OVERVIEW OF THE POWER SECTOR

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Country has surplus generation capacity but deficits continue in some regions

Capacity utilisation of thermal plants has declined

Discoms are in poor financial health and have weak capacity to buy power

Electrification numbers have improved but the quality of supply is questionable

INSIGHTS

Surplus generation capacity but deficits continue, capacity utilisation declining

Two years ago, the central government announced that India has become a power surplus country, and all the villages have been electrified. However, since then, several issues have come up in the sector, and a few others remain to be addressed.

The country continues to face both energy deficit and peak deficit, although at a marginal level. In 2017-18, energy deficit in the country was 0.7%, and peak deficit was 2%. However, the deficit situation is exaggerated in certain states, and the north-eastern region, in particular.

The capacity utilisation of thermal power plants (also called Plant Load factor or PLF) has declined from 78% in 2009-10 to 61% in 2018-19. Low PLF implies that thermal plants have been lying idle, which could be due to non-availability of fuel, surplus capacity (in certain regions of the country), low demand for power, or demand being met through other sources. One of the key reasons behind poor capacity utilisation of thermal power plants is the planned shift in the energy mix. With renewable energy seeing a push through government policies, its tariff has decreased significantly. This poses a challenge to the existing thermal capacity, which is witnessing subdued demand, and poor capacity utilisation as a consequence. The renewable energy market is still developing. However, its growth trajectory may affect the thermal sector, where plants are already operating at lower capacities and facing insolvency, in certain cases.

Capacity to buy still remains weak as discoms are in poor financial health

The poor financial health of discoms has a significant impact on the power sector. Their poor finances imply that they are unable to buy power, and invest in the transmission and distribution infrastructure (including investment for renewable energy). This affects retail consumers and power producers. Consumers do not get good quality of power, and power producers are unable to sell power in the market, thereby facing losses, and default on their loans.

As per the Standing Committee on Energy, as on June 2017, there were 34 stressed thermal power plants with an outstanding debt of Rs 1.74 lakh crore. These thermal power plants are becoming NPAs due to non-availability of coal at power plants, lack of long term power purchase agreements with discoms, and failure of discoms in making timely payments. With respect to renewable energy, the rapidly falling price of power generation due to technological advancements may pose risk to projects which were set up earlier at higher costs. As per the Ministry of Power, the aggregate overdue of discoms to all generators is Rs 54,599 crore, as on July 31, 2019.

While UDAY addressed the outstanding debt of discoms partially, they have not been able to achieve all the goals they were mandated to, under the scheme. Aggregate Technical and Commercial Losses (includes theft and billing issues) are at 20%, as opposed to the target of 15% by 2018-19. The gap between cost of supplying power and the average revenue realised is Rs 0.25/unit, as opposed to the target of being eliminated. Note that one of the key reasons for this revenue gap is the under-pricing of tariff for agricultural and residential consumers. Further, the RBI has noted that UDAY will increase the liabilities of the states, who are taking on the losses of the state discoms.

Rural electrification numbers have improved, but the quality of supply is questionable

In April 2018, the central government announced that all villages have been electrified. Under the Saubhagya scheme, 18,374 households remain to be electrified as on March 31, 2019. However, continuous supply of electricity continues to remain a challenge. Data also shows that about 53% of the villages receive electricity for less than 12 hours in a day for domestic use. Further, supply to rural areas has to be carried out by discoms, many of which are in poor financial health.

OVERVIEW OF THE POWER SECTOR

With India looking at rapid industrialisation and urbanisation over the next three decades, the demand for power in the country is going to increase. The power generation situation in the country has improved in the last few years. In June 2017, the Minister of Power announced that India has become a power surplus country, with no shortage of electricity or coal.[1] Currently, India produces a majority of its energy from thermal sources. However, with the commitment to the Paris Agreement (on climate change), there has been a push towards increasing the renewable generation capacity in the country. With solar and wind power becoming cheaper, cleaner sources of energy have also become affordable.

However, the sector continues to face several issues. Access to power and the quality of power supplied to consumers is still poor. India also continues to face both energy deficit (0.7%) and peak deficit (2%). The deficit situation is worse in certain states such as Jammu and Kashmir, and the north-eastern states. Further, data shows that, in 2018, about 53% of the villages received electricity for domestic use for less than 12 hours in a day.[2] Despite all villages being electrified, continuous supply of electricity continues to remain a challenge.

Another key issue is the poor financial health of the electricity distribution companies, which is affecting their ability to buy power and improve the supply network. While their debt to banks was addressed to a certain extent by UDAY, the debt they owe to power plants is also a concern. As per the Standing Committee on Energy, as on June 2017 (post-UDAY period), there were 34 stressed thermal power plants with an outstanding debt of Rs 1.74 lakh crore.[3]

These trends suggest that surplus power capacity, or electrifying villages may not imply continuous, and good quality power supply across the country. In the first budget of the 17th Lok Sabha, the central government mentioned that a package of power sector tariff and structural reforms will be announced soon. In this context, this note looks at how the power sector is regulated, current status of the power sector, key issues in the sector, recommendations on reforming the sector, and recent policy developments in the sector.

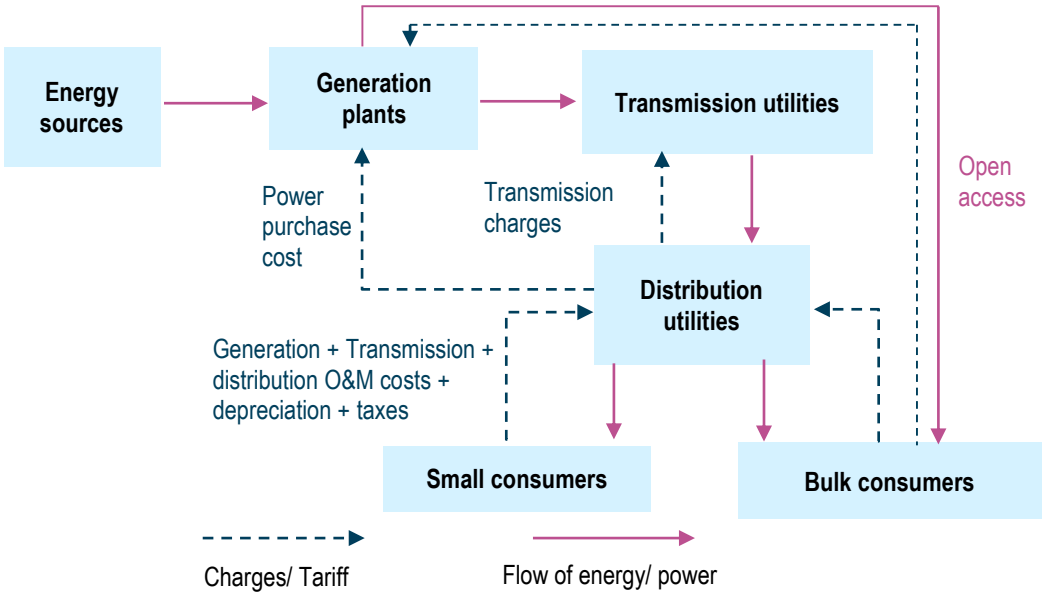
POWER SECTOR IN INDIA

There are three primary segments in the electricity sector: generation, transmission and distribution. Generation is the process of producing power using different fuels and is carried out in generating stations (generation plants). Transmission utilities carry bulk power from the generation plants to the distribution substations through a grid and at high voltages. Distribution utilities supply electricity from the substations to individual consumers through a distribution network. Distribution is the retail stage and operates at lower voltages. Figure 1 shows the overall structure of the power sector.

Generation

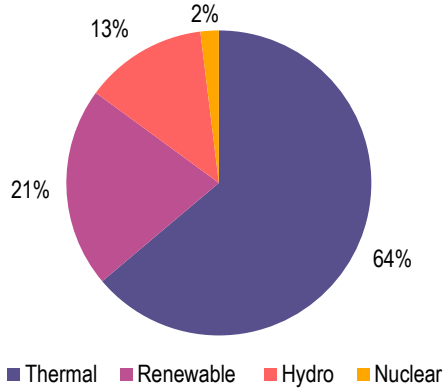
In India, various sources of energy are used to generate power. These include coal, natural gas, hydro, nuclear, and renewable (includes solar, wind, small hydro, biomass). As on December 2018, the power generation capacity of the country is at 349 GW.[4] In the last two decades, India's generation capacity has increased considerably. This increase is attributed to the delicensing of power generation in 2003, which enabled unrestricted participation of private sector companies. Today, private utilities generate 46% of the power in the country, followed by state utilities (30%), and central generating utilities (24%).

Figure 1: Structure of the power sector



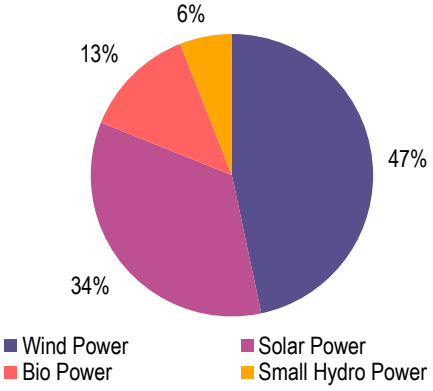
Coal accounts for a majority of power generation at 55%. Overall thermal power generation (including coal, and natural gas) is at 64%. Renewable energy accounts for around 21% of the total generation capacity. Hydro power accounts for 13% of generation and nuclear for 2%. Details of all-India power generation capacity are provided in Figure 2 and Table 1 below. Power sector is the largest user of coal. In 2017-18, 576 MT of coal was dispatched to the power sector (84% of the total coal dispatched in the country).[5]

Figure 2: All India power generation capacity (as on January 2019)



Sources: Ministry of Power; PRS.

Figure 3: Grid interactive renewable power capacities (as on January 2019)



Sources: Ministry of New and Renewable Energy; PRS.

Table 1: Installed generation capacity in MW (as on January 2019)

	Thermal					Nuclear	Hydro (renewable)	Renewable sources	Grand total
	Coal	Lignite	Gas	Oil	Total				
Total capacity	1,91,093	6,360	24,937	638	2,23,028	6,780	45,399	74,082	3,49,289
% of total capacity	54.7%	1.8%	7.1%	0.2%	63.9%	1.9%	13.0%	21.2%	100%

Sources: Ministry of Power; PRS.
Note: Small Hydro, and Hydro projects are classified as Renewable Sources.

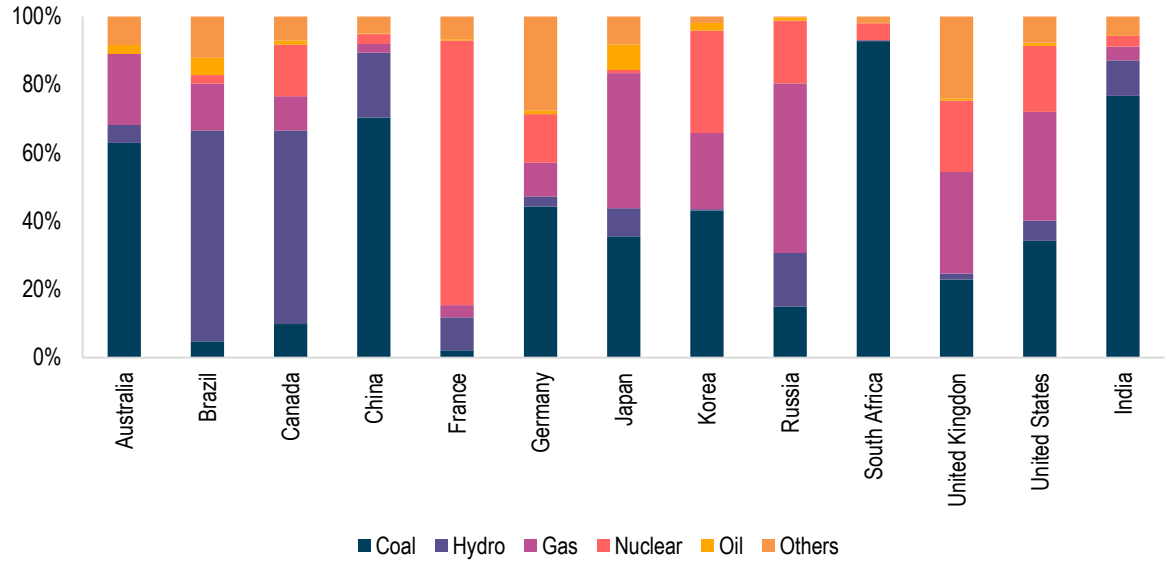
Renewable energy

Renewable energy sources include wind, solar, bio power, and small hydro power. In March 2019, the Union Cabinet announced that hydro power projects will be also classified as renewable energy projects.[6] Renewable sources could either be connected to the grid, or be off-grid systems. Off-grid systems help in meeting the energy requirements of remote areas, and areas which are not likely to be electrified in the near future. Examples of off-grid systems include biomass-based heat and power projects, industrial waste-to-energy projects, and solar roof-top systems.

As of January 2019, the total grid-interactive renewable power capacity (excluding hydro) is at 74 GW.[7] Hydro capacity is at 45 GW. The government has set a target of installing 175 GW of renewable energy capacity by 2022 (excluding hydro).[8] This includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro power.[9] Roughly, this would translate into an average capacity addition of about 33 GW every year till 2022. Currently, the capacity addition is at around 24 GW per year. Note that wind and solar power have a lower plant load factor (PLF) than thermal power given the intermittent wind speed and sunlight, often averaging at 20-25%. Therefore, renewable capacity addition needs to be higher than for thermal plants to generate the same amount of electricity.

Figure 4 below shows the mode-wise electricity generation across several countries. Coal continues to be the primary source of electricity in several countries. Few countries such as Brazil and Canada generate most of their electricity from cleaner sources of energy such as hydro power. Several countries such as Japan, Russia, UK and the US also generate a significant amount of gas-based power, which is cleaner as compared to coal.

Figure 4: Gross electricity generation in various countries mode-wise (2015)



Sources: Central Electricity Authority; PRS.

Transmission

Transmission is carried out primarily by central and state companies and largely remains a government controlled activity. The transmission segment was separated from the central generation agency in 1989 and Power Grid Corporation of India (Powergrid) was set up. Powergrid is responsible for the planning, implementation, operation and maintenance of inter-state transmission system, and the operation of national and regional power grids.

The Electricity Act, 2003 allows for open access which enables consumers to buy power from any power generating plant through non-discriminatory access to transmission and distribution lines, in

a manner specified by the respective state/state regulator. The National Load Despatch Centre (NLDC) manages the scheduling and dispatch of electricity over inter-regional links in accordance with grid standards, and monitors the national transmission grid. It is also the nodal agency providing transmission access to the power exchanges. The Regional Load Despatch Centres (RLDCs) manage the operation of the power system grid in the respective regions.

India's transmission lines have grown at an average annual rate of 6.5% between 2007 and 2019 (till March 2019); substation capacity has grown during the same period at 11.2%.[10,11] Inter-regional transmission capacity has grown from 14 GW in 2007 to 95 GW till January 2019.[12]

Distribution

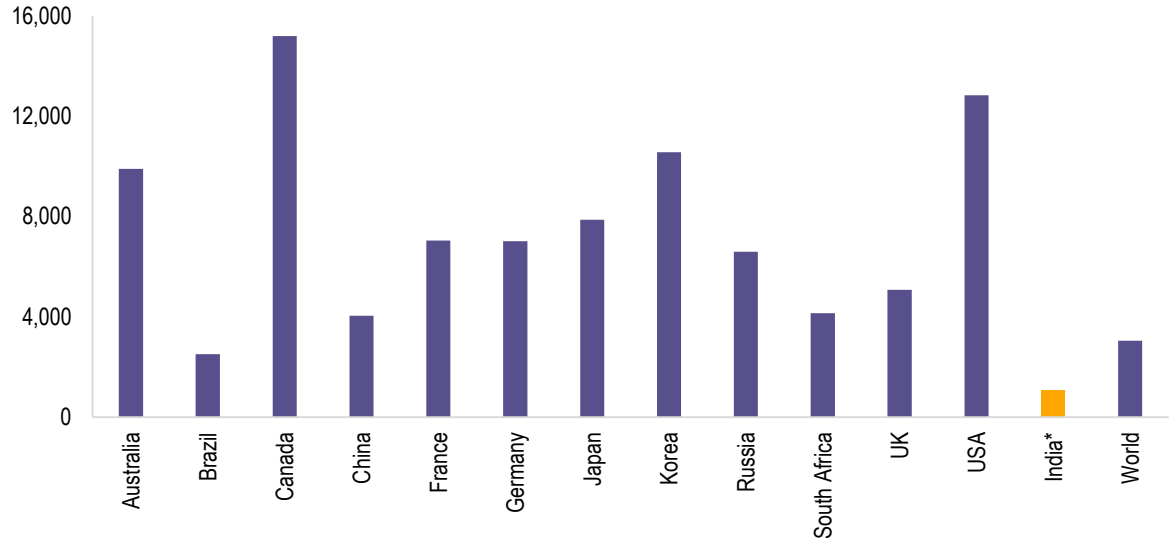
Distribution includes maintenance of the distribution network and retail supply of electricity to the consumers. It is mostly carried out by state-owned distribution companies (discoms). However, in cities such as Delhi, Mumbai, Ahmedabad, and Kolkata, private entities own the distribution business. Discoms (or distribution licensees) purchase power from generation companies through power purchase agreements (PPAs), and supply it to their consumers (in the area of distribution).

One of the key issues with the power sector currently is the poor financial situation of state discoms. This has been affecting their ability to buy power for supply, and the ability to invest in improving the distribution infrastructure. Consequently, this impacts the quality of electricity that consumers receive.

Power consumption

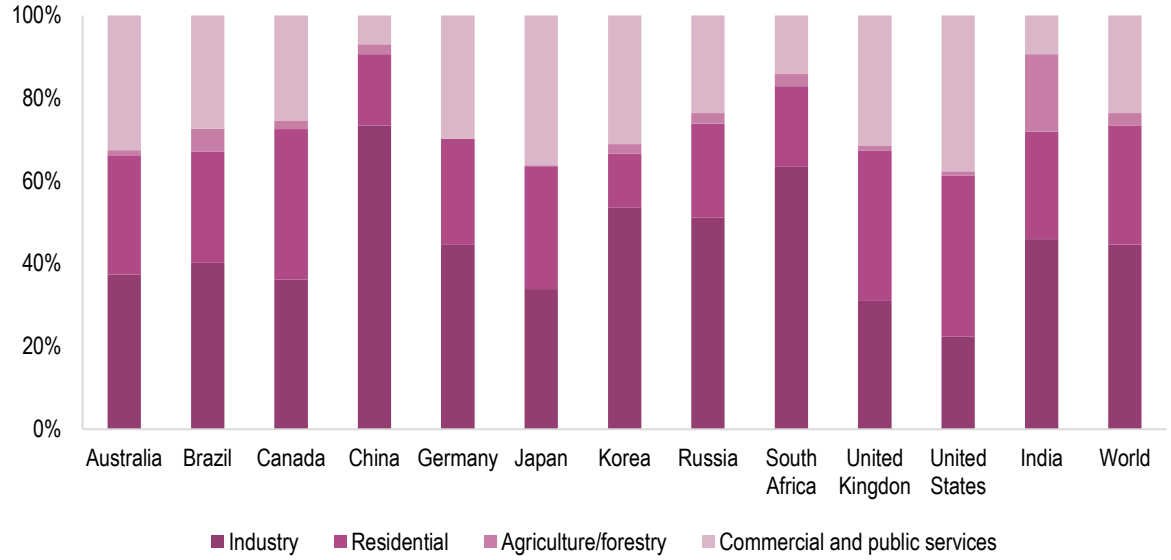
India's per capita power consumption was 1,149 kWh as on March 31, 2018.[13] This consumption has increased at an average annual rate of 4.6% since 1990. However, it is much lower as compared to several other countries (see Figure 5). Across different categories, the consumption by the agriculture sector in India is higher as compared to other countries. On the other hand, in India, the consumption by the commercial sector is lower as compared to other countries (see Figure 6).

Figure 5: Per capita power consumption in 2015 (in kWh)



Sources: Central Electricity Authority; PRS.

Figure 6: Category-wise consumption across countries (in 2015)



Sources: Central Electricity Authority; PRS.

Coal linkages and purchase of power

Coal linkages

In May 2017, the Ministry of Power announced a new scheme for coal linkages for thermal power plants – Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India (SHAKTI).[14] Prior to this, coal was supplied to thermal power plants as per the National Coal Distribution Policy, 2007 (NCDP). Under this policy, a Standing Linkage Committee (under the Ministry of Power) recommended the issuance of Letters of Assurance (LoAs) to power plants. LoA holders that met certain milestones were entitled to enter into Fuel Supply Agreements (FSAs) with coal companies for the long-term supply of coal. The new scheme SHAKTI, proposes to move towards an auction based system for allocation of such linkages (except for central and state generation companies, and certain exemptions provided in the Tariff Policy, 2016).

Under the scheme, thermal power plants with LoAs will be eligible to sign FSAs after ensuring that the plants are commissioned, respective milestones are met, and all specified conditions of the LoA are fulfilled within a specified timeframe. The plants must be commissioned before March 31, 2022. The linkages will be granted by Coal India Limited (CIL) or Singareni Collieries Company Limited (SCCL). Future coal linkages will be granted as per the following:

i. **Central and state generating companies:** On the recommendation of the Ministry of Power;

ii. **Independent power producers with Power Purchase Agreements (PPAs) (based on domestic coal):** On the basis of auction;

iii. **Independent power producers without PPA:** Auction where bidding for linkage will be done over the Notified Price of Coal Company.

Power Purchase Agreements (PPAs)

PPAs are bilateral contracts between the procurers (discoms) and the generators (power plants). Each PPA has specific terms and conditions setting out the rights and obligations of the generators and the procurers. This includes the price at which electricity would be purchased, the mechanism for adjustment of tariffs for select events, mutually agreed conditions for risk sharing and termination of the PPAs. Typically, PPAs tend to be long-term in nature, i.e., around 20-25 years.

REGULATORY STRUCTURE

With growth in the industrial and services sector in the 80s and the 90s, the power sector has changed significantly. Regulatory changes during this period sought to increase private sector participation in the sector, and bring in more competition and efficiency (more details in Table 2). This resulted in the state owned electricity boards being restructured. The generation segment was delicensed, and gradually witnessed increased private participation. Independent regulators were set up at both the central and state level, and Appellate Tribunals were established to hear appeals against these commissions.

Currently, the Electricity Act, 2003 is the primary law regulating the electricity sector. 27 State Electricity Regulatory Commissions (SERCs), and the Central Electricity Regulatory Commission (CERC) regulate inter-state and intra-state matters in generation, transmission, trading and distribution of power. One of the key roles of the Commissions (typically SERCs) is to approve the tariff for retail sale of electricity.

Tariff determination: Typically, electricity tariff consists of two parts: (i) Fixed Cost, and (ii) Variable Cost. It is also called as Two Part Tariff.[15] Fixed cost includes interest, depreciation, operations and maintenance costs, return on equity (profit) and tax liabilities of power generation, transmission and distribution network. The variable cost primarily includes fuel cost (cost of electricity purchased from other utilities, cost of power lost in transmission and distribution, and state levies such as surcharge, tax are also included in certain cases). Discoms/ utilities are required to file their tariff petitions (annually) with the relevant SERC, who then approves such tariff based on the specified criteria.

However, it has been observed in the past that state discoms do not necessarily work on market principles, i.e., they do not price electricity to cover costs and reasonable profit. Many state-owned discoms did not file tariff revision petitions for multiple years from 2003 to 2011.[16] State discoms in states such as Bihar, Karnataka and Punjab did not revise their tariff between 2008 and 2011, in spite of an increase in the cost of electricity. During the same time period, the cost of power supply in these states went up by 12%, 10%, and 29% respectively. In 2011, the Appellate Tribunal for Electricity passed a judgment requiring SERCs to ensure that tariffs are revised in a timely manner by discoms. Following the judgement, it was observed that between 2012 and 2014, more than 20 states revised their tariffs.[17]

Competition in retail supply of electricity: The 2003 Act also provides for multiple distribution licensees to set up their own parallel network in the same area, thus allowing competition in the distribution segment.[18,] Parallel licensing is when multiple licenses are issued to distribution companies to supply electricity in a specific area of supply. However, the distribution segment has not seen much private participation (barring a few areas like Mumbai, and Delhi). Setting up of a new network requires significant capital investment and has acted as an entry barrier for new participants.

Recently, there have been proposals to bring in more private sector participation in the power distribution segment. The Electricity (Amendment) Bill, 2014, (which has now lapsed), and subsequent draft amendments proposed by the Ministry of Power, have proposed further restructuring of the distribution segment to bring in competition. As per the proposed framework, the distribution business will be segregated into the supply and network business. Consumers will have the choice to buy electricity from multiple power suppliers, as opposed to buying from a single distribution company currently. The discoms will maintain the retail networks which will be used by the supply companies on payment of usage charges.

Figure 7: Key stakeholders in the power sector

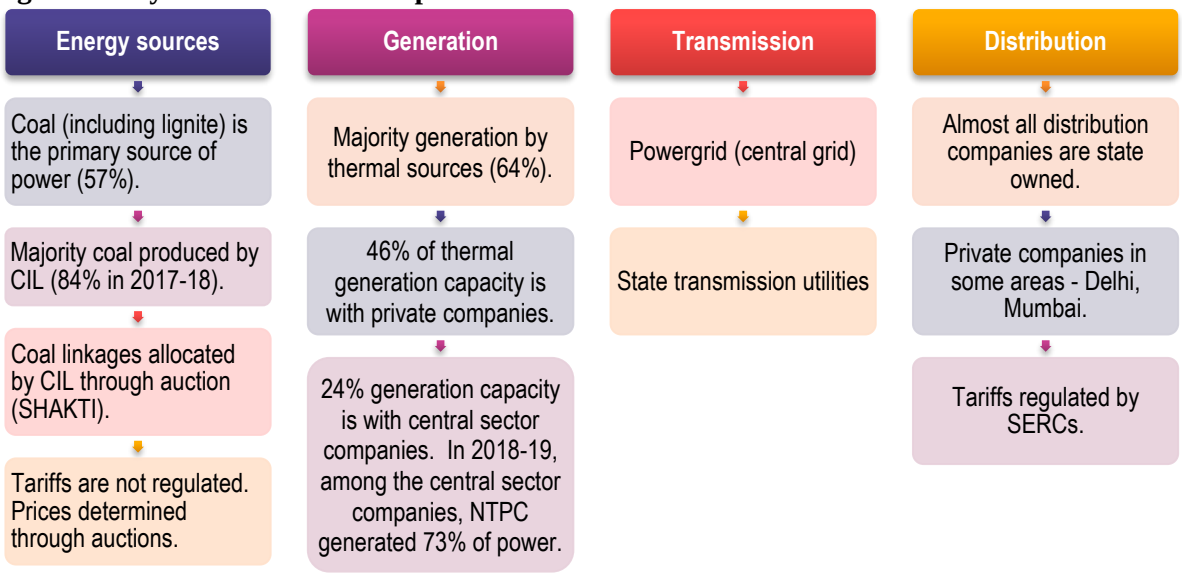


Table 2: Developments in the power sector

Year	Key developments
1948	Electricity Supply Act, 1948: Created state-level vertically integrated utilities responsible for power generation, transmission, and distribution, and for setting tariffs.[19]
1991	1948 Act amended to allow private companies to set up their power generation plants.
1996-98	Some states (Odisha, Haryana) started restructuring their state electricity boards. Restructuring included segregating generation, transmission, and distribution segments, and allowing private participation in the distribution segments.
1998	Established Regulatory Commissions at both the central and state levels through the Electricity Regulatory Commission Act, 1998. These Commissions regulate inter-state and intra-state matters in generation, transmission, and distribution of power.
2003	Electricity Act, 2003: Gave more powers to the Regulatory Commissions; provided for unbundling of the state owned electricity boards and multiple discoms in an area; allowed open access; provided for elimination of cross-subsidies in the sector. The 1948 Act, and 1998 Acts were repealed.
2014	Electricity (Amendment) Bill, 2014 to segregate retail supply from distribution, and bring in multiple supply licensees.
2015-2017	As of March 2015, the state discoms had accumulated losses of approximately Rs 3.8 lakh crore and outstanding debt of approximately Rs 4.3 lakh crore. The Ujwal Discom Assurance Yojana (UDAY) was introduced to allow states to help the discoms by taking over their debt.
2017 - now	India declared as a power surplus country. All villages have been electrified. New household electrification scheme, Saubhagya, launched. Draft amendments to the 2003 Act propose to segregate the network and supply business, and introduce a system of direct benefit transfers with regard to subsidies. Coal linkages are being allocated through auction (SHAKTI).

Sources: Electricity Regulatory Commission Act, 1998; Electricity Act, 2003; 14th Report: Transmission and Distribution Systems and Networks, Standing Committee on Energy; Power Sector Reforms in Odisha: Major Issues and Challenges, Government of Odisha; PRS.

ISSUES IN THE POWER SECTOR

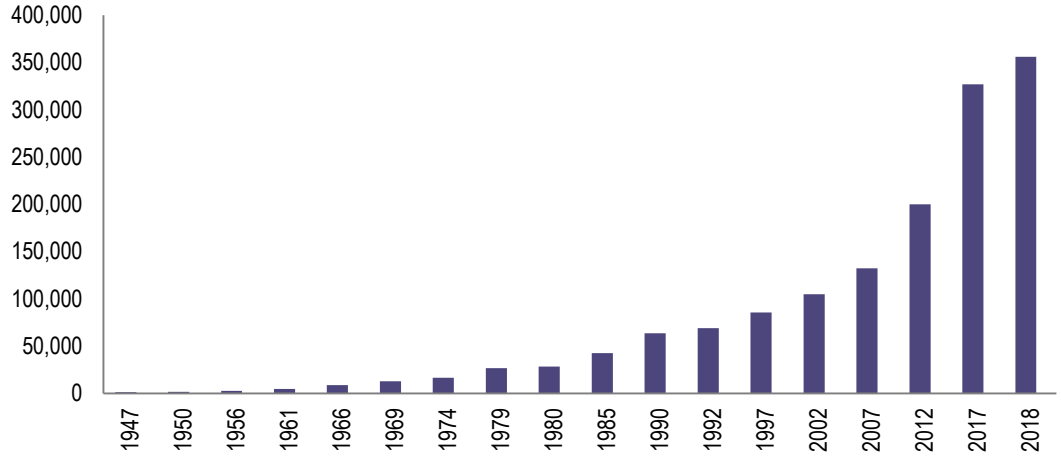
While the overall power situation in the country has improved, several issues still remain. The following sections look at the issues within each segment of the sector.

GENERATION

Peak deficit continues to persist

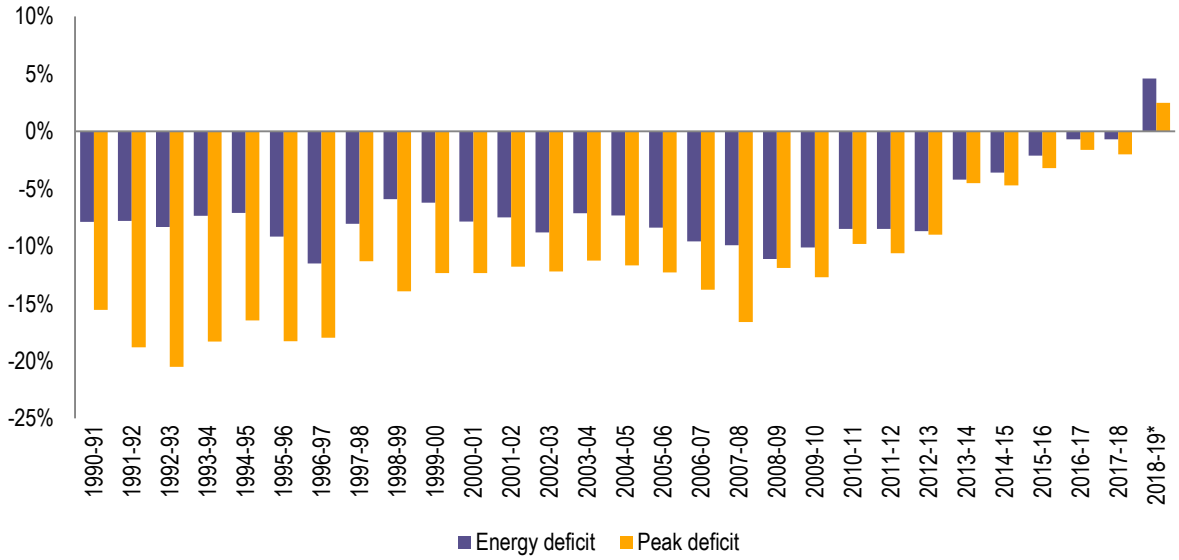
Generation capacity has increased over the years. Thermal generation capacity has had an average annual growth of 7% between 2005-06 and 2018-19. However, the country continues to face a peak deficit of 2%. This implies that in 2017, while the available capacity was 330 GW, the entire peak demand of 164 GW could not be met. This deficit situation is more pronounced in certain regions and states (see Figure 10 and Figure 11).

Figure 8: Total installed generation capacity (in MW)



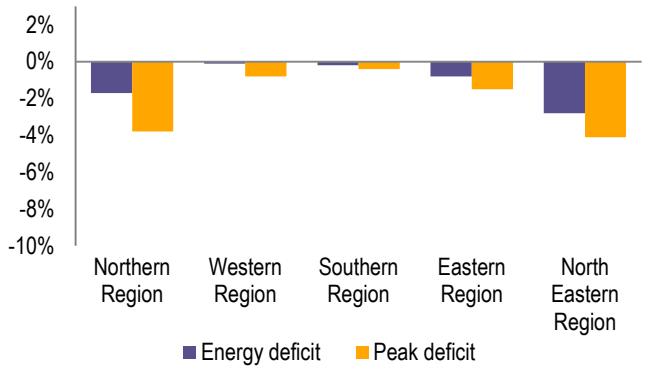
Note: Generation figures are for the end of the financial year.
Sources: Central Electricity Authority; PRS.

Figure 9: Power deficit in India



* Anticipated surplus
Sources: Central Electricity Authority; PRS.

Figure 10: Region-wise power deficit (2017-18)

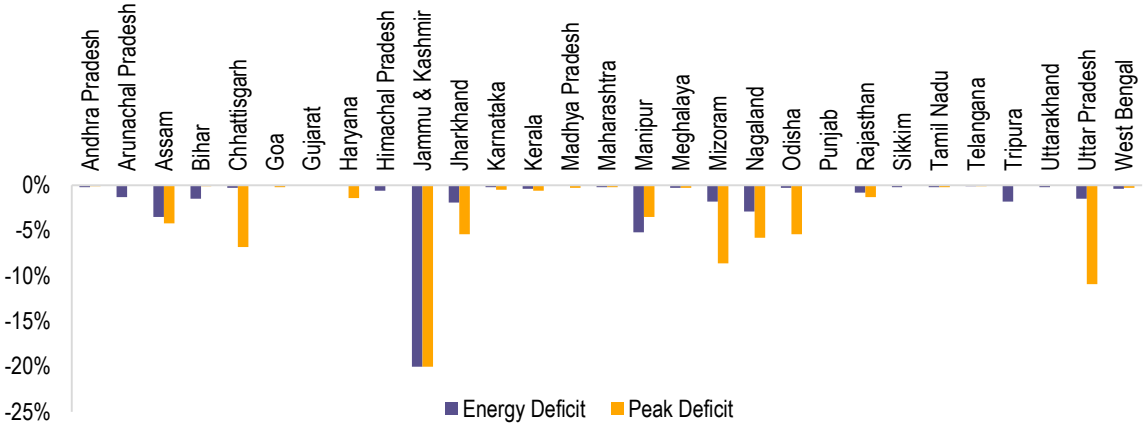


Sources: Central Electricity Authority; PRS.

In 2017-18, energy deficit in the country was 0.7%, and peak deficit was 2%.[20] However, for 2018-19, the Central Electricity Authority has projected an energy surplus of 4.6% and peak surplus of 2.5%.

The deficit situation is worse in certain states such as Jammu and Kashmir (both energy and peak deficit are at 20%), and the north-eastern states (the region saw energy deficit of 2.8%, and peak deficit of 4.1%). Further, certain states such as Chhattisgarh, Odisha, and Uttar Pradesh continue facing high peak deficit despite having significant generation capacity. These states have generation capacity of 13.5 GW, 7.6 GW, and 25 GW respectively, and peak deficits at 6.8%, 5.4%, and 10.9% respectively.

Figure 11: State-wise deficit (as on January 2019)



Sources: Central Electricity Authority; PRS.

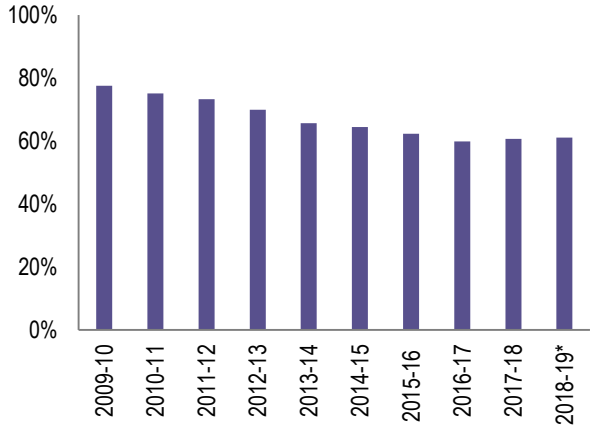
Capacity utilisation of thermal power plants has been declining

While generation capacity has been steadily increasing, the capacity utilisation of thermal power plants (also called Plant Load factor or PLF) has declined from 78% in 2009-10 to 61% in 2018-19.[21] Among the three types of generators (in terms of ownership), the private and state ones have poorer PLF as compared to the central ones. Table 3 shows details of PLF across the different types of generators.

The High Level Empowered Committee (HLEC) on Stressed Assets (2018) noted that in the last six years, 110 GW of generation capacity has been added, of which 100 GW is from coal-based plants. However, the demand has not increased at the same pace. Consequently, the available capacity is more than the demand and peak power shortage has reduced. Therefore, large capacity is lying underutilised.

Low PLF implies that thermal plants have been lying idle, which could be due to non-availability of fuel (gas or coal), surplus capacity (in some parts of the country), or demand for power being low, or demand being met through other sources. Thermal plants require significant fixed costs, and they incur such costs even when the plant is lying idle. Therefore, it may be pertinent to look at current capacity utilisation when estimating the future thermal capacity growth.

Figure 12: Plant load factor (in %)



* indicates provisional numbers (till January 2019)
Sources: Ministry of Power; PRS.

Table 3: Sector-wise PLF (in %)

Year	Central	State	Private
2009-10	86	71	84
2010-11	85	67	81
2011-12	82	68	70
2012-13	79	66	64
2013-14	76	59	62
2014-15	74	60	61
2015-16	73	55	60
2016-17	72	54	56
2017-18	72	57	55
2018-19*	72	58	56

* indicates provisional numbers (till January 2019)
Sources: Ministry of Power; PRS.

Energy mix needs to be balanced for efficient capacity utilisation

The Standing Committee on Energy (2017) had noted that inefficient capacity utilisation is due to several issues in the power sector.[22] Firstly, while there is enough generation capacity, the poor financial condition of discoms is resulting in suppressed demand for power, which leads to lesser utilisation of capacities.

Secondly, the substantive fall in solar tariff and its very low gestation period is posing a threat to the economic viability of thermal power plants. While growth in solar energy is a good sign for the country, thermal energy has been the primary source for the power sector, and will continue to remain an important source of power in the future. Further, given that renewable energy sources are intermittent in nature, a balancing power will be needed to support the grid and even out the fluctuations. For example, if solar energy is being used in an area, it will require an alternate source for the night time requirement. This balancing power could come from gas or hydro based power. As gas is a scarcely available resource, hydro power becomes a more obvious choice.

Thirdly, the share of hydro power has reduced from 25% in 2007-08, to about 13% in 2018-19. Harnessing hydro potential will also improve the power situation in the north-eastern states, Uttaranchal, Himachal Pradesh and Jammu and Kashmir, since a large proportion of hydro power potential is located in these states. It would also help boost economic growth in these states.

Therefore, the Committee recommended that the growth of various sectors should be such that they complement one another in maintaining a balanced energy mix.

Renewable market is still developing

Renewable energy sources are not evenly spread about the country. The NITI Aayog had observed that electricity buyers in renewable poor states are relatively less willing to purchase renewable electricity due to higher costs than the conventional sources.[23] On the other hand, discoms in renewable rich states have indicated that they would support additional renewable deployment only if they are assured of sufficient willing buyers.[23]

The Standing Committee on Energy (2015) had noted that due to the intermittent nature of renewable energy, making renewable generation or purchase mandatory may lead to problems.[24] The NITI Aayog had also recommended that pricing should be such that electricity buyers are indifferent between conventional and renewable energy resources until grid parity is achieved.[23] While renewable tariffs have decreased significantly in some state in the recent years, now the issue is with certain discoms hesitating to honour their renewable PPAs that were based on higher tariffs.

Note that the 2018 draft amendments to the Electricity Act, 2003, make the generation and purchase of a certain amount of renewable energy mandatory. Renewable purchase obligation is defined as the minimum percentage of electricity that must be procured by supply licensees from renewable sources. Renewable generation obligation is defined as the capacity that must be installed or procured by a coal or lignite based generation station, from renewable sources, or an instrument representing renewable energy (such as renewable energy certificates).

High cost of power

The Standing Committee on Energy (2017) noted that higher tariff is also a key reason for lower electricity demand. Note that for discoms the cost of purchasing power from a power plant is roughly 75-80% of the total expenditure. Therefore, any shift in the cost of power can significantly affect the retail tariff.

The Committee noted that running power plants at lower PLF also escalates the generation cost. There is a latent demand for power, which will surface once tariff is made more affordable. It suggested that generation cost can be reduced by improving the availability of cheaper indigenous coal, rationalising coal supply sources, and adapting new technology as per indigenous coal.

Imported coal

India's coal imports have risen from 38.6 million tonnes (MT) in 2005-06 to 208 MT in 2017-18.[25] While imported coal helps in bridging certain gaps in the demand and supply of coal, it costs more (imported coal is 35-55% costlier than domestic coal). Further, there are certain technical limits on the usage of imported coal.[26,27]

Imported coal: Mundra UMPP, Gujarat

Coastal Gujarat Power Limited (wholly-owned subsidiary of Tata Power), has implemented the 4,000 MW UMPP near Mundra, Gujarat. Adani Group has also developed almost similar capacity in Gujarat. The UMPP project supplies power to the five states of Gujarat, Rajasthan, Maharashtra, Haryana, and Punjab. These companies were generating power through coal imported from Indonesia. In 2010, due to a change in the mining regulations in Indonesia, the price of coal being exported from the country increased, and hence affected the commercial viability of the generating plants in India.

In December 2016, CERC noted that since the companies had Coal Sales Agreements for imported coal for the entire quantum of coal required for supply of power, the change in regulations completely changed the premises on which they had quoted tariffs in their bids to their consumers.[28] CERC ruled that the companies can invoke 'force majeure' (unforeseeable circumstances that prevents a contract from being fulfilled). Losses arising due to the increase in price of coal will be paid up by the consumers (through higher power tariff). It also ordered the companies to source domestic coal and reduce dependence on imported coal, subject to technical feasibility.

In October 2018, the Supreme Court ruled that CERC must decide on changes to the Power Purchase Agreements (PPAs) reflecting the increased cost of coal.[29] However, it also allowed the petitioners (a consumer rights group) to raise objections to any proposed amendments with the CERC.

Rationalising coal linkages

The Ministries of Power and Coal have been trying to address some of these concerns. For example, the Standing Committee on Coal (2018) noted that between 2014 and 2016, the rationalisation of coal linkages (buying coal from a mine closer to the power plant) has resulted in estimated savings of Rs 3,000 crore per annum on transportation costs. It further noted that auctioning coal linkages through SHAKTI will give consumers the option to bid for a source of their choice, thereby reducing coal transportation costs.

The Ministry of Coal had constituted an inter-ministerial group to review the existing sources of coal for independent power producers (IPPs) with coal linkages in October 2017.[30] This group suggested that the coal linkage of an IPP may be transferred from one coal company to another.

Such transfer will be based on the existing availability of coal and the future coal production plan of the coal company. This would help link coal mines closer to the power plants, reducing coal transportation costs, resulting in lower coal costs for the power producers.

NPAs in the sector have been increasing

As per the RBI, public sector banks have the highest NPAs, most of which are in the power and the telecom sector. It also noted that the most severe shock to the power sector will cause the banking system NPAs to rise by about 68 bps.[31] The Standing Committee on Energy (2018), had examined 34 independent power producers (IPPs), with a capacity of 40 GW, that had turned into NPAs. As of June 2017, there were 34 stressed thermal power plants with an outstanding debt of Rs 1.74 lakh crore.[3] There are several reasons for financial stress in these thermal power projects, some of which are explained below.

Availability of coal

The Standing Committee on Energy (2018) noted that coal availability is critical in several plants of the NTPC.[3] It recommended that CIL should ensure that generators are provided with the required coal in a time-bound manner. Further, power plants should be provided enough coal to enable them to run at 85% efficiency. Power plants should primarily use domestic coal. They may be allowed to use 15-20% of imported coal, only if they can remain economically viable.

Availability of Power Purchase Agreements

The HLEC on stressed assets in the power sector (2018) observed that while several coal-based power plants have FSAs (agreement between coal company and power plant to buy coal) they do not have medium term/long term PPAs. Further, there have been very few bids by the discoms for long/medium term PPAs, because of the high fixed costs associated with them. In the absence of long/medium term PPAs, these plants are not able to operate because such linkage coal cannot be used against short term PPAs. The Committee recommended that such linkage coal may be allowed to be used against short term PPAs. In March 2019, the Union Cabinet allowed such power plants to use coal from the existing FSAs for sale of power through short-term PPAs.

Resolving NPAs

RBI circular: In February 2018, the RBI released a framework for restructuring of stressed assets of over Rs 2,000 crore on or after March 1, 2018.[32] The framework provided that the resolution plan for restructuring must be unanimously approved by all lenders and implemented within 180 days from the date of the first default. If the plan is not implemented within the stipulated time period, the stressed assets must be referred to the NCLT under the IBC within 15 days. Various power producers appealed to courts against the RBI circular.

Standing Committee's observations: The Standing Committee on Energy (2018) analysed the impact of the circular on power sector.[33] It noted that the new guidelines are stringent and do not consider the problems in the electricity sector. These new guidelines will worsen the NPA crisis in the sector. It recommended that instead of adopting a sector agnostic approach towards stress resolution, more specific and sector friendly approaches should be used.

Supreme Court's order: The Court held that the circular issued by RBI was outside the scope of the power given to it under section 35AA of the Banking Regulation (Amendment) Act, 2017.[34] Consequently, all IBC proceedings initiated under the RBI circular were quashed. During the proceedings, several power companies provided that their reasons for delays in payment of bank dues include: (i) cancellation of coal blocks by the Supreme Court leading to non-availability of fuel, (ii) lack of enough PPAs by states, (iii) non-payment of dues by discoms, and (iv) delays in project implementation leading to cost overruns.

Delayed payments by discoms

The HLEC also noted that one of the major reasons for stress is the delay in payments by the discoms to the power plants. These power plants are unable to cancel PPAs with such discoms, or sell power on the power exchange or through short-term PPAs. This adversely affects the latter's liquidity and ability to service their debt and operate the plant. It recommended that a power plant should be able to terminate a PPA in case of default in payment from the discoms.

Environmental concerns of thermal generation

Environmental sustainability is one of the major concerns with regard to thermal power generation across the world. Studies have indicated a rapid increase in the amount of greenhouse gases including carbon dioxide, methane and nitrous oxide in the atmosphere over the last few decades, primarily from fossil fuel emissions.[35] In 2012, India contributed to about 6% of the world's CO_2 emissions.[36] The annual per capita emission of CO_2 in India is about 1.6 tonnes as compared to the world average of 4.9 tonnes.[36] With the push towards more domestic manufacturing and industrialisation, majority of the energy in India being generated from thermal sources, and increasing levels of consumption, environmental sustainability could become a much bigger concern in the years to come.

In April 2016, India, as a member country of the United Nations Framework Convention on Climate Change, signed on to undertake certain climate actions known as Intended Nationally Determined Contributions (INDCs). India's INDCs include achieving the following targets by 2030: (i) reducing greenhouse gas emissions per unit of GDP by 33-35% from 2005 levels; (ii) achieving 40% of installed electric power capacity from non-fuel based energy sources (such as solar, wind, hydropower); and (iii) creating additional carbon storage and absorption capacity for 2.5- 3 billion tonnes of CO_2 by increasing forest and tree cover.

With regard to these specific INDCs, note that between 2005 and 2014, greenhouse gas emissions per unit of GDP decreased by 19%.[37] However, with about 64% of India's power coming from thermal sources, and a focus on increasing thermal generation capacity through UMPPs and captive mining, it is unclear how a 35% reduction in greenhouse gas emissions will be achieved. As on January 2019, the share of renewable energy (including hydro) in power generation is 34%. This share has to be increased up to 40% by 2030, and simultaneously the share of thermal power has to decrease from the current share of 64%.

The Ministries of Power, and Non and Renewable Energy have set a few targets in order to achieve some of these goals. Some of these include: (i) achieving 40% of electric power installed capacity from non-fossil fuel by 2030; (ii) generating 175 GW of renewable energy by 2022, and increasing capacity under the National Solar Mission from 20 to 100 GW; (iii) development of a National Smart Grid Mission & Green Energy Corridor for efficient transmission & distribution network; (iv) reduction in fossil fuel subsidies; and (v) providing tax free infrastructure bonds introduced for renewable energy.[38] The central government also increased the coal cess from Rs 50 to Rs 200 per ton in 2016-17.

Guidelines for thermal power plants

The Ministry of Environment, Forest and Climate Change (MoEFCC) had issued certain environmental guidelines for thermal power plants in December 2015.[39] As per these guidelines, these plants were required to retrofit or install equipment that would help reduce their emission levels. The MoEFCC allowed the thermal power industry two years to comply with these guidelines (i.e., by December 2017). The guidelines categorised thermal power plants into three categories for compliance purposes. These are plants installed: (i) before December 31, 2003, (ii) after 2003, and before December 31, 2016, and (iii) after December 31, 2016.

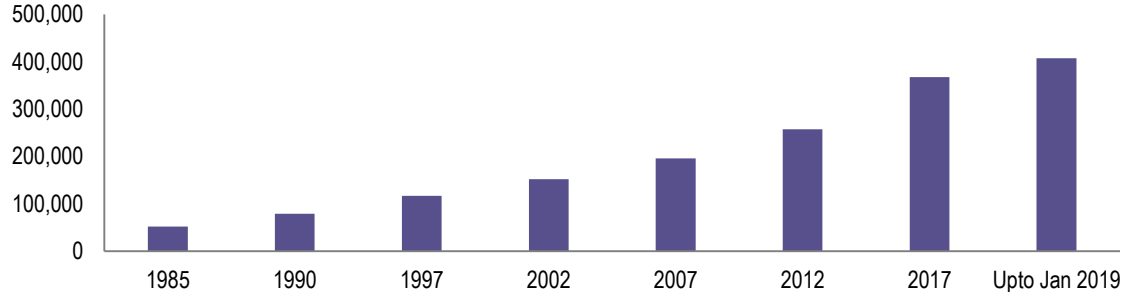
However, these guidelines were opposed by the industry on the grounds that these would increase the cost of producing power for the plants. In May 2018, the Ministry of Power extended the deadline to December 2022.[40] It also noted that the guidelines will be considered as a change in the law in certain cases. In such cases, any additional cost implication due to installation of emission control equipment can be passed through to consumers, in the form of higher tariffs. In April 2018, theMinistry of Power also allowed for flexibility in generation and scheduling of thermal power stations to help reduce emissions.[41] This would be achieved by optimal utilisation of power generated from renewable sources.

TRANSMISSION

Transmission infrastructure issues affect power supply

As of January 2019, the all India transmission lines are 4.07 lakh circuit km long. Since 2007, the transmission lines have grown at an average annual rate of 4%. 54% of the transmission lines are with the state governments, 38% with the centre, and remaining are with private companies.

Figure 13: Length of Transmission lines (in circuit km)



Sources: Central Electricity Authority; PRS.

Bottlenecks in the transmission network cause issues with evacuation of power. Further, a poor transmission network also leads to underutilisation of generation capacity. Congestion means a situation where the demand for transmission capacity exceeds the available transfer capability. The Working Group on Power (2012) had noted that some of the state transmission utilities require financial support, especially for building transmission systems for renewable energy sources.[42] It had recommended providing viability gap funding on a case-to-case basis for building intra-state transmission systems.

The 12th Plan had envisaged a growing role for the private sector in transmission, especially in the intra-state networks. However, private sector transmission projects face challenges such as difficulties in acquiring right of way and delays in land acquisition and forest clearances, cost escalation due to such delays, and unavailability of bank credit.[42] To mitigate these issues, the Working Group on Power (2012) had recommended identifying and reserving transmission corridors in areas with high population density to meet the future growing demand.

Connecting renewable energy sources with the grid

An insufficient transmission network and non-synchronised generation also causes issues with renewable energy.[43] While renewable resources are abundant, the output is variable and subject to uncertainty. Intermittence of renewable sources along with absence of scientific techniques to predict the availability of power creates challenges with maintaining grid discipline.[43]

In the absence of a proper transmission network and poor grid discipline, the generated renewable power may remain unutilised.[23] In contrast, fossil-fired power plants rely on fuels that can be stored (although they may be subject to supply shortages).[23] The Ministry of New and Renewable Energy has proposed the development of a National Smart Grid Mission & Green Energy Corridor for efficient transmission & distribution network.[44]

Increased deployment of large-scale solar, wind power, and small-scale decentralized renewable energy could lead to several complexities with regard to load balancing.[23] These would arise due to the variability in supply and demand caused by seasonal changes in the weather. However, if wind and solar energy is taken as an aggregated whole, the variance in output would be more gradual.[23] Therefore, if the geographic size of the balancing area, and the size of the system is large, the ability of the system to absorb and respond to the variability of renewable energy could be improved. However, this may affect the amount of flexibility of using such power, and the time at which it is needed in the system.[23]

DISTRIBUTION

Poor financial situation of the distribution utilities

Discoms buy power from generation companies and supply it to the consumers. Therefore, for consumers to receive good quality of electricity it is important that the discoms function well. However, discoms across the country have been facing high levels of losses and are struggling with debt. This makes it difficult for them to purchase power, and invest in the distribution network. This leads to a shortfall in power supply, and poor distribution infrastructure.

The accumulated losses of state discoms (after adjusting for subsidies received from state governments) had increased from Rs 11,699 crore in 2004-05 to Rs 71,271 crore in 2013-14.[45] During the same period, their borrowings increased from Rs 1,06,509 crore to Rs 4,59,145 crore. As of March 2015, the state discoms had accumulated losses of approximately Rs 3.8 lakh crore and outstanding debt of approximately Rs. 4.3 lakh crore.[46]

In the last two decades, several measures have been undertaken to address the debt of the discoms and improve their financial situation, the latest one being UDAY. However, these measures have simply addressed part of the problem, and helped the discoms clear their books. Post the bail-outs, discoms tend to accumulate losses again, and the same cycle repeats.

Financial restructuring and bail-out of the discoms - UDAY

In 2012, the central government had announced a Financial Restructuring Package (FRP) to solve the immediate funding needs of the highly distressed state discoms.[47] Under the scheme, state governments were to assume 50% of respective utility's short-term debt while the balance 50% would be restructured. States were also expected to enact a legislation mandating prudent management of their utilities. The central government would provide a grant for AT&C loss reduction in excess of the targets under the Restructured Accelerated Power Development and Reforms Programme (R-APDRP).

The RBI's report on state finances for 2015-16 observed that FRP improved the liquidity of discoms by providing a moratorium on debt repayments. However, the FRP could not deliver the desired results as there were no deterrents to non-compliance with loss-reduction targets.

In November 2015, the central government announced another bailout scheme for the distressed state discoms, the Ujwal Discom Assurance Yojana (UDAY). The scheme was optional for states – 27 states signed up for it. Under the scheme, states had to take over 75% of discoms debt (as on September 30, 2015) over two years (50% in the first year and 25% in the second year). The debt taken over by the states was not counted in their fiscal deficit for the first two years. States that accepted the scheme are to receive additional benefits from the central government. These include: (i) additional or priority funding through Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS), Power System Development Fund (PSDF) or any other such schemes, and (ii) supply of additional coal at notified prices and low cost power from NTPC and other central PSUs (depending on availability).

However, under UDAY, states also had to fulfil certain operational efficiency improvements such as compulsory smart metering, and upgradation of transformers. States not meeting these operational milestones will have to forfeit their claim on the IPDS and DDUGJY grants.

The part of discom debt not taken over by the states would be converted by banks and financial institutions into loans or bonds, or it may be fully or partly issued by the discom as state guaranteed discom bonds at the prevailing market rates. States will take over the future losses of discoms in a graded manner.

While UDAY seeks to improve the financial situation of the state discoms, it is unclear whether it will help reduce the losses in the long term. The RBI's report on state finances for 2015-16 noted

that while UDAY may alleviate the non-performing asset (NPA) problem of banks, it will increase the liabilities of participating states. UDAY is expected to help improve the liquidity of the discoms as well as reduce the losses by lowering the interest burden on them. Further, by involving the states, UDAY may be able to address the issue of efficiency improvement and cost-reflective tariff hikes. However, the report noted that this scheme may reduce the fiscal space of states leading to reduction in the capital expenditure by states. Further, states may not be able to shrink their deficits, which may put an additional burden on the centre.

The Ministry of Power had mentioned that, post UDAY, AT&C losses have reduced to 18.8% in 2017-18 from 20.8% in 2015-16 (only for the states participating in UDAY).[48] The gap between average cost of supply (ACS) and average revenue realised (ARR) has reduced from Rs 0.6/unit in 2015-16 to Rs 0.17/unit in 2017-18.[48] However, as per the latest available information these levels seemed to have increased again. As of September 2019, the AT&C losses are at 21.4%, and ACS-ARR gap is at Rs 0.25/unit.[49] Note that, all these numbers are self reported by the states participating in the scheme. As of July 31, 2019, the outstanding dues of power utilities payable to the central public sector undertakings (such as NTPC) were at Rs 32,968 crore.

While discoms may be able to address some operational issues, there will be challenges to address some core issues such as (i) differential tariff structure, (ii) delays in tariff revisions and subsidy payments, and (iii) high levels of Aggregate Technical and Commercial (AT&C) losses. We discuss some of these issues.

Differential tariff structure

Currently, different consumers buy electricity at different rates. As of September 2019, the gap between average cost of supply and the average revenue realised is Rs 0.25/unit.[49] One of the key reasons for this gap between ACS and ARR is differential tariff structure for different consumers. Currently, consumers are charged different tariff rates based on their consumption category. State governments provide subsidies to most discoms to allow them to charge such differential tariff (from low paying consumers). In addition to these direct subsidies from the state governments, low paying consumers (agricultural and residential) are also cross-subsidised by high paying consumers (commercial and industrial). In case of cross-subsidies, subsidisation is inbuilt in the tariff. However, the overall revenue realisation may not meet the total cost of supply.

Increasing tariffs for low paying consumers may be a challenging task for discoms. However, the ACS and ARR gap means that discoms will continue to not recover their costs, and make losses.

Change in tariffs post UDAY: Punjab

In 2013-14, Punjab was providing free electricity to agricultural consumers, while commercial consumers were paying Rs 6.2/kWh. Post UDAY, the agricultural consumers n Punjab continue to be subsidised and receive free electricity. Figure 14 shows the tariffs across different consumer segments in Punjab (as approved by the Punjab State Electricity Regulatory Commission (PSERC)).

Note: PSERC has noted in its tariff order that the number for commercial category for the year 2017-18 may be erroneous based on the bills submitted by the discom, and has requested the discom to submit correct consumption figures.

Sources: PSERC Tariff Orders from 2015-16 to 2019-20; Annual Report (2013-14) on the Working of State Power Utilities & Electricity Departments, Planning Commission, February 2014; PRS.

Figure 14: Tariffs in Punjab (in Rs/MU)

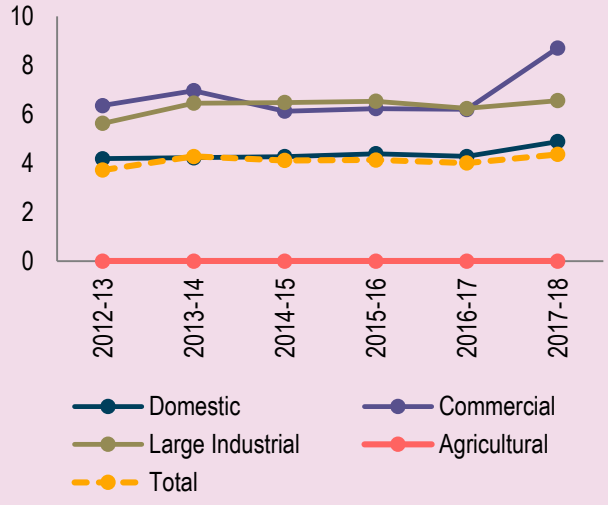
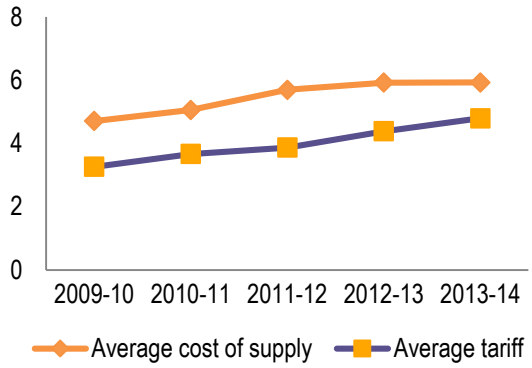
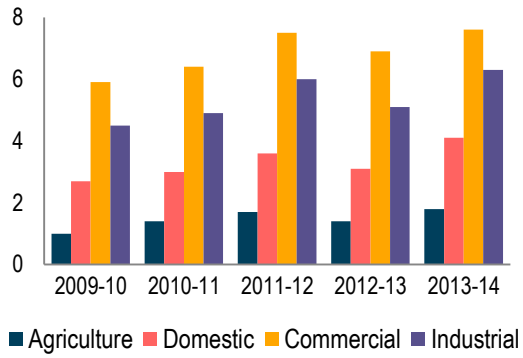


Figure 15: Gap between average cost of supply and tariff (in Rs/kWh)



Sources: Power Finance Corporation; PRS.

Figure 16: Consumer category-wise electricity tariff (in Rs/kWh)



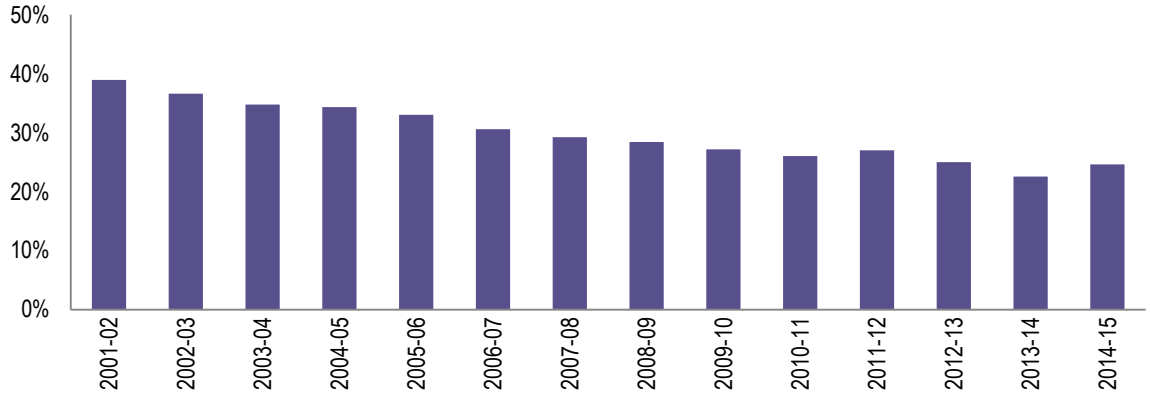
Sources: Power Finance Corporation; PRS.

High AT&C losses

Aggregate Technical and Commercial (AT&C) loss is the ratio of power for which the discom did not receive any payment to the total electricity procured by the utility. AT&C losses can be divided into technical (transmission) losses and non-technical (commercial) losses. Low levels of investment in distribution have resulted in overloaded systems, leading to higher technical losses. Theft and pilferage of power is a key reason for high commercial losses for discoms. Lack of metering and poor billing and collection systems also contribute to commercial losses.

The national average for AT&C losses for 2014-15 was 25% (for 36 discoms out of a total of 55).[50] In comparison, transmission and distribution losses are at about 6% in the US and about 7.2% in the UK.[51,52]

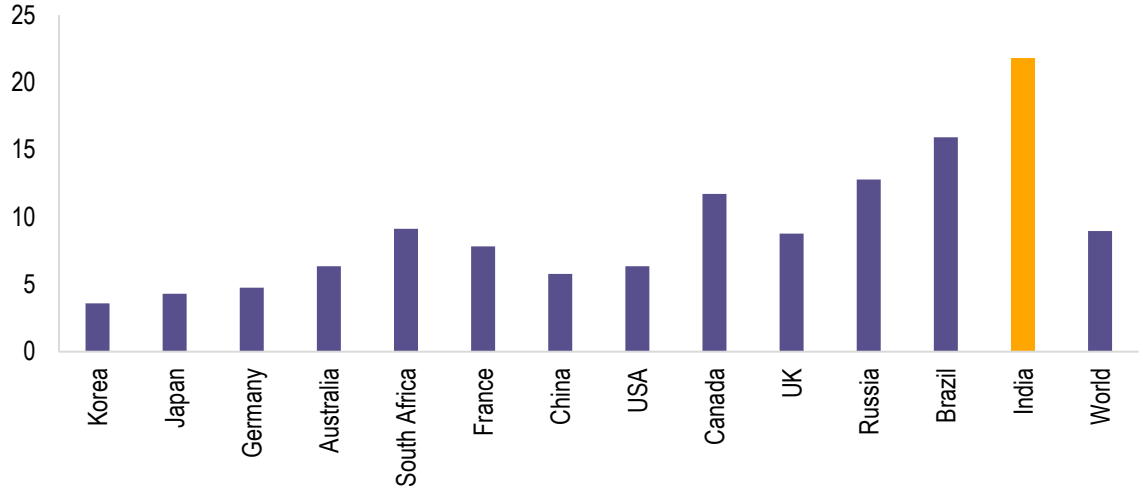
Figure 17: AT&C losses



Sources: Central Electricity Authority; PRS.

The central government had launched the Accelerated Power Development Program in 2001 (later changed to the Restructured - Accelerated Power Development and Reform Programme (R-APDRP)) to improve the working of state power discoms, including reducing AT&C levels. In 2014, the scheme was subsumed under the Integrated Power Development Scheme (IPDS). Despite the attempts at reforms, reduction in AT&C losses (1.1% per annum between 2001-02 and 2013-14) has been slower than the target.[53] UDAY also mandated states to reduce AT&C losses to 15% by 2018-19. As of September 2019, the AT&C losses for 13 states participating in UDAY is 21.4%.

Figure 18: Transmission and Distribution losses across several countries in 2015 (in %)



Sources: Central Electricity Authority; PRS.

Proposed segregation of the distribution function

The Electricity (Amendment) Bill, 2014 was introduced in Lok Sabha in December 2014, and lapsed with the dissolution of the 16th Lok Sabha. The 2014 Bill sought to: (i) increase competition in the sector by segregating the distribution segment into distribution and supply, (ii) rationalise tariff determination, and (iii) promote renewable energy.[54] The 2014 Bill was examined by the Standing Committee on Energy (2015), which suggested certain changes to the Bill.[55] In 2018, the Ministry of Power then proposed draft amendments based on the Committee's recommendations and other stakeholder consultations.[56]

The 2018 draft amendments retained the segregation of distribution into the network and supply business. This would allow for multiple supply licensees in an area of supply, and consumers may choose to buy electricity from multiple suppliers in an area. However, the explicit details of how such switching, or transition between suppliers will work were not provided in the amendments. The Standing Committee on Energy examining the 2014 Bill had suggested that the law should provide certain details regarding consumer switching between supply licensees. These include: (i) the mechanism for providing the consumer with the option to choose a supply licensee, and (ii) the transfer from one supplier to another based on the choice of the consumer, and the cost involved in such choice and transfer.

Removing cross-subsidies in the sector

As discussed earlier, currently, consumers are charged different tariff rates based on their consumption category. While state governments provide direct subsidies to discoms, low paying consumers (agricultural and residential) are also cross-subsidised by high paying consumers (commercial and industrial). In case of cross-subsidies, subsidisation is inbuilt in the tariff. Such differential pricing and subsequent cross-subsidising raises the input costs for manufacturing and service sectors.

The draft amendments provided that any subsidy to any category of consumer will be provided by the state or central government through direct benefit transfer (DBT). Further, the cross-subsidisation within a distribution area will not exceed 20%, and will be progressively reduced and eliminated within three years. The CERC/SERC will have to ensure that the reduction in cross-subsidy is not less than six percent in a year.

The cross-subsidy for a consumer category is the difference between the cost to serve that category of consumers and the average tariff realised from that category of consumers. Two possibilities

may arise due to removal of such cross-subsidy. First, it could increase the tariffs for the currently low paying consumers (agricultural and residential) who are being subsidised. Second, the state or central government may choose to alleviate any increase in their tariffs by giving them explicit subsidies through DBT. This could increase the subsidy burden on the exchequer (either through the Union budget or state budgets or a combination of both).

Note that in August 2018, the Ministry of Power had also proposed amendments to the Tariff Policy, 2016 (for electricity) to simplify the current tariff categories and rationalise retail tariff. The draft suggested that the tariff structure should do away with the concept of different tariff for different categories of consumers. The price should instead be based on load used and energy consumed. Consumers with sanctioned load and unit consumption in lower brackets will be subsidised by consumers in higher load and consumption brackets.

REGULATORS

Electricity regulators need to be strengthened

The Electricity Regulatory Commissions were established in 1998 following the Electricity Regulatory Commissions Act, 1998. The primary objective of setting up the Commissions was to have an independent body regulating tariffs. The 2003 Act, broadened the mandate of the Commissions by providing them the powers to grant licenses for inter-state transmission and trading of power and to amend, suspend and revoke these licences. The Act also gave Commissions the powers to regulate licensees by setting performance standards and ensuring their compliance. The broader objective of the Commissions was to bring in transparency, accountability, and a professional approach to regulate the sector, and also to impartially balance the interests of investors as well as consumers.

The Standing Committee on Energy (2012) had noted that the CERC has not been effective in its role.[57] The Committee had recommended that the government should appoint an independent expert committee to: (i) review the functioning of the CERC, (ii) identify areas to improve the working and autonomy of the organization, and (iii) limitations of the law. The Committee had also recommended that the forum of regulators should ensure that adequate steps are taken by all the SERCs and state discoms to rationalize their tariff annually.

The Committee had observed that the pay structure, service conditions and other amenities available to CERC employees are discouraging. In addition, there is a shortage of manpower in the Commission. It had recommended that the personnel policy of the organization should be well laid down having its own cadre with adequate promotional prospects and better amenities to the officials of the Commission corresponding to their job profile.

Regulatory issues

The HLEC (2018) noted that delays in payments by discoms hurts the viability of generators. The regulator must ensure the sustainable operation of the power sector. However, regulators often insist that the generators forego the late payment surcharge on the delayed payments. This further affects the viability of generators. It recommended that the Ministry may engage with the regulators to ensure that the late payment surcharge is mandatorily paid.

QUALITY OF POWER

Villages have been electrified but quality of supply is still an issue

Under the Electricity Act, 2003, the central and state governments have a joint responsibility in providing electricity to rural areas. Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), launched in 2005, was the first scheme looking at rural electrification. Under the scheme, an electrified village as a village that has the following: (i) provision of basic infrastructure such as

distribution transformers and lines the inhabited locality, (ii) provision of electricity in public places such as schools, panchayat office, health centres, dispensaries, community centres, etc., and (iii) at least 10% of the total number of households in the village are electrified.[58] In December 2014, the Ministry of Power launched the Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY).[59] Components of RGGVY were subsumed under DDUGJY.

In April 2018, the Ministry of Power announced that all villages have been electrified. Just prior to this, the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (or Saubhagya) was launched. The scheme seeks to ensure universal household electrification (in both rural and urban areas) by providing last mile connectivity.

Duration of electricity supply

Currently, 4.3% of villages in India do not receive electricity for domestic use (most of these villages are in the north-eastern region). 4.7% of villages receive electricity (for domestic use) for one to four hours in a day. As per data collected under Mission Antyodaya implemented by the Ministry of Rural Development, in 2018 about 53% of the villages receive electricity for less than 12 hours a day.[2] Therefore, while villages have been electrified, the duration and quality of electricity they receive is poor.

Quality of rural electricity

The Standing Committee on Energy (2017) noted that the village electrification scheme aimed to provide electricity to households for the limited purpose of illumination. The use of electricity for illumination only does not provide scope for the beneficiaries to carry out even small electricity based commercial activities. On the other hand, discoms who provide such connections perceive rural consumers as a liability with little or no scope for revenue generation for them.

The Committee recommended that the government should seek to provide electricity connections in the rural areas that are capable of carrying out some commercial activities. Further, the government should also provide for the supply of quality and reliable power for a reasonable time as mere electrification without adequate electricity supply does not make sense.

The Committee also recommended that every connection provided by the discoms, irrespective of the purpose, type or category, must be metered. 100% metering of all connections will help in better energy auditing and fixing accountability. While free or subsidised electricity could continue to be provided in rural areas it should be metered to better understand the level of consumption and losses, if any.

Saubhagya scheme – household electrification

Though the scheme seeks to create the infrastructure to provide electricity across all households in the country, the supply of electricity continues to be the challenge. If the discoms do not have enough fiscal space to buy power, then the power supply situation will continue to remain poor. Also, note that these are rural areas, or areas with more domestic consumers. They pay lower tariffs and hence more supply to these consumers may lead to increased losses unless the discoms are compensated by the government.

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ANNEXURE

Power sector schemes

Accelerated Power Development and Reforms Programme (APDRP): The APDRP was launched in 2002-03, with the primary objective of reducing the AT&C losses and improving the revenue realisation by the state discoms.

Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY): Launched in December, 2014, the scheme provides for rural electrification. It also provides for separation of agriculture and non-agriculture feeders, strengthening and augmentation of sub-transmission and distribution infrastructure, and electrification of villages across the country. The previous rural electrification schemes (including the Rajiv Gandhi Gram Jyoti Yojana) were subsumed in it.

Financial Restructuring Package (FRP): In 2012, the central government had announced the FRP to solve the immediate funding needs of the highly distressed state discoms. Under the scheme, state governments were to assume 50% of respective utility's short-term debt while the balance 50% would be restructured. States were also expected to enact a legislation mandating prudent management of their utilities.

Integrated Power Development Scheme (IPDS): The scheme was launched in November 2014, to provide quality and reliable power supply in urban areas. Components of the scheme include strengthening of the sub-transmission and distribution network in urban areas, and metering of feeders/ distribution transformers/ consumers in urban areas.

Jawaharlal Nehru National Solar Mission (JNNSM): JNNSM was launched in 2010 and seeks to have 20 GW of grid-connected solar generation capacity in India by 2022. In 2015, the central government increased the overall target under the mission to 100 GW by 2021-22.

National Smart Grid Mission (NSGM): The Mission was launched in March 2015 and seeks to plan and monitor implementation of policies and programmes related to Smart Grid.

Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya): This scheme was launched in October 2017 to achieve universal household electrification by providing last mile connectivity and electricity connections to all households in rural areas, and all poor households in urban areas by March, 2019.

Re-structured Accelerated Power Development and Reforms Programme (R-APDRP): The programme was launched in 2008, to help reduce losses of the state discoms. Under this, discoms had to achieve reduction in AT&C losses at a specified rate.

Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India (SHAKTI): The scheme, launched in May 2017, provides for a coal linkage policy for the allocation of coal among thermal power plants in a transparent and objective manner.

Ujwal Discom Assurance Yojana (UDAY): The scheme was launched in November 2015 for the financial and operational turnaround of state-owned power distribution companies (discoms).

Glossary of key terms

Average Cost of Supply (ACS): The average cost incurred by a discom to supply one unit of power to its consumers. This includes both fixed and variable costs.

Average Revenue Realised (ARR): The average revenue realised by a discom from the sale of one unit of power to its consumers.

AT&C losses: Aggregate Technical and Commercial (AT&C) loss is the ratio of power for which the discom did not receive any payment to the total electricity procured by the utility. Technical losses are incurred due to heat and energy loss in the wires and other equipment. Commercial losses include non-collection of revenue, and pilferage of electricity.

Cross-subsidy: The cross-subsidy for a consumer category is the difference between the cost to serve that category of consumers and the average tariff realised from that category of consumers.

Discom/ Distribution utility: Distribution includes maintenance of the distribution network and retail supply of electricity to the consumers. It is mostly carried out by state-owned distribution companies (discoms).

Energy deficit: Shortfall in energy supply during a day.

Fuel Supply Agreement (FSA): Agreement between coal company and power producer for the buying and sale of coal.

Peak deficit: Shortfall in supply during highest consumption period in a day.

Plant Load Factor (PLF): PLF is a measure of the output of a power plant compared to the maximum output it could produce.

Power Purchase Agreement (PPA): As per the 2003 Act, distribution licensees enter into PPAs with generation companies for the retail sale of electricity. PPAs are bilateral contracts between the procurers (discoms) and the generators (power plants).

Smart Grid: Smart Grid is an electricity network that uses information and communication technology to gather information and act intelligently in automated manner to improve the efficiency, reliability, economics, and sustainability of generation, transmission and distribution of electricity.

Tariff petitions and orders: Discoms file tariff petitions with regulators stating the tariff that they seek to charge from their consumers. The tariffs approved by the regulators are issued in a tariff order. Typically tariff petitions should be filed annually.

Units: Mega Unit (MU) is one million units of electricity where one unit is equal to one Kilowatt hour. Giga is equal to billion (10^9).

State-wise data

Table 4 below illustrates the power generation capacity and deficit data across states. Maharashtra has the maximum generation capacity across all states, followed by Gujarat and Tamil Nadu. The highest energy deficit is seen in the states of Jammu and Kashmir and Manipur, and in the Union Territory of Andaman and Nicobar Islands.

Table 4: Power generation capacity and deficit

State/UT	Installed generation capacity (in MW, as on December 31, 2018)				Energy deficit (2017-18)	Peak deficit (2017-18)
	State	Private	Central	Total	(in %)	(in %)
Andhra Pradesh	6,968	14,707	2,052	23,726	-0.2%	-0.1%
Arunachal Pradesh	107	5	188	301	-1.3%	0.0%
Assam	433	45	1,097	1,575	-3.5%	-4.2%
Bihar	781	536	3,024	4,341	-1.5%	-0.1%
Chhattisgarh	2,411	9,014	2,101	13,527	-0.3%	-6.8%
Goa	0	50	500	550	0.0%	-0.2%
Gujarat	7,714	19,356	4,312	31,382	0.0%	0.0%
Haryana	4,032	4,628	2,600	11,261	0.0%	-1.4%
Himachal Pradesh	951	1,600	1,498	4,049	-0.6%	0.0%
Jammu and Kashmir	1,534	60	1,795	3,389	-20.0%	-20.0%
Jharkhand	554	762	455	1,771	-1.9%	-5.4%
Karnataka	8,890	14,782	3,527	27,199	-0.2%	-0.5%
Kerala	2,170	998	1,915	5,083	-0.4%	-0.6%
Madhya Pradesh	6,528	10,200	5,144	21,873	0.0%	-0.3%
Maharashtra	13,901	22,458	7,420	43,779	-0.2%	-0.2%
Manipur	41	3	198	242	-5.2%	-3.5%
Meghalaya	353	0	212	565	-0.3%	-0.3%
Mizoram	36	0	159	196	-1.8%	-8.6%
Nagaland	31	1	128	159	-2.9%	-5.8%
Odisha	2,488	3,427	1,733	7,648	-0.3%	-5.4%
Punjab	4,636	6,558	2,239	13,432	0.0%	0.0%
Rajasthan	7,574	11,242	3,017	21,833	-0.8%	-1.3%
Sikkim	412	399	151	962	-0.2%	0.0%
Tamil Nadu	7,145	17,182	6,119	30,447	-0.2%	-0.2%
Telangana	8,403	5,427	2,115	15,944	-0.1%	-0.1%
Tripura	186	0	548	733	-1.8%	0.0%
Uttarakhand	1,320	1,160	920	3,399	-0.2%	0.0%
Uttar Pradesh	6,218	12,375	6,468	25,061	-1.5%	-10.9%
West Bengal	6,578	2,774	1,171	10,523	-0.4%	-0.3%
Andaman and Nicobar Islands	45	1	5	52	-9.1%	-6.9%
Chandigarh	-	32	163	195	-0.6%	0.0%
Dadra and Nagar Haveli	-	5	250	255	0.0%	0.0%
Daman and Diu	-	13	177	190	0.0%	0.0%
Delhi	1,935	1,153	4,146	7,234	-0.1%	-0.4%
Lakshadweep	-	1	-	1	0.0%	0.0%
Puducherry	33	2	334	369	-0.3%	-0.8%
Total	**1,04,408**	**1,60,958**	**83,922**	**3,49,288**	**-0.7%**	**-2.0%**

Source: Central Electricity Authority; Power Finance Corporation; PRS.

Tables 5 and 6 show the following: (i) the AT&C losses, and (ii) the gap between the average cost of supplying power (ACS) and the average revenue realised (ARR) from the sale of power, for the states participating in the UDAY scheme.

Table 5: AT&C losses for states participating in UDAY (in %)

State	2015-16 (base figures)	2016-17	2017-18	As on September 2019
Andhra Pradesh	9.41	10.96	8.69	4.5
Arunachal Pradesh	64.27	35.88	65.45	NA
Assam	25.51	23.81	15.71	22.13
Bihar	43.74	38.97	33.19	27.39
Chhattisgarh	21.79	19.34	18.8	23.28
Goa	17.12	16.79	16.12	26.03
Gujarat	15.04	12.28	11.71	13.09
Haryana	29.83	25.43	20.29	26.18
Himachal Pradesh	12.92	8.48	12.14	8
Jammu & Kashmir	61.6	61.34	53.78	49.76
Jharkhand	34.71	31.8	31.78	31.95
Karnataka	14.94	15.36	14.48	16.1
Kerala	16.03	17.28	12.05	10.29
Madhya Pradesh	23.97	26.53	29.74	29.05
Maharashtra	19.07	18.88	17.41	16.95
Manipur	44.21	36.89	24.61	22.55
Meghalaya	36.48	34.87	34.64	37.76
Punjab	15.9	14.46	17.26	12.04
Rajasthan	30.41	26.02	20.02	29.34
Sikkim	38.06	40.59	32.57	33.04
Tamil Nadu	14.58	14.53	14.23	14.02
Telangana	13.95	15.88	13.5	9.99
Tripura	20.94	16.61	15.52	15.24
Uttar Pradesh	26.47	30.21	27.67	37.95
Uttarakhand	17.19	14.02	15.73	12.64
Dadra & Nagar Haveli	–	9.23	6.09	NA
Daman & Diu	13.25	10.65	10.34	NA
Puducherry	19.88	18.98	19.56	16.41
Average for UDAY states	**20.8**	**20.25**	**18.76**	**21.41**

Note: Depicts data of states that have participated in the UDAY scheme. The data is self-reported by the state discoms. Base year corresponds to the year when the UDAY scheme was started.
Source: UDAY Portal, Ministry of Power; Lok Sabha Unstarred Question No. 1043, June 27, 2019; PRS.

Table 6:State-wise details of ACS-ARR Gap Achievement (in Rs/Unit)

State	2015-16 (base figures)	2016-17	2017-18	As on September 2019
Andhra Pradesh	0.82	0.44	0.02	-0.67
Arunachal Pradesh	3.76	5.22	4.32	NA
Assam	0.58	0.3	0.43	1.21
Bihar	0.65	0.59	0.39	0.41
Chhattisgarh	0.18	-0.15	-0.03	0.04
Goa	1.5	0.95	0.41	0.88
Gujarat	-0.02	-0.03	-0.04	-0.39
Haryana	0.18	0.04	-0.02	0.41
Himachal Pradesh	-0.32	0.21	-0.09	-0.08
Jammu & Kashmir	2.55	2.15	1.96	2.13
Jharkhand	1.22	1.39	0.57	0.54
Karnataka	0.06	0.06	0.07	-0.33
Kerala	0.23	0.53	0.27	0.49
Madhya Pradesh	0.92	0.24	0.33	0.88
Maharashtra	0.3	0.28	-0.07	-0.21
Manipur	1.31	0.1	0.08	0.24
Meghalaya	0.88	1.99	1.3	0.68
Punjab	0.53	0.65	0.48	0.05
Rajasthan	1.65	0.36	-0.33	1.16
Sikkim	7.96	4.62	6.93	0.79
Tamil Nadu	0.6	0.39	0.28	0.85
Telangana	0.69	1.24	0.55	0.42
Tripura	0.24	0.02	0.08	0.05
Uttar Pradesh	0.88	0.62	0.28	0.61
Uttarakhand	0.1	0.22	0.17	0.22
Dadra & Nagar Haveli	-	0.27	0.06	NA
Daman & Diu	-0.11	-0.11	-0.02	NA
Puducherry	0.03	-0.11	0	0.04
Average for UDAY states	**0.6**	**0.42**	**0.17**	**0.25**

Note: Depicts data of states that have participated in the UDAY scheme. The data is self-reported by the state discoms. Base year corresponds to the year when the UDAY scheme was started.
Source: UDAY Portal, Ministry of Power; Lok Sabha Unstarred Question No. 1043, June 27, 2019; PRS.

Table 7 shows the estimated requirement of electricity in the year 2019-20.

Table 7: Estimated requirement of electricity in 2019-20 (in million units)

State/UTs	2019-20
Andhra Pradesh	68,034
Arunachal Pradesh	1,210
Assam	11,894
Bihar	31,017
Chhattisgarh	33,463
Delhi	35,380
Goa	5,068
Gujarat	1,20,693
Haryana	57,083
Himachal Pradesh	10,949
Jammu & Kashmir	17,109
Jharkhand	27,488
Karnataka	77,532
Kerala	28,535
Madhya Pradesh	88,022
Maharashtra	1,71,313
Manipur	1,769
Meghalaya	2,378
Mizoram	737
Nagaland	992
Odisha	30,302
Punjab	64,730
Rajasthan	83,168
Sikkim	577
Tamil Nadu	1,23,724
Telangana	75,164
Tripura	1,456
Uttar Pradesh	1,32,476
Uttarakhand	17,007
West Bengal	63,979
Andaman & Nicobar Islands	414
Chandigarh	2,145
Dadra & Nagar Haveli	8,210
Daman & Diu	2,449
Lakshadweep	57
Puducherry	3,387
All India	**13,99,913**

Sources: Unstarred Question No. 5371, Lok Sabha Questions, July 25, 2019.