India’s Energy Overview

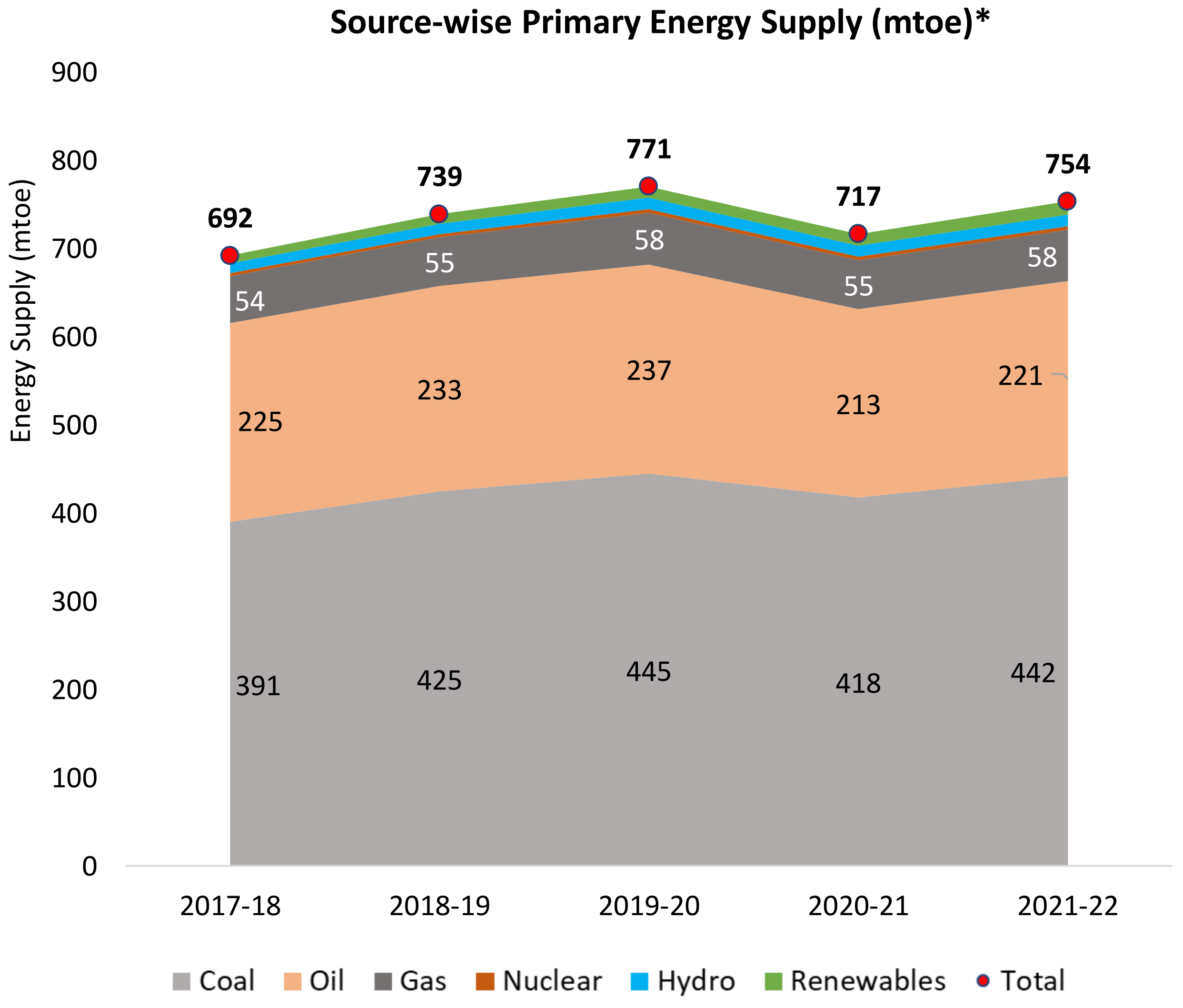
September 2023

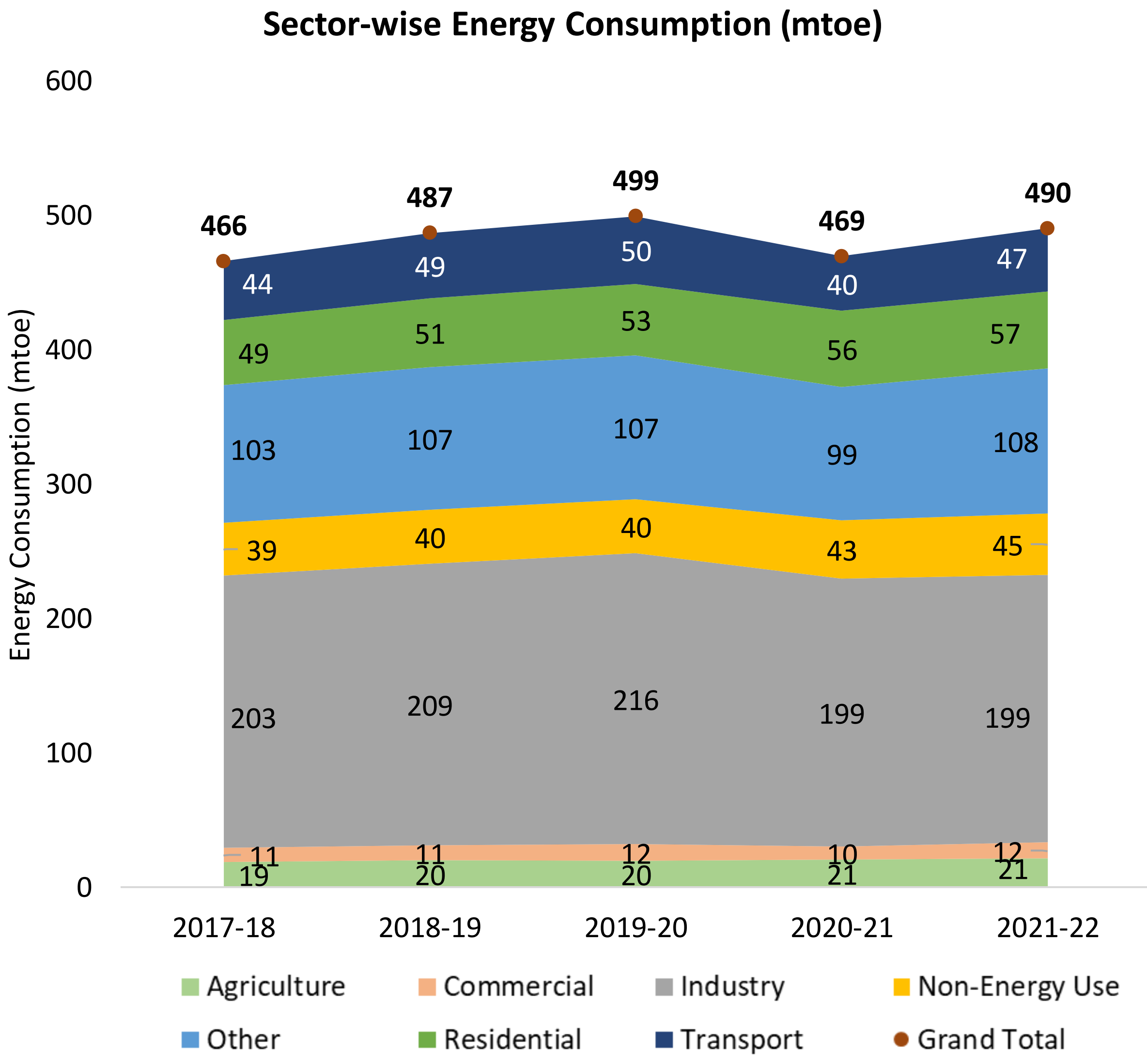
VASUDHA FOUNDATION

Green ways for a good earth!

Contents

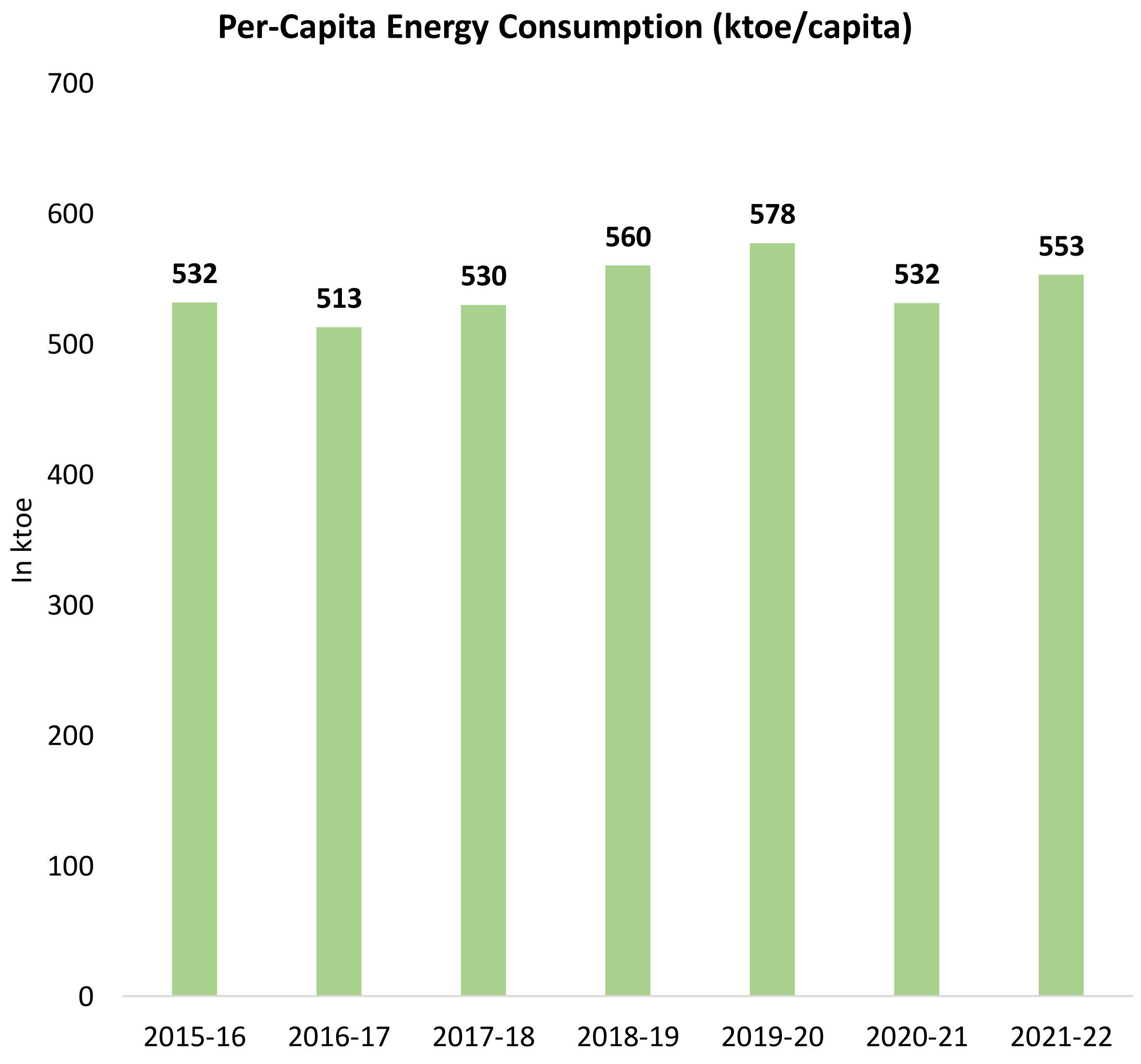
Primary Energy Mix* in India

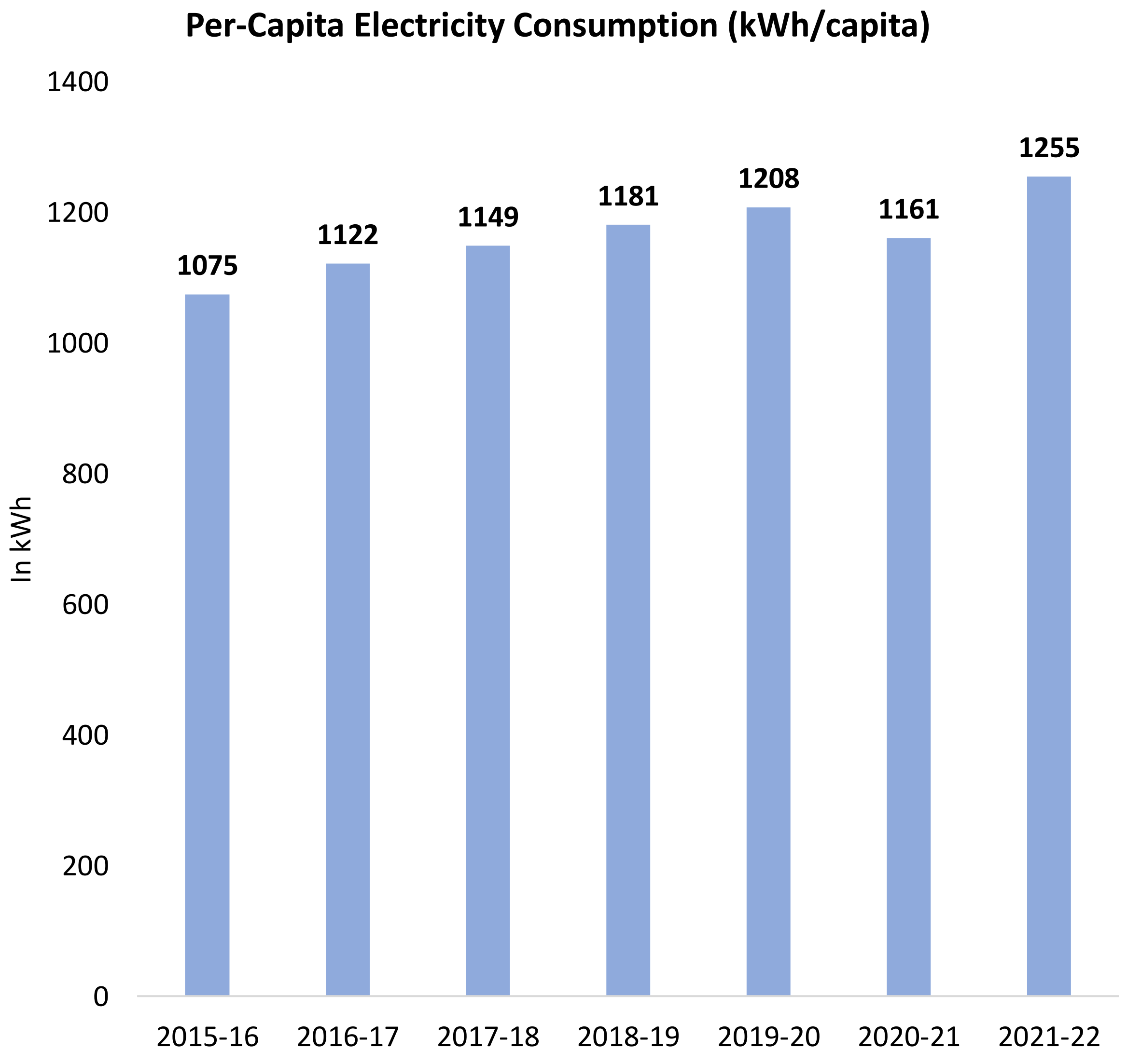




*Excluding biofuels, waste, and other non-commercial source of energy

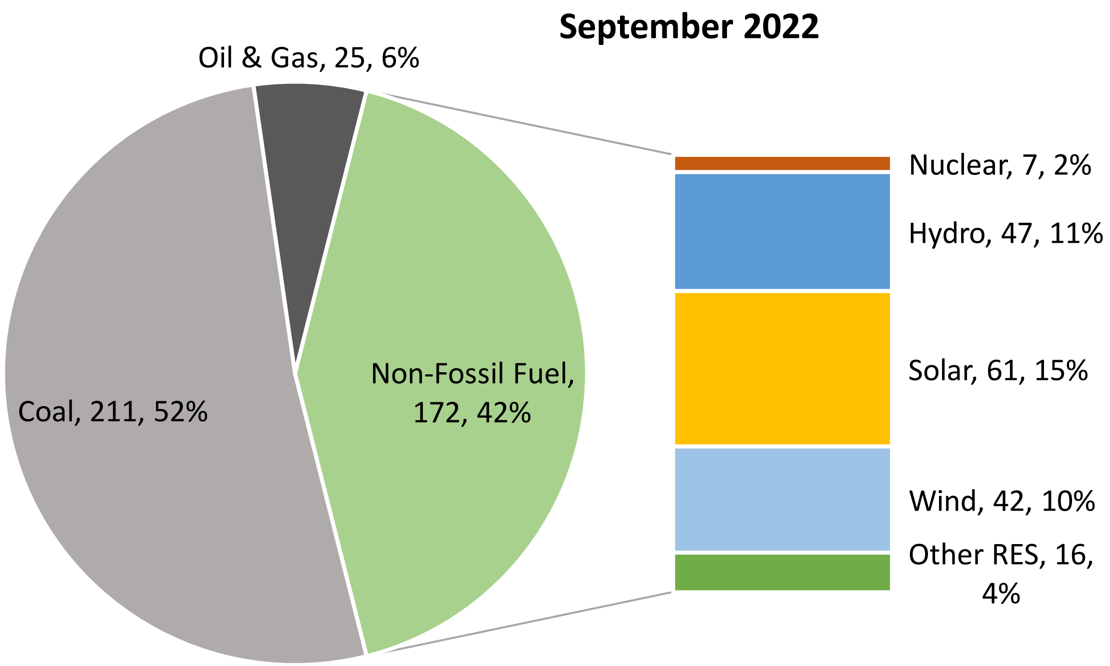
Per-Capita Energy and Electricity Consumption





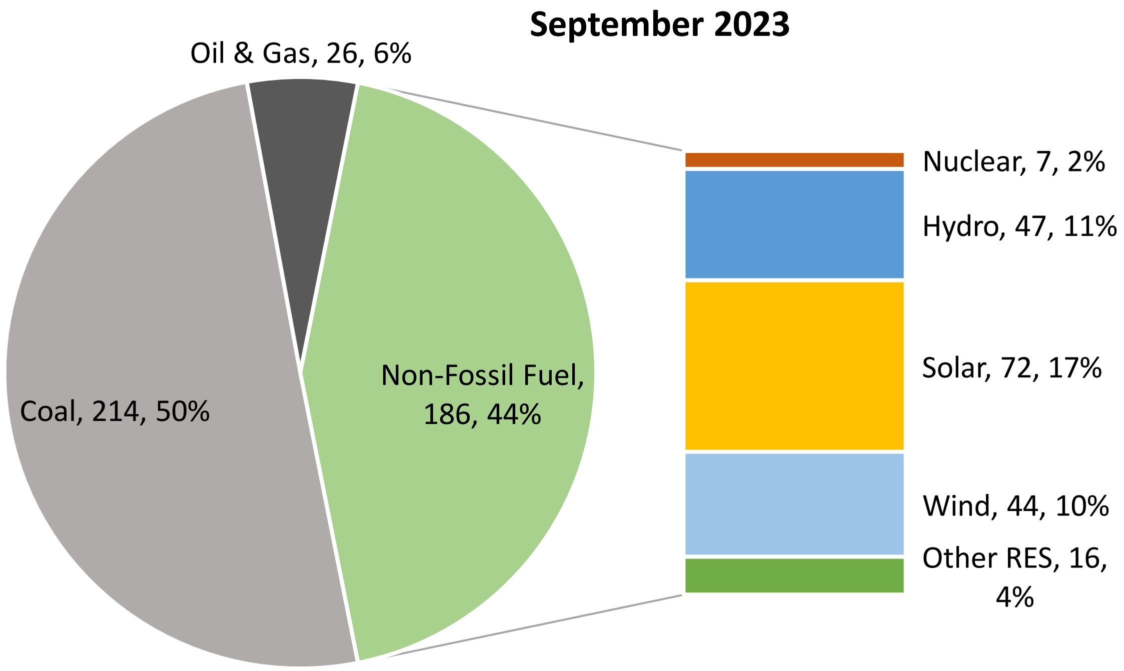
Note: Per Capita energy consumption is calculated on energy supply basis.

India’s Electricity Capacity Mix (Utility-scale)



Total Capacity: 408 GW

*Capacity Numbers are in GW

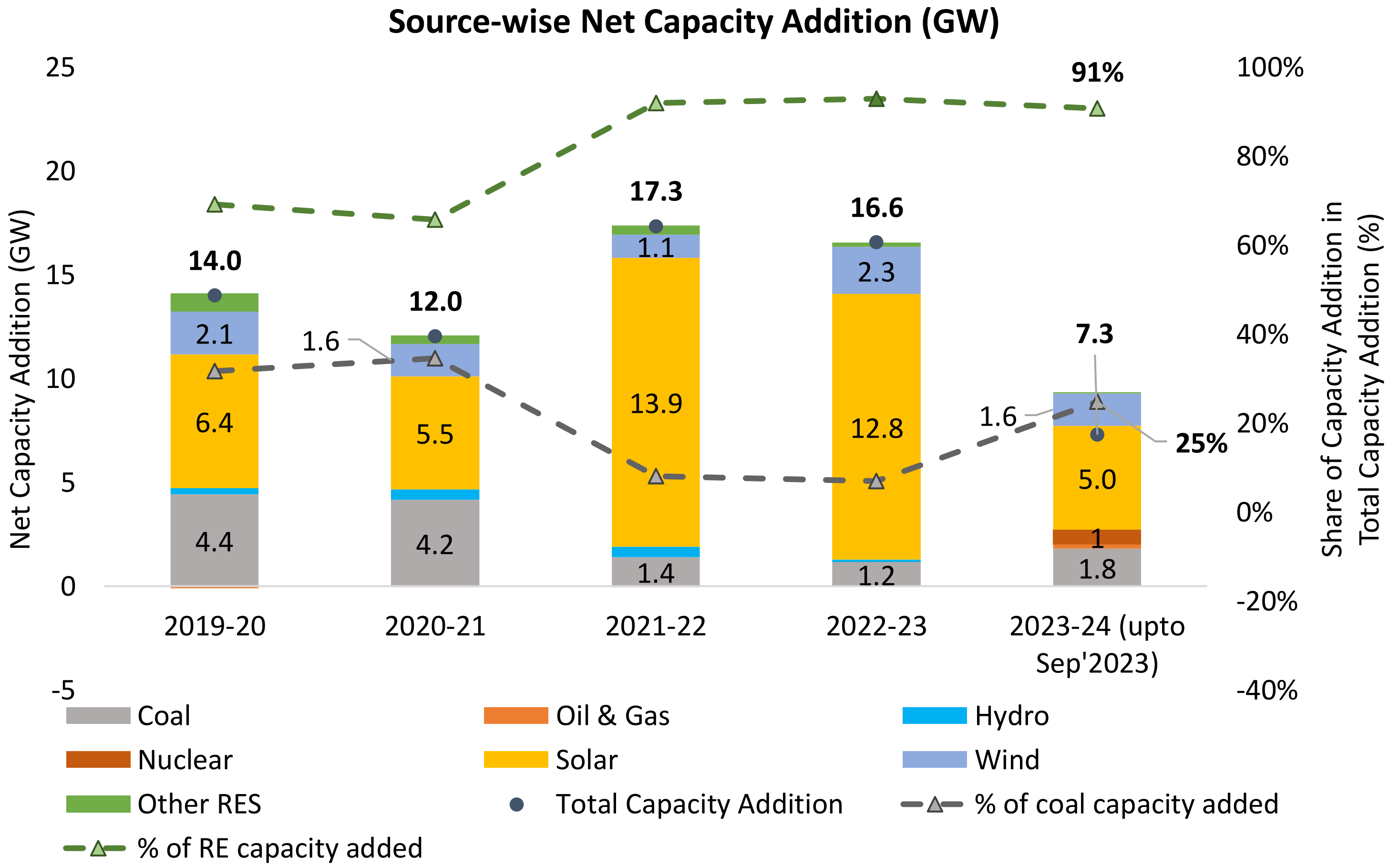


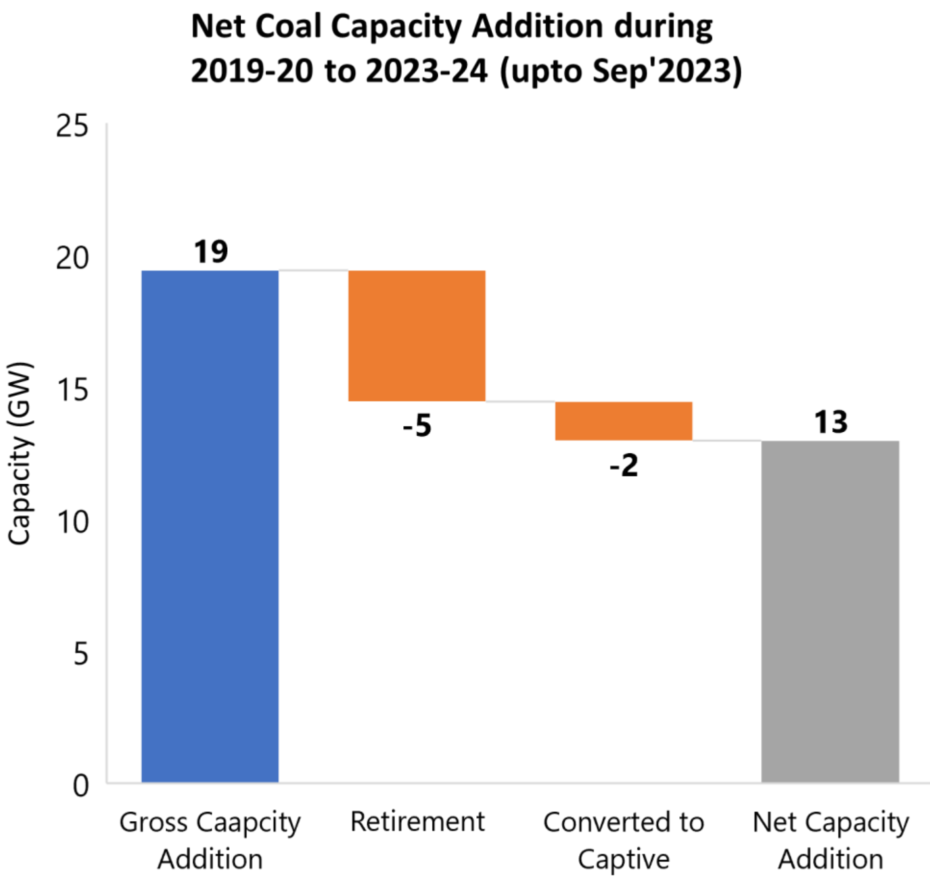
Total Capacity: 425 GW

- India’s electricity generating capacity is 425 GW as on Sep’2023 [coal 214 GW (50%), solar 72 GW (17%), hydro 47 GW (11%), and wind 44 (10%)].
- As on Sep’2023, the share of non-fossil-based electricity capacity is 44% against the set target of 50% non-fossil capacity by 2030.
- As on Sep’2023, India’s renewable energy capacity (including large hydro) stood at 179 GW out of 424 GW.

Source: CEA

India’s Electricity Capacity Addition in last 5 years





- A total of 56 GW of generation capacity has been added in RE (Hydro, solar, wind, and other RES) over the past 5 years, whereas the net coal capacity addition during the same period was 13 GW, mostly in the central sector.
- The share of RE addition in total capacity has shown an increasing trend (from 69% in 2019-20 to 93% in 2022-23).

Source: CEA & MNRE

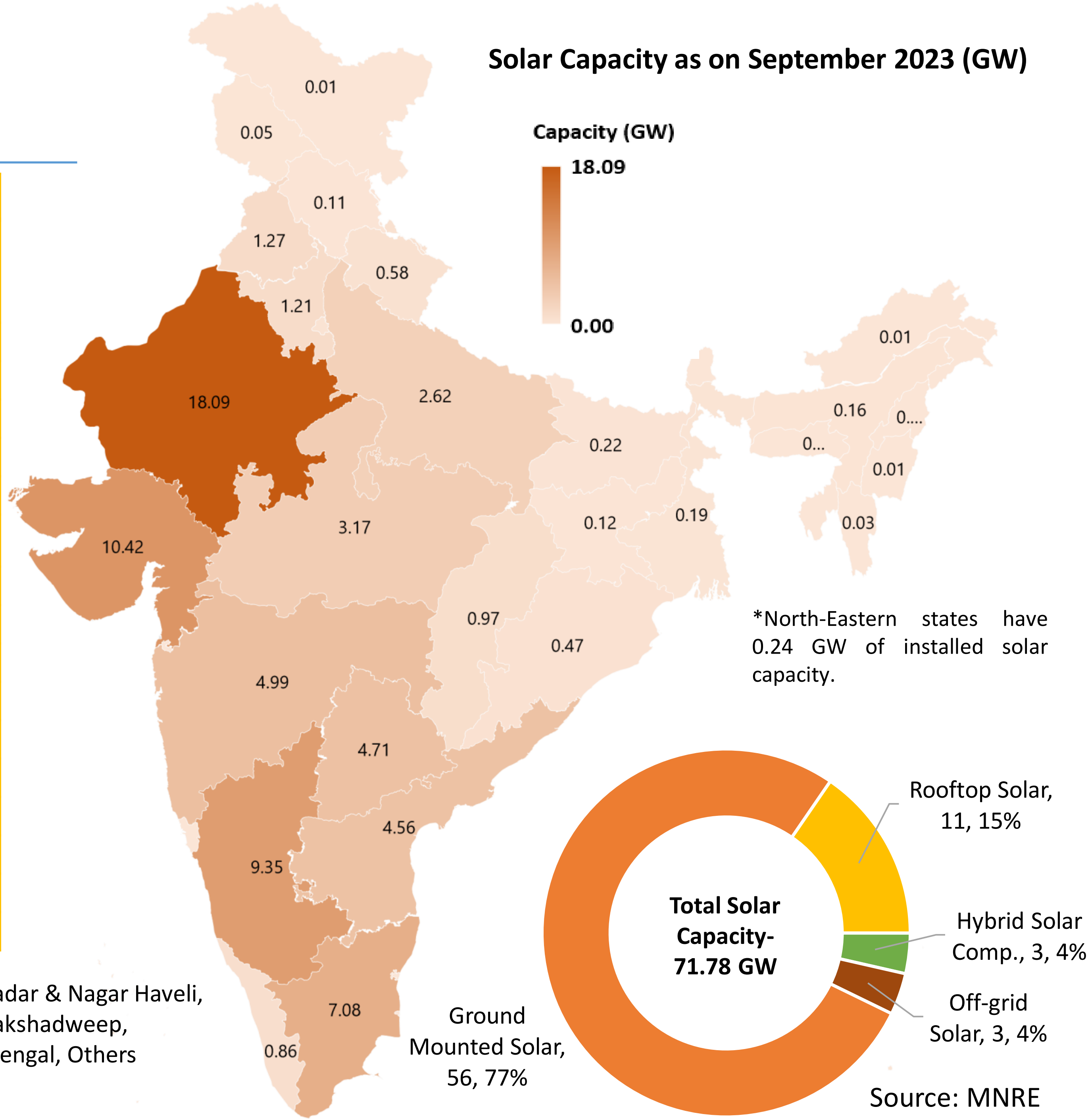
State-wise Solar Capacity

as on September 2023

State-wise installed capacity of Solar Power (GW)					
States	**Ground Mounted**	**Rooftop**	**Solar Component in Hybrid**	**Off Grid**	**Total Solar Power**
Rajasthan	**14.5**	1.0	2.0	0.6	18.1
Gujarat	6.9	**2.9**	0.6	0.1	10.4
Karnataka	7.8	1.6	0.0	0.0	9.3
Tamil Nadu	6.6	0.4	0.0	0.1	7.1
Maharashtra	3.0	1.7	0.0	0.3	5.0
Telangana	4.4	0.3	0.0	0.0	4.7
Andhra Pradesh	4.3	0.2	0.0	0.1	4.6
Madhya Pradesh	2.8	0.3	0.0	0.1	3.2
Uttar Pradesh	2.1	0.3	0.0	0.2	2.6
Punjab	0.9	0.3	0.0	0.1	1.3
Haryana	0.3	0.5	0.0	0.5	1.2
Chhattisgarh	0.5	0.1	0.0	0.4	1.0
Kerala	0.3	0.5	0.0	0.0	0.9
Uttarakhand	0.3	0.3	0.0	0.0	0.6
Others	0.9	0.7	0.0	0.3	1.9
All India	**55.5**	**11.1**	**2.5**	**2.6**	**71.8**

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 September 2023 (GW)



*North-Eastern states have 0.24 GW of installed solar capacity.

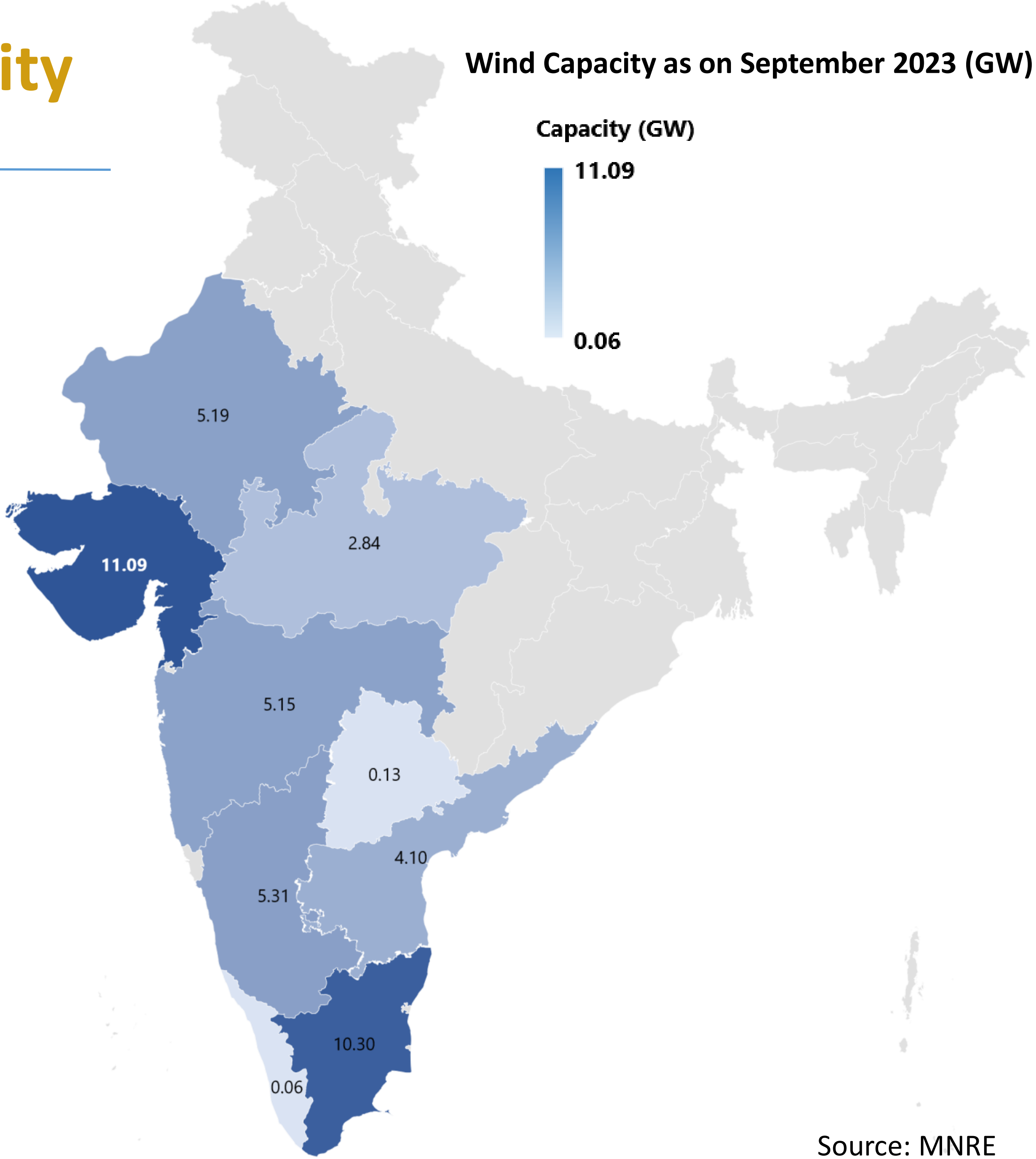
Source: MNRE

State-wise Wind Onshore Capacity

as on September 2023

State-wise installed capacity of Wind (Onshore) Power	
States	**Installed Capacity (GW)**
Gujarat	11.09
Tamil Nadu	10.30
Karnataka	5.31
Rajasthan	5.19
Maharashtra	5.15
Andhra Pradesh	4.10
Madhya Pradesh	2.84
Telangana	0.13
Kerala	0.06
India Total	**44.18**

Wind Capacity as on September 2023 (GW)



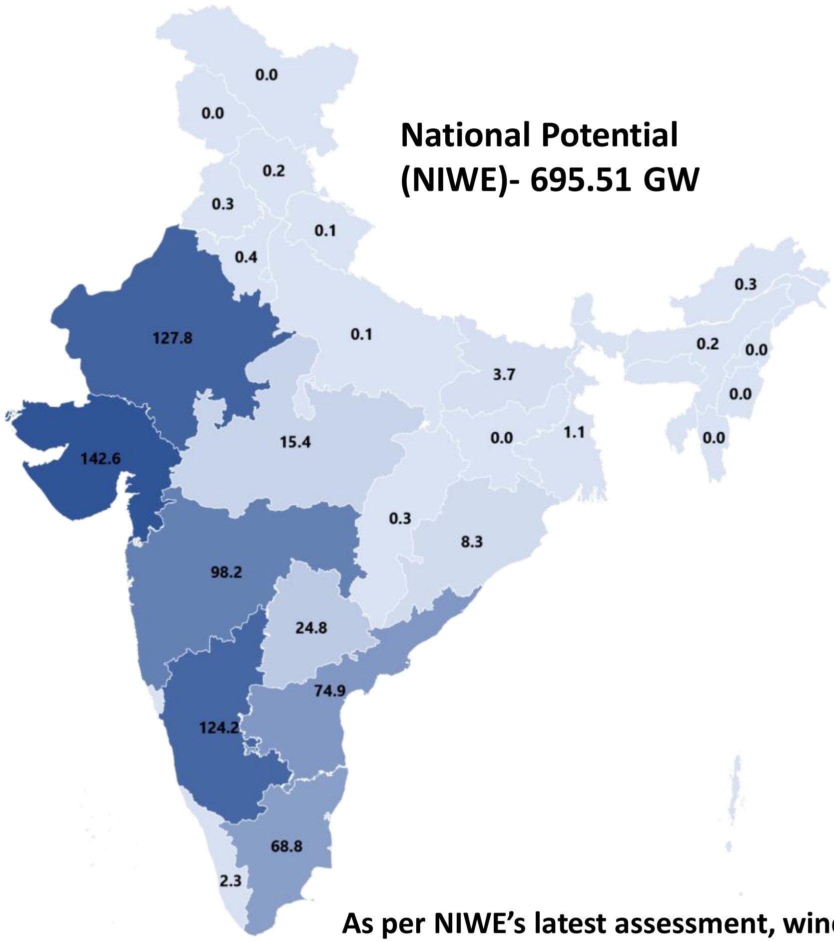
Source: MNRE

RE Potential and Installed Capacity (1/2)

RE potential in the state

Wind Onshore Potential at 120m agl

State Potential (GW) 0.0 – 142.6

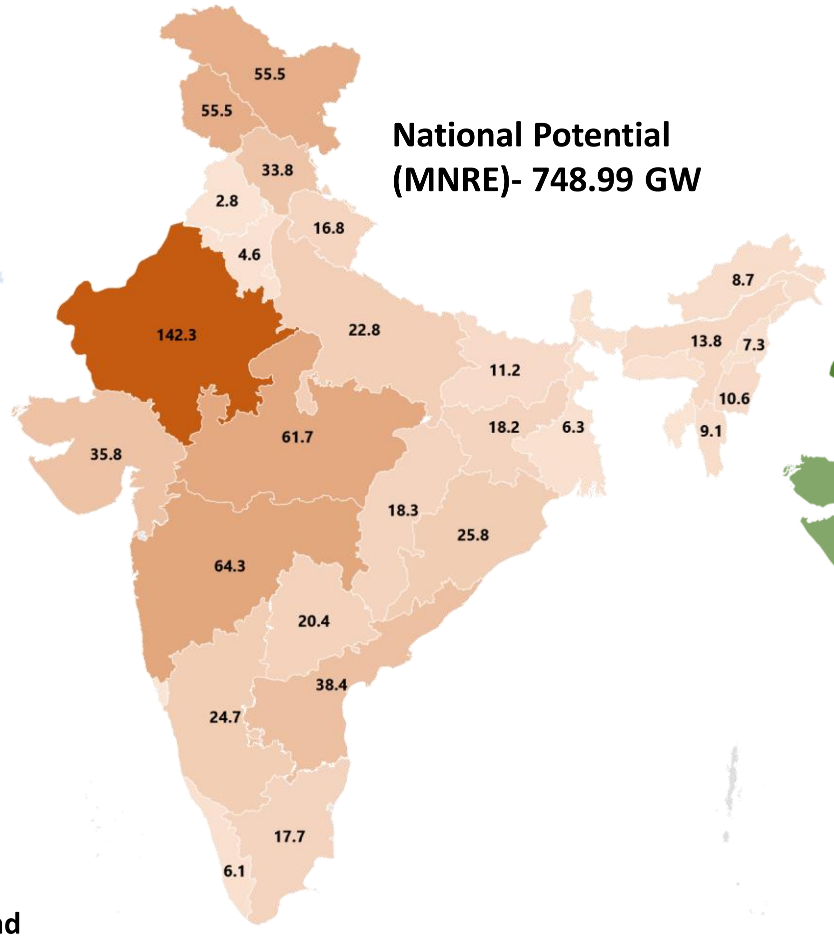


National Potential (NIWE)- 695.51 GW

As per NIWE's latest assessment, wind potential at 150m agl is 1164 GW.

Solar Potential

State Potential (GW) 0.9 – 142.3

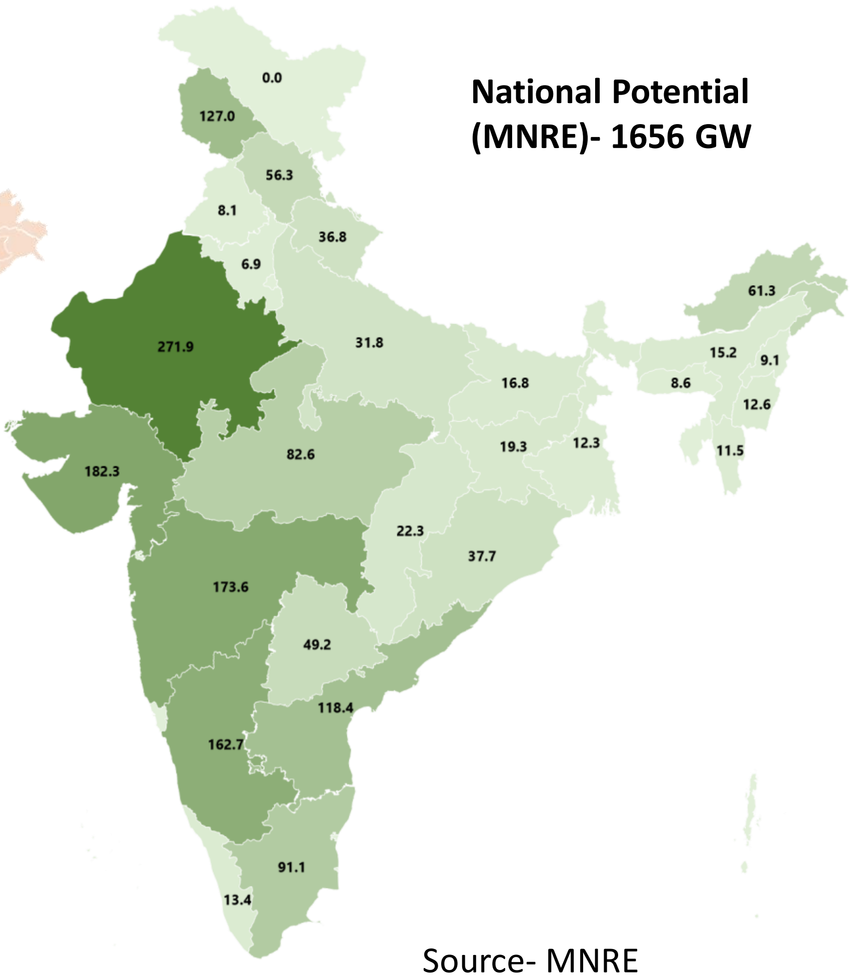


National Potential (MNRE)- 748.99 GW

Market potential for SPV rooftop is 124 GW.

Renewable Energy Potential (all sources including large Hydro)

State Potential (GW) 0.0 – 271.9



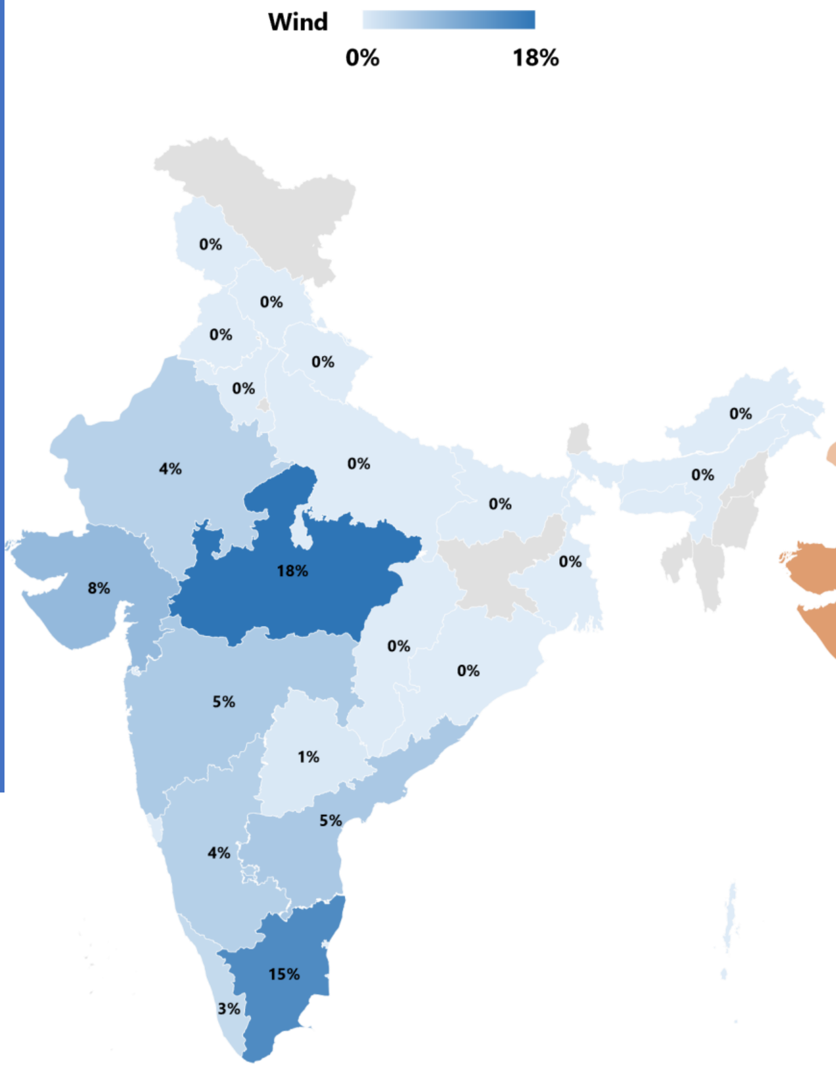
National Potential (MNRE)- 1656 GW

Source- MNRE

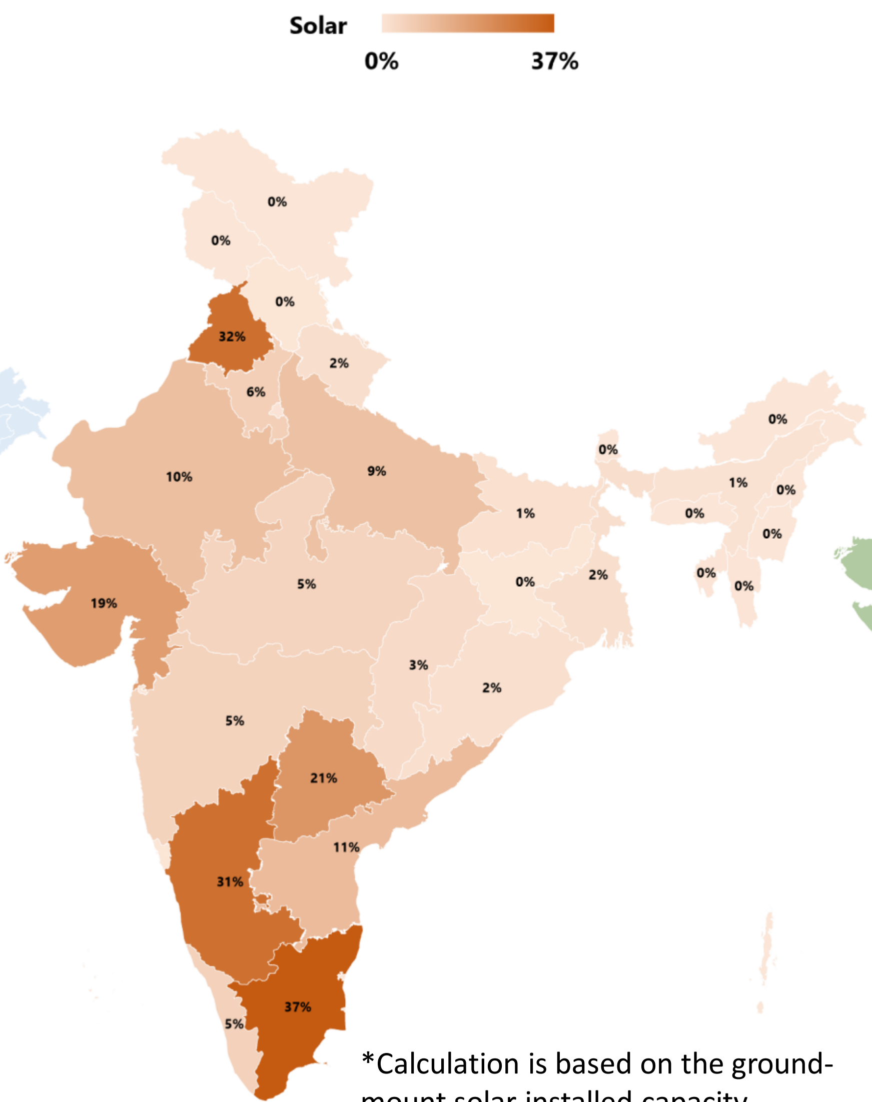
RE Potential and Installed Capacity (2/2)

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

Wind Onshore Capacity

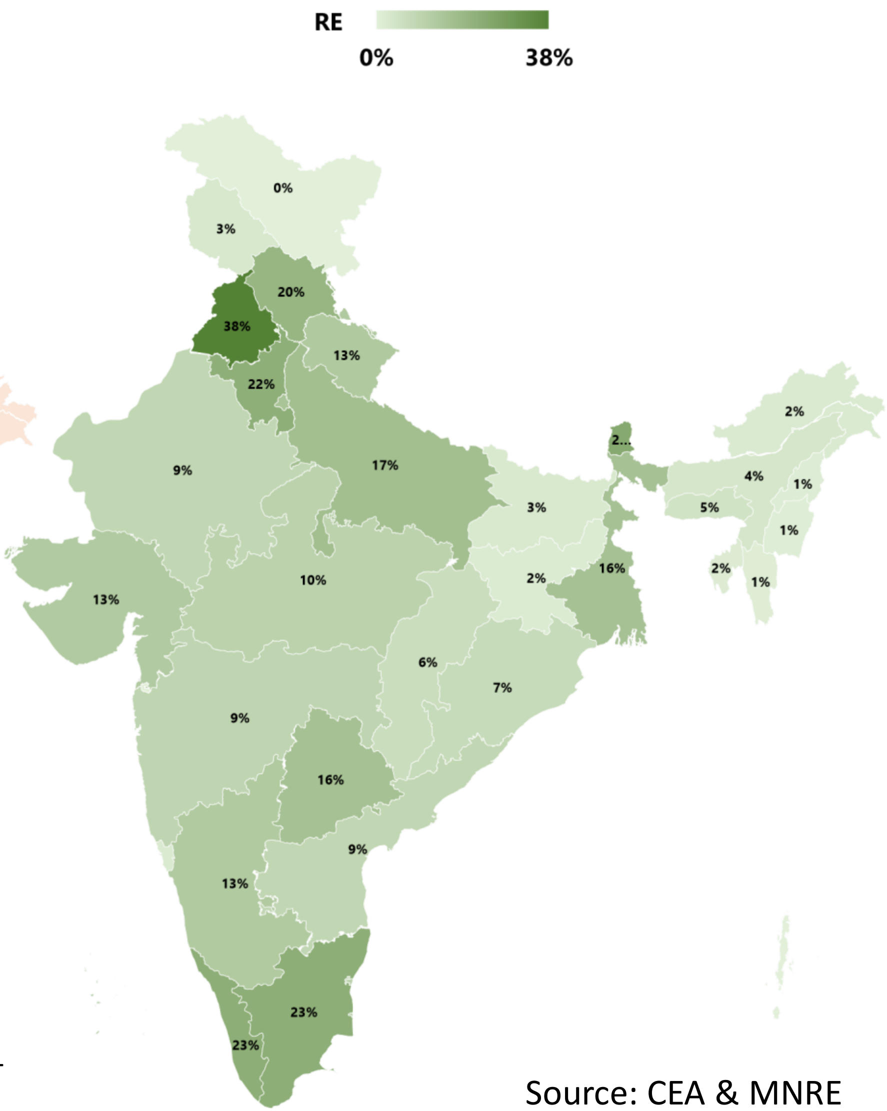


Solar Capacity*



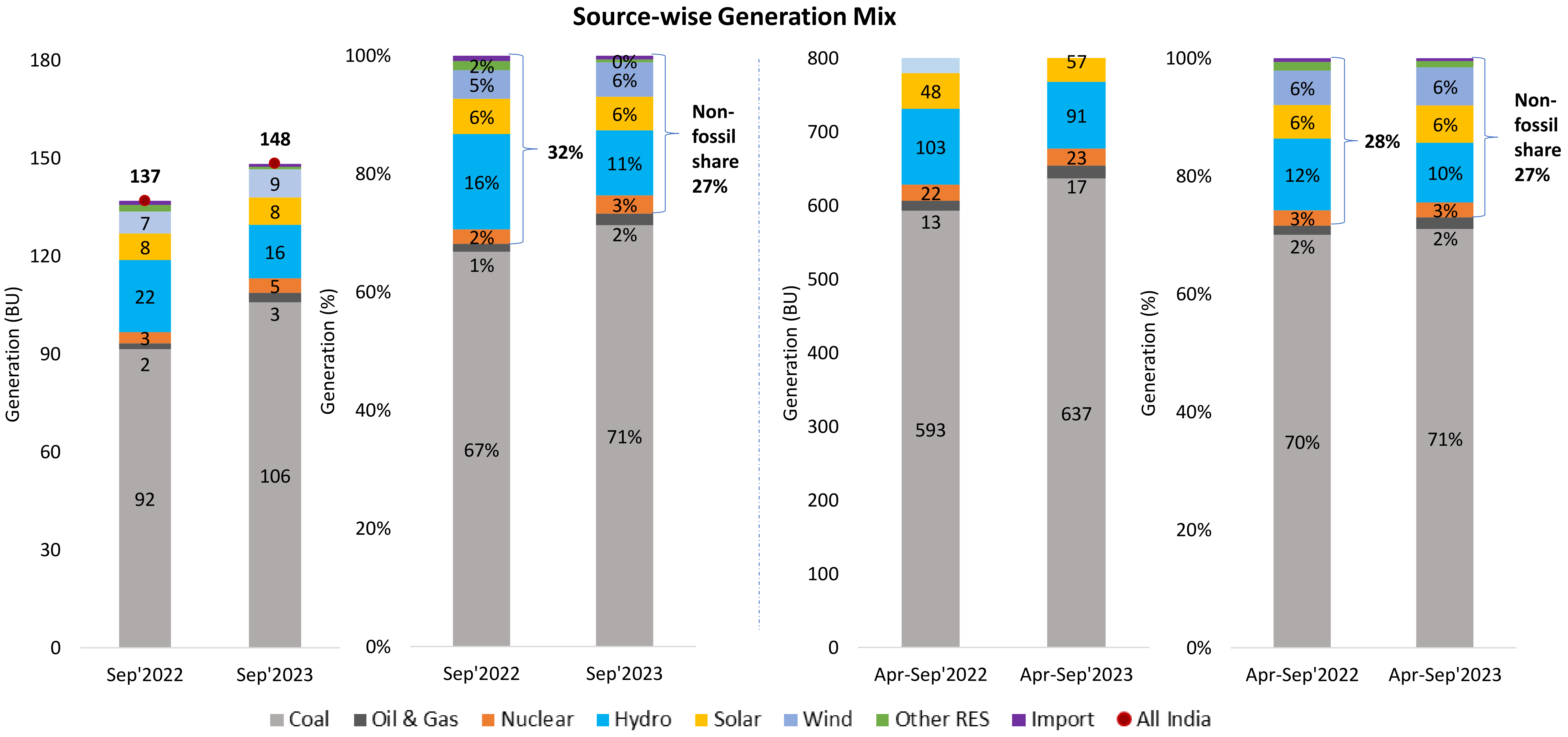
*Calculation is based on the ground-mount solar installed capacity.

RE Capacity (all sources including large hydro)



Source: CEA & MNRE

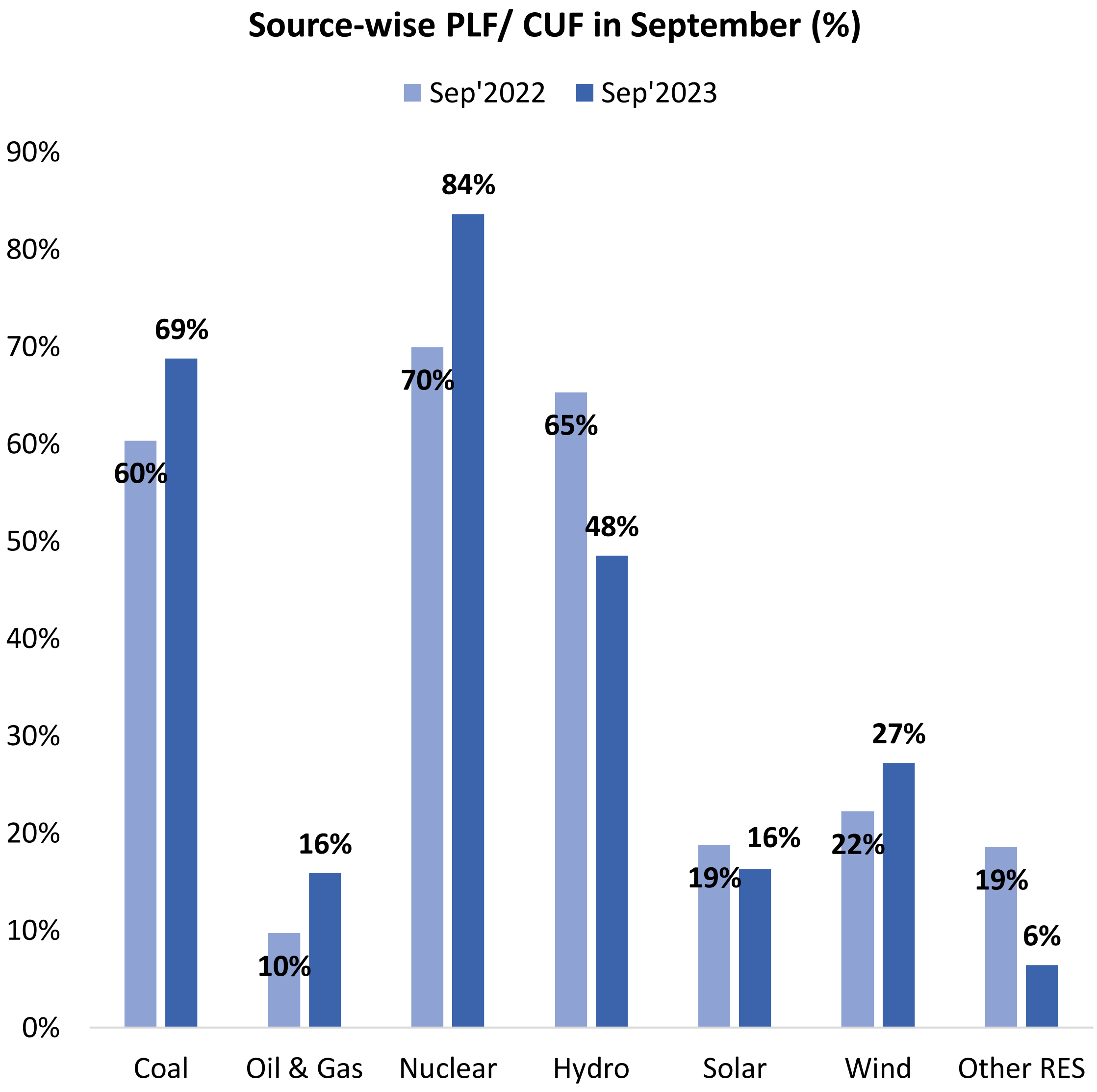
India’s Electricity Generation Mix

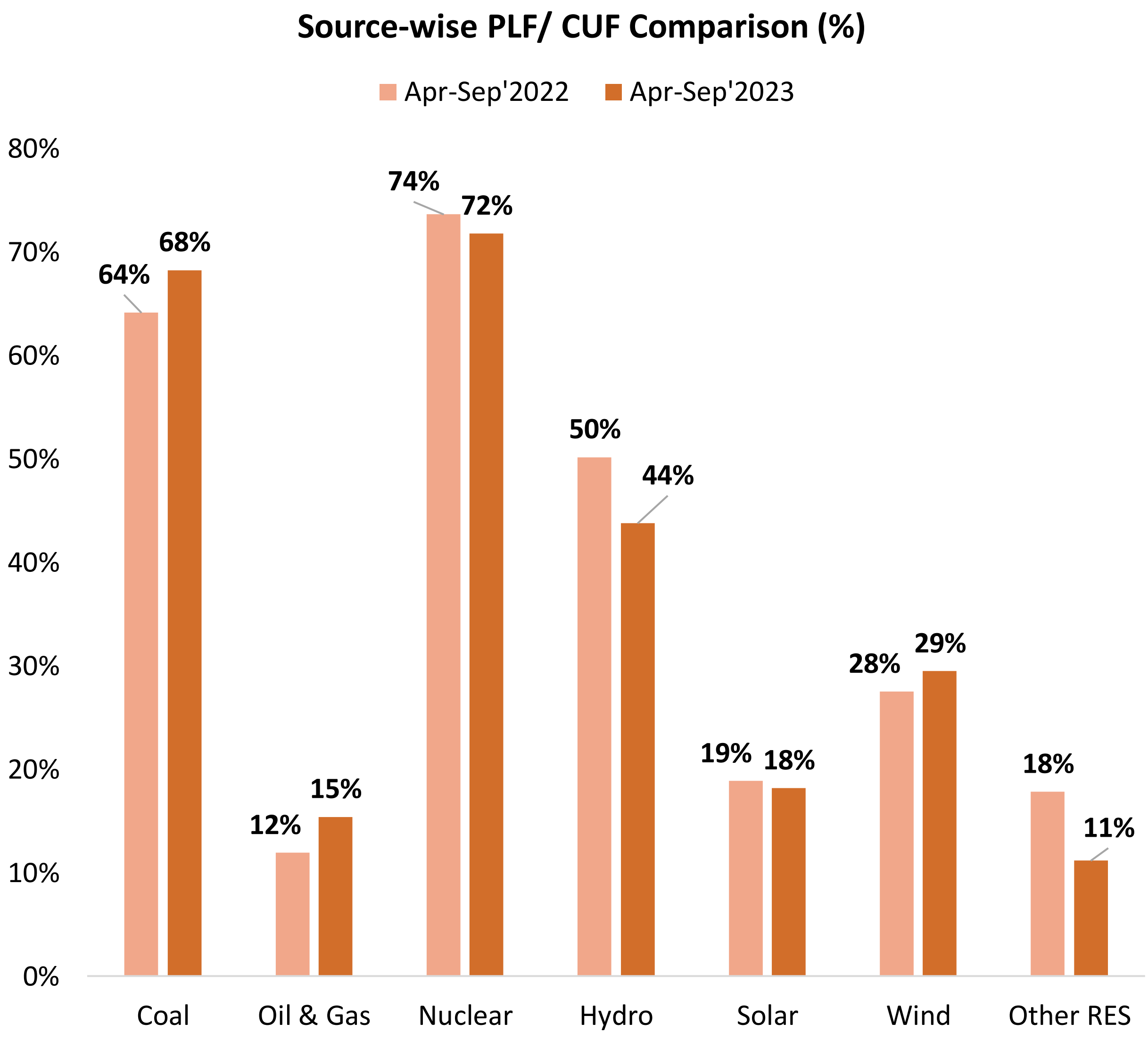


NOTE: The generation data for Sep’2023 is provisional.

Source: CEA

Source-wise PLF/CUF

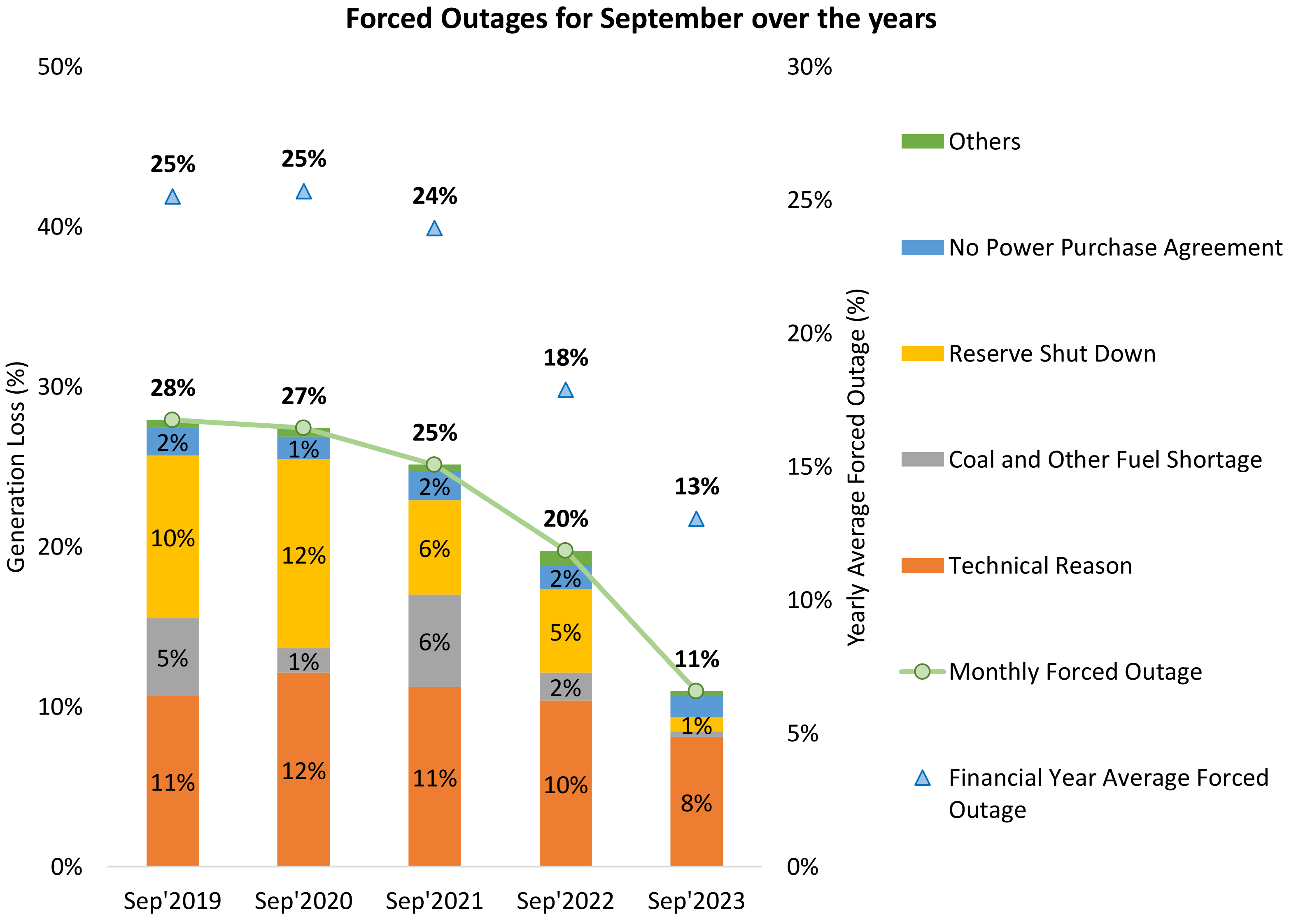




NOTE: The PLF/CUF data is based on provisional generation for Sep’2023.

Source: CEA & MNRE

Thermal Generation Loss and Reasons for Forced Outages

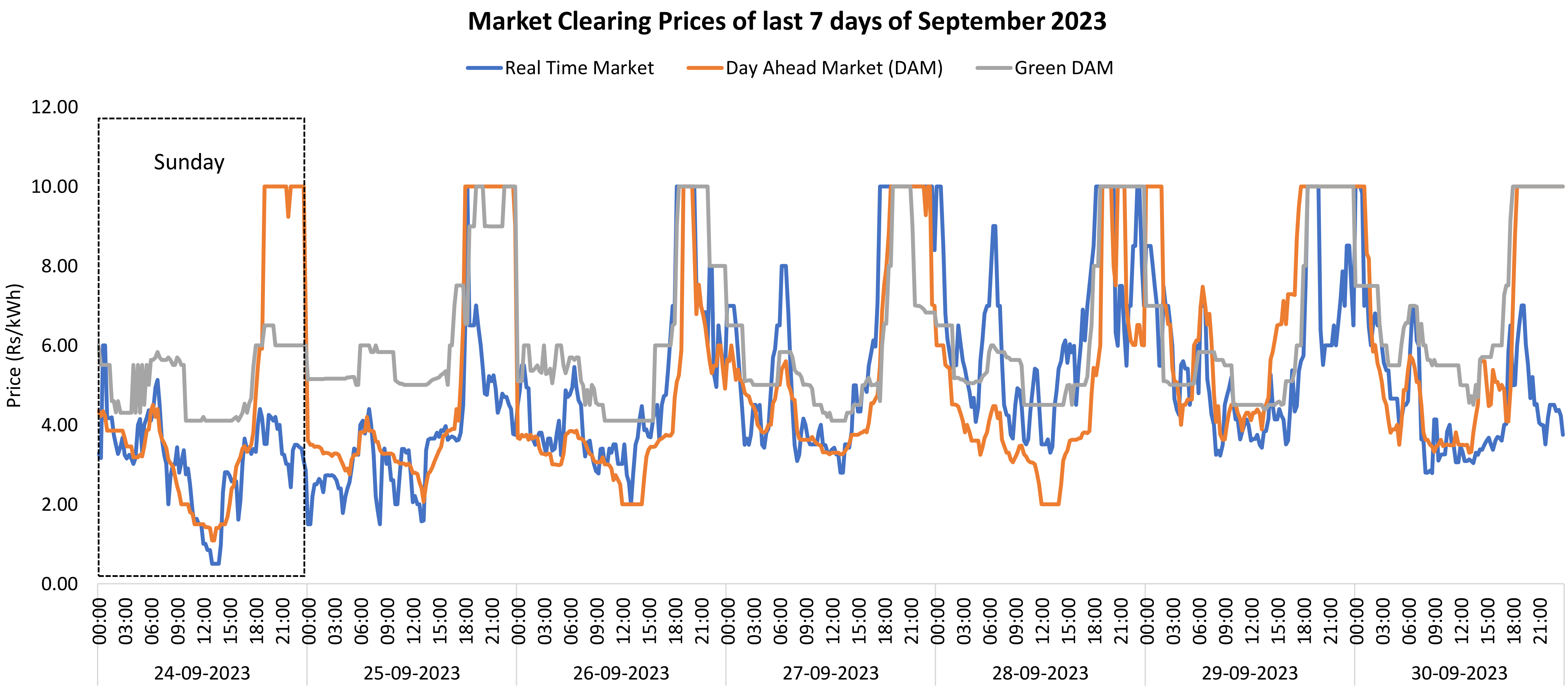


Year/ Month		Average Forced Outage Share
Yearly	FY 2021-22	24%
	FY 2022-23	18%
	FY 2023-24 (up to Sep’2023)	13%
Monthly	Sep’2021	25%
	Sep’2022	20%
	Sep’2023	11%

Thermal includes only Coal and Lignite Plants.

Source: ICED

Indian Electricity Exchange (IEX) Market Snapshot

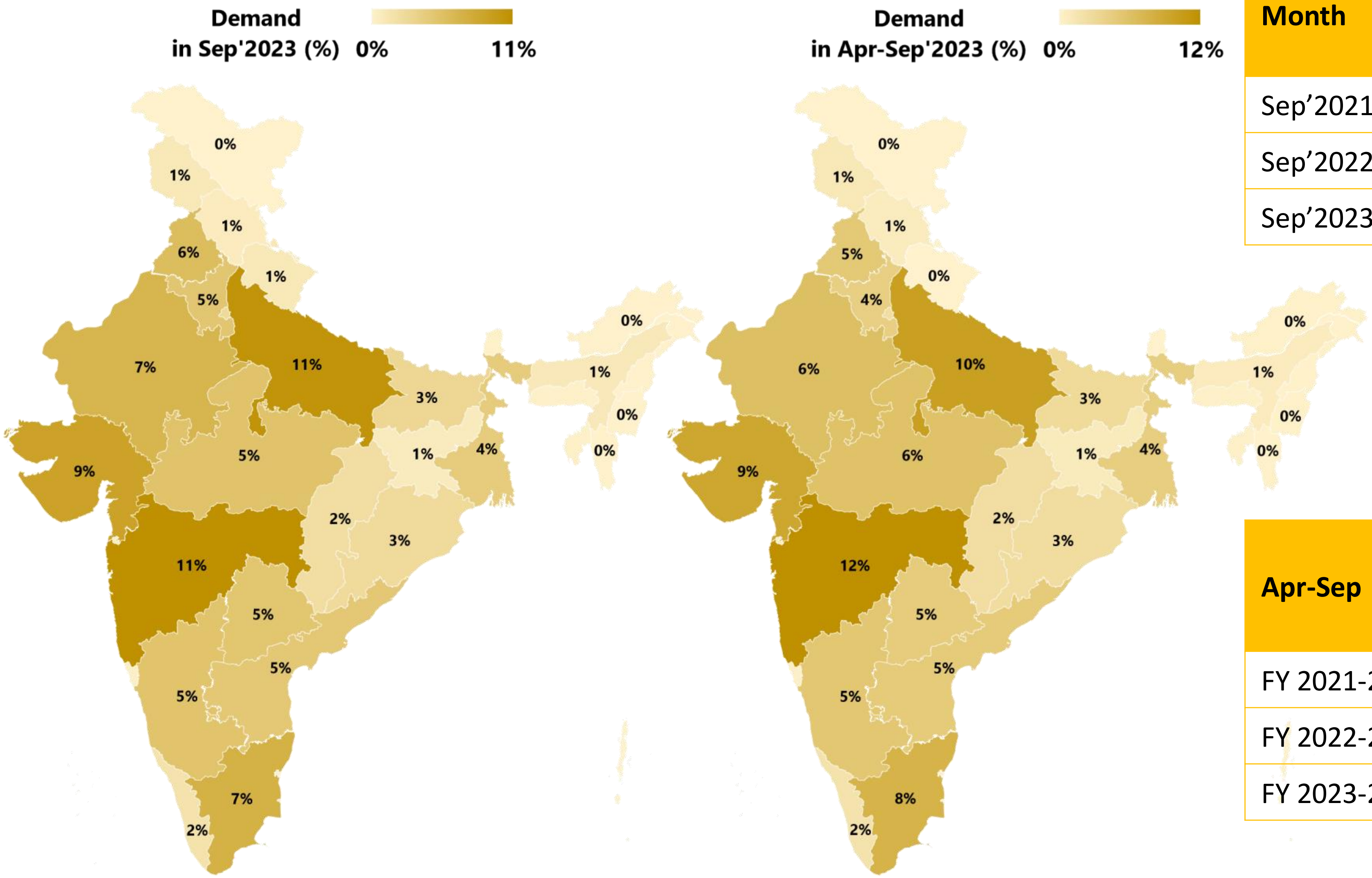


In April 2023, CERC revised the price ceiling from ₹12/kWh to ₹10/kWh in the power exchange market.

Source: IEX

National and State level Electricity Demand

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



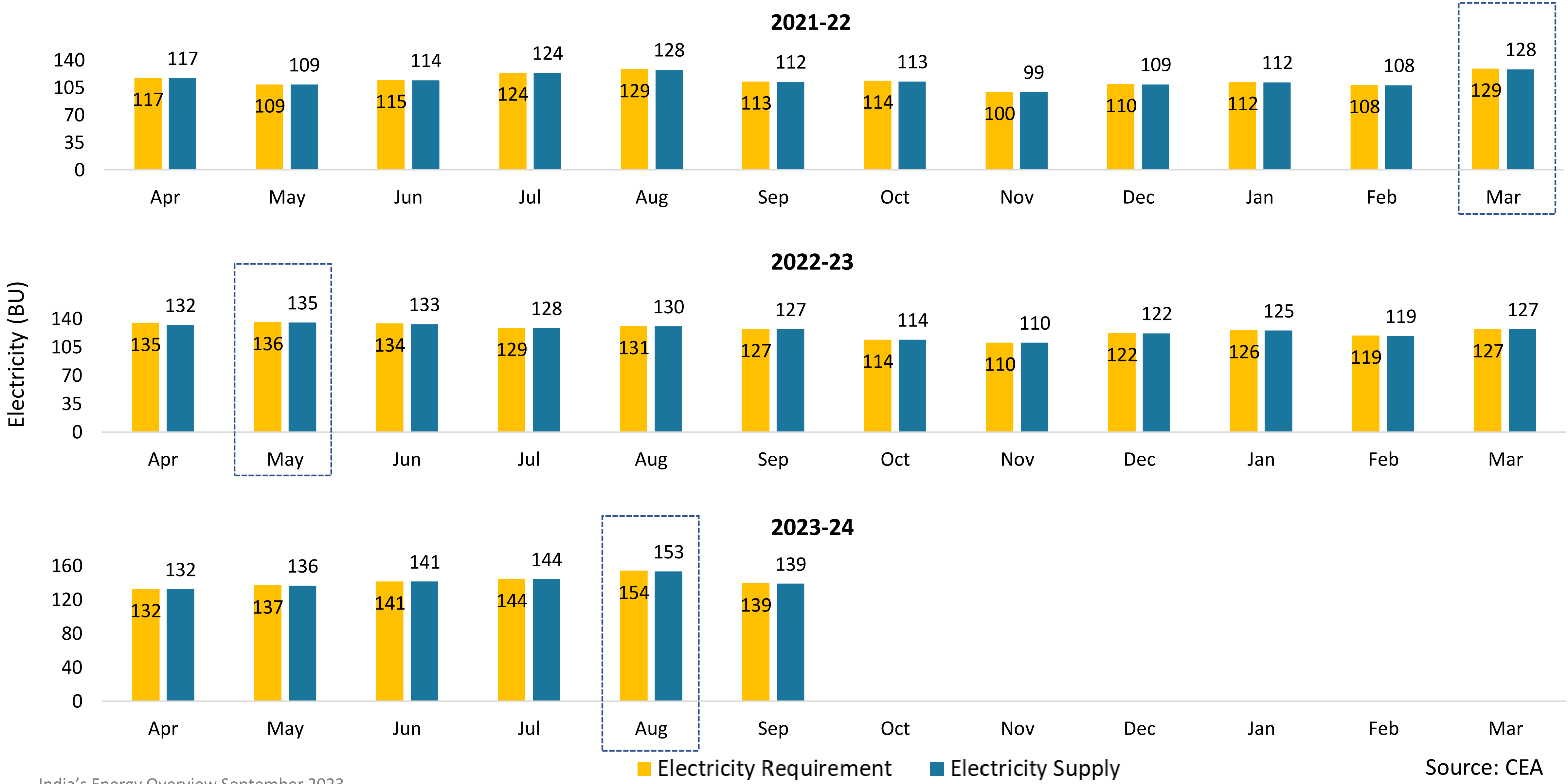
Month	Electricity Demand (BU)	Electricity Supply (BU)	Gap (BU) (+/-)
Sep’2021	113	112	0.5
Sep’2022	127	127	0.3
Sep’2023	139	139	0.5

Apr-Sep	Electricity Demand (BU)	Electricity Supply (BU)	Gap (BU) (+/-)
FY 2021-22	707	704	3
FY 2022-23	791	786	5
FY 2023-24	848	845	2

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

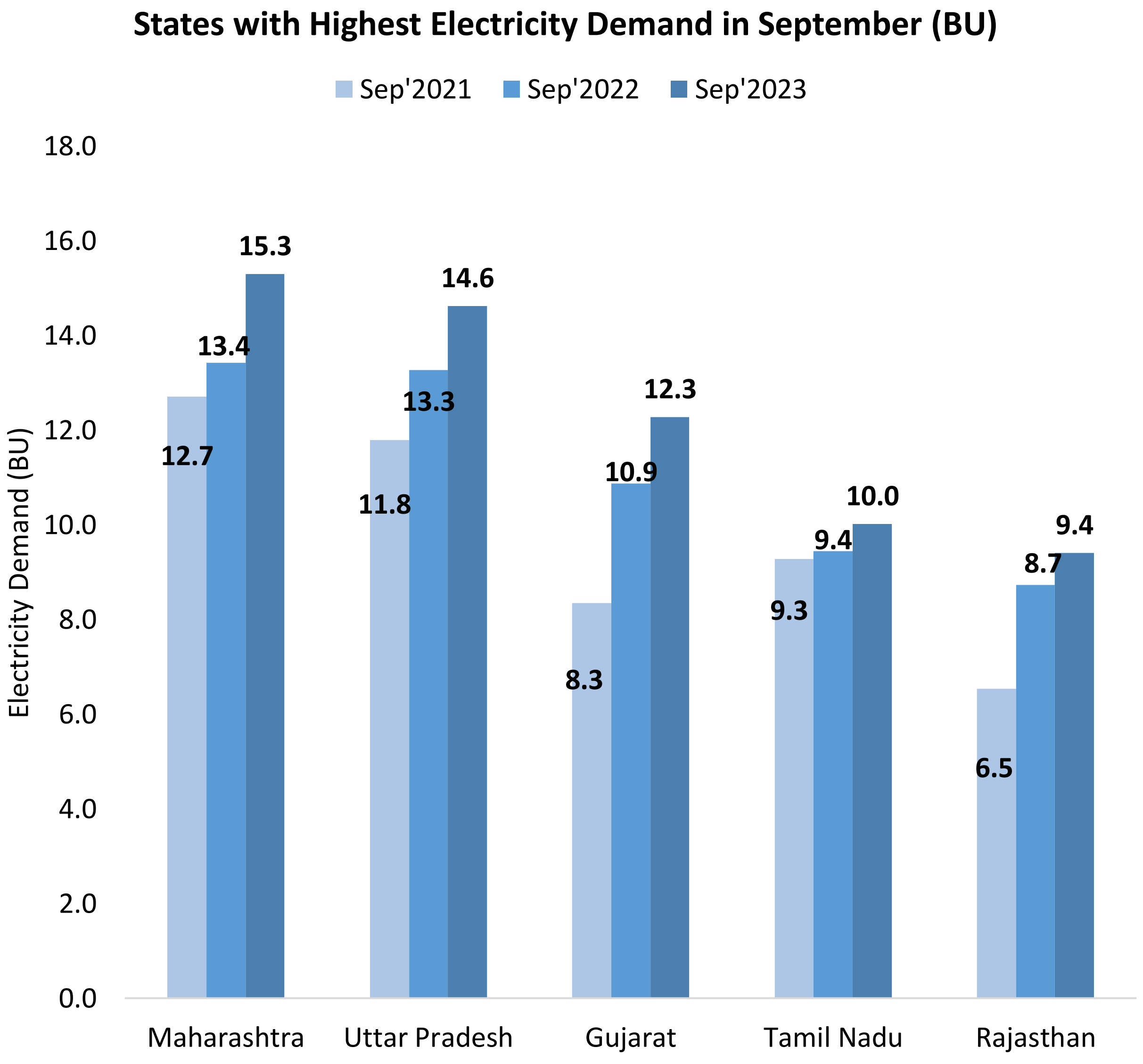
Source: CEA

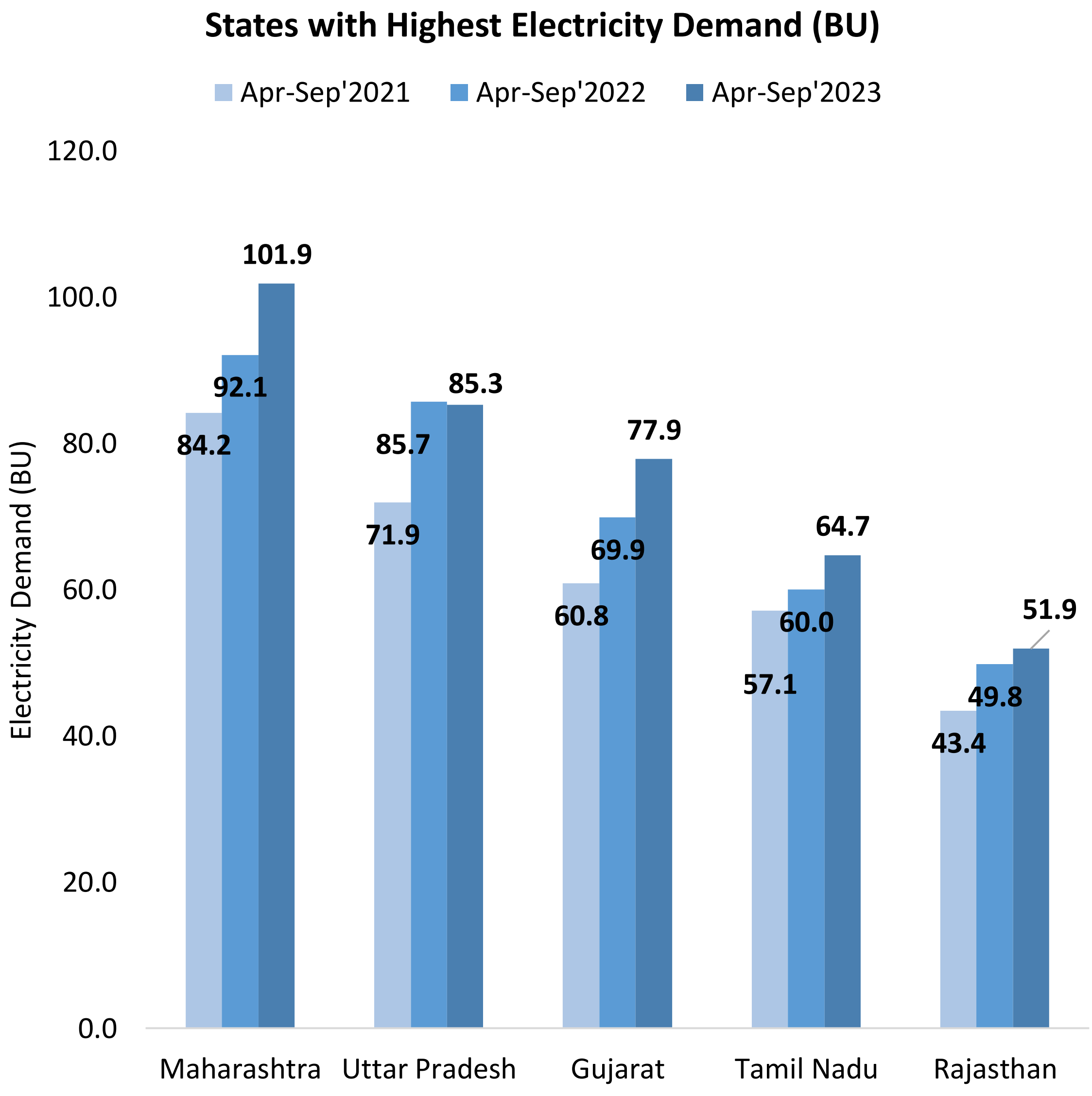
India’s Monthly Electricity Requirement and Supply



Source: CEA

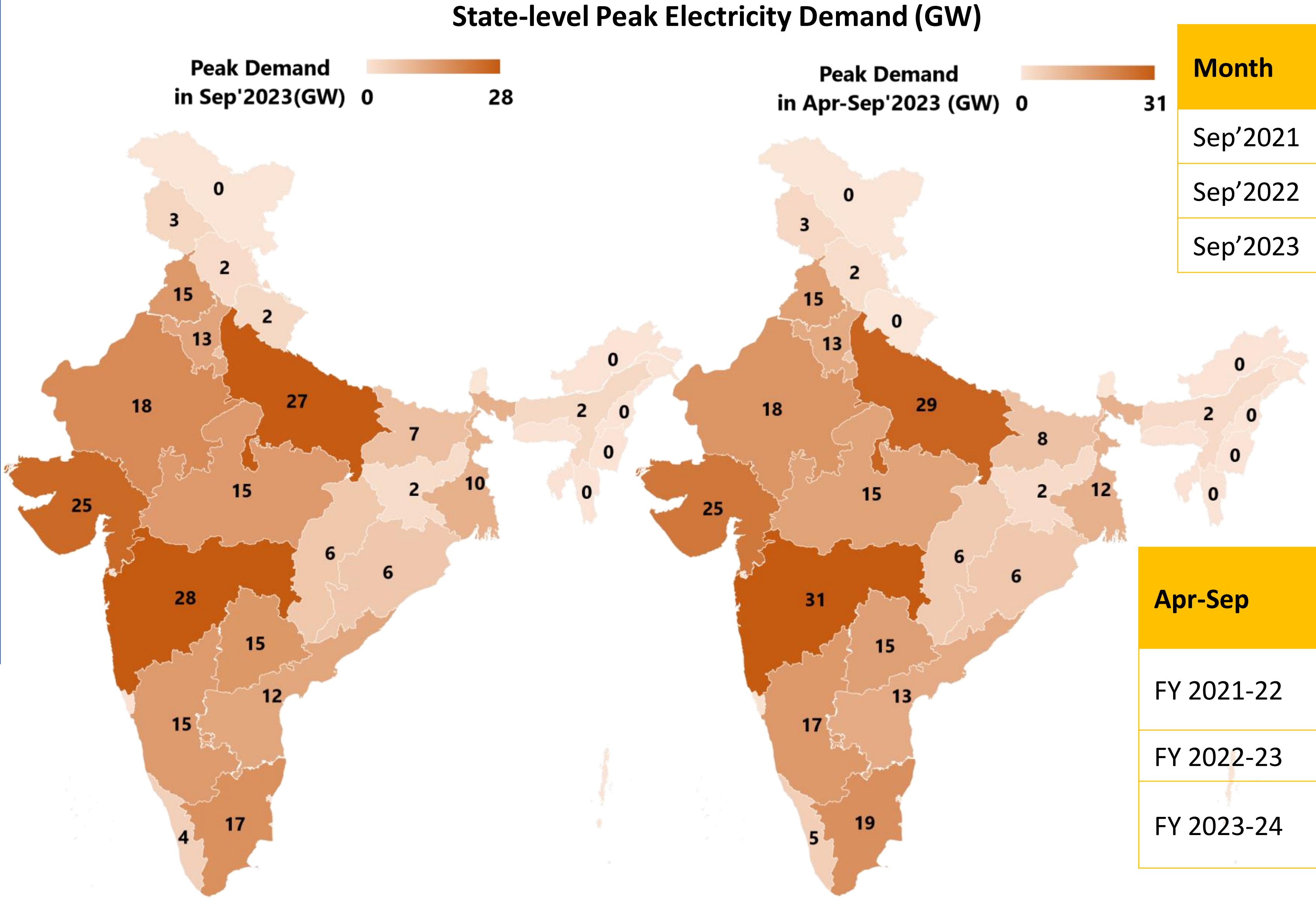
Monthly Electricity Demand of the top 5 states





Source: CEA

National and State level Peak Electricity Demand

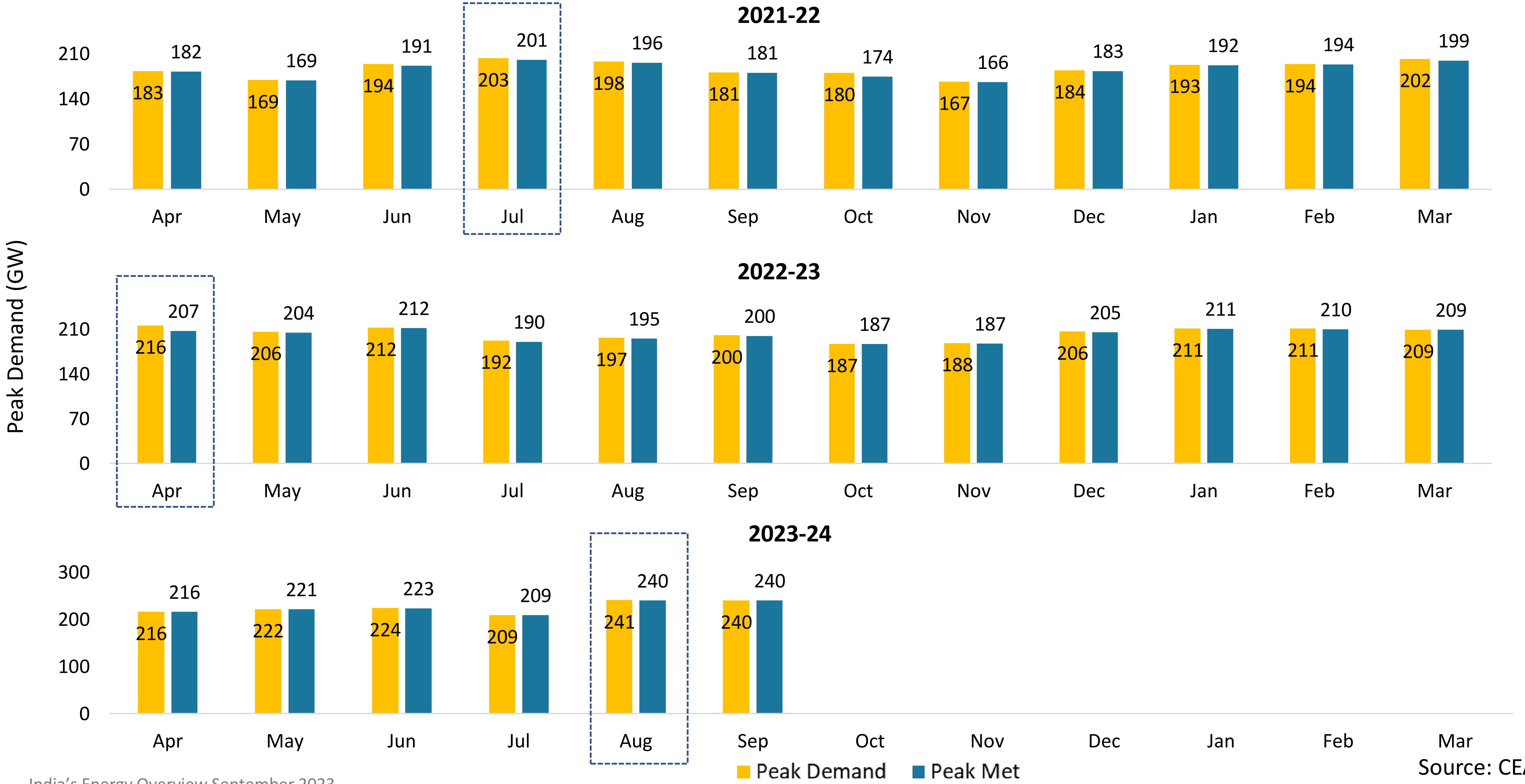


Month	Peak Demand (GW)	Peak Supply (GW)	Gap(BU) (+/-)
Sep’2021	181	181	0.4
Sep’2022	200	200	0.9
Sep’2023	240	240	0.2

Apr-Sep	Peak Demand (GW)	Peak Supply (GW)	Gap (BU) (+/-)
FY 2021-22	203	201	3
FY 2022-23	216	207	9
FY 2023-24	241	240	1

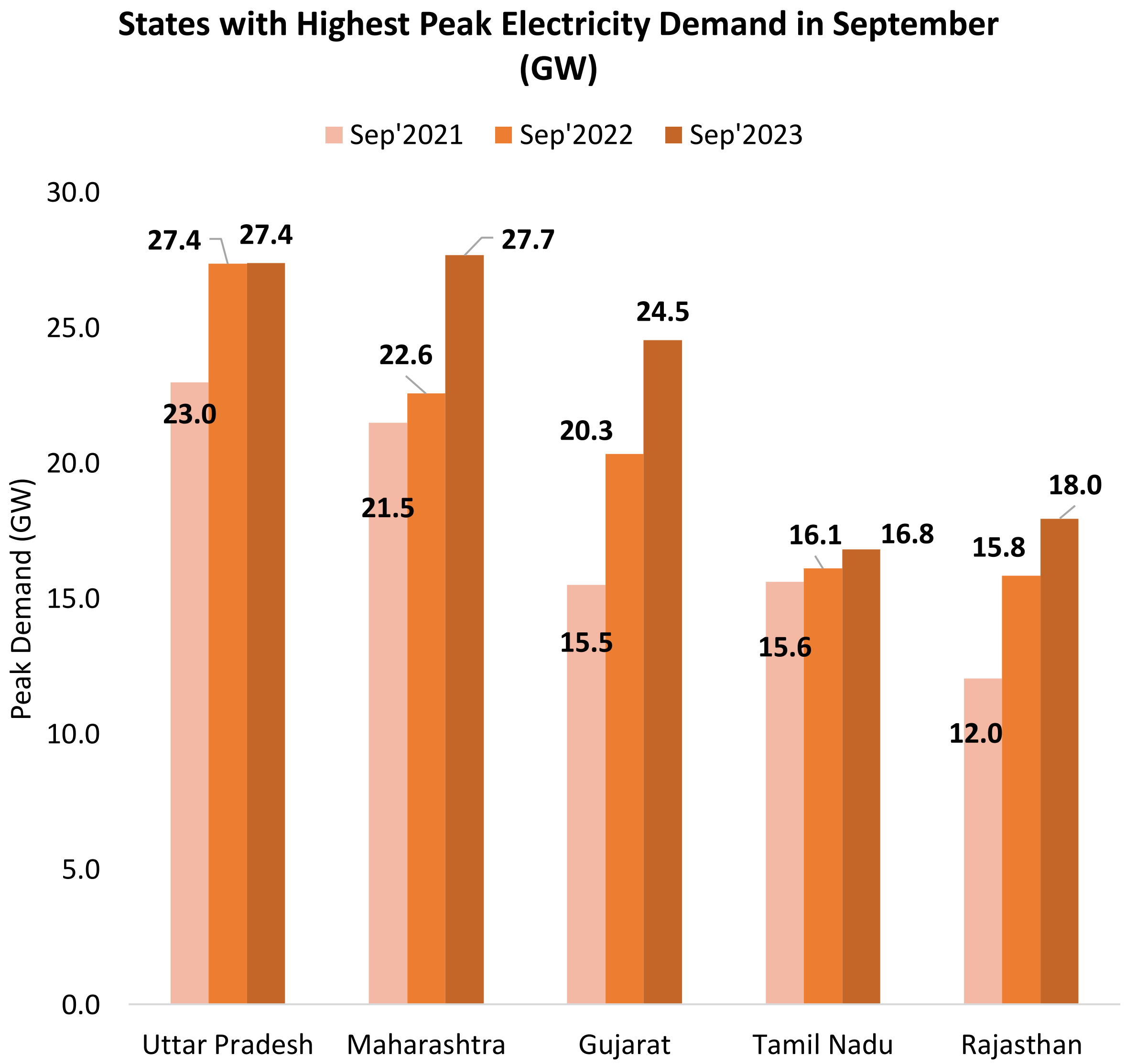
Source: CEA

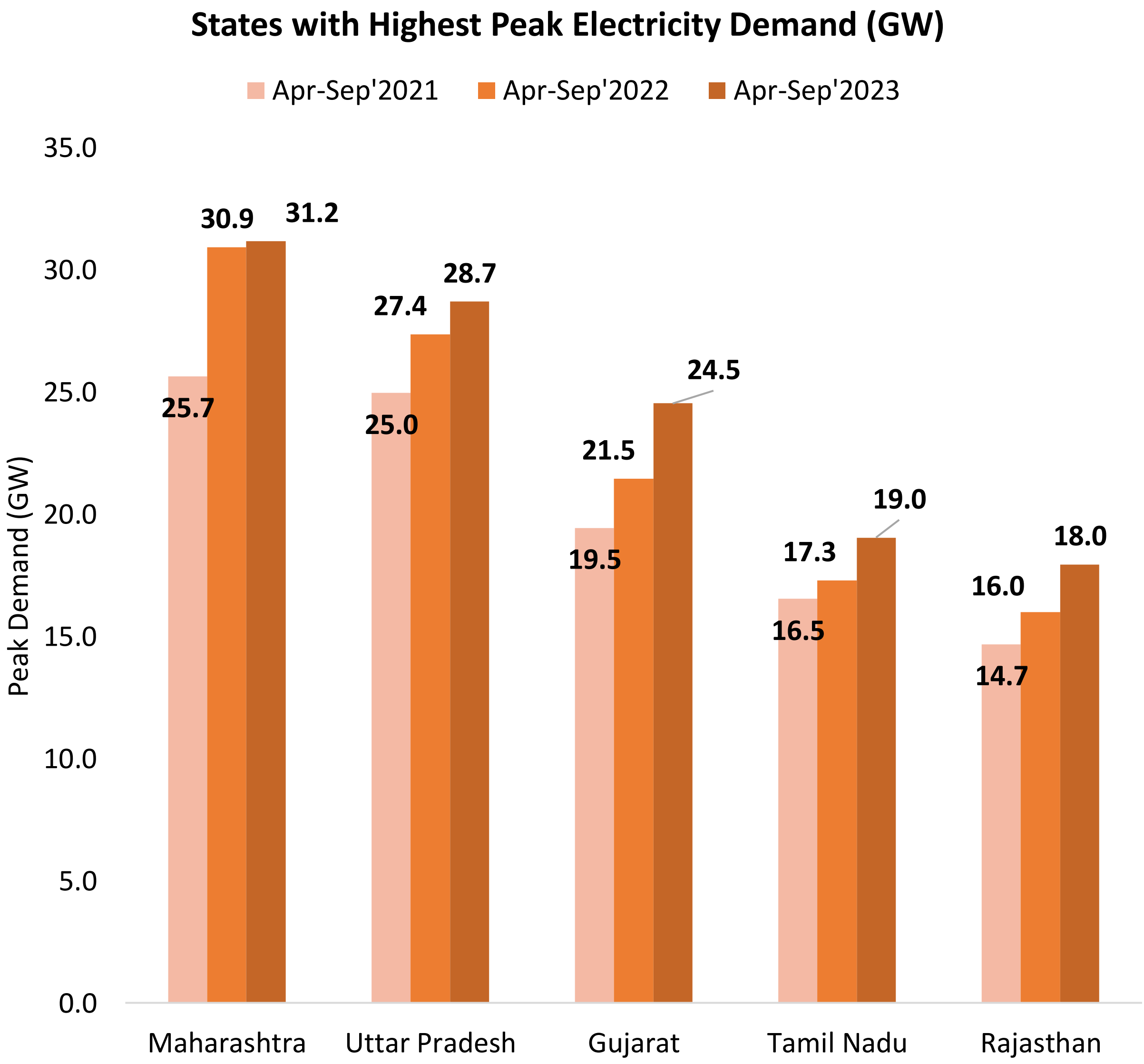
India’s Monthly Peak Electricity Demand and Supply



Source: CEA

Monthly Peak Electricity Demand of the top 5 states

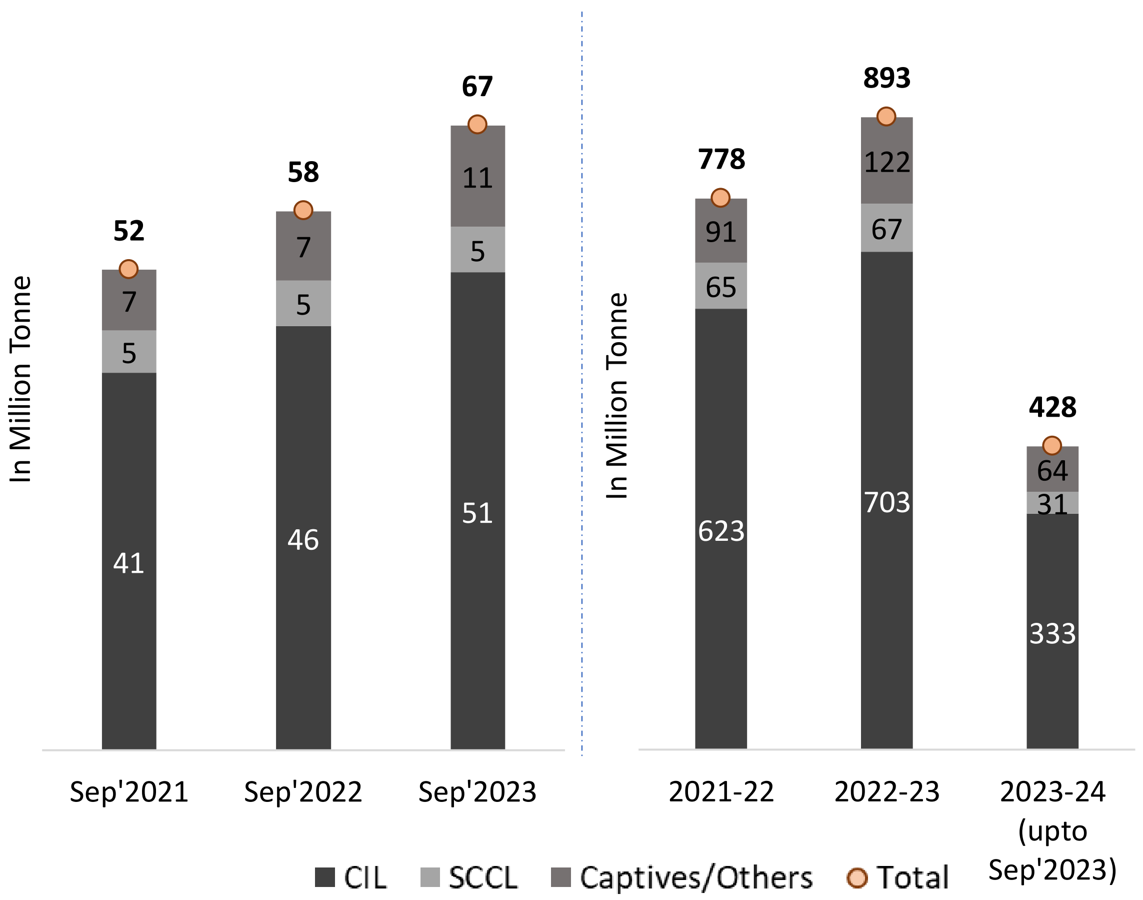




Source: CEA

Monthly Coal Statistics

Monthly/ Annual Coal Production (in Million Tonnes)

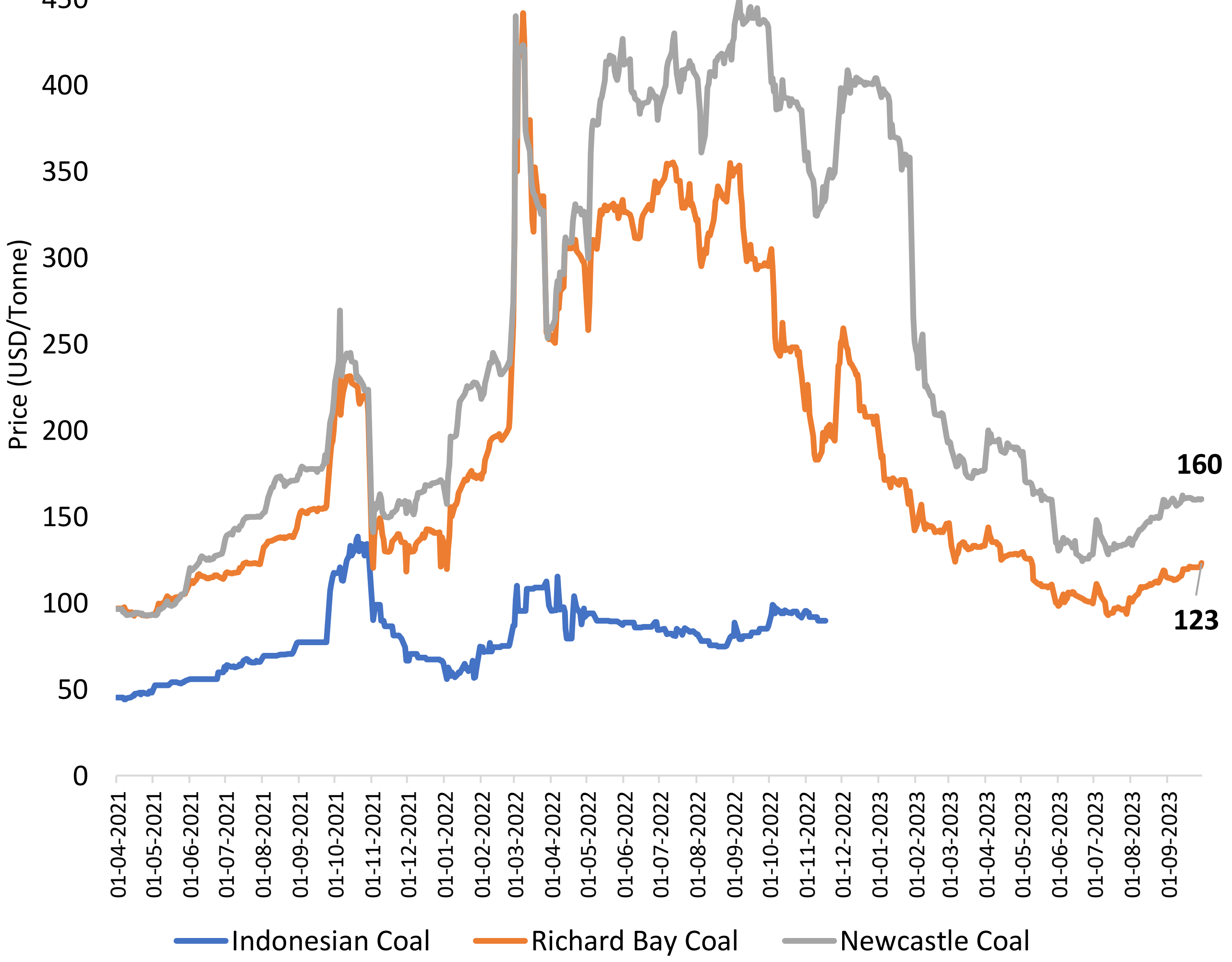


India's coal production increased in Sep'2023 (67 MT) by 16% as compared to Sep'2022.

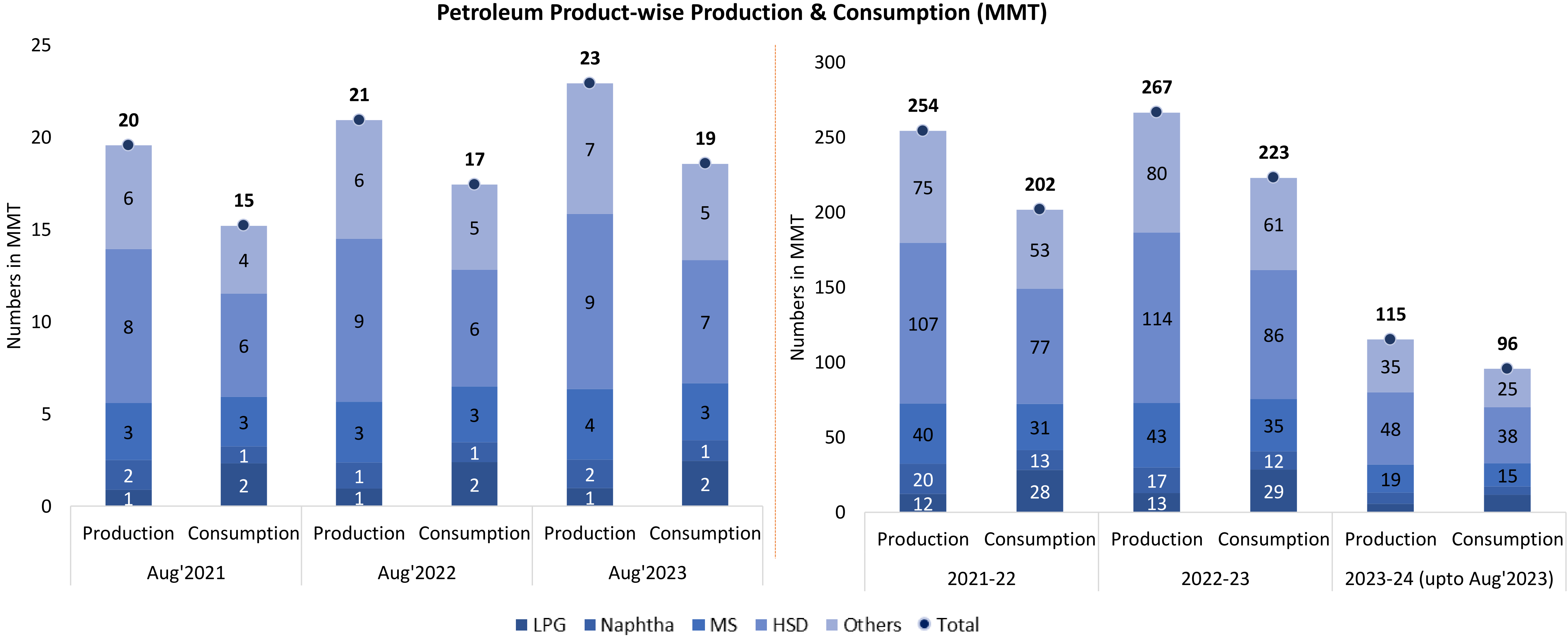
Source: Ministry of Coal

International Coal Prices

Date	Richard Bay	Newcastle
29-Sep-2023	123	160



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

NOTE: The data is available latest up to August’2023

Source: PPAC

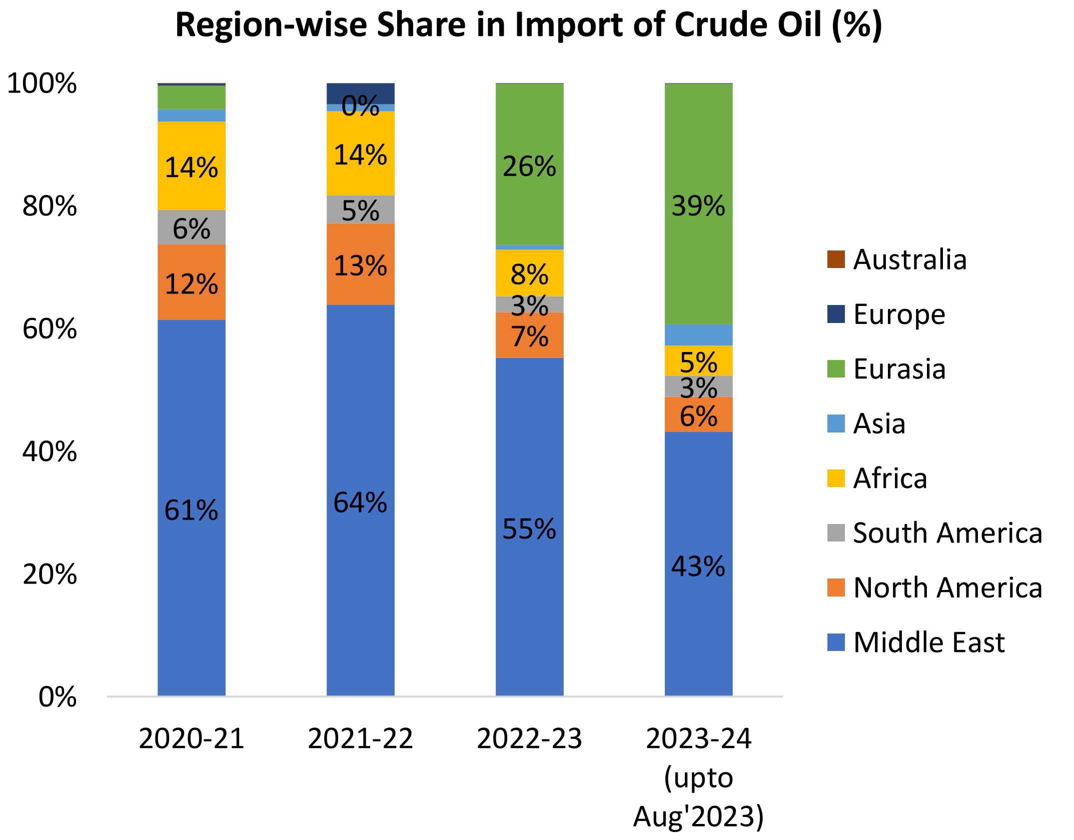
Petroleum Products Market Scenario (2/3)

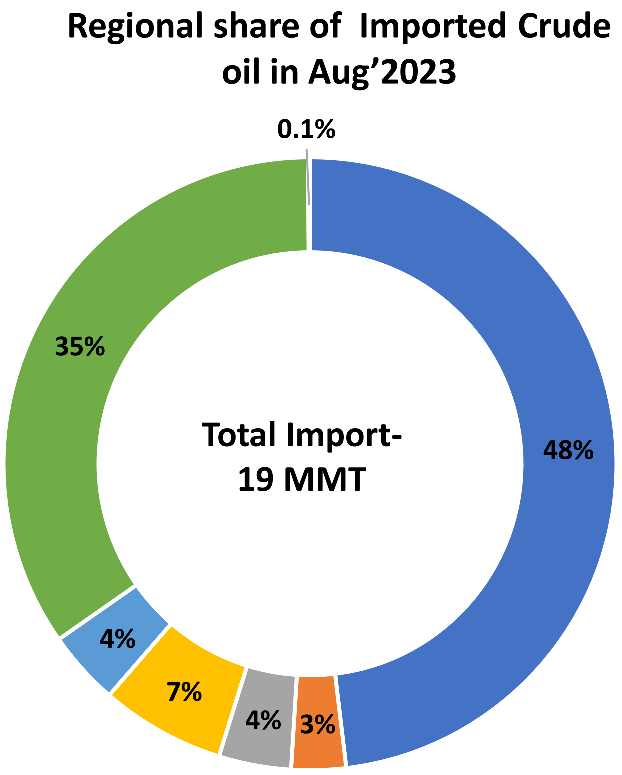
Import/Export of Crude Oil and Petroleum Products ('000 Tonnes)							
Petroleum Products	Import/ Export	Monthly			Yearly		
		Aug'21	Aug'22	Aug'23	2021-22	2022-23	2023-24 (upto Aug'2023)
Crude Oil	Import	17387	17637	18729	212382	232732	98420
	Export	0	0	0	0	0	0
	Net Import	**17387**	**17637**	**18729**	**212382**	**232732**	**98420**
LPG	Import	1695	1574	1569	17043	18309	6701
	Export	43	39	47	513	534	215
	Net Import	**1652**	**1535**	**1523**	**16530**	**17775**	**6486**
Diesel	Import	4	8	5	43	328	15
	Export	2603	2365	2479	32407	28535	11098
	Net Import	**-2599**	**-2357**	**-2474**	**-32364**	**-28206**	**-11083**
Petrol	Import	0	0	149	671	1069	295
	Export	903	1018	1174	13482	13118	6165
	Net Import	**-903**	**-1018**	**-1025**	**-12812**	**-12049**	**-5870**
Others	Import	1343	1627	2340	21259	24835	11825
	Export	1254	1818	2126	16352	18853	8390
	Net Import	**89**	**-190**	**213**	**4907**	**5983**	**3434**

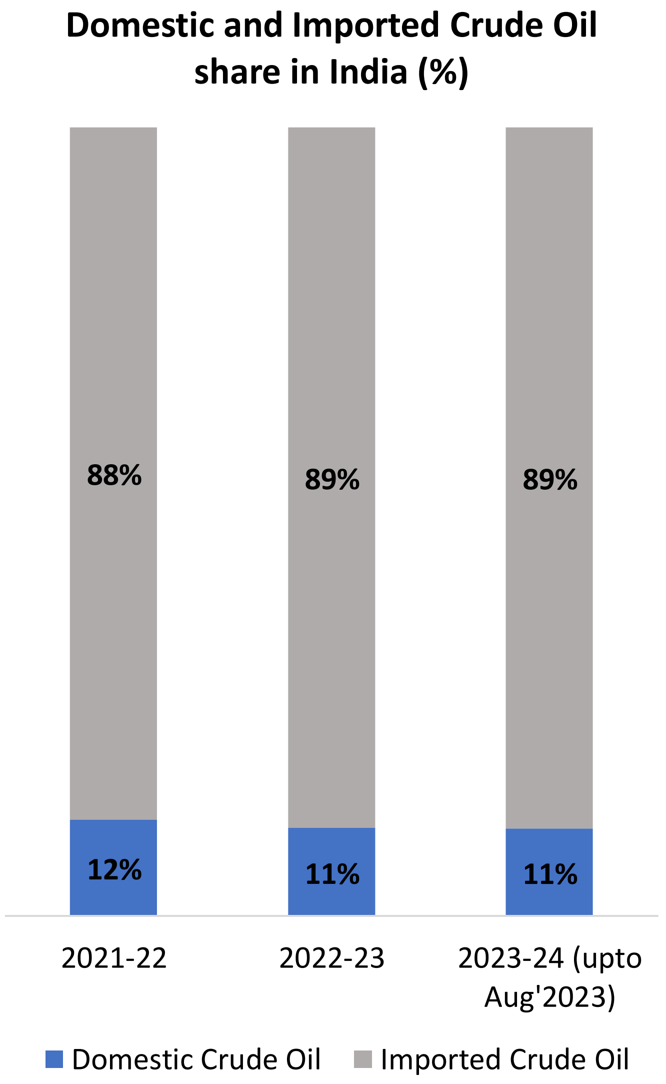
*Others include ATF, Naphtha, SKO, LDO, Lubes, FO, LSHS, Bitumen, pet coke, and others.

Source: PPAC

Petroleum Products Market Scenario (3/3)





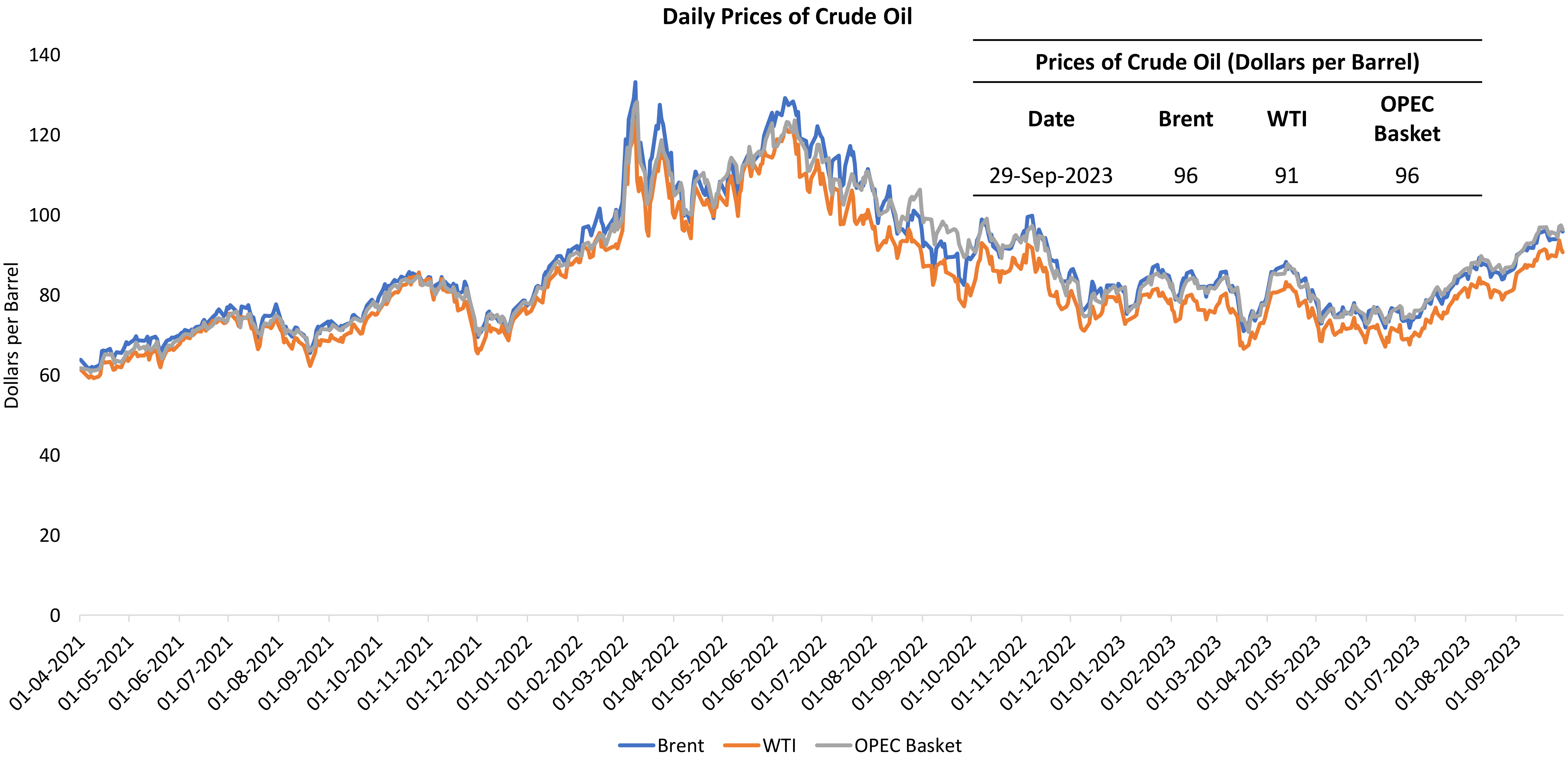


Total Import of Crude Oil (MMT)

Total Import	2021-22	2022-23	2023-24 (up to Aug'2023)
Crude Oil	**212**	**233**	**98**

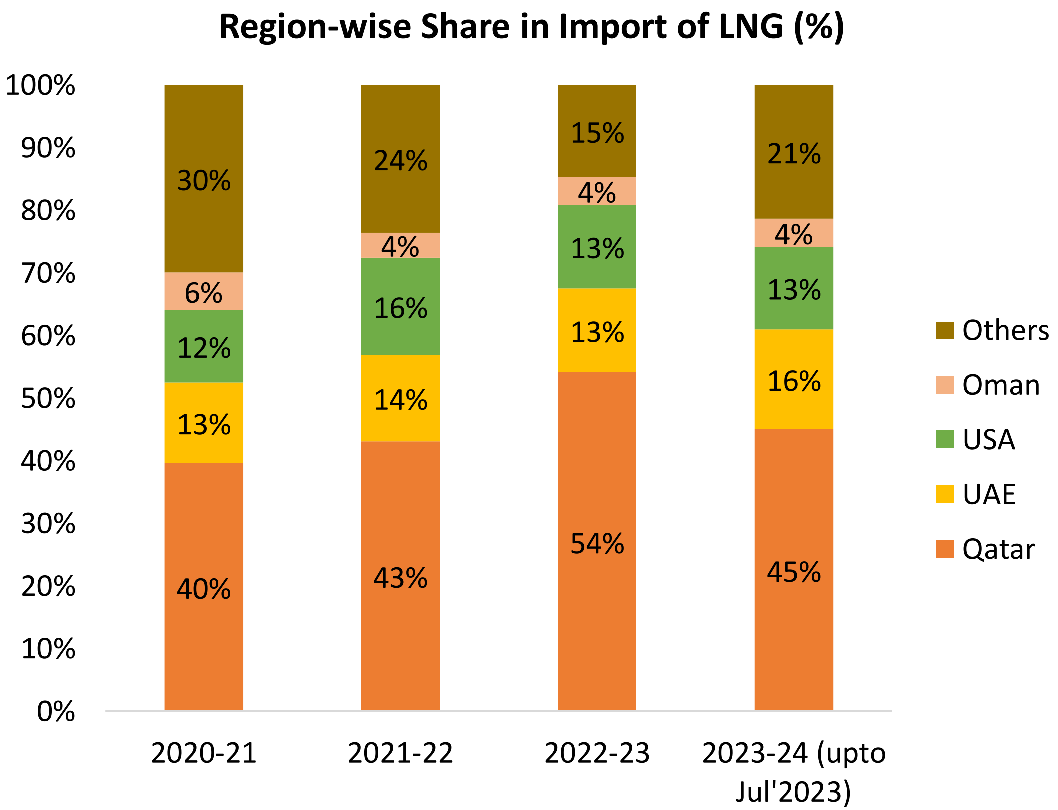
Source: MoPNG and PPAC

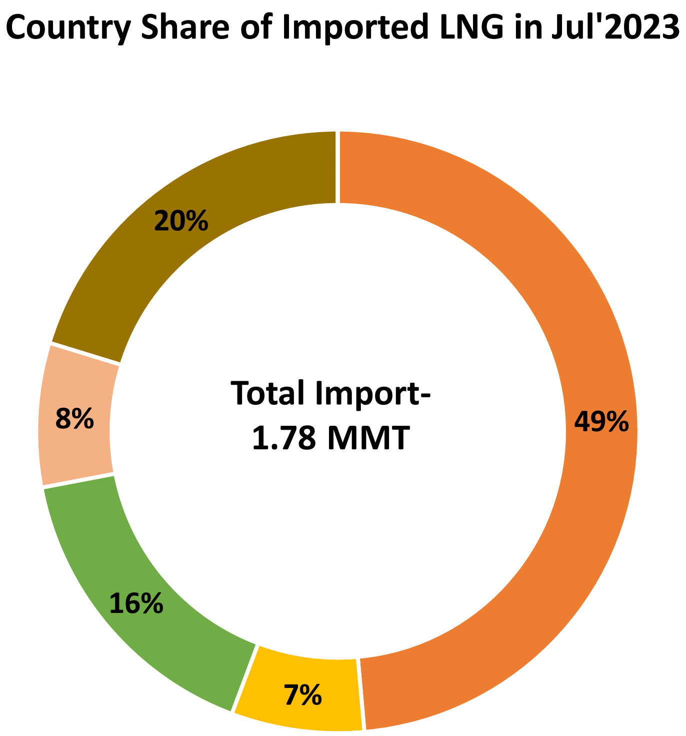
Daily Prices of Crude Oil

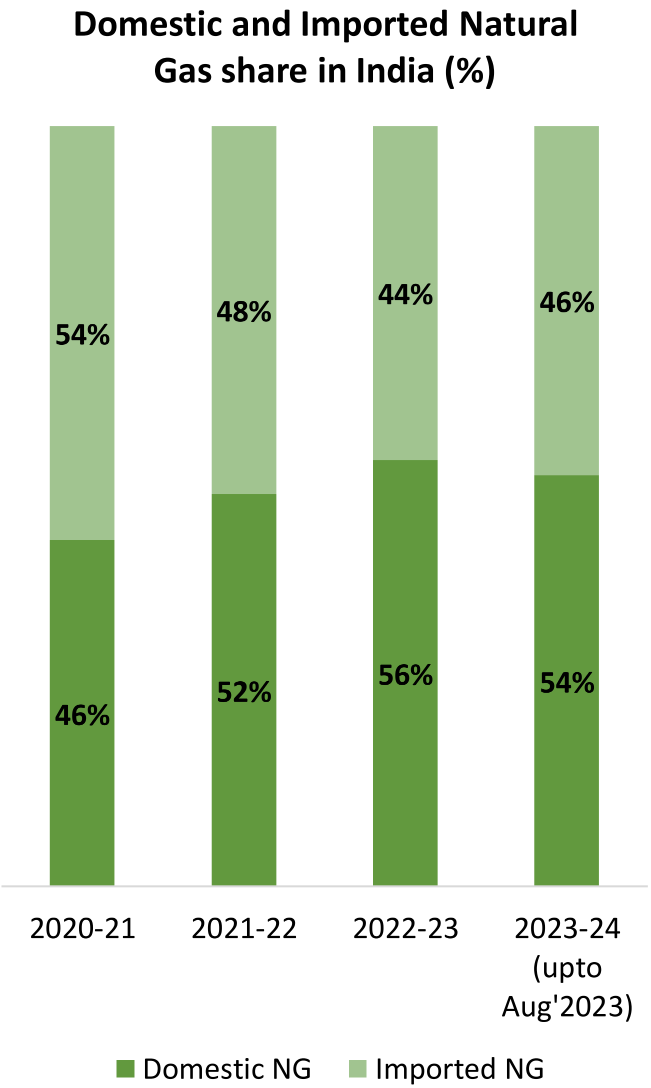


Prices of Crude Oil (Dollars per Barrel)			
Date	Brent	WTI	OPEC Basket
29-Sep-2023	96	91	96

Gas Market Scenario







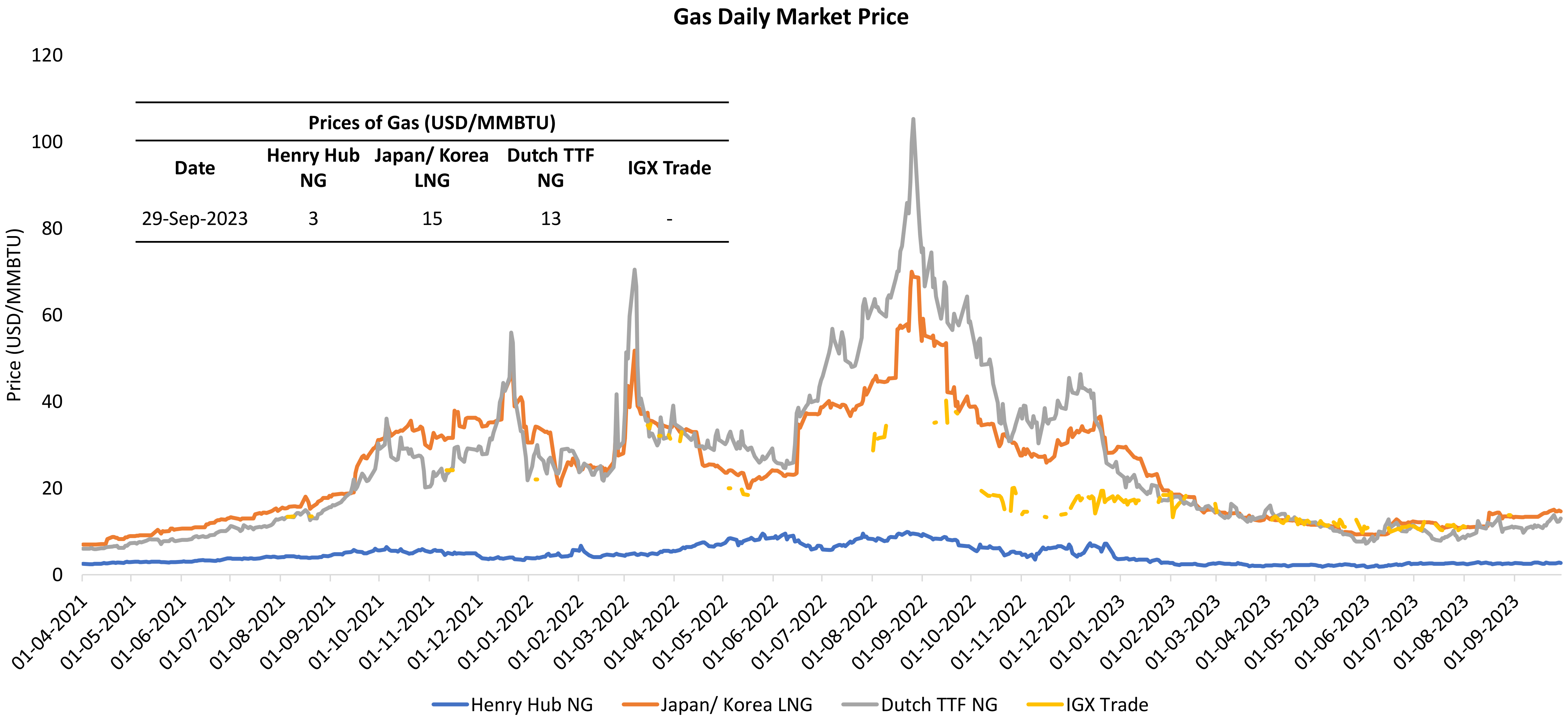
Others include- Equatorial Guinea, Trinidad, Cameroon, Egypt, France, Algeria, Belgium, Indonesia, Turkey, Russia, Spain, Malaysia, Brunei, Netherlands, Norway, and others.

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

Total Import	2021-22	2022-23	2023-24 (upto Jul’2023)
LNG	**23.42**	**19.85**	**7.62**

Source: MoCI and PPAC

Daily Prices of Gas



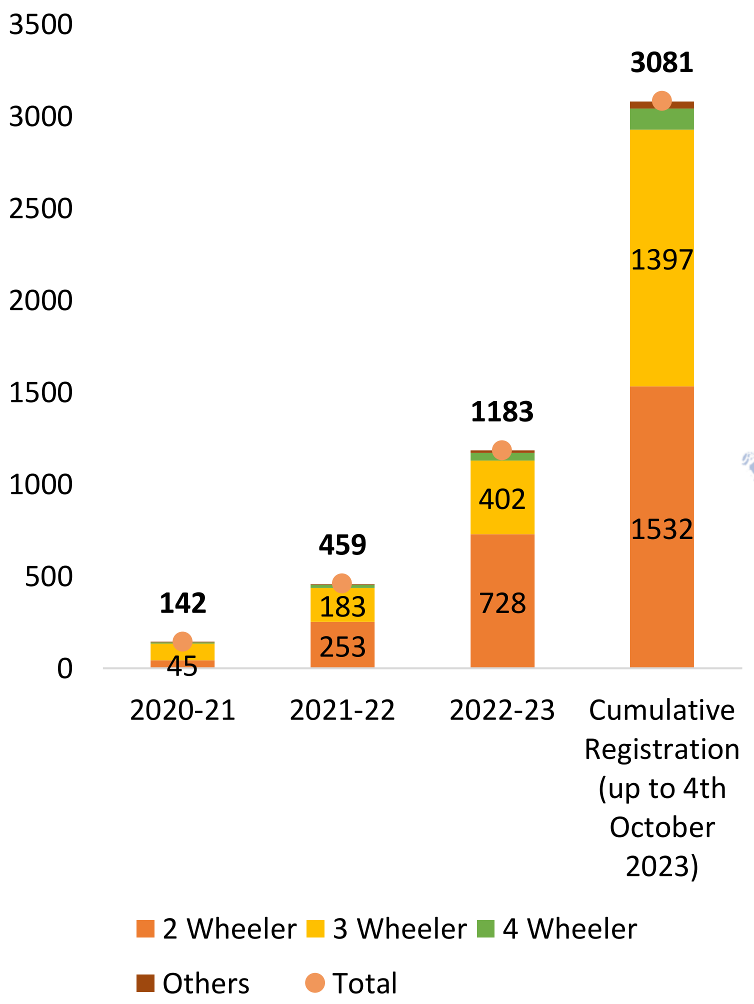
Prices of Gas (USD/MMBTU)

Date	Henry Hub NG	Japan/ Korea LNG	Dutch TTF NG	IGX Trade
29-Sep-2023	3	15	13	-

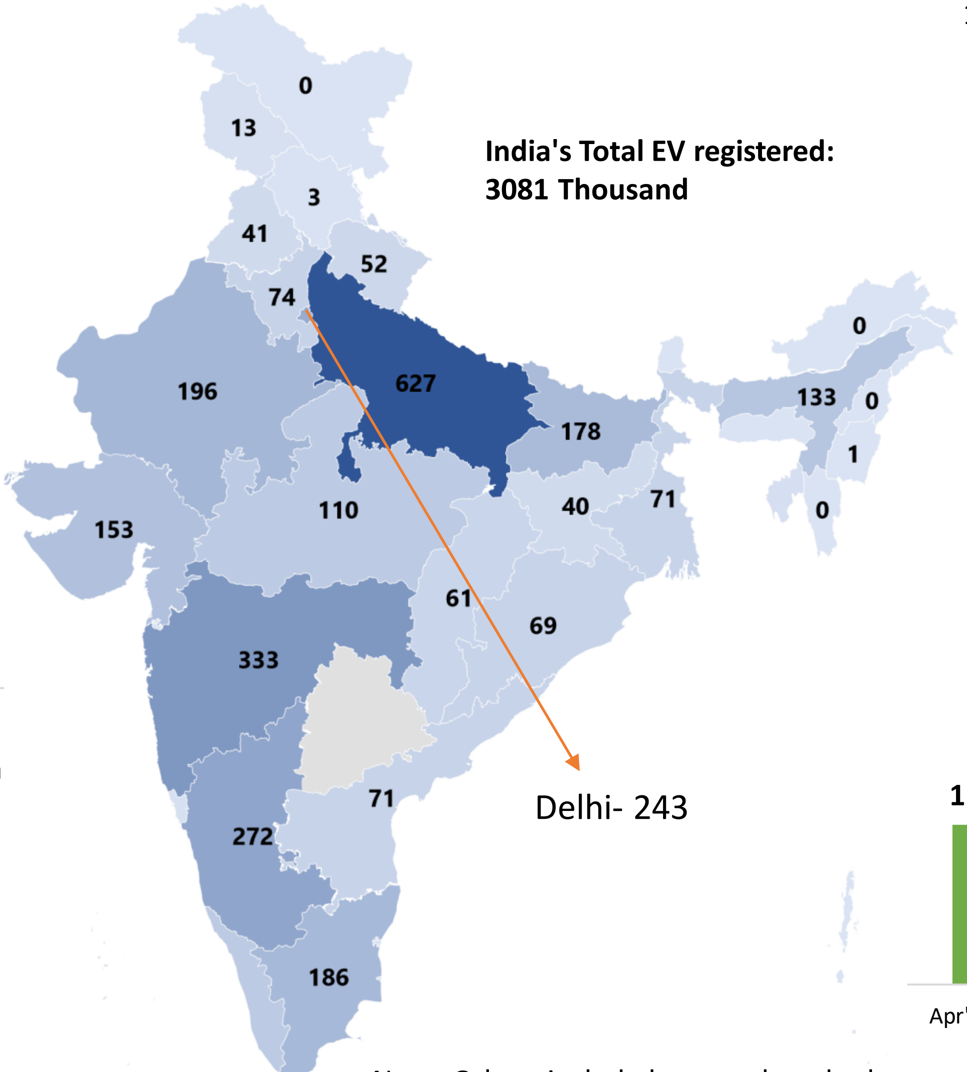
MMBTU- Million Metric British Thermal Unit

Status of Electric Mobility in India

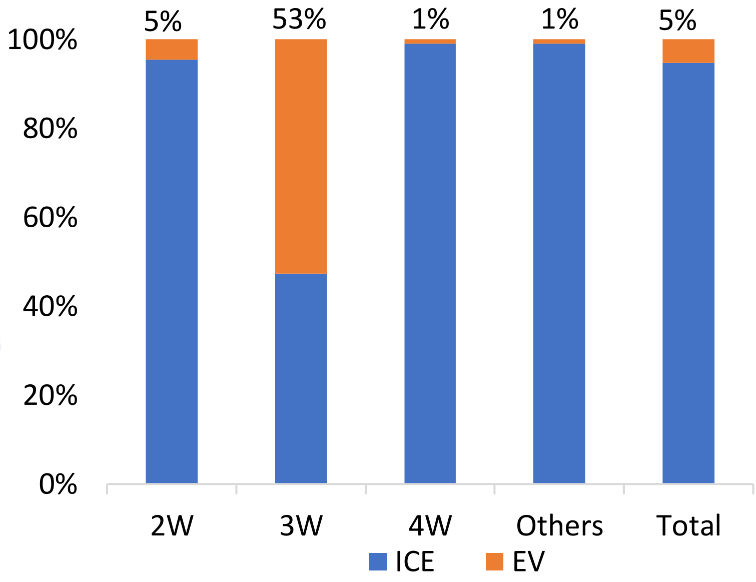
National EV registration (in Thousands)



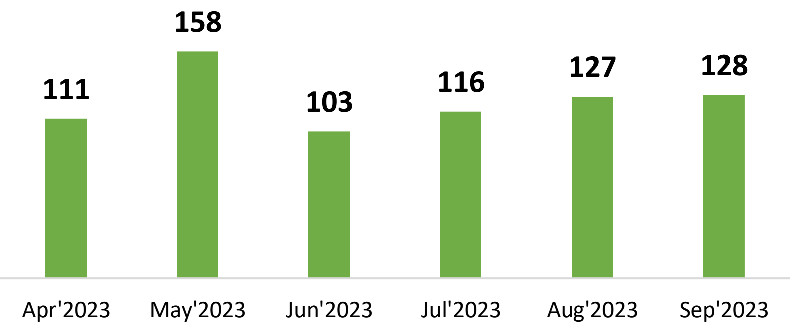
Cumulative State-wise EV registration as on 4th October 2023 (in Thousands)



EV and ICE sale composition in 2022-23



Provisional Monthly EV registered (in Thousands)



Note: Others include bus, truck and others

Source: VAHAN Dashboard

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 ISTS charges are waived for 25 years for the onshore projects being commissioned before 30th June 2025 and for off-shore projects on or before 31st December 2032.

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 extended the waiver of ISTS charges from 30th June 2025 to 31st December 2030.

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 September 2023

- CEA released **the state-wise monthly electricity and peak demand for 2024-25**. India's monthly electricity demand is:

Parameter	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	2024-25
Electricity Demand (BU)	148	151	151	149	159	148	137	130	138	141	134	150	1736
Peak Demand (GW)	238	235	241	230	255	257	228	216	230	235	232	240	257

- Gujarat Energy Development Agency released the **draft Gujarat Renewable Energy Policy 2023**. The policy aims to facilitate the development of 100 GW of cumulative Renewable Energy capacity by 2030 with investments of around Rs. 5 lakh crores by utilizing approximately 4 lakh acres of land.

- MNRE has released the **Strategy for Establishment of Offshore Wind Energy Projects** and plans to auction 37 GW of offshore site leases in the next 7 years (until FY30). They have formulated three models for developing offshore wind energy projects, especially along the southern and western shorelines of the country-
  - Model A: (1 GW) PPA award tender to be supported with Viability Gap Funding (VGF)
  - Model B: (14 GW) Exclusive site lease tender without VGF support
  - Model C: (22 GW) Sea-bed allocation bid for project development without VGF support

- The Ministry of Power has revised the **blending of imported coal from 6% to 4%** for all the central, state generating companies, and IPPs till March 2024.

- Haryana released the **guidelines for scheme on state-level energy conservation awards**. The key objectives of the scheme are:
  - To create awareness among the industrial, commercial, govt. buildings and educational institutes sectors about energy conservation.
  - To recognize the efforts of the industrial, commercial, govt. buildings and educational institutes sector consumers in conserving energy by way of giving them awards/certificates of merit.

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