POWERup

Update on India's electricity capacity, generation and investment

Institute for Energy Economics and Financial Analysis

4Q 2024

1. Installed Capacity

India's power generation capacity grew by 9.3 gigawatts (GW) in 4Q 2024, with renewables accounting for 85.8% of new capacity additions

Fourth Quarter (4Q) 2024 Update:

India added **9,307 megawatts (MW)** of power generation capacity in **4Q 2024 (October – December)**, with renewables accounting for **85.8%** of new capacity additions **(Table 1)**.

The country's cumulative **power generation capacity** crossed **462GW**, with renewables accounting for 45.3% at **209.4GW** by the end of December 2024.[1]

- India has set a target to achieve non-fossil fuel-based installed power generation capacity of 500GW by 2030. This capacity, including nuclear power, stood at **217.6GW** at the end of December 2024.

Solar and **wind** recorded the most capacity additions in renewables, accounting for **76.3% and 8.6%**, respectively.

Coal power accounted for **14.2%** of new capacity additions in the quarter, with the commissioning of Unit-1 (660MW) of the Ghatampur thermal power plant by Neyveli Uttar Pradesh Power Limited (NUPPL) and Unit-2 (660MW) of Jawaharpur super thermal power project by Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited (UPRVUNL).

Table 1: Installed Power Generation Capacity (MW), by Source, 4Q 2024

Energy Source	As on 30 September 2024	As on 31 December 2024	Change (MW)	% of New Capacity Added
Wind Power	47,363	48,163	800	8.6
Solar Power*	90,762	97,865	7,103	76.3
Small Hydro	5,076	5,101	25	0.3
Biomass	10,724	10,728	4	0.0
Waste to Energy	604	620	15	0.2
Large Hydro	46,928	46,968	40	0.4
Nuclear	8,180	8,180	0	0.0
Coal (+ Lignite)	217,650	218,970	1,320	14.2
Gas	24,818	24,818	0	0.0
Diesel	589	589	0	0.0
Total	**452,695**	**462,002**	**9,307**	**-**

*Includes grid and off-grid capacities
[1]Renewables includes Large Hydro

Source: Central Electricity Authority, GoI; IEEFA

Full Year - January- December 2024 update:

Full-year capacity installations increased by 88.9% to 33.9GW in 2024 over 2023; solar capacity additions more than doubled

India added **33,922MW** of new power generation capacity in 2024 (January-December) compared with 17,961MW in 2023, a significant increase of **88.9% (Table 2)**. Solar and biomass primarily drove this growth, with **solar capacity addition** more than doubling (24,546MW vs. 10,016MW) and **a nine-fold growth in biomass capacity addition** (466MW vs. 52MW). Solar capacity additions accounted for **72%** of the total new capacity added in 2024.

- Falling module prices, increased auctions and regulatory certainty after the implementation of the Approved List of Models and Manufacturers mandate on 1 April 2024 drove solar power capacity growth. It also benefited from increasing solar power adoption in the commercial and industrial (C&I) sectors, led by falling module prices and a maturing green corporate power purchase agreement (PPA) market.
- The revised biomass policy, which mandates that thermal power plants must co-fire 5% biomass starting Fiscal Year (FY) 2025, is likely driving growth in biomass power capacity installations.

Table 2: Power Capacity Additions by Source (MW), 12 Months (Jan-Dec), 2023 vs. 2024

Energy Source	Capacity Addition, 2023 (MW)	% of New Capacity Added, 2023	Capacity Addition, 2024 (MW)	% of New Capacity Added, 2024+
Wind Power	2,806	15.6	3,427	10.1
Solar Power	10,016	55.8	24,546	72.4
Small Hydro	51	0.3	114	0.3
Biomass	52	0.3	466	1.4
Waste to Energy (off-grid)	60	0.3	37	0.1
Large Hydro	60	0.3	58	0.2
Nuclear	700	3.9	700	2.1
Coal (+ Lignite)	4,001	22.3	4,574	13.5
Gas	214	1.2	(220)	NA
Diesel	-	0.0	-	0.0
Total	**17,961**	**100.0**	**33,702 (Net capacity added)**	**-**

+As a % of total new capacity added: 33,922MW

Source: Central Electricity Authority, GoI; IEEFA

Wind power capacity additions increased **by 22.1%** to **3,427MW** in 2024 from 2,806MW in 2023, crossing the 3GW level as estimated in the earlier editions of this newsletter. The rising trend of hybrid (wind + solar) auctions and the government's target of meeting 6.94% of power consumption (renewable power purchase obligation) from wind power by 2029-30 are driving the growth.

Capacity Additions Trend:

Record high solar capacity additions in 2024 at 24.5GW; wind capacity additions highest in seven years

At **24.5GW**, India reported **record-high solar power capacity installations** in 2024 **(Table 3)**. In addition to the drivers mentioned above, continued government policy support in the form of a transmission charges waiver (until June 2025) for wind and solar projects and programmes like PM-KUSUM, PM-Surya Ghar and the National Hydrogen Mission are driving growth.

Wind power capacity addition at **3.4GW** in 2024 is also t**he highest in the last seven years**, gaining momentum from 2023, led by increasing solar + wind hybrid auctions and progressive wind power obligation targets until 2030.

Coal power capacity additions tapered off at **4.6GW**, largely driven by public sector enterprises, in 2024 and stayed below the government's expectation to add at least least 13.9GW. Several coal power projects are facing construction delays.

Table 3: Power Capacity Additions by Energy Source (MW), Last Six Years

Energy Source	2019	2020	2021	2022	2023	2024
Wind Power	2,367	1,119	1,459	1,847	2,806	3,427
Solar Power	8,518	3,734	11,882	13,956	10,016	24,546
Small Hydro	154	79	89	96	51	114
Biomass	786	285	30	34	52	466
Waste to Energy (off-grid)	2	29	265	88	60	37
Large Hydro	-	399	714	338	60	58
Nuclear	-	-	-	-	700	700
Coal (+ Lignite)	7,802	870	3,685	586	4,001	4,574
Gas	-	19	(57)	(75)	214	(220)
Diesel	(128)	-	-	79	-	-
Total	**19,501**	**6,534**	**18,067**	**16,950**	**17,961**	**33,702**

Source: Central Electricity Authority, MNRE, IEEFA

Capacity Additions Among Large States:

Rajasthan and Gujarat led renewable energy installations; Rajasthan's Integrated Clean Energy Policy, 2024 will likely drive growth until 2029-30

Among large states (installed renewable power generation capacity of 10GW or more), **Rajasthan** and **Gujarat** continue to lead in renewable energy capacity expansion. In **4Q 2024**, Rajasthan and Gujarat added **2,266MW** and **1,958MW** of renewable power generation capacity, respectively **(Table 4)**.

Notable projects commissioned in 4Q 2024 in Rajasthan include ReNew Power's 750MW solar power plant and ACME's aggregated solar capacity of 1,023MW across projects.

Rajasthan introduced an **Integrated Clean Energy Policy in 2024** to establish a green energy ecosystem and set up **125GW** of renewable power capacity by 2029-30.

Table 4: Renewable Energy Capacity Installations (MW), Large States[2]

	3Q 2023	4Q 2023	1Q 2024	2Q 2024	3Q 2024	4Q 2024
Rajasthan	249	688	2,576	1,068	1,809	2,266
Gujarat	478	262	3,495	944	1,119	1,958
Madhya Pradesh	146	2	825	81	74	823
Maharashtra	187	104	1,219	350	1,251	1,491
Andhra Pradesh	3	10	27	38	25	82
Tamil Nadu	340	407	1,026	592	906	615

Source: Central Electricity Authority, MNRE, IEEFA

[2]States with an installed renewables capacity of close to 10GW or more. Karnataka is excluded from this table due to a data reporting discrepancy in 1Q 2024.

Major projects commissioned in Gujarat include a 200MW solar power project by Ambuja Cement for its captive consumption and a 30MW solar power capacity of the planned 150MW project by NTPC Renewable Energy.

Other notable capacity additions in 4Q 2024 were in **Maharashtra (1,491MW)** and **Madhya Pradesh (823MW)**.

2. Generation

Renewable power generation jumped 21.4% year-over-year to 82.71 billion units in 4Q 2024

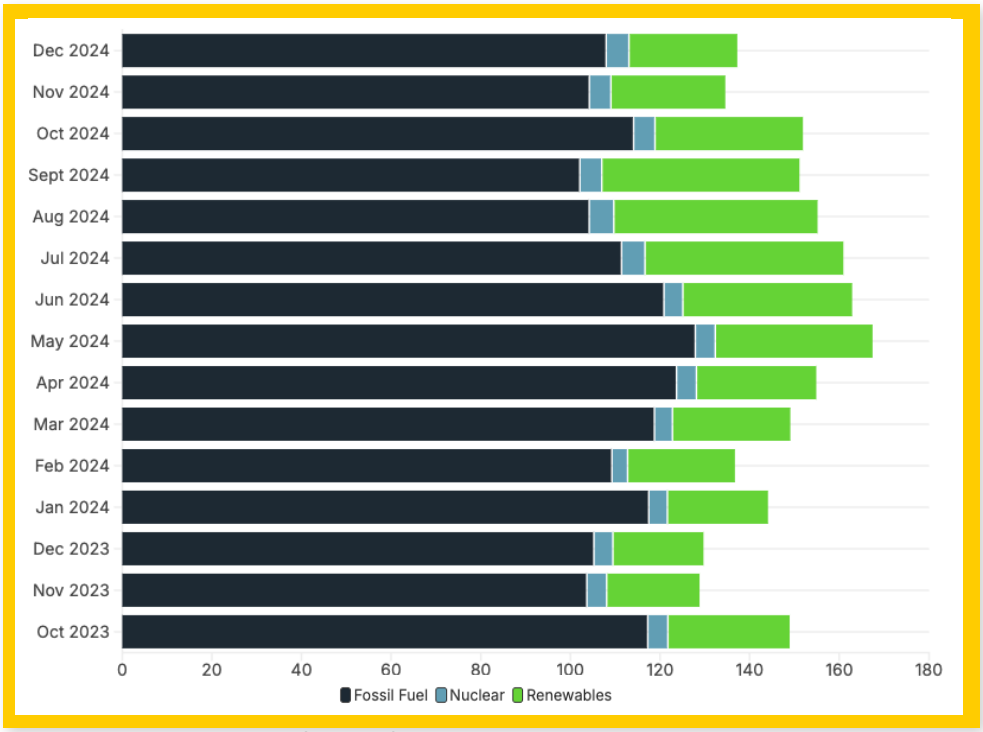
Provisional numbers indicate that **renewable energy generation increased significantly by 21.4%** from 68.10 billion units (BUs) in 4Q 2023 to 82.71BUs in 4Q 2024 **(Figure 1)**.

Nuclear power generation grew by 11.5% from 13.15BUs in 4Q 2023 to 14.66BUs in 4Q 2024 as India added 700MW of new nuclear power capacity in 2024.

Fossil fuel-based power generation remained flat at 326.31BUs in 4Q 2024, registering no growth compared with 4Q 2023, owing to increased nuclear and renewable power generation.

The **share of fossil fuel-based power generation** in total power generation **decreased** from 80.06% in 4Q 2023 to 77.02% in 4Q 2024.

Figure 1: Power Generation by Source (BU), Monthly, 2023-24*



Source: Central Electricity Authority, MNRE, JMK Research, IEEFA
** Data for December 2024 is provisional*

3. Investments

Investments in the renewable energy sector doubled year-over-year in 4Q 2024; full-year investments were below government expectations

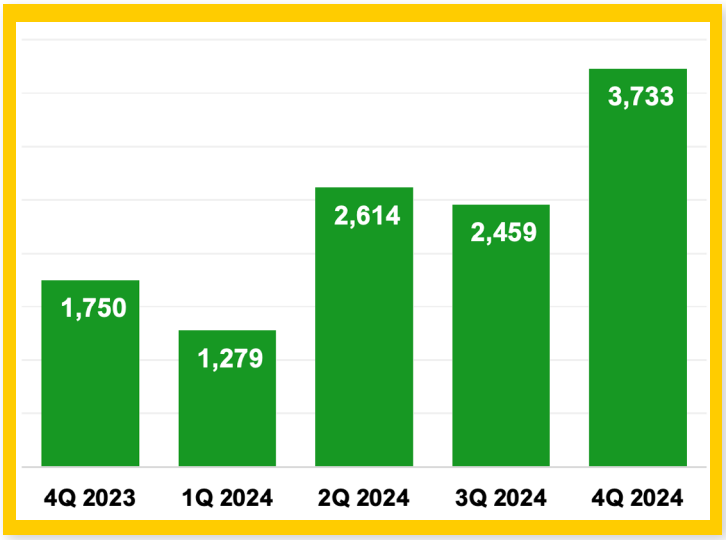
According to industry estimates, investments in the renewable energy sector **more than doubled** year-over-year from US$1,750 million in 4Q 2023 to **US$3,733 million in 4Q 2024 (Figure 2)**.

Investments **grew by 51.8% in sequential quarters** from US$2,459 million in 3Q 2024 to US$3,733 million in 4Q 2024.

However, **full-year investments at US$10.1 billion** in 2024 are **23.7%** below the investments in 2023 and **33.6%** below the all-time high of US$15.2 billion achieved in 2022. The investment slowdown will likely impact renewable energy capacity additions in the next two years.

Overall slowdown of private investments in the economy, high interest rates and competitive tariffs, compounded by the unpredictability of the election year, may have stifled investment in the sector in 2024. However, the onset of a declining interest rate cycle and a more stable and positive policy framework can boost investments in 2025.

Figure 2: Investments in India's Renewable Energy Sector (US$ million)



Source: JMK Research, News Reports

Some of the major investments and deals made during the quarter are:

Tata Power	Tata Power has announced a Rs1.2 trillion (US$13.8 billion) investment plan for Rajasthan's renewable energy sector. The initiative includes solar, wind and hybrid projects, rooftop solar installations, and EV charging infrastructure.
Avaada Group	Avaada Group has pledged to invest over Rs1 trillion (US$11.5 billion) in Rajasthan's renewable energy sector by 2030. The investment will fund a 1,200MW pumped storage project, green hydrogen and ammonia ventures, and wind and solar projects.
JSW Neo Energy	JSW Neo Energy will acquire the 4.6GW O2 Power Pooling renewable energy platform for Rs127 billion (US$1.47 billion) from EQT Infrastructure and Temasek. This acquisition increases JSW Energy's generation capacity by 23%, bolstering its presence in India's energy sector.
Gentari, Petronas	Gentari, Petronas' renewable energy arm, is set to acquire Brookfield Asset Management's 2.2GW green assets for about Rs77.73 billion (US$900 million), which includes 1GW operational and 1.2GW under-development across multiple states in India. This acquisition will double Gentari's renewable energy capacity to 4GW.
Waaree Energies Limited	Waaree Energies Limited approved Rs60 billion (US$694 million) to strengthen its renewable energy portfolio. This investment is to increase the company's solar manufacturing capacity and upgrade its technology.
NTPC Green Energy	NTPC Green Energy and ONGC Green Energy, through a joint venture, bid Rs56 billion (US$650 million) to acquire Ayana Renewable Power. Ayana operates 1,600MW of solar and wind plants in India, with another 2,500MW under construction. The acquisition will give the joint venture a 100% stake in Ayana. NTPC Green Energy secured Rs39.6 billion (US$458 million) from anchor investors, including Goldman Sachs and Life Insurance Corporation, ahead of its IPO. The company will use the funds to repay debt and expand renewable energy operations.
NHPC	NHPC has signed an MoU with the Bihar government to invest Rs55 billion (US$636 million) in solar power and green hydrogen projects. The initiative aims to develop 1,000MW of solar power and green hydrogen mobility projects and will help create around 800 jobs.
ACME Sun Power	ACME Sun Power secured Rs37.53 billion (US$434 million) in term loan financing from REC for a 320MW Firm and Dispatchable Renewable Energy project in collaboration with SJVN. The project spans high-resource areas in Rajasthan and Gujarat, with a signed PPA and land acquired earlier.
Asian Developmnent Bank (ADB)	Asian Development Bank approved a Rs37.52 billion (US$434.25 million) loan to boost renewable energy in Assam. The project includes a 500MW solar PV facility with battery storage. It will be executed through a JV between Assam Power Distribution Company, Oil and Natural Gas Corporation and Tripura Power Company.
AMPIN Energy Transition	AMPIN Energy Transition and Copenhagen Infrastructure Partners (CIP) have announced a second partnership involving over Rs260 billion (US$300 million) in joint equity investments to develop 2 gigawatts peak of renewable energy projects across India. The new partnership will focus on grid-connected solar, wind, hybrid and storage projects.
Jackson Engineers Ltd (JEL)	Jakson Engineers Ltd plans to invest Rs20 billion (US$231 million) to establish a 2,500MW solar cell manufacturing facility in two phases, with phase one set to be completed in 15 months.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. **www.ieefa.org**

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