



India's energy transition: from capacity-led planning to flexibility-driven system design

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About Ember

We are an independent energy think tank that aims to accelerate the clean energy transition with data and policy.

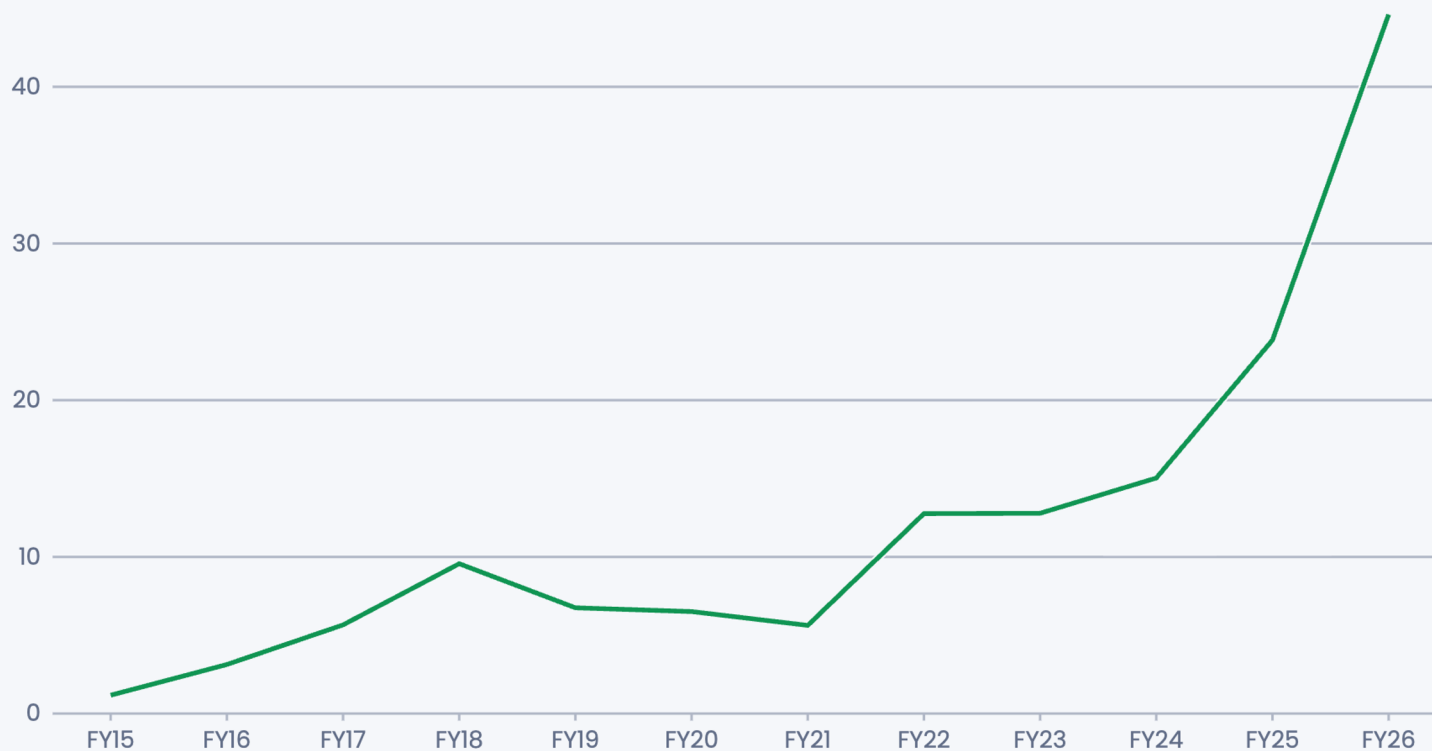
Our mission is to: **shift the world to a clean, electrified energy future.**

Our [data](#) is open, free, and easily downloadable.



India's solar capacity grew ~40x between FY2015 and FY2026

Solar additions in financial year (GW)



Source: MNRE • Capacity is reported as AC capacity, including distributed solar
FY stands for financial year, e.g. FY15 = April 2014 to March 2015.

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India's clean energy transition is accelerating

Total installed **non-fossil fuel capacity** is (288 GW)

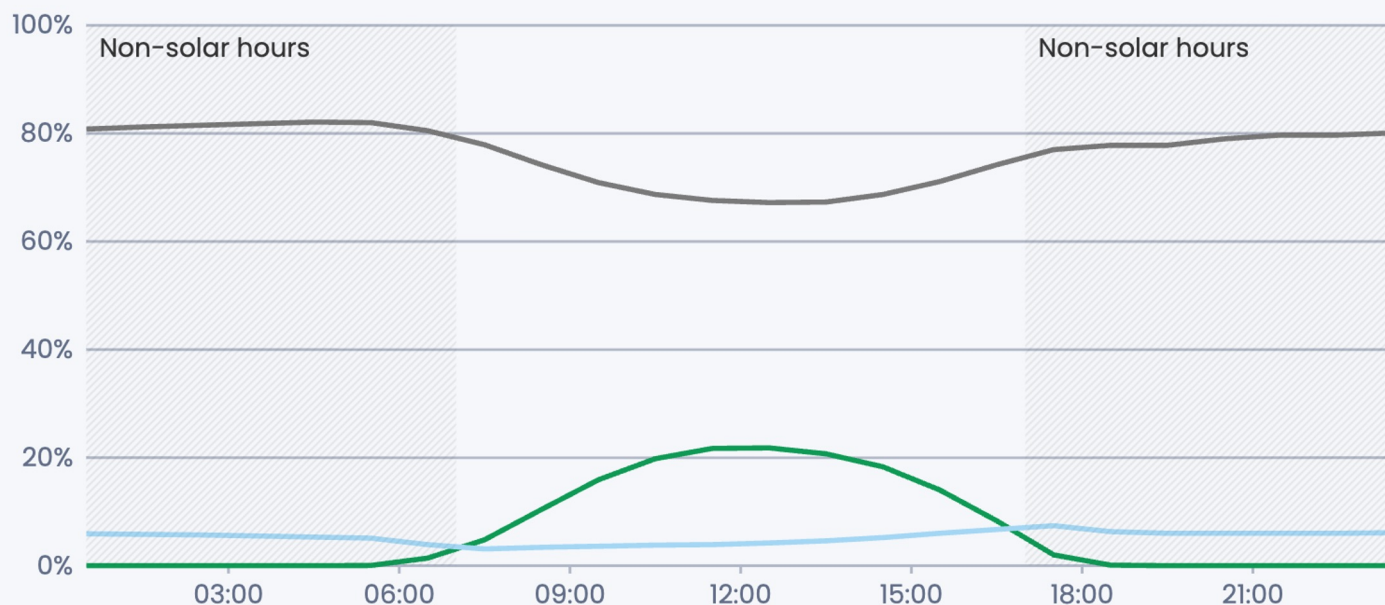
dominated by solar with 154.2 GW as of April 2026.

Solar **generation share stood at 9.4% in 2025** up from 0.5% in 2015.

Solar is accelerating but India is still dependent on thermal in non-solar hours

Sample share of total demand met through various resources

— Solar — Wind — Thermal



Source: Ember's analysis based on Merit India data

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But India's grid observes highest demand when the sun goes down

Non-solar hours are dominated by thermal generation.

With solar surge, clean energy transition is **now** entering an **operationally more complex phase.**

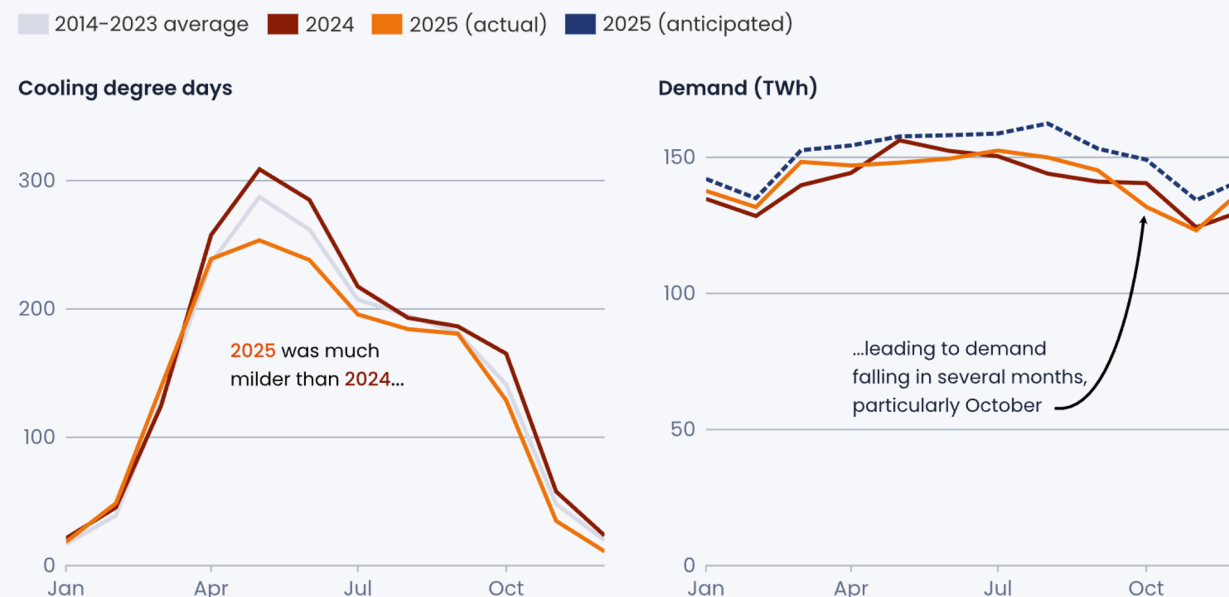
What was revealed in 2025?

- Weaker-than-forecast daytime demand coincided with continued solar expansion.
- Increased system security issues, periods where supply > demand, leading to curtailment of renewable energy (also).

Here, **curtailment of 2.3 TWh renewable energy** is a **system signal, not a failure**.

2025 saw exceptionally mild temperatures in India, slowing demand growth

'Cooling degree days' measure by how much daily temperatures exceed 22°C. The higher the number, the more electricity people need for cooling.



Source: Grid-India, MERIT India, Ember analysis of ERA5 temperature data
Cooling degree days are population weighted to better reflect temperatures in demand centres. Demand data excludes unmetered generation such as rooftop solar.
Anticipated demand calculated as 6% growth from 2024 level, based on Twentieth Electric Power Survey of India (Table 2.5). Monthly estimate based on average seasonal profile from 2021-2024

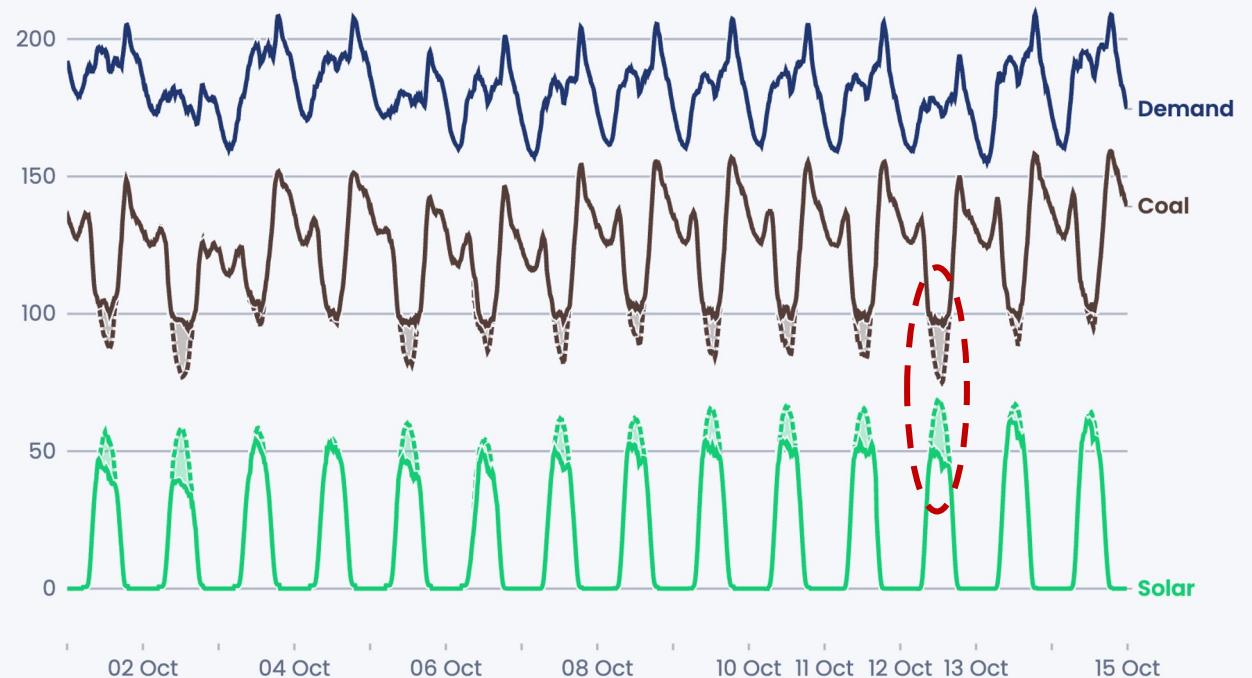
2025 is an early indicator of system needs in a high renewables future

- Thermal generation could not be sufficiently turned down to fully accommodate midday solar while maintaining enough thermal capacity for evening demand.

2025 made the **flexibility gap visible**. A system designed for predictable baseload is **now learning to manage variability**.

Indian midday solar generation is curtailed to keep coal available for the evening ramp

Generation and demand (GW). Dashed line represents Ember's estimate of generation without solar curtailment



Sources: Grid-India, Ember modelling • Curtailment achieved by activating TRAS down



Curtailment signals the need for building flexibility at pace with solar growth

Solutions are taking shape: India's flexibility toolkit

Supply

Optimisation

Improve the coal fleet's flexibility; mandate of achieving minimum technical limit of 55%.

Outcome

Generating assets become flexible and easy to turn off/down during excess solar and wind.

Store

Infrastructure

Both battery energy storage and pumped hydro are in focus.

Outcome

Storing excess renewable power for times of higher demand.

Shift

Mechanisms

Time-of-day tariffs (static) mechanism is already in place.

Outcome

Shifting non-critical demand to periods of abundant renewable availability.

A network diagram background consisting of a series of interconnected nodes and lines. The nodes are represented by small circles, some in a light blue color and others in a light green color. The lines connecting them are thin and light green. The network is more densely connected on the left side and becomes sparser towards the right.

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DATA INTO ACTION



India's experience offers insights for countries scaling solar while managing coal transitions

1

Plan flexibility early

Storage, demand response, and flexible operation of non-solar resources must grow with renewables.

2

Treat curtailment as a diagnostic signal

It shows where grids, markets, and operations need to evolve.

3

Align demand with clean generation

Smart meters, time-of-day tariffs, and industrial demand response can shift load into solar hours.

4

Redesign coal

Coal moves from baseload dominance to a balancing role.

5

Build markets that value flexibility

Real-time markets and ancillary services reduce system stress.

Flex with the sun!