

Great Power, Great Responsibility

India is seeing a record demand for power, spurred both by economic activity and the climate crisis. Power companies are expanding their renewables capacity, even as the country's dependence on coal is on the rise. How are they managing the transition?

By DIVYA SHEKHAR

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“India is looking at 500 GW of clean energy by 2030. Around 300 GW needs to be added in the next six years. All stakeholders must work together.”

Praveer Sinha, CEO & MD, Tata Power



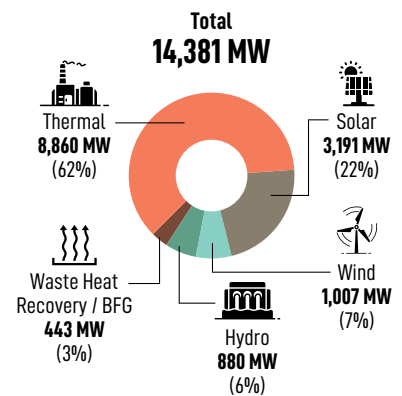
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The power industry in India is having a moment in the sun. Quite literally.

There are two main reasons. First is the rising, unprecedented demand for power, and second is the ambitious green energy transition goals the country has set, which are to be led by renewables.

India logged a record peak electricity demand of 250 GW on May 30, and the power ministry is bracing for it to reach 260 GW in June. Among the main causes for this is rising temperatures and heatwaves that have been gripping the country, leading to a surge in demand for cooling equipment like air conditioners.

Tata Power Generation Capacity Mix (Domestic + International)

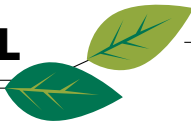


GOALS

To deploy 45% of its estimated capex of around ₹60,000 crore on renewables between FY24 and FY27e

SOURCE : Investor Presentations; company

INFOGRAPHICS: MUKESH SINGH



Economic growth is another reason for high power demand. The International Monetary Fund has said that India will remain the fastest-growing major economy in 2024, and in its latest outlook, raised India's growth projections for the year from 6.5 percent to 6.8 percent. The Reserve Bank of India, in its latest Monetary Policy Meeting, raised the Gross Domestic Product (GDP) forecast for FY25 to 7.2 percent from 7 percent earlier. Sabyasachi Majumdar, senior director at CareEdge Ratings, says it is generally believed that the demand for power grows roughly at 0.9 percent of the GDP demand.

Over the next two decades, India's energy needs are set to account for a quarter of global demand, with projections indicating a surge of 25 to 35 percent in demand by 2030, says Sagar Adani, executive director, Adani Green Energy Limited (AGEL). "This surge is intricately tied to India's ambitious infrastructure development plans, encompassing roads, railway ports, and airports, all of which demand an expansion of energy capacity."

The immediate solution to meet the growing demand has been to increase thermal power capacities, led by coal and gas. The government

is expected to ramp up thermal power plants and operate gas-based power plants in full capacity.

At the same time, paradoxically, at the heart of India's power industry is greening of the grid.

Coal remains significant in power generation, and will remain

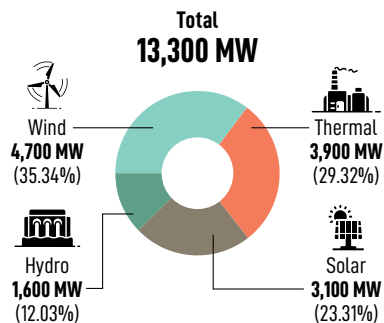
so, but its contribution to India's total installed capacity fell below 50 percent for the first time last fiscal, with renewable energy (RE) accounting for 71 percent of India's power generation capacity addition in FY24.

The ambition for transitioning

MEXY XAVIER

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JSW Energy Generation Capacity Mix



GOALS
Achieve 20,000 MW (20 GW) of generation capacity before 2030; become carbon neutral by 2050

SOURCE: Investor Presentation; company



"A power mix dominated by green energy will differentiate India's economic growth from how the world has grown."

Sharad Mahendra
joint MD and CEO,
JSW Energy

Powering Up

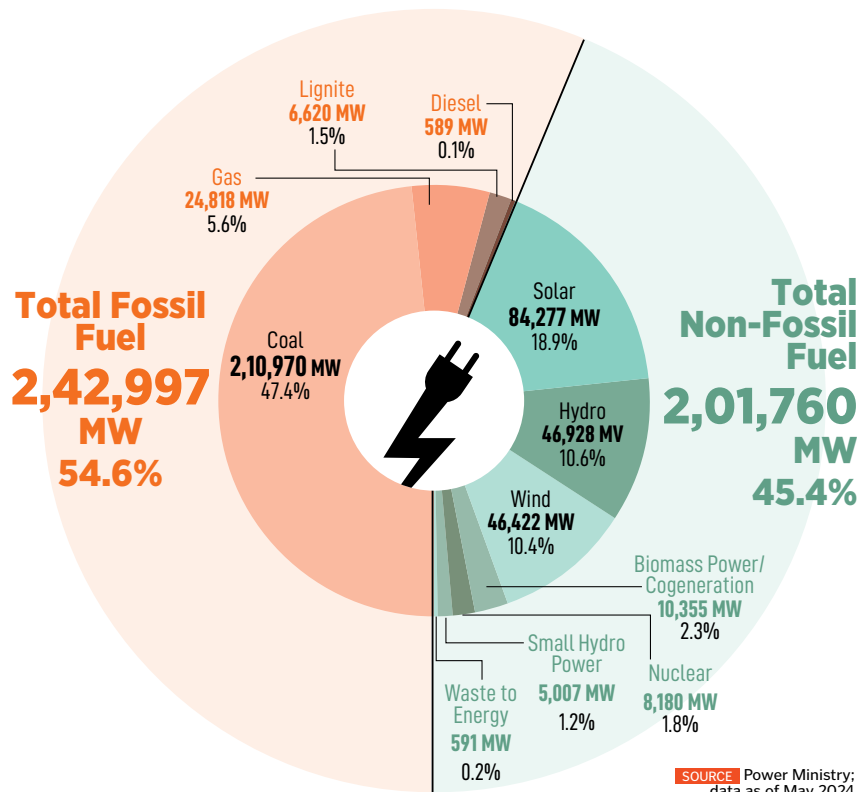
India's power generation capacity by resource

Total Installed Capacity

(Fossil Fuel & Non-Fossil Fuel)

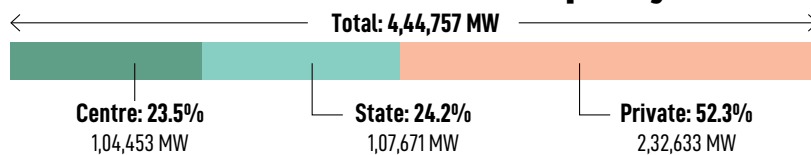
4,44,757 MW

Installed Generation Capacity



SOURCE: Power Ministry; data as of May 2024

Sector-wise Installed Capacity



SOURCE: Power Ministry, data as of May 2024

away from carbon-intensive power is clear: India wants to reach net-zero carbon emissions by 2070, and build 500 GW of non-fossil fuel energy capacity over the next six years. India has built around 200 GW of this capacity so far, and this goal would mean building additional capacity of nearly 50 GW every year.

In early June, Moody's Ratings estimated that \$190 billion to \$215

billion is required to build this capacity by 2030, which will possibly lead to significant inflows into India's power sector. The analytics firm, as per media reports, estimated that another \$150 to \$170 billion investment will be required for electricity transmission, distribution, and energy storage, while adding that coal will remain a major source of electricity generation

over the next eight to 10 years.

India wants to reduce the total projected carbon emission by 1 billion tonne by 2030, and reduce the carbon intensity of the economy by less than 45 percent by the end of the decade, from 2005 levels. The government has incentivised solar power by a production-linked incentive (PLI) to the tune of ₹24,000 crore to enhance manufacturing and export of solar PV modules.

There is also the National Green Hydrogen Mission, which has an outlay of ₹19,744 crore to generate around 5 million metric tonne of green hydrogen/ammonia by 2030. As per Invest India, up to 57 solar cities and parks of 39.28 GW are approved to be set up across states, and the wind-solar hybrid policy is encouraging companies to build more grid-connected wind-solar PV hybrid systems.

Praveer Sinha, CEO and MD, Tata Power, says that apart from industrial and commercial establishments, initiatives like the rooftop solar scheme for electricity will ensure part of the demand for clean energy solutions comes from residences too. Clients are increasingly looking for how companies will bring them bundled solutions based on their distinctive consumption profile, he adds.

"Fortunately, we have digital technology that helps us decide how much to generate at what time based on the consumption profile. Unlike earlier, where we used to set up capacities and then expected that the consumption will happen whenever it happens."

Other factors facilitating the renewable energy push include the cross-border carbon taxation followed by countries like the UK and the European Union, which make it imperative that the power supplied in those markets is produced using clean energy. "We still need to do many things, but the



movement has started,” Sinha says.

As India moves towards clean energy, and rightly so, it is becoming increasingly difficult for power companies, to invest in new coal-fired power plants, says Rajiv Ranjan Mishra, managing director, Apraava Energy, which is a 22-year-old company that is jointly owned by the CLP Group (one of the largest investor-owned power businesses in Asia) and CDPQ (a global investment group). This makes it among the oldest and largest foreign-owned power companies in India.

“The boards of most energy companies will not easily approve a coal-fired power plant. They will find it challenging to get banks that will finance such plants, or insurance companies that will insure them. Even if by some triple

“Our approach is focussed on de-risking our portfolio and return optimisation.”

Sagar Adani

executive director, Adani Green Energy Limited (AGEL)

Ready Reckoner



Net-zero

An organisation will cut down carbon emissions to a small amount, and the residual CO2 emission will be absorbed or stored. This leaves zero carbon in the atmosphere

Carbon neutral

An organisation will capture, remove or store the same amount of carbon dioxide from the atmosphere (through sequestration) as they are emitting. This means they won't necessarily reduce emissions

Intermittency

Renewable energy sources cannot consistently produce the same amount of power during all hours of the day. For example, solar is available during the day and not at night

Hybrid power

Combining multiple sources (like wind and solar, for example) to deliver non-intermittent electric power

miracle all of that is achieved, one will end up with an asset that will eventually be phased out,” he says.

That said, Mishra (who is also chairman of the Association of Power Producers) agrees that India cannot completely do away with coal at least till 2050, if not beyond. “We will need to keep building more renewables capacity, to keep the lights on,” he says, adding that the rate of transition to renewables will be faster in the private sector, which at present, comprises around 52 percent of the total power generation capacity in the country.

Industry's Path to Transition

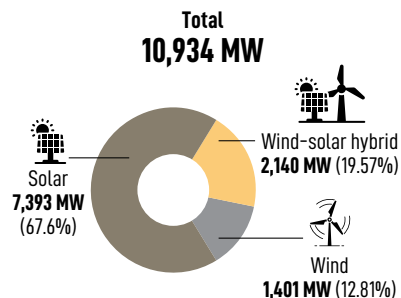
India is the third-largest carbon

emitter in the world, after China and the US. As per the International Energy Agency (IEA), India's carbon emissions grew faster than its GDP in 2023, at slightly more than 7 percent, to reach 2.8 GT. But India's per capita emissions remain very low at around 2 tonne. “India's per capita power consumption is one-third of the world average, one-fourth of China's and one-tenth of the US's consumption levels,” says Shalu Agrawal, director of programmes at the Council on Energy, Environment and Water (CEEW). “In line with the country's economic aspirations, India's power demand will continue to rise in the coming decades to at least converge



Adani Green Energy Limited (AGEL)

Generation Capacity Mix



GOALS
50 GW (50,000 MW) of renewable energy in six years, around 10% of India's goal of 500 GW of non-fossil fuel capacity by 2030

Note: Adani Power, AGEL's sister concern, is the largest thermal power producer in India with current and planned capacity of over 22 GW (22,000 MW)

SOURCE: Investor Presentations; company

and surpass the world average.” Adani Power, the largest private thermal power producer in India and a sister concern of the AGEL, has a current and planned capacity of over 22 GW of thermal power. It anticipates in a March 2024 investor presentation that while non-fossil sources will lead capacity addition, thermal will continue to serve most of the base demand for

power. For instance, it estimates that in FY27, 59 percent of the gross generation 2,025 billion units of power will be thermal, while in FY32, it is expected to be 50 percent of 2,666 billion units.

India’s power reforms trajectory will be different from that of the Western countries, because India’s growth story has also been different from the rest of

the world, says Sharad Mahendra, joint MD and CEO, JSW Energy.

He explains that most underdeveloped or developing countries move from agriculture to manufacturing, and then to services, in their path to development. India is a predominantly agriculture-driven economy that jumped straight to services, and is now focusing on strengthening the manufacturing sector as a growth strategy, through strategies like China+1, and the Make in India initiative.

Mahendra adds that India’s manufacturing efforts, including the push for electric vehicles and the setting up of large data centres, will make huge demands on the power sector. “The Western world is moving in a different direction. We have to catch up, and we have to be fast. And a power mix dominated by green energy will differentiate our economic growth compared to how the world has grown,” he says.

Sinha of Tata Power believes that the transition will take a long time and it can only happen with a new solution that is either as good or better than the present solution. “Coal and gas can be used 24x7, but renewable energy is intermittent—solar is only available during the

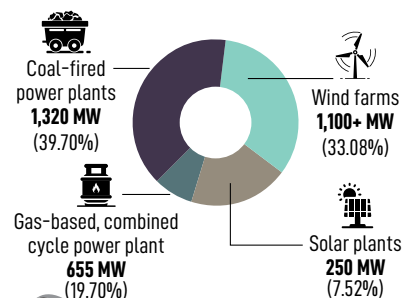


“We will need to keep building more renewables capacity, to keep the lights on.”

Rajiv Ranjan Mishra
MD, Apraava Energy

Apraava Energy Generation Capacity Mix

Total
3,325 MW



GOALS
Double clean energy portfolio by 2025

SOURCE: Company



day, while wind is [available] in the evening or night. We need to ensure uninterrupted, reliable and resilient power supply.”

Transmission and storage are important focus areas. It is not only important to add transmission capabilities, but also to ensure that there is a stable grid that has better integration of power from various sources, Adani says, on email.

It is important for the system to be more flexible, adds Agrawal of CEEW, so that the expanding transmission capacity allows inflow between states. “This will help better utilise surplus power generated in one state, in another state,” she says.

Adani adds that if renewable energy has to replace thermal as the base load, it’s necessary to develop “utility-scale energy storage solutions in a speedy and cost-effective manner”.

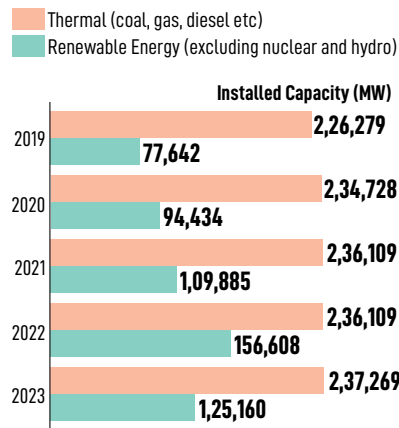
One important way in which this is done is through round-the-clock structures, which combine renewables and storage to supply power on a 24-hour basis. For storage, specifically, companies are exploring pumped storage plants (PSPs) and batteries.

Majumdar of CareEdge explains that if India has a total renewable energy capacity of 450 GW by 2030, it will require at least 19 GW of PSPs and 42 GW of battery storage. “That will require a total capital expenditure of ₹17-18 lakh crore, out of which 75 to 80 percent, will come from the debt side,” he says.

Companies are investing heavily in PSPs. Tata Power will commission two projects of 2.8 GW by 2027-28, with an investment of about ₹13,000 crore, as per a November 2023 article in *Fortune*. JSW Energy, as per their May 2024 investor presentation, is building 3.4 GW of locked-in capacity, which is 2.4 GWh of hydro pump storage and 1 GWh of battery storage. AGEL—which has set a target of

Side-by-Side

Even as India continues to ramp up renewable energy capacities, the importance of thermal power (coal, gas, diesel etc) remains intact



India aims for **500 GW (5,00,000 MW) of installed non-fossil capacity by 2030**



Green hydrogen production target is 5 million tonne by 2030, which will be supported by 125 GW (1,25,000 MW) of RE capacity



Around 57 solar cities and parks of 39.28 GW have been approved



Potential sites identified for **wind energy with an offshore target of 30 GW by 2030**



At the same time: In Nov 2023, then Power Minister RK Singh said **India will add about 88 GW (88,000 MW) of thermal power capacity by 2031-32**

SOURCE: National Power Portal; Invest India; media reports

generating 50 GW renewable energy by 2030, which is around 10 percent of India’s 500 GW goal—wants to develop over 5 GW hydro PSP capacity in the next six years.

PSP is a proven technology, and among of the cleanest ways to store energy, Adani believes, and has a long project life of potentially 100+ years.

Another way in which AGEL wants to accelerate the integration of renewable energy to the grid is by investing in hybrid, which is essentially a combination of different energy sources (like solar and

wind, for example). Its benefits, according to Adani, include increased efficiency, optimal land and grid infrastructure use.

A wind and solar hybrid with storage can also possibly make power more cost-competitive than coal. A study conducted in Tamil Nadu in 2021 by Climate Trends and JMK Research found that installing battery-based energy storage capacity in renewable energy-rich states can “cost-effectively not only meet the state’s demand, but also export surplus enough to power Delhi as compared to coal power”, as per a report in Carbon Copy.

Mahendra of JSW Energy agrees that “in the next few years, plain vanilla wind or solar bids will start reducing”, adding that the company is bidding for more hybrid plus storage, and firm and dispatchable renewable energy (FDRE) tenders that will facilitate the provision of assured peak and round-the-clock power at any hour of the day as per demand specified by the distribution company (discom) that distribute power to the end user.

As far as “ease of doing business is concerned”, says Mishra of Apraava Energy, it will help if the states and the Centre take steps to ensure land blocks are available for renewable energy plants and storage, which are many-a-times spread across multiple kilometres. “Land acquisition, and acquiring right of ways is difficult, varies from state to state, and sometimes even within different areas in the same state. This can result in time and cost delays,” he says. “Renewable energy takes less time to ramp up, but the execution cycle can be improved to meet the nation’s growing demand.”

Agrawal of CEEW says that power being a concurrent subject in the Constitution, it is important for the Centre and the states to be more in sync.