India's Energy Overview

NOVEMBER 2022

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Contents

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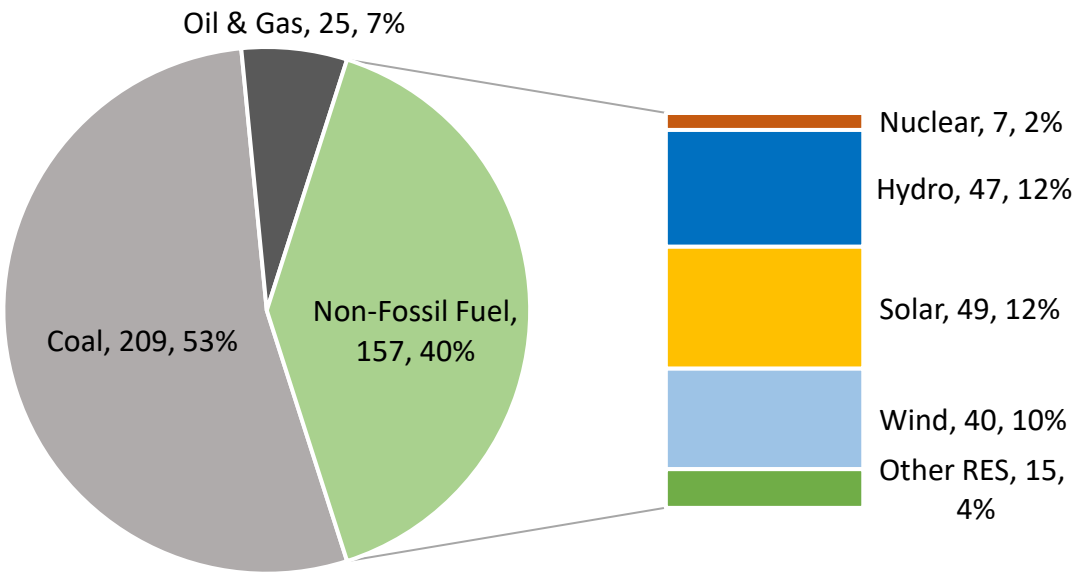
India’s Electricity Capacity Mix (1/3)

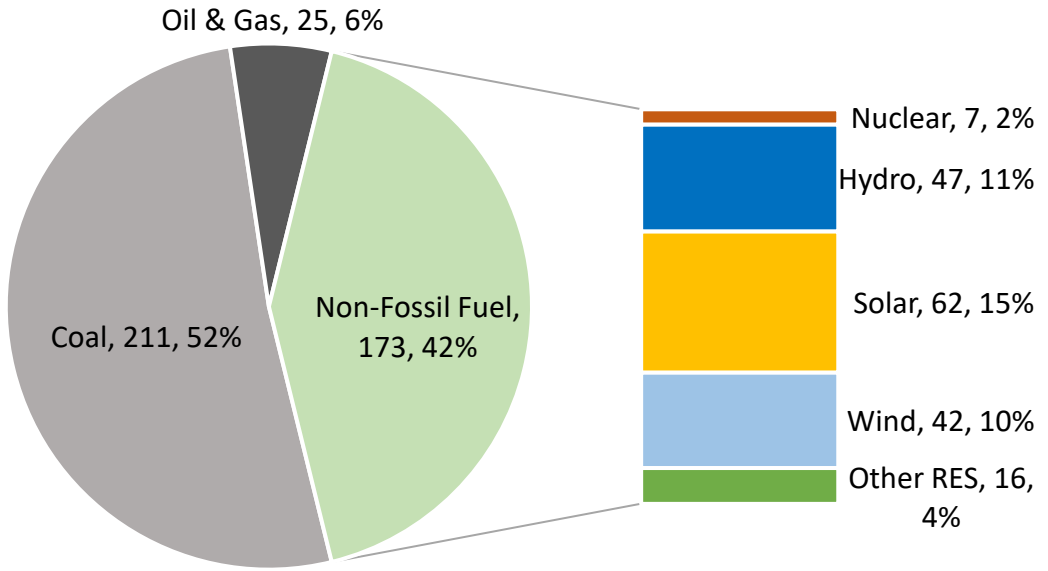
November 2021



Total Capacity: 392 GW

*Capacity Numbers are in GW

November 2022



Total Capacity: 409 GW

- India’s electricity generating capacity is 409 GW as on Nov-2022. Major contributors to the capacity are coal 211 GW (52%), solar 62 GW (15%), hydro 47 GW (11%), and wind 42 GW (10%).
- Non-fossil fuel’s generating capacity has increased from 157 GW to 173 GW since Nov-2021, a jump of 10%. Major capacity addition was in solar technology followed by wind.
- As on Nov-2022, India’s renewable energy capacity (including large hydro) stood at 166 GW.

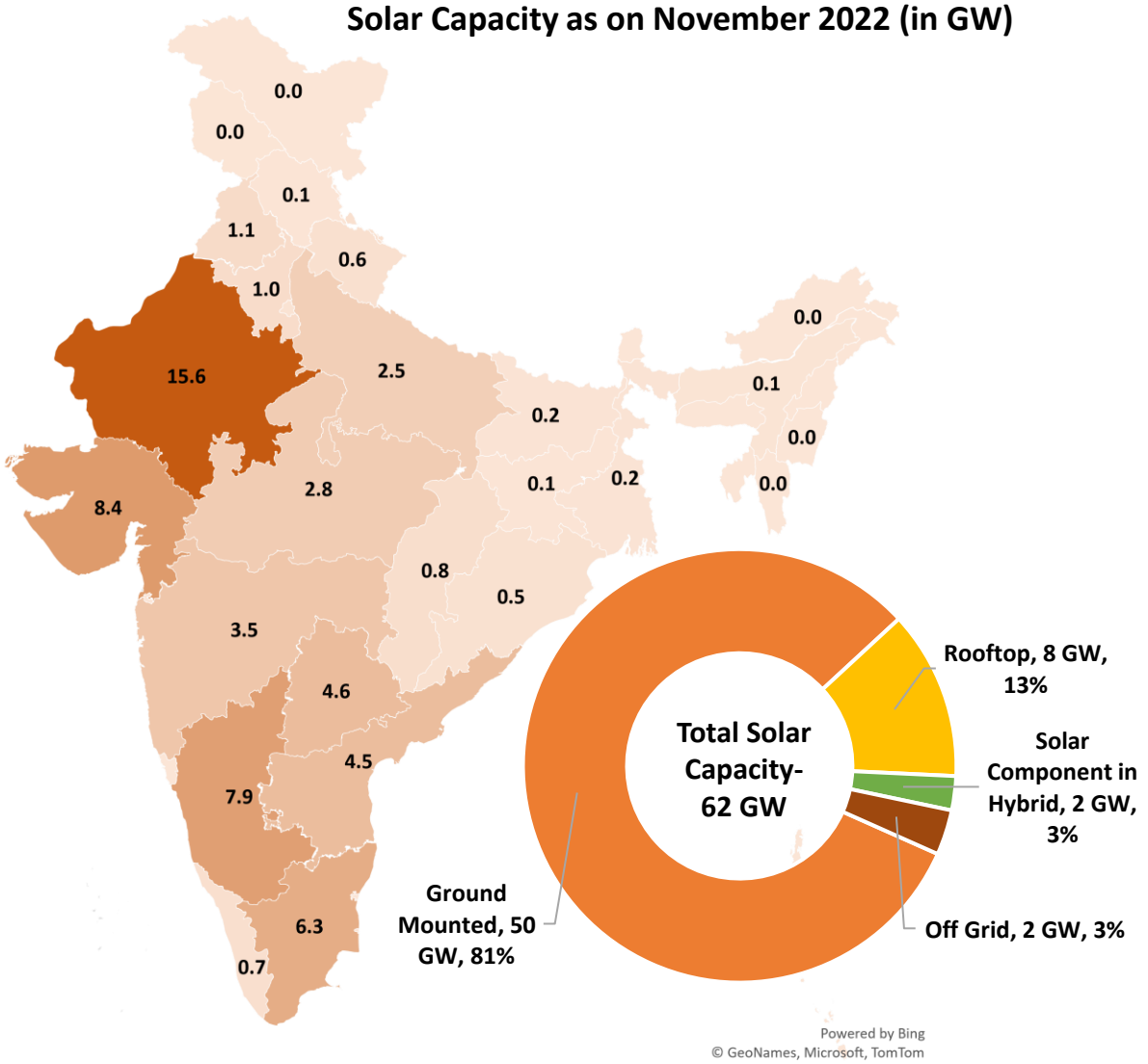
Source: CEA

GW: Giga Watt

India's Electricity Capacity Mix (2/3)

State-wise Solar Installed Capacity as on November 2022

State-wise installed capacity of Renewable Power					
States	**Ground Mounted**	**Rooftop**	**Solar Component in Hybrid**	**Off Grid**	**Total Solar Power**
Rajasthan	12.7	0.8	1.6	0.5	15.6
Gujarat	6.2	2.1	0.0	0.0	8.4
Karnataka	7.5	0.4	0.0	0.0	7.9
Tamil Nadu	5.9	0.4	0.0	0.1	6.3
Telangana	4.4	0.3	0.0	0.0	4.6
Andhra Pradesh	4.3	0.2	0.0	0.1	4.5
Maharashtra	2.1	1.3	0.0	0.1	3.5
Madhya Pradesh	2.5	0.2	0.0	0.1	2.8
Uttar Pradesh	2.1	0.3	0.0	0.1	2.5
Punjab	0.8	0.2	0.0	0.1	1.1
Haryana	0.3	0.4	0.0	0.3	1.0
Chhattisgarh	0.4	0.0	0.0	0.4	0.8
Kerala	0.3	0.3	0.0	0.0	0.7
Uttarakhand	0.3	0.3	0.0	0.0	0.6
Others	0.9	0.6	0.0	0.2	1.7
All India	50.5	7.8	1.6	2.1	62.0



Source: MNRE
GW: Giga Watt
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

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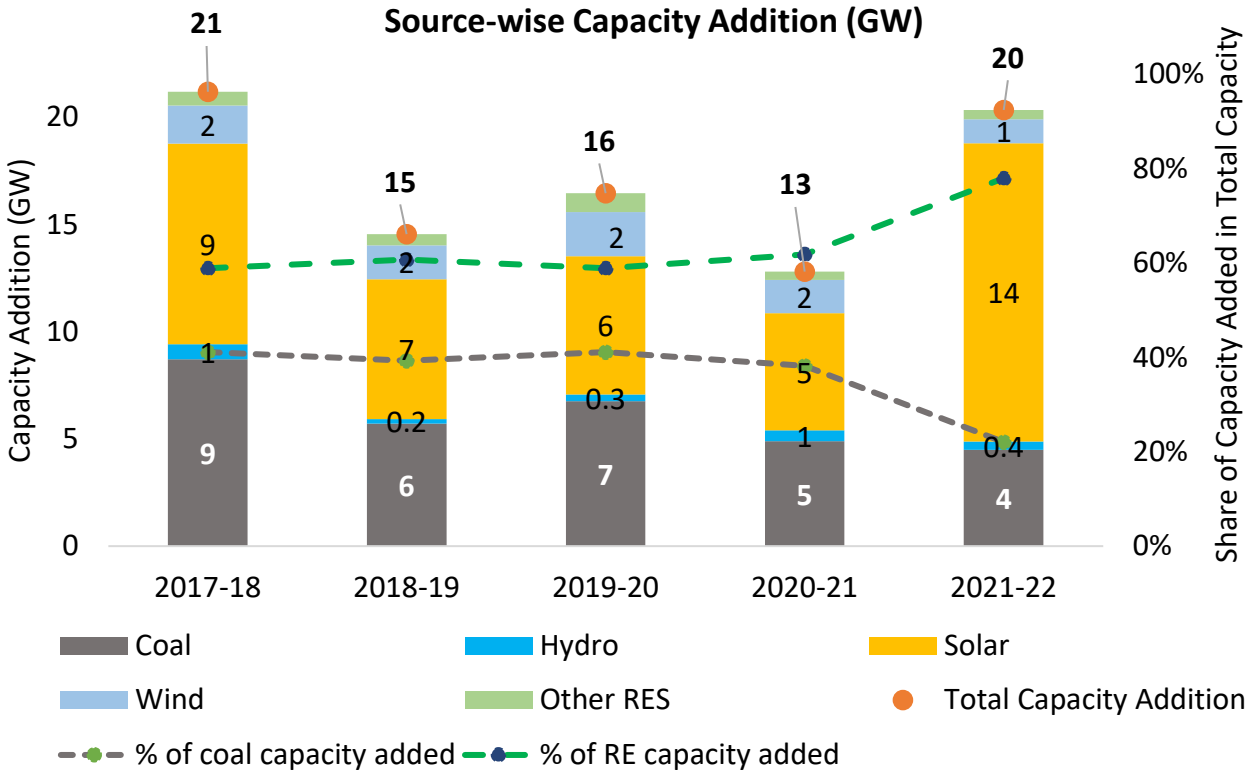
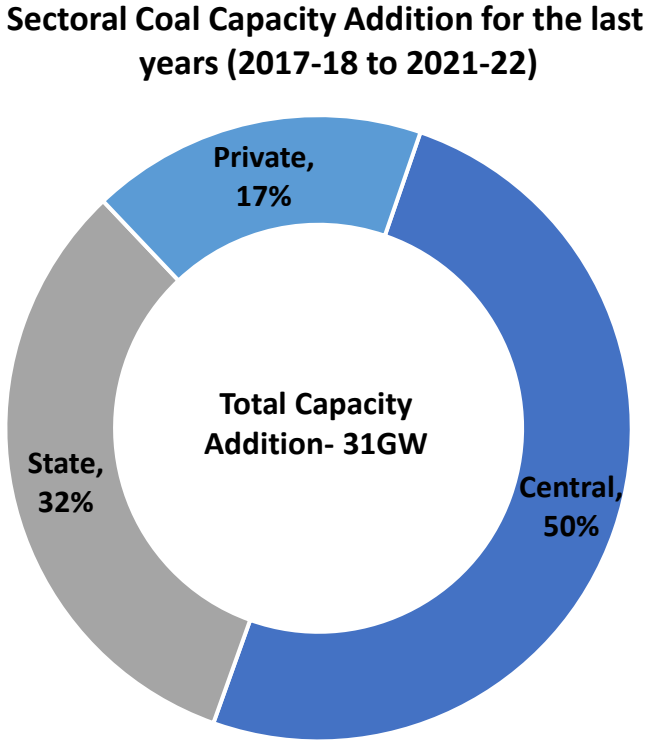
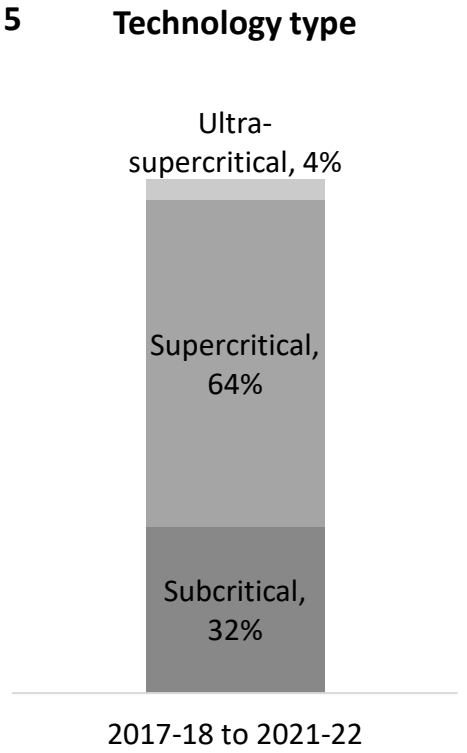
India's Electricity Capacity Mix (3/3)

Source-wise Capacity Addition in the last 5 years







- A total of 55 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 31 GW, mostly in the central sector (50%).
- The share of RE addition in total capacity addition is increasing over the years (from 59% in 2017 to 78% in 2022).
- Since Apr-2017, there has been no capacity addition in nuclear power.

Sources: Vasudha Analysis
RE: Renewable Energy (hydro, solar, wind, and other RES)
GW: Giga Watt
CPPs: Coal Power Plants

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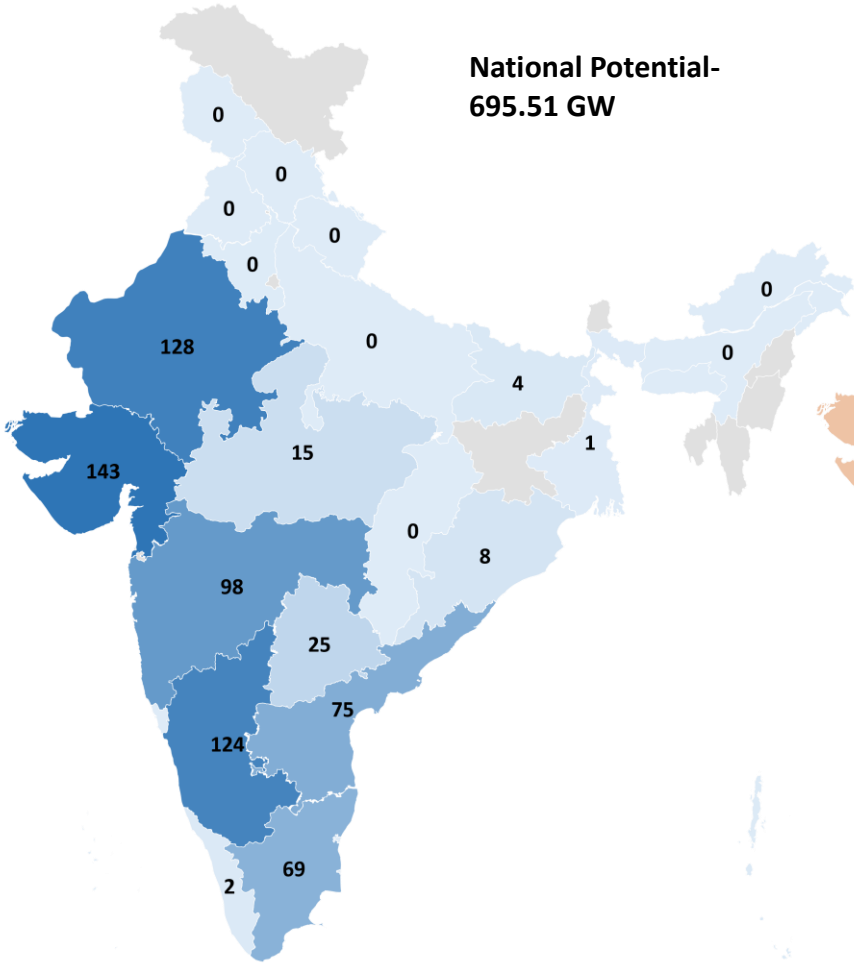
RE Potential and Installed Capacity (1/2)

RE potential in the state as on November 2022

Wind Potential at 120m agl

National Potential-
695.51 GW



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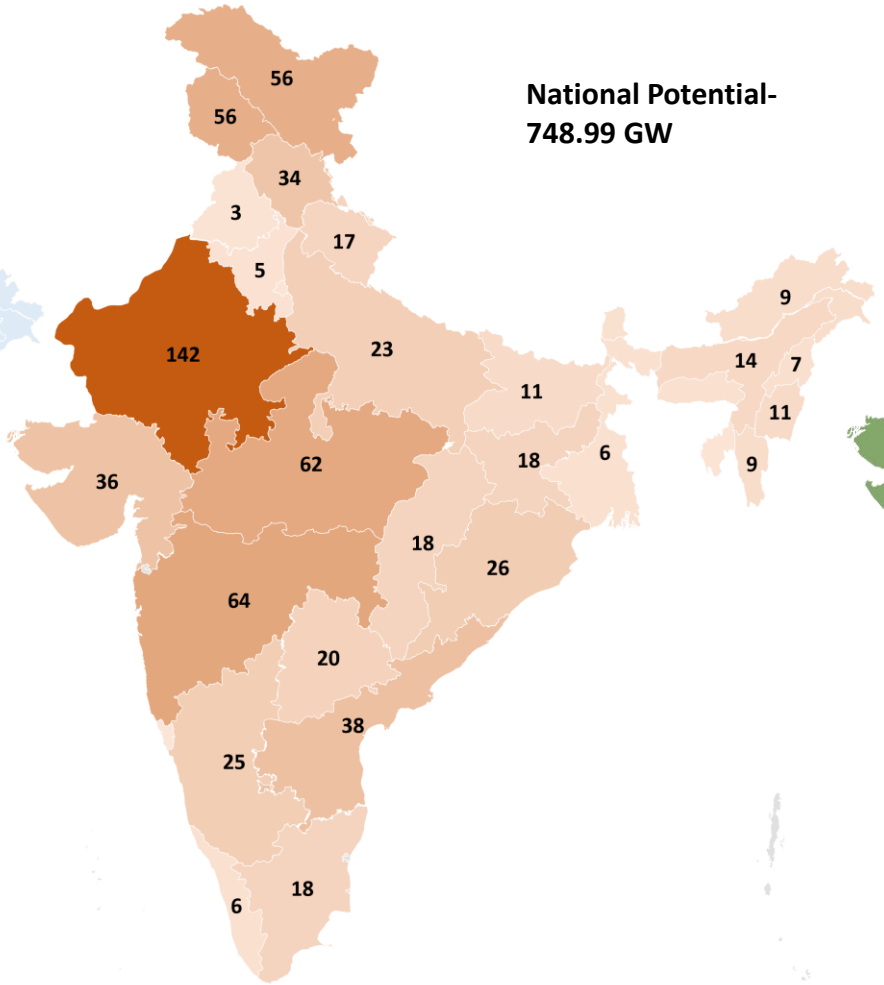
Solar Potential

National Potential-
748.99 GW



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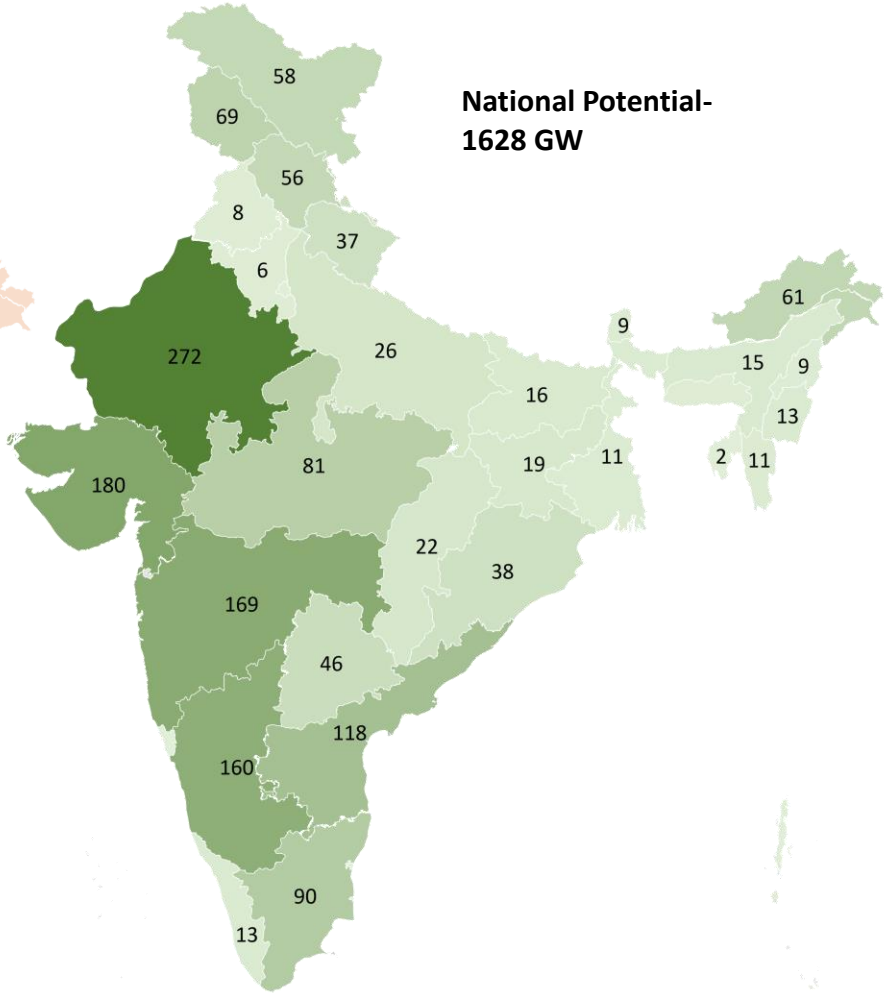
Renewable Energy Potential

National Potential-
1628 GW



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Sources: Vasudha Analysis
Note: 1. Renewable Energy includes solar, wind, biopower, small-hydro, and hydro.
2. In the Wind map, the blank states show that they don't have any wind potential.

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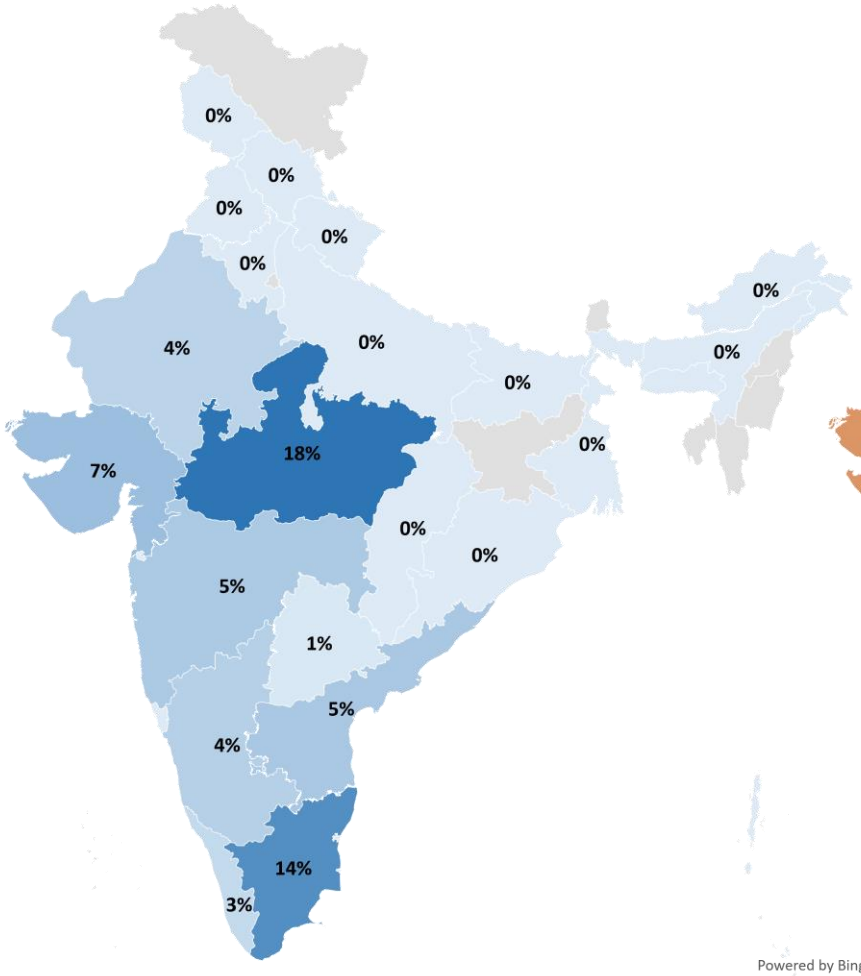
RE Potential and Installed Capacity (2/2)

RE Installed capacity as a Percentage of the total resource potential in the state as on November 2022

Wind Capacity



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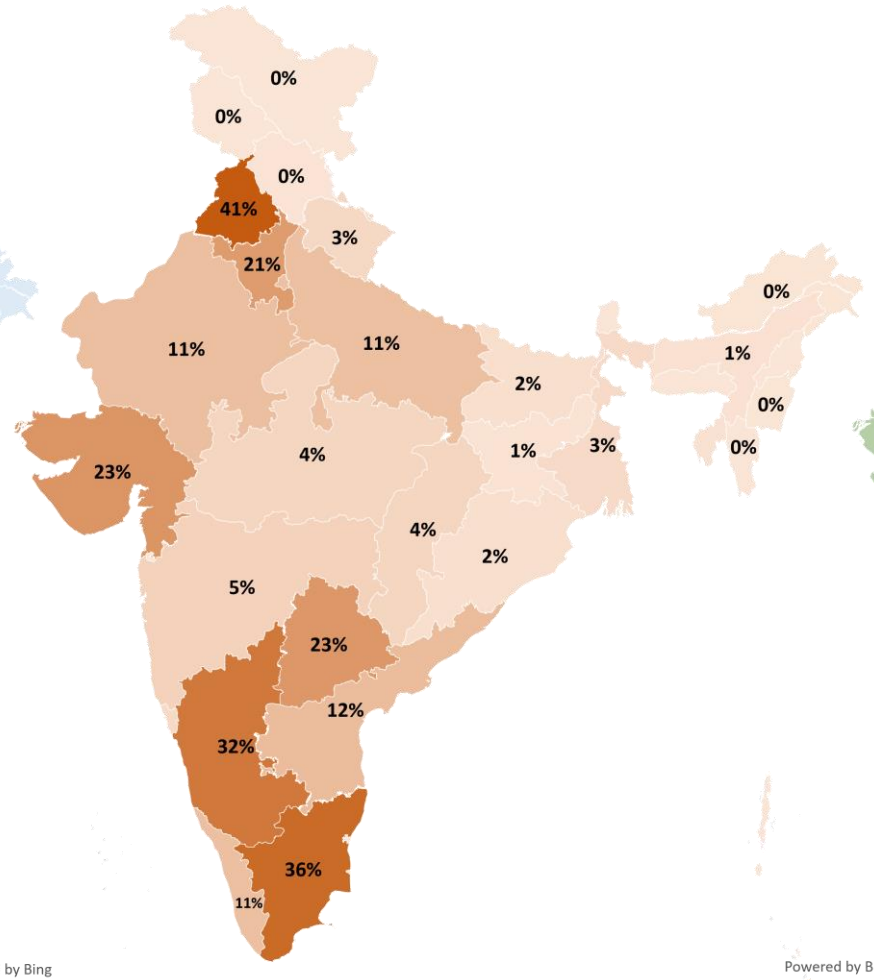
Solar Capacity



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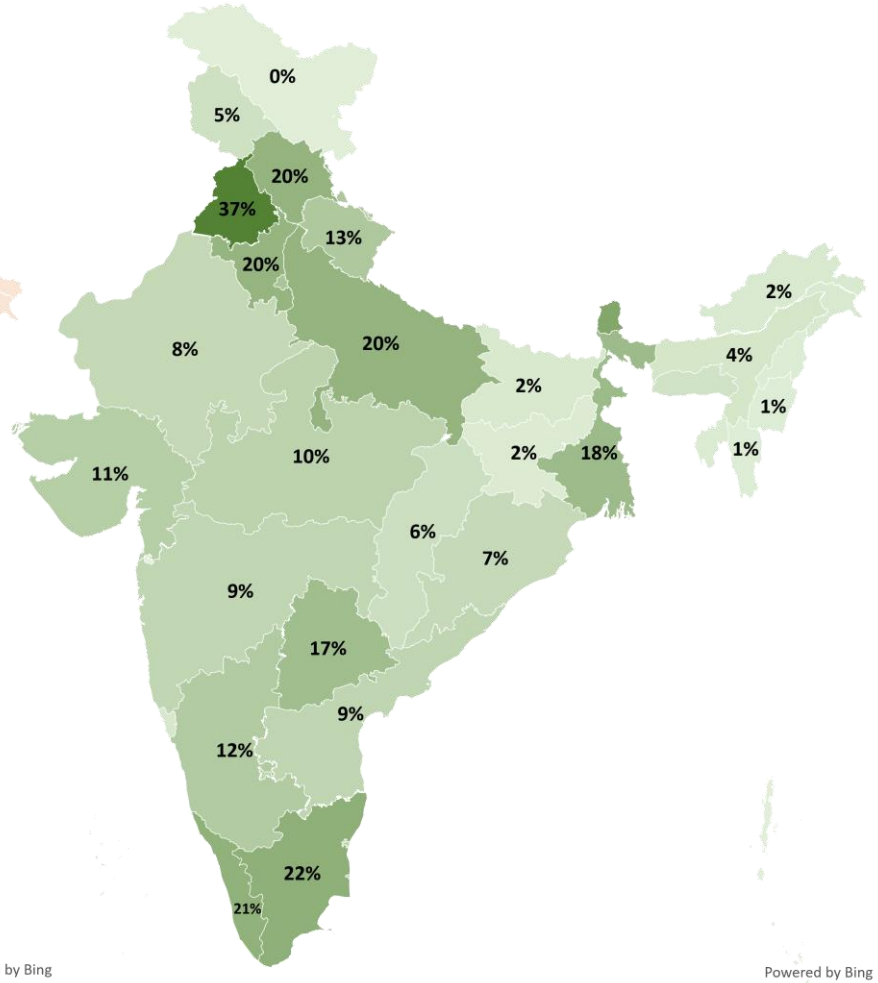
Total RE Capacity



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Sources: Vasudha Analysis
Note: 1. Renewable Energy includes solar, wind, biopower, small-hydro, and hydro.
2. In the Wind map, the blank states show that they don't have any wind potential.
3. RE capacity numbers of the state are within the state's boundaries and do not represent the power procurement/utilizations.

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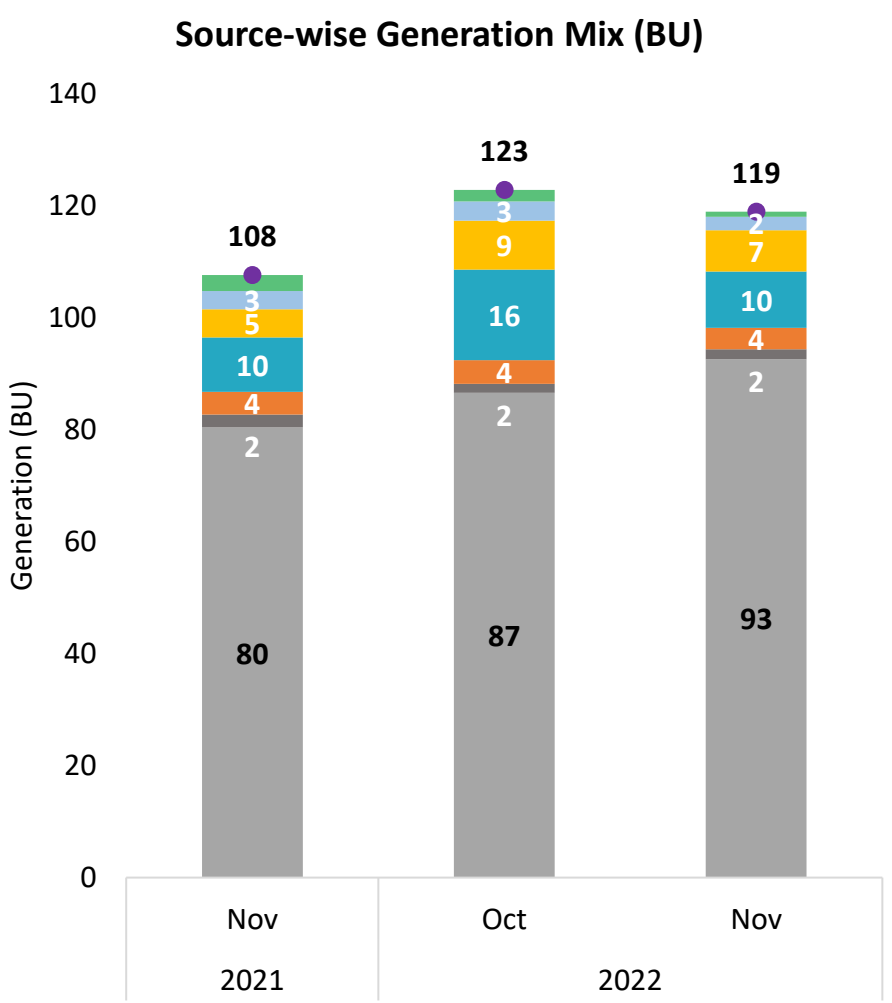
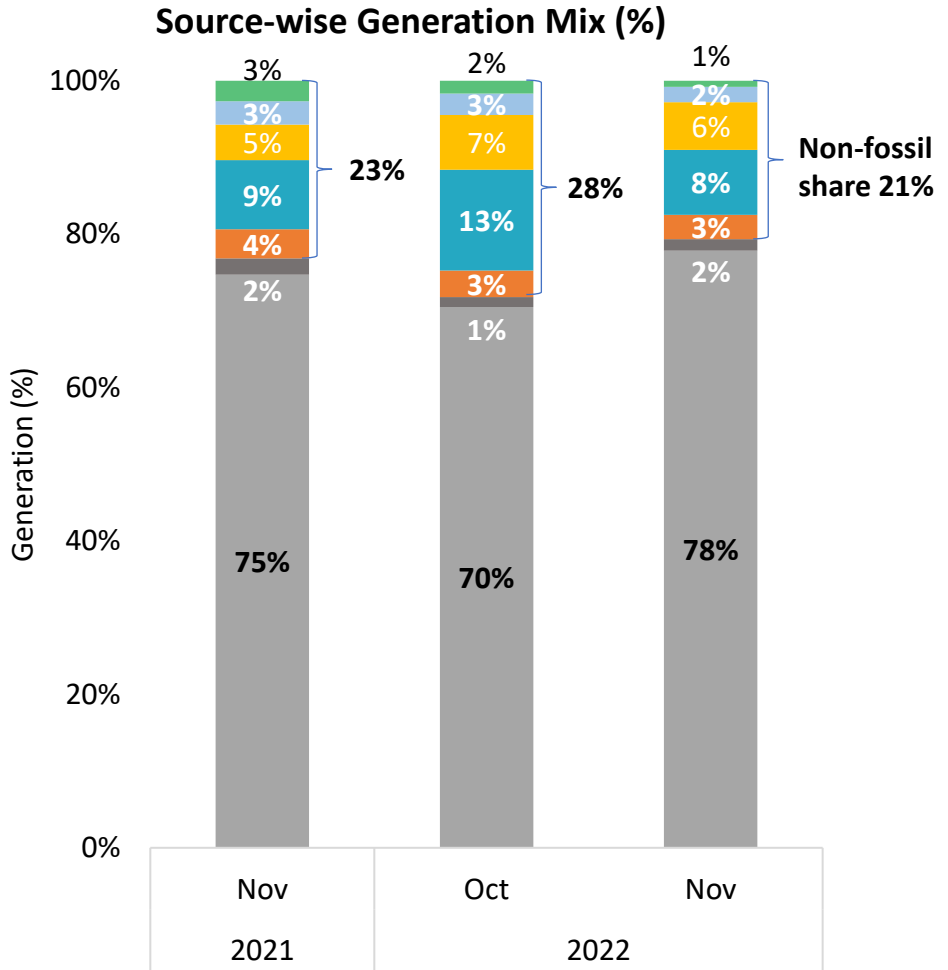
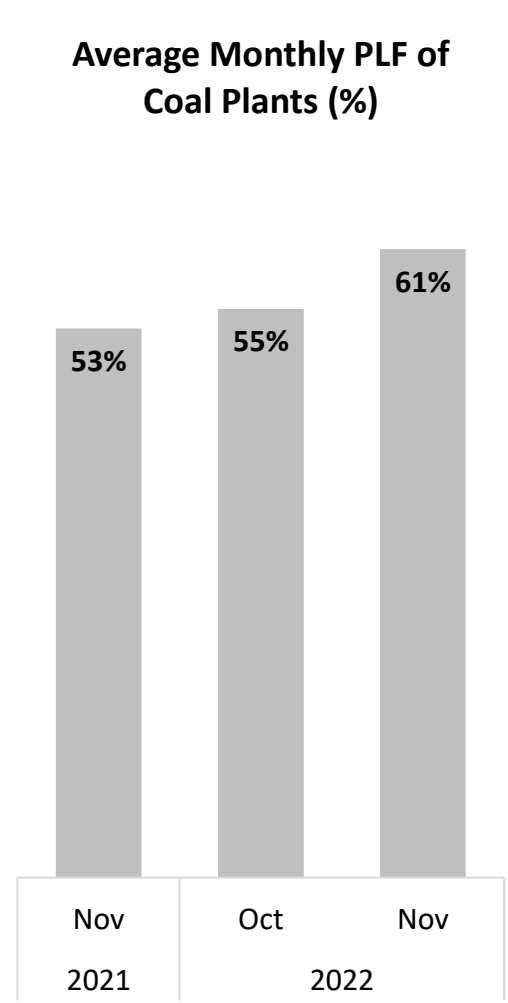
India's Electricity Generation Mix (1/2)







Coal | Oil & Gas | Nuclear | Hydro | Solar | Wind | Other RES | All India

Sources: CEA
PLF: Plant Load Factor BU- Billion Units
Note: Nov-2022 numbers are provisional.

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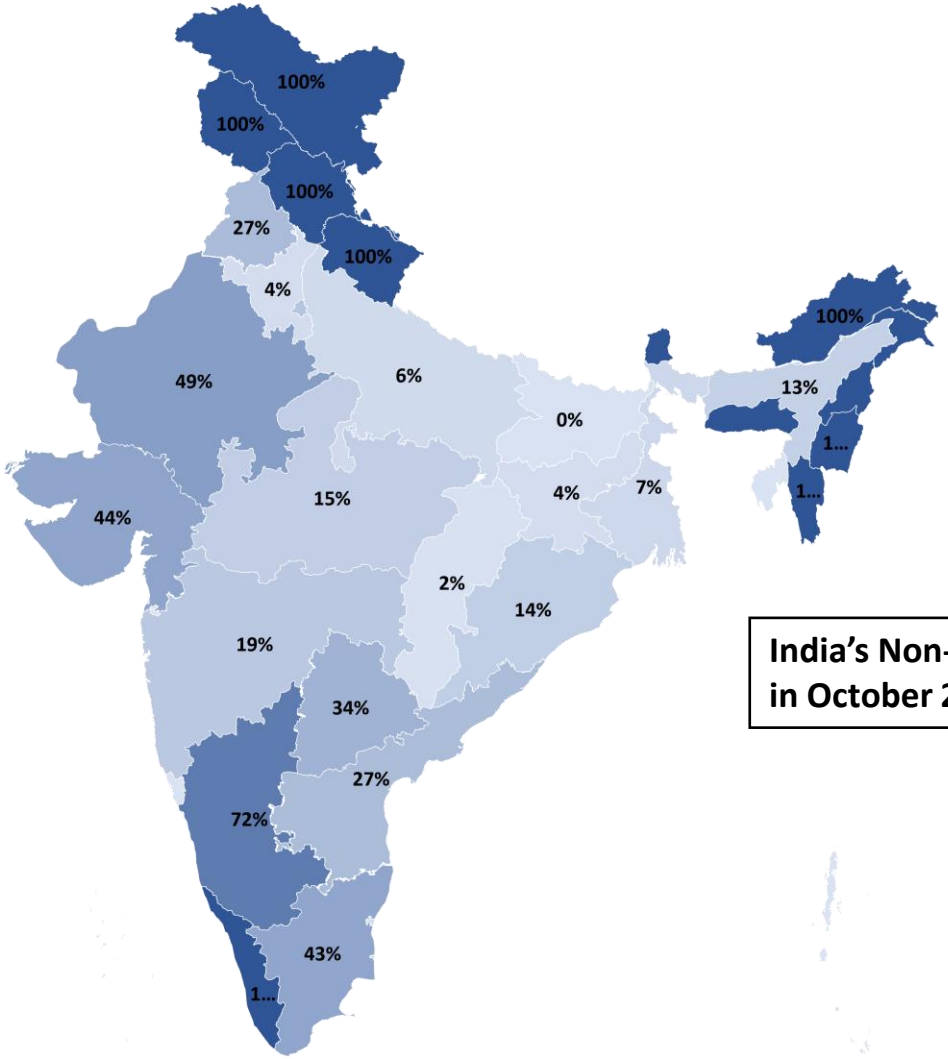
India's Electricity Generation Mix (2/2)

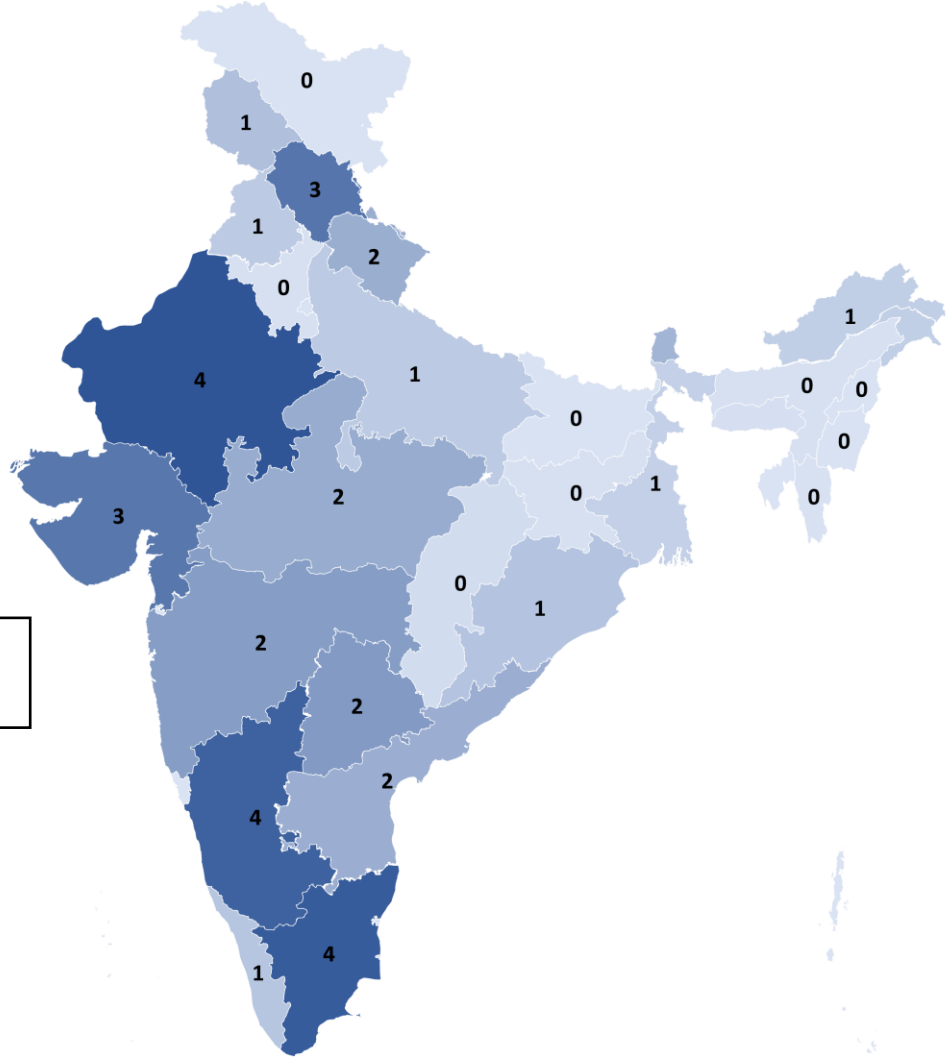
Non-fossil generation in October 2022

Non-Fossil Generation as % of total generation in the state



India's Non-Fossil Generation in October 2022: 35 BU

State-wise Non-Fossil Generation (BU)

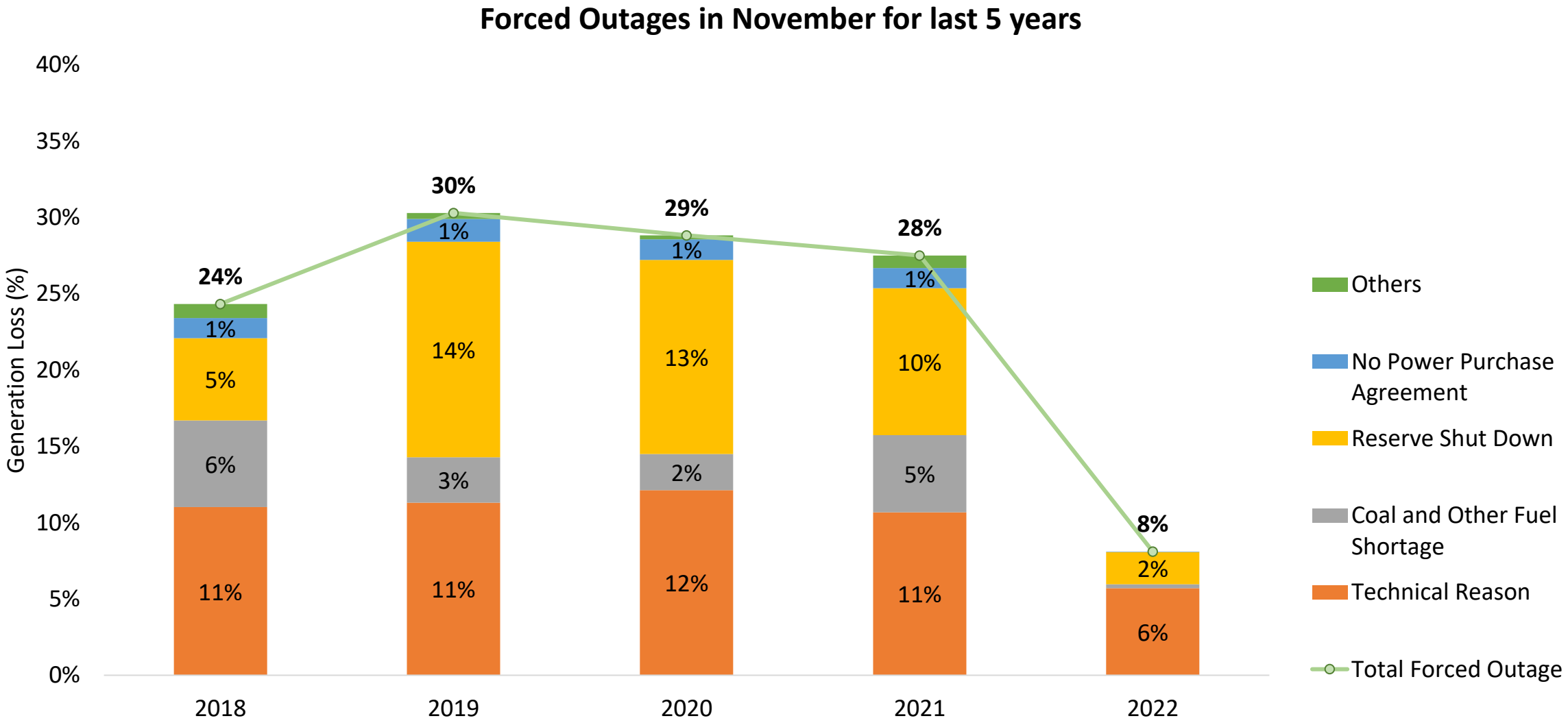


Sources: Vasudha Analysis

Note: 1. Oct-2022 numbers are provisional.

2. RE generation numbers of the state are of power production of RE units within the state's boundaries and do not represent the power procurement/utilizations.

Coal Generation Loss and Reasons for Forced Outages



Sources: Vasudha Analysis
BU: Billion Units
RSD: Reserve shut down, PPA: Power Purchase Agreement

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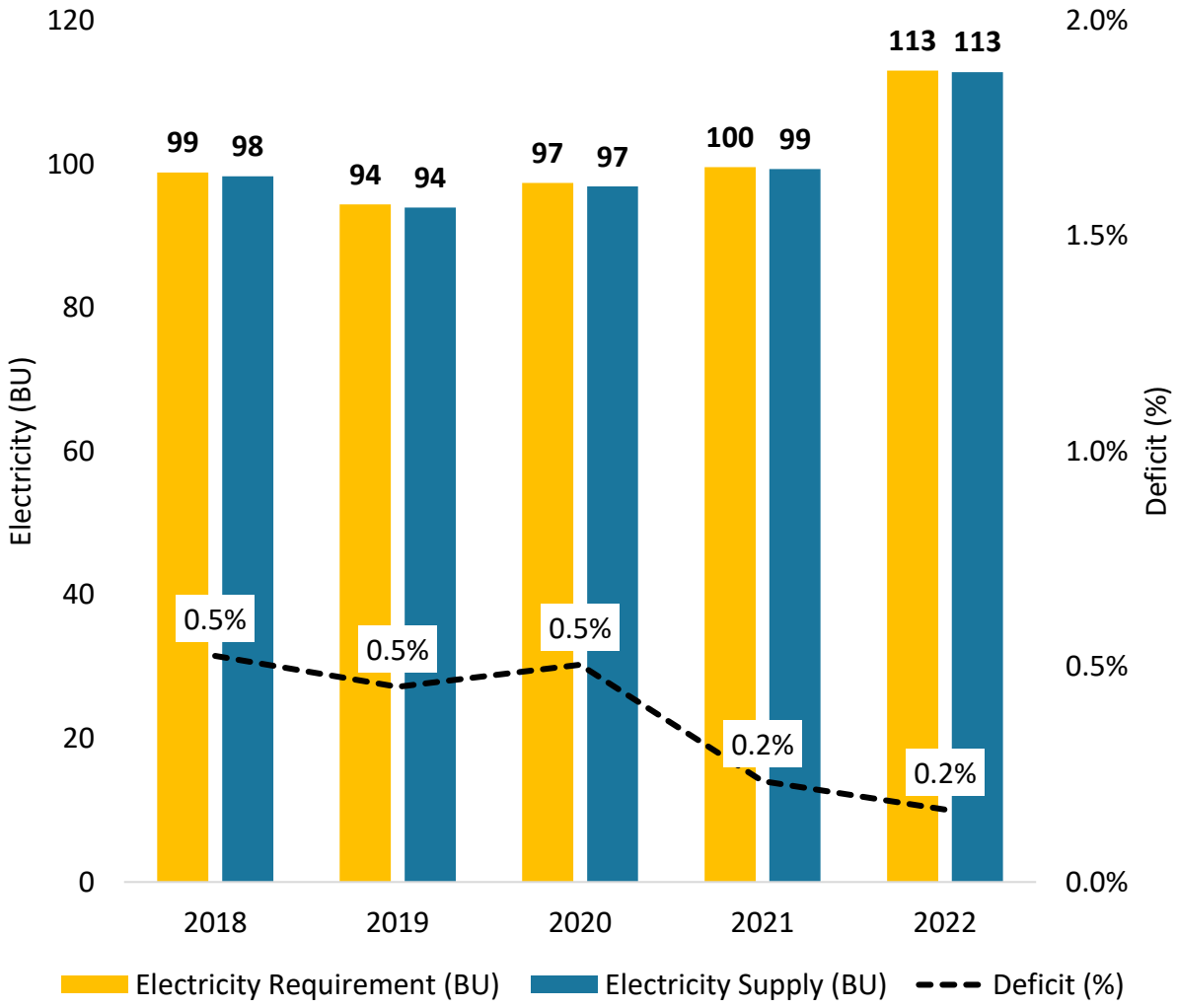
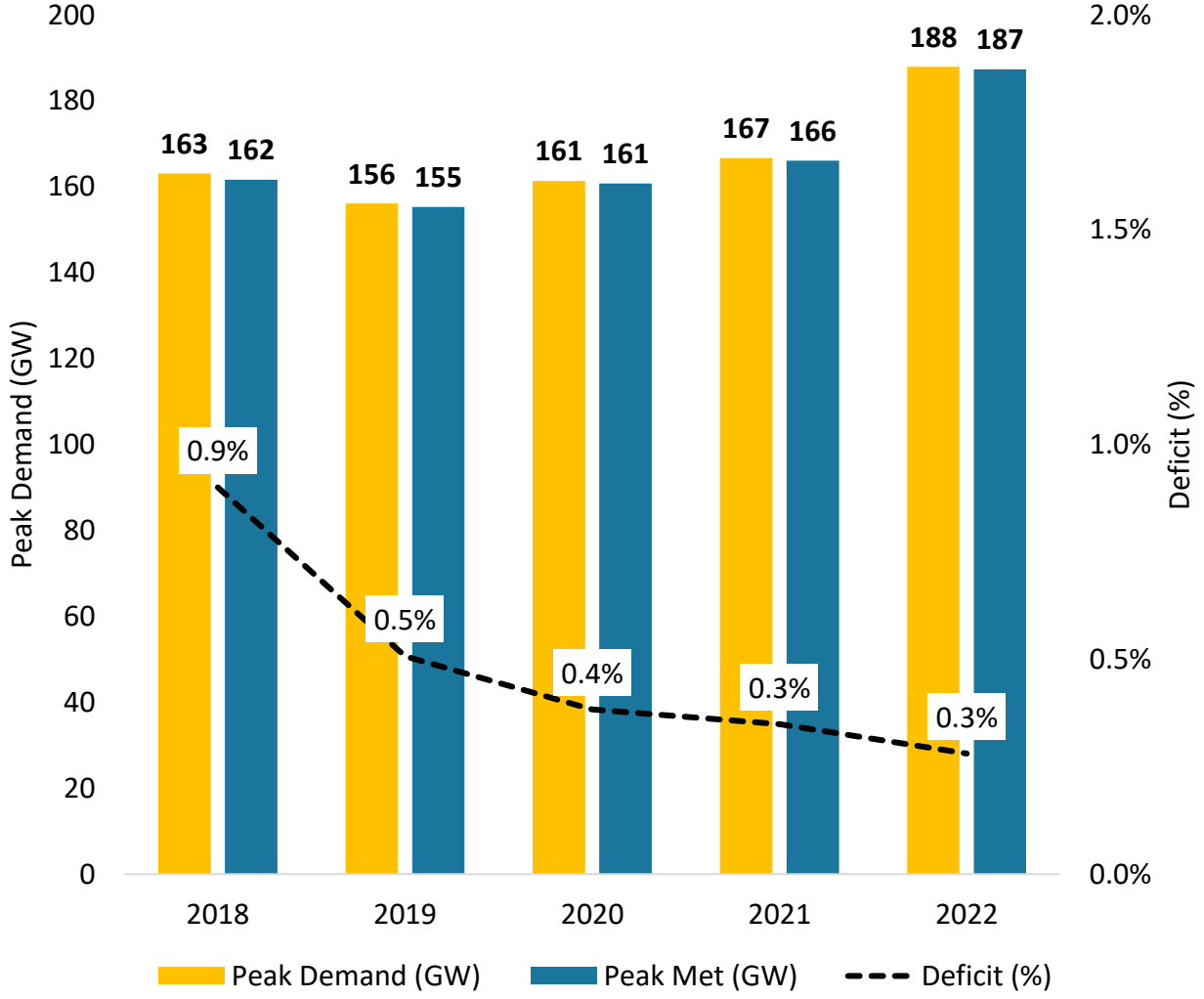
India’s Electricity Demand & Supply Position (1/2)

Electricity Supply Position in November for last 5 years



Peak Demand Position in November for last 5 years



Sources: CEA and POSOCO

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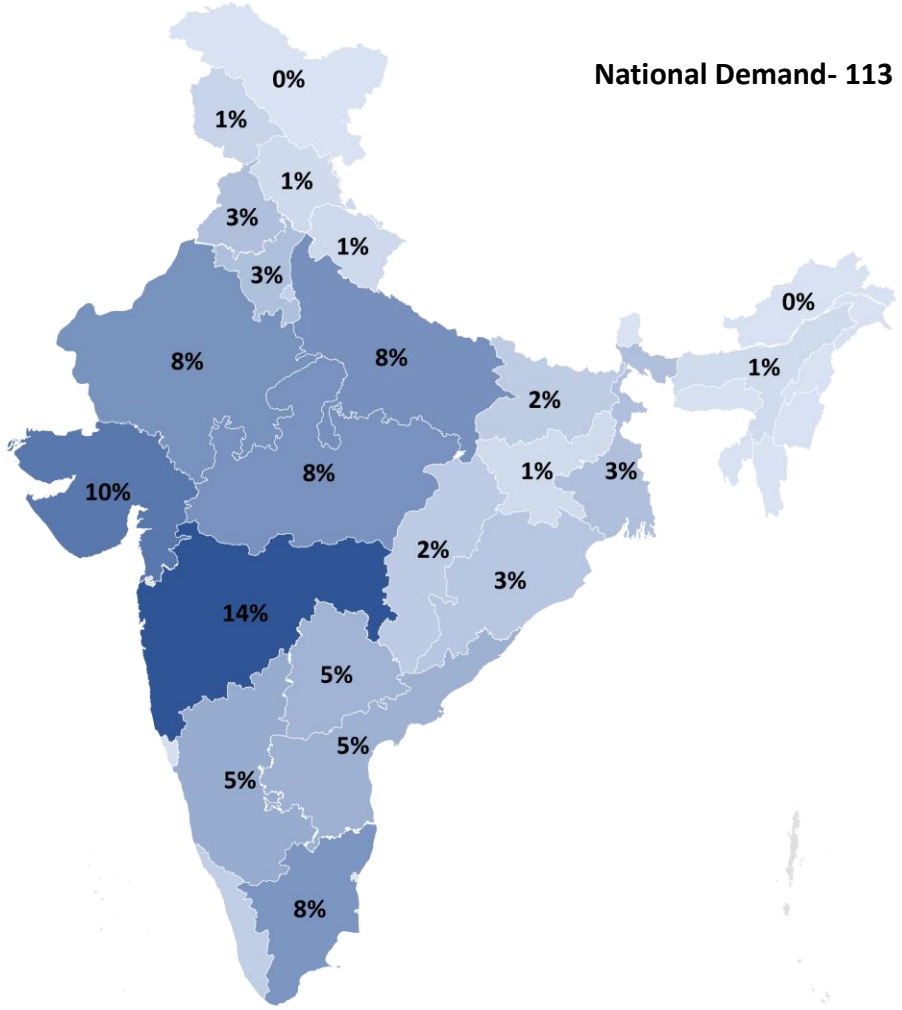
India’s Electricity Demand & Supply Position (2/2)

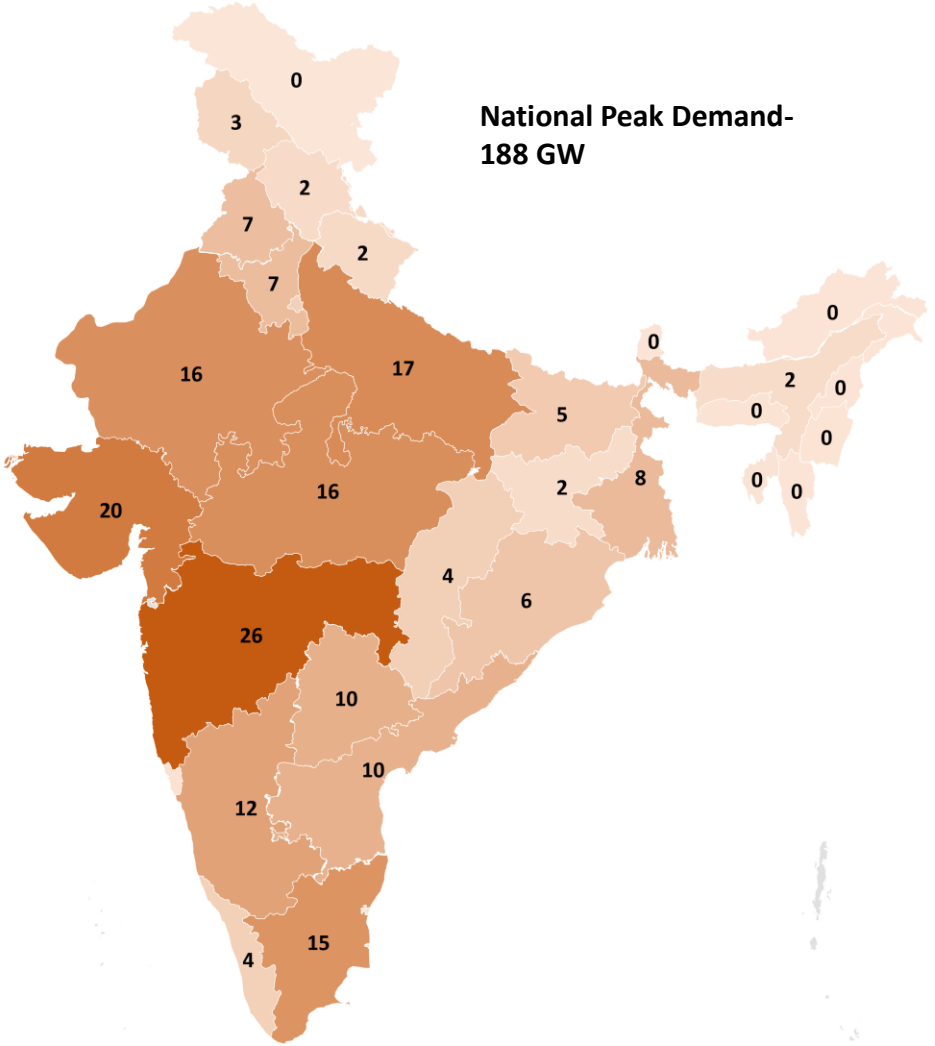
State share in National demand in November 2022 (%)

National Demand- 113 BU



State Peak Demand in November 2022 (GW)

National Peak Demand- 188 GW



Source: POSOCO
Note: Nov-2022 numbers are provisional.

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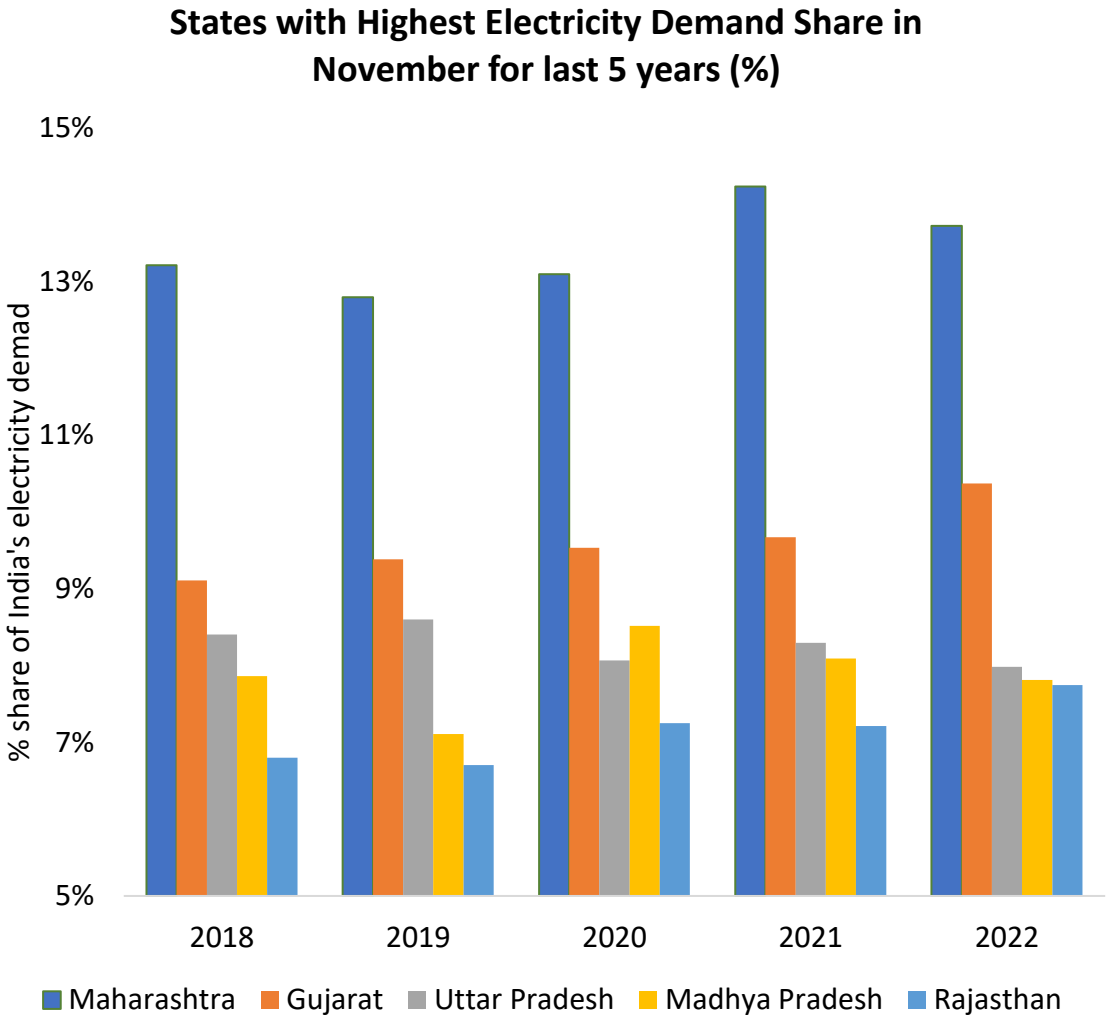
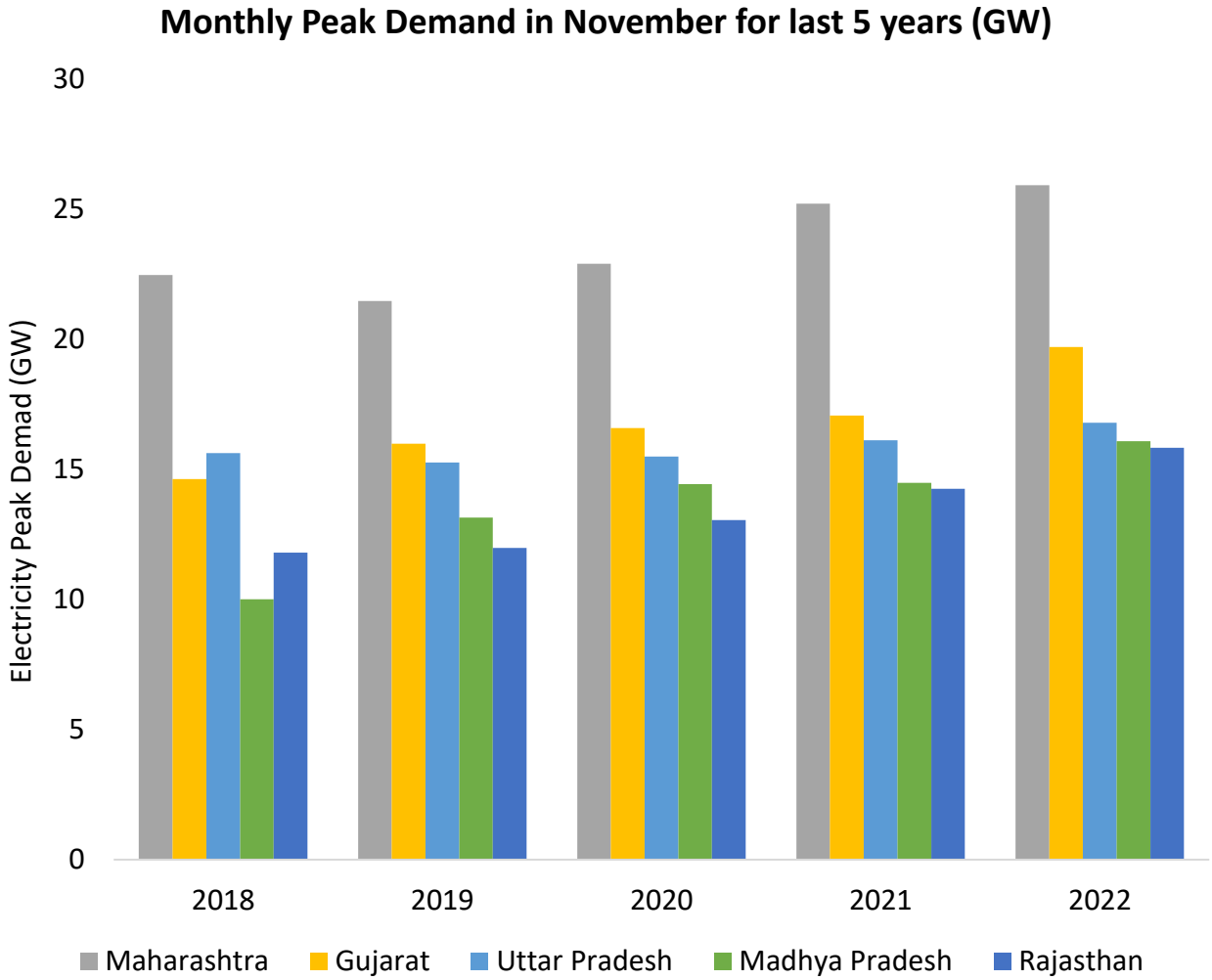
Monthly Electricity Demand of the top 5 states (1/2)





Sources: CEA and POSOCO

Note: Nov-2022 numbers are provisional.

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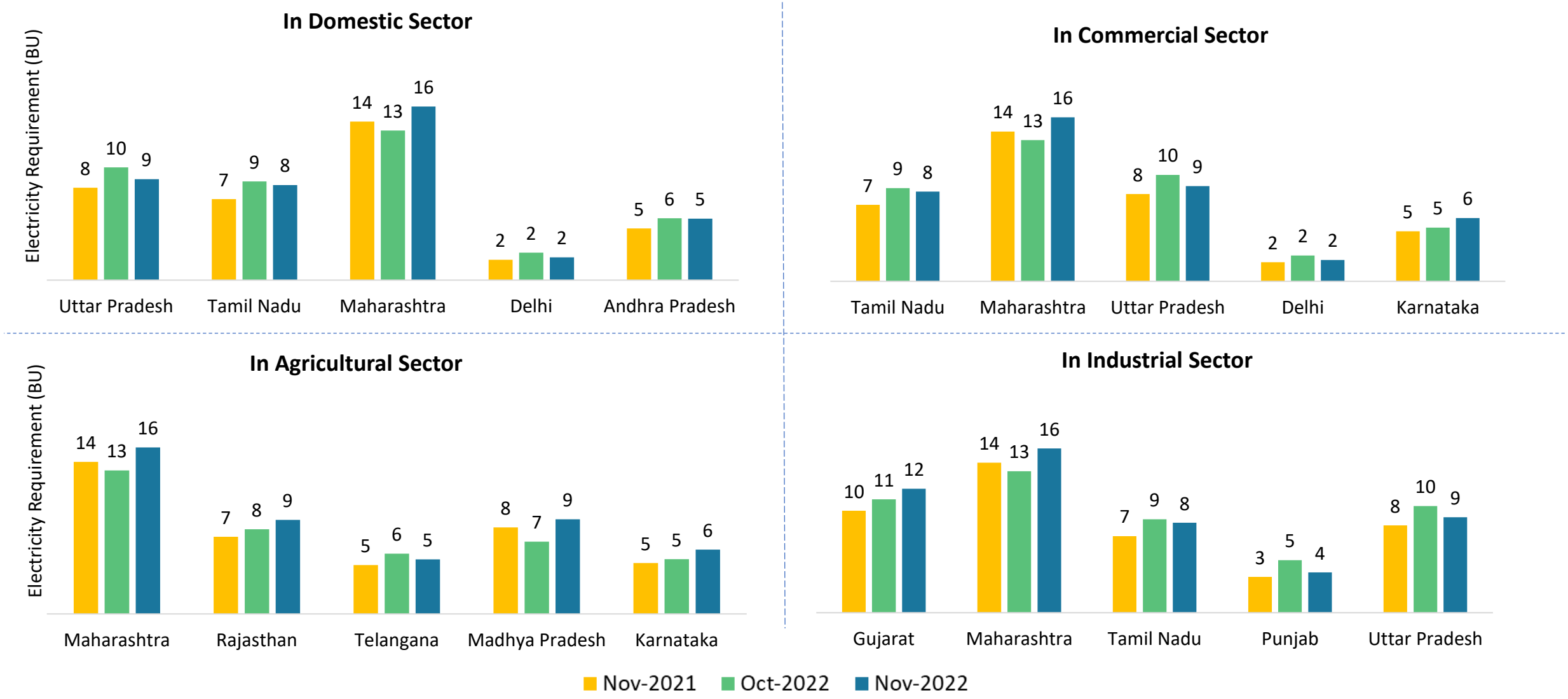
Monthly Electricity Demand of the top 5 states (2/2)

States have been selected on the basis highest electricity consumption in the sector



Sources: CEA and POSOCO

Notes: 1. Top 5 states under sectors are selected based on trued-up sectoral electricity sales in FY20 mentioned in the state tariff orders. However, the numbers presented in the graphs are total monthly electricity sales as sector-specific monthly electricity consumption numbers are not available for the current financial year.

2. Nov-2022 numbers are provisional.

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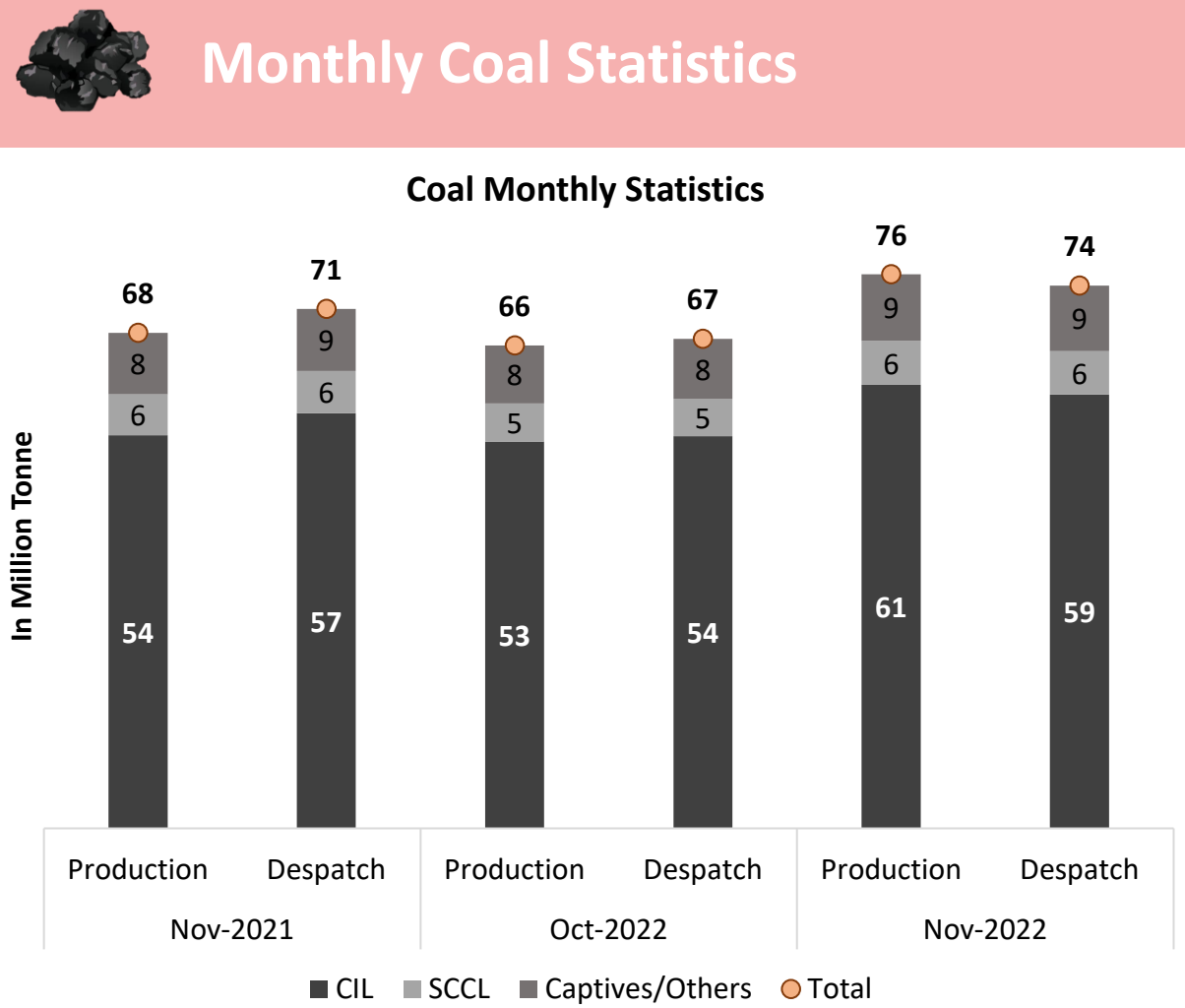
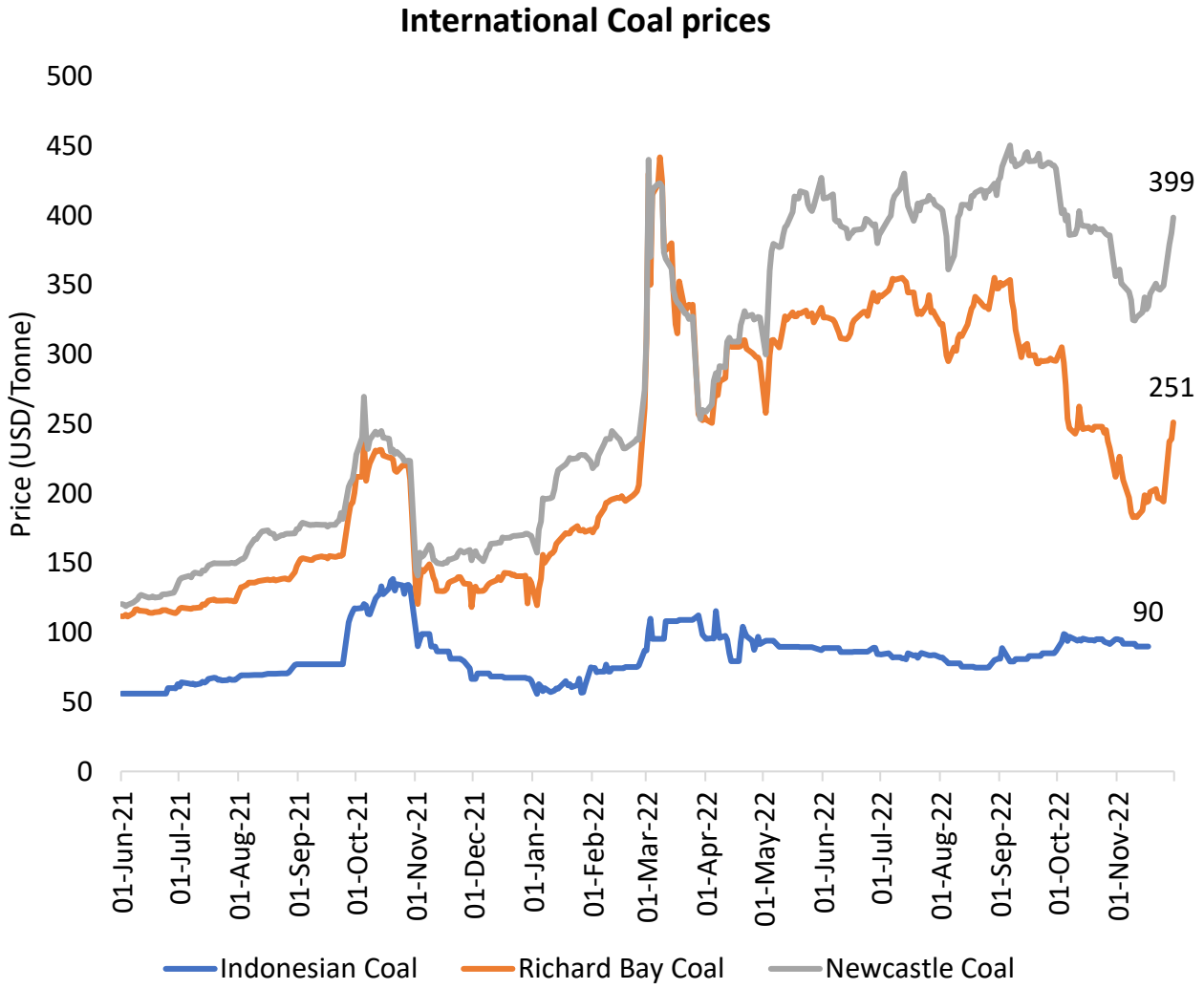
Monthly Coal Statistics



India's coal production increased in Nov-2022 (76 MT) by 12% as compared to Nov-2021 (68 MT). Similarly, the coal despatch increased by 4% in November this year as compared to Nov-2021.



Sources: Ministry of Coal
MT: Million Tonnes
NOTE: Richard Bay and Newcastle coal are exported from South Africa and Australia respectively.

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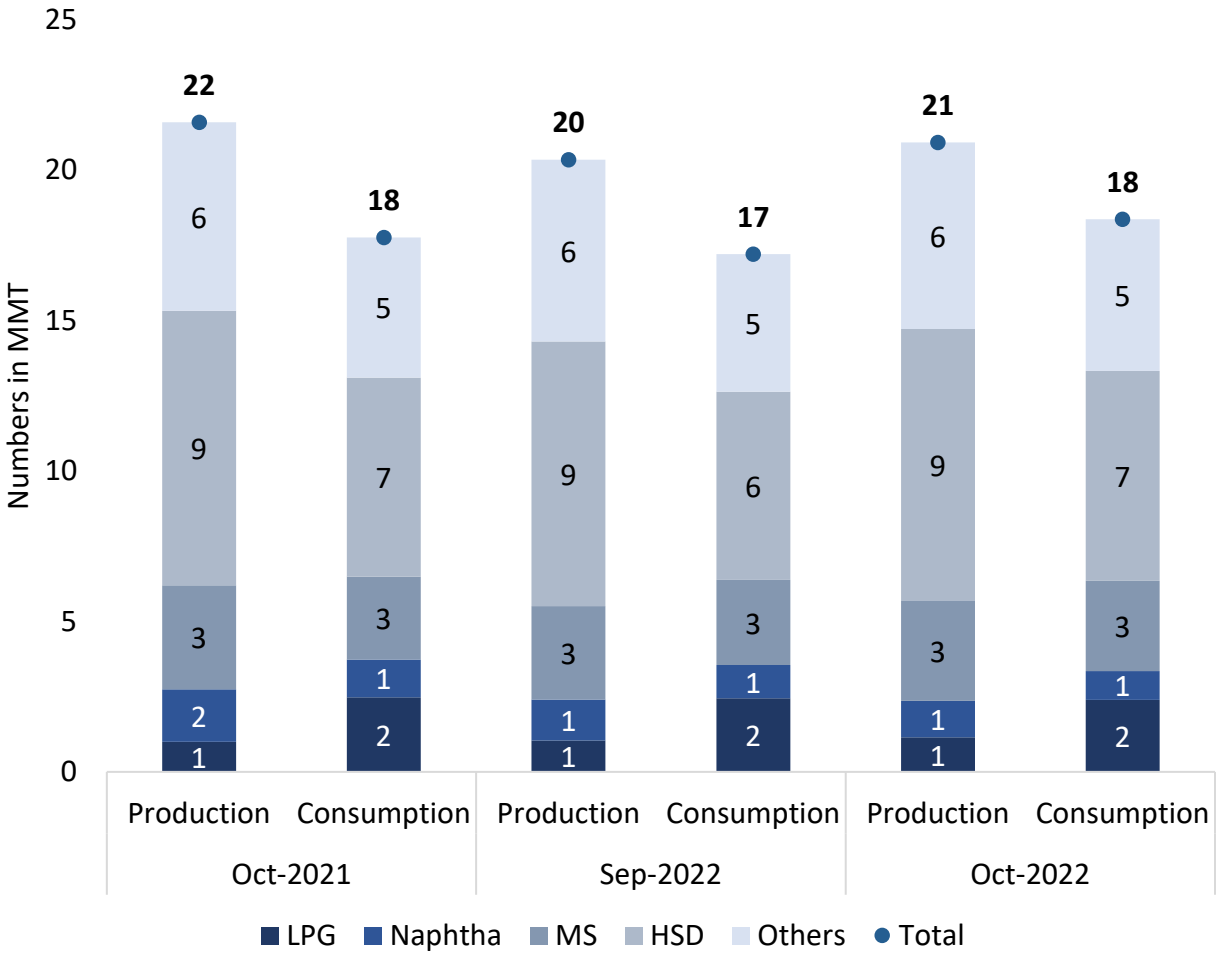
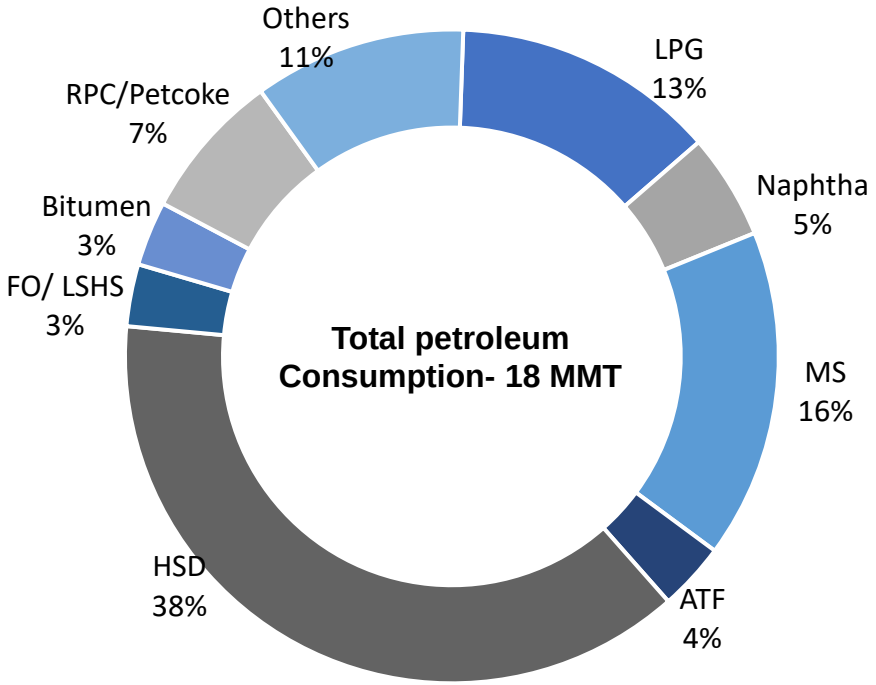
Petroleum Products Market Scenario (1/3)

Petroleum Product-wise Production & Consumption (MMT)



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

Consumption share of Petroleum Products in Oct-2022



Others include SKO, LDO, Lubes, and Others

Abbreviations

ATF-Aviation Turbine Fuel

FO- Furnace Oil

HSD- High-Speed Diesel

LDO- Light Diesel Oil

MS- Motor Spirit (Petrol)

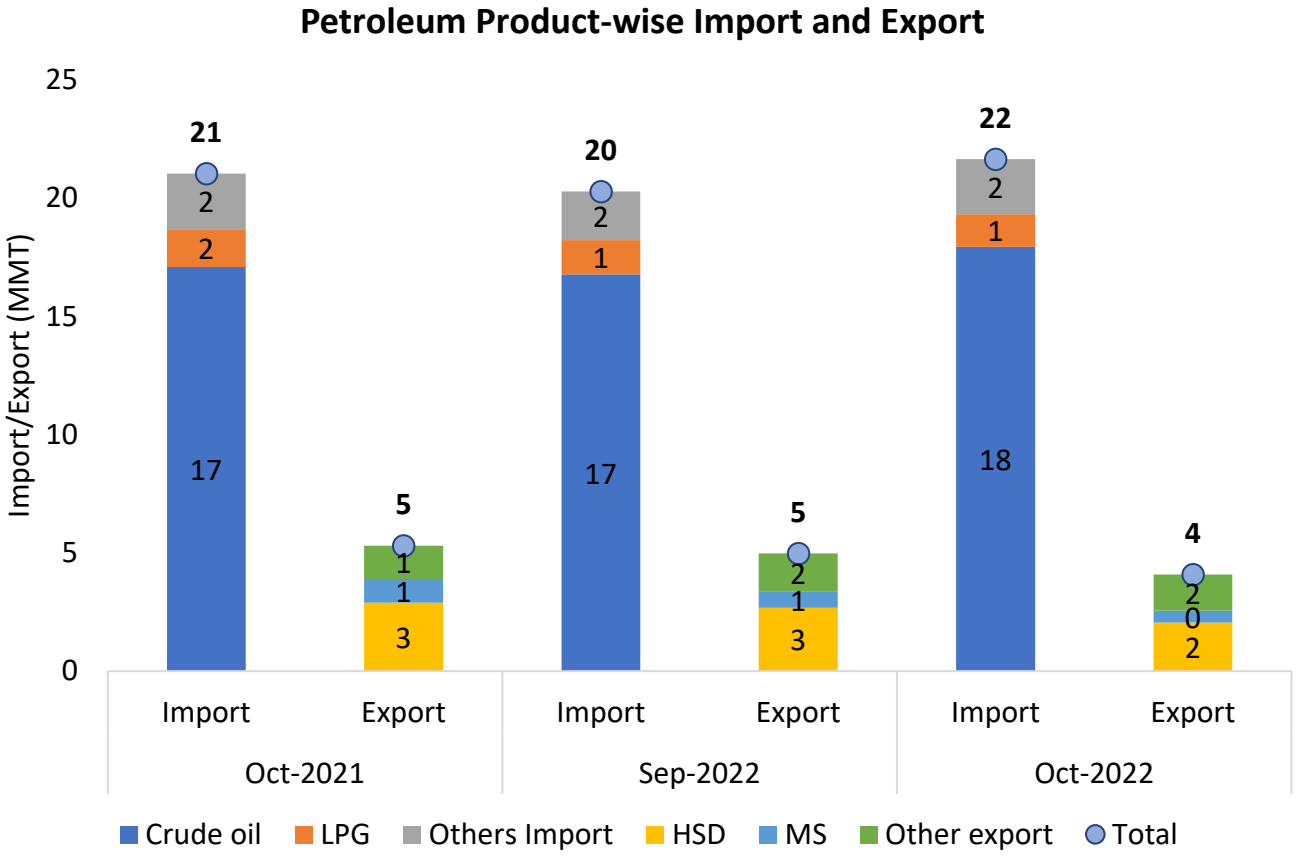
SKO- Superior Kerosene Oil

LSHS- Low Sulphur Heavy Stock LPG- Liquefied Petroleum Gas

Sources: PPAC

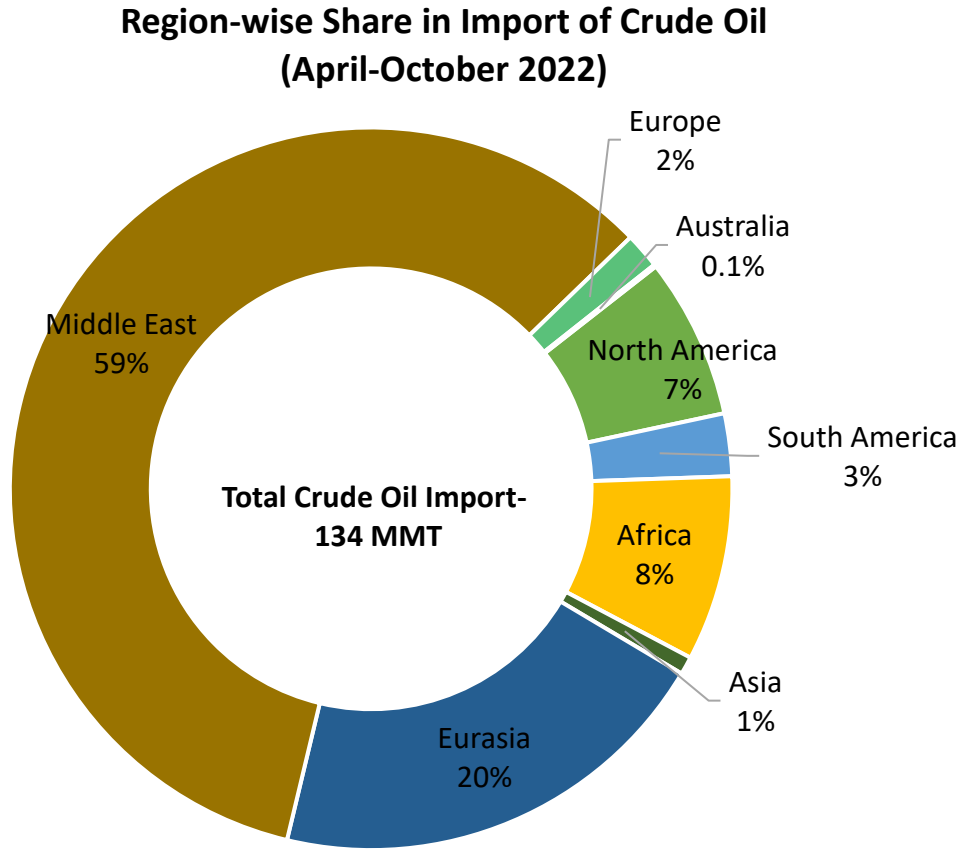
MMT: Million Metric Tonnes

Petroleum Products Market Scenario (2/3)



*Other Imports include Naphtha, MS, ATF, SKO, HSD, LDO, Lubes, FO, Bitumen, pet coke, and Others.

*Other Exports include LPG, Naphtha, ATF, SKO, Lubes, FO, Bitumen, pet coke, and Others.



•Crude oil imports increased by 12.8% during Apr-Oct 2022 as compared to the import in corresponding period of the previous year

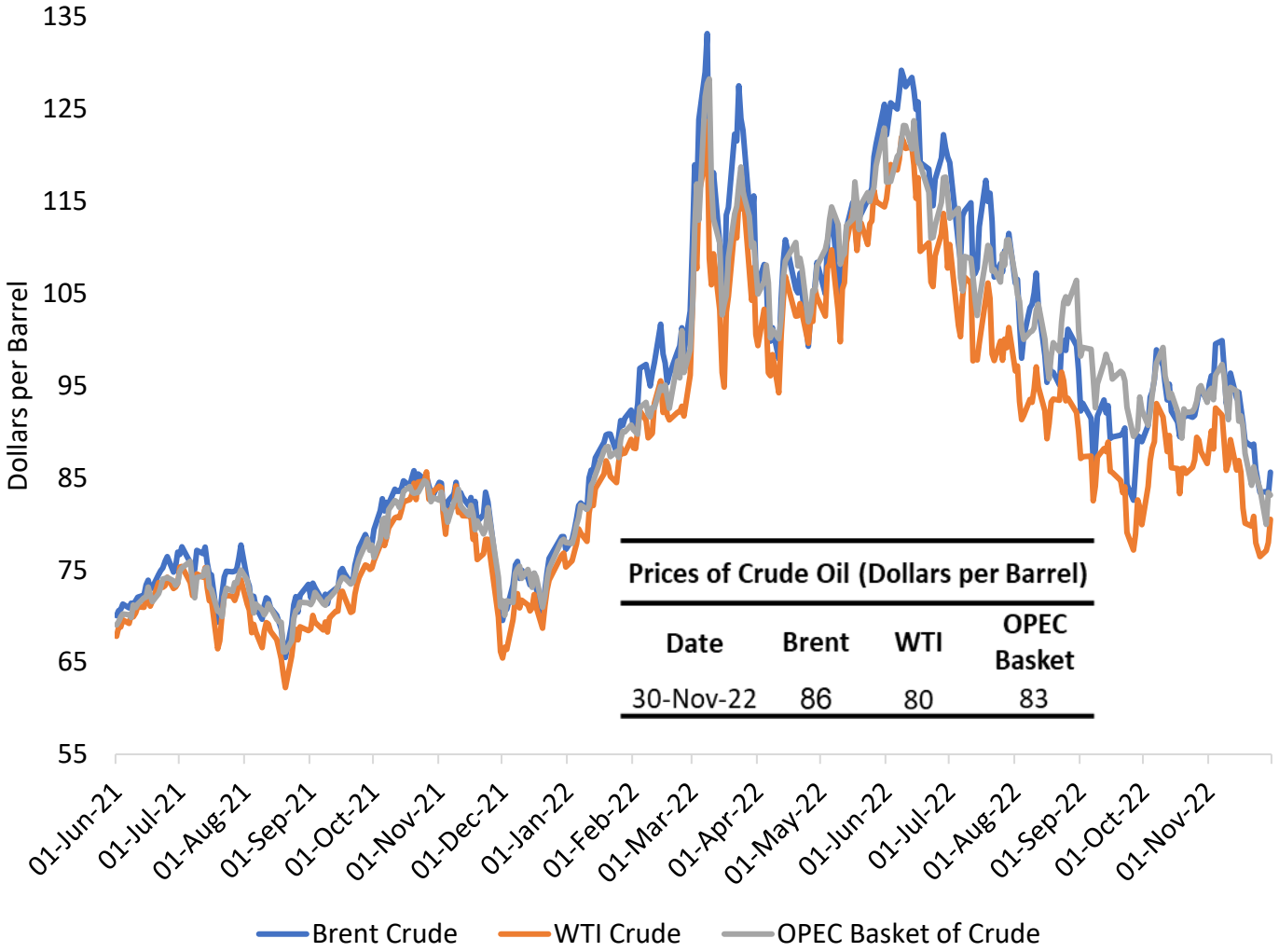
•Crude oil imports from OPEC countries decreased to 63.4% of total imports during Apr-Oct 2022 as compared to 69.8% during Apr-Oct 2021.

Sources: PPAC

MMT: Million Metric Tonnes

Petroleum Products Market Scenario (3/3)

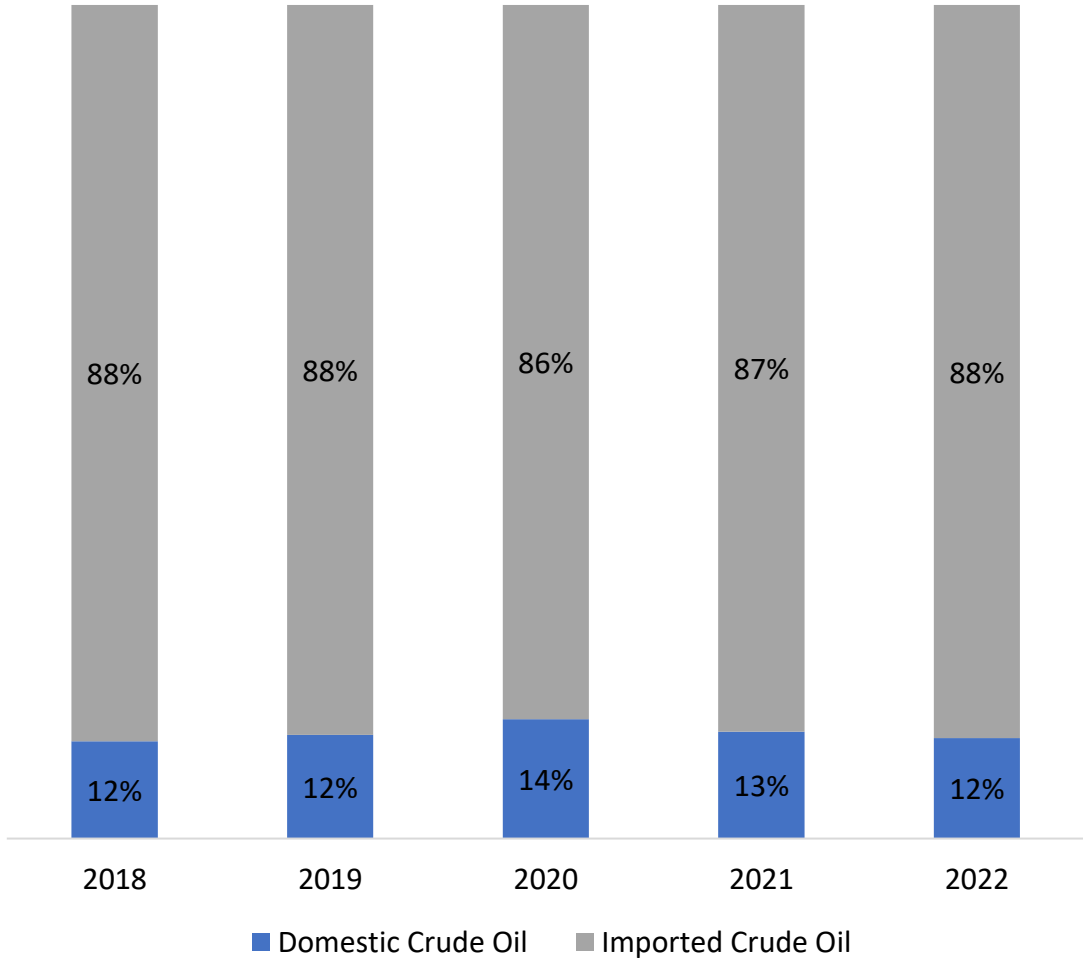
Daily Prices of Crude Oil



Prices of Crude Oil (Dollars per Barrel)

Date	Brent	WTI	OPEC Basket
30-Nov-22	86	80	83

Domestic and Imported Crude Oil share in October for last 5 years

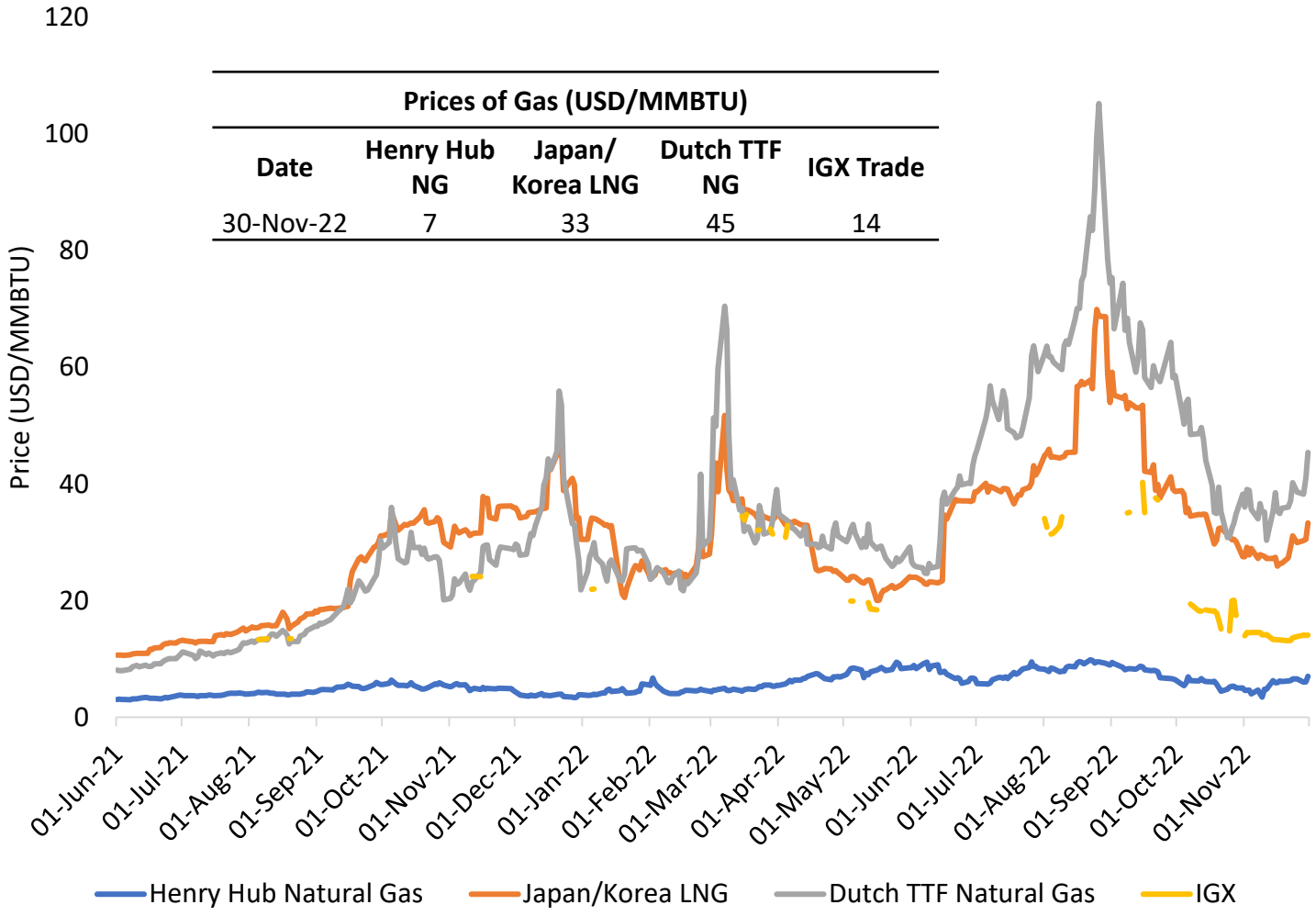


Sources: U.S. Energy Information Administration (EIA) and Organization of the Petroleum Exporting Countries (OPEC), MoPNG, and PPAC
WTI- West Texas Intermediate

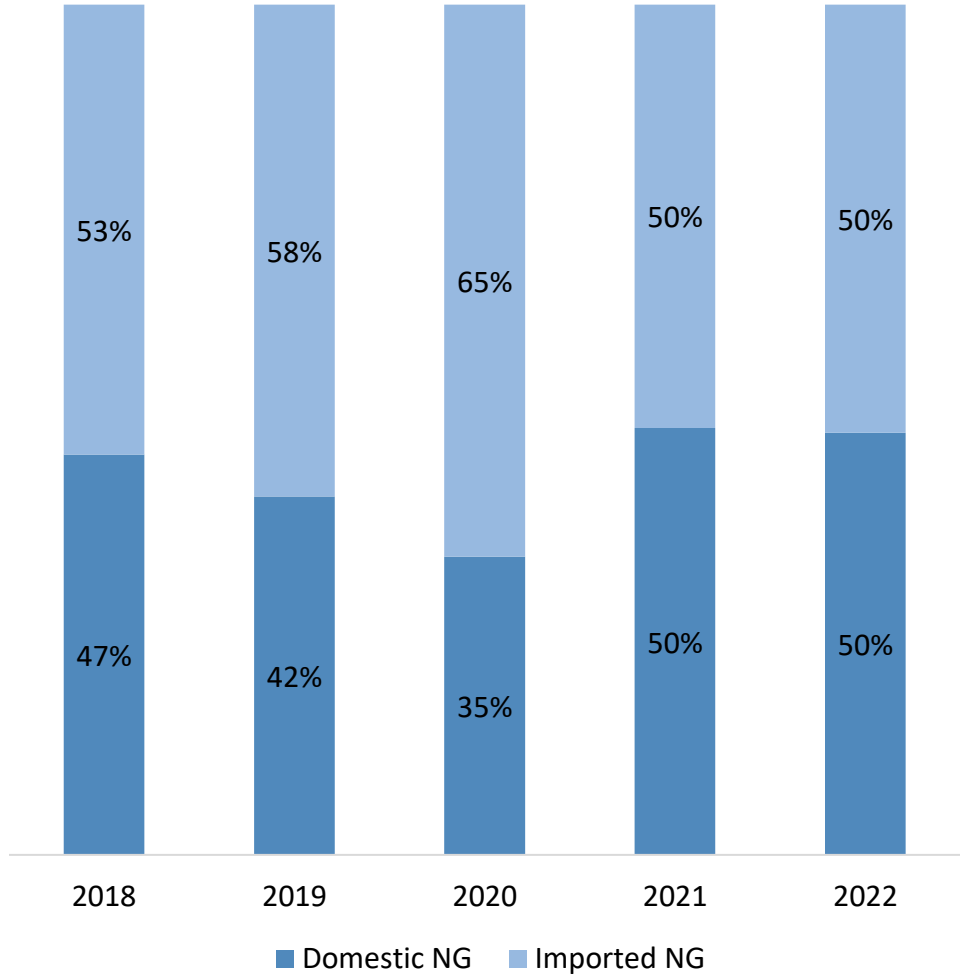
Gas Market Scenario

Gas Daily Market Price

Prices of Gas (USD/MMBTU)				
Date	Henry Hub NG	Japan/ Korea LNG	Dutch TTF NG	IGX Trade
30-Nov-22	7	33	45	14



Domestic and Imported Natural Gas share available for sale in October for last 5 years



Sources: EIA, Indian Gas Exchange (IGX)
NG- Natural Gas, LNG- Liquefied Natural Gas
NOTE: 1. The data for IGX is not available for these dates.
2. Natural Gas Domestic dependency is the net production of domestic NG for sale which is available after the flare losses and internal consumption of gas-producing companies.

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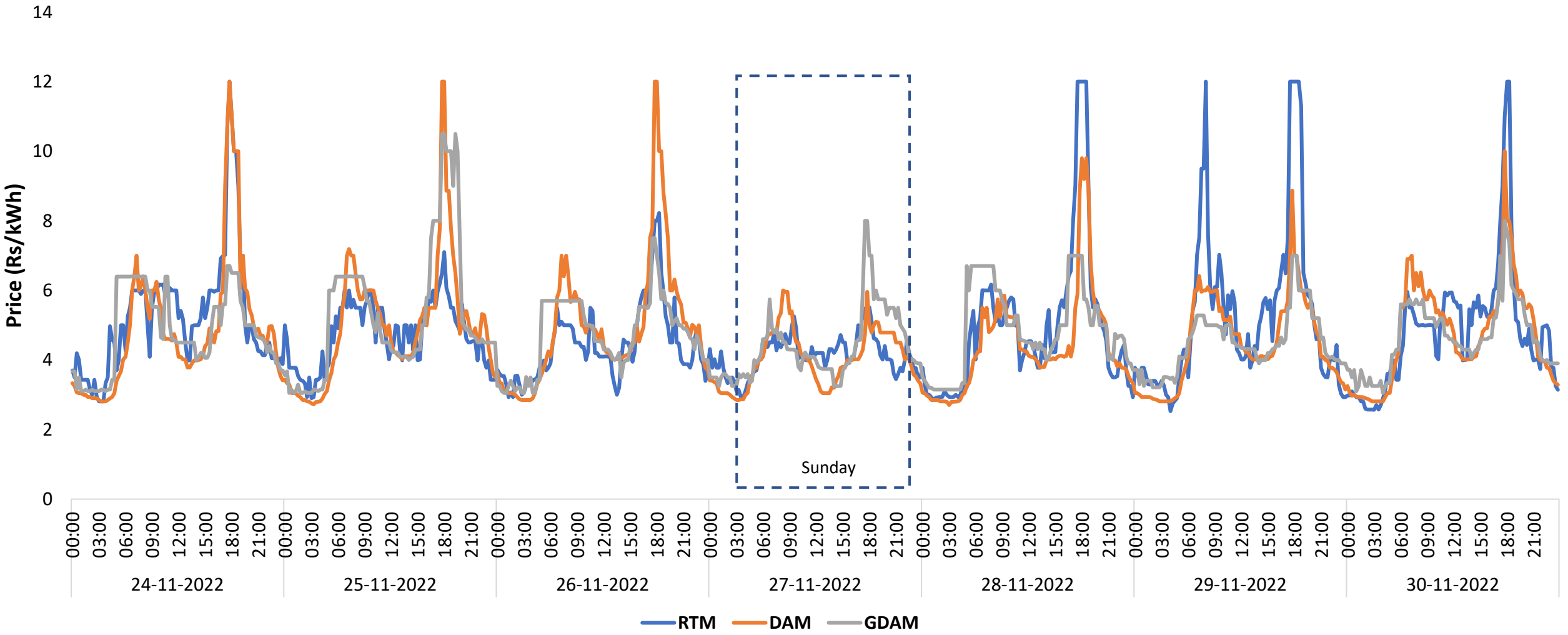
IEX Market Snapshot

Market Clearing Prices at the interval of 15 minutes



Sources: IEX
RTM: Real-Time Market, DAM- Day Ahead Market, GDAM- Green Day Ahead Market
NOTE: CERC has imposed a cap of Rs 12/kWh on the power trading exchange markets.

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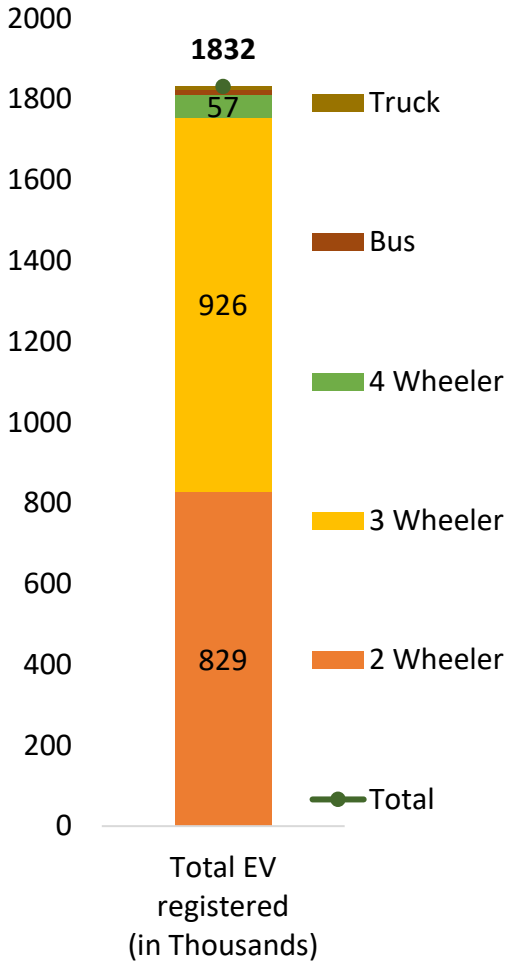
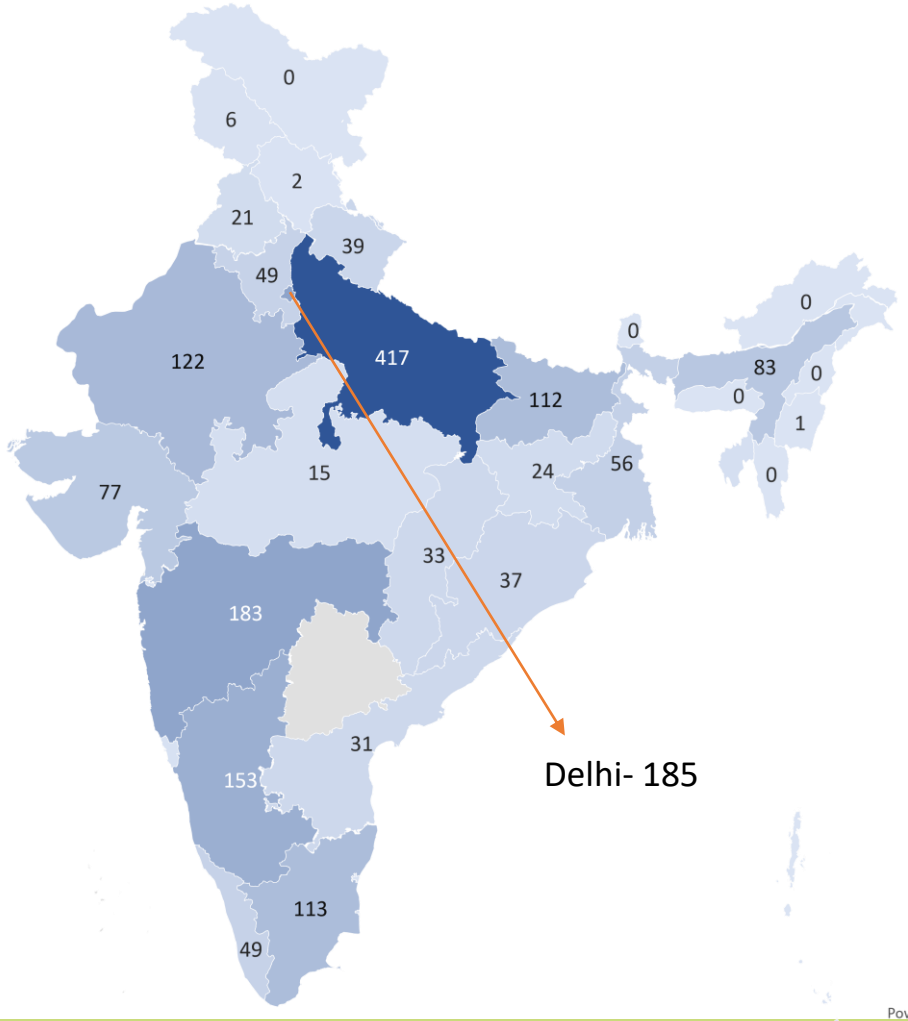
Status of Electric Vehicles in India

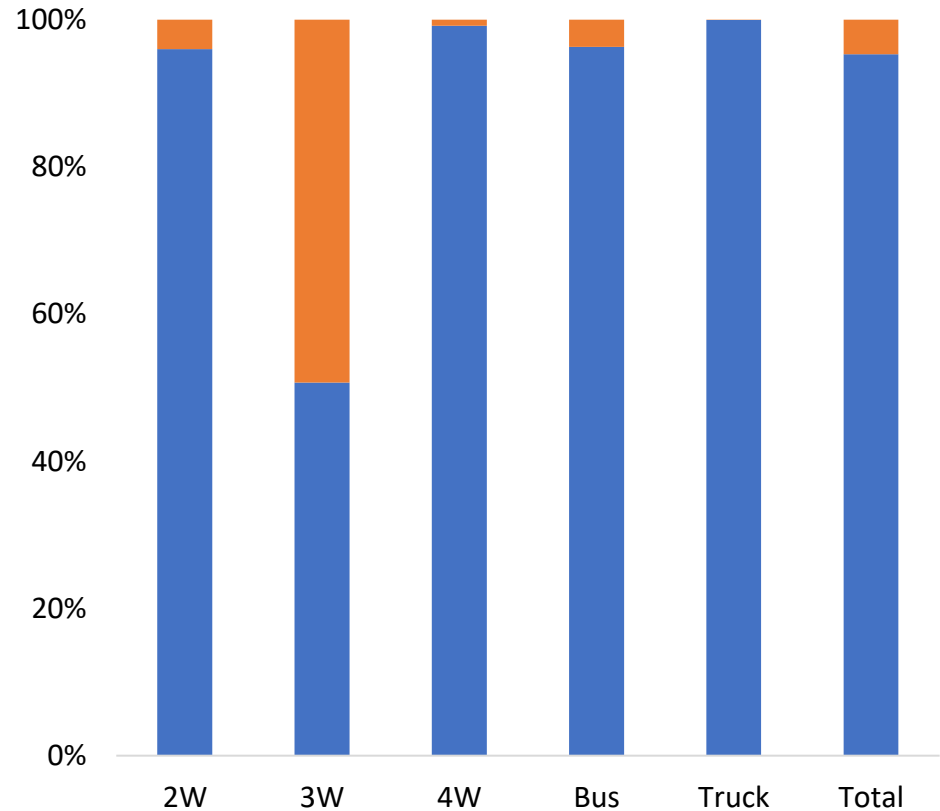
Cumulative National EV registration (as on 5th December 2022)



Cumulative State-wise EV registration as on 5th December 2022 (in Thousands)



EV sale and ICE sale composition in 2022 (till 5th December 2022)



Total Vehicles Registered in 2022 (in Thousands)	2W	3W	4W	Bus	Truck	Total
	13,986	624	3,653	163	789	19,215

Sources: Vahan Dashboard

1. In Madhya Pradesh most of the EV registrations are in the current year.
2. Data of Telangana is not available in the Vahan dashboard.
3. EV: Electric Vehicle, ICE: Internal Combustion engine vehicle

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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

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)

The Hon'ble PM launched the National Hydrogen Mission to meet the target of 5 million tonnes of green hydrogen production by 2030.

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.

NOTE: We have tried to compile only the major interventions (last 2 years), however, a number of initiatives have been taken to support decarbonization.
PLI: Production Linked Incentive, CFA: Central Finance Assistance, VNM: Virtual Net Metering, ACC: Advanced Chemistry Cell, OIL: Oil India Limited, RPO: Renewable Purchase Obligation
*Vasudha Foundation Event on Green Hydrogen in India: Prospects and Opportunities, held on 11th October 2022.

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Key Highlights or Announcements of November 2022 (1/3)

1. Shri Bhupender Yadav, Union Minister for Environment Forest and Climate Change, launched the "Long-Term Low Emission Development Strategy (LT LEDS)" during the 27th Conference of Parties (COP27) on 14th Nov 2022. The salient feature of the strategy are:
    - India aspires to maximize the use of electric vehicles, ethanol blending to reach 20% by 2025, a strong modal shift to public transport for passengers and freight. The increased use of green hydrogen fuel is expected to further drive the low carbon development of the transport sector.
    - India's forest and tree cover are a net carbon sink absorbing 15% of CO2 emissions in 2016, and it is on track to fulfilling its NDC commitment of creating 2.5 to 3 billion tonnes of additional carbon sequestration in forest and tree cover by 2030.
    - Climate finance by developed countries will play a very crucial role and needs to be enhanced, in the form of grants and concessional loans in accordance with the principles of the UNFCCC.

2. The government of Uttar Pradesh has released the Solar Energy Policy 2022 which aims to achieve the target of 22GW of solar power projects by 2026-27. The main highlights of the policy are-
    1. The 22 GW target will be achieved by 14 GW through solar parks, 4.5 GW through residential rooftop solar projects, 1.5 GW through non-residential rooftop projects, and 2 GW through the PM KUSUM Yojana (component C).
    2. 30,000 youth will be trained as Surya Mitra according to the training Curriculum of U.P. skill development mission & National Institute of Solar Energy.
    3. To promote the installation of grid-connected rooftop systems under the net metering arrangements in the private residential sector, Central Financial Assistance will be provided. Besides the state government will also provide a subsidy of Rs 15,000/kW to a maximum limit of Rs 30,000/- per consumer.

NOTE:
*PEUM- Partial End Use Methodology, which is a combination of time series analysis and End-Use Method.

Key Highlights or Announcements of November 2022 (2/3)

3. Central Electricity Authority (CEA) released the 20th Electricity Power Survey of India (EPS) which provides all India, regions, states, UTs, and discoms electricity demand projections through PEUM* for the years 2021-22 to 2031-32, 2036-37, and 2041-42. The main highlights are-

All India	2021-22	2026-27	2031-32	2036-37	2041-42
Energy Requirement (Ex-Bus)- BU	1,382	1,908	2,474	3,095	3,776
Energy Consumption- BU	1,138	1,610	2,133	2,756	3,423
Peak Demand (Ex-Bus)- GW	203	277	366	466	575
T&D Losses (Ex- Bus) - %	17.60	15.61	13.76	10.97	9.36

4. Shri R.K Singh, Union Minister for Power and New & Renewable Energy launched the Green Energy Open Access Portal. The portal will allow consumers to access green power easily through transparent, simplified, uniform, and streamlined procedures. Any consumer with a connected load of 100 kW or above can get Renewable Energy (RE) through open access from any RE-generating plant. The open access has to be granted within 15 days. The application for open access can be made on this portal itself. (The portal can be accessed at https://greenopenaccess.in/)

Key Highlights or Announcements of November 2022 (3/3)

5. Uttar Pradesh has become the second state after Rajasthan to release the draft Green Hydrogen Policy 2022. The policy aims to initiate the transition of the state towards a green hydrogen economy by focusing on the chemical, fertilizer, and refinery sectors. The main highlights of the policy are -
    - To reduce green hydrogen cost to $2/kg in the next 5 years and whittle it further to $1/kg in the long term.
    - To achieve 20% green hydrogen blending in total hydrogen consumption by 2028 for existing fertilizer and refinery units and ramp it up further to 100% green hydrogen by 2035.
    - To set up a state Centre of Excellence (CoE) which will lead research, development, and techno-economic innovation activities in the state.
    - Proposed capital expenditure subsidy of 60% of the electrolyser cost in 2024, and bringing it down to 20% by 2027. The minimum capacity to avail of the subsidy must be above 50 MW.

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