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INDUSTRY OUTLOOK

POWER SECTOR OF INDIA: OUTLOOK AND CHALLENGES

29 December 2020

Introduction

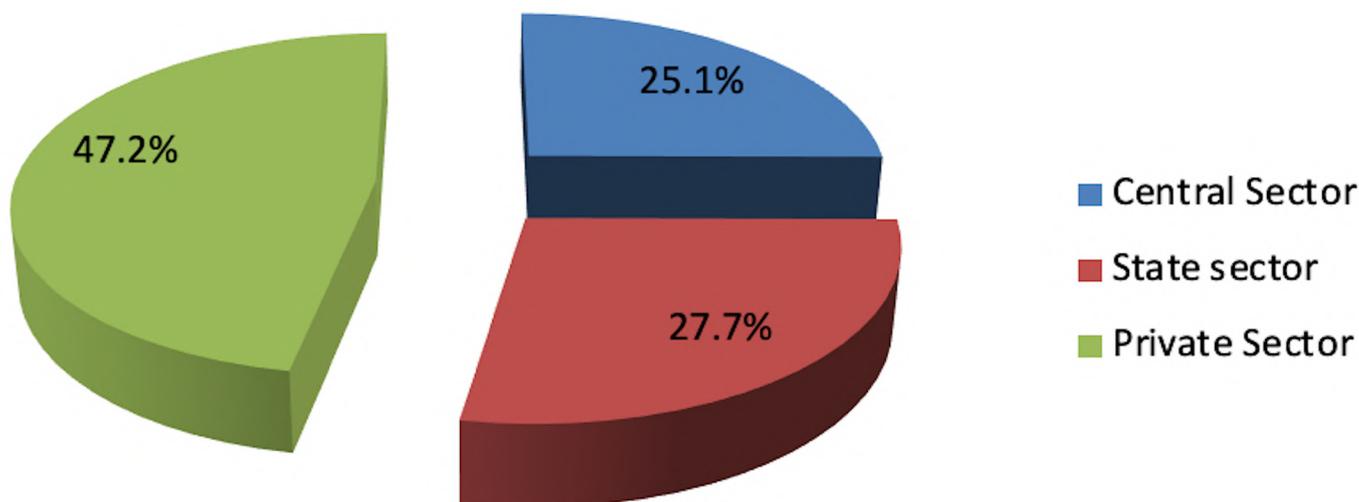
Power is one of the most critical components of infrastructure crucial for the economic growth and welfare of nations. In India, sources of power generation range from conventional sources such as coal, lignite, natural gas, hydro and nuclear power to viable non-conventional sources such as wind, solar, biomass etc. The Indian Power sector has come a long way from conventional generation, large energy deficits and a low-performing grid by making efforts towards large-scale Renewable Energy (RE) based capacity addition.

According to the International Energy Agency (IEA), India has seen its energy demand increasing faster as the country continues to urbanize. This growing demand is met through various energy sources, with coal set to remain the largest source of energy supply.¹



Chart 1: Total Installed Capacity at Central, State and Private sector (% of Total) (As on 30.11.2020)*

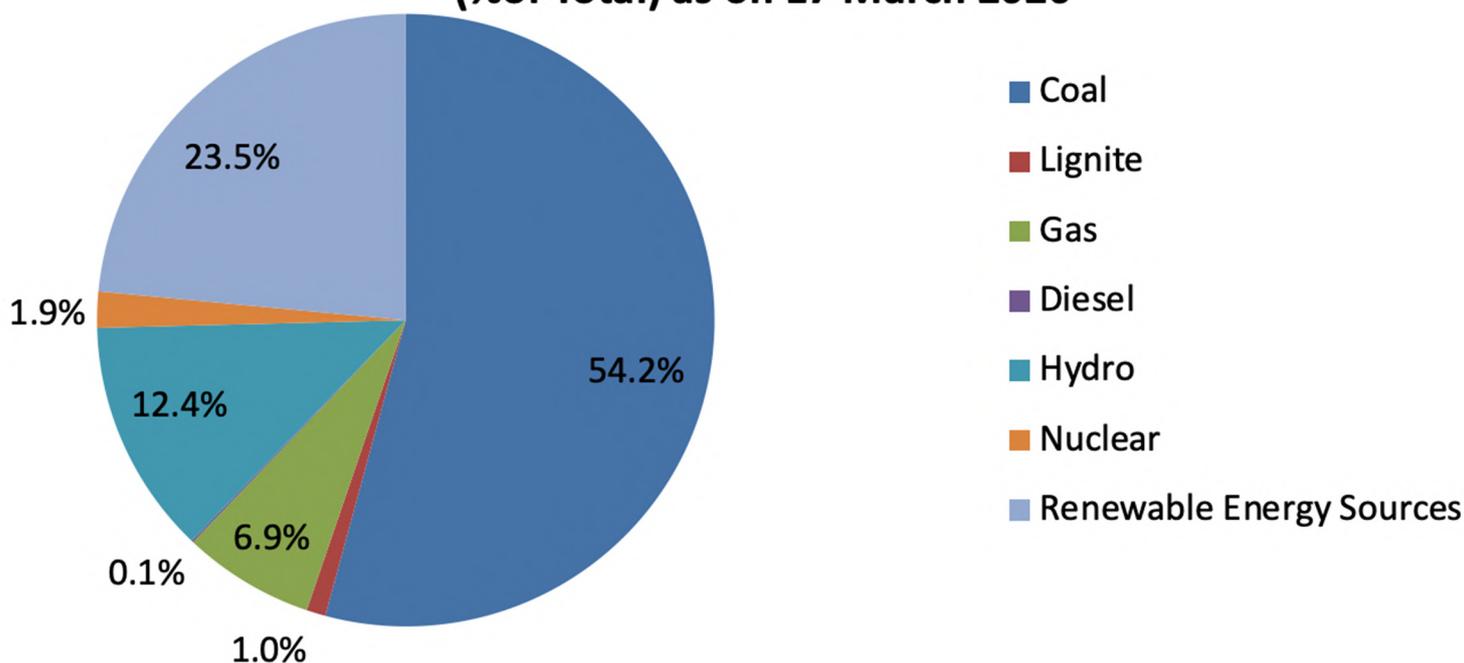
Per Cent of total installed capacity



* According to the Ministry of Power, data accessed on 17 December 2020; Source: "Power Sector at a Glance ALL INDIA" (17 December 2020) Ministry of Power. <https://powermin.nic.in/en/content/power-sector-glance-all-india>

Coal continues to be the largest domestic source of energy supply in India despite government's push for renewable energy (RE). Amid more stringent air pollution regulations, new coal power plants that are more efficient, flexible and relatively lower in emissions will be better positioned for their economic viability. By contrast, old and inefficient plants, which require expensive retrofits to comply with environmental standards, are in a difficult position.

Chart2: Conventional and Non Conventional Energy Resources (%of Total) as on 17 March 2020

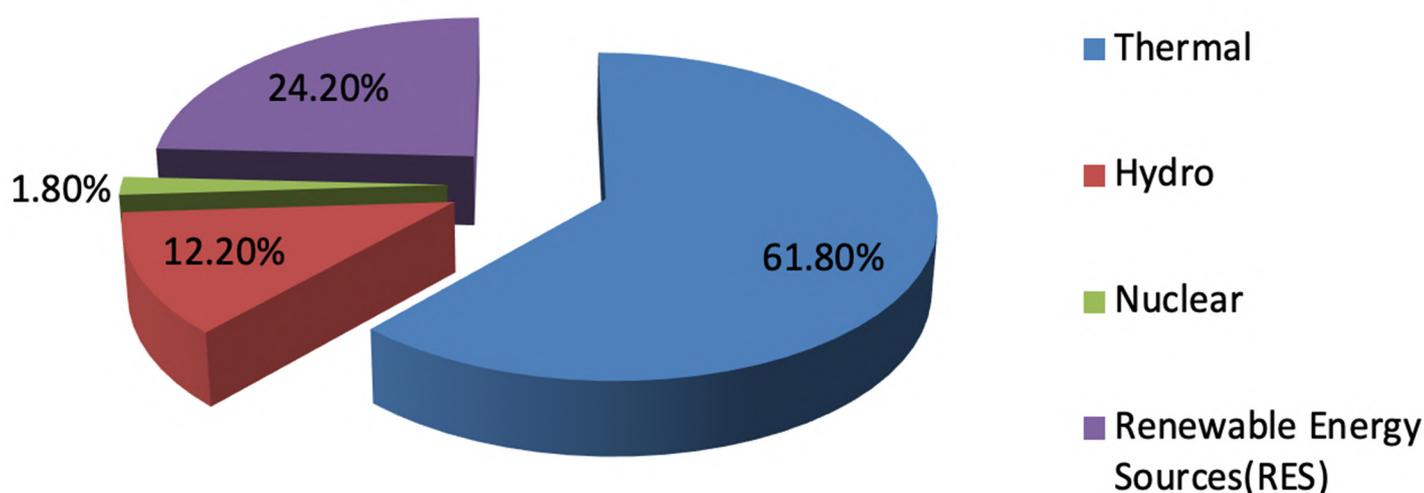


Source: Ministry of Power

With an installed renewables capacity of 83 GW, plus 31 GW under development and a further 35 GW out for tender, India is among the top-five clean-energy producers globally and is well on course to surpass its original target. In fact, it is now eyeing 225 GW from renewables by 2022 and a target of 40 per cent clean energy by 2030.2 A notable development in this regard is that with the incoming Biden administration promising to bring climate change back, the nature of the strategic energy partnership between the two countries will come into focus. The new US administration is likely to push for faster decarbonisation and a more renewables-based energy transition for India.

The US has a mature and rapidly evolving power market, with experience from inter-state power flows, utility-scale battery storage, vast corporate procurement towards assets based securitization of residential solar loans, power price hedges and net metering. For India, the major challenge is reducing reliance on coal while continuing to meet its increasing energy needs in a way that will be affordable to most of the country's population.

Chart 3: Total Installed Capacity according to Thermal, Hydro, Nuclear and Renewables (As on 30.11.2020)



* Installed capacity in respect of RES (MNRE) as on 30.11.2020.
 RES (Renewable Energy Sources) include Small Hydro Project, Biomass Gasifier, Biomass Power, Urban & Industrial Waste Power, Solar and Wind Energy.
 According to the Ministry of Power, data accessed on 17 December 2020; Source: "Power Sector at a Glance ALL INDIA" (17 December 2020) Ministry of Power. <https://powermin.nic.in/en/content/power-sector-glance-all-india>.

Global Energy Review 2020

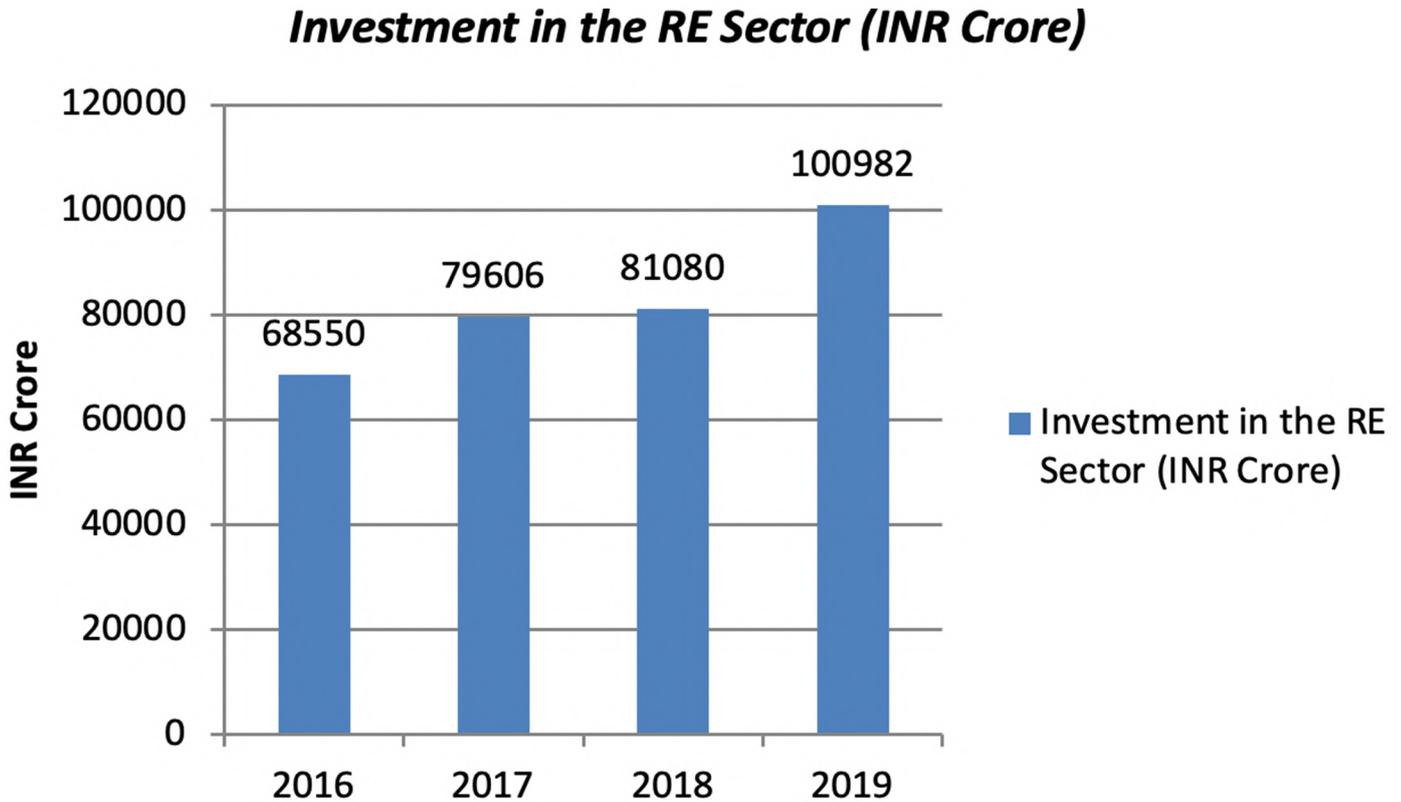
According to the IEA, the current crisis has major implications for global economies, energy use and CO2 emissions. Global energy demand waned by 3.8 per cent in the first quarter of 2020,3 with most of the impact felt in March 2020 as confinement measures were enforced in Europe, North America and elsewhere. According to the review, coal demand declined by almost 8 per cent compared with the first quarter of 2019, since, China (a coal-based economy) was impacted by Covid-19 in the first quarter; cheap gas and continued growth in renewables elsewhere challenged coal; and mild weather also capped coal use.

Oil demand was also hit strongly, down nearly 5 per cent in the first quarter, mostly by curtailment in mobility and aviation, which account for nearly 60 per cent of global oil demand. The impact of the pandemic on gas demand was more moderate, at around 2 per cent, as gas-based economies were not strongly affected in the first quarter of 2020. Renewables were the only source that posted a growth in demand, driven by larger installed capacity and priority dispatch.

Investments in Renewables

India's investment in solar photovoltaic (PV) was greater than in all fossil fuel sources of electricity generation together. By December 2019, India had deployed a total of 84 GW of grid-connected renewable electricity capacity⁴. In 2018, India's power sector saw investments of USD 35 billion in the generation subsector led by renewable power generation, another USD 20 billion in the grid network led by transmission.⁵ Investments in renewable sector (RE) fell 14 per cent to INR 68,550 crore in 2019. India has set an ambitious production target of 175 GW of renewable energy by 2022.

Chart 4: Investments in the Renewable Energy(RE) Sector (INR Crore)



Source: 'Investments in renewable sector fall 14 pc to Rs 68,550 crore in 2019'(19 March 2020) Economic Times <https://economictimes.indiatimes.com/industry/energy/power/investments-in-renewable-sector-fall-14-pc-to-rs-68550-cr-in-2019/articleshow/74718595.cms?from=mdr>

Table1: MNRE Target vs Achievement [Megawatt (Mw)]

Financial Year	Target(MW)	Achievement(MW)
FY2019-20	11,852	4,272*
FY2018-19	15,355	8,519
FY2017-18	14,445	11,876
FY2016-17	16,560	11,319

*Up to September 2019.

Source: Economic Times (13 February 2020) ETEnergyWorld.com

<https://energy.economictimes.indiatimes.com/news/renewable/parliamentary-panel-pulls-up-mnre-for-missing-renewable-energy-targets-over-years/74117607>

The third report of the Standing Committee on Energy (12 March 2020) ⁶ observed and recommended the following:

Exhaustive utilization of allocated funds and remedial measures against factors responsible for low utilization, recommended: The Gross Budgetary Support to the Ministry was substantially decreased at the RE stage as the allocation was reduced by more than 25 per cent. Further, the Ministry was unable to fully utilize the allocations during the previous years.

Timely achievement of wind energy targets is recommended: The Ministry remained short of its wind energy targets during the years 2017-18 and 2018-19, where against the target of 4000 MW each, the Ministry could achieve 1865 MW and 1481 MW with shortfall of 53 per cent and 63 per cent respectively.

Proper implementation of Net-Metering and Simplification of subsidy disbursement, recommended: The Committee observed that against the target of 3000 MW of Roof-Top solar in 2019-20, 580.15 MW have been installed as on 31 January 2020. The Committee, therefore highlighted that the Ministry needs to focus on this programme on a Mission Mode so as to give it a fillip.



Separation of the exposure limit for Renewable Energy Sector from that of Conventional Power Sector, recommended: The Committee observed that the Renewable Energy Sector is finding it difficult to get loans from the banks as the conventional power sector has nonperforming assets (NPAs) with most of the banks, and also clarity is lacking as both Conventional Power Sector and Renewable Energy Sector are clubbed within the same Power Sector Exposure Norms. While the Committee found that small hydro and biomass sector have NPAs, wind and solar are largely insulated from bad loans, but a caveat is that if the States/Discoms are unable to pay back their outstanding dues, many of the solar and wind projects may also turn into NPAs.

Increase in the capital base of the Indian Renewable Energy Development Agency Limited (IREDA) through equity infusion, recommended: The Committee have expressed concern as IREDA had NPA of 3.74 per cent during 2018-19, and noting the overall market liquidity problem, not so conducive market condition, suggested equity financing and other debt-reducing innovative financing.

Strict Compliance of Renewable Purchase Obligations (RPO) and enforcement of penal provisions against the defaulting Obligated Entities, recommended: The Committee noted that a long-term Renewable Purchase Obligations (RPO) trajectory has been issued to promote RE. The Committee observed that most of the States do not follow the mandated trajectory and State Electricity Regulatory Commissions (SERCs) have defined their own respective RPO regulations which have a off-putting effect on RPO compliance. The Committee expressed their opinion that carry forward or waiver of RPO should not be permitted. Identification of weak areas and continuous monitoring of the implementing agencies, recommended: The Committee observed that non-achievement of the assigned yearly physical targets, the Ministry may find it difficult to achieve 175 GW by 2022.

In recent times, many of the auction winners were overseas companies, indicating confidence in India as an investment destination, For instance, in case of solar, during July 2020 several companies, e.g., Spanish company Solarpack shows interest for building 300 megawatts, whereas others include Italy's Enel, the United States-based Amp Energy and Eden Renewables from France.⁷ Some companies are also exploring storage solutions for batteries, pumps and other for balancing. In renewables, solar has become the "blue-eyed boy", where the competitiveness of the tariff has increasingly come into focus, and also land and transmission challenges are relatively stronger for wind (as wind is more site-specific and not available across the country).

Solar tariffs have substantially declined due to declining solar panel prices and improved technology. For instance, Aljomaih Energy & Water Company and Green Infra Wind Energy Limited have set a new record by offering to sell solar power at INR 2 a unit.⁸ Green Infra Wind Energy Limited (GIWEL) is promoted and owned by Sembcorp Green Infra Limited (SGIL), which is a part of Singapore-headquartered Sembcorp Industries. In August 2019, Sembcorp Industries, the Singapore-based energy made an equity infusion of INR 521 crore ⁹ into Sembcorp Energy India Ltd. The fund was aimed to expand the Singapore-based company's renewable energy portfolio in India. At the same time, ReNew Power and Shapoorji Pallonji announced they will collectively invest nearly INR 750 crore in a 150 megawatt (mw) floating solar power project in Uttar Pradesh.

The project was initially targeted 21 months to complete once started. ¹⁰ Since it would utilise the same power evacuation lines currently used by hydro power project, the capital expenditure (capex) was estimated to be lower. Besides, it would arrest the evaporation of water from the Rihand reservoir during the daytime. The two companies had won the project after competitive bidding, conducted by the Solar Energy Corporation of India, while state energy regulator UP Electricity Regulatory Authority (UPERC) had approved these proposals.



On the Renewable sector, Tata Power Solar Systems received a letter of award to build 300 megawatt (MW) plant for NTPC at an all-inclusive price of INR 1730 crore following a post-reverse auction held on 21 February 2020. The commercial operation date for the grid-connected solar photovoltaic (PV) project is set for 21 September 2021.¹¹ This is a domestic content requirement project, where the company will build the project with their own cells and modules.¹²

In January 2020, however, Solar power contracts of three major power plant developers with state-run NTPC Ltd have been cancelled due to delays in regulatory approvals, potentially disrupting India's clean energy trajectory by knocking 1,400MW off it. The Power Purchase Agreements (PPAs) of Acme Solar, Azure Power and Shapoorji Pallonji group have been terminated. This comes against the backdrop of termination of wind PPAs of Hero Future Energies, ReNew Power Ventures and Mytrah Energy with NTPC Ltd to supply 300MW each.¹³ In February 2020, Global emerging market fund Actis has acquired solar energy assets of 600 megawatt capacity from Acme Cleantech Solutions in a deal worth INR 3,000 crore.¹⁴

Government Initiatives

As part of the "stimulus" packages announced by the central government due to COVID-19, INR 90,000 crore¹⁵ was initially earmarked for electricity Distribution Companies (DisComs) meant to address DisComs' financial difficulties (especially for paying their dues to Transmission and Generation companies), and the government subsequently announced that it could be extended to a limit of INR 1.25 lakh crore to bridge the gap of dues to upstream generators (who themselves owe significant money to their own suppliers).¹⁶



Loans worth INR 1.18 lakh crore have been sanctioned so far by state-run non-banking finance firms Power Finance Corporation (PFC) and REC under the liquidity package for stressed power distribution utilities. Under the Central liquidity infusion scheme, REC and PFC are extending financial assistance at a concessional interest rate. Against INR 90000 crore of liquidity infusion package announced by the Government, INR 70,590 crore worth of loans have been sanctioned and INR 24,742 crore has already been disbursed/released till 14-09-2020.¹⁷

A crucial initiative has been taken by the Gol as part of its production linked incentive (PLI) scheme, in allocating INR 4500 crore towards the Ministry of New and Renewable Energy (MNRE) in the sector High Efficiency Solar PV Modules. The Press release (11 November 2020) highlighted the inherent challenges thus:

“Large imports of solar PV panels pose risks in supply-chain resilience and have strategic security challenges considering the electronic (hackable) nature of the value chain. A focused PLI scheme for solar PV modules will incentivize domestic and global players to build large-scale solar PV capacity in India and help India leapfrog in capturing the global value chains for solar PV manufacturing.”¹⁸

India has been addressing energy-related environmental pollution since the 1980s, including air, water, land and waste issues. Reducing the health impacts of air pollution is a key priority. Over the years, the government adopted the National Clean Air Programme (NCAP), which focuses on monitoring and enforcement. In 2015, the government made its intentions to transition to a lower-emission electricity system clear by declaring an ambitious target of 175 GW from renewables by 2022.¹⁹ Ujwal Discoms Assurance Yojana (UDAY) was launched by the Government of India 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. Though it was thought to be a game changer, discoms started to face huge losses; and the recent Covid-19 crisis exacerbated the already grave situation.²⁰

The Pradhan Mantri Sahaj Bijli Har Ghar Yojana, shortened into Saubhagya, was flagged off in September 2017, with the objective of electrifying all left-out Indian households. The original completion date of March 2019 has been advanced to December 2018. The scheme covers both urban and rural households. Under it, free electricity connections are provided to below poverty line (BPL) households, while other households have to pay INR 500 for the connection. Under the Saubhagya scheme, all states have declared electrification of all households on March 2019, except 18,734 households in left wing extremism affected areas of Chhattisgarh. At that time, there were 19.1 lakh un-electrified households which were unwilling to get electricity connection.²¹

The Discom “Distress”

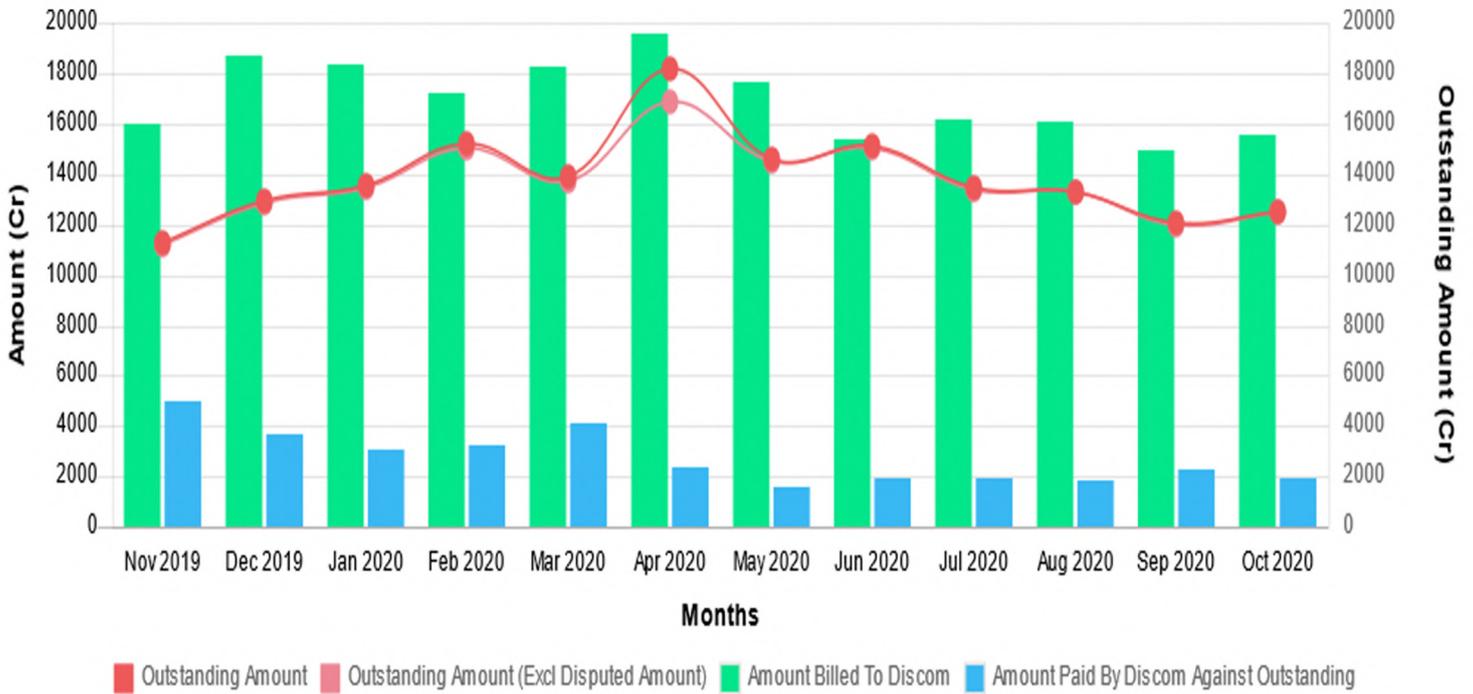
A crucial issue is that while the non-payment of Discoms towards “generation companies” (or “Gencos”) have been overtly discussed, non-payment to Discoms by state governments for electricity consumption or promised subsidies as well as dues to other suppliers and vendors beyond generators, in addition to other dues or liabilities remain also other issues to receive serious attention. Discom’s demand has also been affected due to disproportional reduction in demand from high-revenue commercial and industrial consumers. According to the Payment Ratification And Analysis in Power procurement for bringing Transparency in Invoicing of generators (PRAAPTI) portal, Discom’s total outstanding dues at September 2020 stood at INR 1.38 lakh crore. Power producers give forty-five days to Discoms for paying bills for the supply of electricity. Subsequently outstanding bills become overdue and generators charge penal interest on such overdues. Such overdues stood at INR 1.26 lakh crore out of the INR 1.38 lakh crore outstanding dues.²²

Table 2: Discomm Losses: Data Available As on Oct 2020

Sl No.	Item/Topic	Number/Amount (INR Crore)
1	Number of Overdue Invoices	21390 (number)
2	Overdue Amount at month start	124824 (crore)
3	Total Amount billed to Discoms	15581 (crore)
4	Amount paid by Discoms against overdue	11757 (crore)
5	Amount paid by Discoms against outstanding	1979 (crore)
6	Overdue Amount at month-end	126226 (crore)
7	Outstanding Amount in month-end	12508 (crore)

Source: Payment Ratification And Analysis in Power procurement for bringing Transparency in Invoicing of generators (PRAAPTI) portal; <http://praapti.in/>

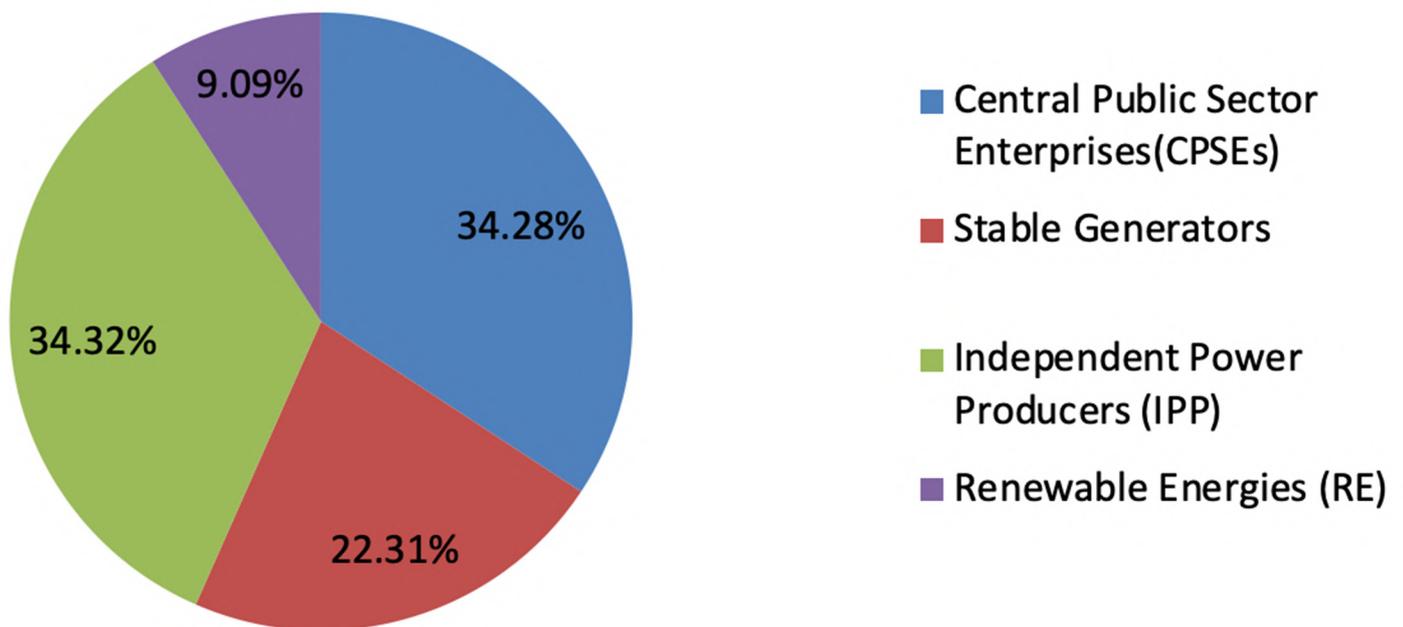
Chart 5: Summary of Overdue Outstanding Amount of Discoms (INR Crore)



Source: Payment Ratification And Analysis in Power procurement for bringing Transparency in Invoicing of generators (PRAAPTI) portal; <http://praapti.in/>

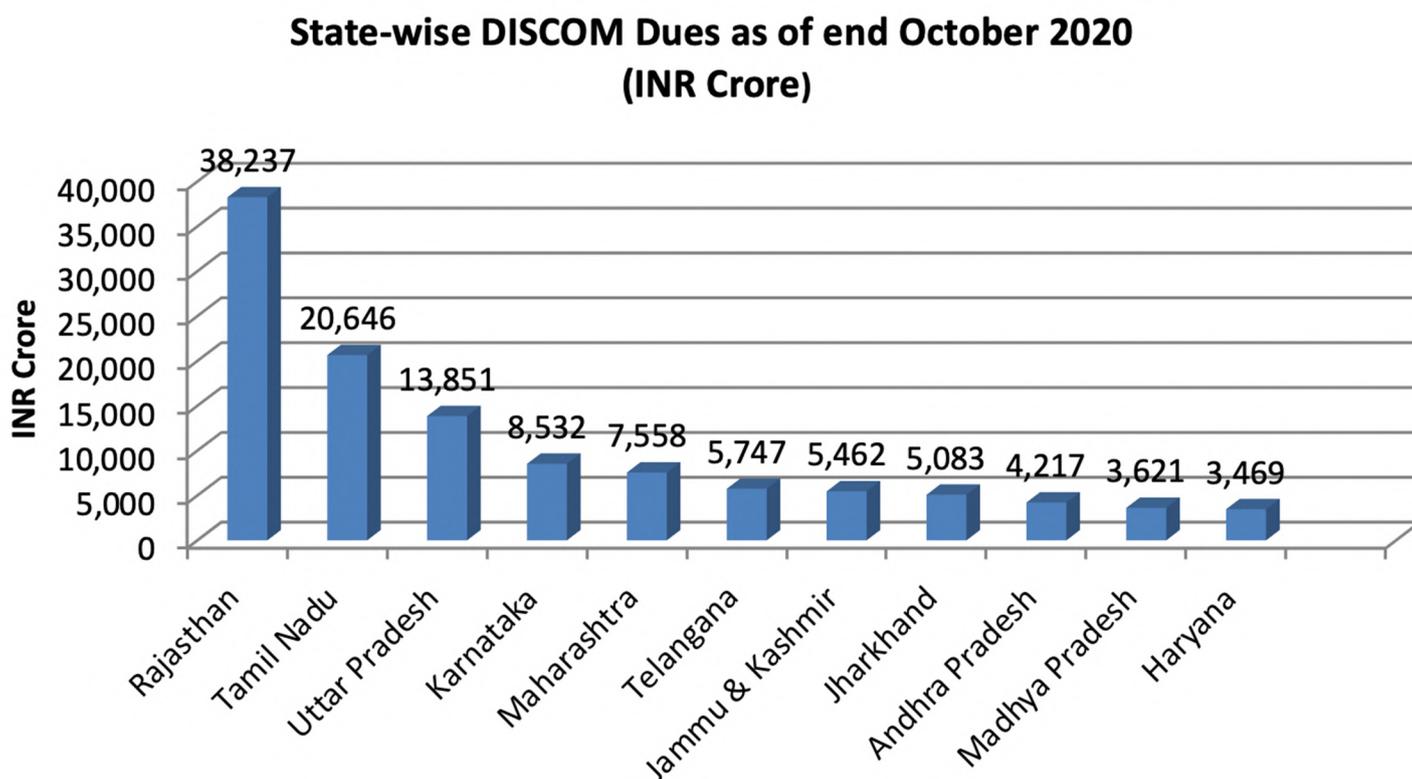
Chart 6: Overdue Outstanding Amount of Discoms (% to total) in October 2020

% of Overdue Amount (In October 2020)



Source: Payment Ratification And Analysis in Power procurement for bringing Transparency in Invoicing of generators (PRAAPTI) portal; <http://praapti.in/>

Chart 7: State-wise DISCOM Dues as of end October 2020 (INR Crore)



Source: Payment Ratification And Analysis in Power procurement for bringing Transparency in Invoicing of generators (PRAAPTI) portal; <http://praapti.in/>

Industry Risk

The Covid-19 outbreak has severely affected private sector power generators as state-run power distribution utilities (discoms) asked private sector gencos, with whom they have entered into power purchase agreements (PPA), to shut down and not expect any payment till further notice.

Operational efficiencies of many discoms are yet to record a discernible improvement, despite various institutional measures in past few years. Some major issues confronting the discoms today are – distribution losses, collection and billing inefficiency, increasing gap between average required revenue and average supply cost, demand decline from industry and commercial clients etc. Further, inability to read meter reading due to lockdown amid Covid-19 pandemic also impacted revenue realisations. Recovery of AT & C losses crucially depends upon discom's regaining of collection efficiency. Receivables or dues to DisComs are greater challenge for cash flows than AT&C losses;²³ which mainly attributes pending subsidies from the state governments and unpaid dues from consumers.²⁴

Earlier, amid the Covid-19 crisis, many discoms of Uttar Pradesh, Punjab, Haryana, Telangana, Madhya Pradesh, and Dadra and Nagar Haveli (a union territory) have invoked the 'force majeure' ²⁵ clause for an indefinite period. According to the Punjab State Power Corporation Ltd (PSPCL), the decision was taken in view of a "drastic reduction in demand" due to the shutdown of industrial units. What is unique in this notice is that discoms are absolving themselves from paying even the fixed charges or the cost of installing a power project, which includes repayment obligations to lenders. All PPAs come in two parts: fixed and variable. A buyer may be absolved from payment of variable cost but payment of fixed charges is mandatory, unless and until the contract is scrapped altogether.²⁶

India has an abundance of sunlight throughout the year but cannot convert it into grid electricity without Chinese gear. Solar power parks are dependent on Chinese imports. A whopping 80 per cent of solar cells and modules, which absorb sunlight to generate electricity, used in India are imported from China-based manufacturers, including Trina Solar, Jinko Solar and China Solar. Amid the Covid-19 crisis, an increase in solar module prices would pose further challenges. A further increase would lead to decline in electricity demand in commercial and industrial activities as well as project delays. According to a KPMG report,²⁷ about 62 GW thermal, 11 GW RE and transmission projects under construction likely to get delayed with sustained lockdown and would impact debt servicing and project viability.

Due to regulated prices and the other bump, India's distribution companies (discoms) lose around INR 360 (\$4.63) on every megawatt-hour of electricity they deliver — equivalent to roughly 10 per cent of the retail price. Spread that across a market generating more than 1.5 billion megawatt hours a year, and the losses quickly mount up. Total debt in the sector now amounts to INR 4.3 lakh crore (\$56.4 billion).²⁸ Collection delays, industrial and commercial defaults due to business discontinuity will put more pressures on discoms and a cascading adverse effect on payment to generators.



There are several other challenges in the wake of the Covid-19 crisis. For instance, forty thermal power units with a capacity of 30 gigawatt (GW) mostly from northern India stopped lifting coal as demand has declined sharply during the lockdown, which has led to an increase in stocks at pitheads by nearly 20 million tonnes to about 75 million tonnes. Most of the power plants refusing to lift coal are from Haryana, Punjab, Uttar Pradesh and Rajasthan. Coal India Ltd's (CIL) subsidiary Central Coalfields is the worst hit as almost all its power consumers are refusing to accept supplies and make payments. Power demand has declined 30 per cent since the lockdown began, forcing nearly 65 GW of coal-fired plants to back down, with further decline in the capacity utilization.²⁹

Further, India could face over 21.6 per cent of 3 gigawatts (GWs) of solar power and wind energy projects being delayed as a legacy effect of lockdown.³⁰ While wind projects would be impacted by labour disruption in the peak season, solar photovoltaic (PV) installations are likely to take a setback as the industry is heavily dependent on Chinese PV module import, which have been disrupted due to coronavirus. With over 3 GW of wind projects under construction scheduled for 2020 completion, supply and labour disruptions from the current lockdown could delay 400 megawatts (MW) into 2021.³¹

Gujarat delivered 58 per cent or 1.4 GW of newly added wind capacity in India in 2019 and is one of the worst-hit states in terms of coronavirus infections. On the solar front, Karnataka (2.0 GW), Tamil Nadu (1.6 GW) and Rajasthan (1.7 GW) were the top three states accounting for 55 per cent of solar PV installations in 2019; who are likely to be severely affected. Accordingly, solar PV and wind installation developers' cash flows will also likely to be affected.³²

The power supply position in the country during 2009-10 to 2020-21:

Year	Energy				Peak			
	Requirement	Availability	Surplus(+)/Deficits (-)		Peak Demand	Peak Met	Surplus(+) / Deficits(-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	(%)
2009-10	8,30,594	7,46,644	-83,950	-10.1	1,19,166	1,04,009	-15,157	-12.7
2010-11	8,61,591	7,88,355	-73,236	-8.5	1,22,287	1,10,256	-12,031	-9.8
2011-12	9,37,199	8,57,886	-79,313	-8.5	1,30,006	1,16,191	-13,815	-10.6
2012-13	9,95,557	9,08,652	-86,905	-8.7	1,35,453	1,23,294	-12,159	-9.0
2013-14	10,02,257	9,59,829	-42,428	-4.2	1,35,918	1,29,815	-6,103	-4.5
2014-15	10,68,923	10,30,785	-38,138	-3.6	1,48,166	1,41,160	-7,006	-4.7
2015-16	11,14,408	10,90,850	-23,558	-2.1	1,53,366	1,48,463	-4,903	-3.2
2016-17	11,42,929	11,35,334	-7,595	-0.7	1,59,542	1,56,934	-2,608	-1.6
2017-18	12,13,326	12,04,697	-8,629	-0.7	1,64,066	1,60,752	-3,314	-2.0
2018-19	12,74,595	12,67,526	-7,070	-0.6	1,77,022	1,75,528	-1,494	-0.8
2019-20	12,91,010	12,84,444	-6,566	-0.5	1,83,804	1,82,533	-1,271	-0.7
2020-21*	8,34,672	8,31,937	-2,735	-0.3	1,77,019	1,76,413	-605	-0.3

* Upto November 2020 (Provisional), Source : Central Electricity Authority (CEA).

Capacity Addition Target and Achievement for 2019-20 (in MW)

	Thermal		Hydro		Nuclear		Total	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
Central	6040	3940	600	300	700	0	7340	4240
State	4256.15	2780	210.99	0	0	0	4467.14	2780
Private	0	45	379	0	0	0	379	45
Total	10296.15	6765	1189.99	300	700	0	12186.14	7065

Source: "Executive Summary on Power Sector"(October 2020) Central Electricity Authority (CEA), Ministry of Power, Gol.

Capacity Addition Target and Achievement for 2018-19 (in MW)

	Thermal		Hydro		Nuclear		Total	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
Central	2760	1960	710	110	0	0	3470	2070
State	4506	2850	130	30	0	0	4636	2880
Private	0	972	0	0	0	0	0	972
Total	7266	5782	840	140	0	0	8106	5922

Source: "Executive Summary on Power Sector"(October 2020) Central Electricity Authority (CEA), Ministry of Power, Gol.

Capacity Addition Target and Achievement for 2017-18 (Figures in MW)

	Thermal		Hydro		Nuclear		Total	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
Central	4880	3170	800	390	500	0	6180	3560
State	3546	1760	300	200	0	0	3846	1960
Private	2940	3780	205	205	0	0	3145	3985
Total	11366	8710	1305	795	500	0	13171	9505

Source: "Executive Summary on Power Sector"(October 2020) Central Electricity Authority (CEA), Ministry of Power, Gol.

ENDNOTES

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- In the backdrop of COVID-19 and its unprecedented shock to the economy, the Government of India initially announced a relief of Rs 90,000 crore to assist the stressed electricity distribution sector for liquidating their dues to suppliers like generation companies (GenCos) and transmission companies (TransCos) via loans through the Power Finance Corporation Ltd. (PFC) and the Rural Electrification Corporation Ltd. (REC).
- Loksabha UNSTARRED QUESTION NO.867TO BE ANSWERED ON 17.09.2020; <http://164.100.24.220/loksabhaquestions/annex/174/AU867.pdf>
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19. "Why India is the new hotspot for renewable energy investors"(14 January 2020) World Economic Forum
<https://www.weforum.org/agenda/2020/01/india-new-hotspot-renewable-energy-investors/>
20. While UDAY's focus was on discom debt, structural and infrastructure bottlenecks remain unaddressed. On the cost side, long term power purchase agreements with power generators does not allow discoms to revise prices. On the revenue side, discoms are constrained by the inability to change politically-sensitive electricity tariffs. Inadequate subsidy payments by states, electricity theft and unmetered electricity to the agriculture sector limit discom revenues. See 'Why the lights dimmed on UDAY'(18 March 2020) Livemint
<https://www.livemint.com/news/india/why-the-lights-dimmed-on-uday-11584513638778.html>
21. '7.28 lakh households 'unwilling' to take electricity connections remain unelectrified: Govt in Lok Sabha'(14 March 2020) Financial Express
<https://www.financialexpress.com/economy/7-28-lakh-households-unwilling-to-take-electricity-connections-remain-unelectrified-govt-in-lok-sabha/1897387/>
22. "Discom liquidity package: Loans of INR 1.18 lakh crore sanctioned"(12 November 2020) The Financial Express.
23. Cash flow or even (book-value) income statement deficit revolve around electricity losses, often "commercial losses" which include theft as well as lack of billing and collection. The composite measure is dubbed aggregate technical and commercial (AT&C) losses, the latter spanning theft and non-collection, see "Reconciling DisCom 'stimulus' and dues: We must look beyond the tip of the iceberg" (24 September 2020) Centre for Social and Economic Progress (CSEP)
<https://csep.org/impact-paper/reconciling-discom-stimulus-and-dues-we-must-look-beyond-the-tip-of-the-iceberg/>
24. A critical subset of the latter is dues from state governments; see, "Reconciling DisCom 'stimulus' and dues: We must look beyond the tip of the iceberg" (24 September 2020) Centre for Social and Economic Progress (CSEP)
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25. Force majeure refers to a clause that is included in contracts to remove liability for natural and unavoidable catastrophes that interrupt the expected course of events and restrict participants from fulfilling obligations.
26. Six power distribution utilities invoke force majeure clause, tell private sector generators not to expect payment' (2 April 2020) The HinduBusiness Line.
27. 'Potential Impact of Covid-19 on the Indian Economy'(April 2020) KPMG.
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<https://energy.economicstimes.indiatimes.com/news/coal/forty-thermal-power-units-stop-lifting-coal-as-demand-sees-sharp-drop/75023213>
30. 'India's renewables installation could fall by a fifth due to lockdown: Wood Mackenzie'(7 April 2020) ETEnergyWorld.com.
31. *ibid.*
32. *ibid.*

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