India’s Energy Overview

APRIL 2023

VASUDHA FOUNDATION
Green ways for a good earth!

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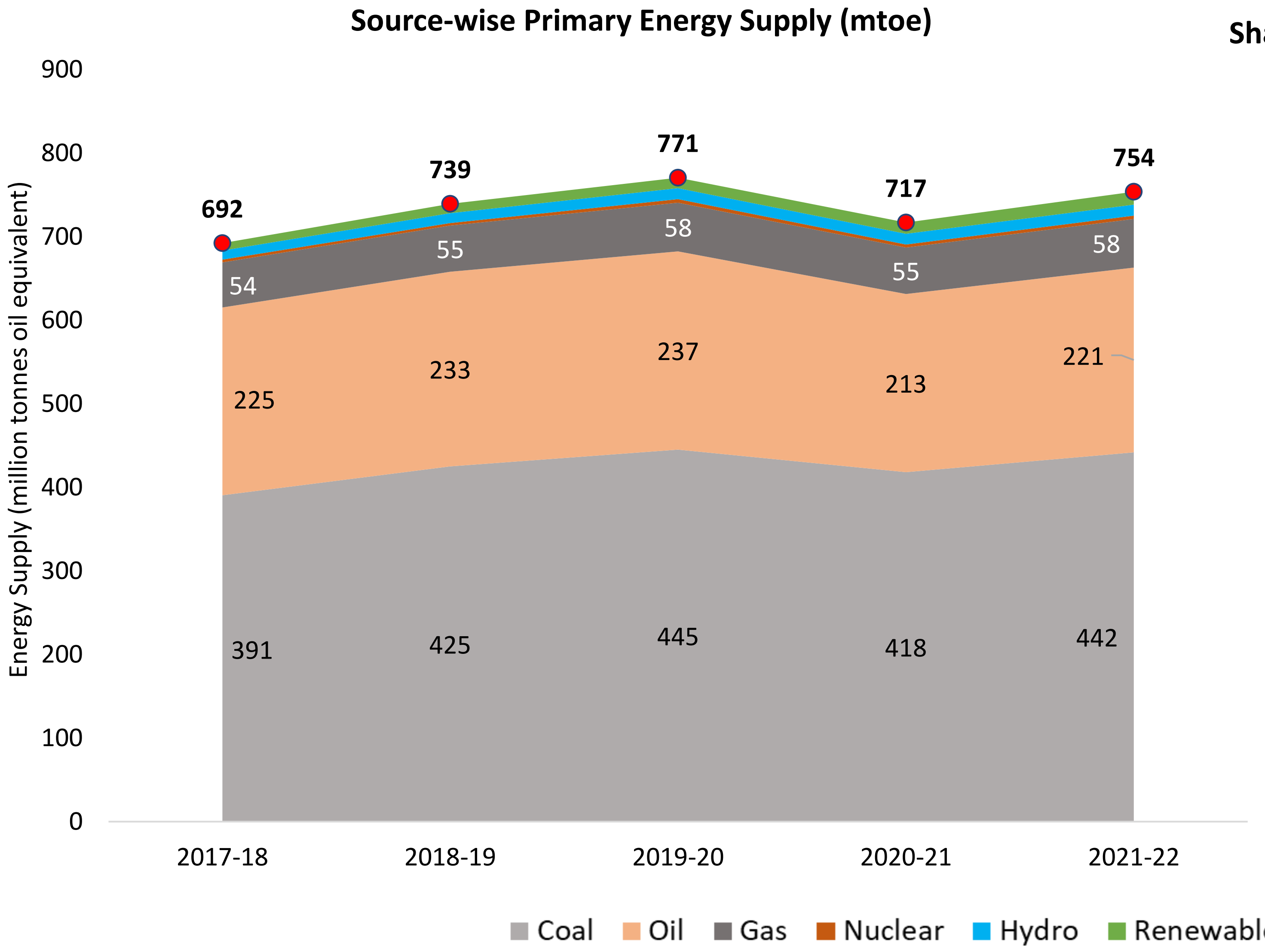
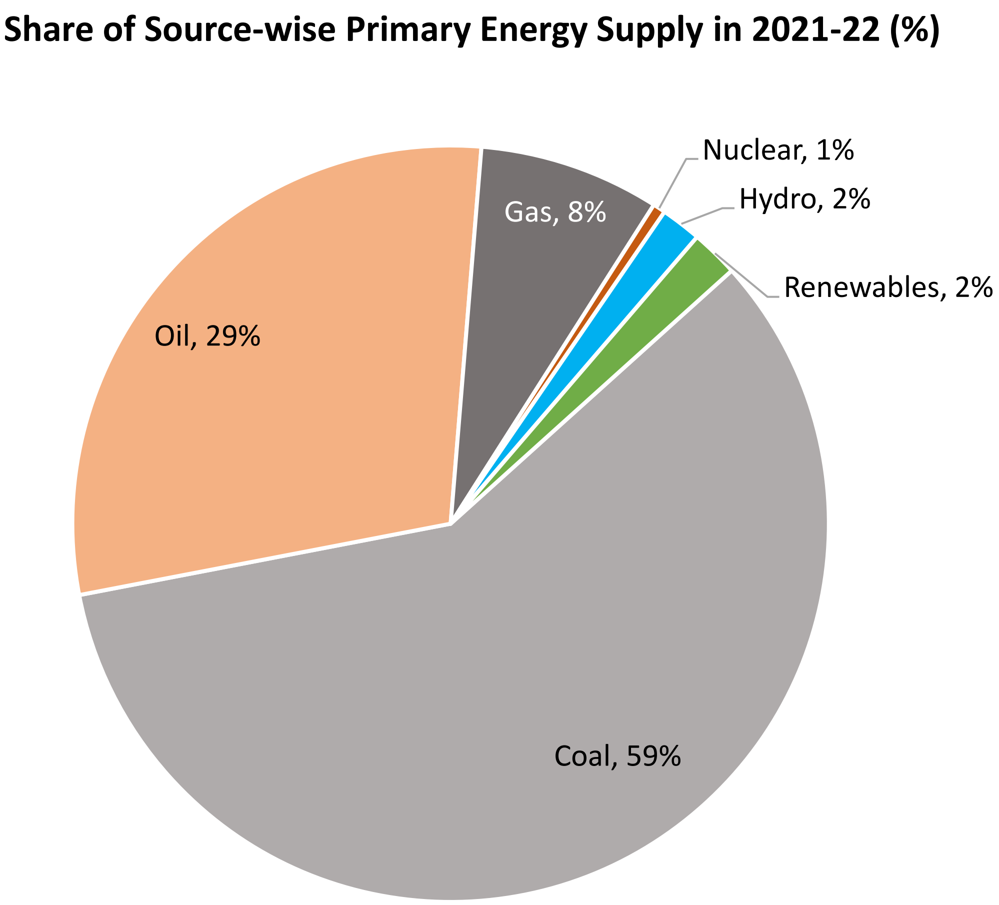
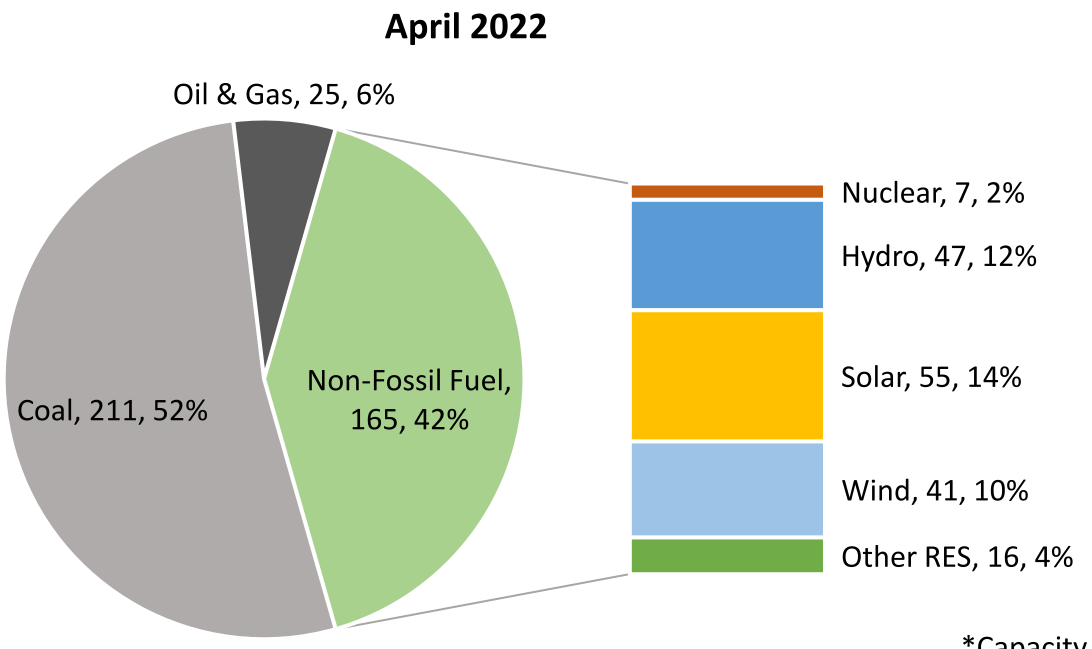
Primary Energy Mix* for 2021-22





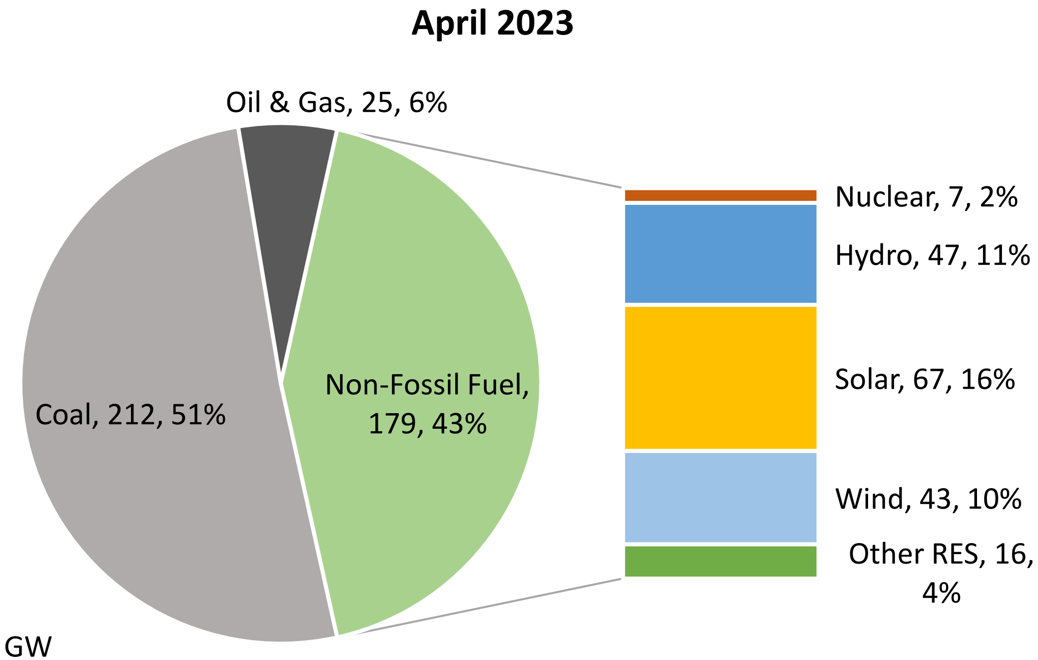
*Excluding biofuels, waste, and other non-commercial source of energy

India's Electricity Capacity Mix (Utility-scale)



Total Capacity: 401 GW

*Capacity Numbers are in GW

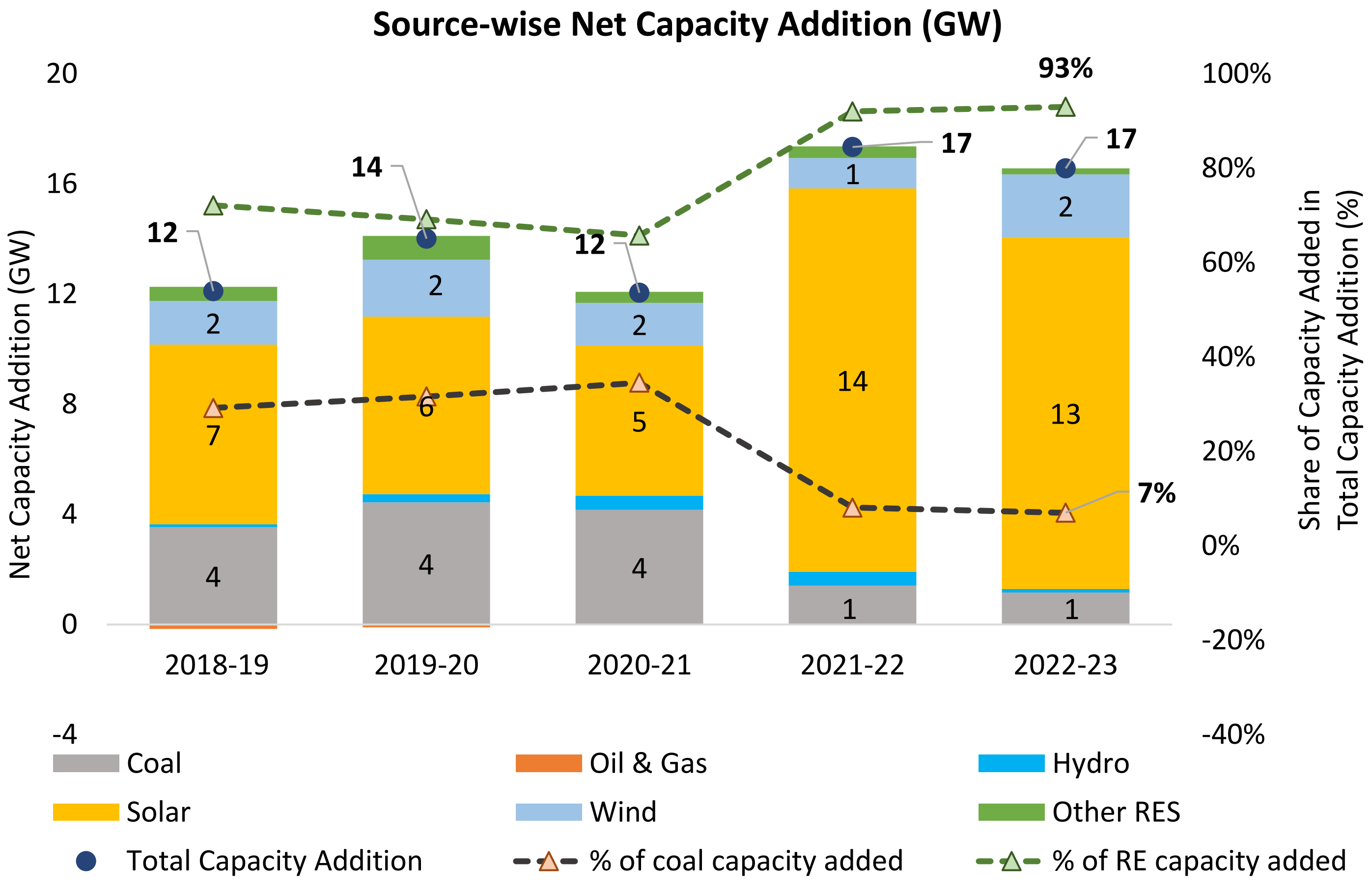


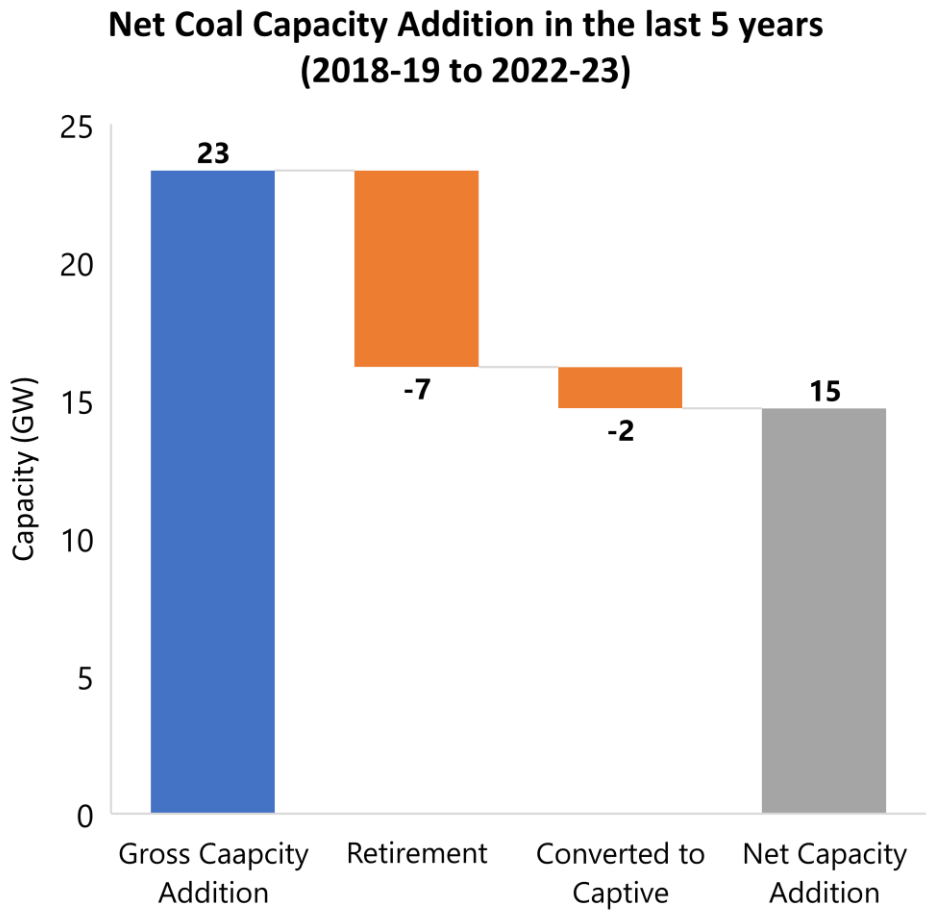
Total Capacity: 417 GW

- India's electricity generating capacity is 417 GW as on Apr'2023 [coal 212 GW (51%), solar 67 GW (16%), hydro 47 GW (11%), and wind 43 (10%)].
- As on Apr'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 Apr'2023, India's renewable energy capacity (including large hydro) stood at 173 GW out of 416 GW.

Source: CEA

India's Electricity Capacity Addition in last 5 years





- A total of 58 GW of generation capacity has been added in RE (Hydro, solar, wind, and other) over the past 5 years, whereas the net coal capacity addition during the same period was 15 GW, mostly in the central sector.
- The share of RE addition in total capacity has shown an increasing trend (from 72% in 2018-19 to 93% in 2022-23).

Source: CEA & MNRE

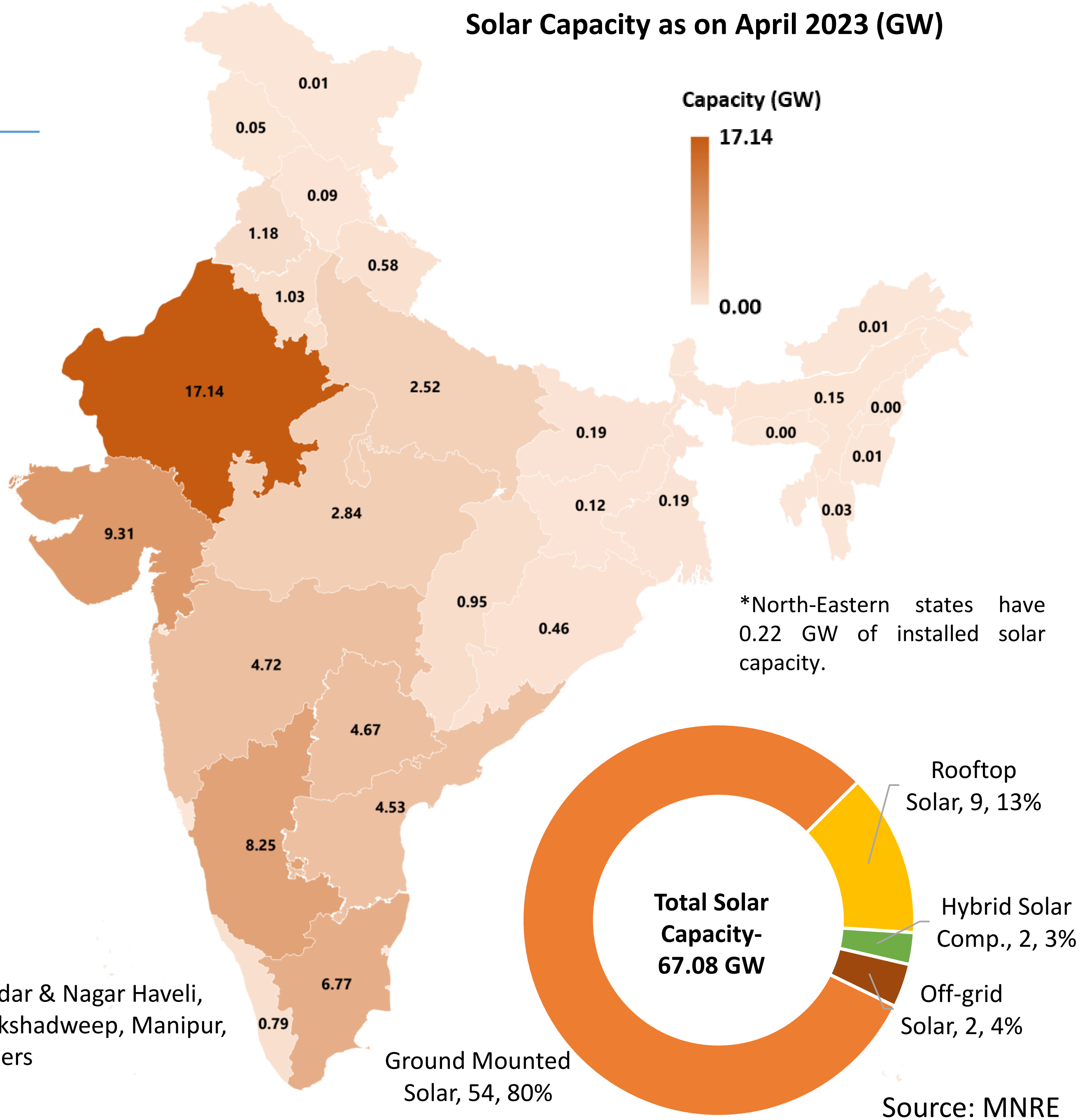
State-wise Solar Capacity

as on April 2023

State-wise installed capacity of Solar Power (GW)					
States	**Ground Mounted**	**Rooftop**	**Solar Component in Hybrid**	**Off Grid**	**Total Solar Power**
Rajasthan	14.08	0.92	1.58	0.57	17.14
Gujarat	6.59	2.49	0.18	0.05	9.31
Karnataka	7.62	0.60	0.00	0.03	8.25
Tamil Nadu	6.29	0.41	0.00	0.07	6.77
Maharashtra	3.01	1.49	0.00	0.23	4.72
Telangana	4.36	0.30	0.00	0.01	4.67
Andhra Pradesh	4.28	0.17	0.00	0.09	4.53
Madhya Pradesh	2.48	0.27	0.00	0.09	2.84
Uttar Pradesh	2.07	0.27	0.00	0.18	2.52
Punjab	0.83	0.26	0.00	0.08	1.18
Haryana	0.27	0.43	0.00	0.33	1.03
Chhattisgarh	0.51	0.06	0.00	0.39	0.95
Kerala	0.30	0.47	0.00	0.02	0.79
Uttarakhand	0.30	0.26	0.00	0.01	0.58
Others	0.91	0.63	0.00	0.26	1.80
All India	53.89	9.02	1.76	2.40	67.08

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 April 2023 (GW)



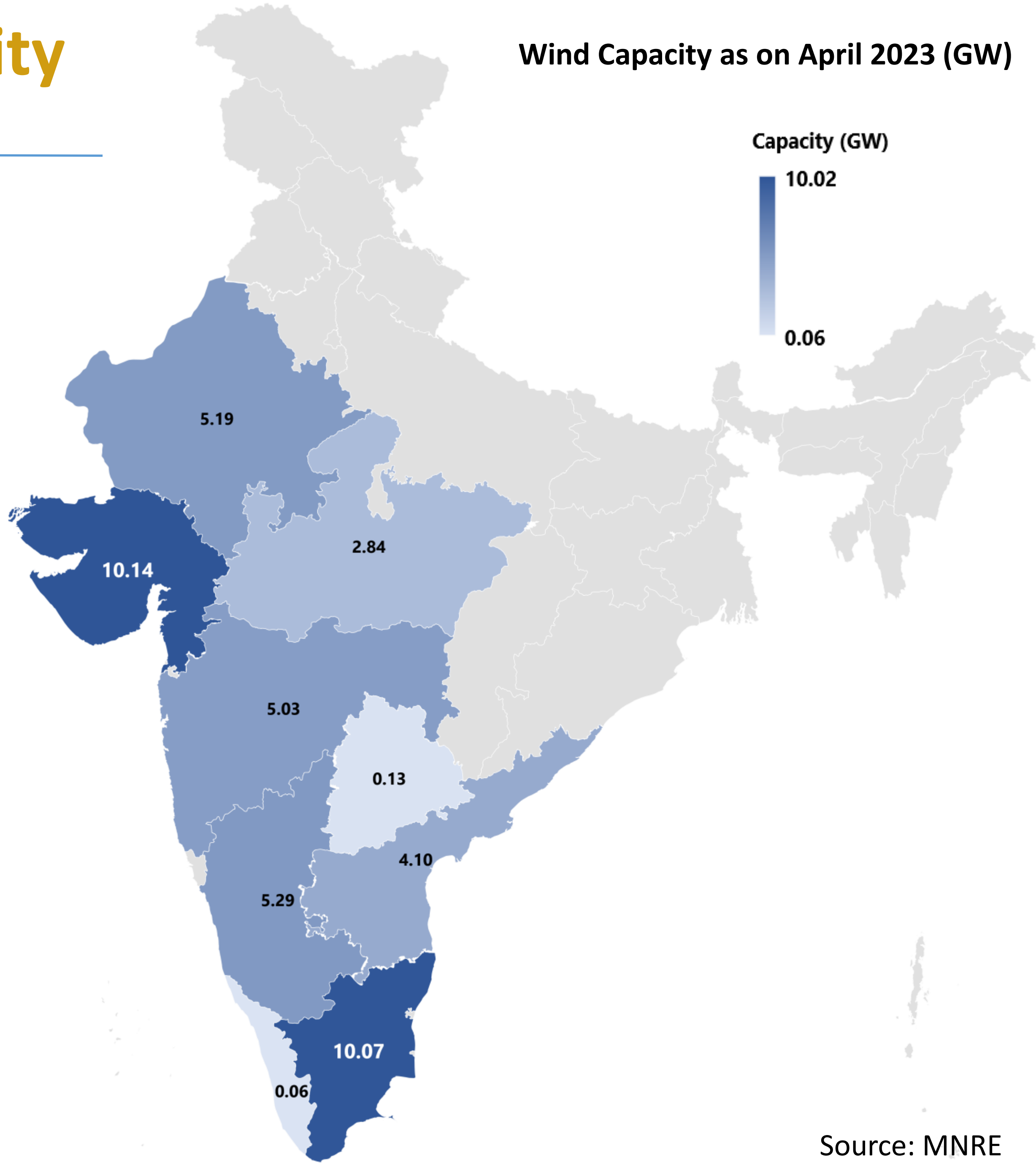
*North-Eastern states have 0.22 GW of installed solar capacity.

Source: MNRE

State-wise Wind Onshore Capacity
as on April 2023

State-wise installed capacity of Wind (Onshore) Power	
States	**Installed Capacity (GW)**
Tamil Nadu	10.07
Gujarat	10.14
Karnataka	5.29
Rajasthan	5.19
Maharashtra	5.03
Andhra Pradesh	4.10
Madhya Pradesh	2.84
Telangana	0.13
Kerala	0.06
India Total	**42.87**

Wind Capacity as on April 2023 (GW)

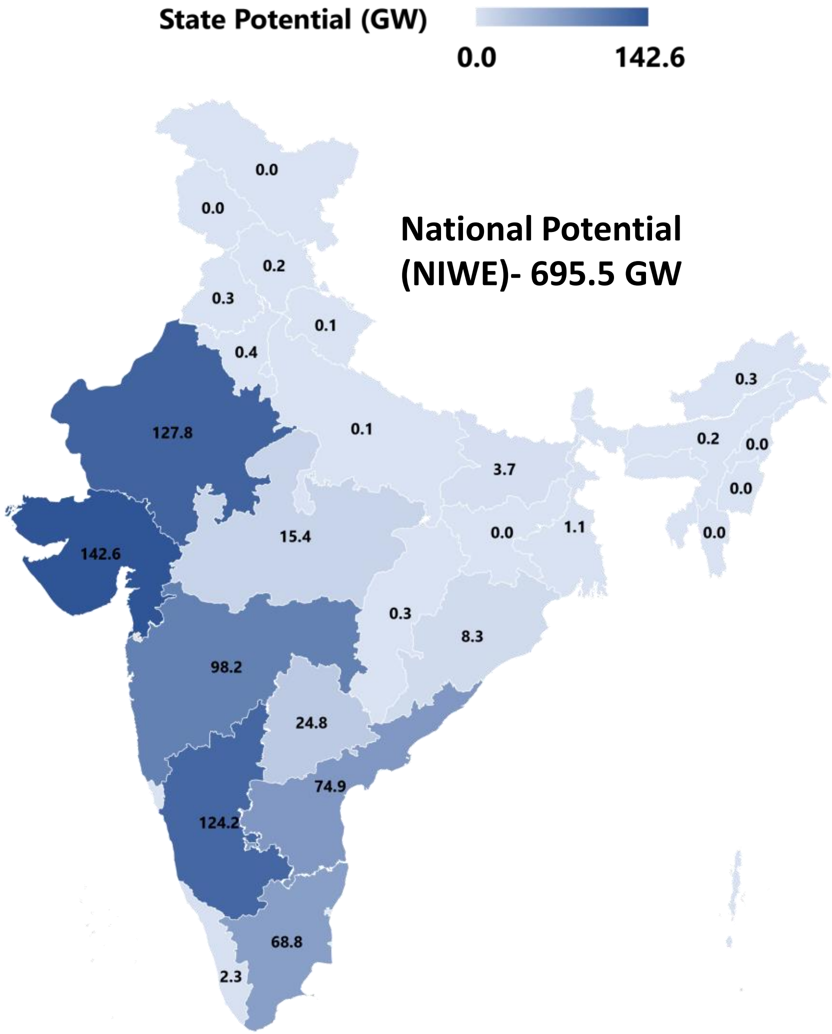


Source: MNRE

RE Potential and Installed Capacity (1/2)

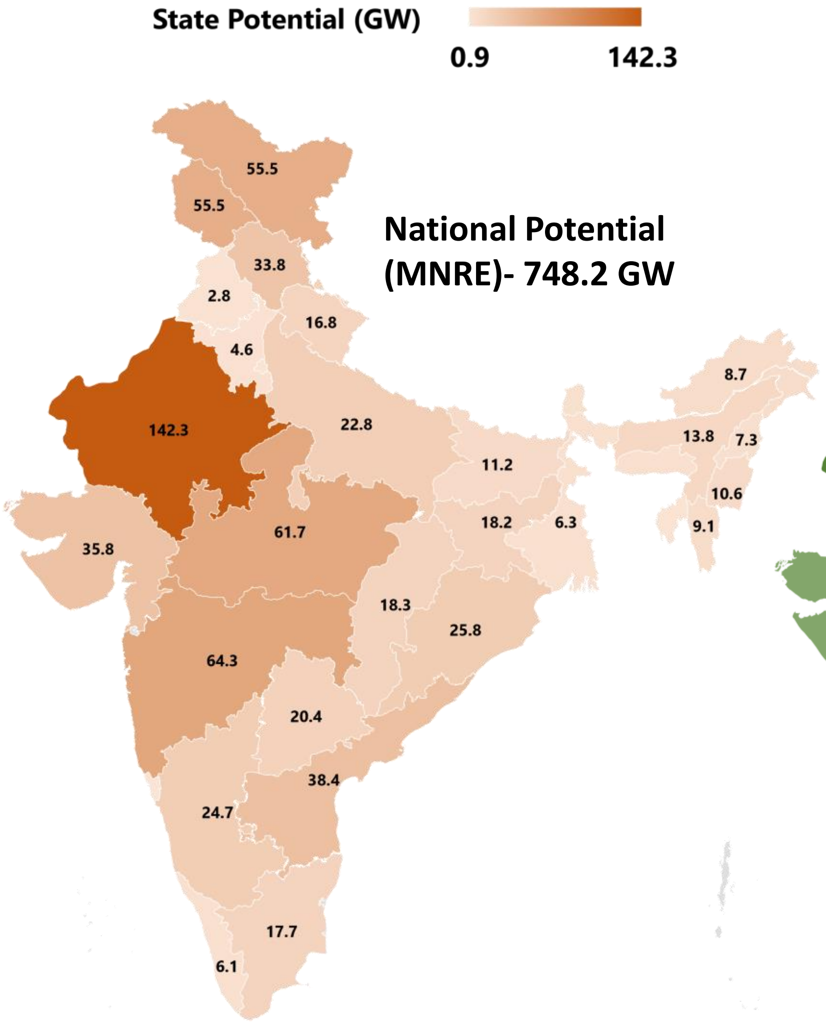
RE potential in the state

Wind Onshore Potential at 120m agl



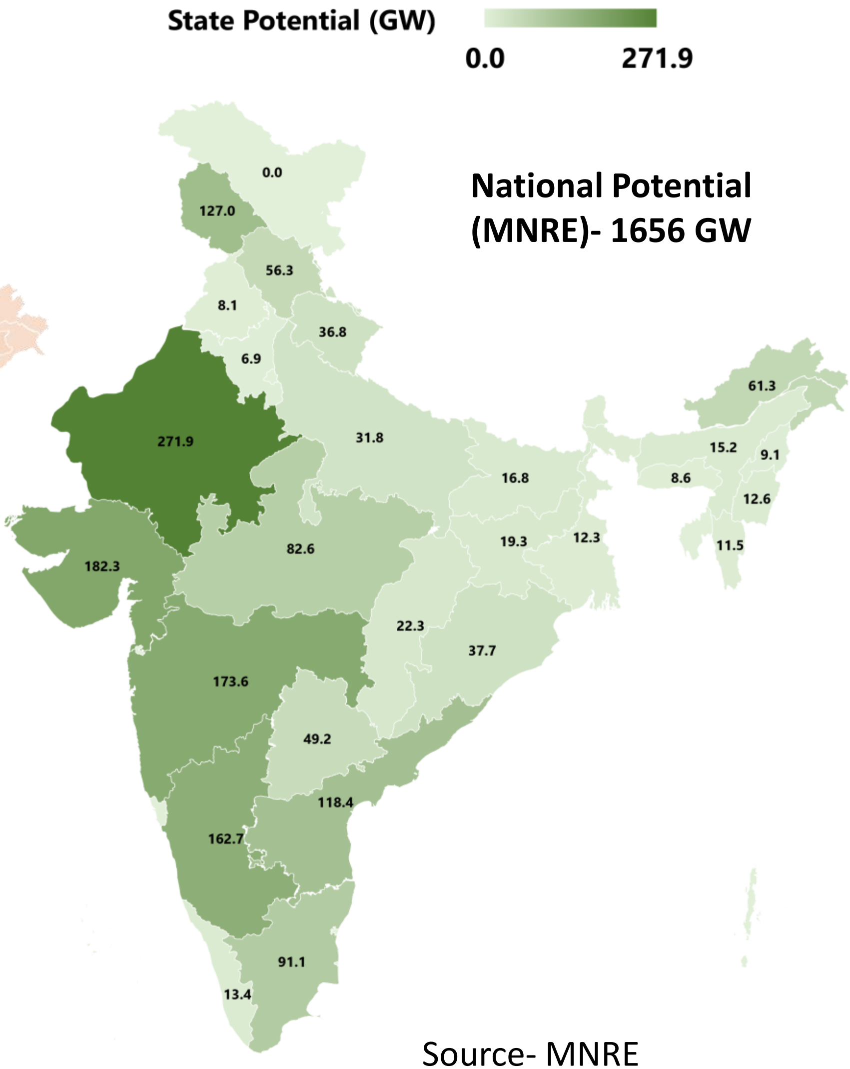
National Potential (NIWE)- 695.5 GW

Solar Potential



National Potential (MNRE)- 748.2 GW

Renewable Energy Potential (all sources including large Hydro)



National Potential (MNRE)- 1656 GW

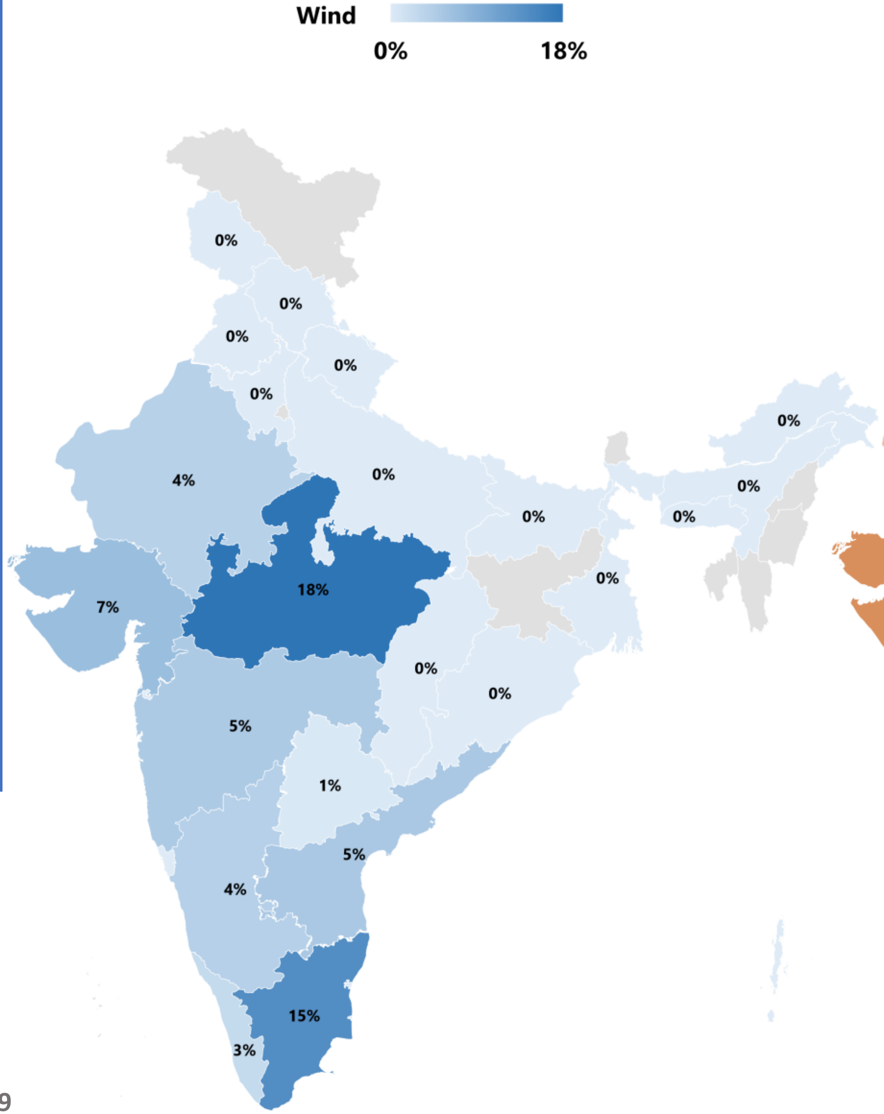
In India, market potential for SPV rooftop is 124 GW

Source- MNRE

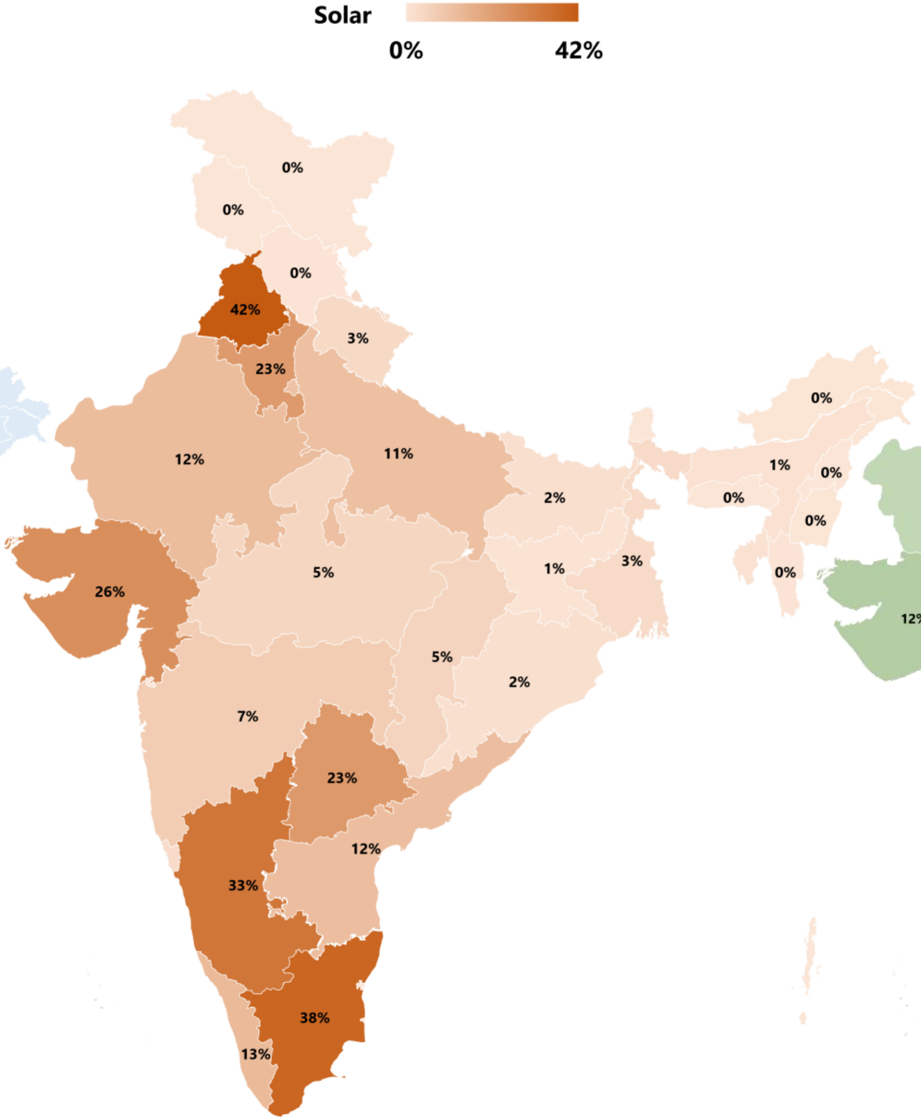
RE Potential and Installed Capacity (2/2)

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

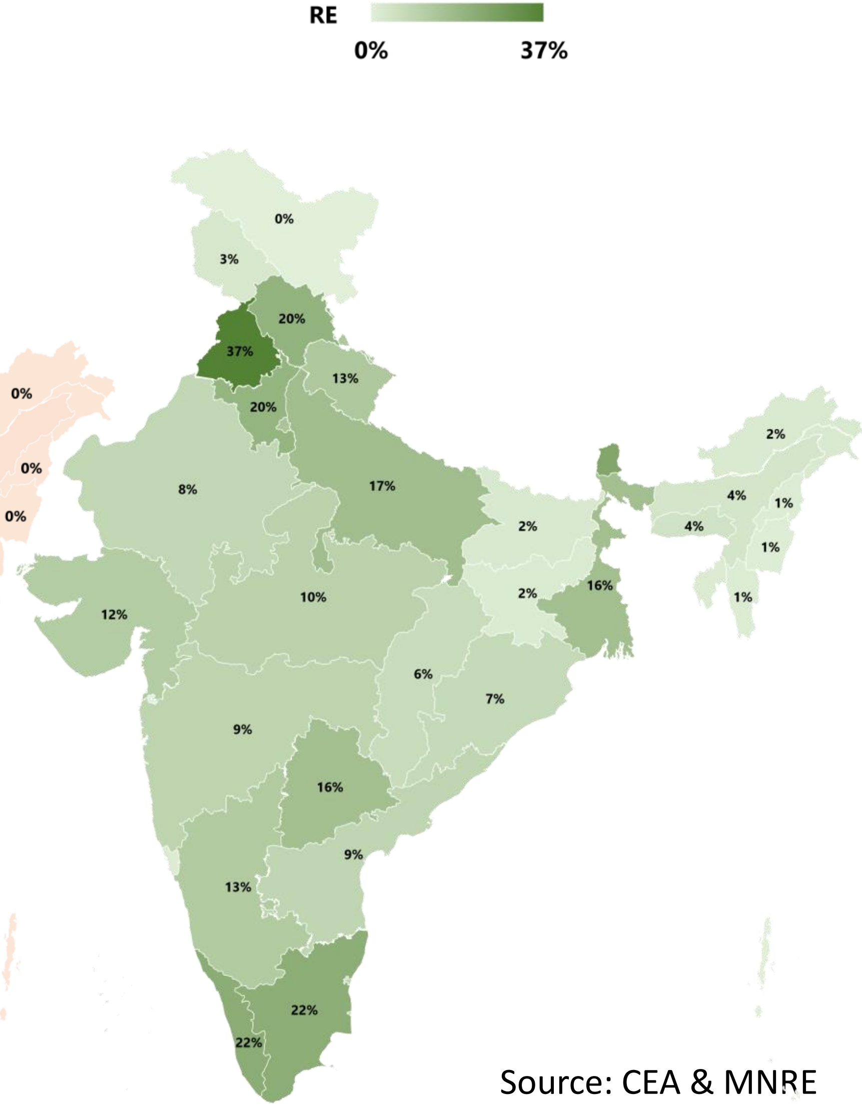
Wind Onshore Capacity



Solar Capacity

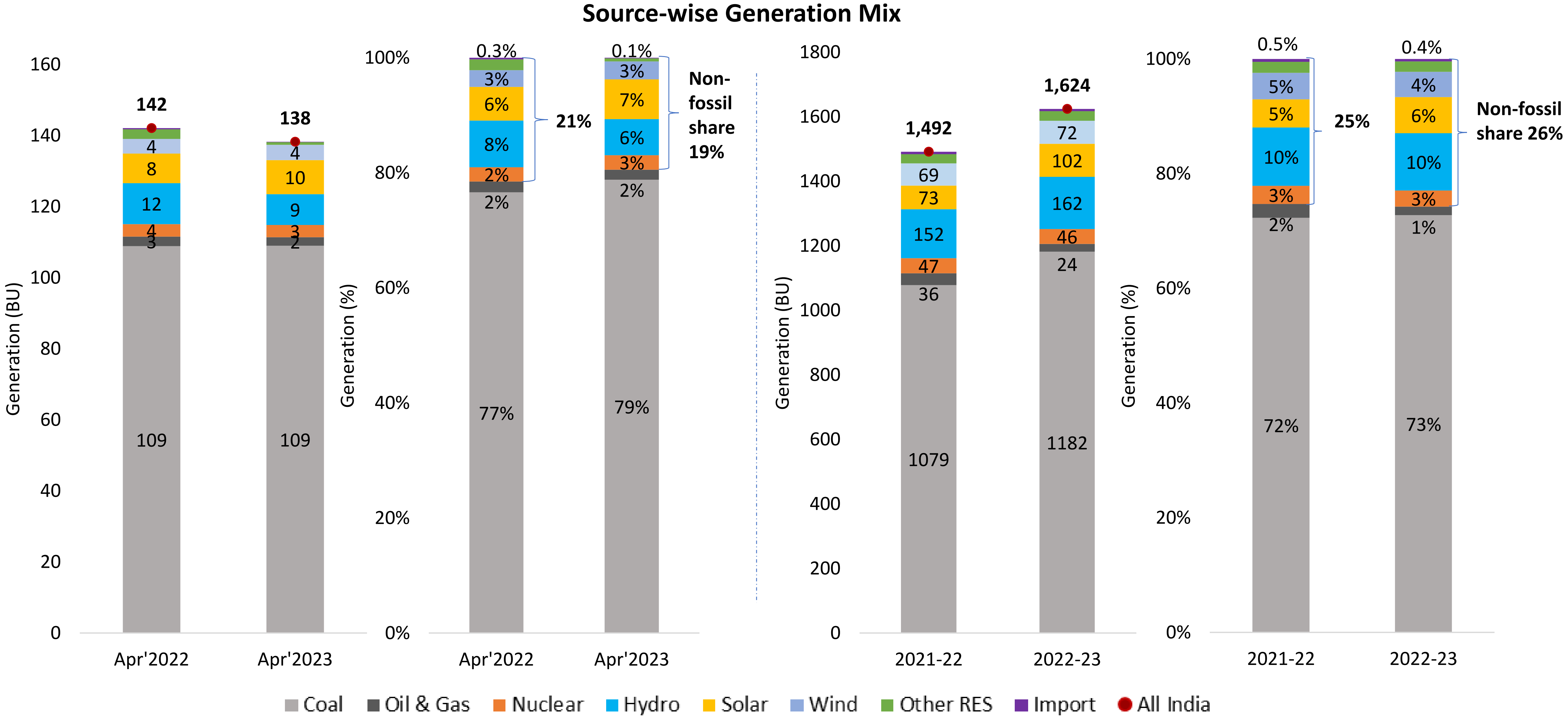


RE Capacity (all sources including large hydro)



Source: CEA & MNRE

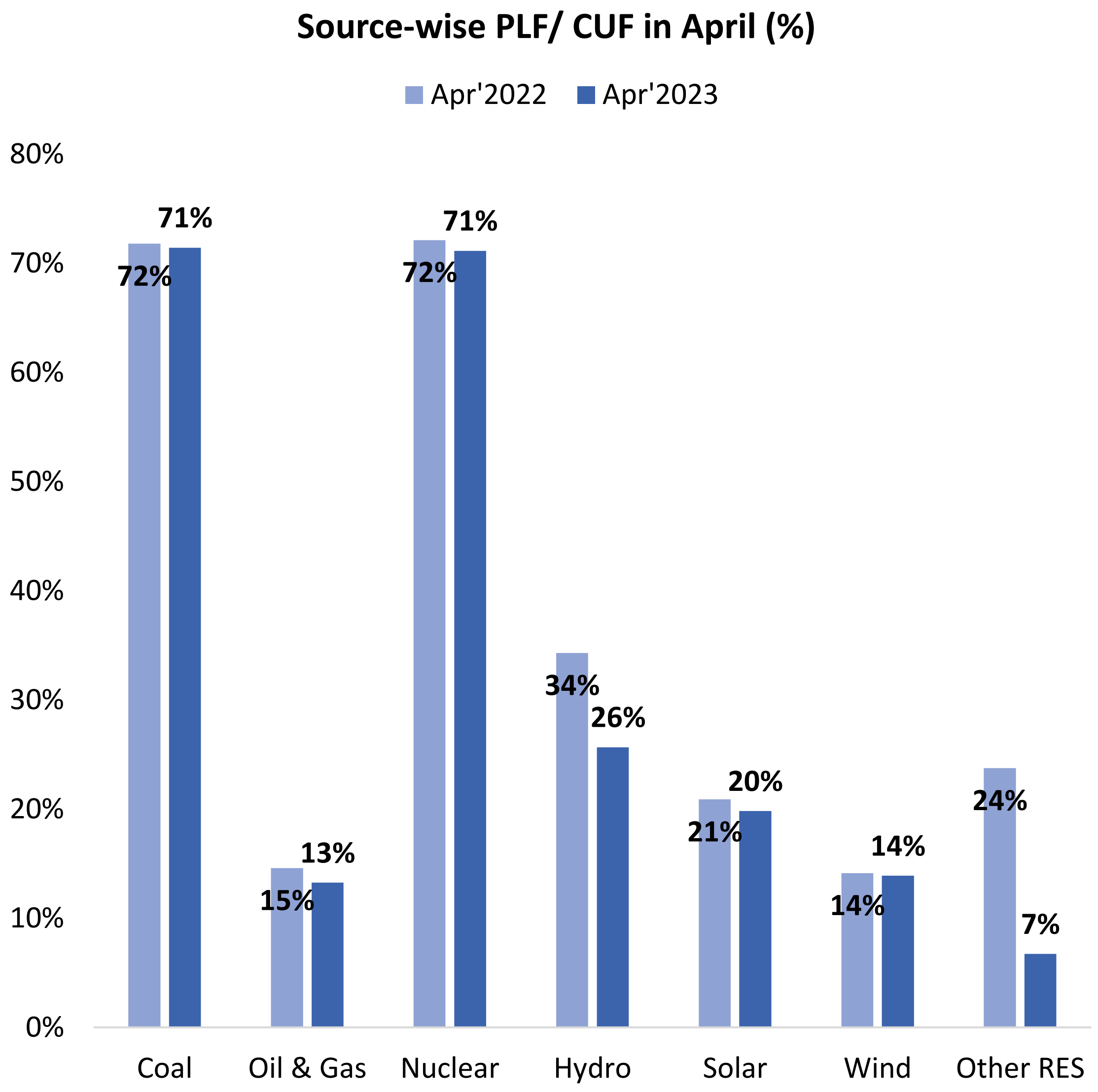
India's Electricity Generation Mix

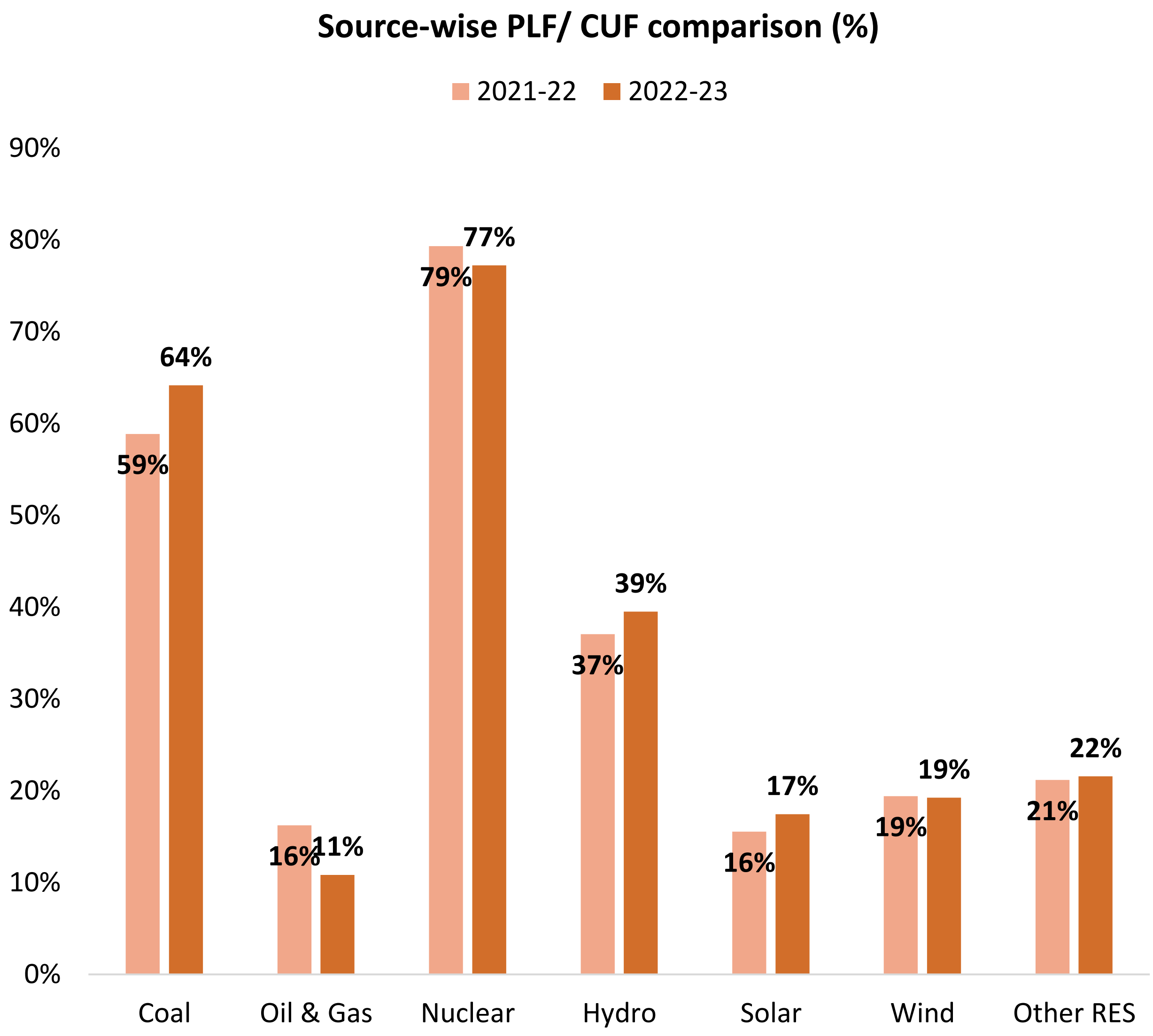


NOTE: The data is only up to April 2023 for the current year 2023-24. The generation data for Apr'2023 is provisional.

Source: CEA

Source-wise PLF/CUF

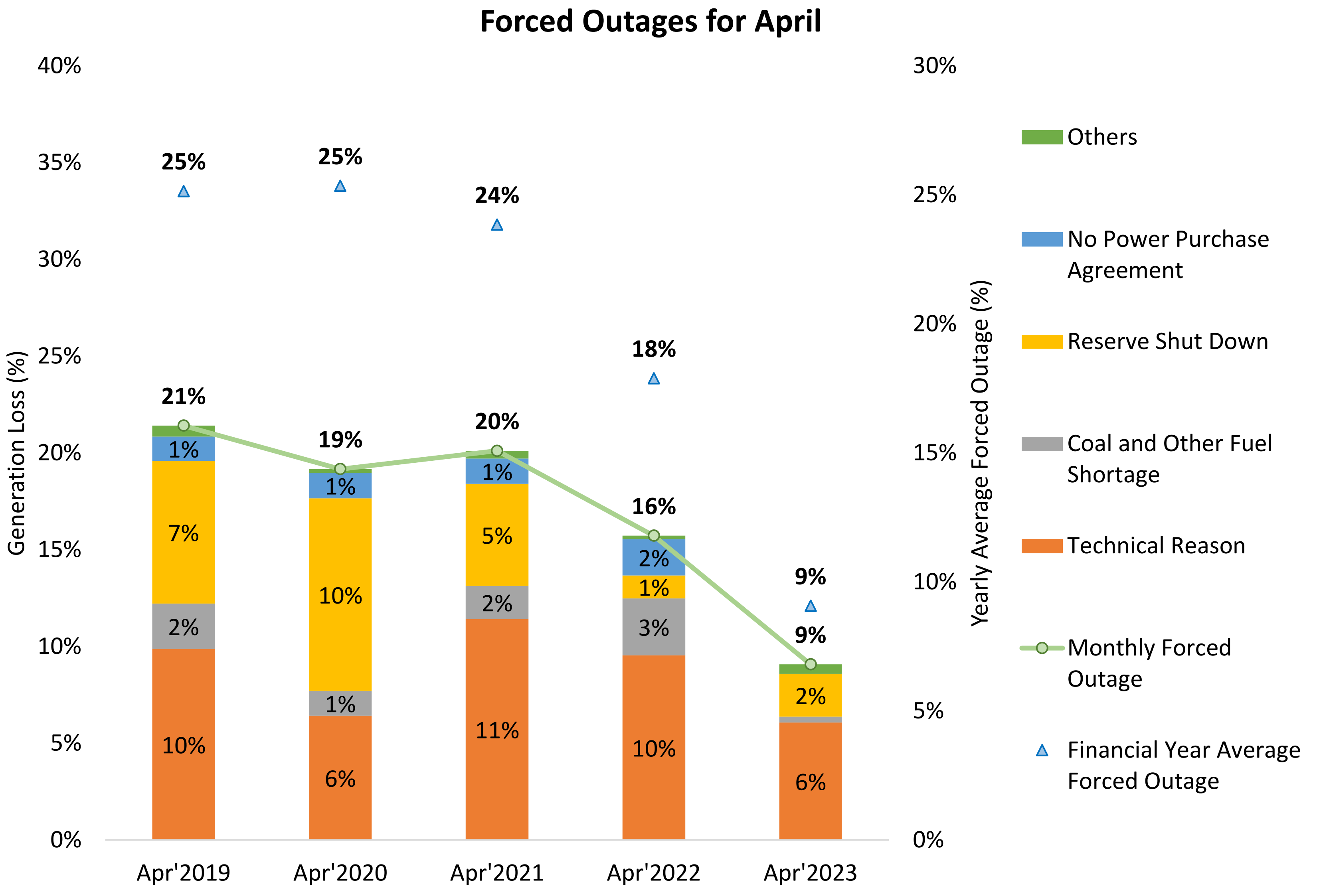




NOTE: The PLF/CUF data is based on provisional generation for Apr’2023.

Source: CEA & MNRE

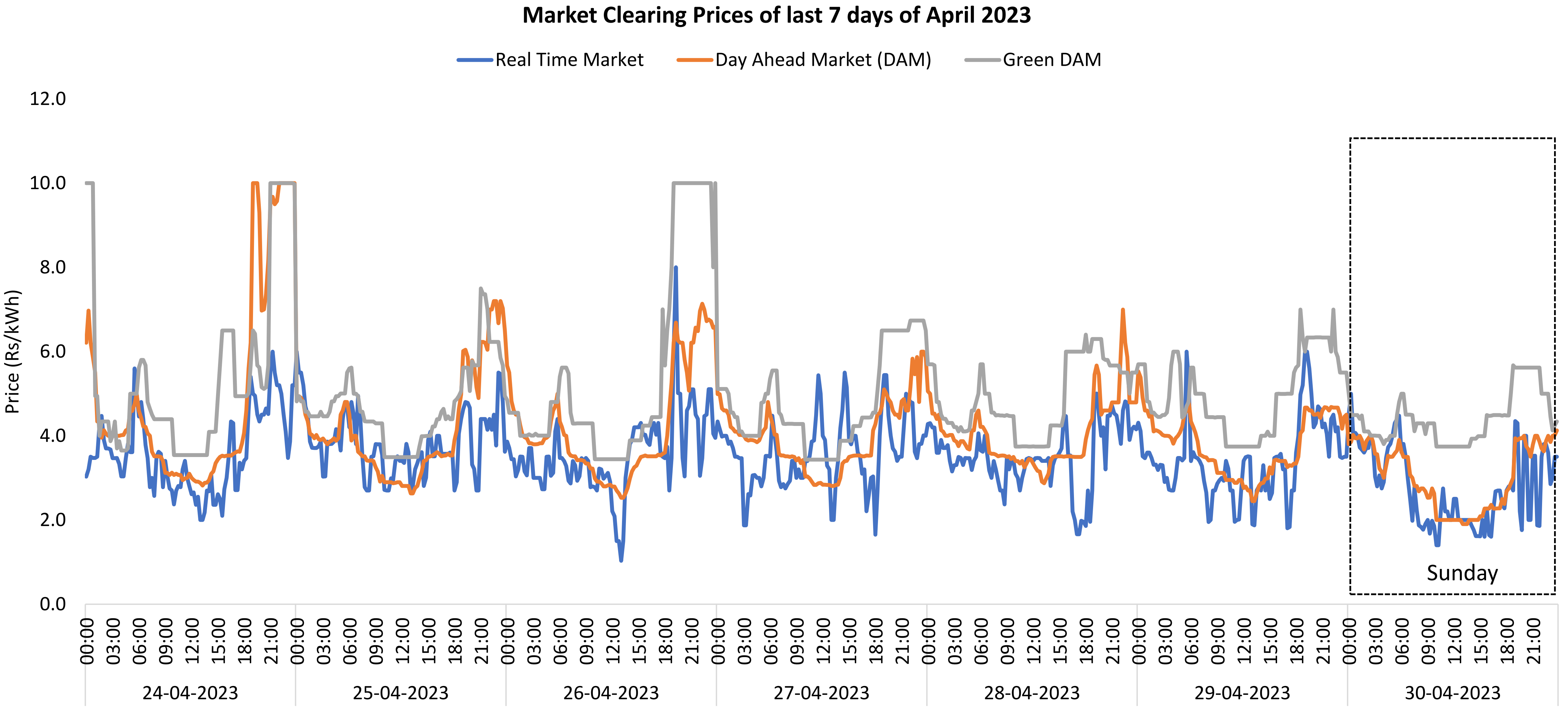
Thermal Generation Loss and Reasons for Forced Outages



Year/ Month		Average Forced Outage Share
Yearly	FY 2021-22	24%
	FY 2022-23	18%
	FY 2023-24	9%
Monthly	Apr’2021	20%
	Apr’2022	16%
	Apr’2023	9%

Thermal includes only Coal and Lignite Plants.

Indian Electricity Exchange (IEX) Market Snapshot

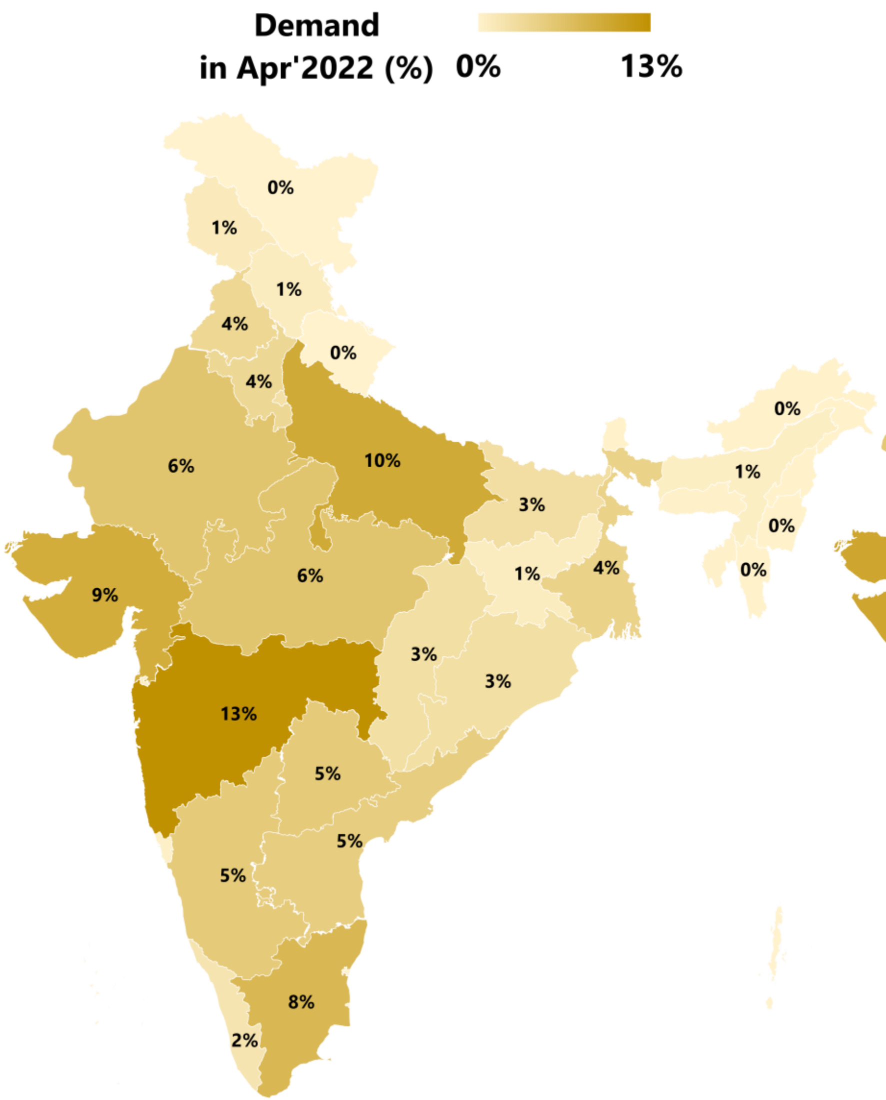


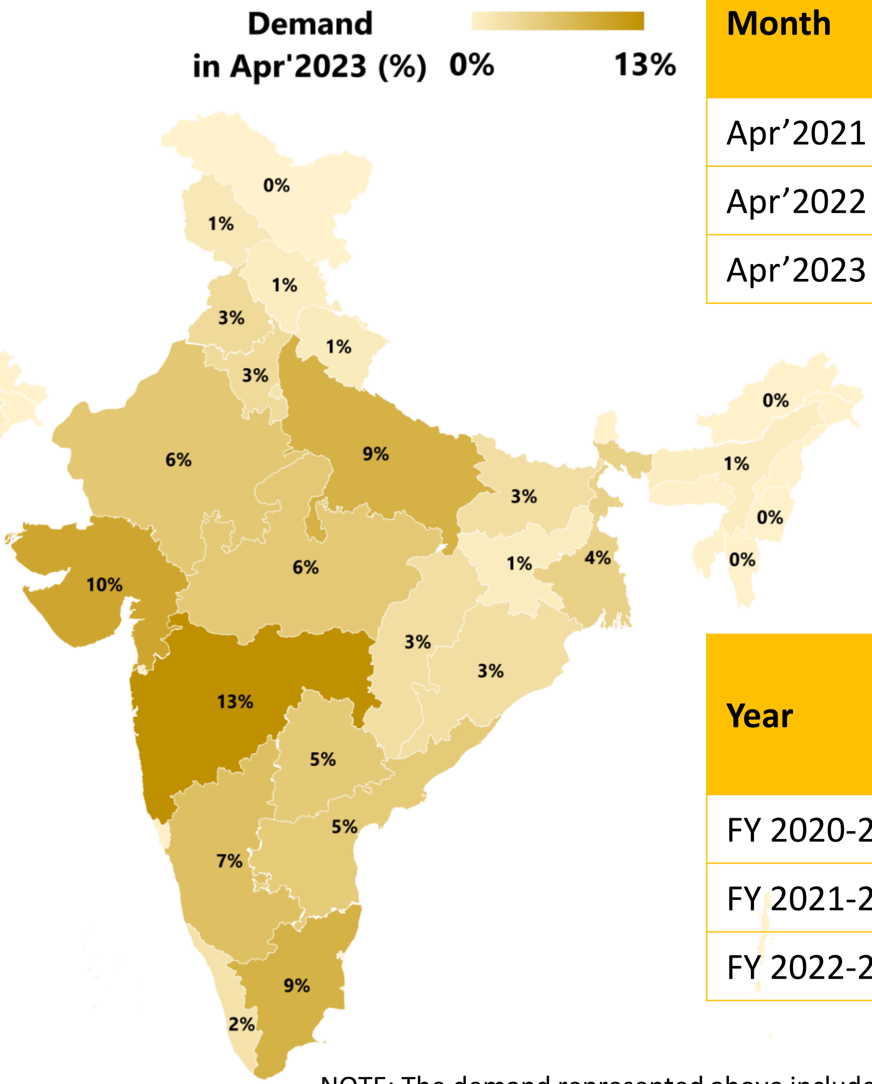
CERC has imposed a cap of Rs 12/kWh on the power exchange rate.

Source: IEX

National and State level Electricity Demand

State-level Electricity Demand as a percent of National Demand (%)





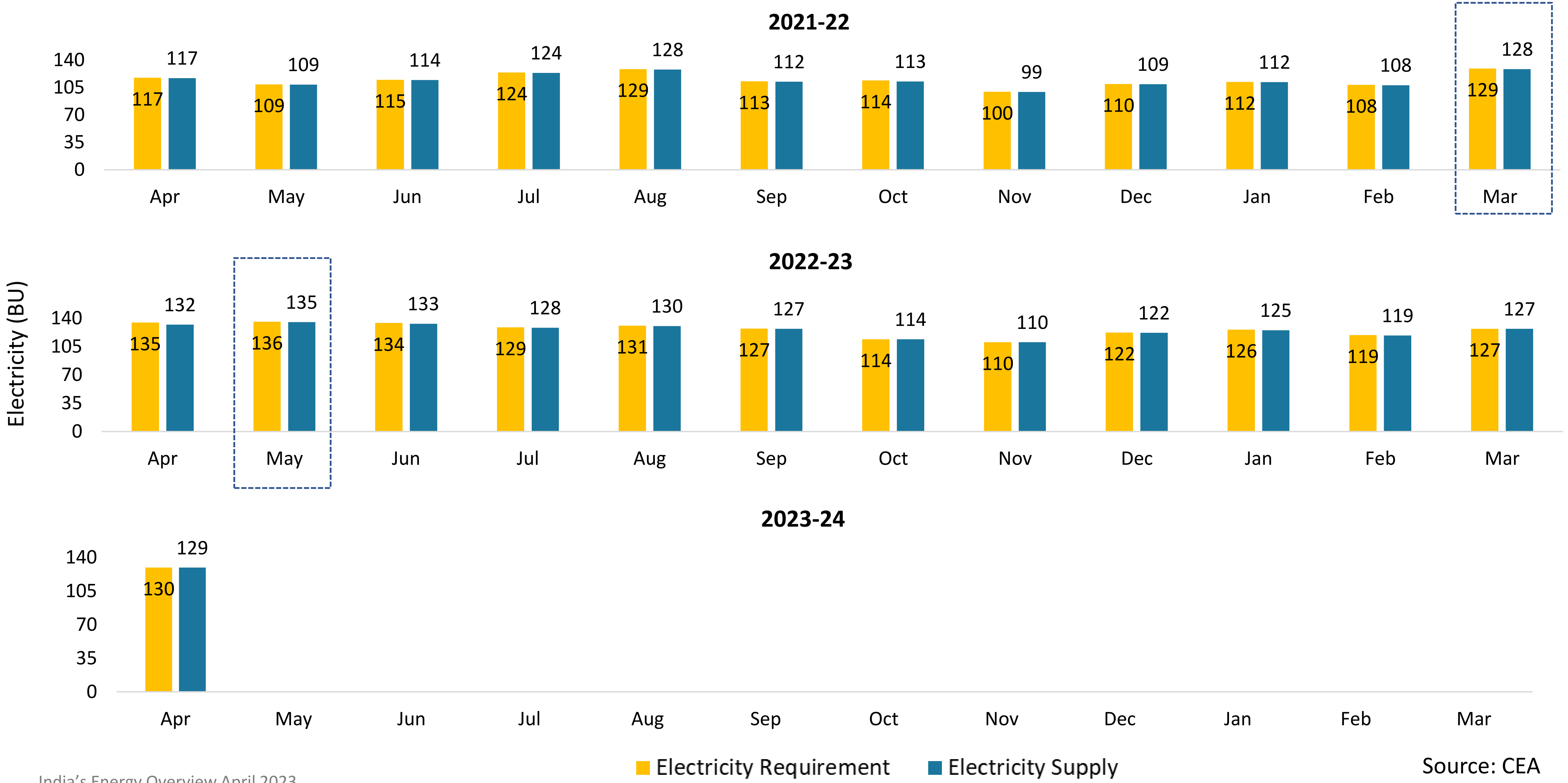
Month	Electricity Demand (BU)	Electricity Supply (BU)	Gap (BU) (+/-)
Apr'2021	117	117	0.4
Apr'2022	135	132	3
Apr'2023	130	129	0.3

Year	Electricity Demand (BU)	Electricity Supply (BU)	Gap (BU) (+/-)
FY 2020-21	1276	1271	5
FY 2021-22	1380	1374	6
FY 2022-23	1512	1504	8

NOTE: The demand represented above includes intra state T&D losses.

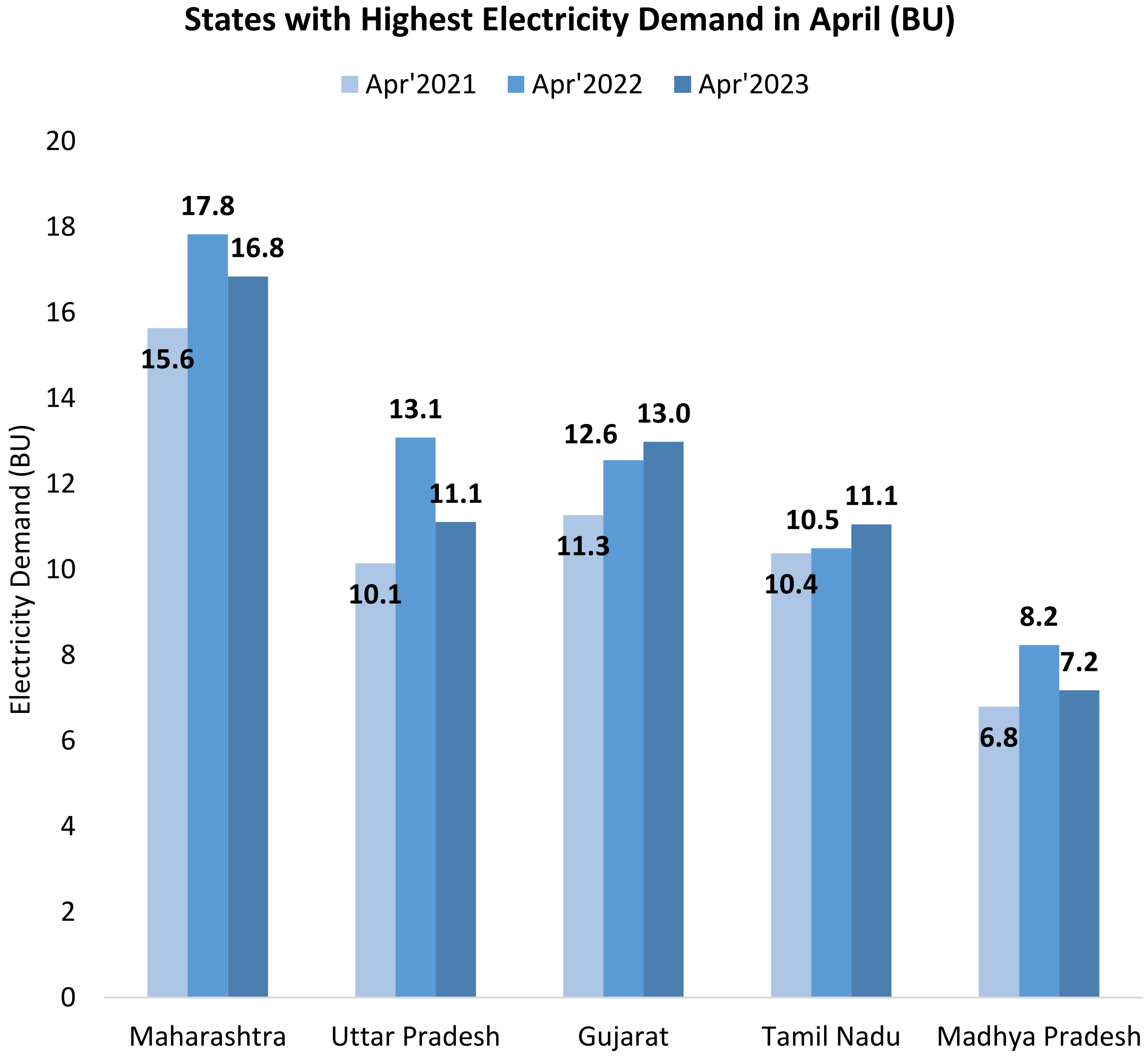
Source: CEA

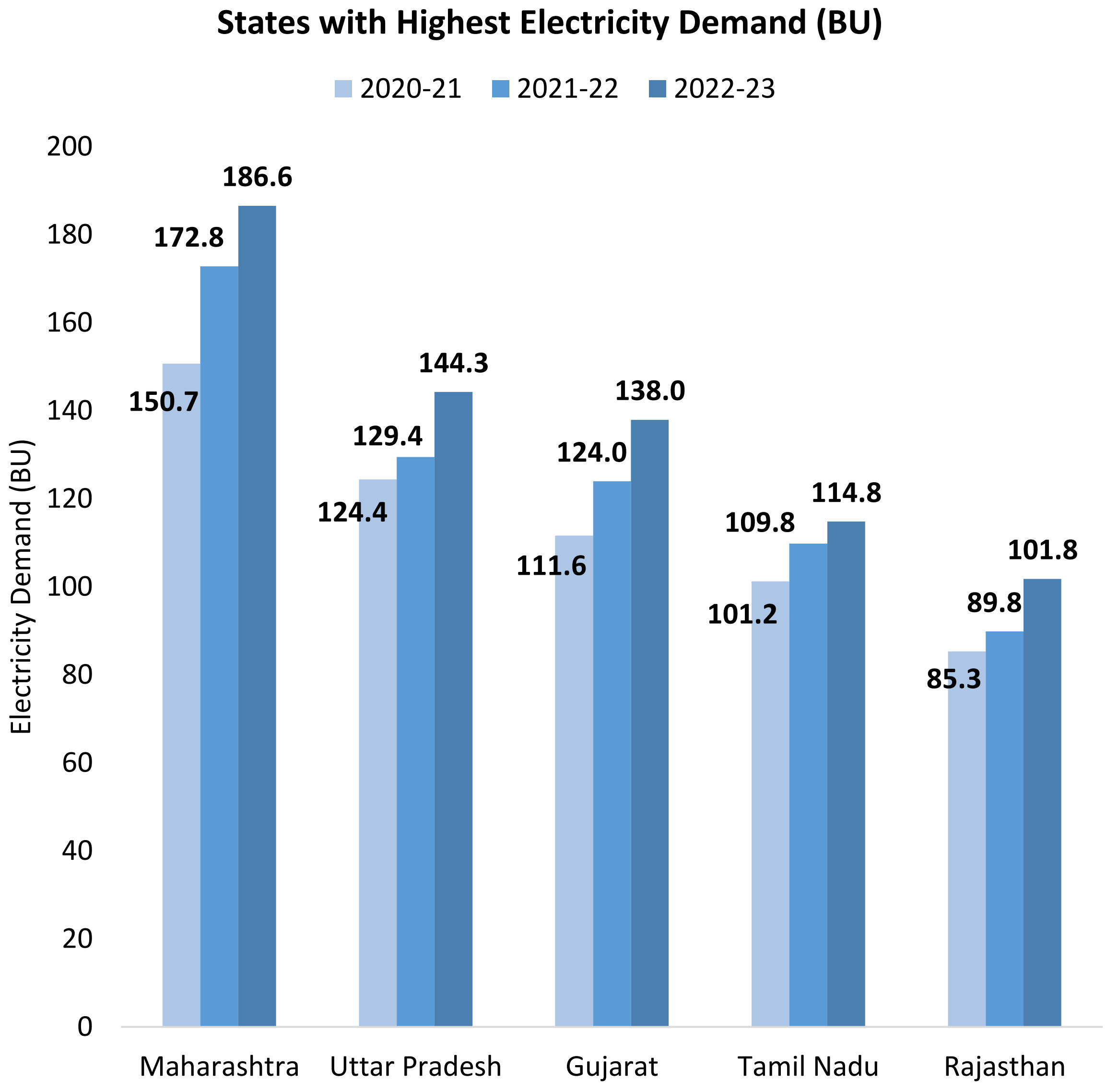
India’s Monthly Electricity Requirement and Supply



Source: CEA

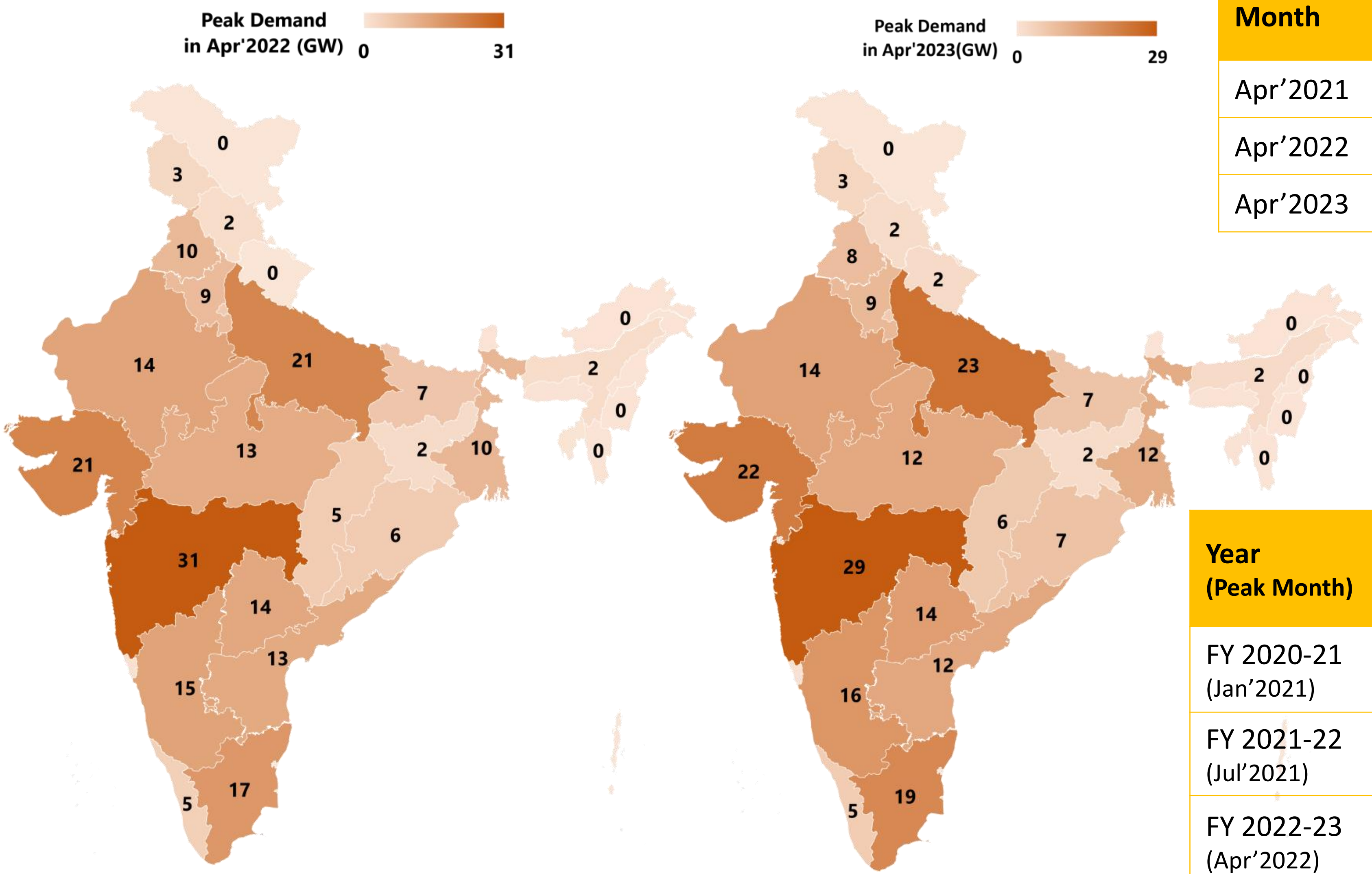
Monthly Electricity Demand of the top 5 states





National and State level Peak Electricity Demand

State-level Peak Electricity Demand (GW)

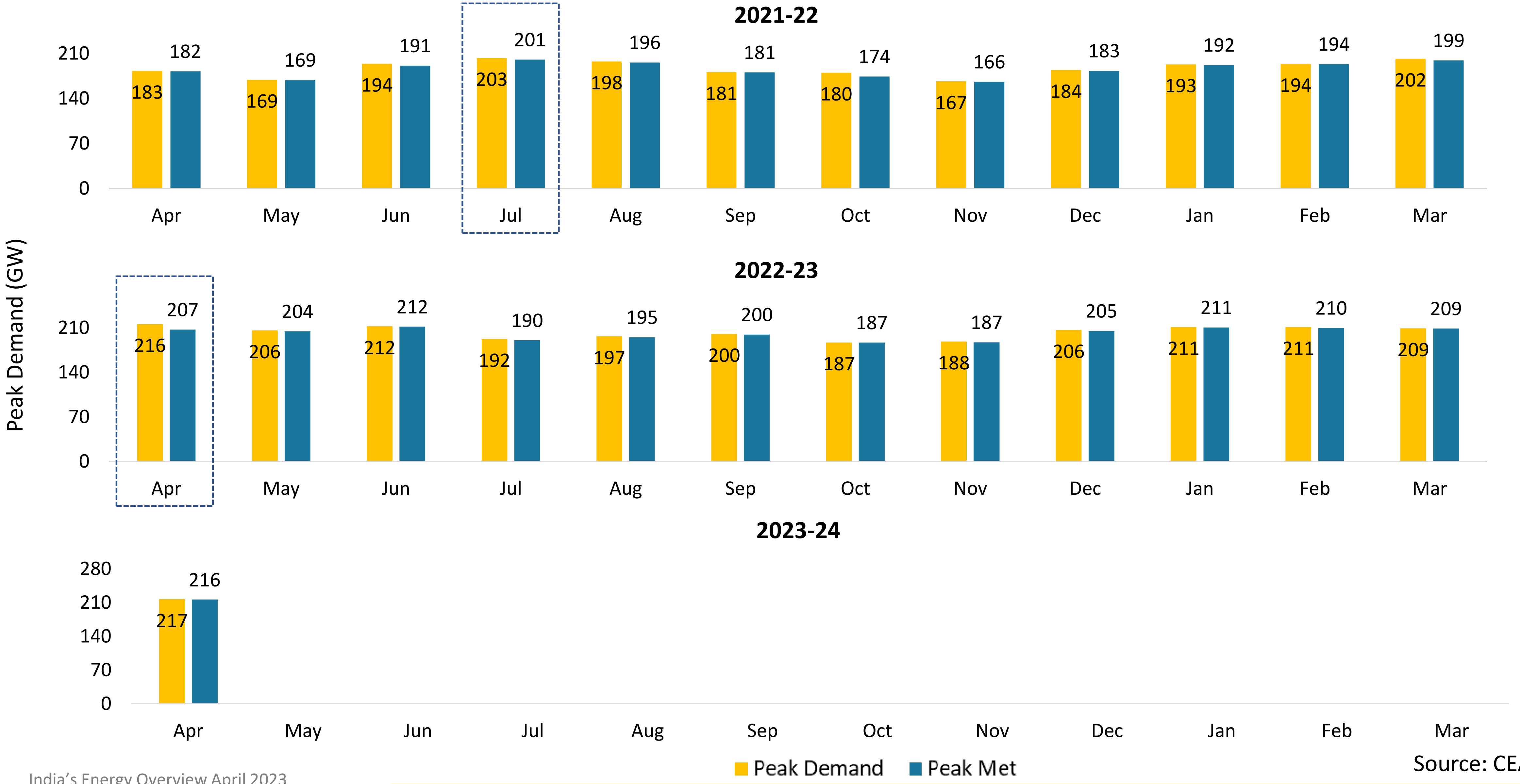


Month	Peak Demand (GW)	Peak Supply (GW)	Gap(BU) (+/-)
Apr’2021	183	182	1
Apr’2022	216	207	9
Apr’2023	217	216	1

Year (Peak Month)	Peak Demand (GW)	Peak Supply (GW)	Gap (BU) (+/-)
FY 2020-21 (Jan’2021)	190	189	1
FY 2021-22 (Jul’2021)	203	201	2
FY 2022-23 (Apr’2022)	216	207	9

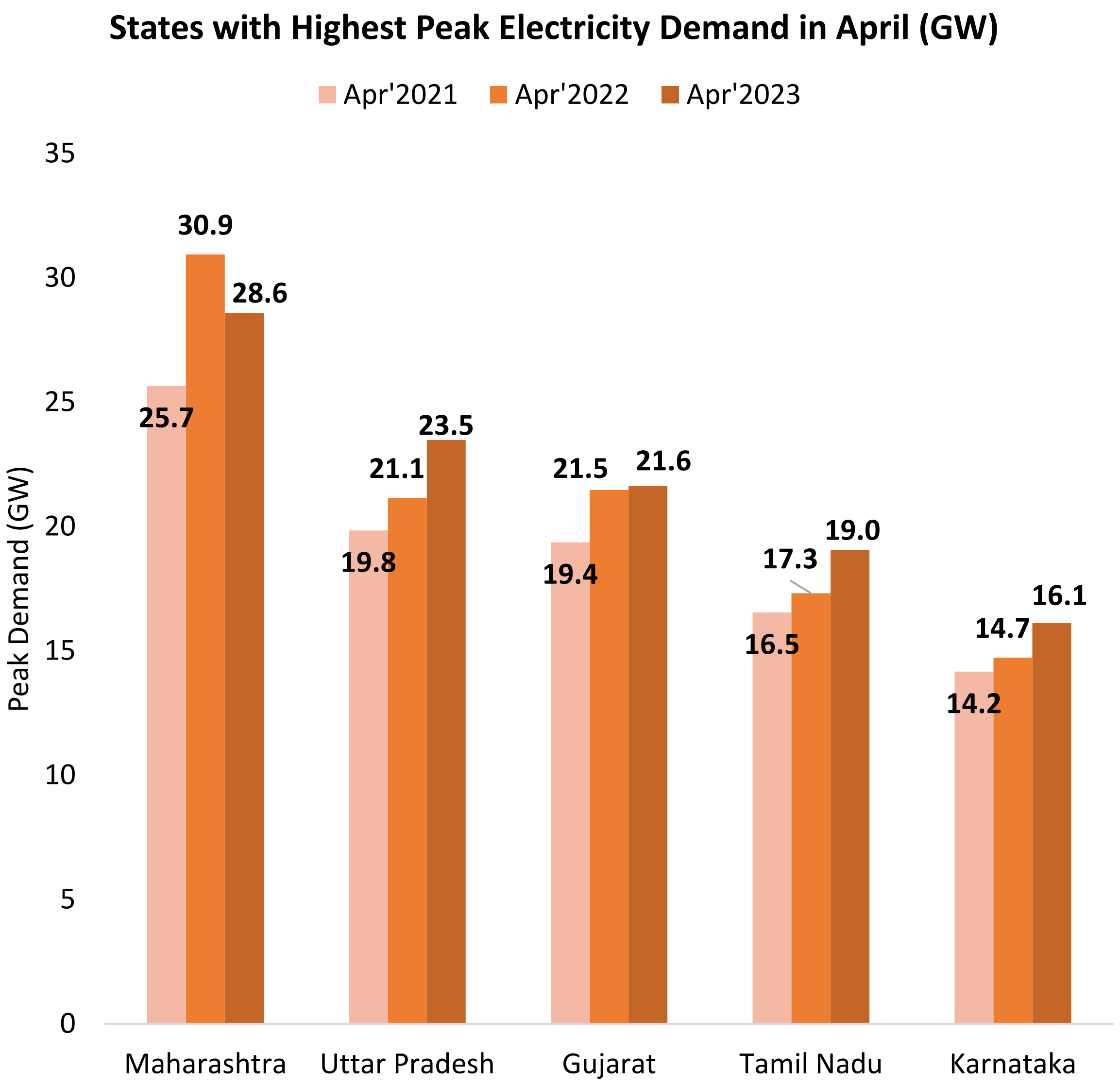
Source: CEA

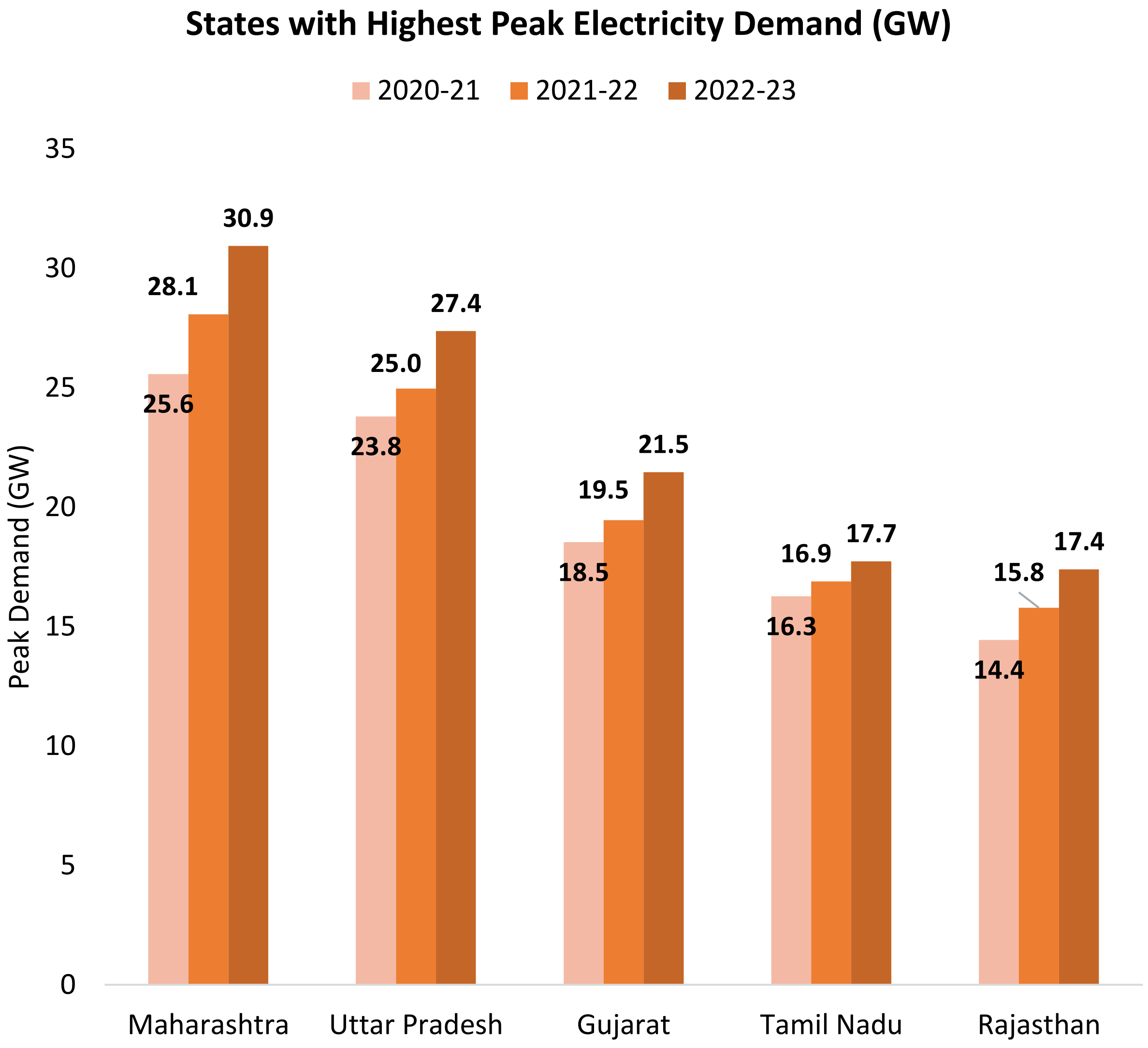
India's Monthly Peak Electricity Demand and Supply



Source: CEA

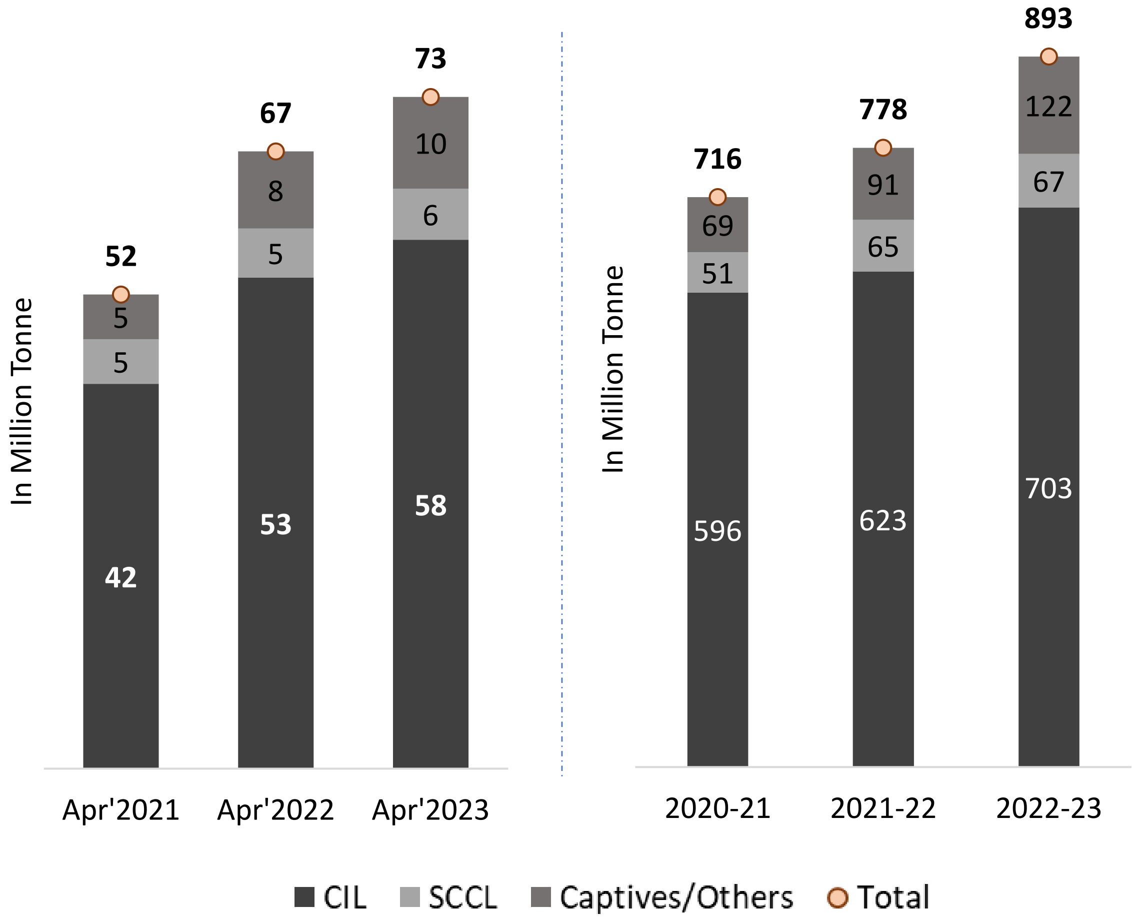
Monthly Peak Electricity Demand of the top 5 states





Monthly Coal Statistics

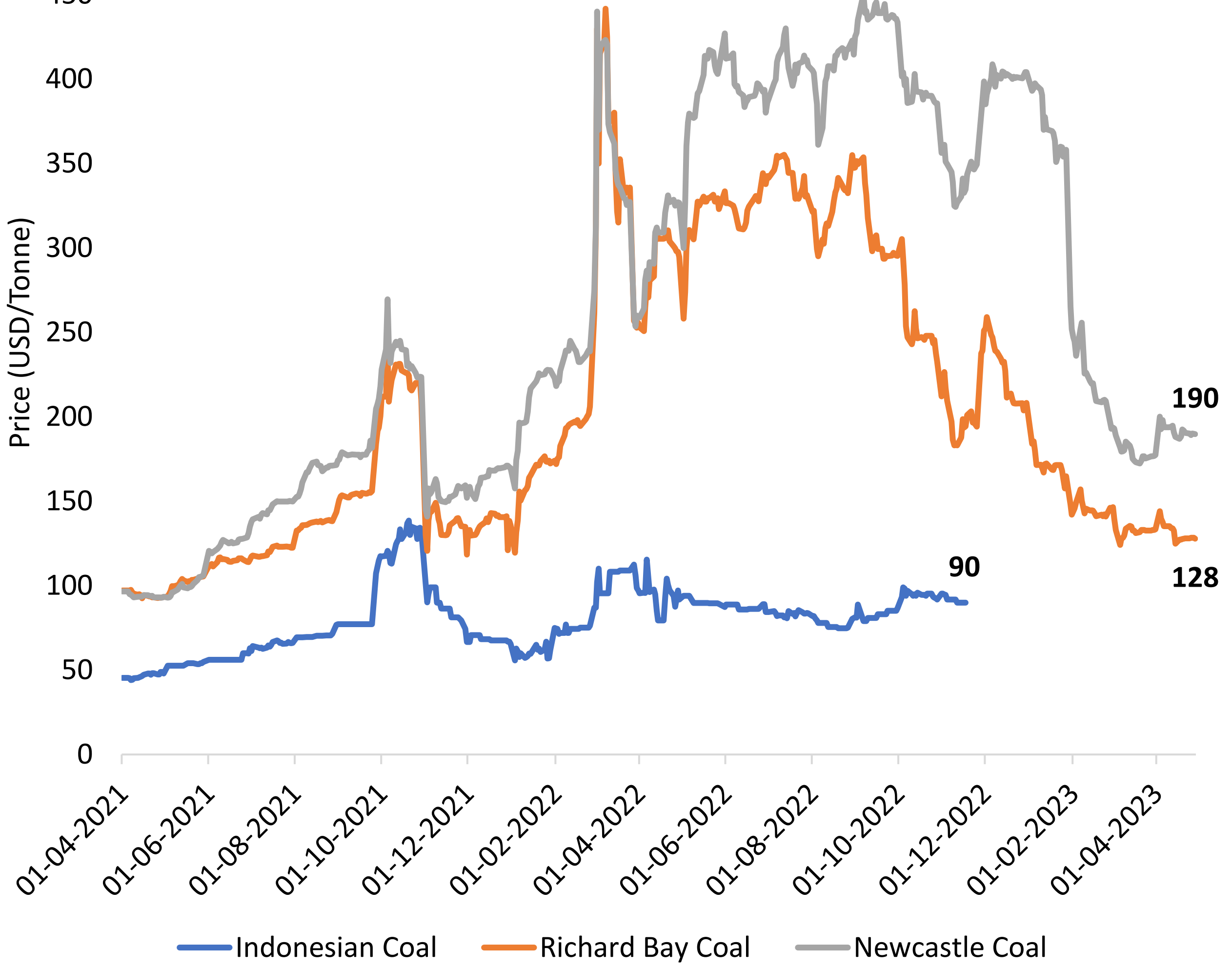
Monthly/ Annual Coal Production (in Million Tonnes)



India's coal production increased in Apr'2023 (73 MT) by 9% as compared to Apr'2022.

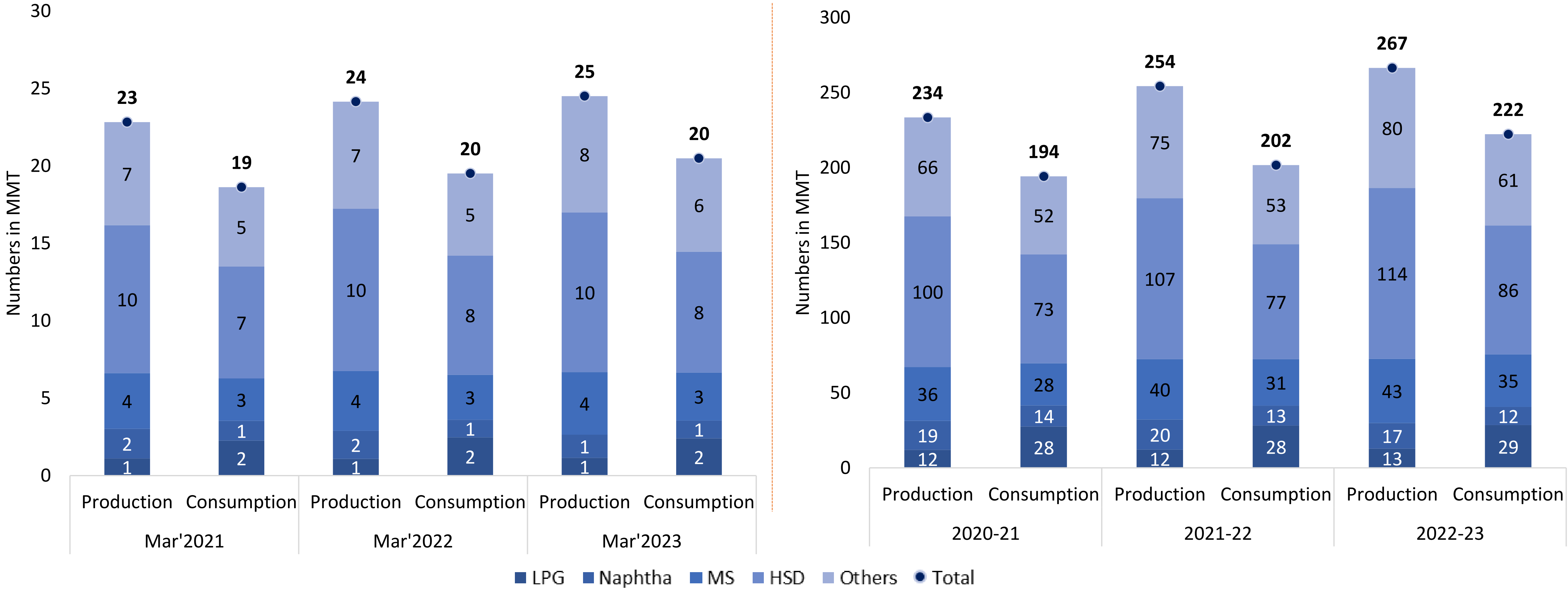
International Coal Prices

Date	Richard Bay	Newcastle
28-Apr-2023	128	190



Petroleum Products Market Scenario (1/3)

Petroleum Product-wise Production & Consumption (MMT)



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

NOTE: The data is available latest up to Mar’2023.

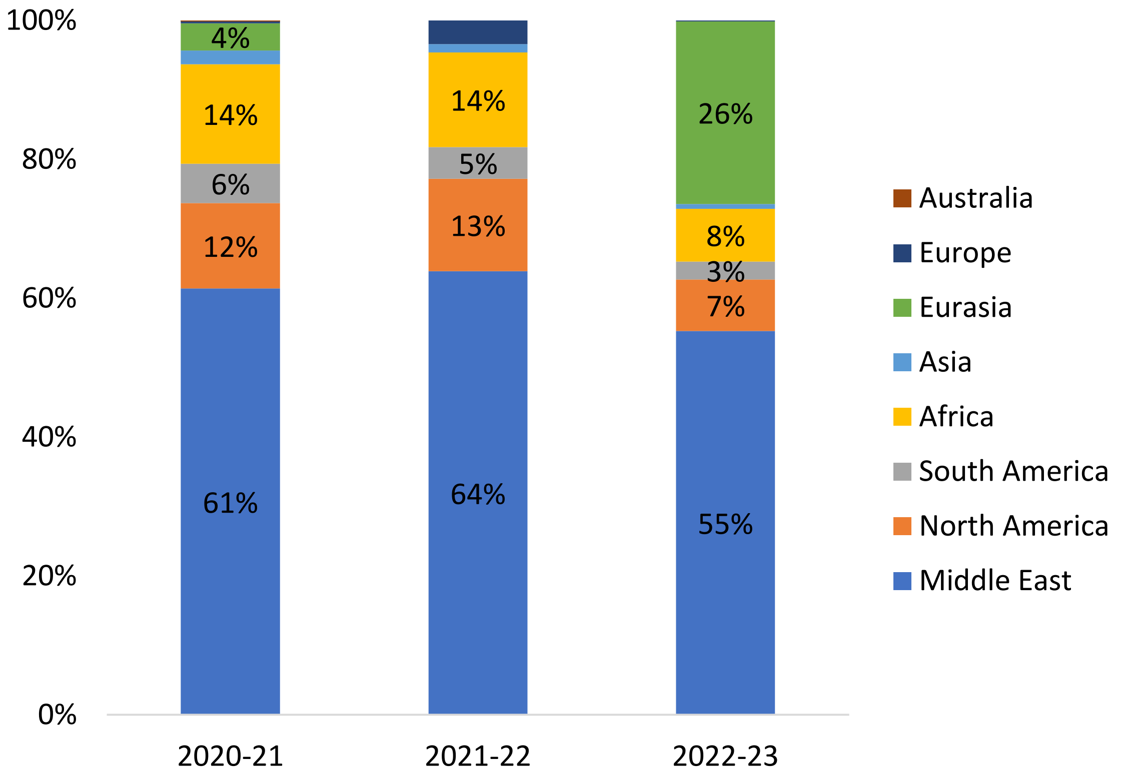
Petroleum Products Market Scenario (2/3)

Import/Export of Crude Oil and Petroleum Products ('000 Tonnes)							
Petroleum Products	**Import/ Export**	**Monthly**			**Yearly**		
		Mar'2021	**Mar'2022**	**Mar'2023**	**2020-21**	**2021-22**	**2022-23**
Crude Oil	Import	18261	19031	20729	196461	212382	232561
	Export	0	0	0	0	0	0
	Net Import	**18261**	**19031**	**20729**	**196461**	**212382**	**232561**
LPG	Import	1355	1438	1410	16476	17043	18309
	Export	47	37	51	452	513	534
	Net Import	**1308**	**1401**	**1359**	**16024**	**16530**	**17775**
Diesel	Import	9	5	6	648	43	327
	Export	3069	3365	2482	30576	32407	28535
	Net Import	**-3060**	**-3360**	**-2476**	**-29928**	**-32364**	**-28208**
Petrol	Import	133	0	0	1351	671	1069
	Export	1290	1600	1470	11606	13482	13118
	Net Import	**-1157**	**-1600**	**-1470**	**-10255**	**-12812**	**-12049**
Others*	Import	2505	2227	2228	24772	21259	24129
	Export	1673	1741	2002	14135	16352	18853
	Net Import	**831**	**486**	**226**	**10637**	**4907**	**5276**

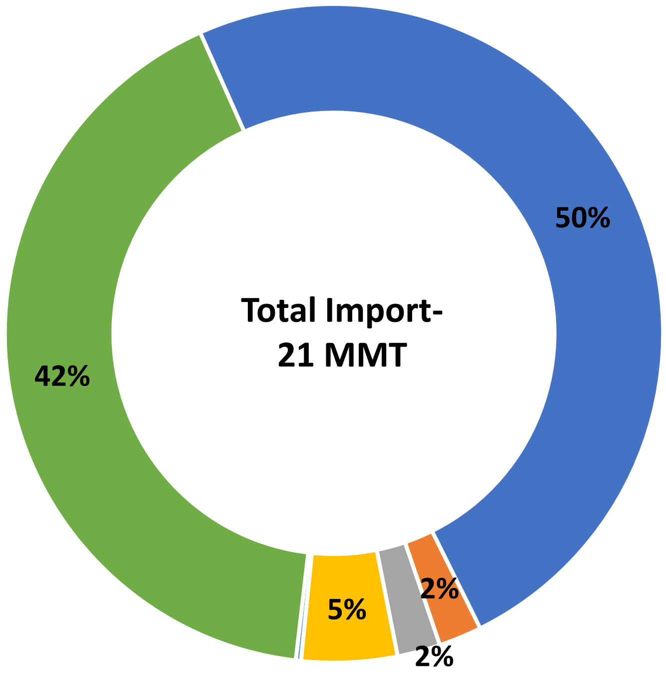
*Others include ATF, Naphtha, SKO, LDO, Lubes, FO, LSHS, Bitumen, pet coke, and others.

Petroleum Products Market Scenario (3/3)

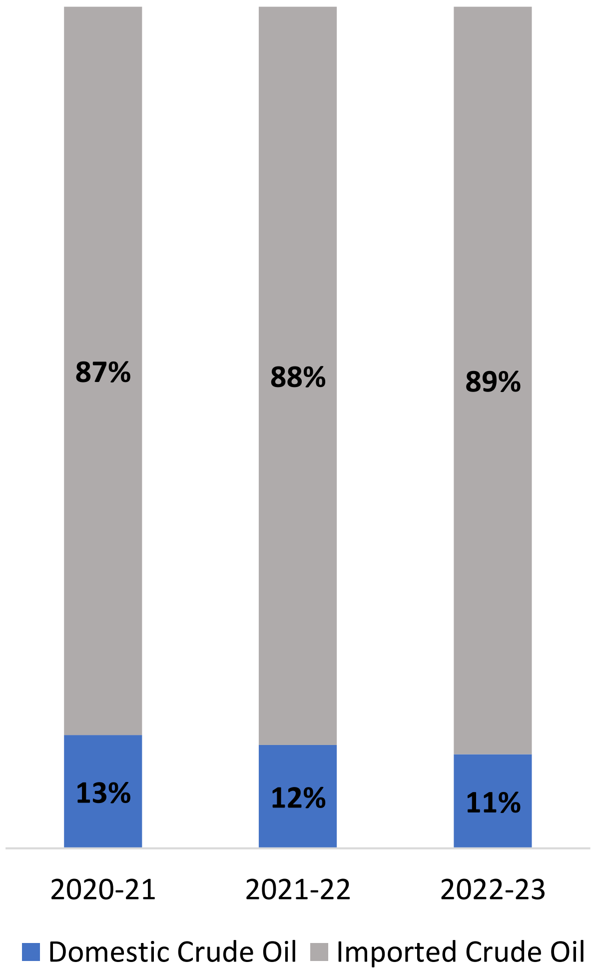
Region-wise Share in Import of Crude Oil (%)



Regional share of Imported Crude oil in Mar'2023*



Domestic and Imported Crude Oil share in India (%)



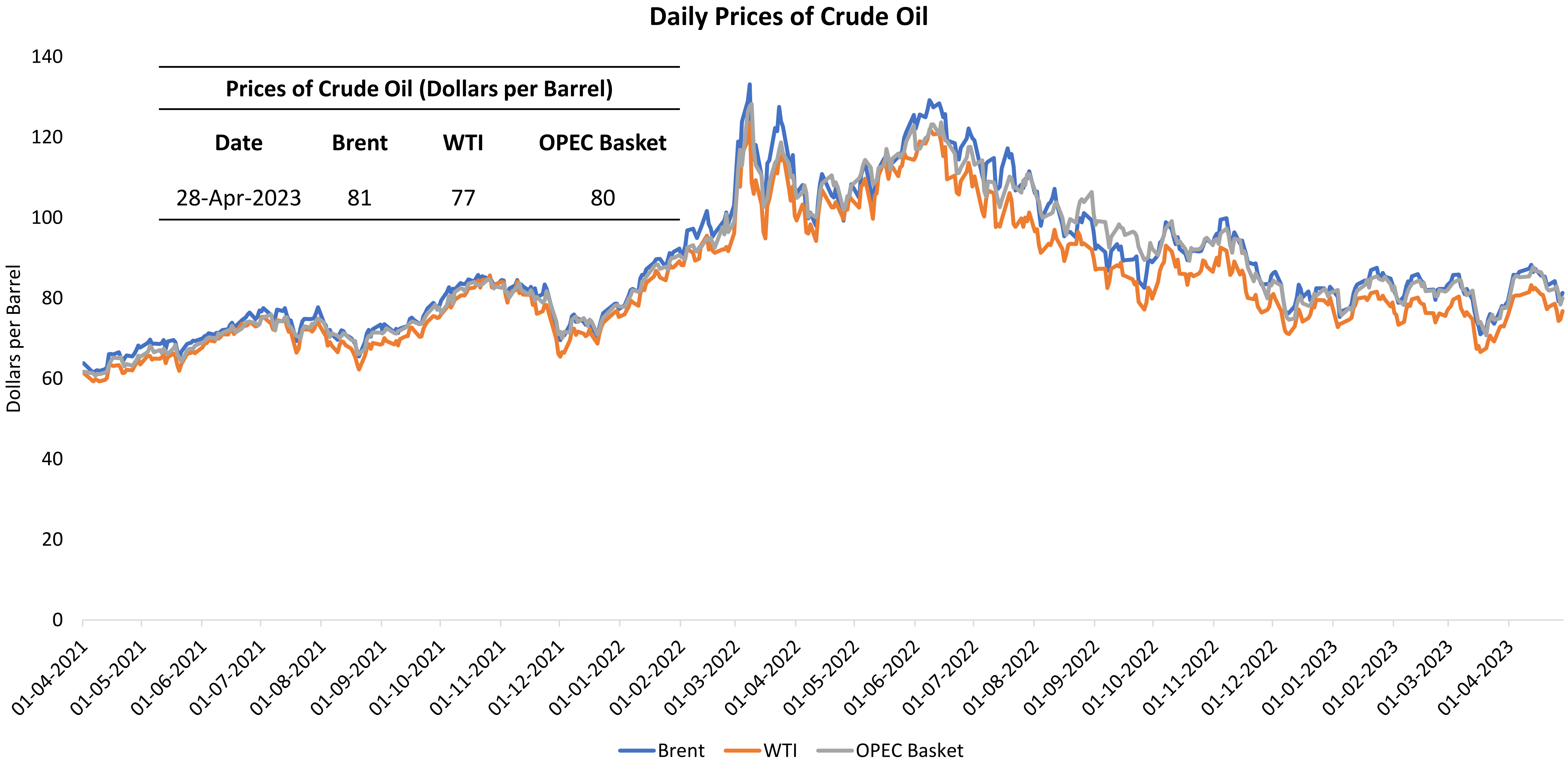
Total Import of Crude Oil (MMT)

Total Import	2020-21	2021-22	2022-23
Crude Oil	**196**	**212**	**233**

*Provisional

Source: MoPNG and PPAC

Daily Prices of Crude Oil

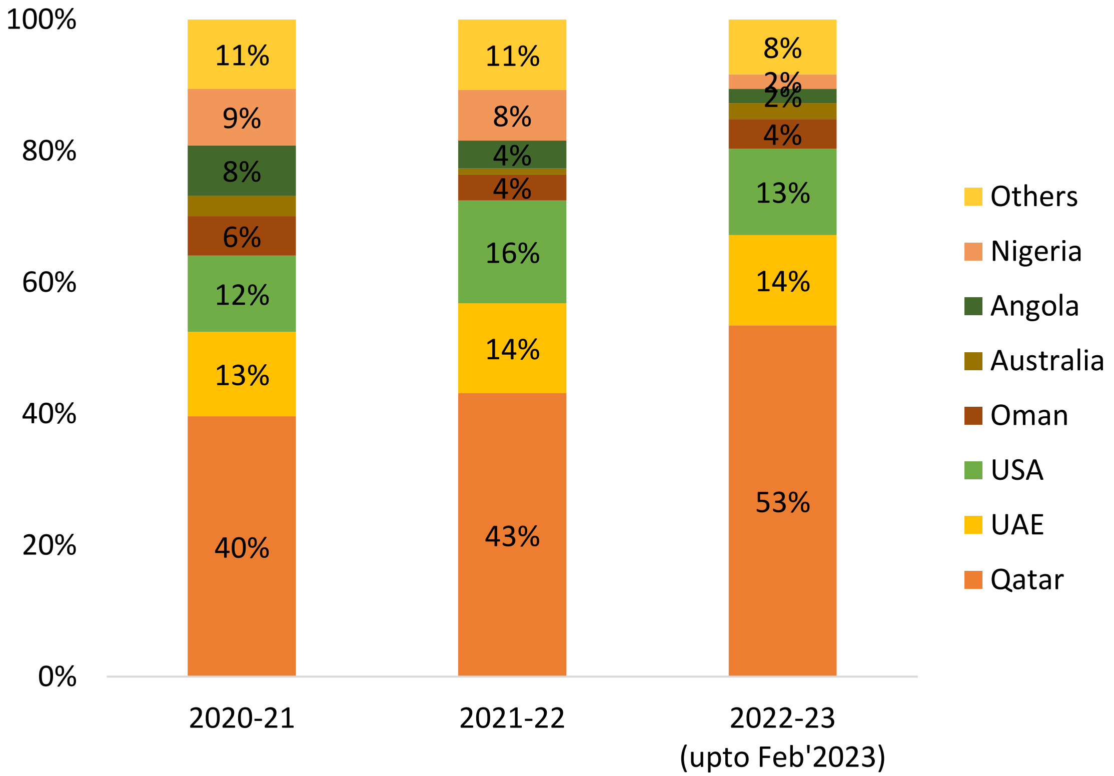


Prices of Crude Oil (Dollars per Barrel)

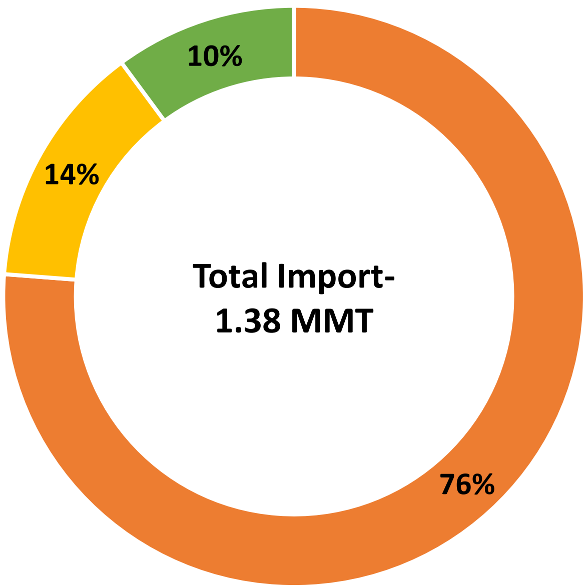
Date	Brent	WTI	OPEC Basket
28-Apr-2023	81	77	80

Gas Market Scenario

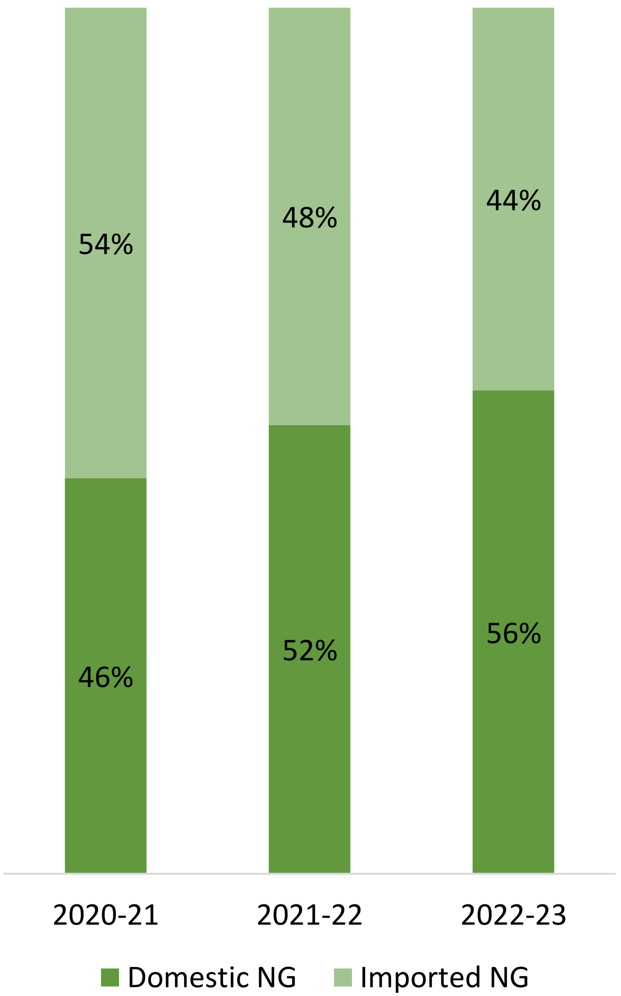
Region-wise Share in Import of LNG (%)



Country share of Imported LNG in Feb'2023*



Domestic and Imported Natural Gas share in India (%)



Others include- Equatorial Guinea, Trinidad, Cameroon, Egypt, France, Algeria, Belgium, Indonesia, Turkey, Russia, Spain, Malaysia, Brunei, Netherlands, Norway, and others.

Total Import of Liquified Natural Gas (LNG) (MMT)

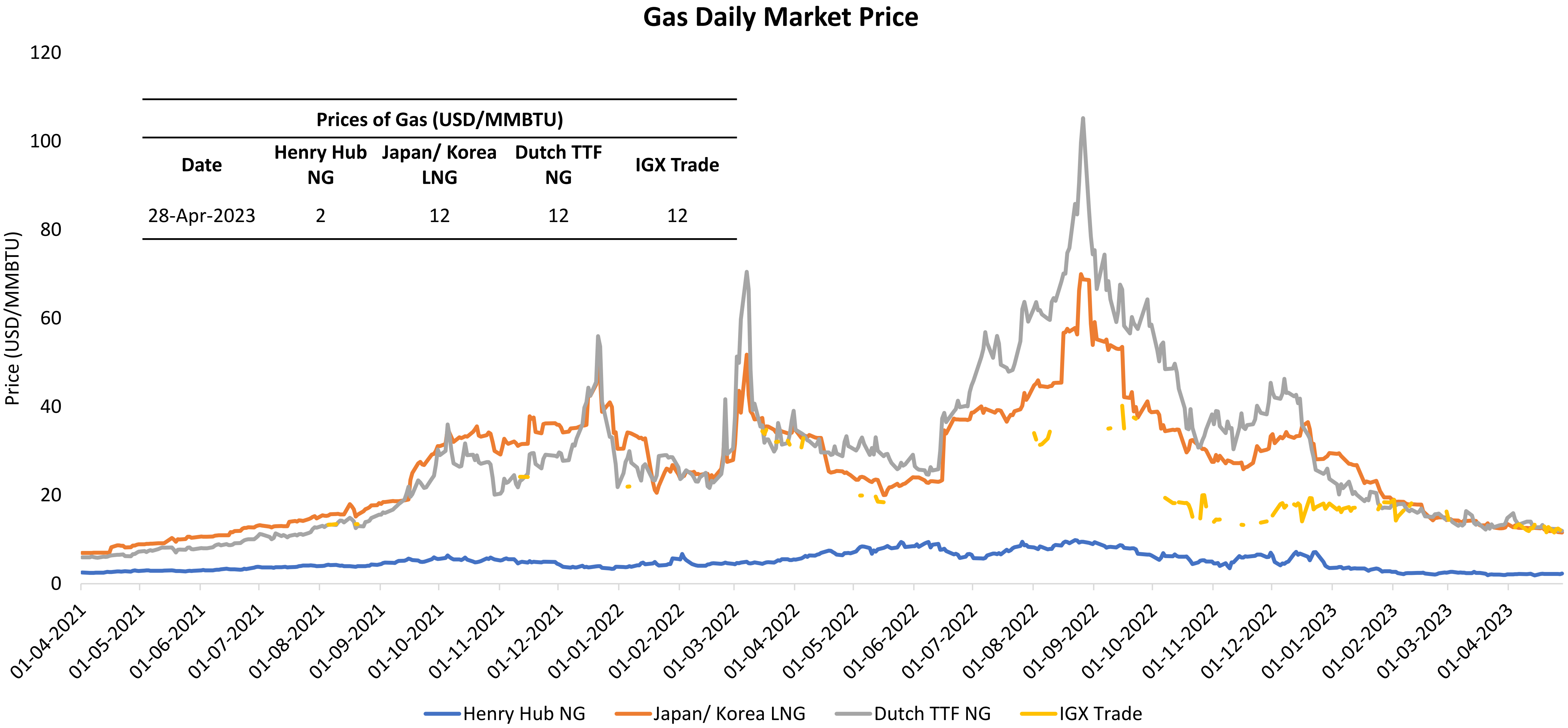
Total Import	2020-21	2021-22	2022-23
LNG	**25.05**	**23.42**	**20.11**

*Provisional

Source: MoCI and PPAC

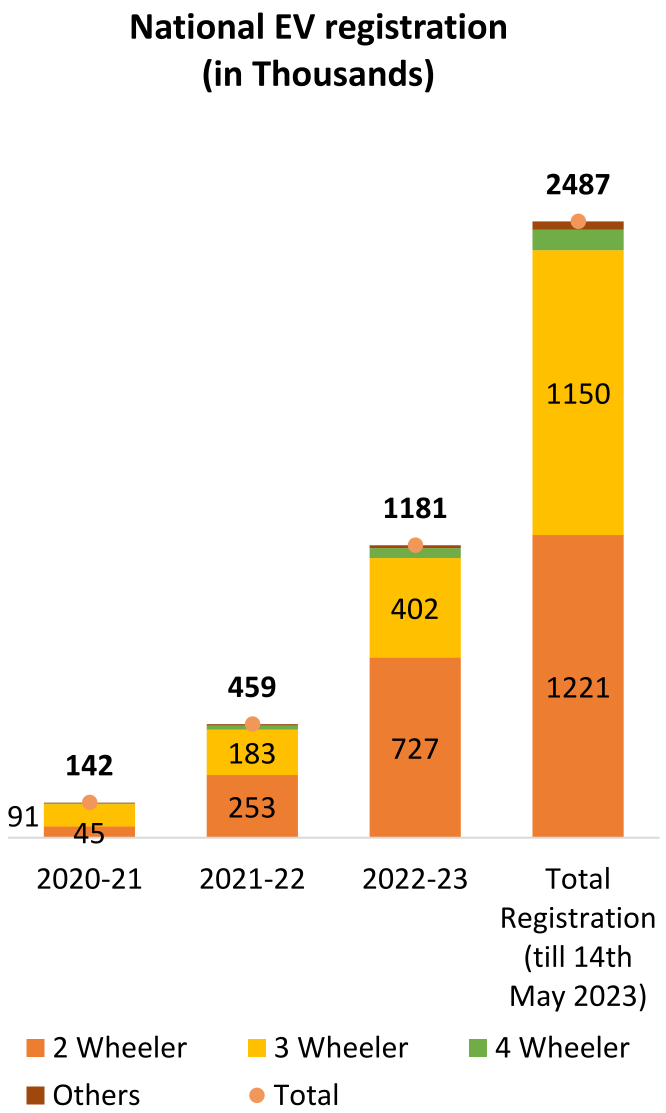
Daily Prices of Gas

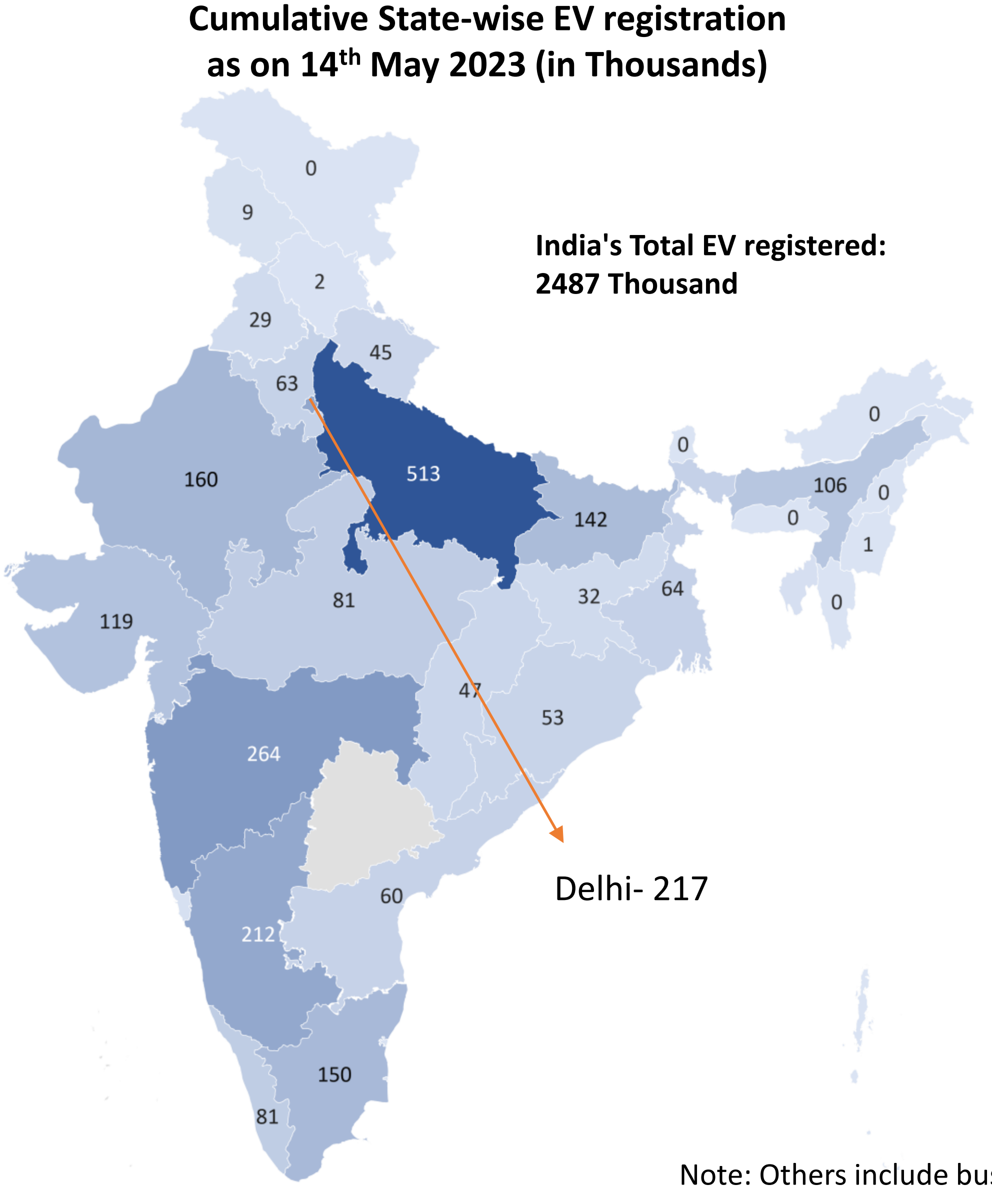
Prices of Gas (USD/MMBTU)				
Date	Henry Hub NG	Japan/ Korea LNG	Dutch TTF NG	IGX Trade
28-Apr-2023	2	12	12	12

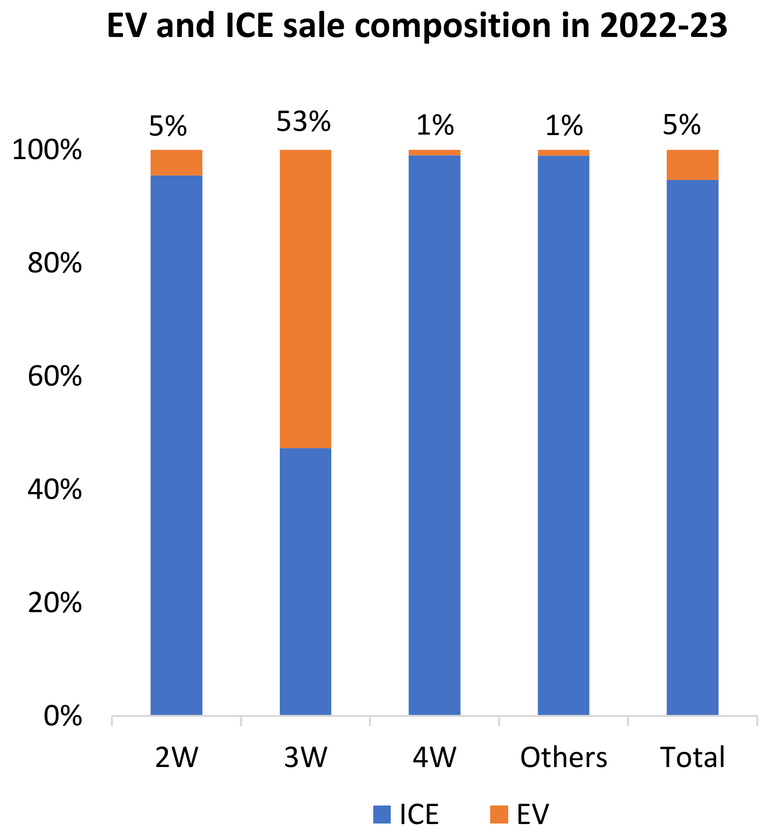


MMBTU- Million Metric British Thermal Unit

Status of Electric Mobility in India







Vehicle Registered in FY 2022-23 (in Thousands)

Fuel Type	2W	3W	4W	Others	Total
EV	727	402	40	12	**1,181**
ICE	15,285	361	4,219	1,179	**21,044**

Note: Others include bus, truck and others

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.

Approved List of Models and Manufacturers abeyance till 31 March 2024.
MNRE has reduced the application fee by 80% and the inspection fee by 70%.

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.

The GoI has decided to invite bids for 50 GW of RE annually, which includes up to 10 GW of wind capacity.

Energy Storage

Ministry of Power has released the guidelines for the development of PSP with the target of 26.7 GW of PSP and 47.2 GW of BESS to integrate with RE capacity till 2032.

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.

Indian Railways to run 35 Hydrogen trains under "Hydrogen for Heritage" at an estimated cost of ₹ 80 crores per train and ground infrastructure of ₹ 70 crores per route on various heritage/hill routes.

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 April 2023

- Ministry of Power has released the "**draft Electricity (Amendment) Rules, 2023**" which proposes that:
  - The state commission will issue a quarterly report on the findings of subsidy demands, the actual payment of subsidies, and any gaps in the subsidy payments.
  - A framework for financial sustainability.

- Ministry of Power and Power Finance Corporation Limited released the "**11th Annual Integrated Rating and Ranking of Power Distribution Utilities**". The main highlights-
  - Aggregate subsidy disbursal was higher than the subsidy booked during the year.
  - AT&C losses improved to 16.5% in FY22, almost 5% lower than the losses in FY21 and 3% lower than the losses in FY20.
  - 65 out of 71 utilities published new tariffs for FY23, compared to 58 utilities in FY22.
  - Days payable, while improving from 175 days in FY21 to 163 days in FY22, which can be reduced further.
  - Subsidy arrears stood at INR 66,000 crore at the end of FY22.
  - Out of 57 discoms only 10 discoms received the highest rating of A+ which included private utilities such as Adani Electricity Mumbai Limited, Noida Power Company Limited, Tata Power Limited – Mumbai; state-owned discoms of Gujarat (4), Haryana (2), and Dadar Nagar Haveli Power Distribution Corporation Limited.

Key Highlights or Announcements of April 2023

- Ministry of New and Renewable Energy has declared a plan to **add 50 GW of renewable energy capacity annually for the next 5 years** to achieve the target of 500 GW by 2030. These annual bids will also include setting up a wind power capacity of at least 10 GW per year. The government has also declared a quarterly plan of the bids for FY 2023-24, which comprises bids for at least 15 GW of renewable energy capacity in each of the first and second quarters of the financial year (April-June 2023 and July-September 2023 respectively), and at least 10 GW in each of the third and fourth quarters of the financial year (Oct-December 2023 and January-March 2024 respectively).

- Ministry of Power has issued a "**Scheme for Pooling of Tariff of those plants whose PPAs have expired**". The government will create a common pool of efficiently-operated coal and gas-based power plants operated by CPSUs, that have completed 25 years of operations and whose power purchase agreements (PPAs) have expired. This scheme will be implemented from 1st July 2023 to ensure resource adequacy, conserve capex, and capacity utilization.

- The government has provided **bulk approval for the installation of ten nuclear reactors** (each of 700 MW). These reactors are planned to be set up in 'fleet mode' progressively by the year 2031 for Rs 1,05,000 crores.

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