India's Energy Overview

JANUARY 2023

VASUDHA FOUNDATION
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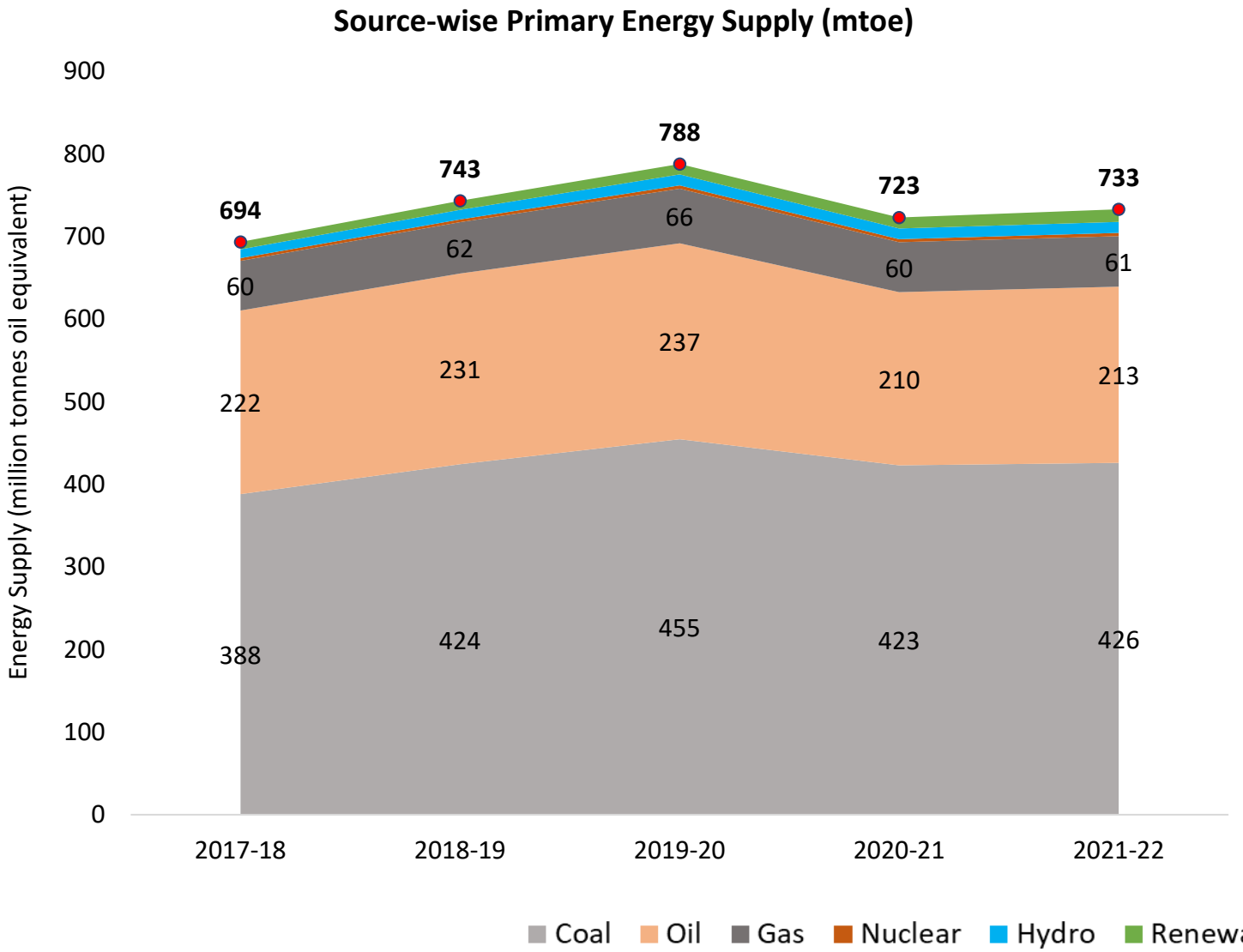
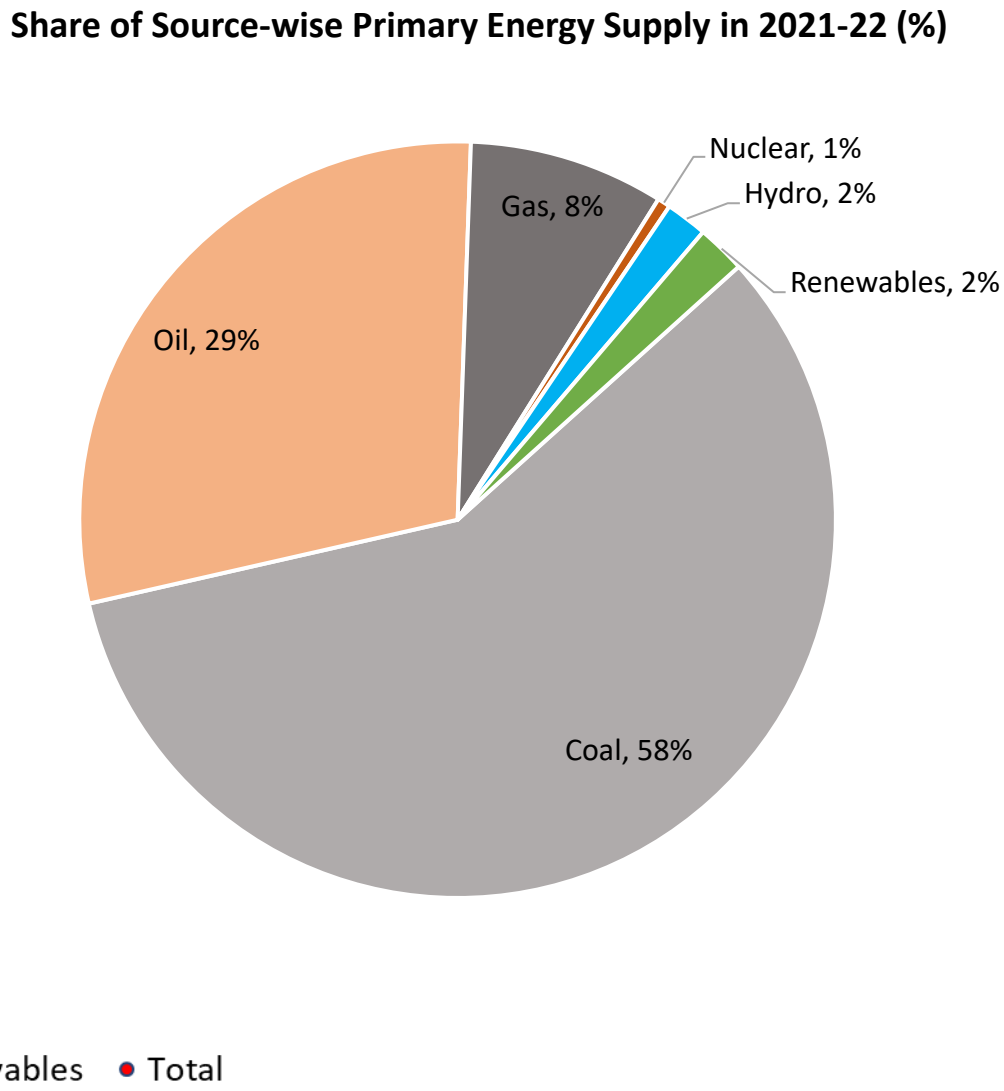
Primary Energy Mix* for 2021-22

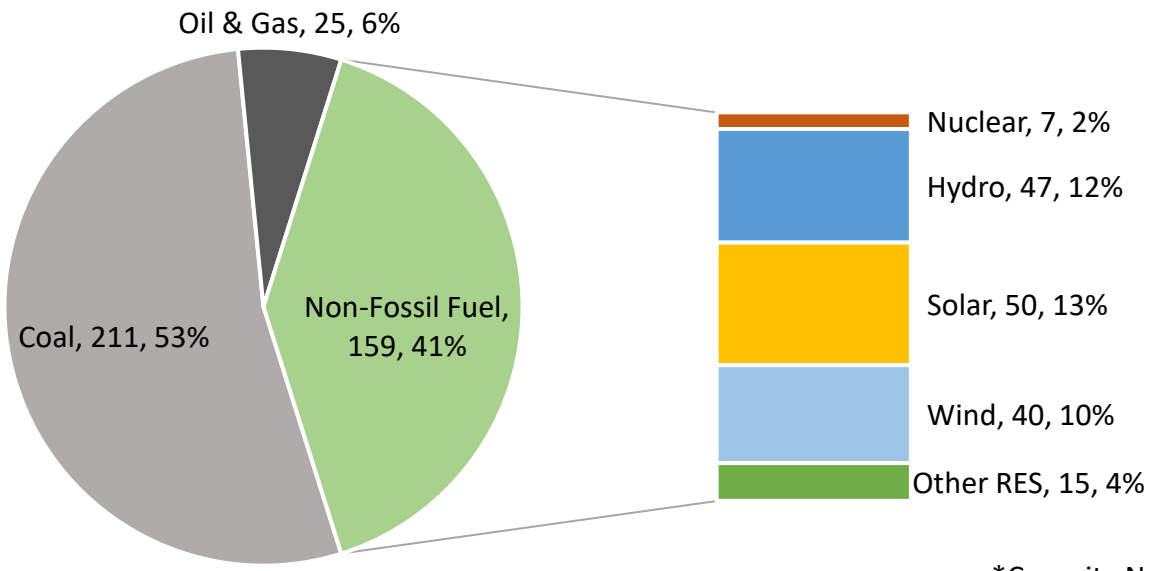




*Excluding biofuels, waste, and other non-commercial source of energy

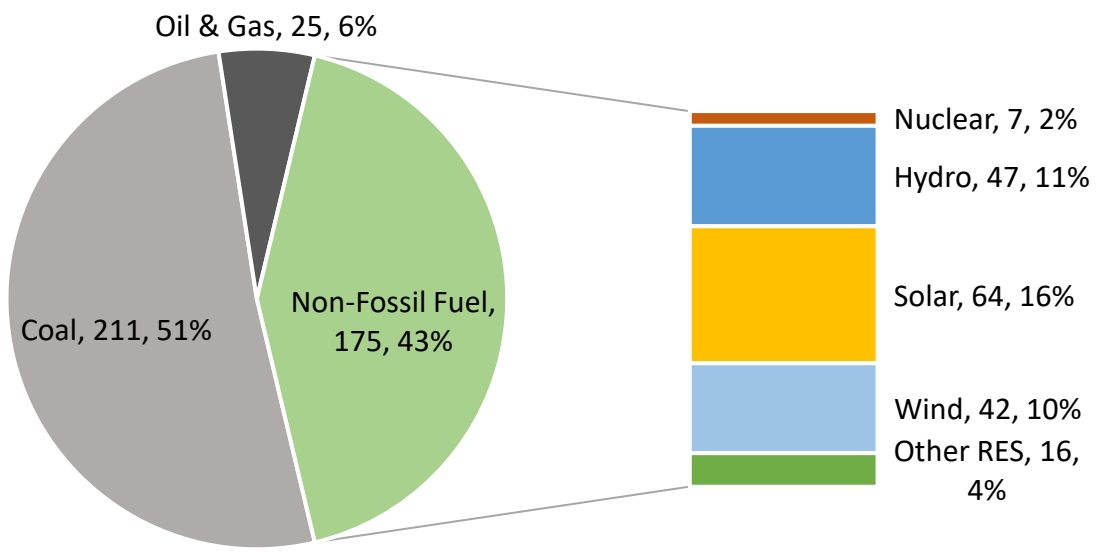
Electricity Capacity Mix

January 2022



Total Capacity: 395 GW

January 2023



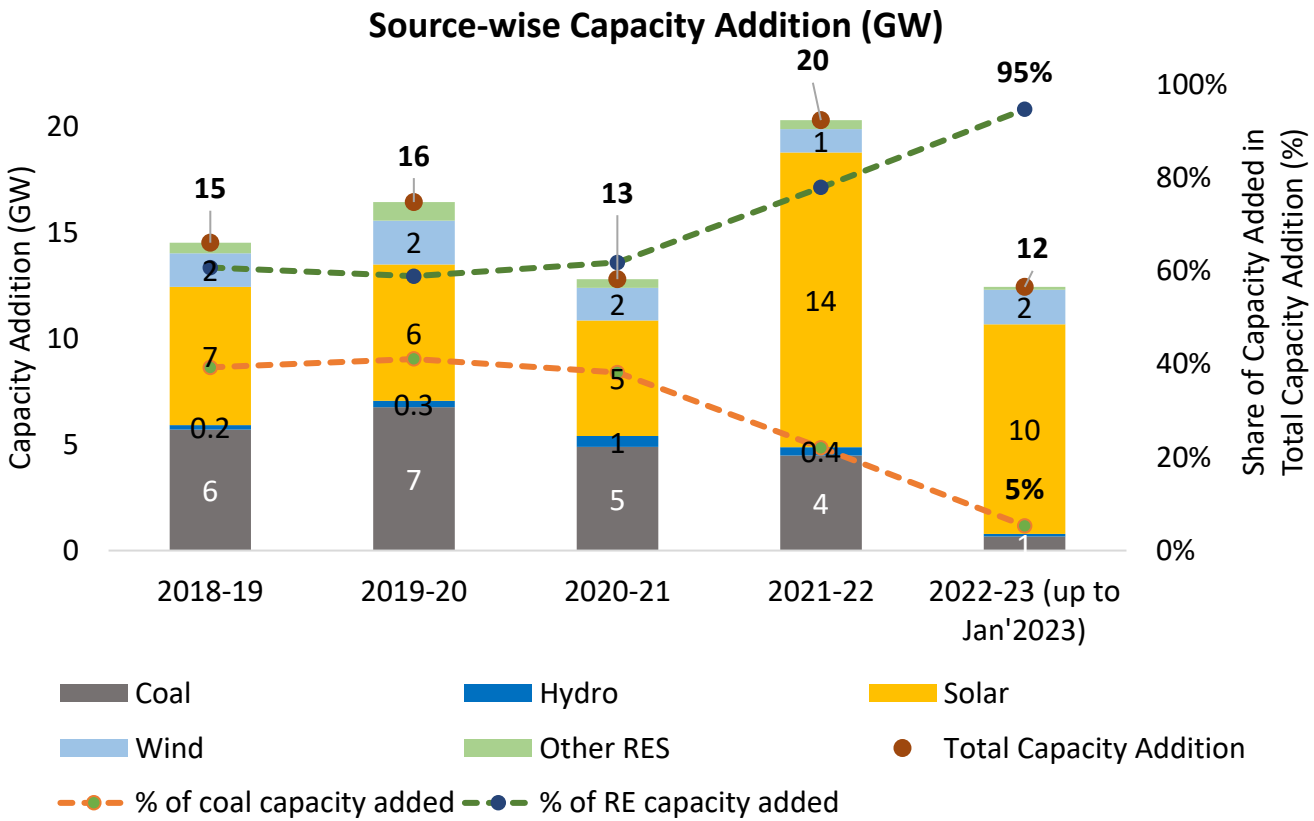
Total Capacity: 412 GW

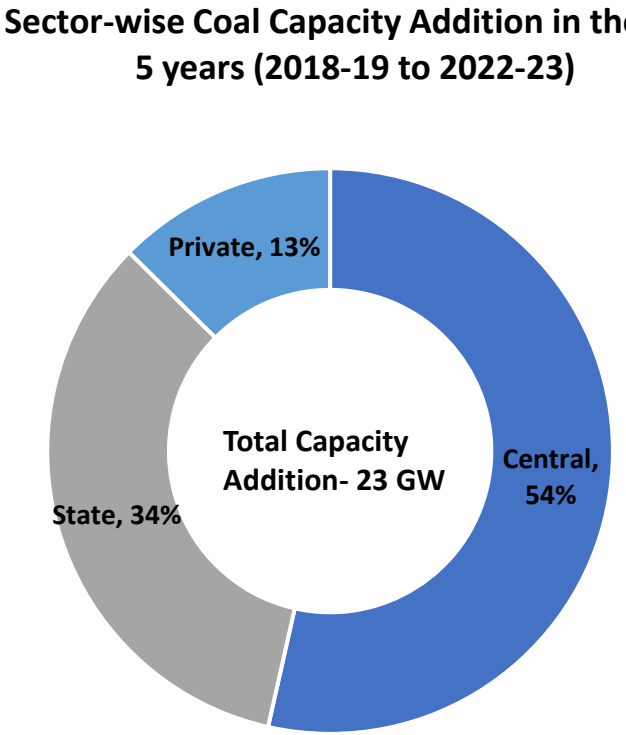
*Capacity Numbers are in GW

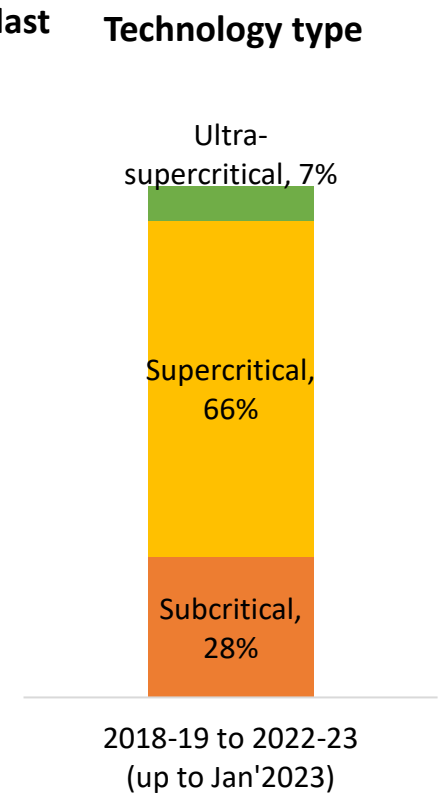
- India's electricity generating capacity is 412 GW as on Jan'2023 [coal 211 GW (51%), solar 64 GW (16%), hydro 47 GW (11%), and wind 42 (10%)].
- As on Jan'2023, the share of non-fossil-based electricity capacity is 43% as against the set target of 50% non-fossil capacity by 2030.
- As on Jan'2023, India's renewable energy capacity (including large hydro) stood at 175 GW out of 412 GW.

Source: CEA

Electricity Capacity Addition in last 5 years







- A total of 54 GW of generation capacity has been added in RE (Hydro, solar, wind, and other) over the past 5 years, whereas the coal capacity addition during the same period was 23 GW, mostly in the central sector (54%).
- The share of RE addition in total capacity has shown an increasing trend (from 61% in 2018-19 to 95% in 2022-23 up to Jan’2023).

Source: CEA & MNRE

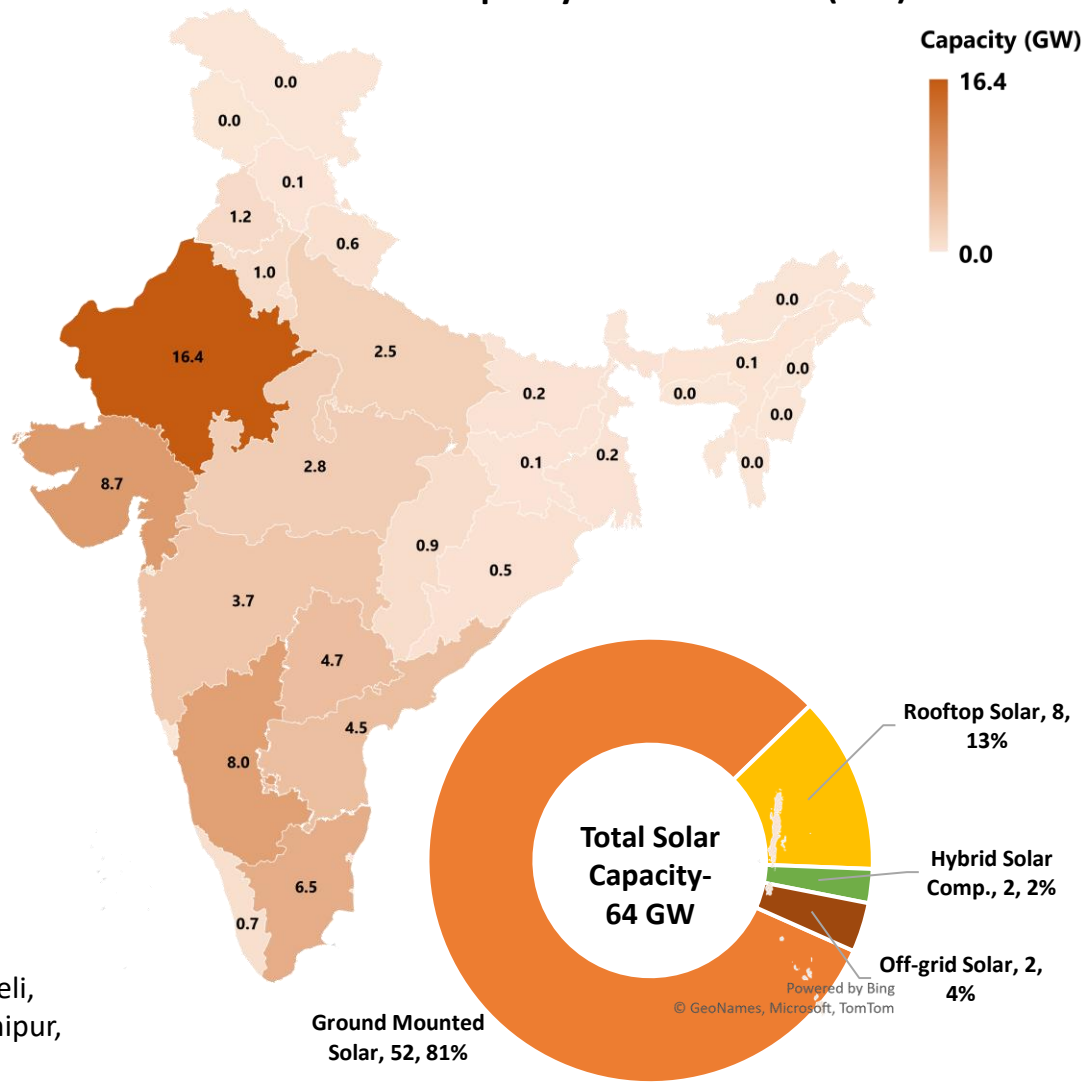
State-wise Solar Installed Capacity

as on January 2023

State-wise installed capacity of Solar Power (GW)					
States	**Ground Mounted**	**Rooftop**	**Solar Component in Hybrid**	**Off Grid**	**Total Solar Power**
Rajasthan	13.40	0.84	1.58	0.54	16.35
Gujarat	6.43	2.26	0.00	0.05	8.75
Karnataka	7.57	0.42	0.00	0.03	8.02
Tamil Nadu	6.06	0.37	0.00	0.06	6.50
Telangana	4.36	0.29	0.00	0.01	4.66
Andhra Pradesh	4.27	0.17	0.00	0.09	4.53
Maharashtra	2.09	1.42	0.00	0.19	3.70
Madhya Pradesh	2.46	0.23	0.00	0.09	2.77
Uttar Pradesh	2.07	0.26	0.00	0.16	2.49
Punjab	0.83	0.24	0.00	0.08	1.15
Haryana	0.27	0.42	0.00	0.32	1.00
Chhatisgarh	0.51	0.05	0.00	0.39	0.94
Kerala	0.29	0.40	0.00	0.02	0.71
Uttarakhand	0.30	0.26	0.00	0.01	0.58
Others	0.89	0.59	0.00	0.26	1.74
All India	51.81	8.22	1.58	2.29	63.89

Others include- Andaman & Nicobar, Arunachal Pradesh, Assam, Bihar, Chandigarh, Dadar & Nagar Haveli, Daman & Diu, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Ladakh, Lakshadweep, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Puducherry, Sikkim, Tripura, West Bengal, Others

Solar Capacity as on Jan'2023 (GW)

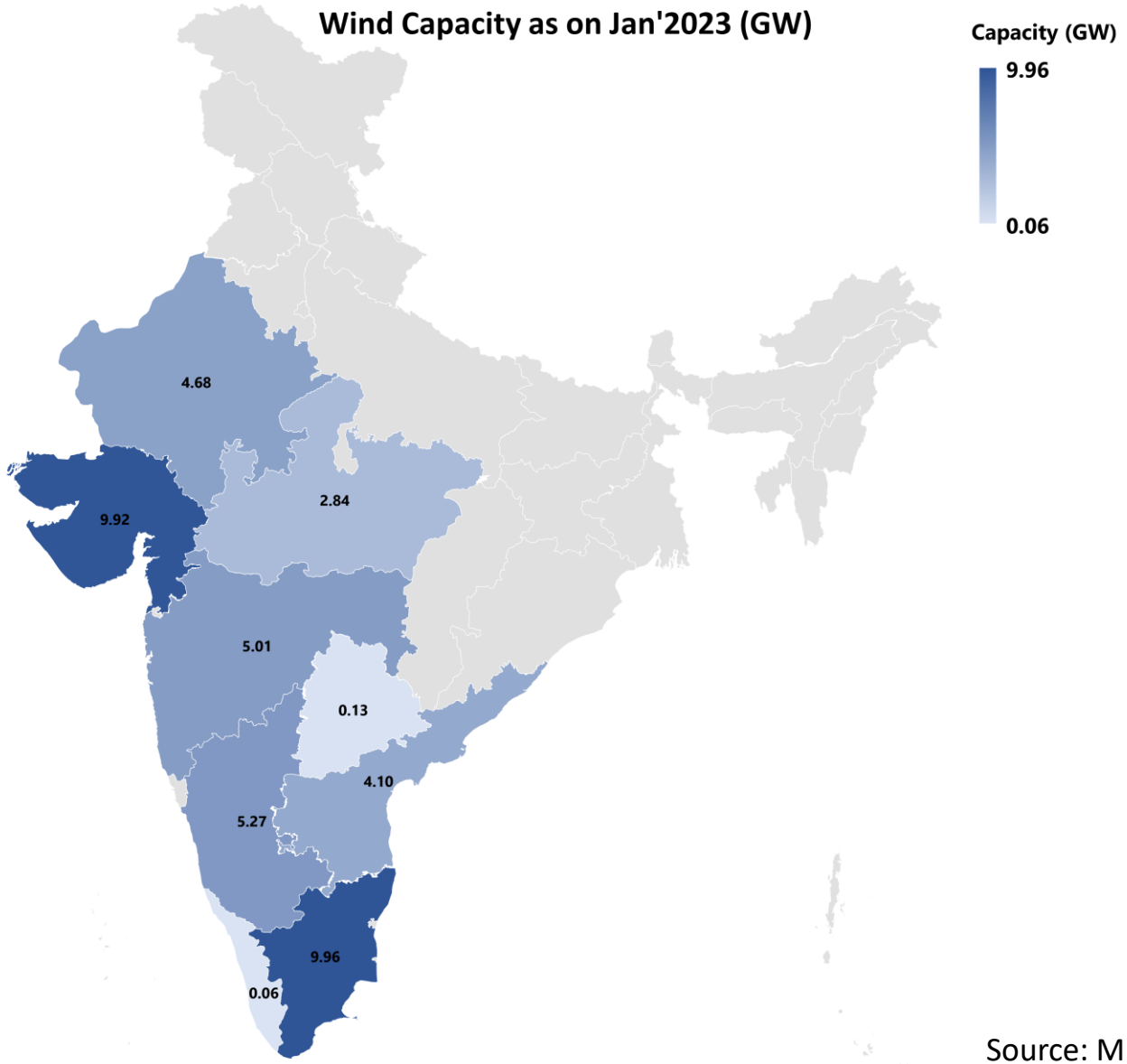


Source: MNRE

State-wise Wind Installed Capacity

as on January 2023

State-wise installed capacity of Wind Power	
States	**Installed Capacity (GW)**
Tamil Nadu	9.96
Gujarat	9.92
Karnataka	5.27
Maharashtra	5.01
Rajasthan	4.68
Andhra Pradesh	4.10
Madhya Pradesh	2.84
Telangana	0.13
Kerala	0.06
India Total	**41.98**

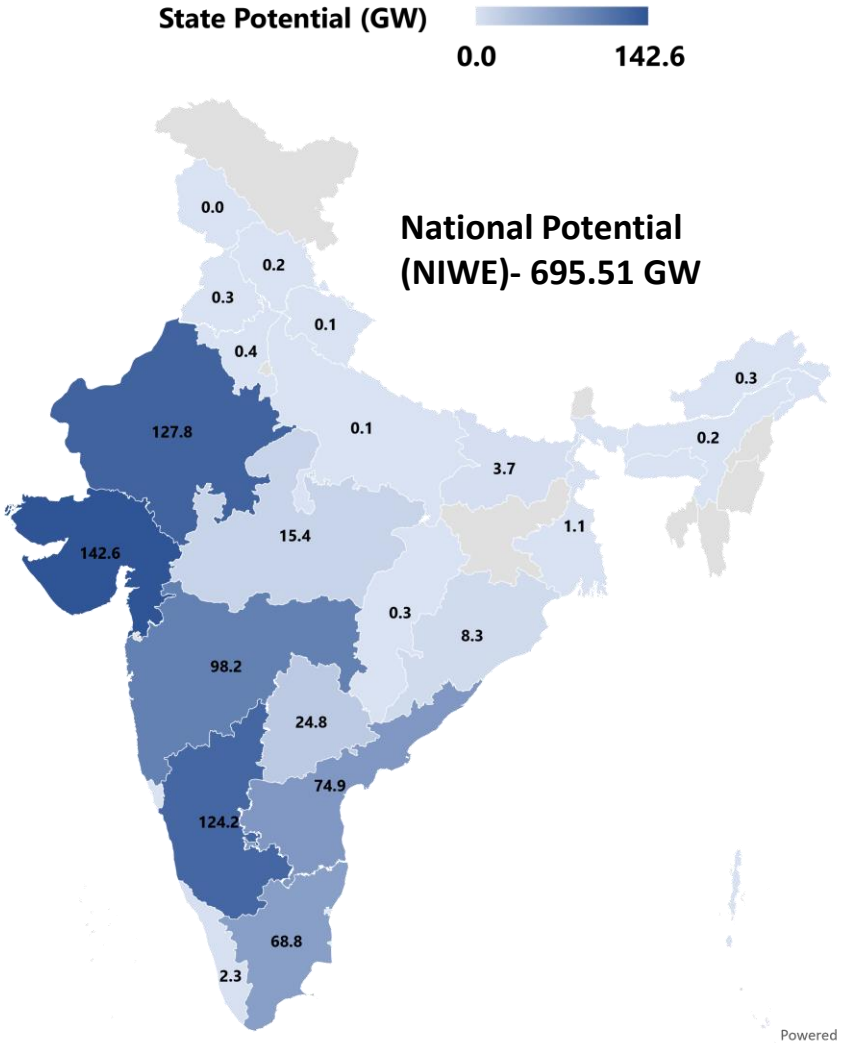


Source: MNRE

RE Potential and Installed Capacity (1/2)

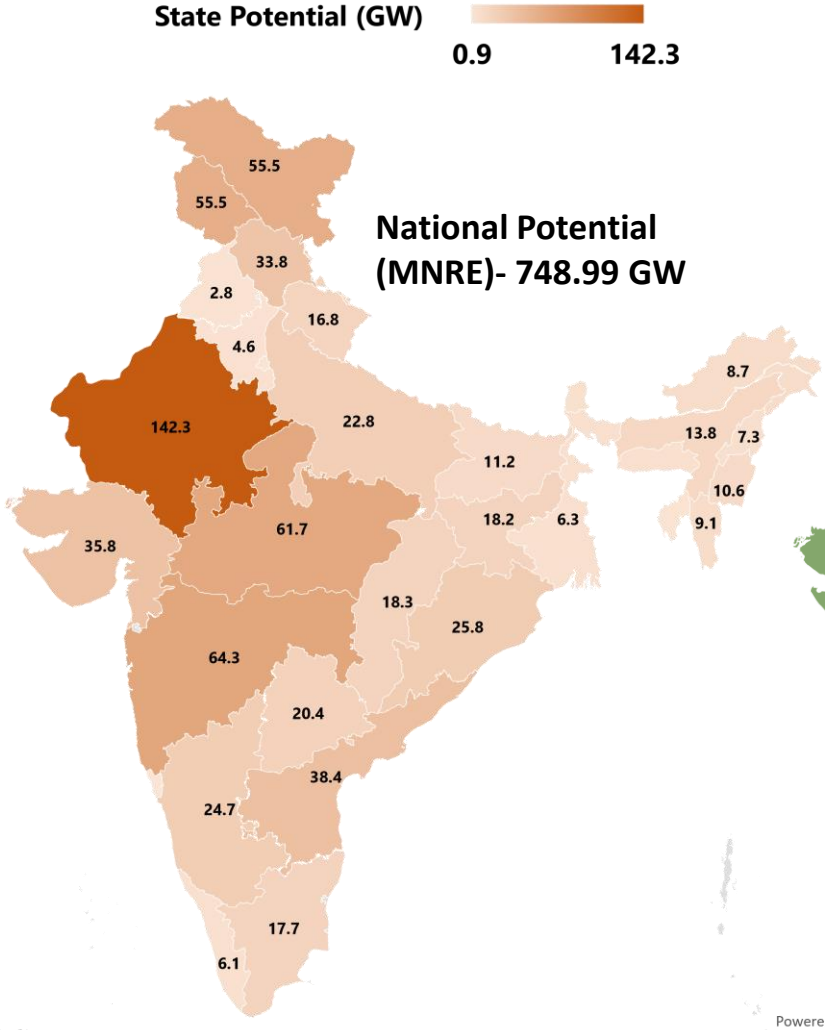
RE potential in the state as on January 2023

Wind Potential at 120m agl



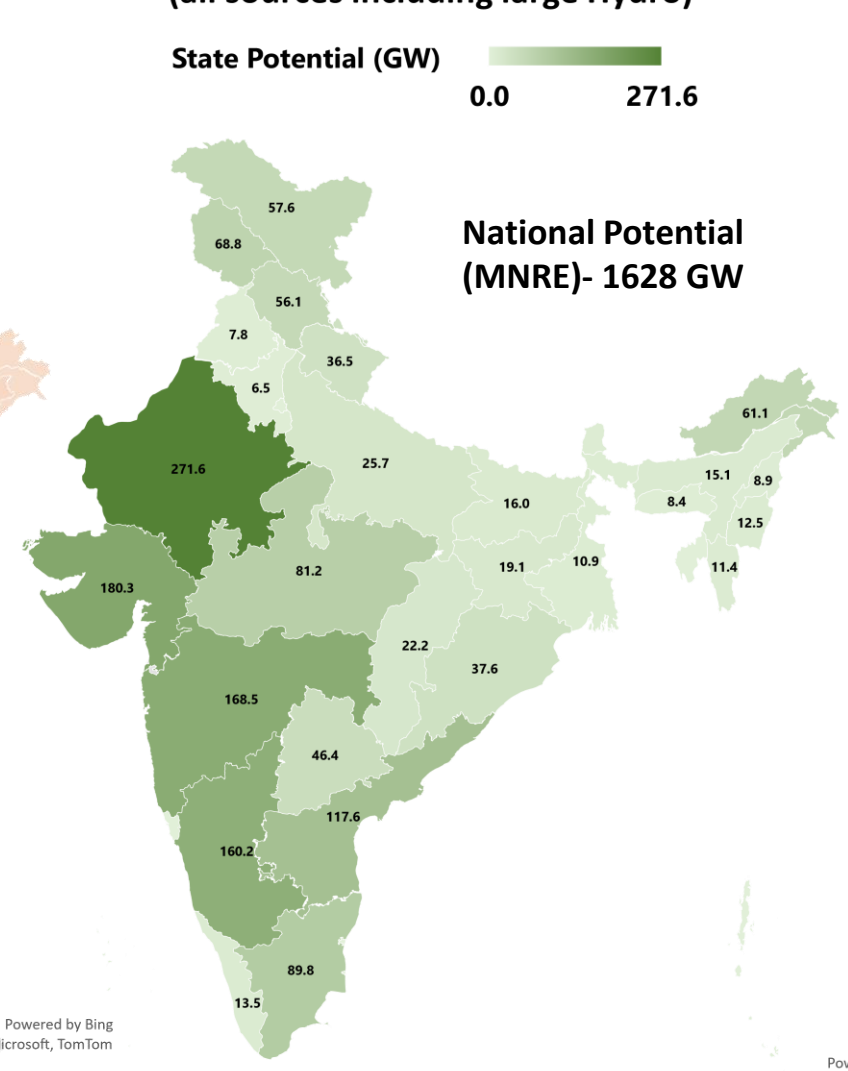
National Potential (NIWE)- 695.51 GW

Solar Potential



National Potential (MNRE)- 748.99 GW

Renewable Energy Potential (all sources including large Hydro)

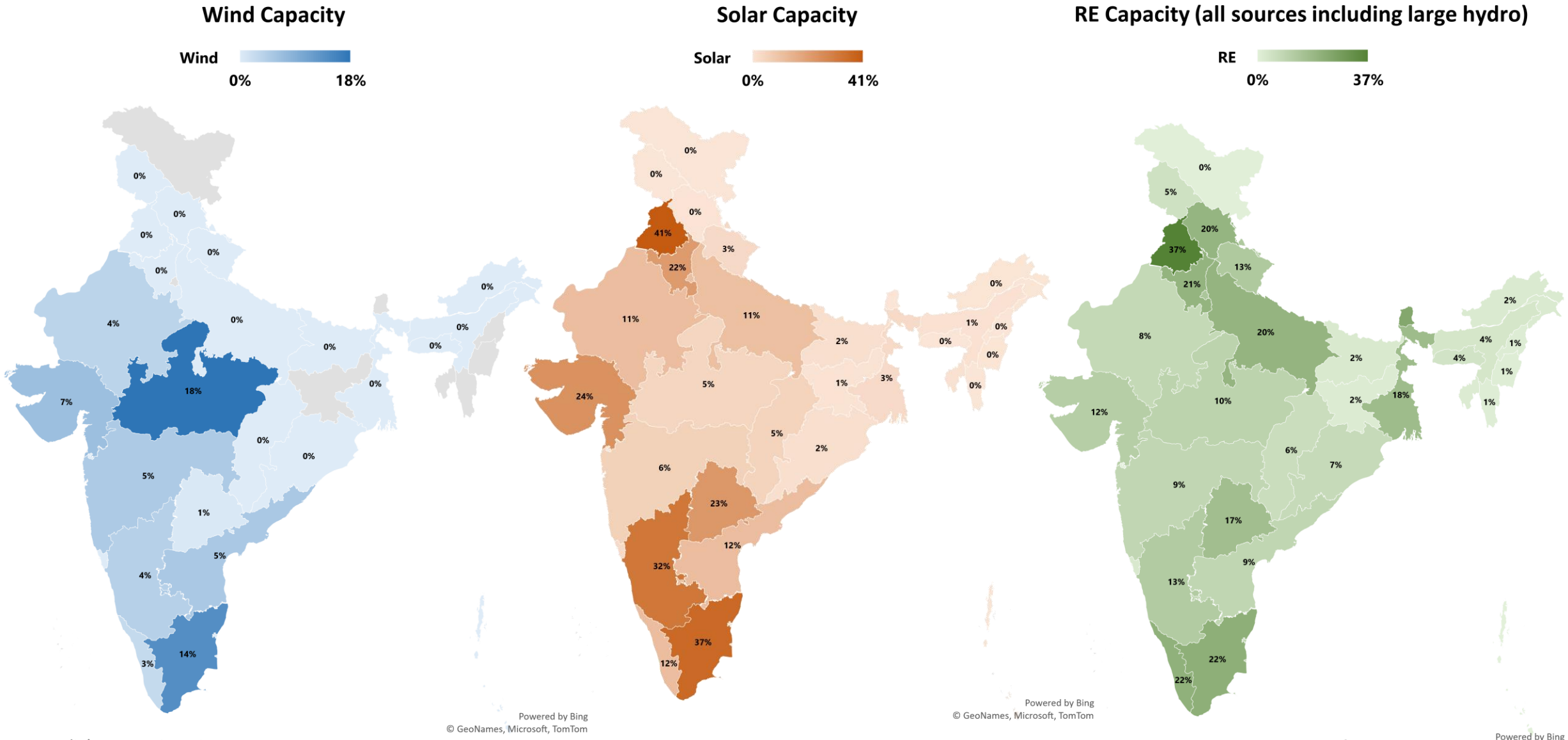


National Potential (MNRE)- 1628 GW

In India, market potential for SPV rooftop is 124 GW

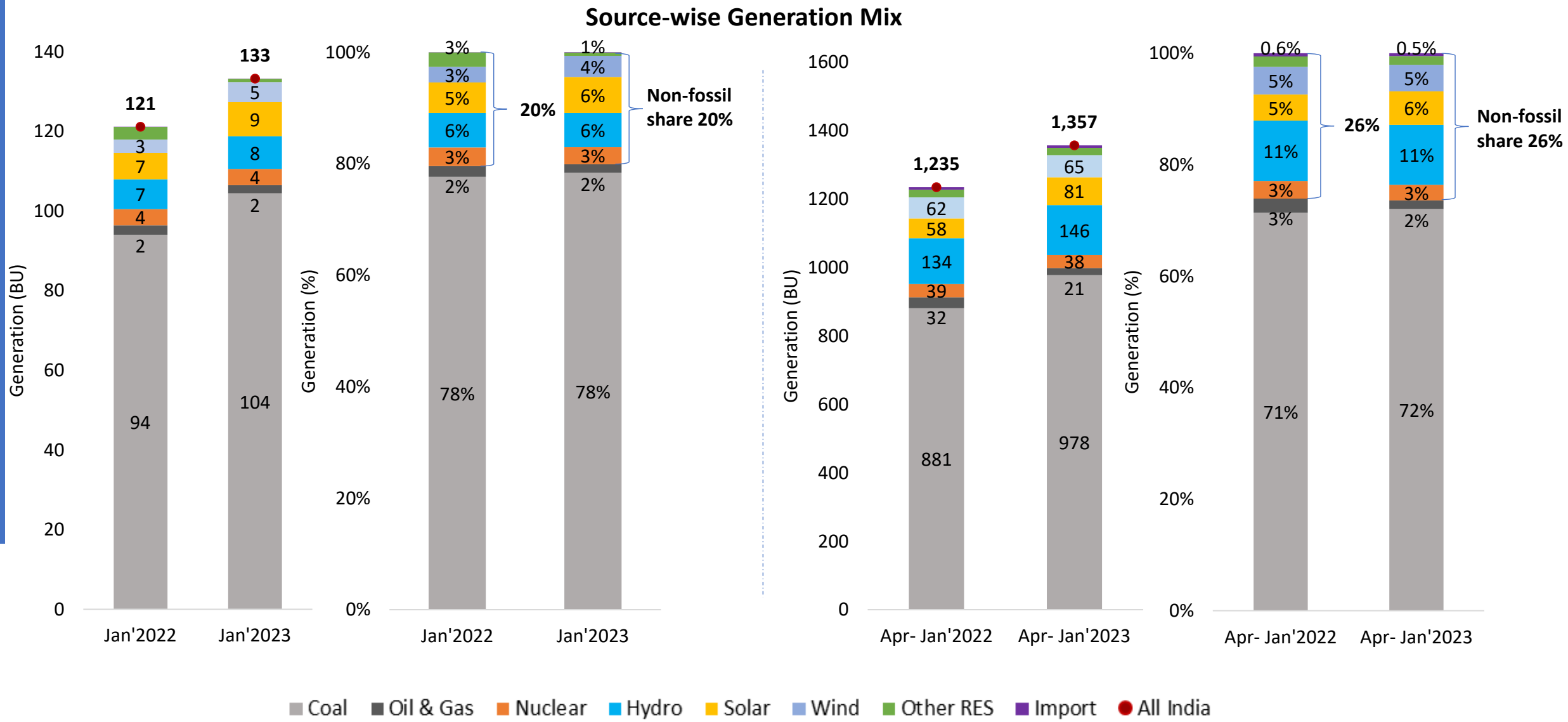
RE Potential and Installed Capacity (2/2)

RE Installed capacity as a Percentage of the total resource potential in the state as on January 2023



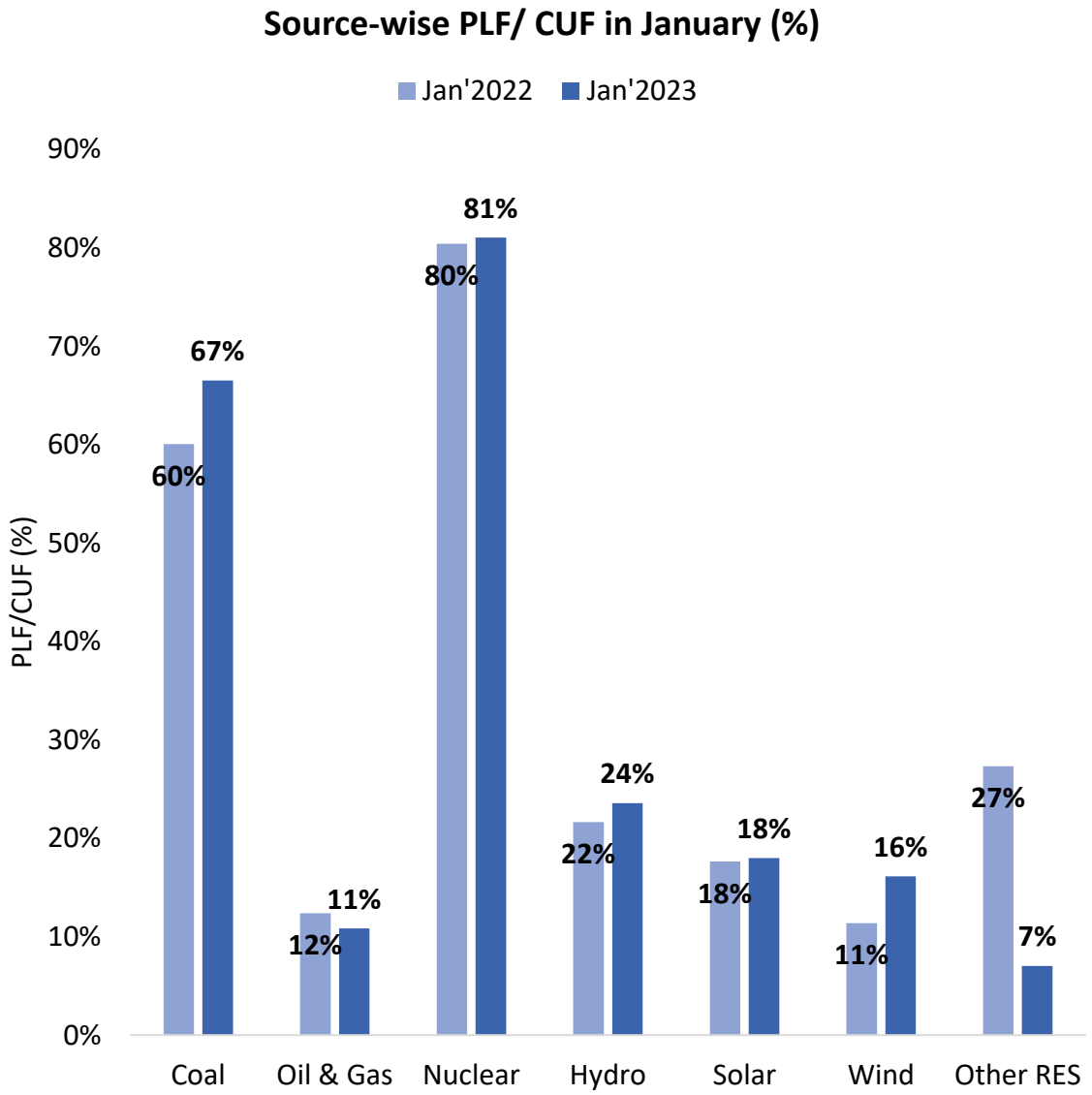
Source: CEA & MNRE

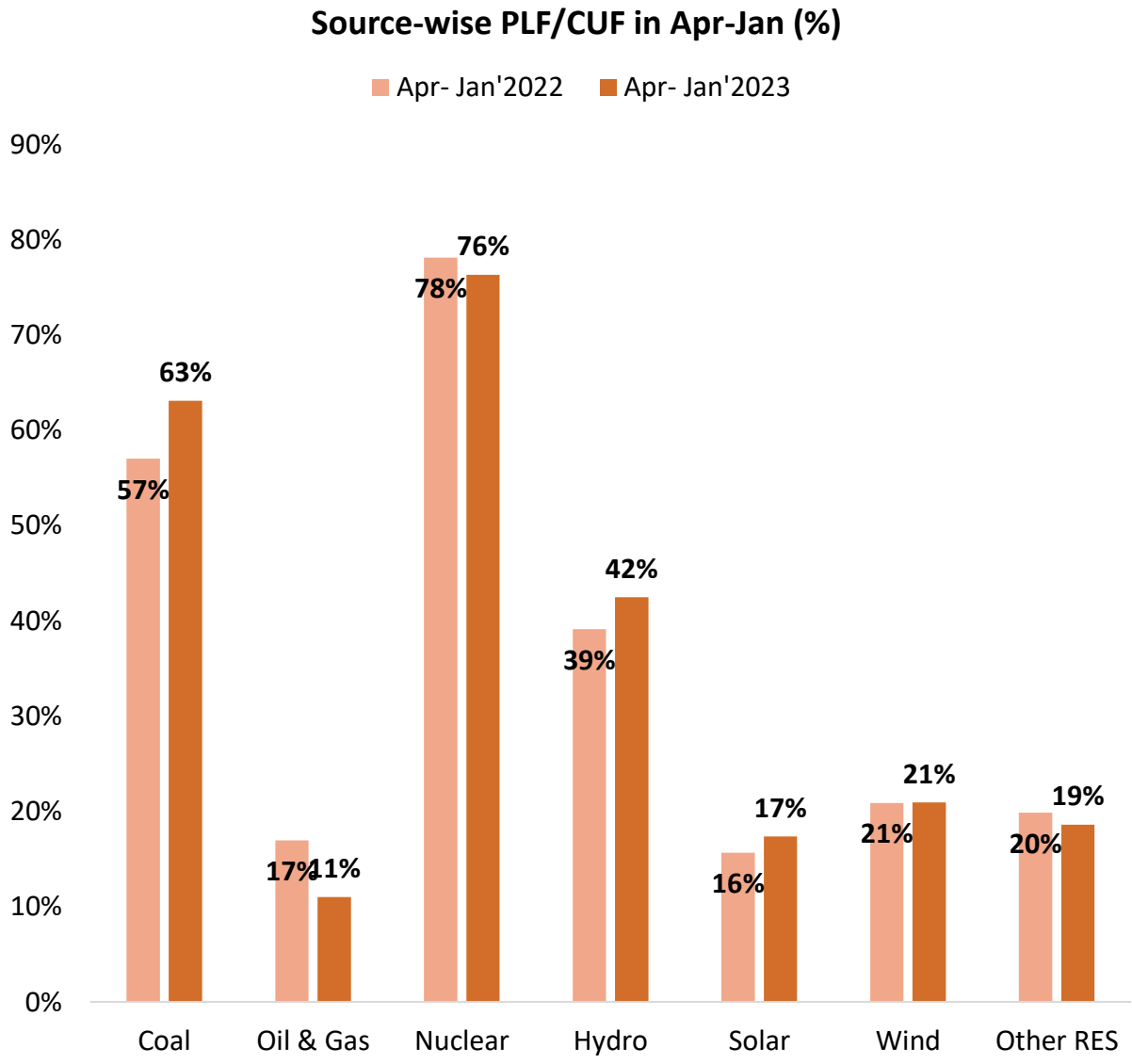
India’s Electricity Generation Mix



Source: CEA

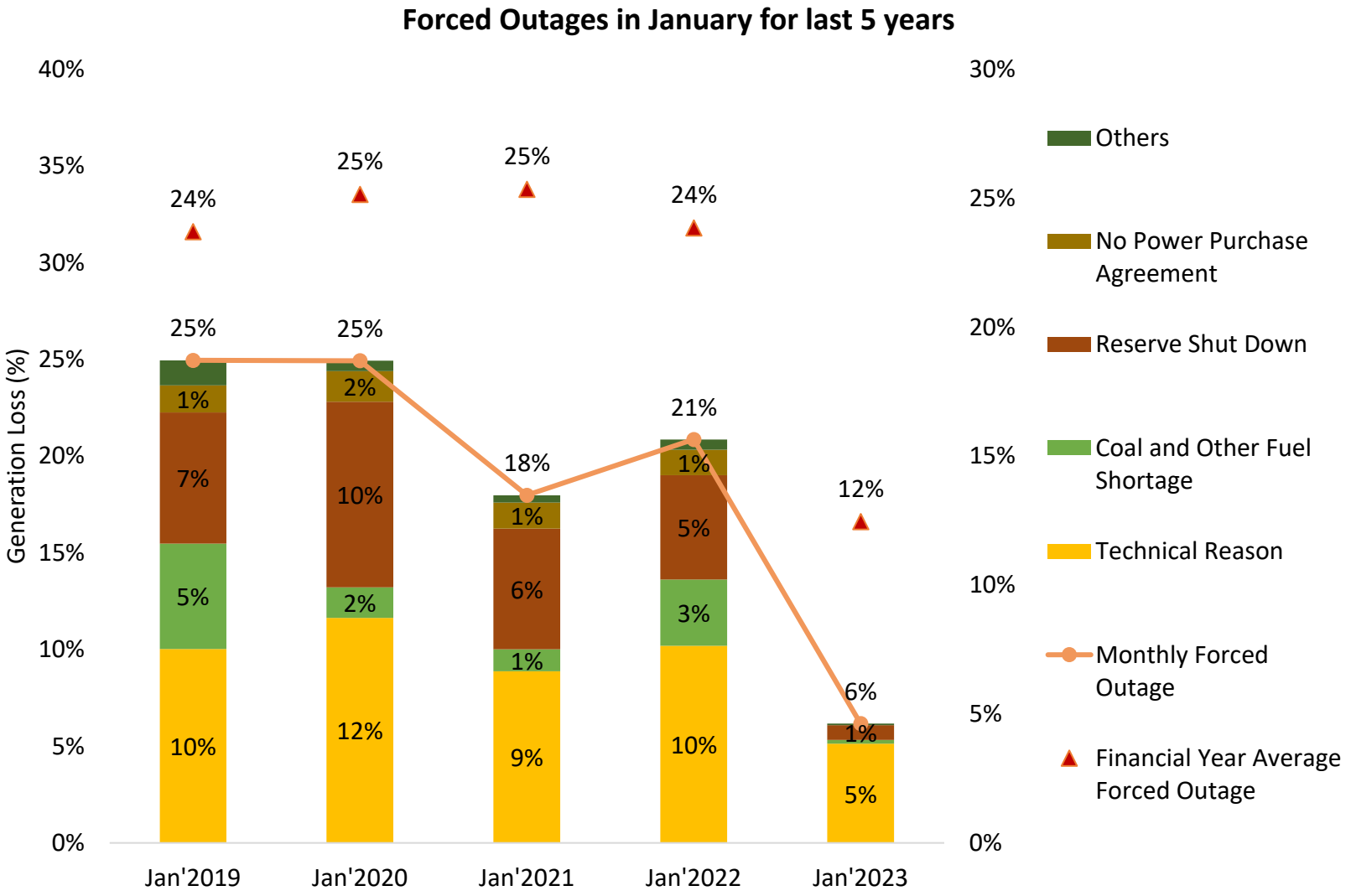
Source-wise PLF/CUF





Source: CEA & MNRE

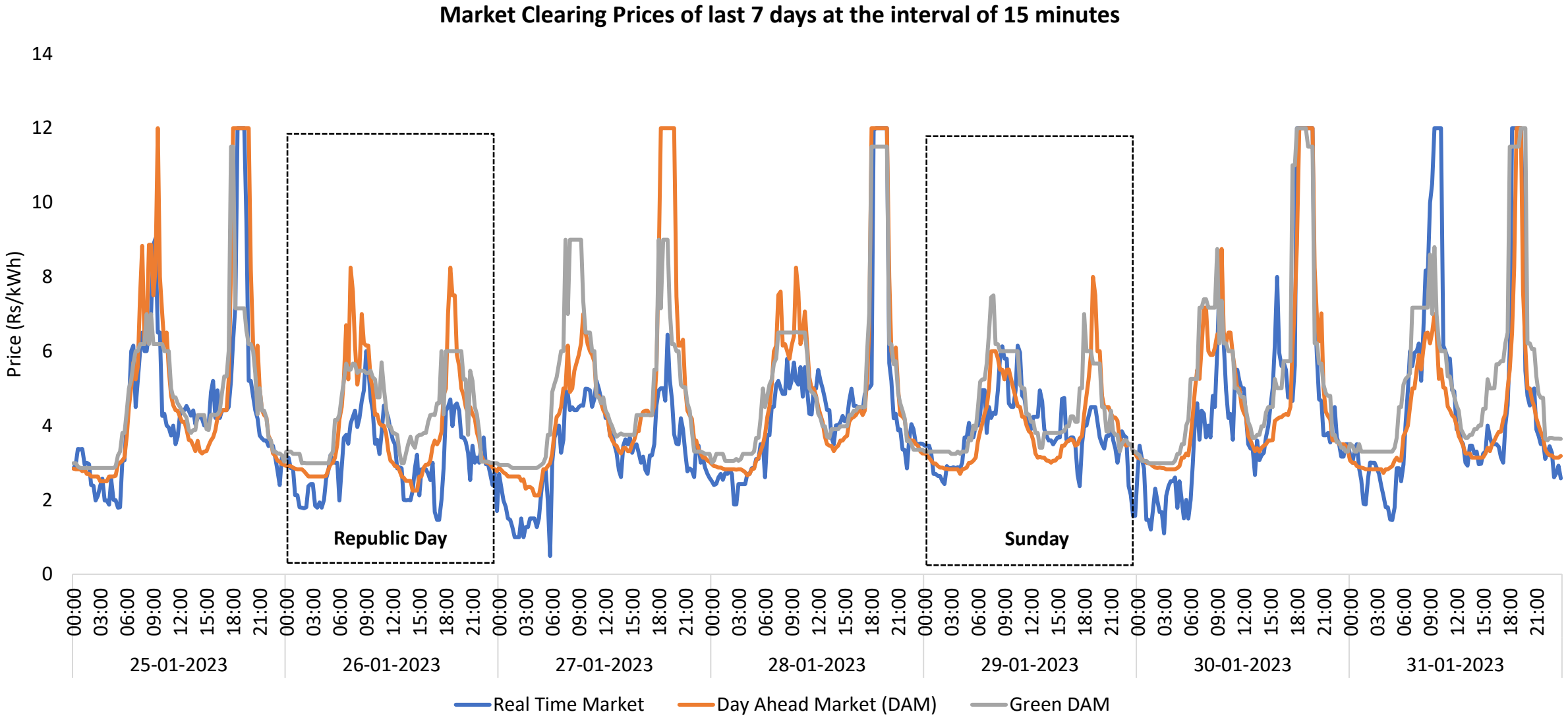
Thermal Generation Loss and Reasons for Forced Outages



Year/ Month		Forced Outage Share
Yearly	FY 2020-21	25%
	FY 2021-22	24%
	FY 2022-23 (up to Jan'2023)	12%
Monthly	Jan'2021	18%
	Jan'2022	21%
	Jan'2023	6%

Thermal includes only Coal and Lignite Plants.

Indian Electricity Exchange (IEX) Market Snapshot

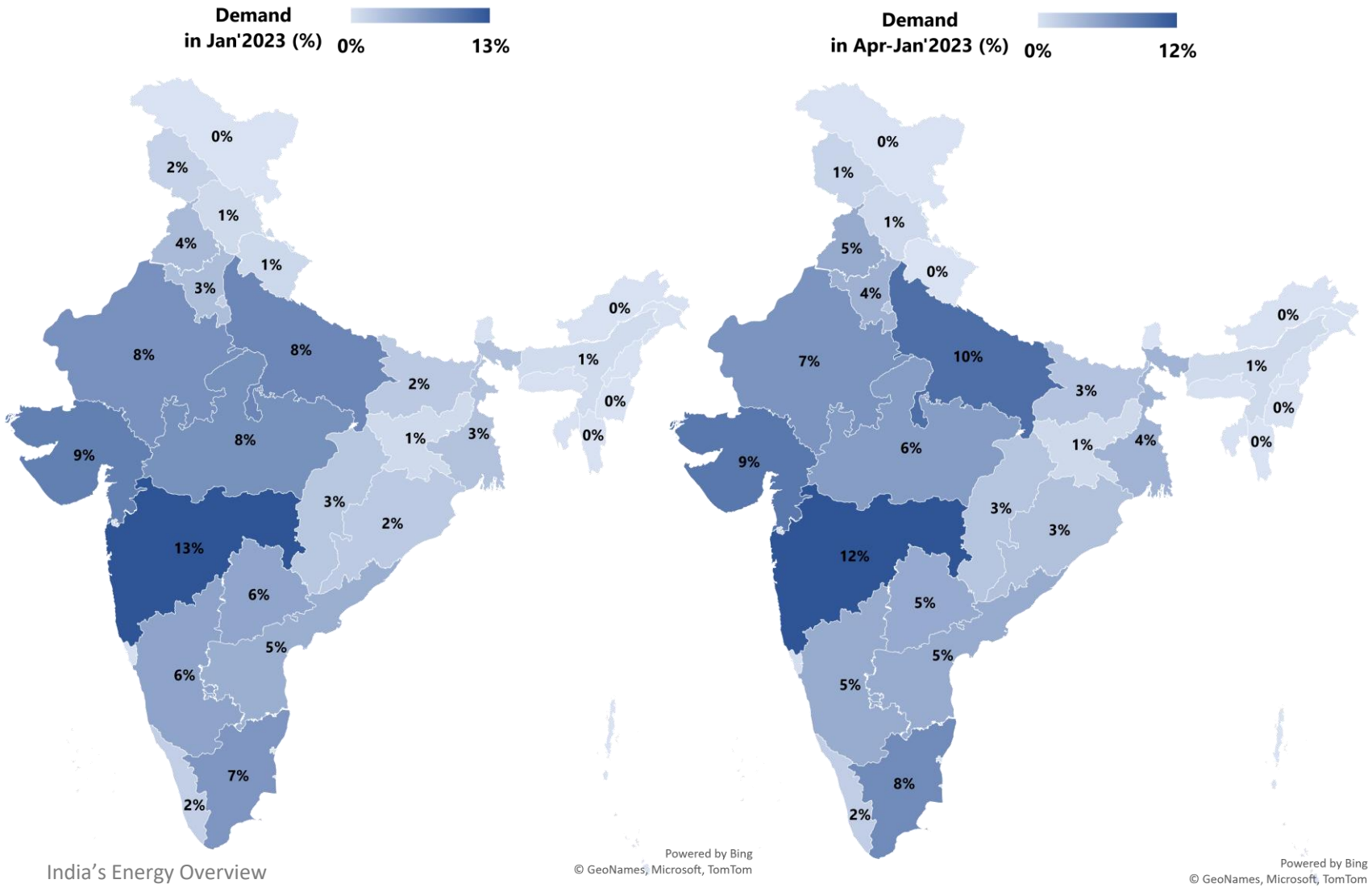


CERC has imposed a cap of Rs 12/kWh on the power exchange rate.

Source: IEX

National and State level Electricity Demand

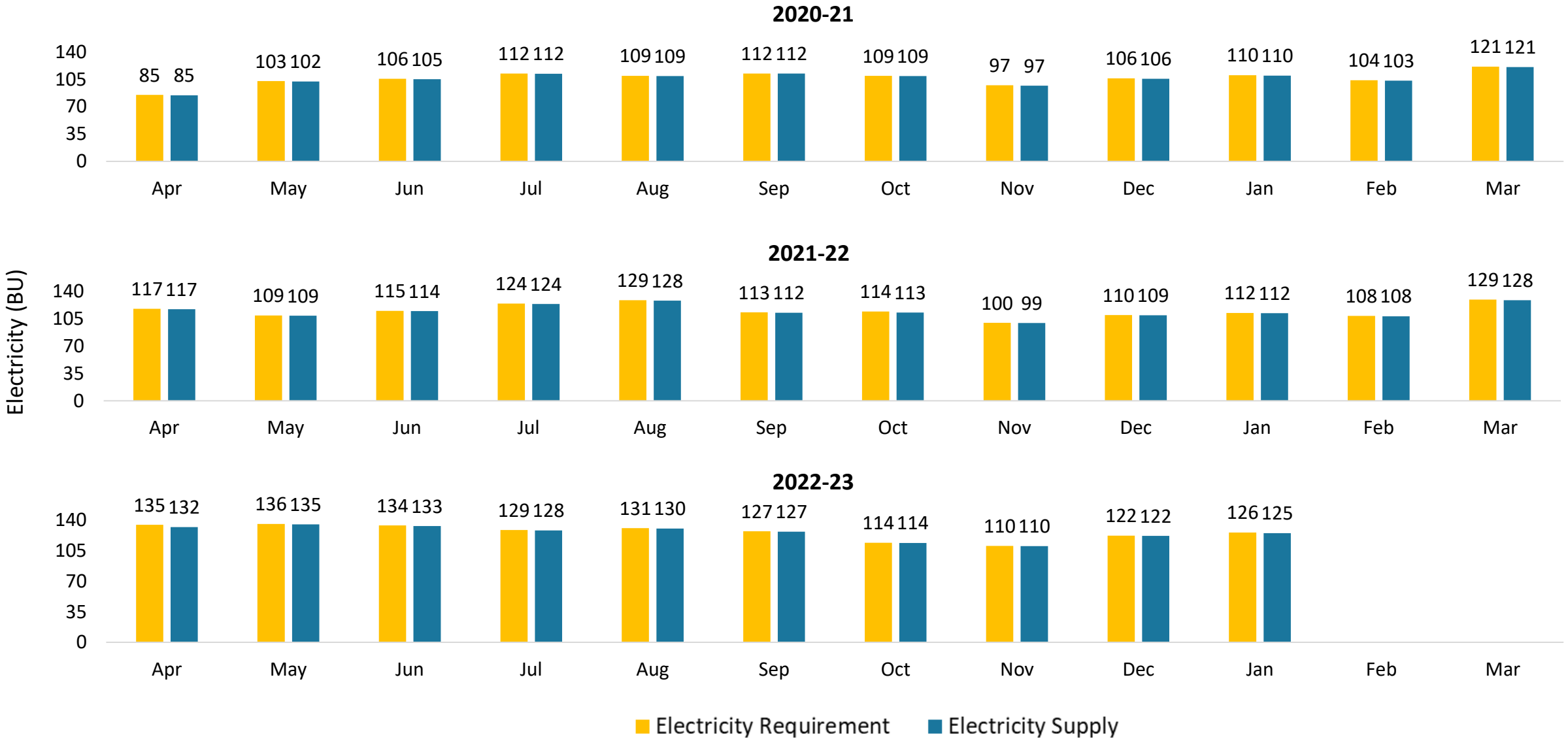
State-level Electricity Demand (%)



Year/ Month		Electricity Demand (BU)
Yearly	FY 2020-21	1276
	FY 2021-22	1380
	FY 2022-23 (up to Jan'2023)	1264
Monthly	Jan'2021	110
	Jan'2022	112
	Jan'2023	126

Source: CEA

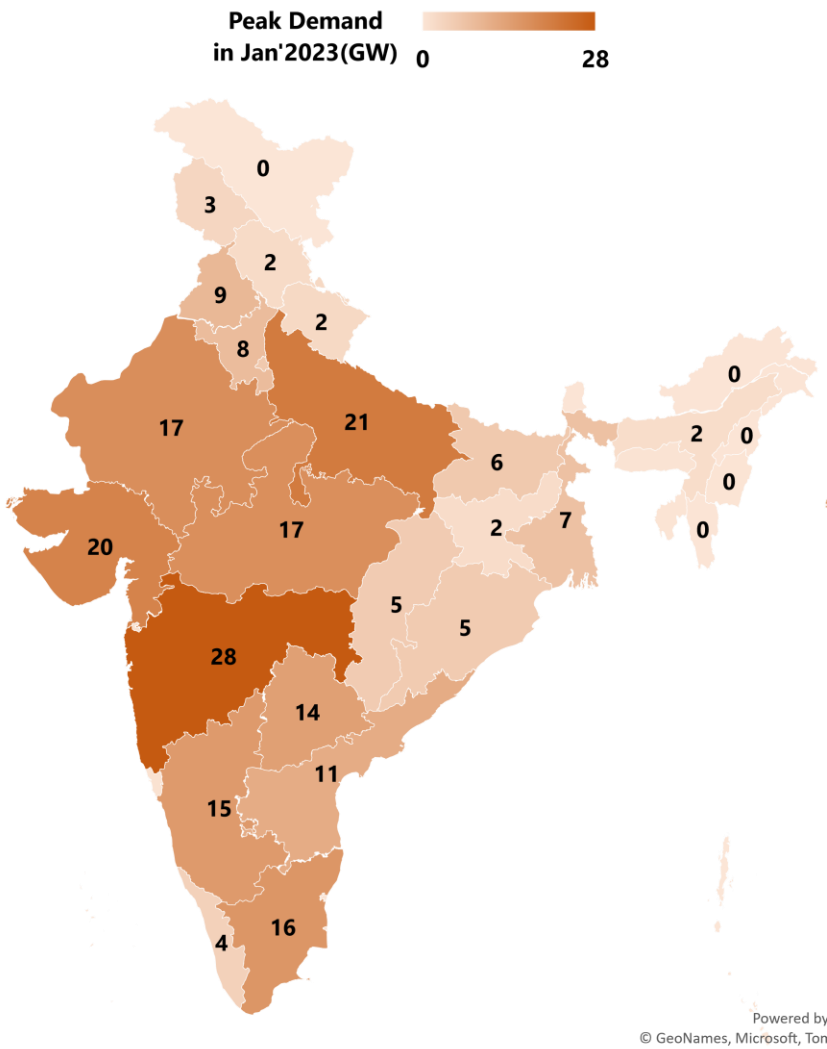
India’s Monthly Electricity Requirement and Supply

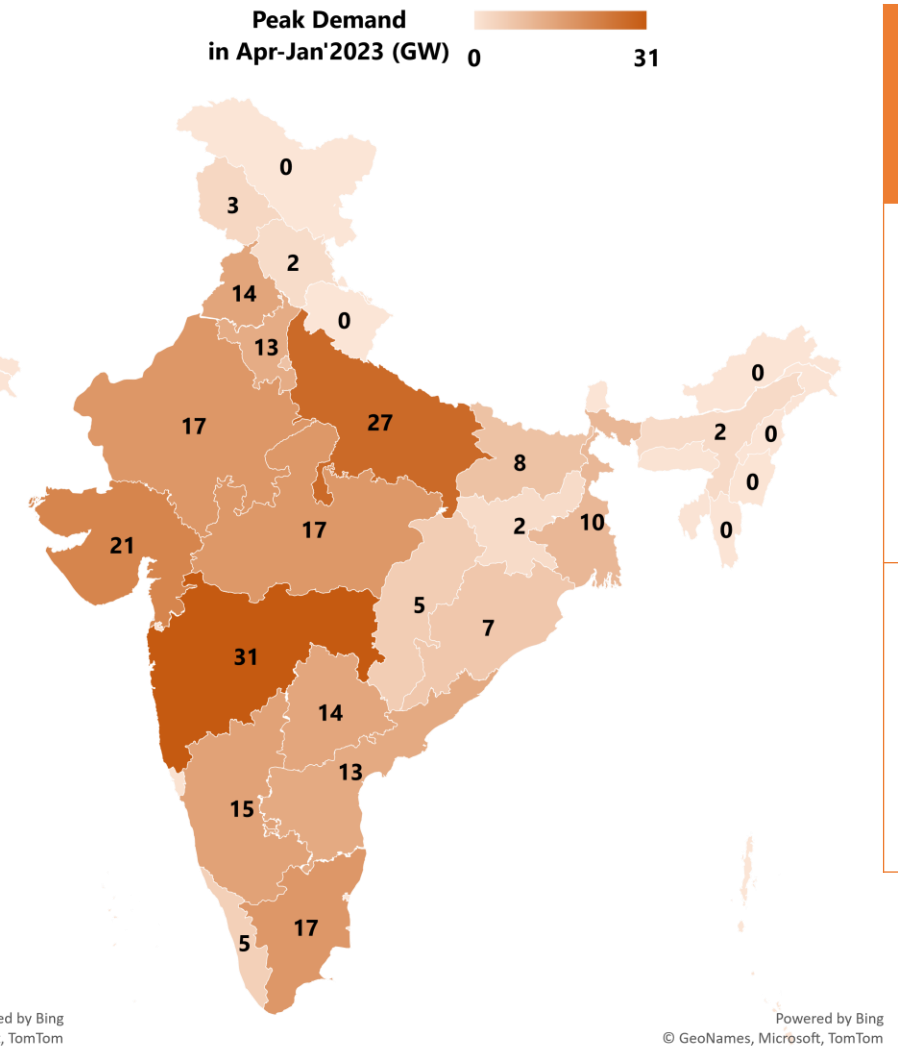


Source: CEA

National and State level Peak Electricity Demand

State-level Peak Electricity Demand (GW)

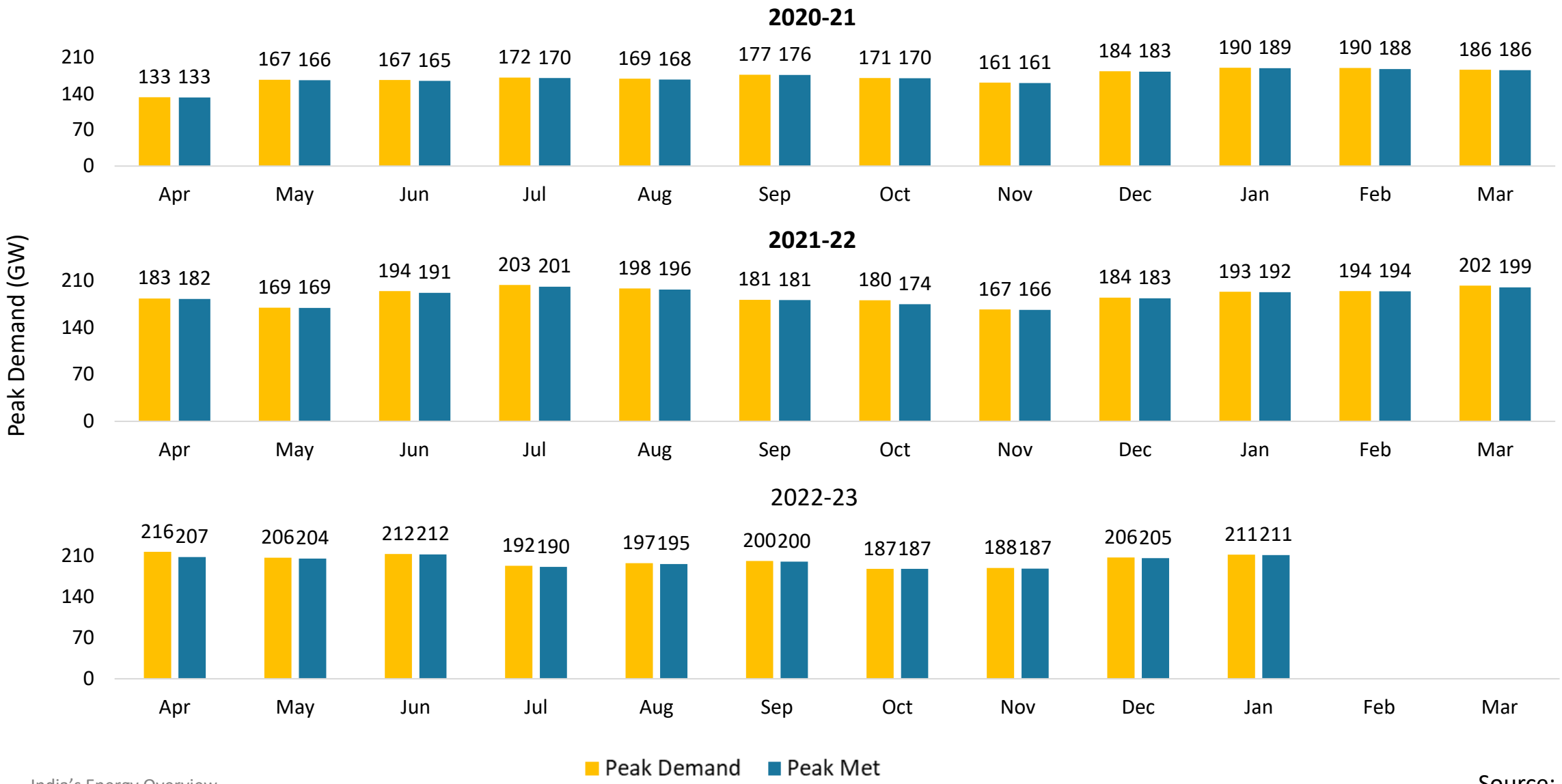




Year/ Month		Peak Electricity Demand (GW)
Yearly	FY 2020-21	190
	FY 2021-22	203
	FY 2022-23 (up to Jan'2023)	216
Monthly	Jan'2021	190
	Jan'2022	193
	Jan'2023	211

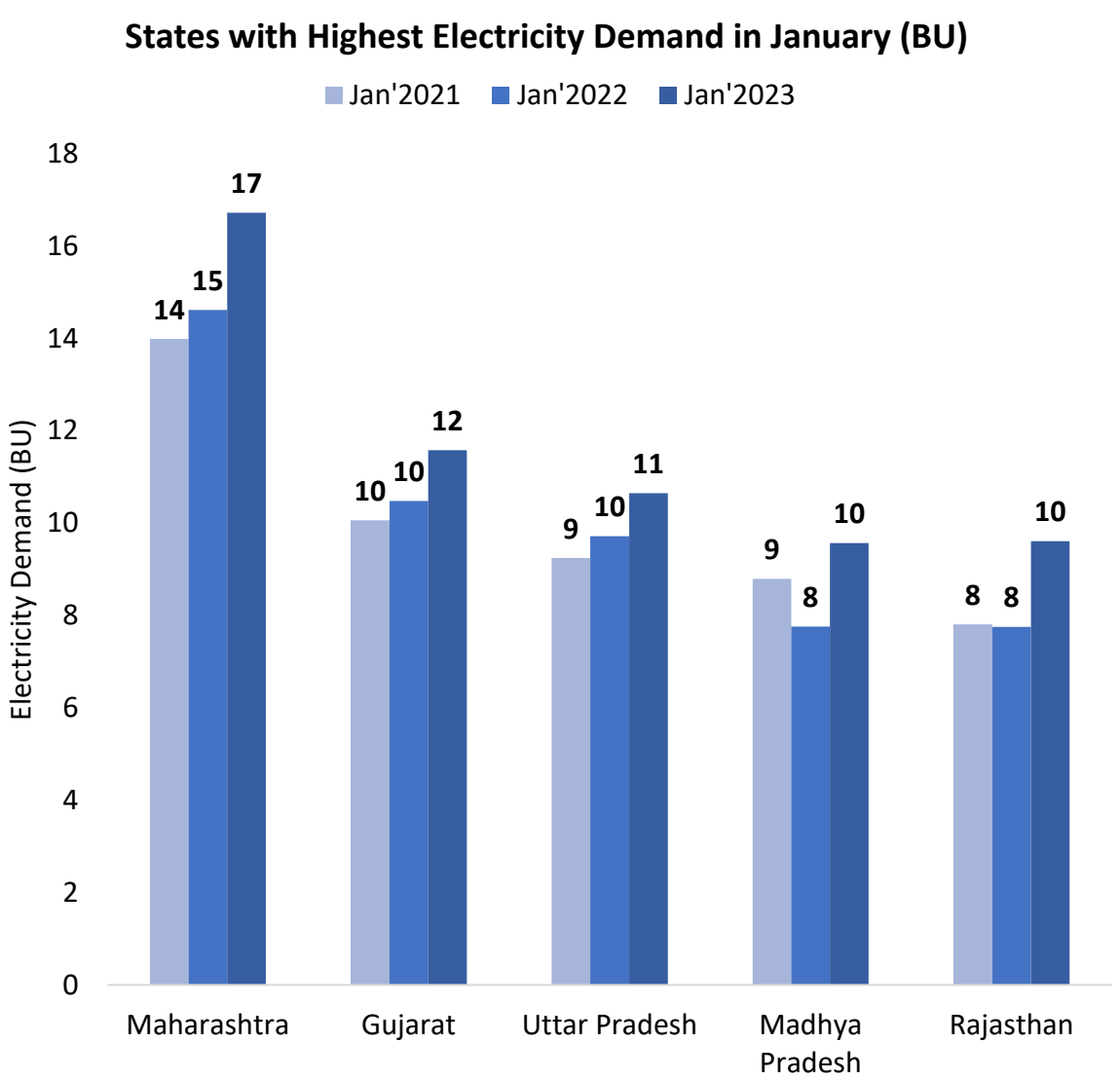
Source: CEA

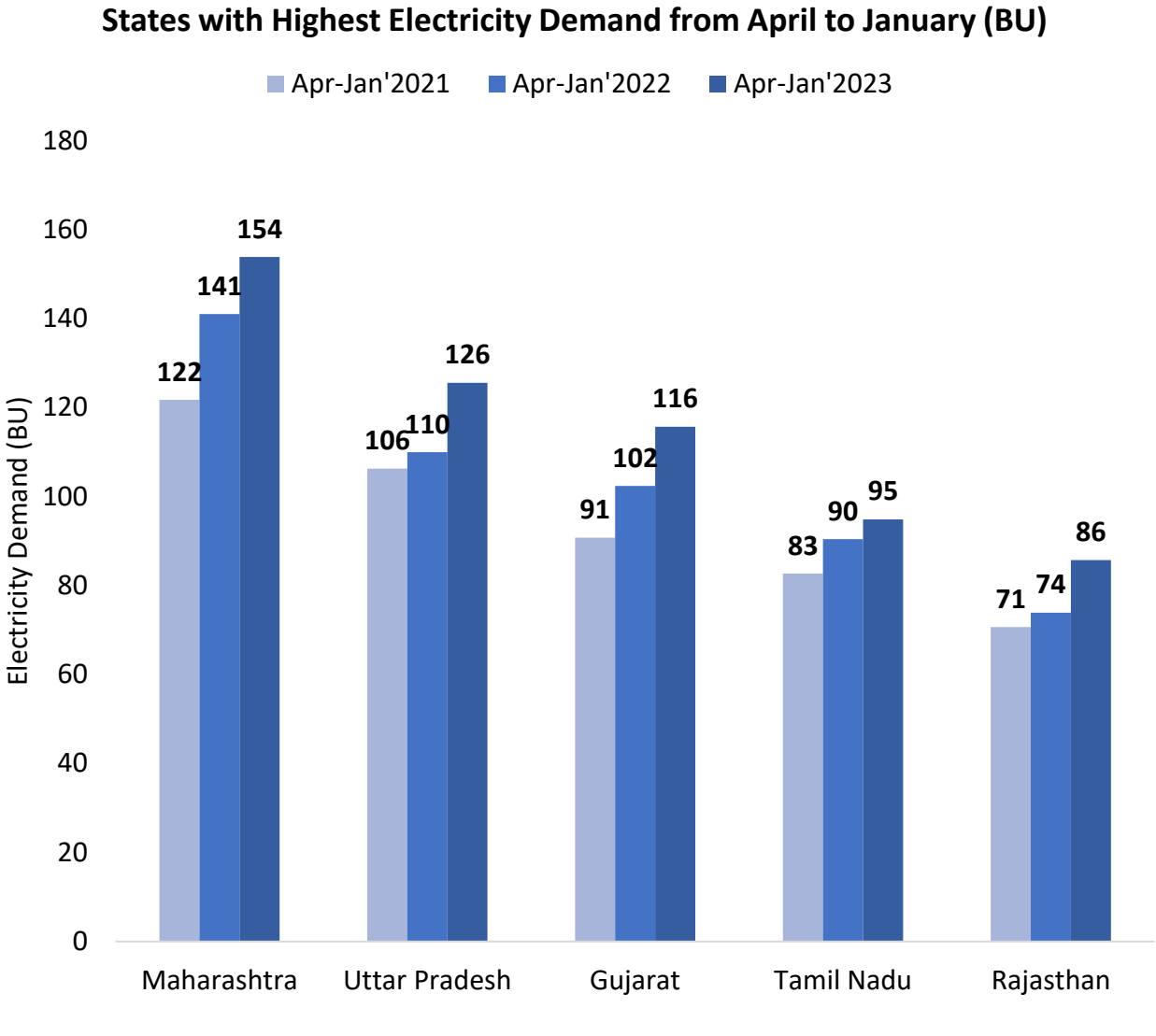
India’s Monthly Peak Electricity Demand and Supply



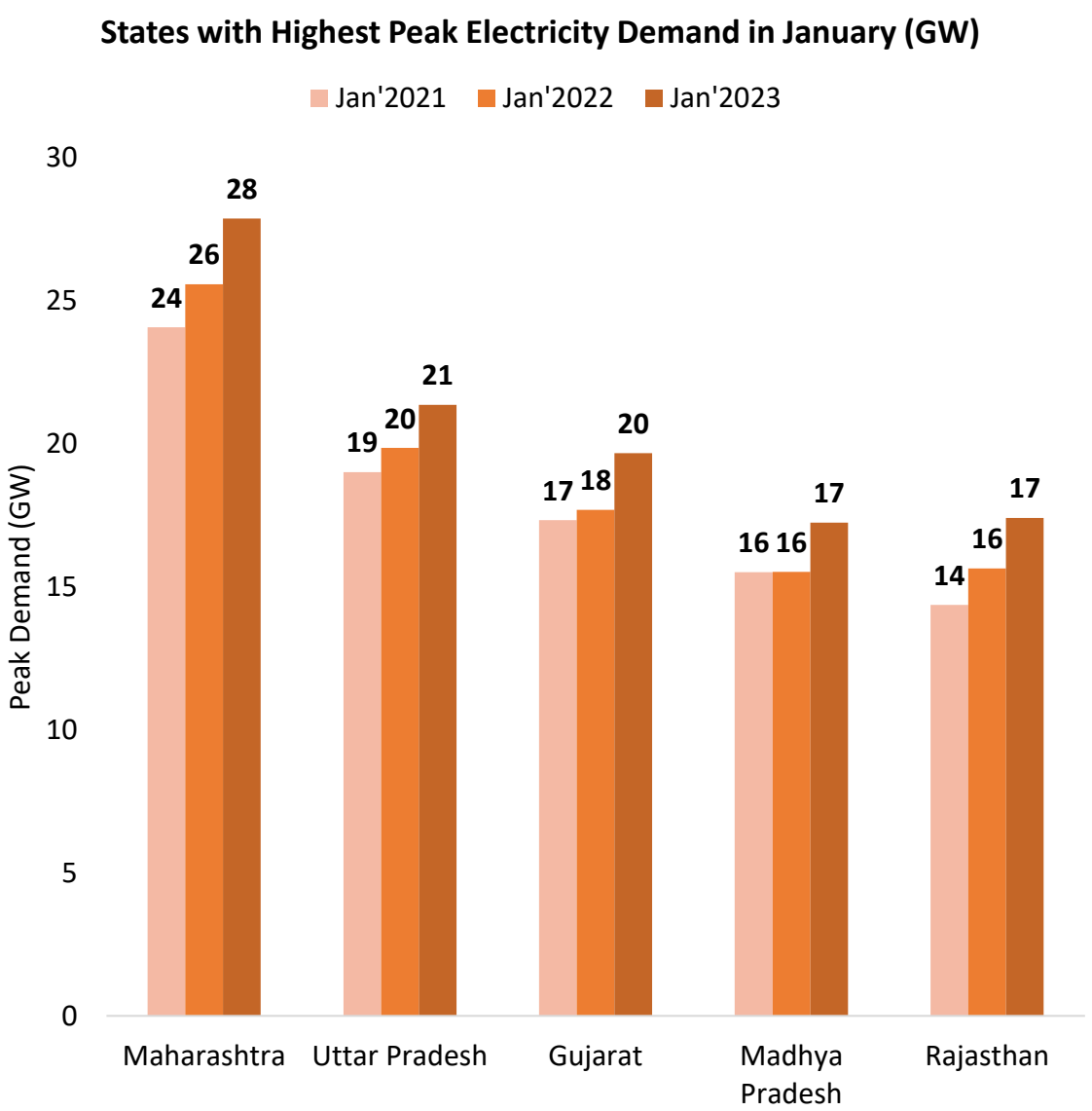
Source: CEA

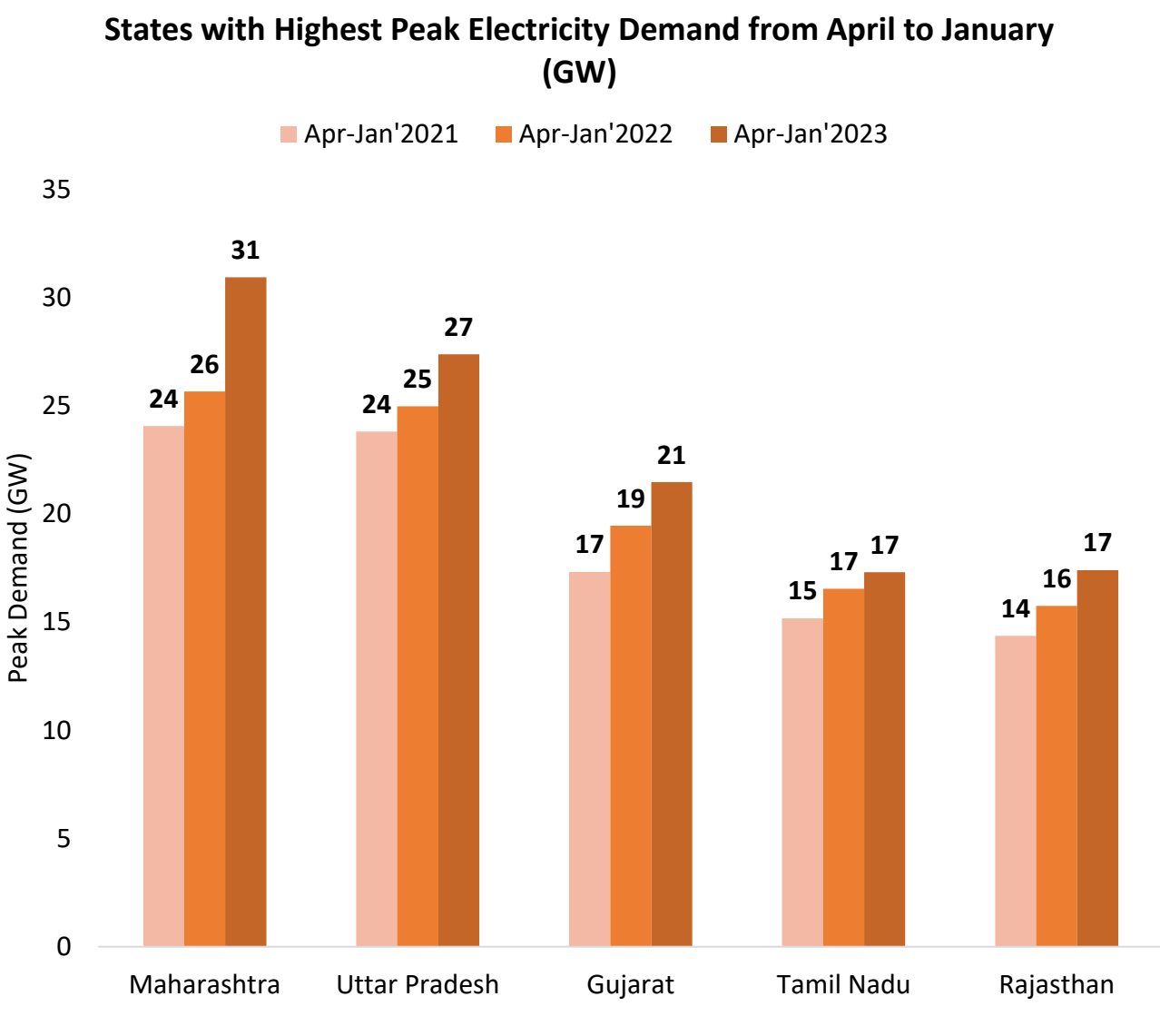
Monthly Electricity Demand of the top 5 states (1/2)



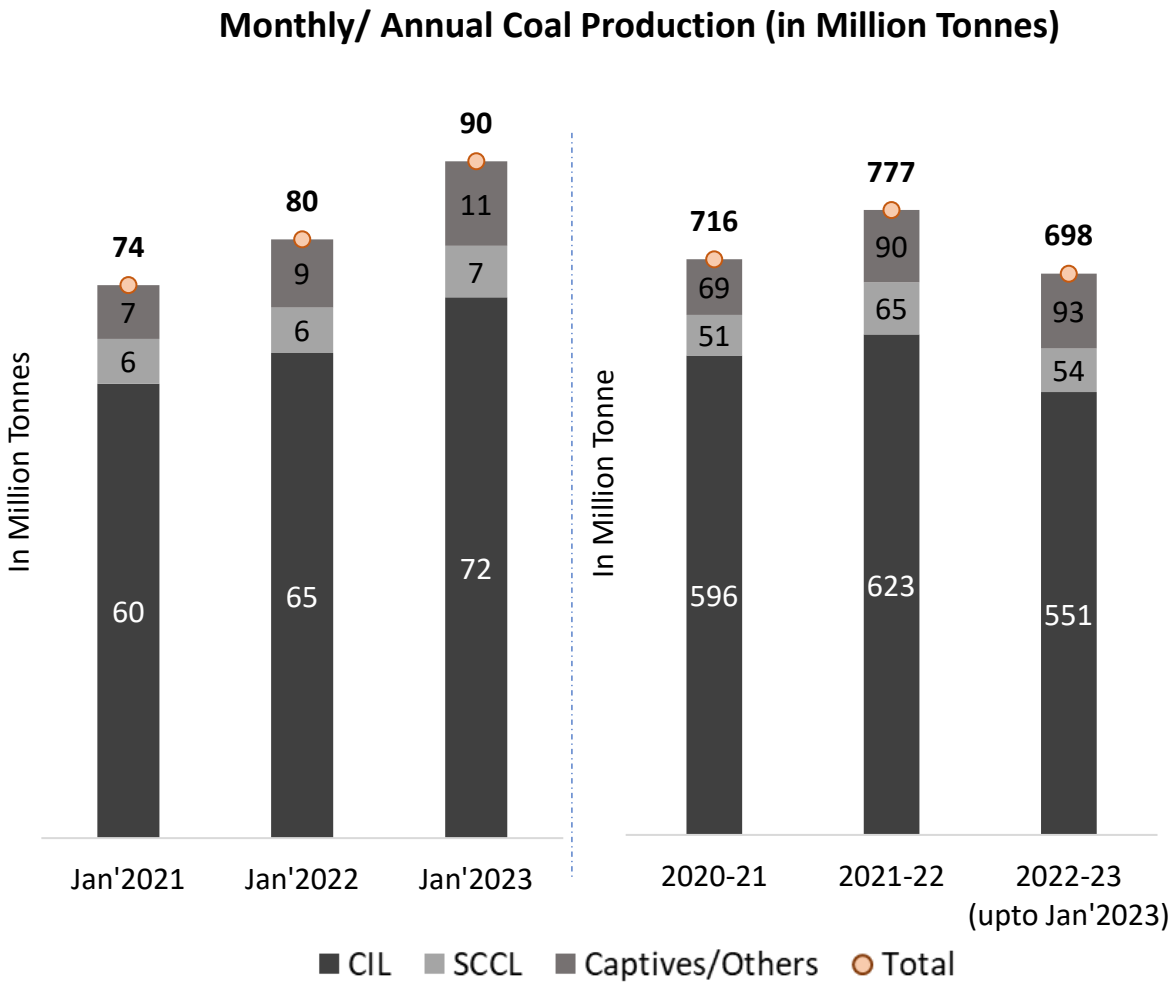


Monthly Electricity Demand of the top 5 states (2/2)

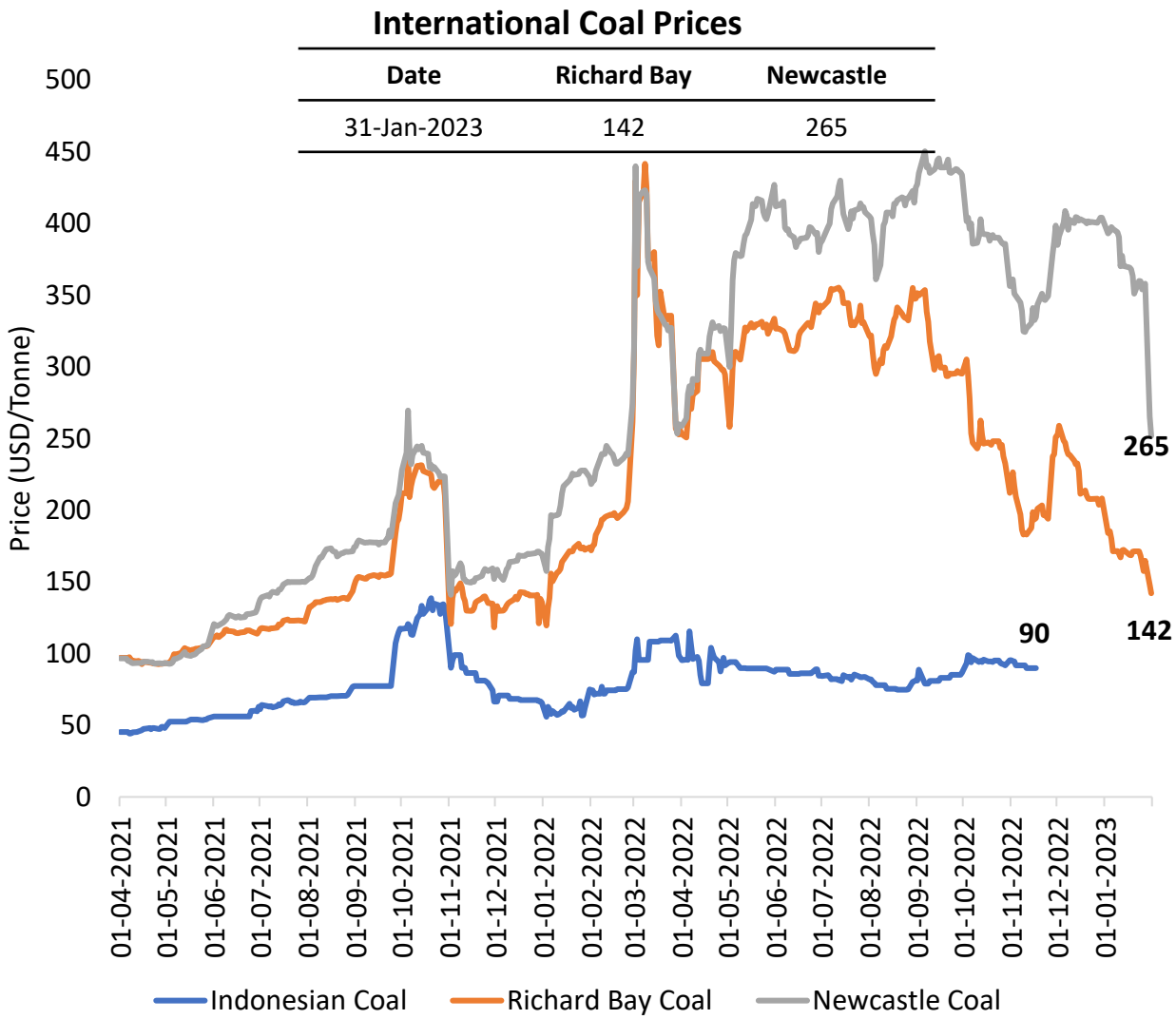




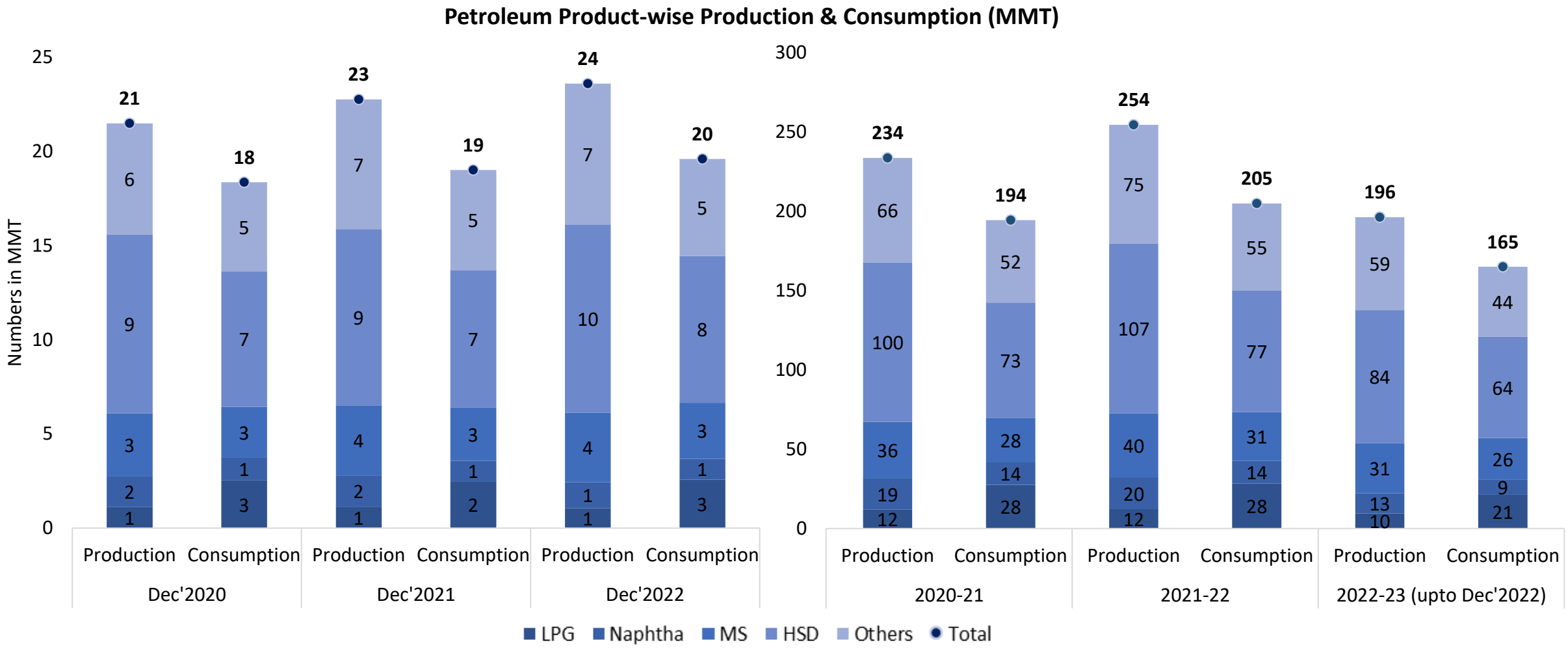
Monthly Coal Statistics



India's coal production increased in Jan'2023 (90 MT) by 13% as compared to Jan'2022.



Petroleum Products Market Scenario (1/3)



Others include ATF, SKO, LDO, Lubes, FO, LSHS, Bitumen, pet coke, and others.

Abbreviations: ATF- Aviation Turbine Fuel, FO- Furnace Oil, HSD- High-Speed Diesel, LDO- Light Diesel Oil, MS- Motor Spirit (Petrol), SKO- Superior Kerosene Oil, LSHS- Low Sulphur Heavy Stock, LPG- Liquefied Petroleum Gas, MMT- Million Metric Tonne

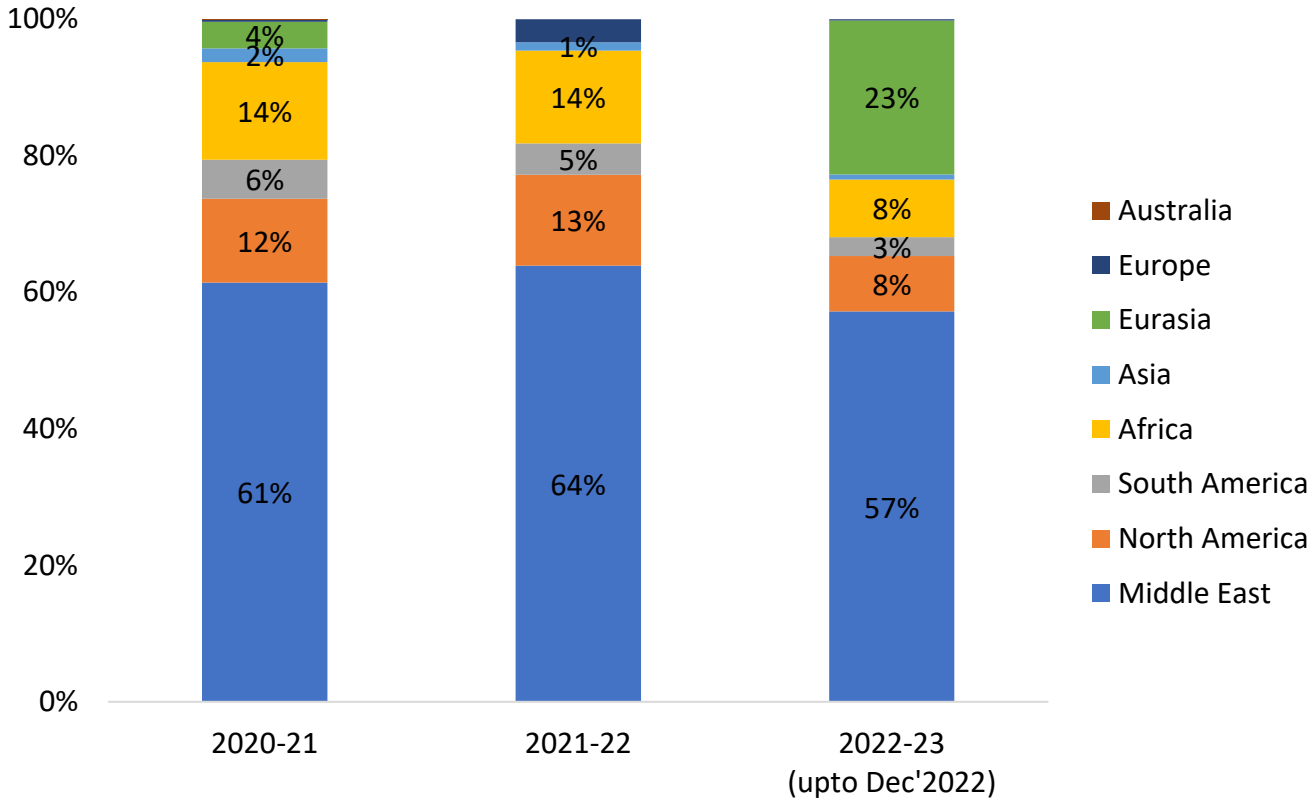
Petroleum Products Market Scenario (2/3)

Import/Export of Crude Oil and Petroleum Products ('000 Tonnes)							
Petroleum Products	Import/ Export	Monthly			Yearly		
		Dec'2020	Dec'2021	Dec'2022	2020-21	2021-22	2022-23 (up to Dec'2022)
Crude Oil	Import	20489	19648	19518	196461	212382	172390
	Export	0	0	0	0	0	0
	Net Import	**20489**	**19648**	**19518**	**196461**	**212382**	**172390**
LPG	Import	1503	1660	1724	16476	17120	13554
	Export	41	50	44	452	513	393
	Net Import	**1462**	**1610**	**1680**	**16024**	**16607**	**13162**
Diesel	Import	246	5	6	648	75	313
	Export	2653	3057	2413	30576	32407	21912
	Net Import	**-2407**	**-3052**	**-2406**	**-29928**	**-32332**	**-21599**
Petrol	Import	544	0	120	1351	671	1069
	Export	954	1374	1241	11606	13482	9101
	Net Import	**-410**	**-1374**	**-1121**	**-10255**	**-12812**	**-8033**
Others*	Import	1707	2754	2264	24772	24196	17937
	Export	1045	1495	2137	14135	16352	14324
	Net Import	**661**	**1259**	**127**	**10637**	**7844**	**3613**

*Others include ATF, Naphtha, SKO, LDO, Lubes, FO, LSHS, Bitumen, pet coke, and others.

Petroleum Products Market Scenario (3/3)

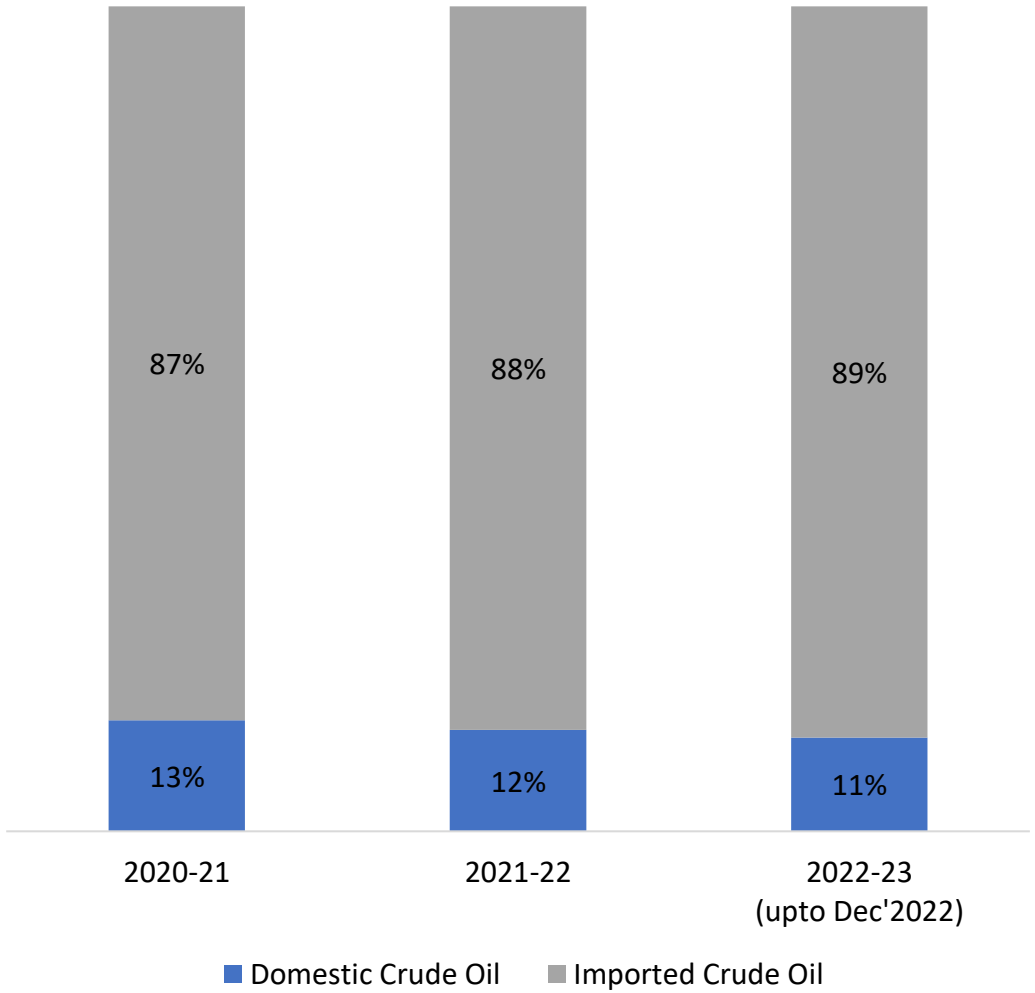
Region-wise Share in Import of Crude Oil (%)



Total Import of Crude Oil (MMT)

Total Import	2020-21	2021-22	2022-23 (up to Dec'2022)
Crude Oil	**196**	**212**	**172**

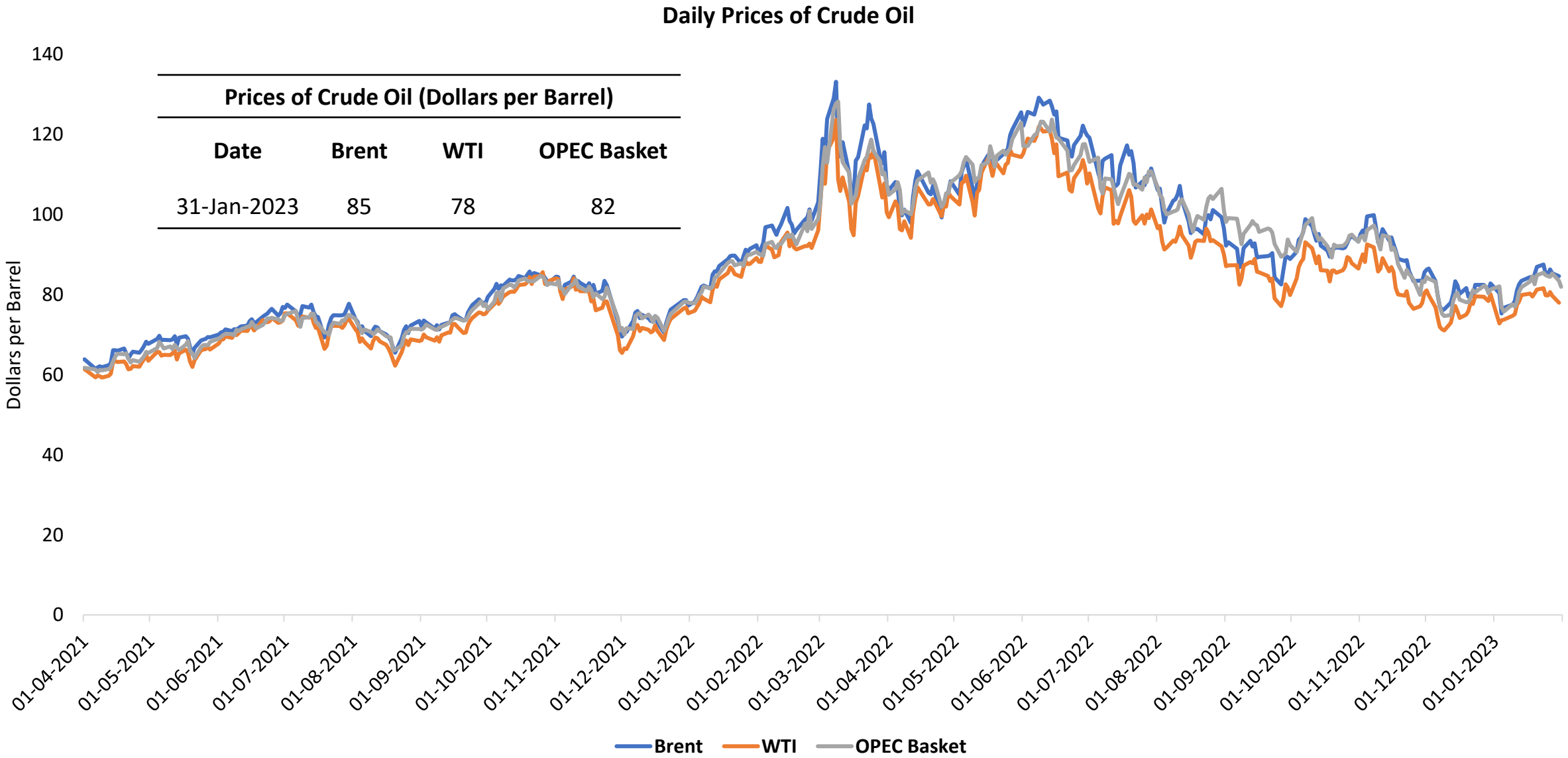
Domestic and Imported Crude Oil share in India (%)



Source: MoPNG and PPAC

Daily Prices of Crude Oil

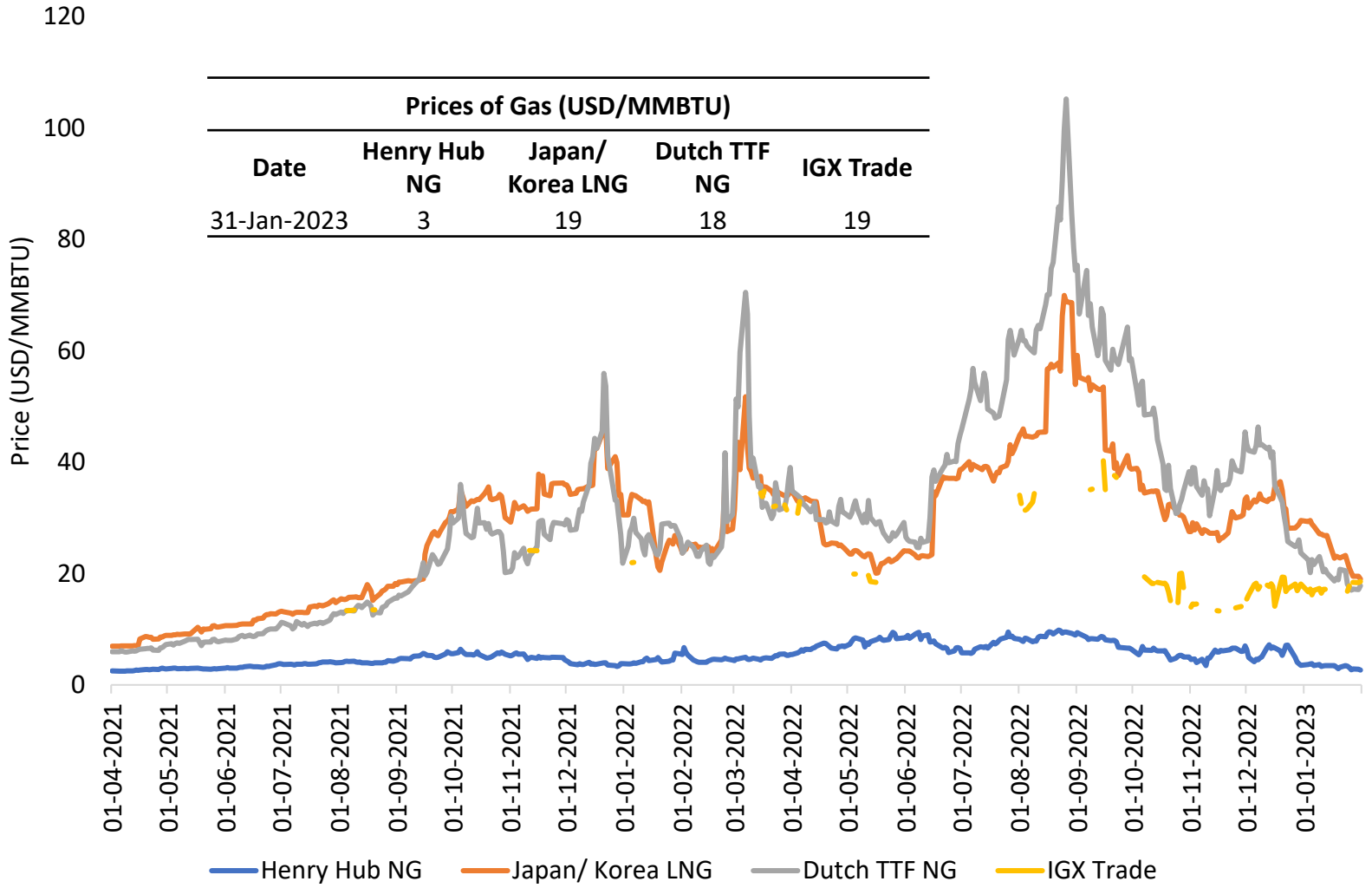
Prices of Crude Oil (Dollars per Barrel)			
Date	Brent	WTI	OPEC Basket
31-Jan-2023	85	78	82



Gas Market Scenario

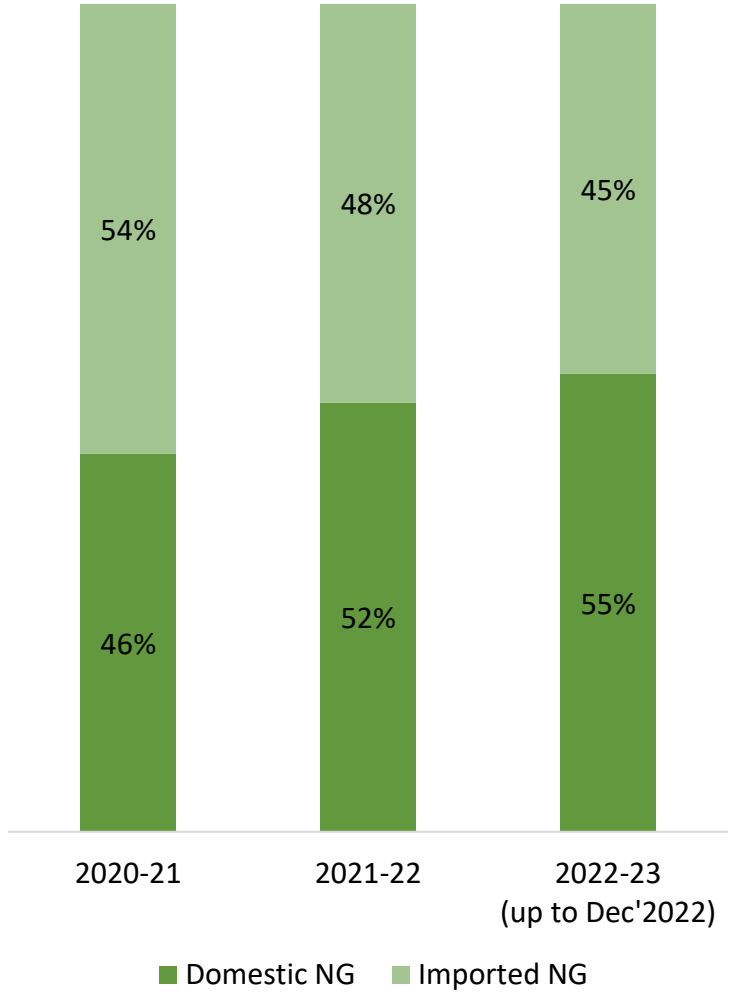
Gas Daily Market Price

Prices of Gas (USD/MMBTU)				
Date	Henry Hub NG	Japan/ Korea LNG	Dutch TTF NG	IGX Trade
31-Jan-2023	3	19	18	19



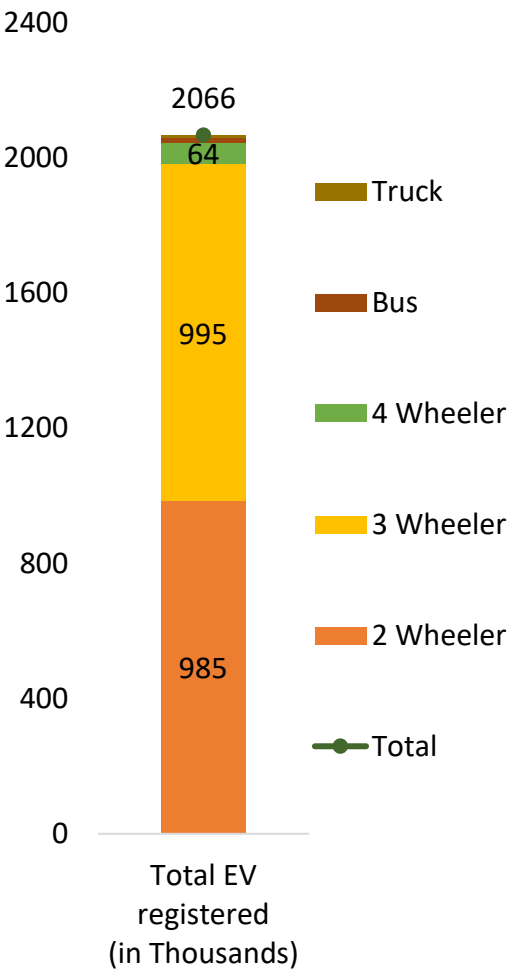
MMBTU- Million Metric British Thermal Unit

Domestic and Imported Natural Gas share in India (%)

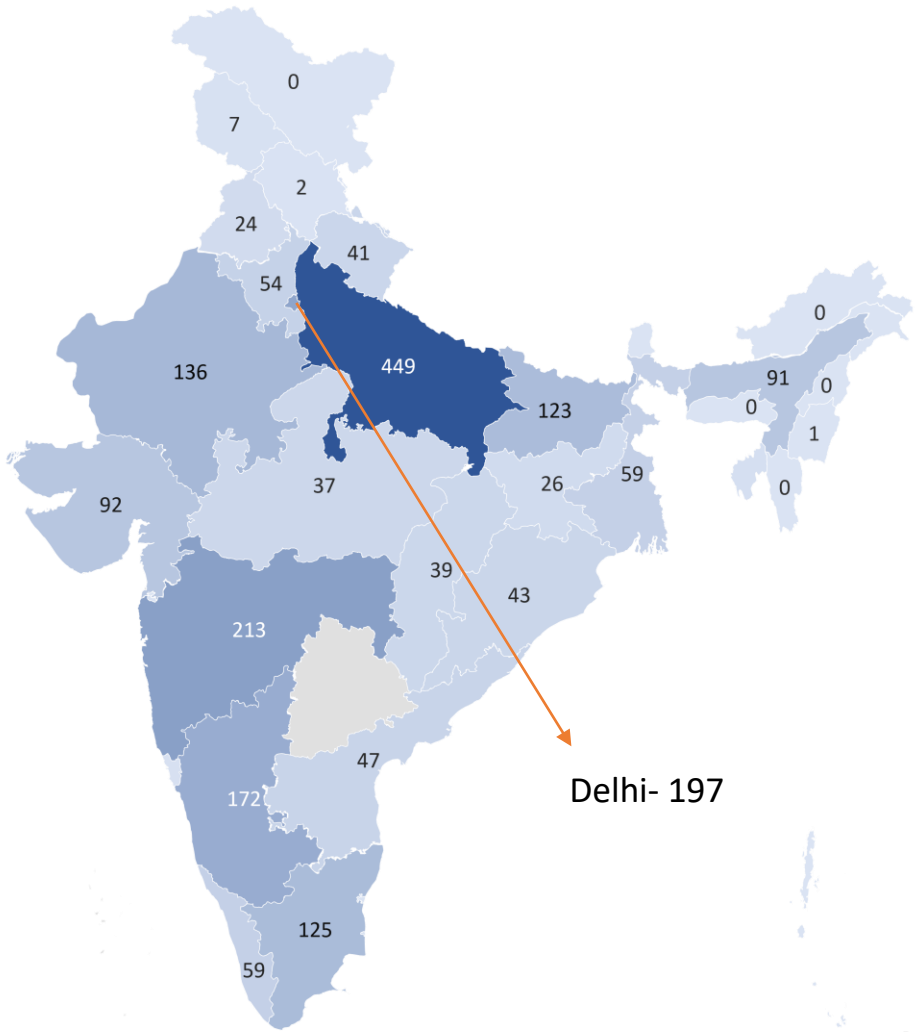


Status of Electric Mobility in India

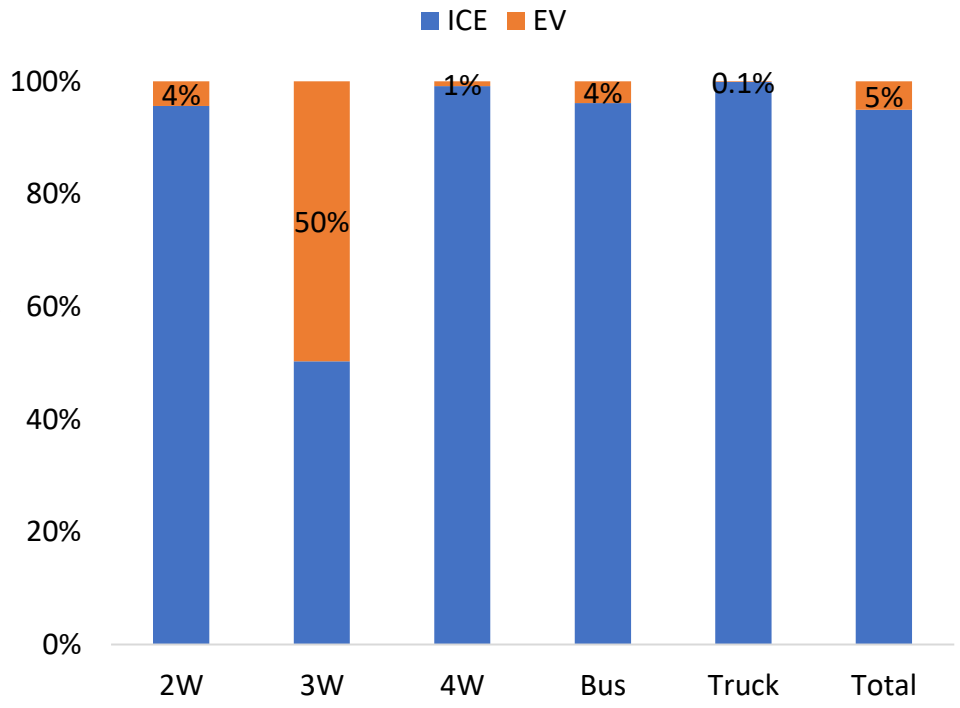
National EV registration (till 7th February 2023)



Cumulative State-wise EV registration as on 7th February 2023 (in Thousands)



EV and ICE sale composition in 2022-23 (till 7th February 2023)



Vehicle Registered in FY 2022-23 [till 7th February 2023] (in Thousands)

Fuel Type	2W	3W	4W	Bus	Truck	Total
EV	610	329	31	7	1	**976**
ICE	13355	333	3676	175	767	**18305**

Recent Interventions to promote Renewable Energy

Solar

Under the PLI scheme, the GOI has announced INR 19,500 crores to incentivize the manufacturing of domestic solar PV modules.

CFA/ subsidy is available for residential solar rooftop projects up to 10kW.

CFA is applicable under RTS Phase II for residential consumers in rural areas under the VNM arrangement up to 3kW.

The inter-state transmission charges are waived for 25 years for the projects being commissioned before 30th June 2025.

The updated RPO compliance supports solar integration of up to 33.57% of the electricity purchased by DISCOMs/states till the year 2029-30.

PM KUSUM scheme has been extended till Mar'26 to install pump sets up to 15 HP in selected areas.

Wind

Reverse auctions have been scrapped for wind projects. A traditional two-part (technical and financial) bid system has been put in place.

To support off-shore wind, SECI will invite bids for up to 4GW to set up offshore wind plants off the coast of Tamil Nadu and Gujarat.

The inter-state transmission charges are waived for 25 years for the projects being commissioned before 30th June 2025.

The updated RPO compliance supports WIND integration of up to 6.94% of the electricity purchased by DISCOMs/states till the year 2029-30.

The draft National Repowering Policy for wind power projects is released for the optimum utilization of wind energy resources by maximizing energy (kWh) yield per sq. km of the wind project areas.

BESS

PLI scheme unveiled for setting up 50 GWh ACC battery storage with an outlay of ₹18,100 crores.

Under the Waste Management Rules 2022, the disposal of waste batteries in landfills and incineration is prohibited and the recycling of waste batteries is made mandatory.

CERC, under RRAS regulation, has allowed the use of energy storage in secondary and tertiary ancillary support.

The Energy Storage Obligation of DISCOMs is pegged at 4.0% up to 2029-30.

The pilot projects are:

i. 1.4 MW SPV Project with 1.4 MWh BESS in Lakshadweep.
ii. 50 MWp SPV Project with 20 MW/50 MWh BESS in Phyang, Ladakh
iii. 100 MW SPV Project with 40 MW/120 MWh BESS in Chhattisgarh.

Green Hydrogen (H_2)

National Green Hydrogen Mission was approved by the Cabinet in January 2023. The mission aims to meet the target of 5 million metric tonnes of green hydrogen production by 2030. The initial outlay for the Mission will be INR 19,744 crores.

MOP has released the Green Hydrogen Policy under which the inter-state transmission charges are waived for 25 years of the projects being commissioned before 30th June 2025.

MNRE has proposed using green H_2 in Direct Reduced Iron (DRI) production by partly replacing natural gas with H_2 in gas-based DRI plants.

The pilot projects are*-

i. 25kW AC hydrogen grid at NETRA that includes a 500kW PEM electrolyzer
ii. 5MW PEM electrolyzer at NTPC Vindhyachal.

Key Highlights or Announcements of January (1/2)

1. The Hon'ble Prime Minister Shri Narendra Modi, has approved the **National Green Hydrogen Mission** on 4th January 2023. The initial outlay for the mission will be Rs 19,744 crores, including an outlay of Rs 17,490 crores for the Strategic Interventions For Green Hydrogen Transition (SIGHT) programme, Rs1,466 crores for pilot projects, Rs 400 crores for R&D, and Rs 388 crores for other mission components. MNRE will formulate the scheme guidelines for the implementation of the respective components. The following outcomes to arise from the mission by 2030 are:
    - Development of green hydrogen production capacity of at least 5 MMT per annum with an associated renewable energy capacity addition of about 125 GW in the country
    - Over Rs. 8 lakh crore in total investments
    - Creation of over 6 lakh jobs
    - Cumulative reduction in fossil fuel imports over Rs 1 lakh crore
    - Abatement of nearly 50 MMT of annual greenhouse gas emissions.

    The Mission strategy accordingly comprises interventions for-
    - Demand creation by making Green Hydrogen produced in India competitive for exports and through domestic consumption.
    - Addressing supply side constraints through an incentive framework, and
    - Building an enabling ecosystem to support scaling and development.

Key Highlights or Announcements of January (2/2)

2. NTPC Ltd commissions **India's first green hydrogen blending project** on 3rd January 2022. The project is a joint effort of NTPC and Gujarat Gas Limited (GGL). The green hydrogen blending has been started in the piped natural gas (PNG) network of NTPC Kawas township, Surat. Green hydrogen in Kawas is made by electrolysis of water using power from an already installed 1 MW floating solar project.

3. The **Ministry of Coal aims to produce 1,017 million tonnes of coal during the year 2023-24**. Further, the target is segregated into 780 million tonnes (MT) for CIL, 75 MT for Singareni Collieries Company Ltd., and 162 MT for captive and commercial mines.

4. CEA released the notification regarding the **Renovation and Modernization (R&M) of aged coal-fired Thermal Power Stations** on 20th January 2023. CEA advised all power utilities not to retire any thermal units till 2030 and urged them to carry out R&M for life extension (LE) and to improve the flexibility and reliability of thermal units considering the expected demand scenario.

5. **MNRE has scrapped the e-reverse bidding mechanism for the wind sector** to ensure faster capacity addition. The ministry has also decided to issue 8 GW of wind capacity tender every year starting from Jan'2023 to 2030.

6. CEA released the **CO2 Baseline Database for the Indian Power Sector version 18.0** in January 2023. The weighted average CO2 emission factor for FY 2021-22 is 0.81 tCO2/MWh **(0.71 tCO2/MWh taking RE generation into account)** based on generation, fuel consumption, and fuel quality data obtained from the power stations.

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