CREDENCE CAPITAL

(Investment Club of IIM Lucknow)

Power Sector Report – September 2020

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Introduction

Power generation, transmission and distribution forms a crucial sector for the economic growth and welfare of nations. The existence and development of adequate infrastructure of this sector is essential for sustained growth of the Indian economy.

Economic growth at a sustainable rate continues to drive electricity demand of the India. The Government of India (GoI) has been focussing on providing power to the remote locations which has led to increased capacity addition within the country. At the same time, the competitive intensity is increasing at both the market and supply sides (fuel, logistics, finances, and manpower).

India's power sector is one of the most diversified in the world. Sources of power generation range from conventional sources such as coal, lignite, natural gas, oil, hydro and nuclear power to viable non-conventional sources such as wind, solar, and agricultural and domestic waste.

Total Installed Capacity as on 31 August 2020		
Sector	**MW**	**% of total**
Central Government	94,027	25%
State Government	1,03,617	28%
Private Sector	1,75,050	47%
Total	***3,72,694***	***100%***
Tyoe of Fuel	**MW**	**% of total**
Thermal	**2,31,422**	**62%**
Coal	*1,99,595*	*54%*
Lignite	*6,360*	*2%*
Gas	*24,957*	*7%*
Diesel	*510*	*0%*
Hydro	**45,699**	**12%**
Nuclear	**6,780**	**2%**
Renewable Energy	**88,793**	**24%**
Solar	*35,122*	*9%*
Wind	*37,669*	*10%*
Others	*16,002*	*4%*
Total	***3,72,694***	***100%***

Majority of India's installed capacity for power generation is from Thermal with Coal based power plants forming the main fuel source. However, GoI has been aiming for increase in renewable power generation and taken measures in this direction.

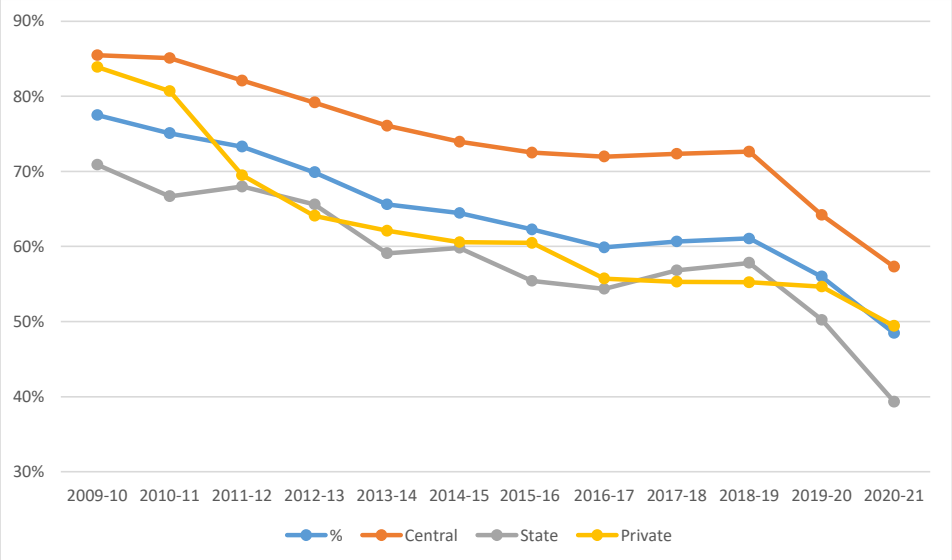
With installed power capacity reaching 372.69 GW as of August 2020, India is now the 3rd largest producer and consumer of electricity in the world. The country also has the 5th largest installed capacity in the world. India is ranked 4th in wind power, 5th in solar power and 5th in renewable power installed capacity as of 2018.

What is Plant load factor (PLF)?

Plant Load Factor as a percentage of energy sent out by the power plant corresponding to installed capacity in that period. **Formula = Total units generated / Total unit generation of installed capacity**

Eg. For 1 MW of installed capacity, total unit generation can be calculated as 1MW x 365 days x 24 hours x 1000 KWs. 87,60,000 units can be generated with installed capacity of 1MW

PLF % (Coal & Lignite based)				
Year	%	Central	State	Private
2009-10	78%	86%	71%	84%
2010-11	75%	85%	67%	81%
2011-12	73%	82%	68%	70%
2012-13	70%	79%	66%	64%
2013-14	66%	76%	59%	62%
2014-15	64%	74%	60%	61%
2015-16	62%	73%	55%	60%
2016-17	60%	72%	54%	56%
2017-18	61%	72%	57%	55%
2018-19	61%	73%	58%	55%
2019-20	56%	64%	50%	55%
2020-21	48%	57%	39%	49%



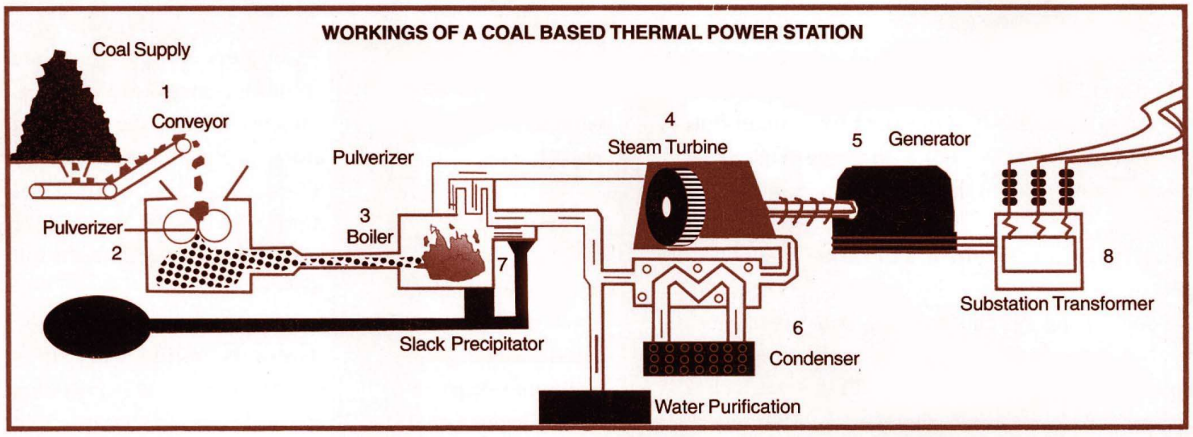
Although demand for power has grown at only CAGR 5.5% over the last 10 years, installed capacity has grown at a higher CAGR 8.6% over the same period. This has led to reduction in the PLF at which power plants are operating in India. Factors affecting PLF –

- Quality of coal
- Operational efficiency
- Auxiliary consumption
- Generation requirement and purchase agreements

Value Chain of Industry

1. **Generation –** The first stage of the power sector value chain is the generation of power. Thermal (coal) being the major source of power generation, the generation process can be briefly described as

Thermal power generation

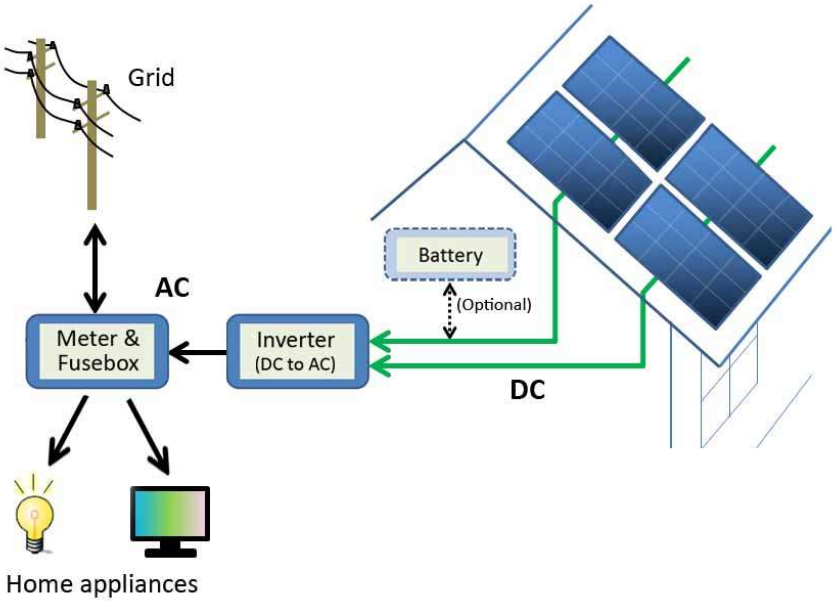


The below steps can briefly summarize the generation of power in a thermal power plant –

- **Mining** – The major natural resource for thermal power generation is coal which is mined from the earth. The quality of coal is determined from the calorific value of the coal which determines the purity / impurities present in the coal and the heat rate with which it will burn to generate electricity. Major coal belts in India are a part of the states on the eastern coast i.e. Jharkhand, Odisha and Chhattisgarh.
  Coal is among the top five commodities imported by India. Countries like Indonesia, South Africa and Australia usually export better quality coal to India
- **Boiler Operation –** The coal brought to the plant is feed into the boiler which acts as a firebox or a furnace to burn the fuel and generate heat. The generated heat is transferred to water to convert it to steam as a part of the process of boiling.
- **Steam turbine –** The generated steam is then blown into the steam turbine and allowed to condense thereby converting the heat energy into mechanical energy which is used to run the steam turbine.
- **Generation of electricity –** The turbine is connected to a generator which converts this energy into electricity and transmits into the transmission wires
- **Transmission to substation –** Once the electricity is generated, it is transmitted to a substation transformer which is connected with the distribution grid. In the whole process, some electricity gets lost which is accounted as **auxiliary loss**.

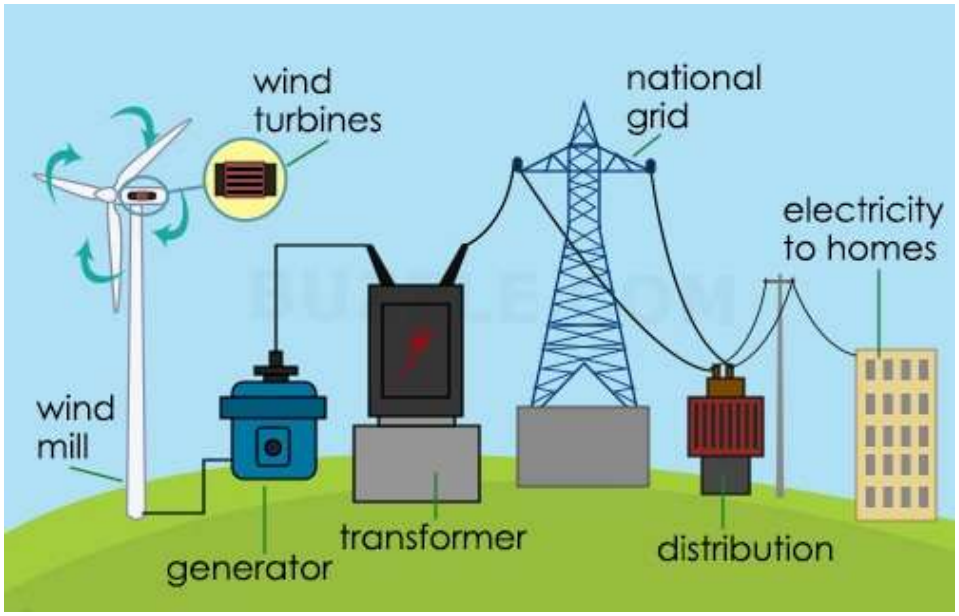
Renewable power generation

Solar power generation – Solar generation used solar rays and captures the energy and converts it into electricity. Solar farms require large areas of plain surface with preferable evenness in the ground. States of Karnataka, Telangana, Rajasthan, Andhra Pradesh and Gujarat have the major solar farms in India. The basic working of the solar power generation can be explained as –

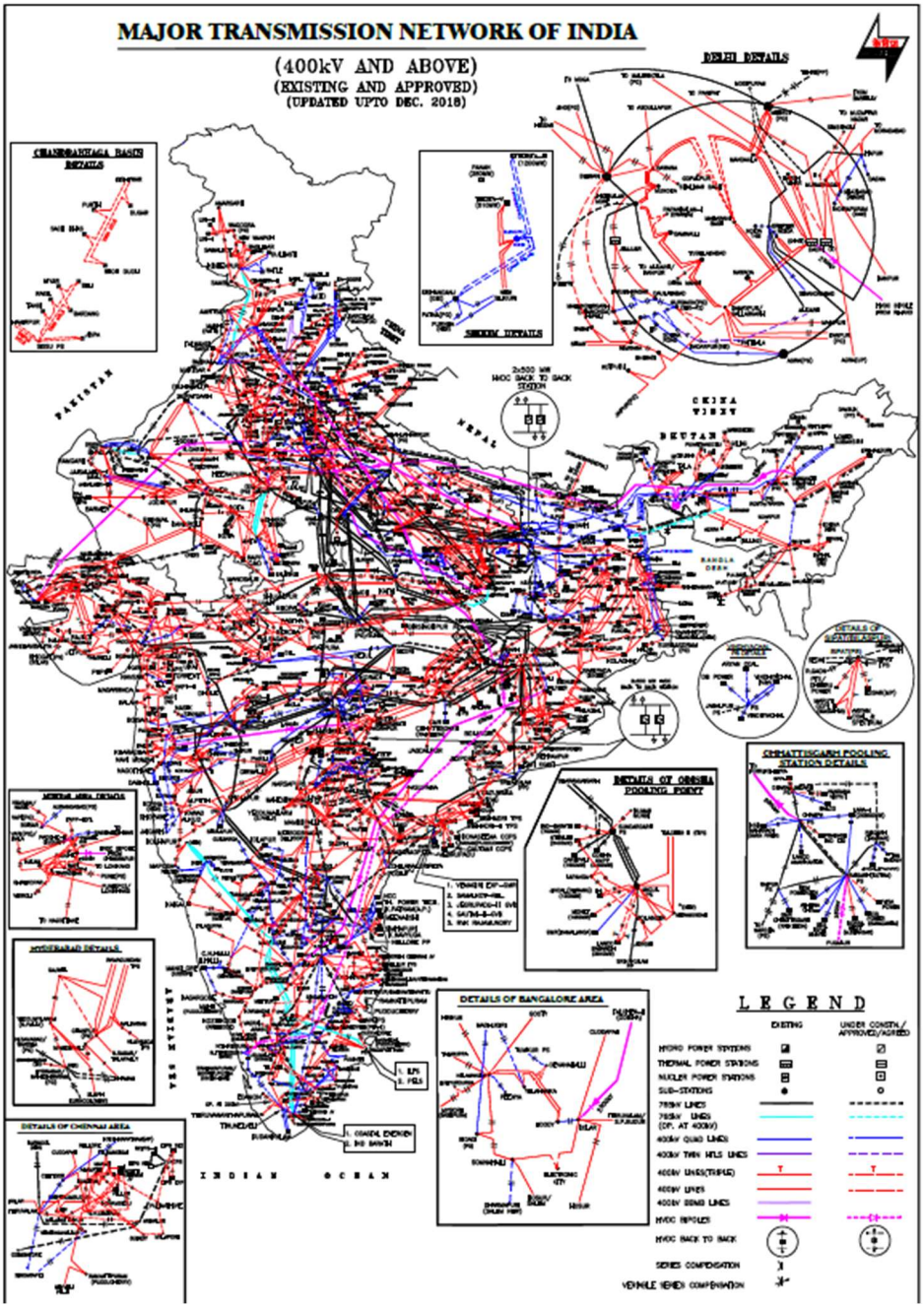


Typical grid connected PV solar system

Wind power generation – Generation of power involves use of wind to provide the mechanical power through the wind blades to rotate the wind turbines and the generators to turn the energy into electricity. Locations situated at a height usually are preferred for setting up of wind mills. Tamil Nadu, Gujarat and Maharashtra are the major states producing wind power in India. The brief process for wind power generation can be explained as –



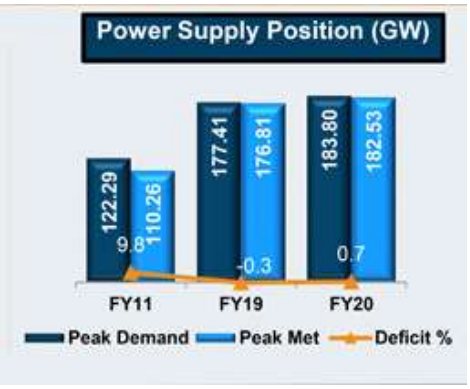
2. **Transmission –** Transmission is the process of delivering generated electricity - usually over long distances to the distribution grid located in populated areas. It facilitates the transmission from the generation power source to the electricity consumption areas. Transformers convert the low voltage electricity into high voltage for efficient transportation and the transmission lines carry them over long distances. India has a connection of transmission lines known as the Grid.

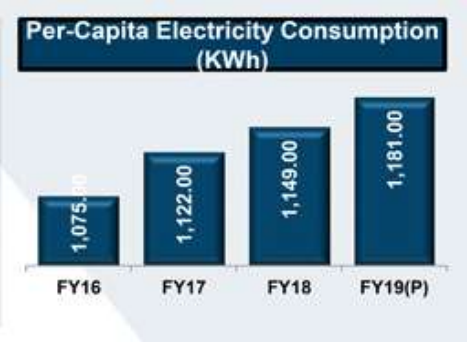


3. **Distribution –** The final step in the value chain, it forms the retail distribution arm of the electricity to homes, offices and factory usage.

Power Sector Demand and Supply

India has been an energy deficit nation with demand being greater than the production over the years. GoI has initiated a number of programs to promote rural electrification and increase the per capita consumption of electricity.

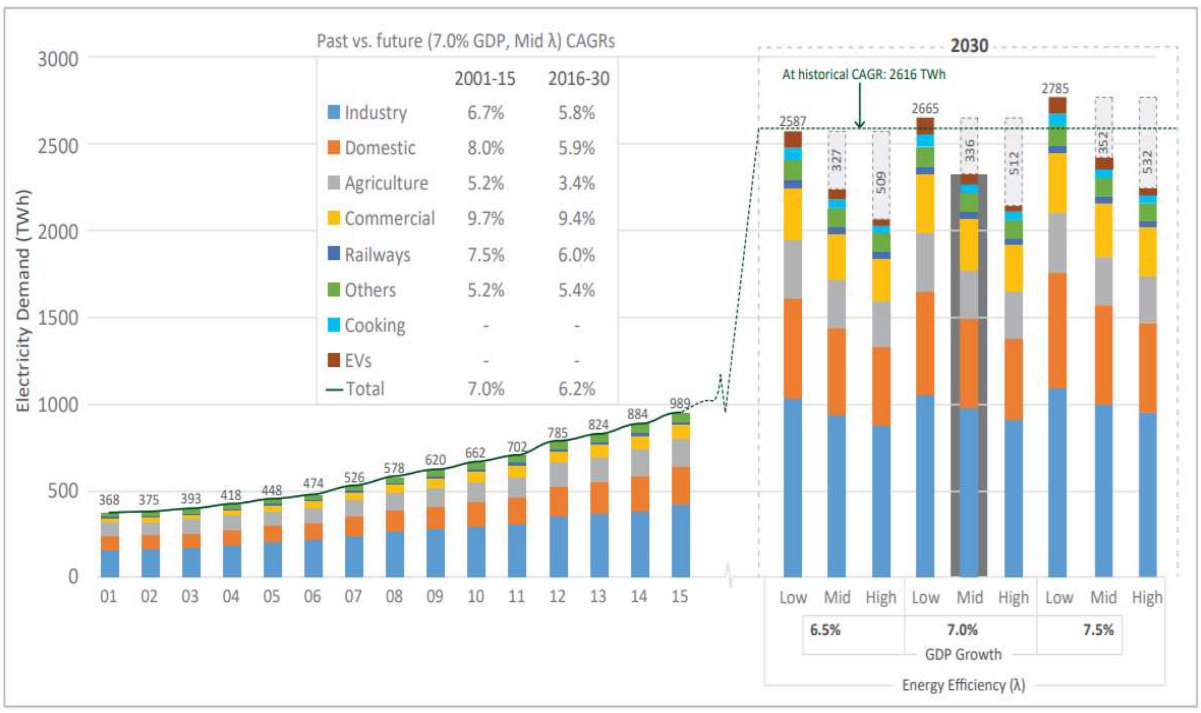




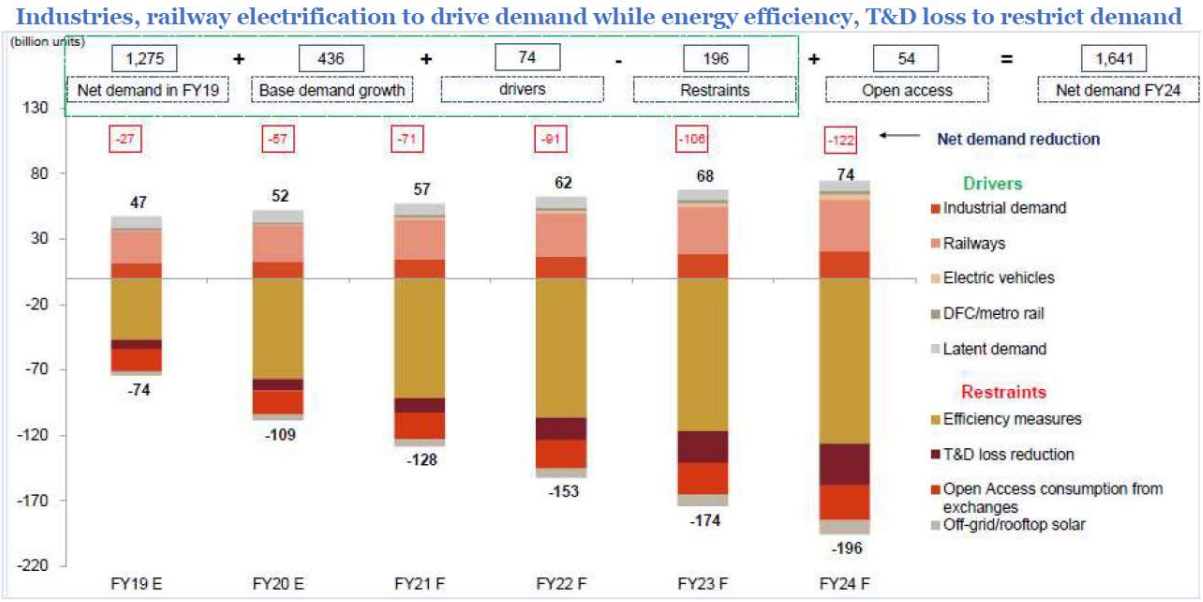
Expected demand forecast

Power demand is expected to grow at 6.2% CAGR over the coming years till 2030 mainly driven by unlock down of Indian economy and pick in economic activity supported by budgetary announcements, government led investments in large infra projects and rising capacity utilisations on account of expected consumption push. Further, strengthening of transmission and distribution infrastructure, intensive electrification across country, improved power quality and reduced power cuts are expected to fuel power consumption.

Snapshot of key results: Past vs Future of Electricity Demand



Factors driving and restraining demand –

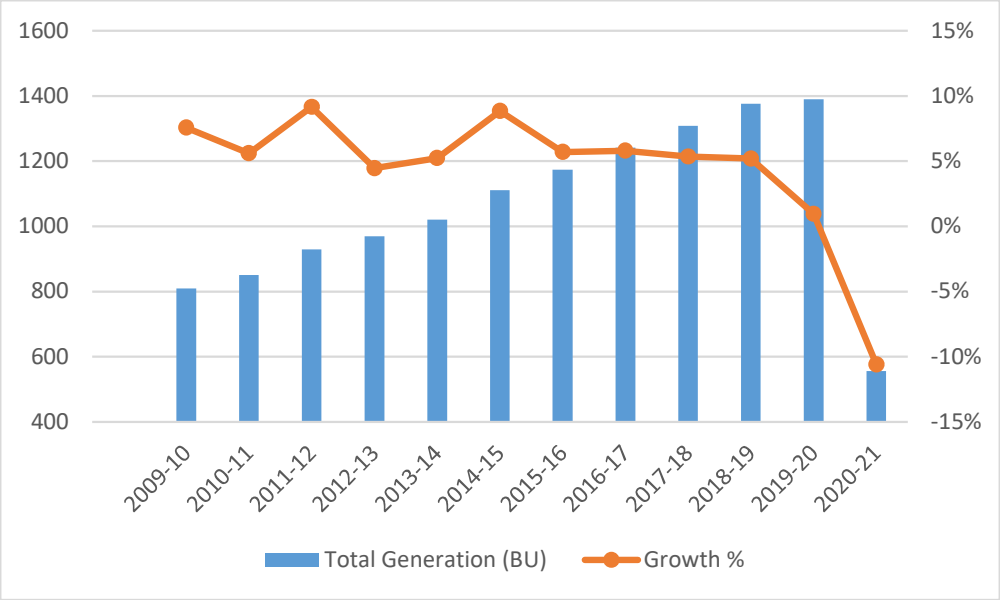


Power Generation (supply) –

Majority of India's installed capacity for power generation is from Thermal with Coal based power plants forming the main fuel source. However, GoI has been aiming for increase in renewable power generation and taken measures in this direction.

The electricity generation for the country has been increasing at a steady rate in the past. The budgeted electricity generation target of conventional sources for the year 2020-21 has been fixed to achieve a growth of around 6.33% over actual conventional generation of previous year (2019-20). However, the actual growth in generation was ~1%.

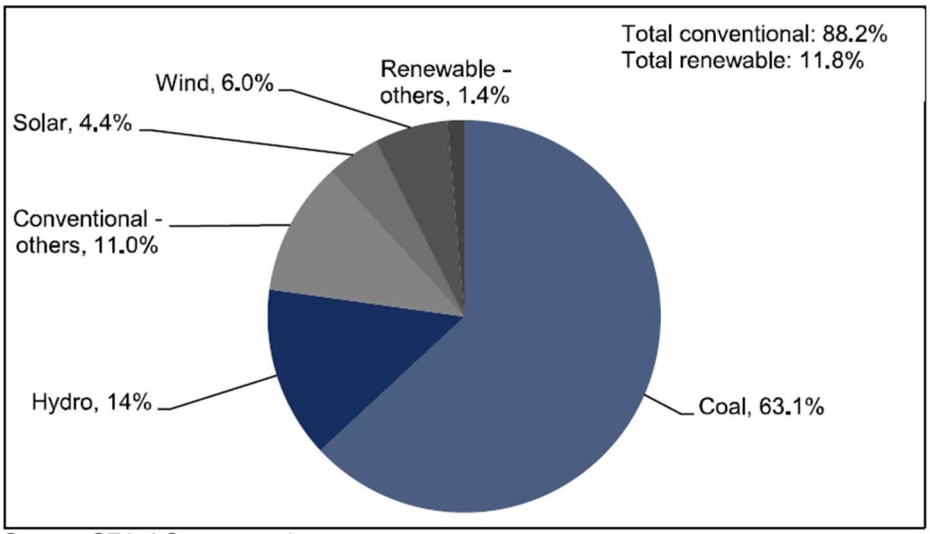
Year	Total Generation (BU)	Growth %
2009-10	808	*8%*
2010-11	850	*6%*
2011-12	928	*9%*
2012-13	970	*4%*
2013-14	1020	*5%*
2014-15	1110	*9%*
2015-16	1174	*6%*
2016-17	1242	*6%*
2017-18	1308	*5%*
2018-19	1376	*5%*
2019-20	1389	*1%*
2020-21	555	*-11%*



Fuel wise generation during 5MFY21–

Coal has continued to be the favoured energy source comprising of majority of the generation and during 5MFY21 experienced improved substantially from June 2020 as the demand normalised post unlock down.

While conventional generation continues to constitute the majority, renewable generation' share in total generation is increasing every quarter. Renewable sources received the status of 'Must Run' during the 5MFY21 and thus their total contribution increased to 11.8% of the total generation as compared to 10.6% /10.8% in the same period of FY19 /FY20. Further, early and above-normal monsoons have resulted in better hydro generation compared to previous years.

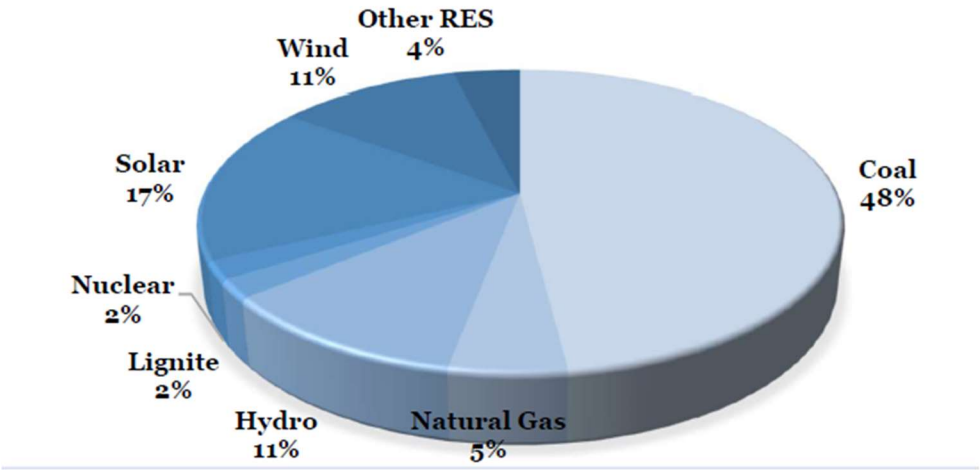


Source: CEA, I-Sec research

Expected addition in Installed Capacity –

All-India installed capacity to reach ~455 GW by fiscal 2024, led by renewables. Capacity additions will be mainly driven by the central sector as the stressed financials of private players as well as lack of long-term PPAs limit the private investments. Renewable capacity of ~66 GW is expected to be added over the next five years.

The expected installed capacity division based on type of Fuel by FY24 is



Power Surplus / (Deficit)

India has remained a Power deficit country due to higher power demand over supply. Power supply deficit has narrowed down over the years due to installed capacity additions. In the last 10 years, the deficit of ~13% has reduced to ~1%.

Year	Energy				Peak			
	Requirement (MU)	Availability (MU)	Surplus(+)/Deficts(-) (MU)	(%)	Peak Demand (MW)	Peak Met (MW)	Surplus(+) / Deficts(-) (MW)	(%)
2009-10	8,30,594	7,46,644	-83,950	-10	1,19,166	1,04,009	-15,157	-13
2010-11	8,61,591	7,88,355	-73,236	-9	1,22,287	1,10,256	-12,031	-10
2011-12	9,37,199	8,57,886	-79,313	-9	1,30,006	1,16,191	-13,815	-11
2012-13	9,95,557	9,08,652	-86,905	-9	1,35,453	1,23,294	-12,159	-9
2013-14	10,02,257	9,59,829	-42,428	-4	1,35,918	1,29,815	-6,103	-5
2014-15	10,68,923	10,30,785	-38,138	-4	1,48,166	1,41,160	-7,006	-5
2015-16	11,14,408	10,90,850	-23,558	-2	1,53,366	1,48,463	-4,903	-3
2016-17	11,42,929	11,35,334	-7,595	-1	1,59,542	1,56,934	-2,608	-2
2017-18	12,13,326	12,04,697	-8,629	-1	1,64,066	1,60,752	-3,314	-2
2018-19	12,74,595	12,67,526	-7,070	-1	1,77,022	1,75,528	-1,494	-1
2019-20	12,91,010	12,84,444	-6,566	-1	1,83,804	1,82,533	-1,271	-1
2020-21*	5,15,412	5,13,528	-1,883	-0	1,71,510	1,70,408	-1,101	-1

*Upto August 2020

Further, with the aggressive capacity expansion plan it is expected that the deficit will narrow down further and the oversupply situation would persist.

Major Companies in the power sector

1. Adani Power Limited and Adani Green Energy Limited

Adani Power Limited is engaged in power generation by coal-based thermal power plants and coal trading. Its business activity is undertaken at Mundra Thermal Power Plant (4,620 MW) of the company in Gujarat and Thermal Power Plant of its subsidiaries at Tiroda (Maharashtra) (3,300 MW), at Kawai (Rajasthan) (1,320 MW) and at Udupi (Karnataka) (1,200 MW). It has approximately five power projects with aggregate 10,480 MW power generation capacity.

2. National Thermal Power Corporation (NTPC) Limited

NTPC Limited is engaged in the generation and sale of electricity. The main business activity of the company is the electric power generation by coal-based thermal power plant. The company also provides consultancy, project management and supervision, re-gasification, oil and gas exploration and coal mining. Total installed capacity – 48,895 MW, including joint ventures (JVs) with over 18 coal-based, seven gas-based stations and one hydro based station. The company has approximately nine joint venture stations and holds approximately nine renewable energy projects. NTPC plans to set up a 5-Gigawatt Solar Power Park in Gujarat.

3. Power Grid Corporation

Power Grid Corporation of India Limited is a transmission company engaged in the power transmission business with planning, implementation, operation and maintenance of inter-state transmission system and operation of national and regional load dispatch centres. The company's provides consultancy. The transmission segment includes extra high voltage/high voltage (EHV/HV) networks and grid management.

4. Tata Power –

Tata Power is India's largest integrated power company, with significant presence in solar, hydro, wind and geothermal energy space. Tata Power, together with its subsidiaries & joint entities, has a generation capacity of 12,742 MW of which 30% comes from clean energy sources. The company accounts for 52 per cent of total generation capacity in the private sector. By 2022, the company plans to increase the generating capacity to 18 GW, distribution networks by 4 GW and energy resources by 25 million tonnes per annum.

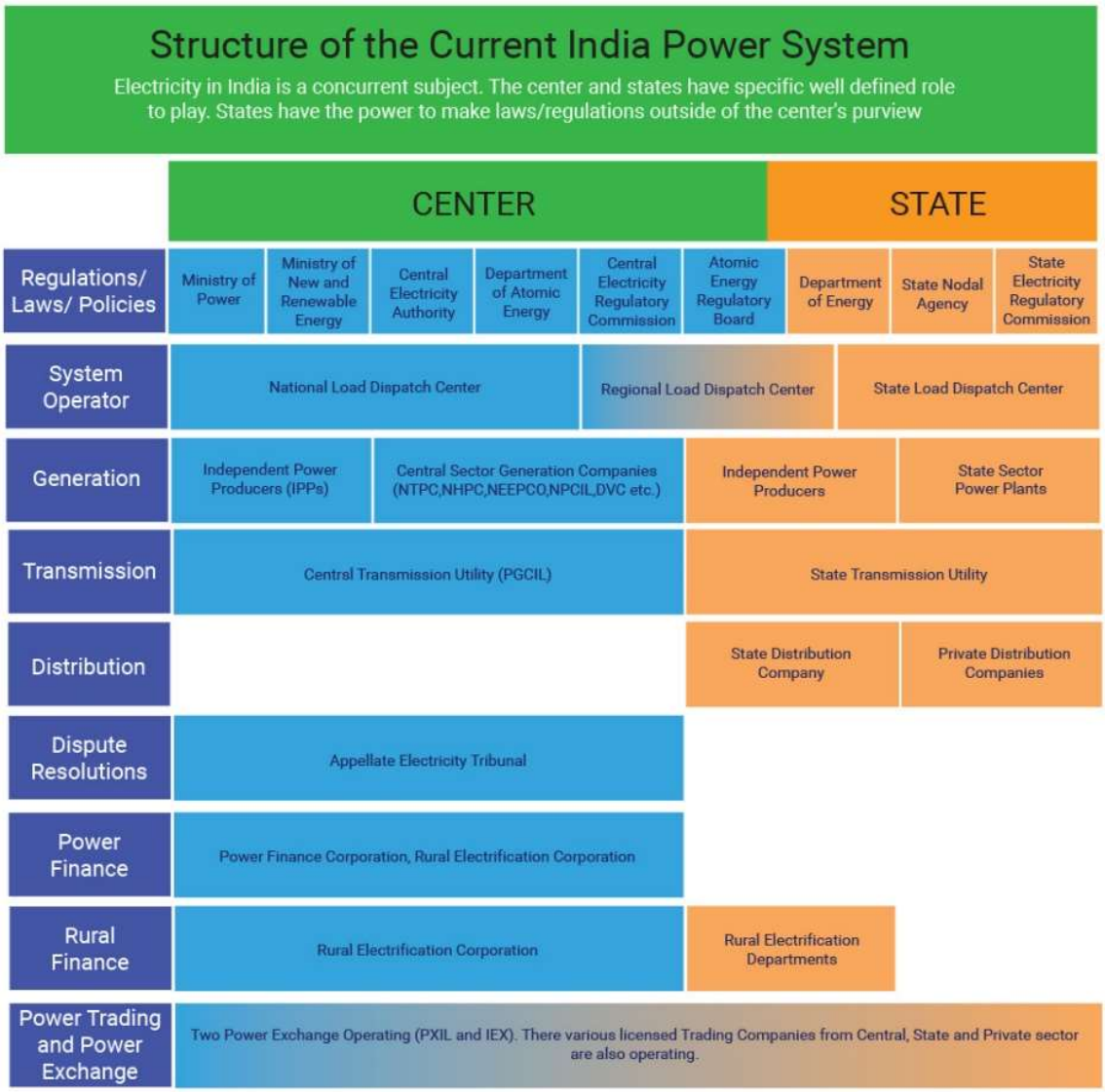
5. NHPC

NHPC Limited is the largest organisation for hydropower development in India, with capabilities to undertake all the activities from conceptualization to commissioning in relation to setting up of hydro projects. NHPC Limited has also diversified in the field of Solar & Wind power. NHPC Limited presently has an installation base of 7,071.2 MW from 24 power stations on ownership basis including projects taken up in Joint Venture

6. PFC –

Power Finance Corporation Limited (PFC) is an NBFC engaged in financing and development activities within the Indian power sector. Major products and services include project term loans, lease financing, direct discounting of bills, short-term loans and consultancy services.

Structure of Indian Political system –



Power Exchange – Indian Energy Exchange

Indian Energy Exchange Limited (IEX) is the first and largest energy exchange in India providing a nationwide, automated trading platform for physical delivery of

- Electricity
  - Day Ahead Market
  - Term Ahead Market
- Renewable Energy Certificates
- Energy Saving Certificates

The exchange platform enables efficient price discovery and increases the accessibility and transparency of the power market in India while also enhancing the speed and efficiency of trade execution. The benefiting open access consumers belong to various industries such as metal, food processing, textile, cement, ceramic, chemicals, automobiles, information technology industries, institutional, housing and real estate and commercial entities. The Exchange is a publicly listed company with NSE and BSE. IEX is approved and regulated by Central Electricity Regulatory Commission (CERC).

Valuation metric –

- **Discounted Cash flows –** As revenue is regulated based on the Power Purchase Agreement (PPA's) and the cost are based mainly on the operational cost and cost of coal, discounted cash flow forms the most important method for valuation
- **EV / EBITDA –** A market approach which is evaluated based on the acquisition transactions executed in the market. However, state wise Discoms follow different timelines for release of dues and thus location of plants has an important role while comparing the metric.
- **EV / MW –** An operational metric used to evaluate the value of the power plant based on its capacity installed and PLF%.

Financial stress in the power sector –

The financial stress and debt burden experienced in the power sector is amongst the highest in industrial segment. With increasing outstanding dues from government departments: most Discoms find issue in debt as the key obstacle in remaining debt restructuring. Inconsistent tariff hike across states, while states like AP, MH, UP, TN have not hiked tariffs as per UDAY MoUs Stressed power assets:

Measures taken by government for stress resolution:

- Fuel linkages under SHAKTI
- PPA aggregation –pilot scheme for procurement of 2,500 MW and rationalisation of coal escalation index
- Pass through of costs of meeting environmental norms
- Direction for timely implementation of 'change in law'
- Tracking of Discom payments to generators -PRAAPTI portal and expected Reforms under the UDAY scheme
- Reduction of cost of generation through various initiatives
- Other measures –clearing of payment dues from Discoms on time

Progress achieved and way forward:

- Coal linkage under SHAKTI –9 GW (5 plants) got linkage from CIL
- Stake sale by lenders –Two projects (SKS and Jaypee Prayagraj)
- Amendment to SHAKTI policy to allow linkage coal to plants with short term PPAs
- Govt. approved the recommendations of high level committee constituted to address problems faced by stressed thermal power plants. Government-led initiatives to accelerate resolution

Government Initiatives

GoI has been striving to promote sustained industrial growth, and the power sector forms a key sector of focus on its promotion. Few initiatives undertaken to boost the power sector in India are as follows:

- Government plans to establish renewable energy capacity of 500 GW by 2030.
- GoI has allocated Rs. 15,875 crore in the Union Budget 2020-21 to the Ministry of Power and an allocation of Rs 5,500 crore has been made towards the Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY).
- The Saubhagya Scheme or Pradhan Mantri Sahaj Bijli Har Ghar Yojana is an Indian government project to provide electricity to the households. The project was announced in September 2017 by Prime Minister Narendra Modi, who said that the aim was to complete the electrification process during financial year 2018 – 19.
- GoI has been in process of distributing electricity saving and LED lamps across the nation to promote availability of electricity. They have distributed 36+ crore lamps as a part of the UJALA Scheme across nation.
- In September 2018, a draft amendment to Electricity Act, 2003 was introduced. It discussed separation of content & carriage, direct benefit transfer of subsidy, 24*7 power supply as an obligation, penalisation on violation of PPA, setting up smart meter and prepaid peters along with regulations related to the same.
- Ujwal Discoms Assurance Yojana (UDAY) was launched by the Government to encourage operational and financial turnaround of State-owned Power Distribution Companies (DISCOMS) with an aim to reduce Aggregate Technical & Commercial (AT&C) losses to 15 per cent by FY19.

Electricity (Right to Consumers) Rules, 2020

New draft guidelines are expected to be approved to bring reforms in the sector.

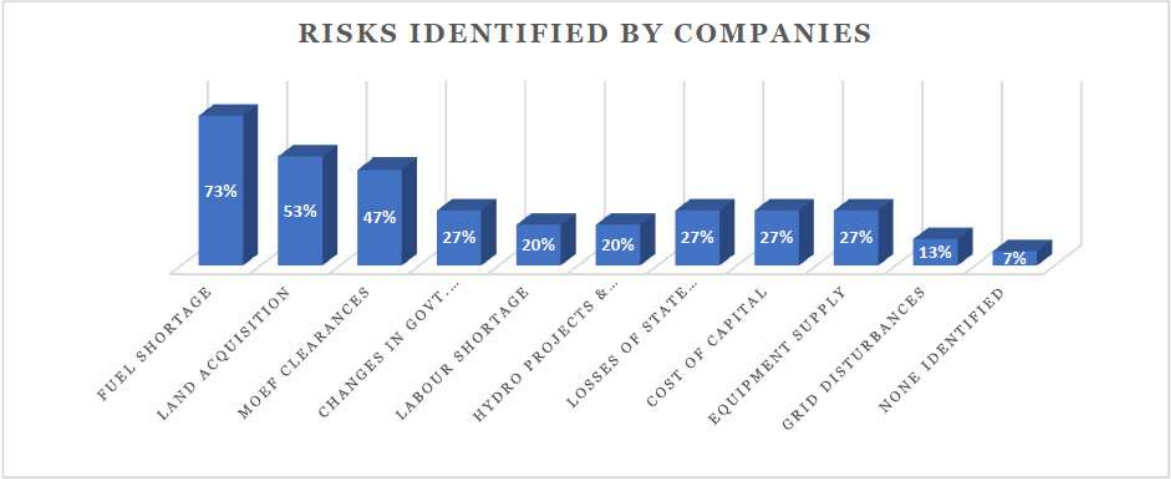
Achievements

- In April 2020, NTPC Vindhyachal became the largest power plant in the country to achieve a plant load factor (PLF) of 100 per cent.
- India's rank jumped to 22 in 2019 from 137 in 2014 on World Bank's Ease of doing business - "Getting Electricity" ranking.
- Energy deficit reduced to 0.7 per cent in FY20 from 4.2 per cent in FY14.

Risks identified for the Sector –

- Inadequate supply of fossil fuels
- Delay in land acquisitions and environment clearances
- Changes in government regulations and policies
- Cost of capital
- Financial burden and stress in power sector
- Losses of state Discom and delay in payments
- Lack of working capital facility
- Disturbances in grid transmission
- Others

Risks identified



The Way Ahead

GoI has released its roadmap to achieve 175 GW capacity in renewable energy by 2022, including 100 GW of solar power and 60 GW of wind power. The Union GoI is also in process of initiating 'rent a roof' policy for supporting its target of generating 40 gigawatts (GW) of power through solar rooftop projects by 2022. Coal-based power generation capacity in India, which currently stands at 230 GW, is expected to reach 330-441 GW by 2040.

Indian Government is in process of increasing the power generation capacity of the country to meet the increasing consumption requirements.