads[4]. Public transport is not getting priority. Private vehicles are encouraged. Giving priority to railways and public transport will significantly reduce oil demand.

Large industries are technically and financially strong enough to practice energy efficacy. Some of our cement plants have highest energy efficiency in the world. SME and residential sectors account for about 50% of energy consumption and needs to be vigoursly targeted for energy efficiency.

Use of star-labelled products like fans, refrigerators and air-conditioners has to be made mandatory. Similarly, star-labelled industrial products like motors and transformers must be made mandatory. Large campaigns for energy efficiency must be launched for domestic and SME sectors.

Firewood, agricultural waste and cow dung still supply about one-third of the energy needs of our country (Table 6). Efficiencies of use of these fuels are poor (10%). Smokeless, energy-efficient chullas and solar cookers need to be aggressively promoted.

BEE, PCRA, GEDA, MEDA and similar agencies are doing good work. They are staffed by few dozen people

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Table 1. Selected energy indicators – 2010

Region country	Population (million)	Total primary energy TOE/capita	Electricity consumption kWh/capita	CO_2/ capita tonnes
World	6825	1.86	2892	4.44
China	1345	1.81	2958	5.43
India	1170.94	0.59	644	1.39
Japan	127.38	3.90	8399	8.97
Germany	81.76	4.0	7217	9.32
USA	310.11	7.15	13,361	17.31

TOE, Tonnes of oil equivalent 1 kg oil = 10,000 kcal.

Table 2. Selected economic indicators – 2010

Region/country	GDP/Capita (US $)*	GDP/Capita (PPP)** (US $)
World	7,464	10,026
China	3,013	7,001
India	1,065	3,216
Japan	35,938	30,575
Germany	35,924	33,324
USA	41,990	41,990

*Exchange rate; **PPP, Purchasing power parity which takes into account purchasing power of currency.

Table 3. Energy efficiency indicators – 2010

Region country	TPES/GDP (TOE/1000 2005 USD)	TPES/GDP PPP (TOE/1000 2005 USD)
World	0.25	0.19
China	0.60	0.26
India	0.56	0.18
Japan	0.11	0.13
Germany	0.11	0.12
USA	0.17	0.17

TPES, Total primary energy supply.

Table 4. Commercial energy sources

	2010–11	2011–12	2012–13
Coal production (excluding lignite) (mt)	532	540	571
Coal imports (mt)	70	105	126
Power capacity (MW)	173,626	199,877	223,343.60
Electricity generation (billion kWh)			
Hydro	114.3	130.5	113.6
Thermal	665	708.8	760.4
Nuclear	26.3	32.3	32.9
Total generation (billion kWh; including import from Bhutan)	811.1	876.9	911.7
T&D losses	27.5		
Crude oil production (mt)	37.7	38.1	38.2
Crude oil import (mt)	153.1	164.0	171.4
Petroleum products import (mt)	14.5	15.6	16.1
Consumption of petroleum products (mt)	141.8	148	155.6
Natural gas production (billion cubic metre)	52.2	47.5	41.3

against thousands working in energy supply industries. Their financial and human resources have to be brought at similar level as the utilities.

Energy policy in India has always been supply-side-oriented. It needs a drastic shift to demand-side management. Our energy resource base is poor; 1% of the world's energy resources with 17% of the world's population. Energy efficiency requires high priority for achieving energy security, improving balance of payment and reducing emissions to mitigate climate change.

Table 5. Trends in relative rail and road traffic: 1970–71 to 2006–07

Mode	1970–71	1990–91	2001–02	2003–04	2005–06	2006–07
Freight traffic						
Road (%)	30.1	38.1	60.7	61.0	60.0	61.3
Rail (%)	69.9	61.9	39.3	39.0	40.0	38.7
Total (billion tonne-km)	158.4	380.9	848.2	976.2	1100.7	1249.6
Passenger traffic						
Road (%)	64.0	72.2	83.1	85.0	87.4	NA
Rail (%)	36.0	27.8	16.9	15.0	12.6	NA
Total (billion tonne-km)	328.1	1063.3	2904.0	36114	4867.3	NA

Table 6. Commercial sources MTOE (2009)

Coal	222.76
Hydro	9.48
Nuclear power	1.28
Renewable	2.44
Natural gas	37.8
Crude oil	151.77
Total	408.16

Total energy consumption according to Key Energy Statistics 2009 = 675.83 MTOE. Difference = 267.67 MTOE is accounted by non-commercial sources like agricultural waste, cow dung and fire wood.

Table 7. Savings by BEE award scheme for 1999–2012 (14 years)

Annual savings	Rs 18,675 crores
Investment	Rs 26,142 crores
Payback period	16.8 months
Avoided MW	3581

BEE's energy conservation award scheme has resulted in good savings for large industries (Table 7)[5].

Power sector

Highlights of the power sector are given in Tables 8–10 (ref. 6).

Renewable energy is contributing about 10% of our power capacity, but contributes about 2% electrical energy. About 80% is contributed by thermal energy. Hydro accounts for only 15%. Ideal mix is 50% hydro and 50% thermal. Electricity boards are running into huge losses due to subsidies to residential and agriculture sectors.

Concluding remarks

India is importing 80% of oil, 15–20% of coal and gas. This dependence will only increase in the foreseeable future. Such heavy dependence on imported energy poses serious questions about energy security and balance of payment. Rupee will slide further against foreign currencies. To meet the challenge of climate change and environmental pollution, improving energy efficiency is a cost-effective solution. Per capita consumption of energy at about 590 kg oil equivalent and 644 kWh/capita only shows that 40–50% of the people do not have access to modern fuels like electricity, LPG, oil, etc.

To improve the standard of living, per capita consumption has to increase to three times its present value, i.e. to 1500 kg oil equivalent and 2000 kWh/capita. This presents a major challenge to energy planners. Two major policy directions are required. (a) To opt for a development model which is not energy-intensive. Increase in human development index (HDI) rather than GDP as emphasized at present. (b) Vigorous pursuit of energy efficiency in all sectors of economy.

Present planning remains supply-oriented. It must be oriented to demand management. Major resources, financial and human, must be provided to demand management.

Passengers and freight traffic has moved from railways to roads. Railways are far more energy-efficient and environment-friendly compared to roads. Railways must receive high priority in investment so as to carry a high share of passengers and freight traffic. Public transport has to receive high priority compared to private transport.

Non-commercial sources like firewood, agricultural waste and dung cake still contribute about 33% of our energy needs. Their end-use efficiency as well as supply management must form an integrated part of our energy policy. Energy-efficient cook stoves, solar cookers and decentralized solar systems must form part of major policy initiatives.

Wind and solar grid connected system are receiving government attention. About 10% of installed capacity is accounted for wind and solar energy. Contribution to energy generation remains at about 2%. Decentralized systems, including energy storage systems require high priority in energy research and development.

Education system must emphasize energy efficiency and energy conservation and moderate lifestyle. Use of products like fans, refrigerators and air-conditioners has to be made mandatory. Similarly, industrial products like motors and transformers must be made mandatory.

Table 8. Installed generation capacity (as on 31 March 2013)

All-India	Thermal				Nuclear	Hydro	MNRE renewable	Total
	Coal	Gas	Diesel	Total				
MW	130,220.89	20,109.85	1,199.75	151,530.49	4,780.00	39,491.40	27,541.71	223,343.60
Percentage	59.3	9.0	0.5	2.1	2.1	17.7	12.3	100.0

Table 9. Electricity generation (2012–13)

Achievement	Hydro	Thermal	Nuclear	Bhutan (IMPORT)	Total
MU (million kWh)	113,626.2	760,366.43	32,870.86	4,788.82	911,652.31

Table 10. Average cost of power supply and average realization (paise/kWh)

Year	Cost of supply (paise/unit)	Realization (paise/unit)	
		Including agriculture	Only agriculture
2004–05	254	209	75.68
2005–06	260	221	76.36
2006–07	276	227	74.23
2007–08	293	239	77.27
2008–09	340	263	87.13
2009–10	355	268	88.70
2010–11	378	301	115.12

Source: PFC reports on the performance of state power utilities.

Campaigns for energy efficiency must be launched for domestic and SME sectors.

BEE, PCRA, GEDA, MEDA and similar agencies are staffed by few dozen people against thousands working in energy supply industries. The financial and human resources of these agencies have to be brought at similar level as utilities. Significant efforts have to be devoted to the domestic sector and small and medium industries. We must also choose a development model avoiding energy-intensive industries and infrastructure like expressways.

1. Key World Energy Statistics 2012. International Energy Agency; www.iea.org
2. Energy Statistics 2013, Central Statistics Office, Government of India; mospi.nic.in/Mospi New/upload/Energy_Statistics_2013.pdf
3. Centre for Monitoring Indian Economy, Mumbai; www.cmie.com/
4. *TERI Energy Data Directory and Yearbook 2011/12*, The Energy and Resources Institute, New Delhi; http://www.teriin.org/
5. Bureau of Energy Efficiency, http://www.beeindia.in/
6. Central Electricity Authority; www.cea.nic.in

ACKNOWLEDGEMENTS. Use of library facilities of Community Science Centre, Vadodara is acknowledged. I thank Mrs Harshangi Yagnik (Community Science Centre) for help.

Received 10 June 2013; accepted 10 December 2013