

Webinar On

# INDIA'S POWER SECTOR

*The journey till date and going forward*

Featuring

## India's Power Outlook Series

---

9<sup>th</sup> July 2020



Supported by:



# CONTENTS

---

- Rationale & Objective of the Series
- Insights from Volume-I and II
- Questions to the Panel for Discussion

# RATIONALE & OBJECTIVE OF THE SERIES

---

## Rationale:

- 1 Need for an open source knowledge product presenting a comprehensive power sector outlook for India.
- 2 Challenges in keeping track of multiple Government reports, dashboards and portals to holistically understand and be updated with sector progress.

## Objective:

- 1 To provide the current status and insights on India's power sector and act as a tracker for its latest trends and developments.
- 2 To enhance discourse amongst all stakeholders about the barriers that impede a sustainable energy transition in India and recommend new strategies.

# What does the Power Sector Outlook Series include?

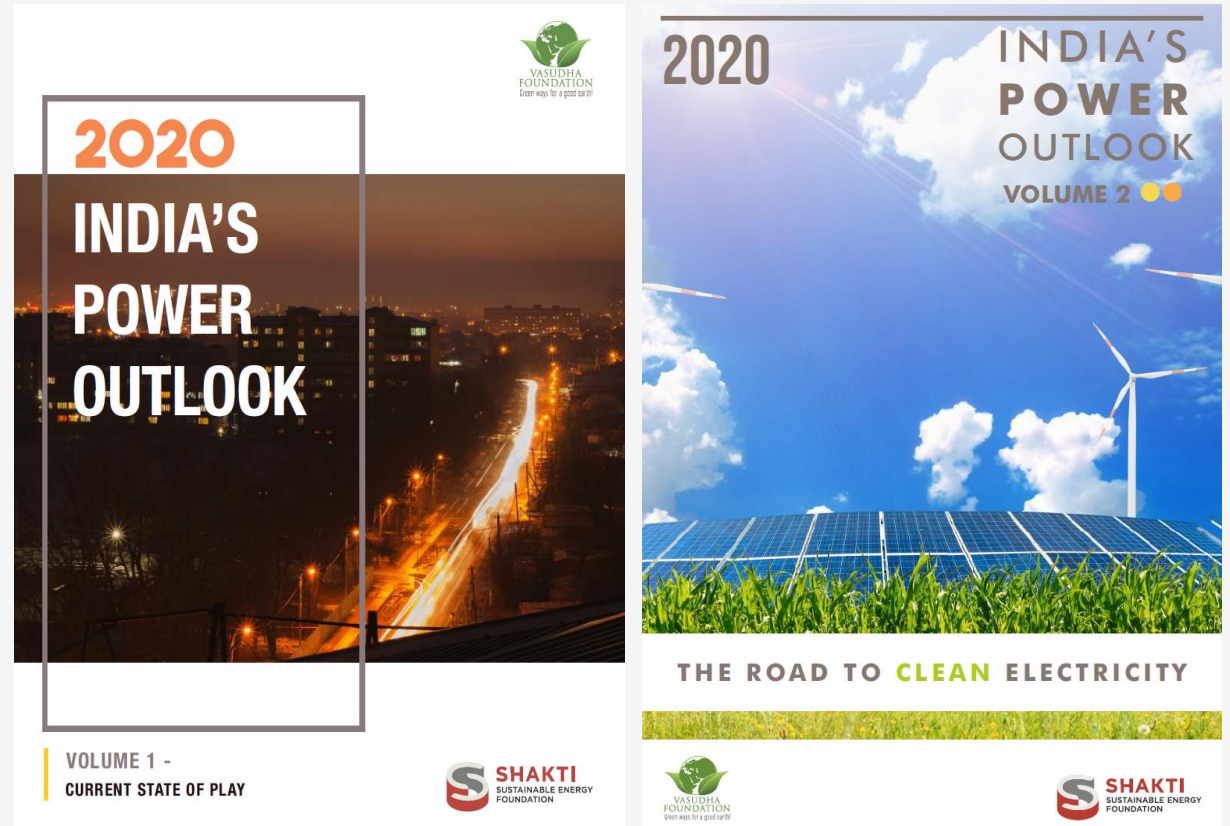
- The Series covers elements from the entire power sector value chain.
- It includes policy progress, emerging trends and other updates from the generation , transmission and distribution sub-sectors and further threads consumer, development and environment related issues in an integrated manner.
- Till date , we have developed two volumes under the series:

Volume 1: Current State of Play – February 2020

*Provides a brief narrative of the India power sector and its policy implications*

Volume 2 : The Road to Clean Electricity - July 2020

*Provides an overview of renewable energy in India and assesses its progress across the power sector value chain.*

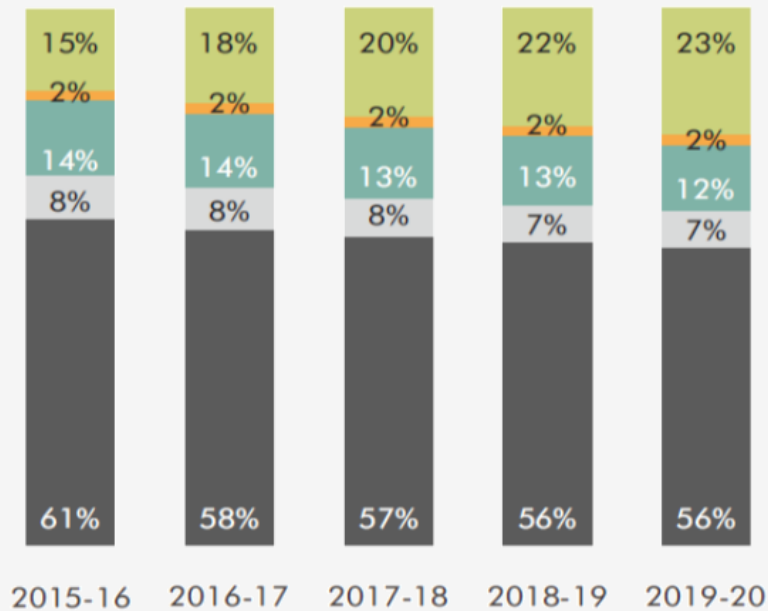


# INSIGHTS FROM VOLUME I AND II

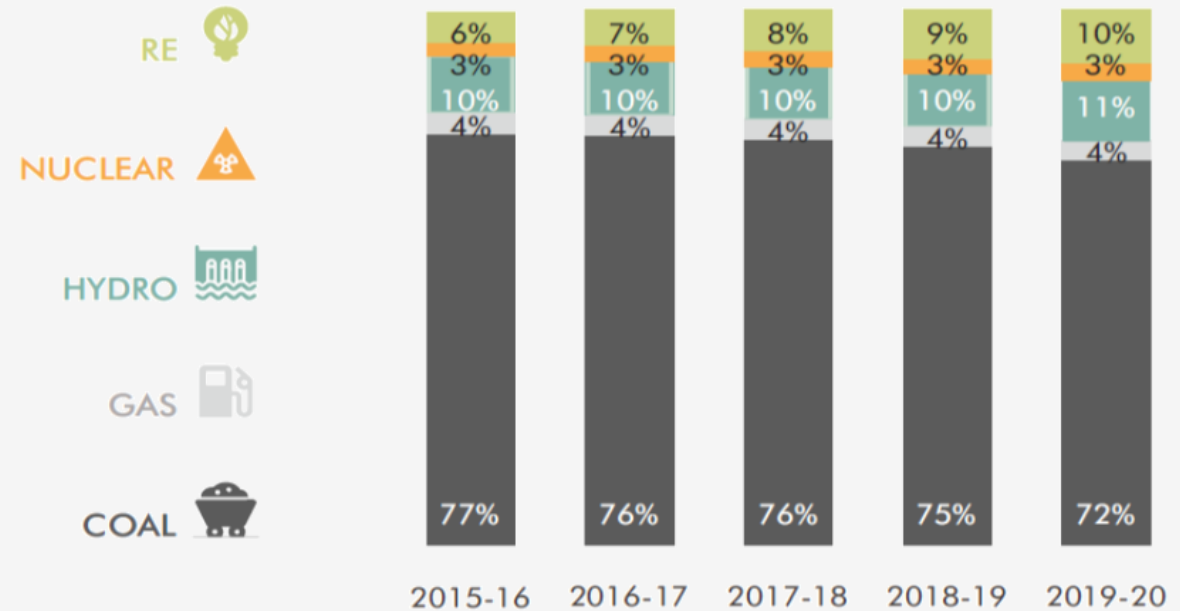
---

# India's power picture is set for a major change in its electricity mix with rising shares of wind and solar

**Installed Capacity Mix**  
In last 5 years



**Electricity Generation Mix**  
In last 5 years



Source: CEA, MoP, 2020. Executive Summary. CEA, 2019. Growth of Electricity Sector in India from 1947-2019.

1

Renewable energy is the fastest growing source of energy, accounting for more than 50% (51.25 GW) of capacity addition since March 2015.

2

The RE share in overall electricity generation mix has risen from 6% in 2015-16 to 10% in 2019-20

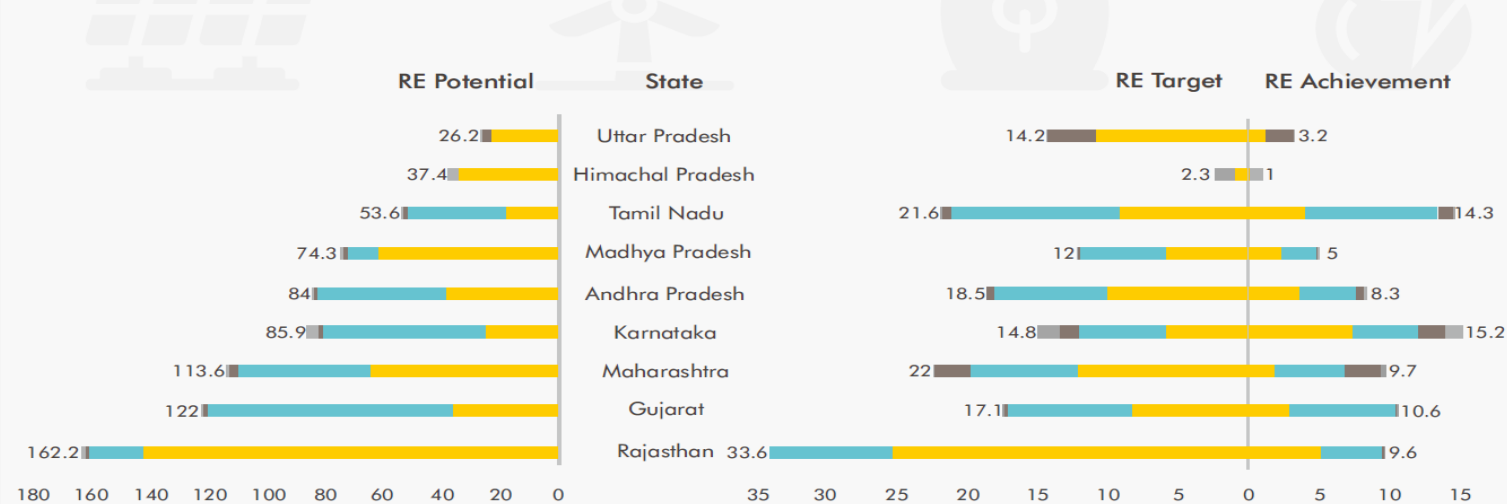
# While there has been some success, a lot needs to be done to meet the 175 GW RE target

As on March, 2020,

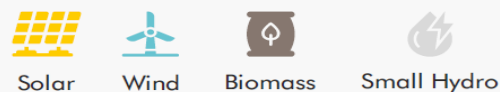
- India had achieved (installed, under implementation and tendered) a total of 150 GW of renewable energy, only 14% less than the existing target.
- However, the actual installed solar and wind capacity is only at a 34.6 GW and 37.6 GW respectively, with solar more than 60% away from the targeted capacity to be achieved by 2022.
- Further, only a few states will be able to meet their RE targets by 2022.



### RE Potential, 2022 Target and Achievement (in GW)



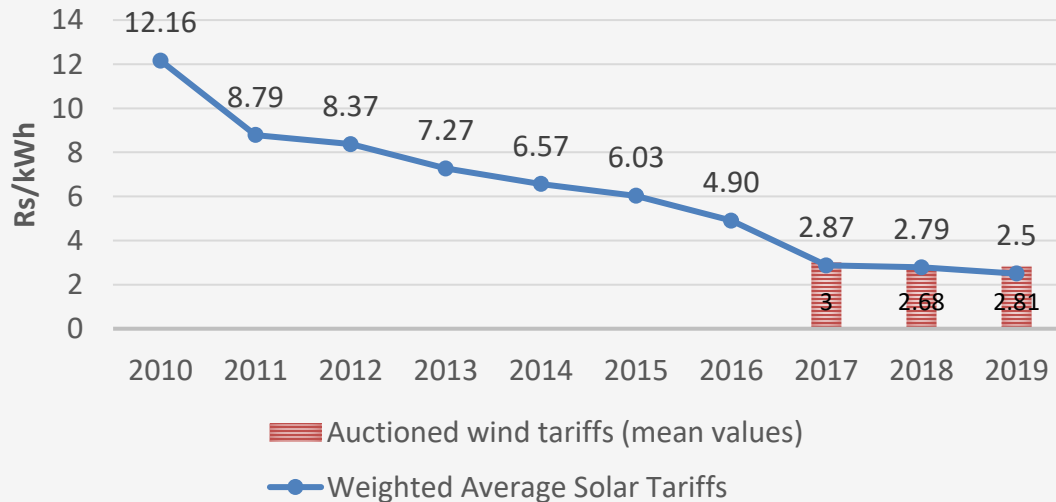
MNRE, 2020. State-wise Break-up of RE target (175 GW) to be Achieved by 2022. MNRE, 2020. State-wise Installed Capacity of Grid Interactive Renewable Power.



# Aggressive RE targets and conducive policies behind India's clean energy ambition

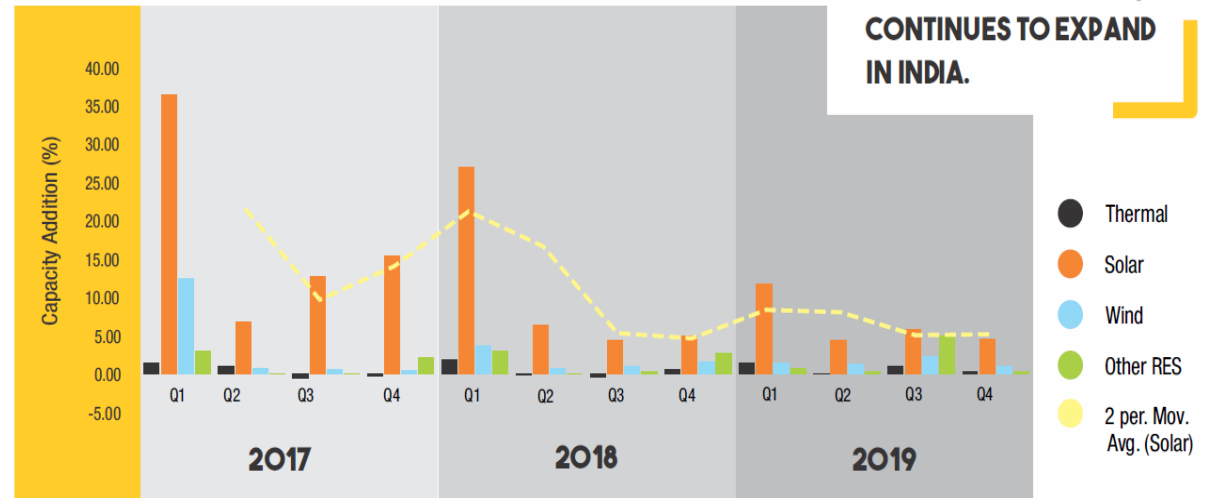
- ▶ India has installed 9.4 GW RE capacity in 2019-20, against 8.6 GW in 2018-19. In 2017-18, 11.77 GW was added; the highest ever.
- ▶ With record low tariffs for solar, wind and RE+ storage; RE offers a level playing field with other conventional generation sources

INDIA'S SOLAR AND WIND TARIFFS TRAJECTORY



Source: Data taken from Standing Committee on Energy (2016-17 to 2017-18), MNRE<sup>12</sup> and India Wind Energy Association<sup>13</sup>  
Vasudha Foundation Analysis

Source-wise quarterly percentage capacity addition in India From 2017 to 2019



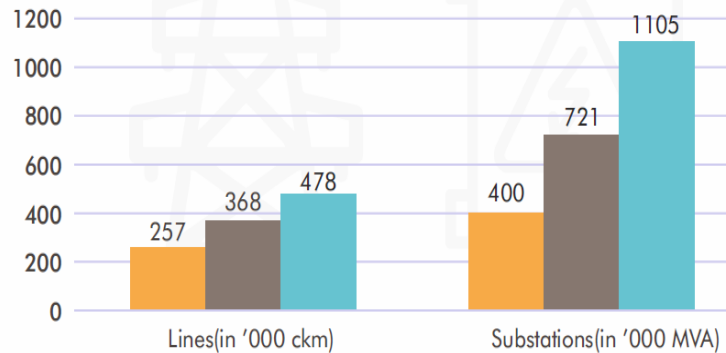
Source: CEA reports on installed capacity from 2017-2019<sup>8</sup>

Bid details of the 1.2 GW RE+ Storage auction by SECI

Winners	Capacity won	Minimum Storage Capacity Required	Peak Power Tariff		Off-peak Power Tariff		Weighted Average Tariff		APPC-FY19
			Rs/kWh	\$/kWh	Rs/kWh	In \$	Rs/kWh	\$/kWh	
Greenko	900	450	6.12	0.086	2.88	0.04	4.04	0.057	3.6
ReNew Power	300	150	6.85	0.096	2.88	0.04	4.3	0.06	



# Power networks in India moving towards a new phase of network augmentation and grid maturity

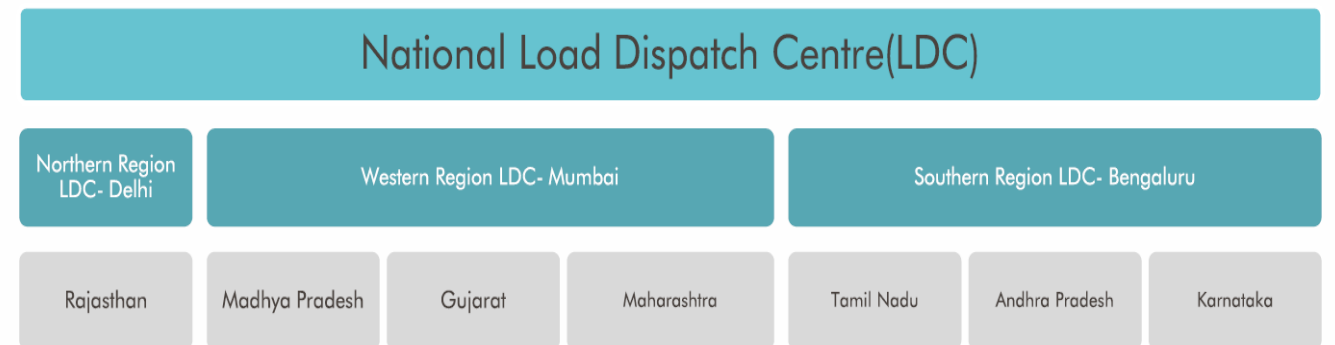


Source: CEA, 2019. National Electricity Plan, Volume-II.

- ▶ As per CEA, 1.1 lakh ckm of powerlines and 3.8 lakh MVA of transformation capacity addition during 2017-22 is expected to adequately meet the projected demand in 2021-22.
- ▶ This said, the year 2019-20 witnessed drastic reductions in the transmission lines addition compared to the previous years. This is reportedly attributed to the decrease in RE capacity addition and uptake by states.

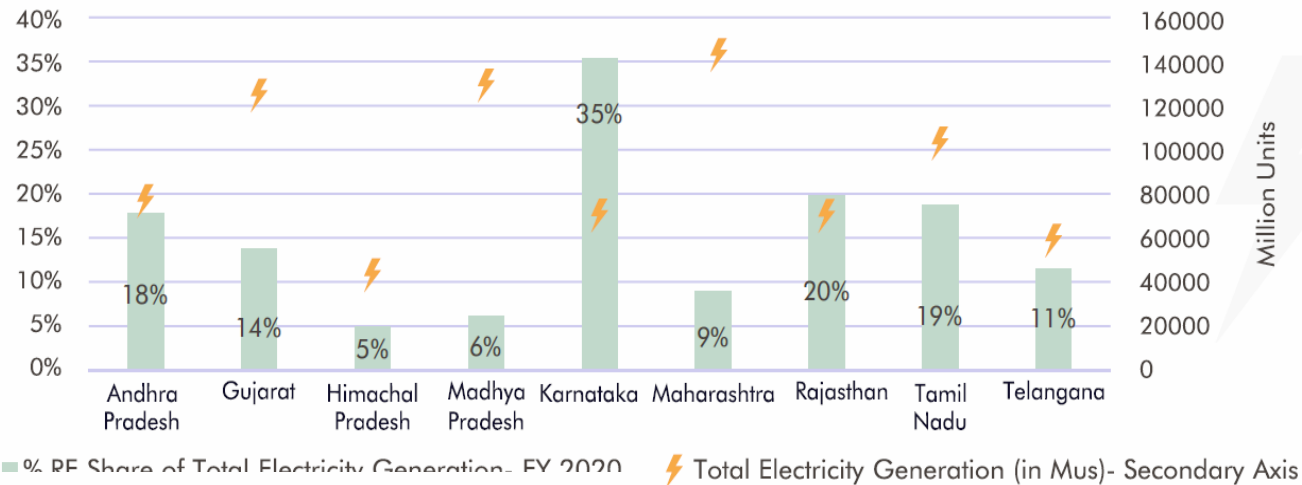
- ▶ The progress of the Green Energy Corridor scheme devised to bolster RE integration has been slower than expected, particularly at the Intrastate levels.
- ▶ However, all the 11 Renewable Energy Management Centre's (REMCs) planned under the GEC were recently commissioned in February 2020 for forecasting and real time RE monitoring.

## List of 11 REMCs



# State level grid integration strategies critical for large scale RE penetration and lower curtailments levels

Percentage RE Share of Total Electricity Generation- FY 2020



Source:  
CEA, 2020, Monthly Renewable Energy Generation Report.  
CEA, 2020, Daily Renewable Energy Generation Report.

Future Renewable Energy Target Trajectory



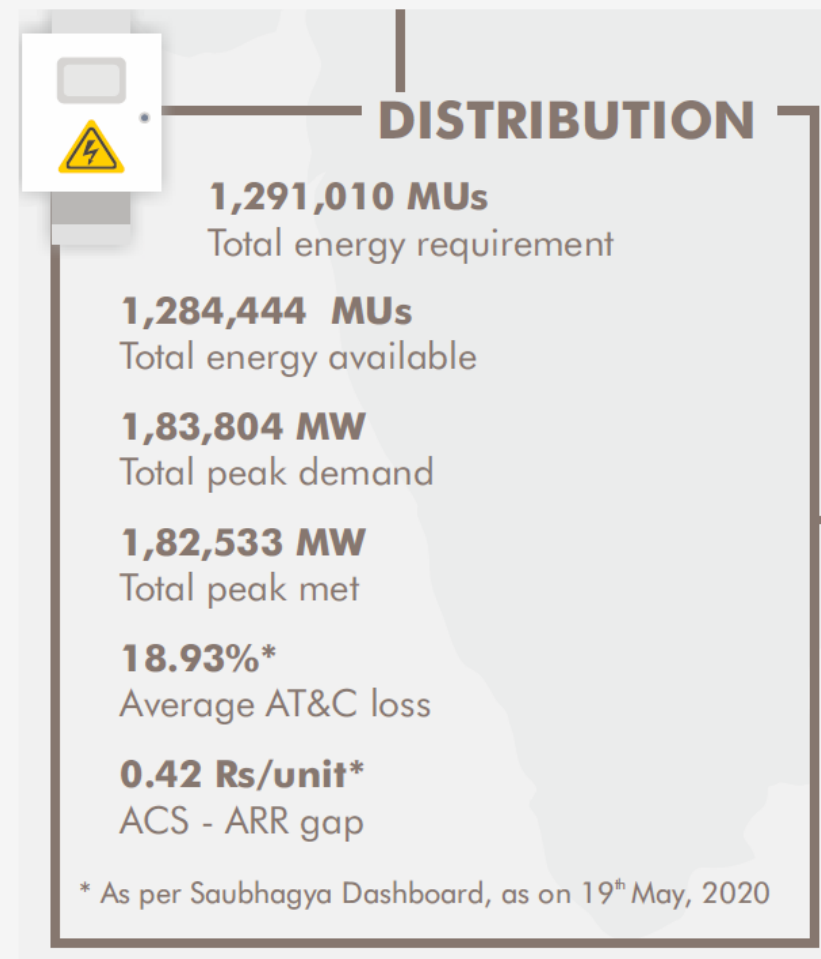
Source:  
MNRE, 2020. Public Information. <https://bit.ly/37niiYn>  
POSO, 2019. Large Scale Grid Integration of Renewable Energy in India. <https://bit.ly/2MIK3NA>

- According to IEA, out of the six levels of grid maturity, India is currently classified under the second phase of grid integration and hence poses only a minor to moderate impact on system operation.
- However, RE curtailment is already a big issue with high RE generating states like Karnataka, Andhra Pradesh and Tamil Nadu.
- At a national level, the RE generation is expected to rise from the present levels of 10% to ~20% , 24% and 37% in FY 2022, FY 2027, and FY 2030, respectively.

# Lower demand deficits, declining AT&C losses, narrowing ACS-ARR gap, improving supply quality presents hope for the electricity distribution sector

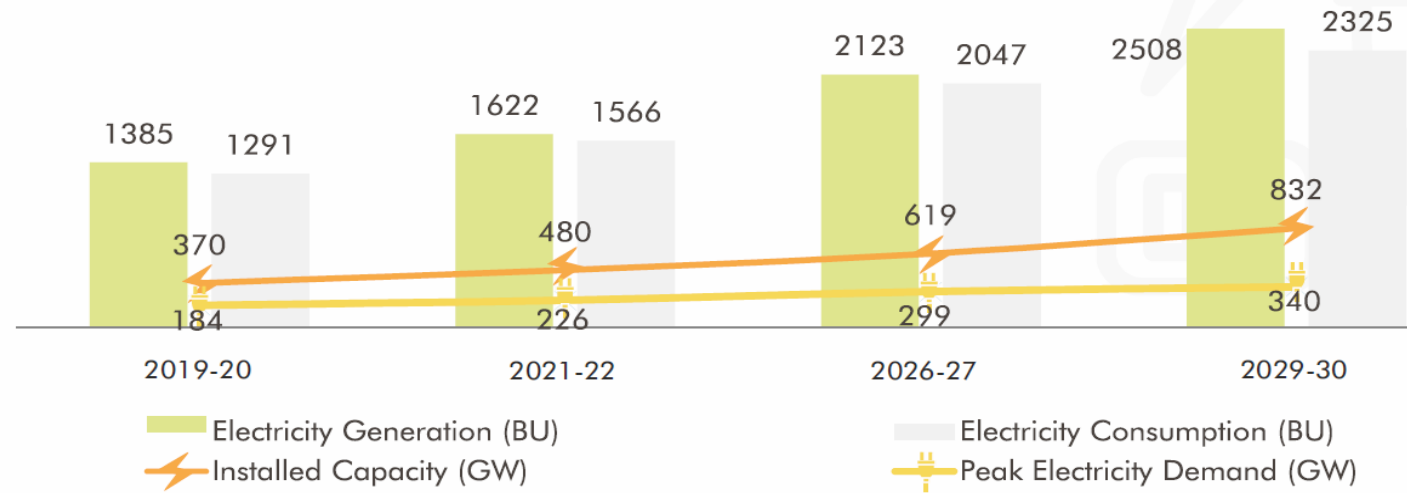
## STATE STORIES

- ▶ Bihar, Andhra Pradesh and Uttar Pradesh have seen the highest growth in its electricity requirement.
- ▶ The electricity consumption in three heavily industrialized states of Gujarat, Maharashtra and Tamil Nadu has grown the slowest at a ~2% CAGR; indicating an industrial slowdown
- ▶ UP, with one of highest power deficit state has tremendously brought down its peak power deficit levels from 15% in 2015-16 to 2.4% in 2019-20.
- ▶ Tamil Nadu presents the lowest increase in the growth of peak power, saturating at ~15-16 GW since 2016-17.



# Peak electricity demand to almost double between 2020 and 2030

**Comparison of Electricity Supply Vs Demand**  
for 2022, 2027 and 2030



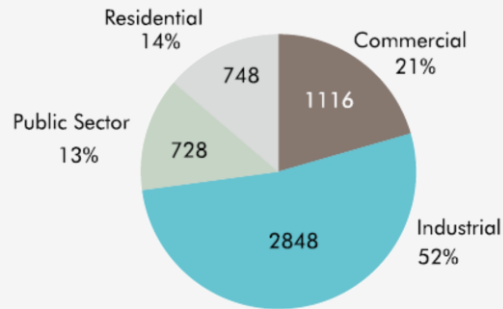
Source:  
CEA, 2019. Draft Optimal Mix Generation Capacity Mix For 2029-30.  
CEA, 2019. National Electricity Plan, Volume-II.  
CEA, 2016, 2017, 2018, 2019 and 2020. Power Supply Position Reports.

- A large number of macroeconomic factors such as growth and development, climate, technological changes, consumer preferences, energy choices, policy environment etc. are responsible for impacting electricity demand requirements in the short and long term.
- With the rising shares of intermittent RE in the power procured, it becomes imperative for Distribution Companies to accurately estimate the disaggregated electricity demand and understand its varying patterns.

# An accelerated push to Solar Rooftop additions will ensure 175 GW RE by 2022

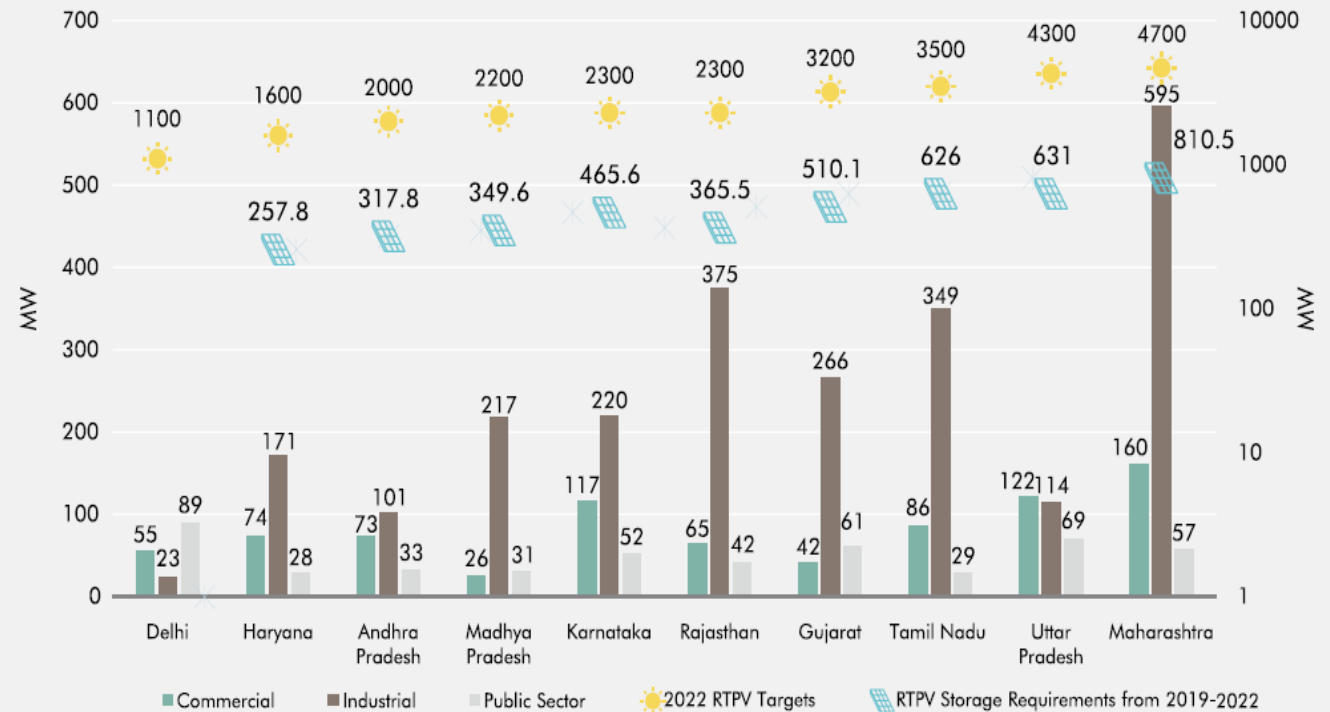
- ▶ 40 GW rooftop solar target saw an aggregated capacity of only 5.44 GW as on December 2019, of which only 748 MW was installed in the residential sector.
- ▶ According to the recent State Rooftop Solar Attractiveness Index (SARAL) — Karnataka, Telangana, Gujarat and Andhra Pradesh were ranked as the top A++ performers and 11 other states were rated as A+ and A performers. The Index is to evaluate Indian states based on their preparedness to support RTPV deployment.

**Consumer-wise Solar Rooftop Capacity (MW)**  
As on 31<sup>st</sup> December 2019



Source: Bridge to India, 2019. India Solar Rooftop Map. <https://bit.ly/2B0YihO>

**Solar Rooftop Capacity 2019 Vs Target for Key States**  
As on 31<sup>st</sup> December 2019



Source: Bridge to India, 2019. India Solar Rooftop Map. <https://bit.ly/2B0YihO>  
ISGF and IESA, 2019. Energy Storage Roadmap for India 2019-2032. <https://bit.ly/2XOm3Pi>

<sup>†</sup>The graph does not provide a breakup for the residential category.

# Battery storage is critical to ensure future RE success

- ▶ The total energy storage (mainly batteries) estimated for integration of 40 GW of RTPV by 2022 lies at 9.4 GWh
- ▶ The cost of battery storage is expected to decline at an average rate of 12% against the 6% decline for Solar PV, thus occupying ~23% of the project costs by 2022.

## Energy Storage Potential for Grid-scale Applications (in GWh) ~ 30 GWh From 2019-2025

Fast Response Ancillary Services	Grid scale- Wind	Distribution Utility Storage	Grid scale- Solar
2	6	10	13

Source: ISGF and IESA, 2019. Energy Storage Roadmap for India 2019-2032. <https://bit.ly/2XQm3Pi>

## Energy storage Potential for Behind-the Meter Applications (in GWh) ~ 160 GWh from 2019-2025

Diesel Replacement	HVAC	BTM Rooftop Solar	UPS	Telecom	Inverter
2	4	6	29	36	84

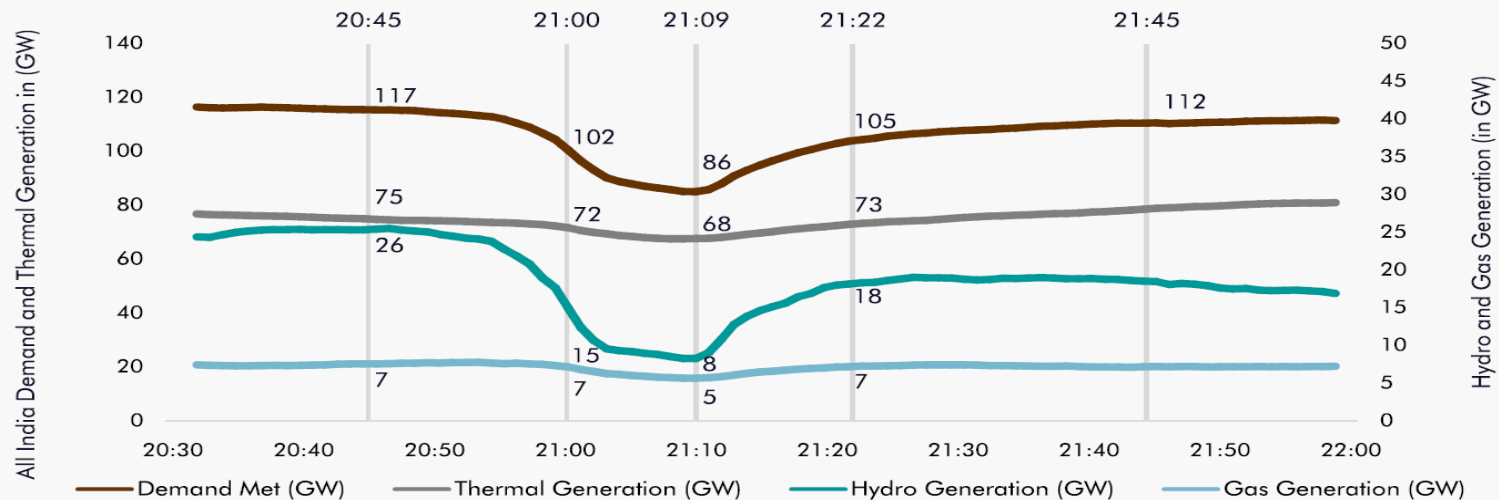
Source: ISGF and IESA, 2019. Energy Storage Roadmap for India 2019-2032. <https://bit.ly/2XQm3Pi>

# Can Pumped Hydro become an integral part of India's Storage journey?

Progress of Pumped Storage Development in India (in MW)- As on March 2020			
Installed		Under Construction	Proposal Development
Operational	Not operational	Commissioning by 2022-23	
3,305	1,480	1,580	8,380

Source: (CEA, 2020)<sup>17</sup>

## 9 minutes at 9 pm: A Perfect Example for Testing Grid Flexibility and Readiness



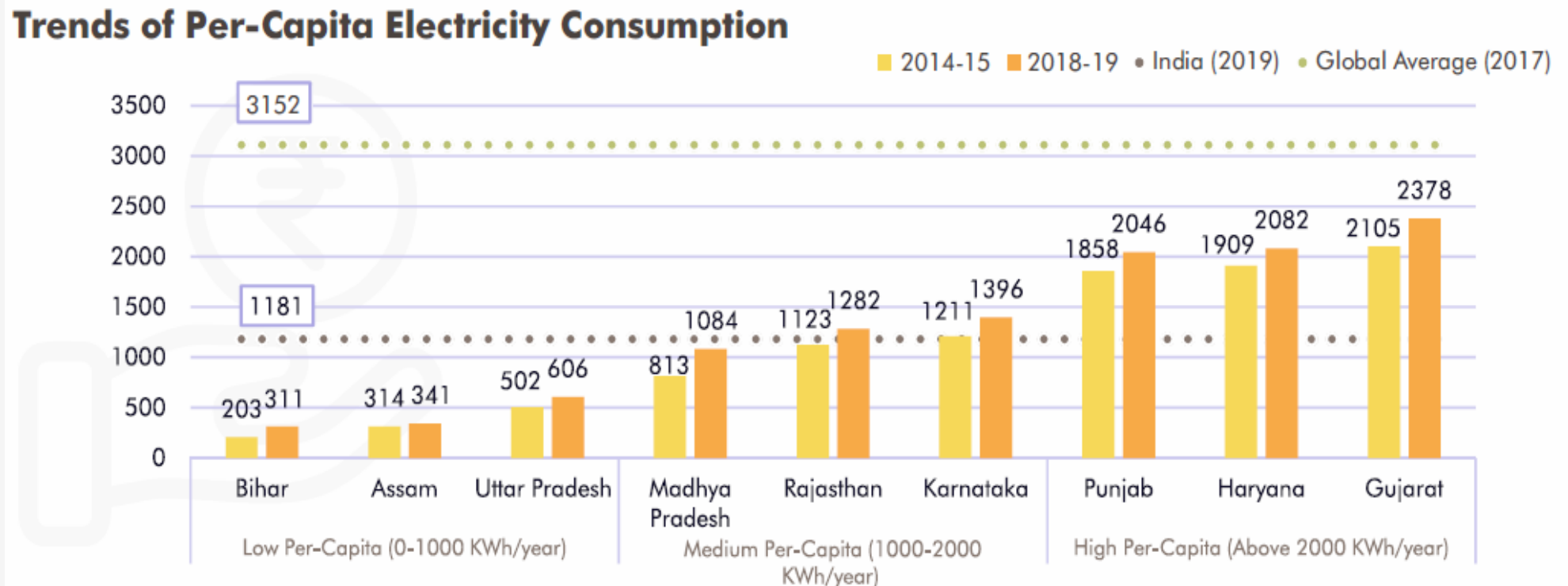
The total reduction in all India demand during the 9-minute event was **~31 GW**, almost **60%** higher than the estimated 12-13 GW.

The minimum demand of **85.7 GW** was recorded at 21.10 Hrs.

The sharp reduction in load was chiefly met by **hydro** and **gas** resources.

# India ranks far below in its per capita electricity consumption in comparison with the global average with some Indian states even below the national average

- ▶ India constitutes 13% of the global population with an electricity consumption share of only 4% of the total consumption. Countries like the US, high to very high HDI countries, where sparsely populated countries occupy a major share of electricity consumption.
- ▶ Programs like 'Atmanirbhar Bharat Abhiyaan', Make in India will enhance the domestic production, thus yielding higher per capita electricity consumption in future.



Source:  
MoP, 2018-19. State-wise Per Capita Consumption of Power in India  
CEA, 2019. Growth Of Electricity Sector In India from 1947-2019. [↓](#)  
MoP, 2017. State wise details of per capita electricity consumption. [↓](#)



# Despite large scale electrification, many rural and urban households experience frequent power outages and poor quality of electricity

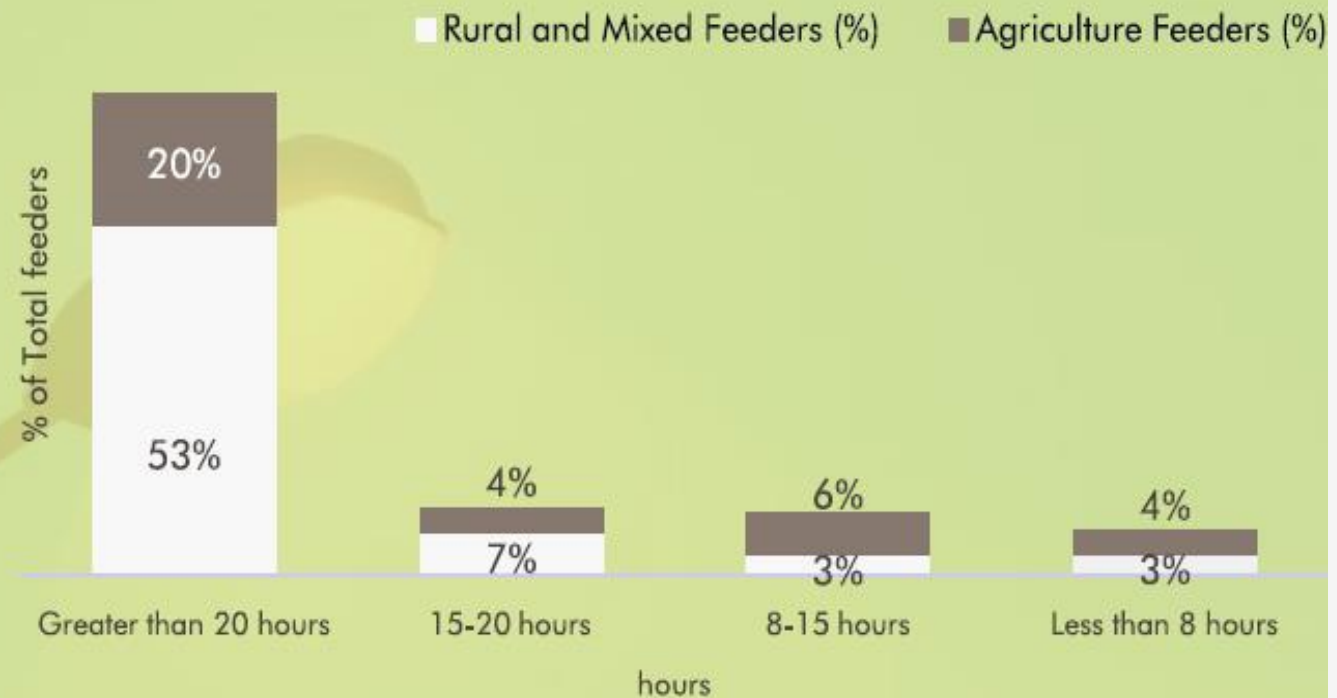
- ▶ Almost 84% of the feeders across 37 distribution utilities in 19 major states receive electricity higher than 15 hours a day.

## Avg. Power Supply Monitoring Statistics (In Hrs) (March 2020)

**Total Feeders (11KV Only): 77882**

\*The data is for 1,02,522 feeders, out of which only 77,882 modems were communicating data.

Source:  
National Power Portal, 2020. Rural Distribution, Power Supply Outages.  
<https://bit.ly/37hcrQa>



# Only a small percentage of the planned coal power plants have installed FGD systems

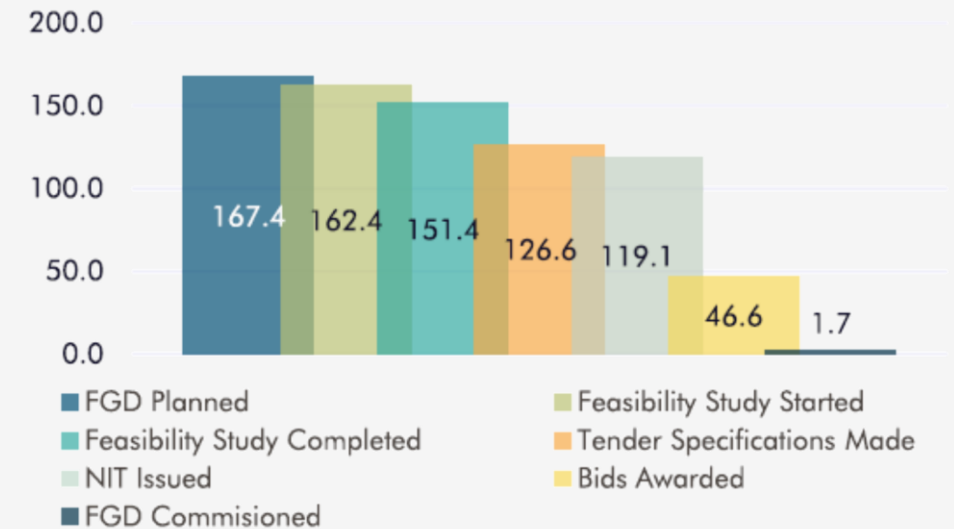
- ▶ However recently, the FGD has gained momentum with the new MoEFCC notification to limit SOx emissions
- ▶ There are many challenges such as time constraints, space constraint, generation cost, shut down and related MU losses.

## State-wise Capacity of Power Plants with FGDs (To be installed and Already installed in GW) -As of June 2020



Source: CEA 2020, FGD Installation Status. <https://bit.ly/2Uw0d0O>

## FGD Installation Status for the 167 GW Capacity Progress Stages As on June 2020

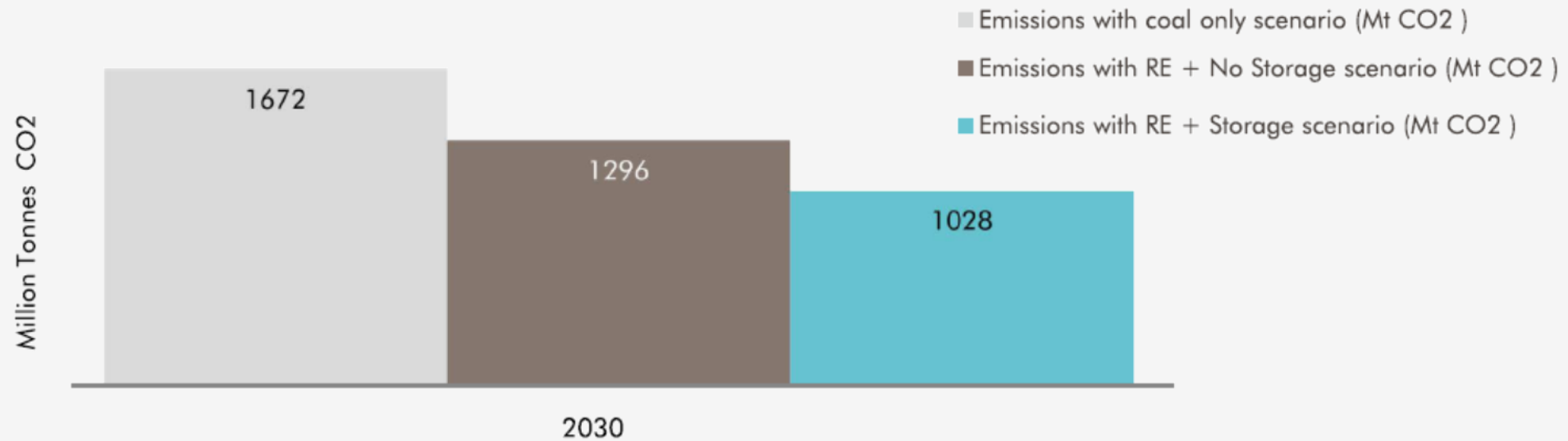


Source: CEA 2020, FGD Installation Status. <https://bit.ly/2UNCLwd>

## The emissions drop by 21% if storage is considered, from the RE + No storage scenario

- ▶ According to CEA, battery energy storage only appears from 2026-27 onwards due to reduction in cost of solar and BESS systems.

### Potential Impact of Storage on Power Sector Emissions (in Mt CO<sub>2</sub>)



Source:  
Vasudha's Analysis  
CEA, 2019. Draft Optimal Mix Generation Capacity Mix For 2029-30. <https://bit.ly/30pmUrw>

# QUESTIONS TO THE PANEL FOR DISCUSSION

---

## 1 Rs 90,000 crore DISCOM Package

How this is going to provide relief to DISCOMs under financial stress?

## 2 9 minutes at 9 pm, PAN India light switch off event on 5<sup>th</sup> April 2020

The importance of grid flexibility and role of storage technologies like battery, pump storage.

## 3 Achieving RE Targets of 175 GW and 455 GW

Challenges and issues for RE sector

## 4 Power Sector and the pandemic

How the economic slowdown owing to the Covid-19 pandemic will impact the viability of the already stressed power sector?