

Power – Thermal and Nuclear Energy

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Overview

Conventional Energy (Coal, Natural Gas and Diesel) plays a vital role as it is one of the most cost efficient methods of producing electricity and provides uninterrupted power. Thermal power plants provide over 35% of the global electricity supply and 2/3rd of the total electricity generated in India.

With continued economic expansion, expanding access to electricity and urbanization, the demand for uninterrupted electricity will increase. Thermal and other conventional energy forms the base of our energy requirements due to their ability to provide continuous production and supply.

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Table 1. Installed Capacity: Thermal & Nuclear (As on 31st March, 2017)

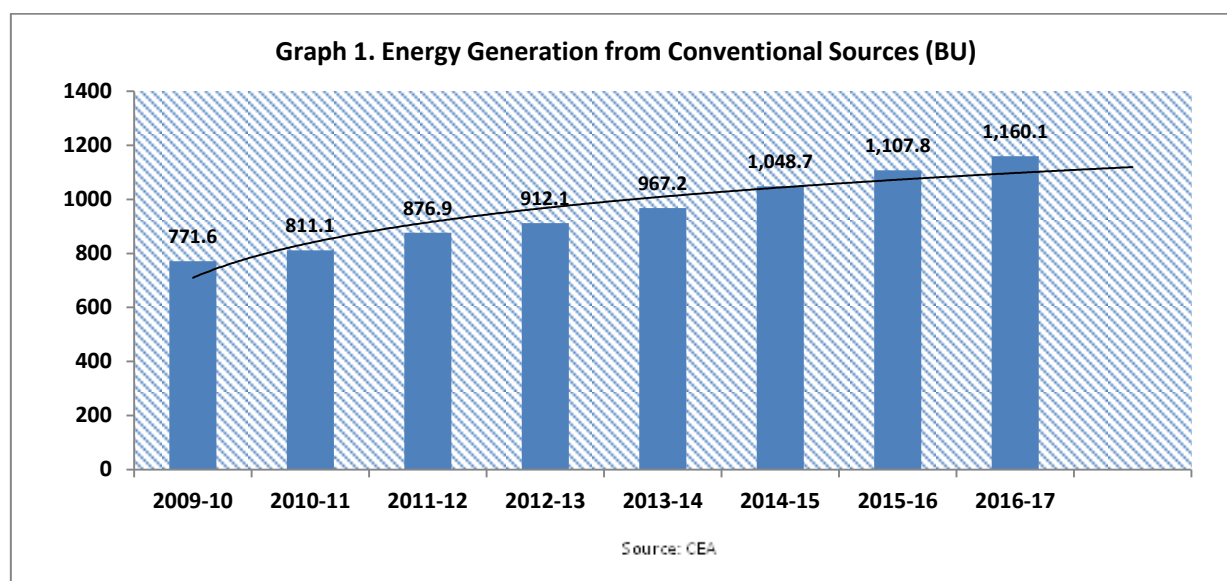
Fuel	MW	% of Total
Total Thermal	220,570	67.0%
Coal	194,403	59.1%
Gas	25,329	7.7%
Oil	838	0.3%
Nuclear	6,780	2.1%

Source: CEA

Energy production sector would require well over \$120 billion between 2017-22 in order to setup up power plants, power infrastructure and improving the transmission network. A majority of this i.e. almost 60% would be allocated towards renewable energy and the rest towards thermal and nuclear energy.

We expect the thermal power industry and its allied industries to remain subdued for the next 2 years in terms of capacity addition given the Government's thrust to meet substantial part of its "Mission 2022 renewable targets" by 2019. This does not include the thermal plant capacity of approximately 50 GW which are in different stages of construction. Conventional energy companies have been installing renewable energy capacity especially Solar, and this would mean higher competition in renewable space and tariffs of conventional energy would remain range bound. New thermal capacity addition is unlikely in the next two years since existing capacity is under-utilized by as much as 40%.

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Thermal Power

Thermal power plants utilize three types of fuel:

Coal based power plants:

Coal based thermal plants constitute close to 59% (194GW) of the total electricity generation capacity installed in the country and it forms the backbone of our electricity generation capacity. Vindhyachal Thermal Power Station in the Singrauli district of Madhya Pradesh, with an installed capacity of 4,760MW, is currently the biggest thermal power plant in India. It is a coal-based power plant owned and operated by NTPC.

Global Coal Trends: In 2016, global coal consumption fell by 53 million tonnes of oil equivalent (mt), or 1.7%, the second successive annual decline. Growth in global primary energy consumption remained low in 2016; and the fuel mix shifted away from coal towards lower carbon fuels. Coal’s share of global primary energy consumption fell to 28.1%, the lowest share since 2004. World coal production fell by 6.2%, or 231 mt, the largest decline on record.

Table 2. The PLF in the country (Coal & Lignite based) from 2009-10 to 2017-18

Year	Plant Load Factor	Sector-wise PLF (%)		
	%	Central	State	Private
2009-10	77.5	85.5	70.9	83.9
2010-11	75.1	85.1	66.7	80.7
2011-12	73.3	82.1	68.0	69.5
2012-13	69.9	79.2	65.6	64.1
2013-14	65.60	76.10	59.10	62.10
2014-15	64.46	73.96	59.83	60.58
2015-16	62.29	72.52	55.41	60.49
2016-17	59.88	71.98	54.35	55.73

Significance: Coal is an affordable fuel and source of energy. Coal based power plants score over other conventional energy for their economical set up (lowest cost in terms of per MW capacity installed) and fuel costs as well as, uninterrupted power supply capabilities. But coal is an impure fuel and produces more

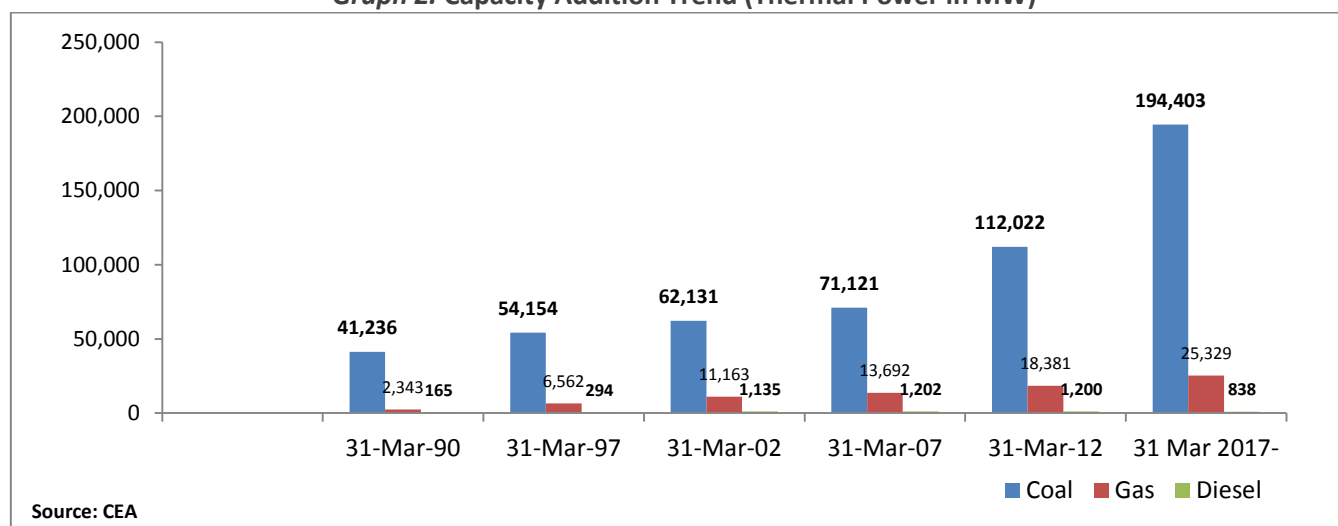
greenhouse gas and pollution than an equivalent amount of petroleum or natural gas. India has over 15 coal powered thermal plants with a capacity over 2000MW. A wide variety of environmental impacts are associated with generating electricity from coal. Not only does burning coal for heat to convert water into steam cause air pollution, but huge quantity of water is required as a coolant for coal based plants, which is another disadvantage. Data from a Global Energy company suggests a considerable fall in the production and consumption of coal in major economies which includes USA, China, Europe and India.

Gas based thermal power:

Gas based power generation capacity is 25.3 GW in India which constitutes for 7.5 % of the total installed generation capacity in the country. As per data from Central Electricity Authority, over 70% of privately operated gas plant potential is underutilized due to unavailability of natural gas required to fuel them. For the ones operated by Centre or State, the under-utilization is lower at 38-40%. In 2016-17, they operated at a mere 22.51% plant load factor, producing 49 billion units of electricity. One of the major factors hurting gas based plants is the high price of fuel which is pushing their tariffs to as high as Rs. 11-12 per unit of electricity in case of LNG based plants.

Global Natural Gas Trends: During 2016, World natural gas consumption grew by 63 billion cubic meters (bcm) or 1.5%, slower than the 10-year average of 2.3%. Global natural gas production increased by only 21 bcm, or 0.3%. Gas trade grew by 4.8%, helped by 6.2% growth in LNG imports/exports.

Graph 2. Capacity Addition Trend (Thermal Power in MW)



*Upto April 2017.

Significance of Gas powered plants: Gas powered plants are far less polluting compared to coal powered plants. But due to the unavailability of Natural Gas, the same capacity has been left technically stranded. They mainly rely on Liquefied natural Gas (LNG) as fuel. Two main benefits of LNG based power plants is a far lesser gestation period of 2-3 years compared with 4 or more years for other conventional power plants and far lesser requirement of land for setting up plants and lower requirement of water for cooling towers. When it comes to cost of generation and power tariff, gas based power is competitive compared to coal.

Nuclear Energy

As of 31st March, 2017, India had 6.78 GW of installed nuclear electricity generation capacity which constitutes 1.91% of total installed electricity generation capacity in India.

India's nuclear power plant development began in 1964. In 1987, India created Nuclear Power Corporation of India Limited to commercialize nuclear power. Nuclear Power Corporation of India Limited is a public sector enterprise, wholly owned by the Government of India, under the administrative control of Department of Atomic Energy. Its objective is to implement and operate nuclear power stations for India's electricity sector.

India has nuclear power plants operating in the following states: Maharashtra, Gujarat, Rajasthan, Uttar Pradesh, Tamil Nadu and Karnataka. These reactors have an installed electricity generation capacity between 100 MW and 1000 MW each. India's share of nuclear power plant generation capacity is just 1.2% of worldwide nuclear power production capacity, making it the 15th largest nuclear power producer. India aims to supply 9% of its electricity needs with nuclear power by 2032.

Industry Structure:

In India, 67% of the thermal energy plant capacity is managed and operated by the central or state government. The remaining 33% of the installed capacity is being operated by the private sector, a majority of which has been added post 2007. *Coal power capacity increased from 112 GW in 2012 to 192 GW in 2017* while gas based power plant capacity almost doubled from 13.6 GW to 25.3 GW. Diesel or Oil based power plants have declined during this period to under 1 GW.

Nuclear power plants due to longer gestation have been left behind renewable energy sources. Nuclear power plants are operated and regulated by Government bodies due to their security sensitive nature. Nuclear power Corporation of India Limited is responsible for the development and operation of Nuclear power plants in India. India is trying to indigenously set up its own Nuclear power plants.

Table 3. Global Comparative: GDP-Population-Power Consumption

	India	China	U.S.A.
% GDP vs World GDP(Nominal)	2.9%	14.6%	24.2%
% Population vs World Population	17.4%	18.1%	4.2%
% Power Consumption vs World Total	4.6%	27.1%	17.9%

Global comparison of power production/consumption

Table 3 exhibits comparison between GDP, Population and Power Consumption as a percentage of global aggregates of three major economies. India, which is home to 17.4% of the world population, is under penetrated in terms of domestic electricity usage compared with developed and larger countries like USA and China. Even though this could be mainly attributed to under-penetration of infrastructure across the geography especially due to lack of connectivity in case of domestic rural electrification.

Major Consumers of Power In India

As per CEA data for 2015-16, Industry sector accounted for the largest share (42.3%), followed by domestic consumers (23.7%), agriculture (17%) and commercial, railways and miscellaneous constituting the rest (17%). The electricity consumption in the industrial and the domestic sector has increased at a much faster pace compared to other sectors during 2006-07 to 2015-16 with CAGR of 9.4% and 7.9% respectively.

Industrial consumers are affected by unreliable and unpredictable power supply which led to rapid addition of captive power plants. Increased industrial tariffs, unreliable supply, have led a number of companies to produce their own electricity, using back-up diesel generators etc. Energy-intensive industries, such as steel, cement, chemicals, sugar, fertilizers and textiles have been producing over 60% of the electricity that they consume and is majorly coal-fired. However they are unable to feed excess power into the grid.

Domestic consumers, who account for 23.8% of the consumption, are an underpenetrated segment, and this consumption could well double as the transmission and grid network infrastructure deepens. According to data in the power ministry's Grameen Vidyutikaran (GARV) dashboard, 13,523 villages have been electrified, but 100% household connectivity has been achieved in only 1,089 villages.

Besides, 25% (45 million) of rural households across the country still have no electricity. In Uttar Pradesh, Nagaland, Jharkhand and Bihar, fewer than 50% of rural households have electricity, which once covered would be a huge growth driver.

Unreliability of power and low duration of supply has been a major impediment for non-attractiveness of taking electricity connection especially amongst rural households. But given the excess installed capacity, the same could be addressed. It is important that Government initiates and promotes schemes that provide for free on-grid electricity connections to below poverty line households.

Apart from rural households and industrial growth, development of 100 smart cities would mean more cities coming under the ambit of 24x7 electricity in the next 2-5years. These would be the next major growth drivers.

Financial performance of power generation and distribution companies:

Given below is the financial performance of listed power generation and distribution companies. Between 2013-17, the revenue growth in absolute terms has been 25.3% and CAGR has been 4.6%. The operating profit margin has expanded from 36.7% in 2013 to 40.5% in 2017. The interest expense of these companies has more than doubled from Rs. 11,190 crore in 2013 to Rs. 23,905 crore in 2017. The PAT margin of these companies has decreased from 17.2% in 2013 to 10.8% in 2017.

Table 4. Financial Performance: 2012-17 (Source: Aceequity)					
Rs crore	2013	2014	2015	2016	2017
No of Companies	32	32	32	32	32
Net Sales	1,52,534	1,67,402	1,76,614	1,85,014	1,91,160
Operating Profit	55,940	61,586	63,763	74,520	77,342
Operating Margin(%)	36.7	36.8	36.1	40.3	40.5
Interest	11,190	15,510	17,861	22,368	23,905
Interest Coverage	4.9	3.9	3.5	3.3	3.2
Profit After Tax	26,173	24,038	25,392	28,358	20,587
PAT Margin(%)	17.2	14.4	14.4	15.3	10.8

Data for all listed companies in Power Generation and Distribution segment.

Challenges and Risk for Thermal Power

- 1. Lack of Growth in demand:** One of the major reasons for flat demand is inaccessible power for a large population due to inadequate grid and transmission network. Another reason for lack of demand is consumer tariff's not priced properly to cover the cost price of power procured by discoms. In this scenario, discoms would avoid supplying to consumers at a loss which affects the demand. Interestingly, even though the government has been instrumental in formulating a policy to provide "Power to All" but not much has been done for formulation of prices in order to make it sustainable for producers as well as the distribution companies.
- 2. Fuel Security Concerns:** Thermal capacity addition is impacted deeply by the growing fuel availability concerns faced by the Industry. While a significant gas based capacity is idle due to non-availability of gas, coal supplies too are restricted to around 65% of actual coal requirement by coal based thermal plants leading to increased dependence on imported coal leading to high power generation costs. India is forced to import high quality coal to meet its coal requirements. India's coal imports have risen from 43.08 million metric tons (0.04749 billion short tons) in 2006-07 to 199.88 million metric tons (0.22033 billion short tons) in 2015-16. Most of the Indian coal reserves are of low calorific value and high ash content. This leads to burning more coal for every unit of electricity generated which also pollutes the environment.

- 3. Financial Health of State Discoms:** Populist tariff schemes in the past, mounting Aggregate Technical and Commercial Losses (AT&C losses) and operational inefficiencies have adversely affected the financial health of State Discoms which are currently plagued with out-standing debt of Rs 3.95 lac cr as last reported by the Government.

“Technical Losses can be classified as overloading of existing lines and substation, higher amount of current flow in the system, poor repair and maintenance of equipment, non-installation of sufficient capacitors/reactive power equipment whereas commercial losses can be categorized as low metering/billing/collection efficiency, theft, pilferage of electricity and tampering of meters, low accountability of employees and absence of Energy Accounting and Auditing. Even though the Government has introduced UDAY scheme to turn-around financials of discoms, but given persistent operational and technical inefficiencies, it would take considerable amount of time and some stern and sustainable policy actions in order to correct the same.”

- 4. Under-procurement of Power by States and payment delays by discoms:** Poor financial health of State Discoms, have contributed to suppressed demand projections by State Discoms. The demand growth from the industry has been subdued due to energy efficiency and related improvements which has to an extent cut their incremental power requirement. On the domestic consumer demand, even though the government claims to have electrified a large part of the country in the past few years, but addition of consumer and demand from those newly added consumers is still not reflected from the official data available. What further escalates the issue is the fact that state power discoms have not been making their payments as per schedule which is leading to stress in the overall industry.

Table 5. Tariffs of Electricity Based on Auction Data (Source- CERC Report 2015-16)

Solar Energy	Rs. 2.42 - Rs. 4.00	Coal Energy	Rs. 2.63 – Rs. 5.70
Hydro Energy	Rs. 1.85 - Rs. 6.00	Gas-based Energy	Rs. 4.31- Rs. 6.57
LNG Based	Rs. 8.10 - Rs. 12.00	Nuclear Energy	Rs. 0.94- Rs. 3.88

- 5. Financing Environment:** Power sector as a whole is facing over Rs. 3-4 trillion worth of stressed assets, mostly owed by private sector companies due to underutilization, and slow or stagnant power demand Disruption led by rapid renewable energy capacity addition and its price discovery has only added to the woes of the thermal power producers.
- 6. Tariff disputes:** Tariff disputes especially in case of Power Purchase agreements have gone into litigation and with most cases ending up with the apex court of the country; it adversely affects the cash flows of the power producers.
- 7. Pollution from thermal power plants:** The high ash content in India's coal affects the thermal power plant's potential emissions. The operating coal fired power stations need to invest nearly INR 10-12 million per MW capacity for installing pollution control equipment to comply with the latest emission norms notified by the Ministry of Environment and Forests in the year 2016. This may lead to further escalation in tariff, thus affecting their competitiveness with other conventional and renewable power sources.

Outlook

- Even though the Natural gas prices have been low since 2016, lack of capacity for LNG regasification especially on the eastern coast of the country is causing scarcity of fuel for gas fired power plants. We expect the same to persist in the current year which means the natural gas power plants to remain under-utilized. Additionally, the government has rolled back subsidies under the gas priced pooling mechanism to the the gas powered power companies post March 31st, 2017. Additionally, gas prices auctioned by Government are much higher, as much as double the prevailing global prices for natural gas.

Table 6. Power Demand and Supply for 2017-18 (Projected)

	2015-16	2016-17	Actual Growth (%)	Projected Growth 2017-18* CARE(%)
Energy Requirement (MU)	1114408	1142929	2.6	3.5-4.5%
Peak Demand (MW)	153366	159542	4.0	4.0-5.0%
Energy Availability (MU)	1090851	1135334	4.1	4.5-5.5%
Peak Met (MW)	148463	156934	5.7	5.0-6.0%

*As per data available from CEA Website. Projected Growth calculated on the basis of data available between 2009-17.

- We expect some demand uptick from both domestic consumers as well as industrial consumers. The demand and supply growth forecast is exhibited in the table above. With good monsoons expected during the year, the agriculture sector demand may be lower compared to previous years. The overall demand is expected to remain slightly higher (4-5%) compared to last year's demand.
- GST will have an impact for coal based power plants. GST rate on domestic coal has been fixed at 5% which would act as a reprieve for discoms as coming down of cost per unit production of electricity would be further passed on by the producers to the consumers. Preliminary estimates by Coal India suggest that consumers were effectively charged 11-11.5% for procurement, which is going to decrease to 5% under the new tax rules. The additional green cess of Rs 400 /ton will continue while stowing cess of Rs. 10 /ton has also been done away with. This should lead to decrease in tariffs by 4-6 paise per unit electricity generated depending upon the amount of domestic coal used.
- We expect the coal and natural gas power tariff to remain range bound with some downward pressure mainly due to excess capacity and competition from renewable especially solar energy.
- We expect some lower efficiency-small capacity power plants, especially those operated by government to be replaced by larger ones with super-critical technology. In the interim, this would lead to shut down of older plants and hence better utilization of idle capacity owned by private and state power producers.

Reference: CEA, Government of India report, CERC Annual Report (2015-16) and IBEF.org


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