



1. Installed Capacity

Fourth Quarter (4Q) 2023 Update:

Renewables continue to account for more than 70% of the new power capacity additions

India added a total power generating capacity of **2,893 megawatts (MW) in 4Q 2023** (October – December), with renewables accounting for 74.8% of all new capacity additions (Table 1). With these additions, India's cumulative power generation capacity reached **428.3 gigawatts (GW)** by the end of December 2023.

Among renewables, wind and solar recorded the majority of capacity additions, accounting for **19.1% and 53.2%**, respectively, of the total capacity added during the quarter.

India recorded a net coal power capacity addition of **730MW** during 4Q, taking the total installed base of coal power capacity to **214.4GW** or **50.1%** of the total installed power generation capacity. Net coal power capacity addition was on account of the commissioning of Unit 8 (800MW) at APGENCO's Dr. N Tata Rao thermal power station.

For the first time in six quarters, India recorded an addition of 60MW of Large Hydro power generation capacity with the commissioning of both the units (2x30MW) of SJVN's Naitwar Mori hydroelectric project in Uttarakhand.

Table 1: Installed power generation capacity (MW), by source, 4Q 2023

Energy Source	As on 30 September 2023	As on 31 December 2023	Change	% of New Capacity Added
 Wind Power	44,185	44,736	552	19.1
 Solar Power	71,781	73,318	1,538	53.2
 Small Hydro	4,983	4,987	4	0.1
 Biomass	10,262	10,262	0	0.0
 Waste to Energy (off-grid)	573	583	9	0.3
 Large Hydro	46,850	46,910	60	2.1
 Nuclear	7,480	7,480	0	0.0
 Coal (+ Lignite)	213,666	214,396	730	25.2
 Gas	25,038	25,038	0	0.0
 Diesel	589	589	0	0.0
Total	425,407	428,300	2,893	100.0

Full Year 2023 Update:

Total power capacity additions surged by 6% in 2023; non-fossil fuel capacity additions fell short by 66% of the targeted 40.7GW installation per year

Capacity installations in the 12 months of 2023 increased by **6.0% to 17,961MW** compared with 16,950MW added in 2022. Solar, coal, and wind power capacity additions are the major contributors to the installed capacity growth (Table 2).

While solar power capacity additions accounted for 55.8% of the total capacity additions in 2023, the share has fallen from 82.3% recorded in 2022. Solar power capacity additions **fell by 28.2% YoY** as project commissioning deadlines got extended due to procurement delays because of uncertainty surrounding the Approved List of Models and Manufacturers (ALMM) policy.

However, wind power capacity additions witnessed a 51.9% increase in 2023 over 2022, driven by rising hybrid (wind + solar) tenders and the Ministry of Power's specification of wind power obligation until 2029-30.

Total renewable energy capacity additions in the full year fell by 20.3% to 13,046MW in 2023 from 16,360MW in 2022.

To achieve the goal of 500GW of non-fossil fuel power capacity by 2030, India has to install 40.7GW of the said capacity every year starting from 2023. However, **the non-fossil fuel power capacity** (renewables + nuclear power) added in 2023 was only 13,746MW, **falling short by 66% of the intended target for the year.**

Coal power capacity additions grew strongly (4GW vs 0.6GW) in 2023 over 2022, driven by growing electricity demand and record peaks in the country.

Table 2: Power capacity additions by source (MW), 12 Months, 2022 vs. 2023

Energy Source	Capacity Addition, 2022 (MW)	% of New Capacity Added, 2022	Capacity Addition, 2023 (MW)	% of New Capacity Added, 2023
 Wind Power	1,847	10.9	2,806	15.6
 Solar Power	13,956	82.3	10,016	55.8
 Small Hydro	96	0.6	51	0.3
 Biomass	34	0.2	52	0.3
 Waste to Energy (off-grid)	88	0.5	60	0.3
 Large Hydro	338	2.0	60	0.3
 Nuclear	-	0.0	700	3.9
 Coal (+ Lignite)	586	3.5	4,001	22.3
 Gas	(75)	-0.4	214	1.2
 Diesel	79	0.5	0	0.0
Total	16,950	100.0	17,961	100.0

Source: Central Electricity Authority, GoI; IEEFA

Capacity additions trend:

Solar, wind, and coal continue to drive the growth in capacity additions across the quarters except for 700MW nuclear capacity addition in 2Q 2023 (Figure 1).

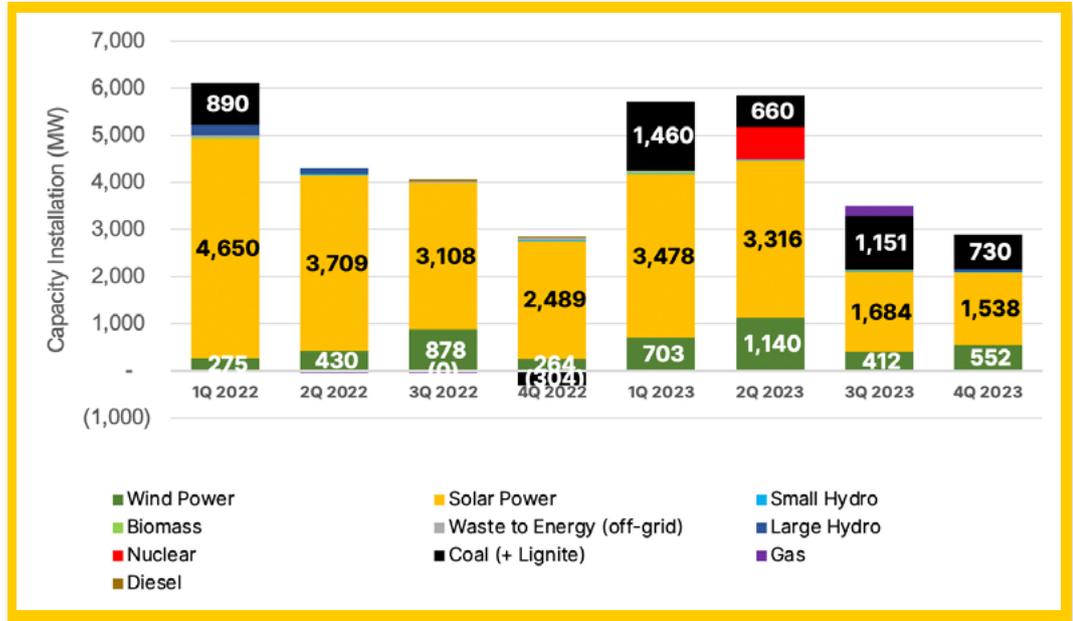
Solar capacity additions have significantly fallen from the peak of 4,650MW achieved in 1Q 2022 to register just 1,538MW in 4Q 2023, the lowest in the last eight quarters. Capacity additions in 2023 have slowed down due to lower auction volumes and supply chain challenges.

India registered four consecutive quarters of coal power capacity additions totalling 4,001MW in 2023 against a net addition of just 586MW in 2022.

The share of renewable energy in total capacity addition is 75% in 4Q 2023, averaging 72% in 2023 compared to >85% throughout 2022. This was due to a slowdown in solar capacity additions and an increase in coal

Solar, wind and coal continue to drive the growth in capacity additions; Solar capacity installations are the lowest in the last 8 quarters

Figure 1: Capacity Additions Trend by Energy Source (MW), Last Eight Quarters



Source: Central Electricity Authority, MNRE, IEEFA

Capacity additions among large states:

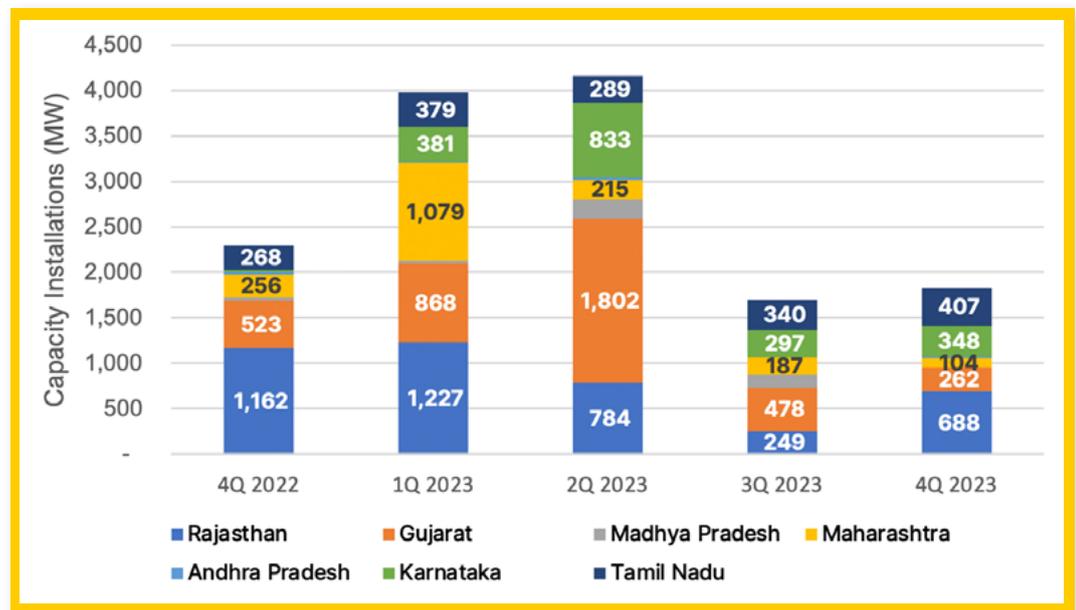
Among large states (in terms of installed renewables power generation capacity of close to 10GW or more), Rajasthan and Gujarat are the main drivers of renewable energy capacity expansion by adding 822MW and 787MW on average in the last five quarters.

Maharashtra and Karnataka follow next with average capacity additions of 368MW and 377MW per quarter. Tamil Nadu is a steady performer, adding renewable energy capacities in the range of 250-400MW every quarter at an average of 337MW per quarter.

Andhra Pradesh trailed the others in this group, adding only an average of 12MW of renewable energy capacity in the last five quarters.

Rajasthan and Gujarat continue to be the leaders in renewables capacity installations

Figure 2: Renewable Energy Capacity Installations (MW), Large States



Source: Central Electricity Authority, MNRE, IEEFA

2. Generation

Total power generation grew by 6.6% in 2023; renewables generation remained flat due to a drop in generation from Large Hydro power projects

Renewable energy generation in the 12 months (January-December) of 2023 increased marginally by **0.39% to 358.62 billion units (BU)** compared with 357.23BU generated during January - December 2022 (Figure 3). The flat growth in renewable energy generation is largely due to a 15.4% drop in generation from large hydro power projects in 2023.

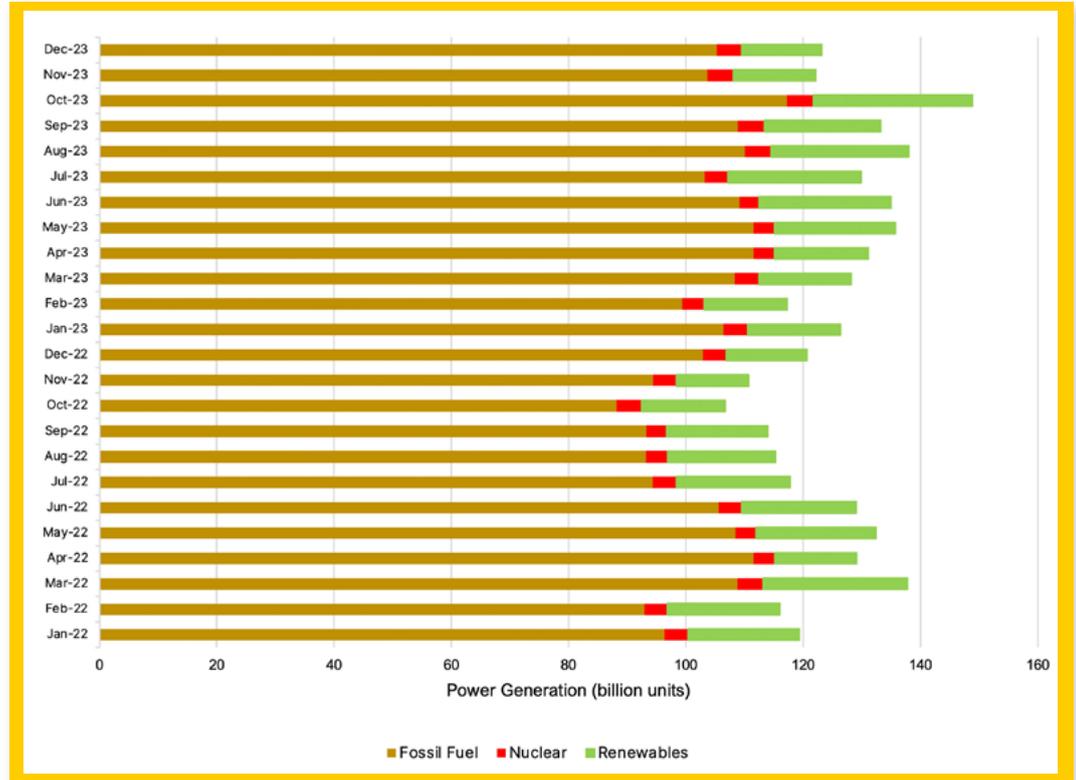
Power generation from fossil fuel sources **increased faster at 8.8%** in 2023 to **1,295BU** from 1,190BU in 2022 (Figure 3). The rise in fossil fuel-based power generation is due to a government directive to operate imported coal-based power plants at full capacity from February until October 2023 to meet the rising power demand.

Overall power generation from all sources **increased by 6.6% to 1,701BU** in 2023 from 1,596BU in 2022.

More than 75% of the power generated in the country for the full year (Figure 4) continues to depend on fossil fuels.

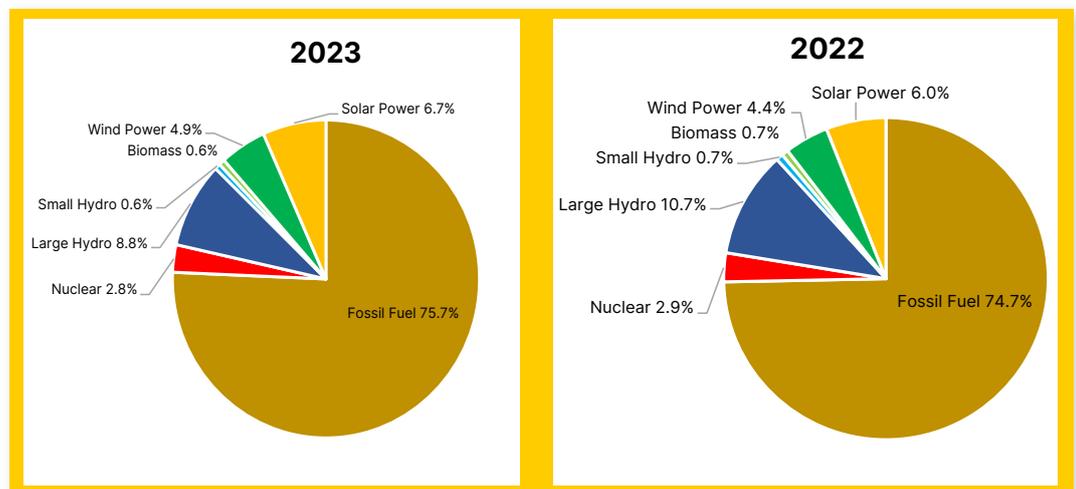
The share of renewable energy in total energy generated marginally decreased to 21.5% in 2023 from 22.4% recorded in 2022, largely due to a fall in generation from large hydro projects.

Figure 3: Power Generation by Source (BU), Monthly, 2023*



Source: Central Electricity Authority, MNRE, JMK Research, IEEFA
* Data for December 2023 is provisional

Figure 4: Power Generation Shares by Energy Source, January-December, 2023* vs. 2022



Source: Central Electricity Authority, MNRE, IEEFA
*Data for 2023 is for 11 months from Jan-Nov

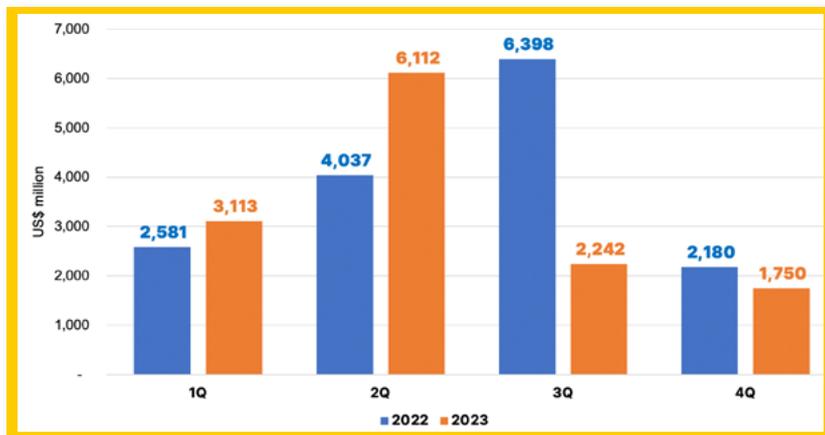
3. Investments

Higher interest rates and material costs hampered investment flows

Investments in the renewable energy sector reduced by 19.7% in 4Q 2023 to US\$1,750 million from US\$2,180 million in 4Q 2022. Investments for the full year 2023 amounted to US\$13,217 million against US\$15,196 million in 2022, a 13% decrease (Figure 5).

The investments achieved in 2023 fall short by US\$11.8 billion of the government’s expectation of achieving full-year investments of [US\\$25 billion](#) in the clean energy sector. Overall, fund flows to clean energy projects in 2023 were affected by concerns over profitability in the backdrop of rising interest rates and material costs.

Figure 5: India Renewable Energy Sector Investments (US\$ million)



Source: JMK Research, News Reports

Some of the major investments and deal announcements made during the quarter are:

Adani Green Energy	Adani Green Energy Ltd closed the financing of a US\$1.36 billion (Rs113 million) senior debt facility for Khavda Renewable Energy Park in Gujarat. The funding was backed by a pool of eight renowned international banks: BNP Paribas, Coöperatieve Rabobank U.A., DBS Bank Ltd, Intesa Sanpaolo S.p.A., MUFG Bank, Ltd, Societe Generale, Standard Chartered Bank and Sumitomo Mitsui Banking Corporation.
Vikram Solar Limited	At the COP28 Summit, Vikram Solar Limited announced that it had signed a ceremonial retainer letter with the US International Development Finance Corporation (DFC) to finance the company’s upcoming project of a 3GW cell and module manufacturing plant at Gangaikondan, Tamil Nadu, for about US\$200 million (Rs16 billion).
Sembcorp Industries	Singapore’s Sembcorp Industries is acquiring 428MW of wind energy assets in India and China. The agreements are valued at US\$149.8 million (Rs12.47 billion). With the support of state-owned investor Temasek Holdings Pte, the company is set to obtain more than 200MW of wind assets from Coimbatore-based Leap Green Energy.
Ampln Energy	Ampln Energy has announced a US\$376 million (Rs31 billion) investment to establish renewable energy projects in states such as West Bengal, Bihar, Odisha, Jharkhand, Chhattisgarh, and the Northeastern states.
Engie India	Engie India plans to invest US\$421 million (Rs35 billion) in India for 700MW renewable energy projects. The French energy company operates across seven states and has both wind and solar assets. These projects are expected to be commissioned by 2025.
The Indian Oil Corporation (IOC)	The Indian Oil Corporation (IOC) has announced its commitment to invest an equity amount of US\$199 million (Rs16.6 billion) in Indian Oil NTPC Green Energy Pvt. Ltd. This newly established joint venture (JV) with NTPC Ltd. aims to develop renewable power plants of about 650MW capacity to supply round-the-clock renewable power to IOC refineries.
The Indian Cabinet	The Indian Cabinet has approved Phase 2 of the Green Energy Corridor (GEC) Phase-II – Inter-State Transmission System (ISTS) for the 13GW Renewable Energy Project in Ladakh. The cost of this project is estimated at US\$2.5 billion (Rs207 billion) with a target of the fiscal year 2029-30.

About IEEFA

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