

India aims to be developed by 2047 and net-zero by 2070, requiring a transformative energy transition to achieve these goals

# The shift fuelling country's growth engine

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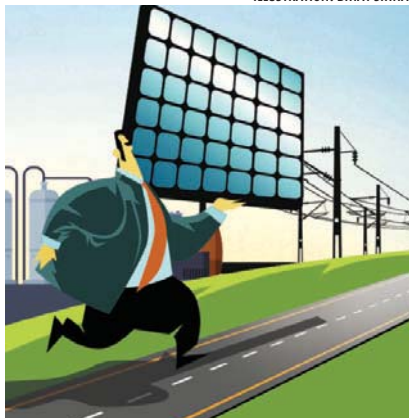
India's largest coal-fired power generator, NTPC, marked its golden jubilee last month with the listing of its renewable energy (RE) company, NTPC Green Energy, on the Indian stock exchanges. The move underscores the transition India's energy sector is witnessing.

From exporting oil and mining coal to building mega hydro dams, and now focusing on solar panels and biofuels, the country's energy journey reflects its socio-economic growth. Over the past 25 years, India has seen the evolution of its public sector undertakings (PSUs), energy access schemes, regulatory frameworks, private investment, and a push towards RE.

## Striking oil, but...

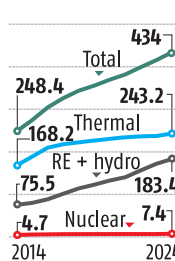
Understanding India's energy landscape requires going back in time to the

ILLUSTRATION: BINAY SINHA



## POWER STATUS

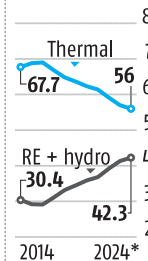
Installed Capacity In Gw



\*as of March 2024

Source: National Power Portal, Central Electricity Authority

% share in energy basket



late 19th century, when an English engineer discovered oil fields in Assam. His persistent instruction of "dig boy, dig" to the labour saw the emergence of India's first oil town, Digboi. However, it was only after the mid-1900s that the country set up its oil giants – from the

government-owned explorer, ONGC, to marketing companies like IOCL, BPCL, and HPCL.

Since 2000, a lot has changed in terms of private and foreign participation and technological advancements, but this progress has been tempered by

stagnant domestic production, rising imports, and the constant threat of foreign conflicts driving up fuel prices at home. ONGC had discovered the Bombay High oil field (now called Mumbai High) 160 km into the Arabian Sea off India's western coast in 1974.

The project, which has gone through four redevelopment plans and accounts for 70 per cent of India's domestic oil production, prompted the government to open up oil and gas exploration to the private sector. And in 1999, just before the turn of the century, it launched the New Exploration Licensing Policy (NELP).

Next-generation fuels like biodiesel and green hydrogen yet to show promise at scale.

Under NELP, Reliance Industries

Ltd (RIL) discovered a major deep-sea reservoir of gas reserves in the Krishna Godavari basin (KG-D6) in 2002. Two years later, Cairn Energy unearthed the Mangala oil field — the world's largest onshore oil find — in Barmer, Rajasthan. Before these, in 1999, RIL had commissioned the world's largest single-site refinery with a capacity of

1.4 million barrels per day at Jamnagar, Gujarat.

However, production from KG D6 has dropped multiple times, causing market disruptions, and Mangala oil has yet to achieve its full potential. As a result, India remains a net importer of crude oil, with domestic output stagnating since 2011 at around 30-35 million metric tonnes annually.

Despite nine rounds of bidding under the Open Acreage Licensing Policy, India's domestic crude production in 2023-24 (29.4 million tonnes) was less than in 1999-2000 (31.95 million tonnes). Turn to Page 4 ▶



ENERGY



# Next-generation fuels yet to show promise at scale

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Aging fields like Mumbai High, limited success in finding new reserves, and high exploration costs have stymied growth. As a result, the government is focusing on promoting green fuels to reduce import dependency.

The national biofuel policy of 2018 aims to increase biofuels' share in India's overall energy mix. The Centre's ethanol blending programme has seen success, with E20 petrol (20 per cent ethanol blend) available at retail fuel outlets nationwide in 2024. As of the 2023-24 Ethanol Supply Year, ethanol blending has surpassed 13 per cent, with the government targeting 20 per cent by 2025-26, which will require up to 10.16 billion litres of ethanol.

Next-generation fuels like biodiesel and green hydrogen are yet to show promise at scale, though the government is launching policies to support them.

### Digging for black gold

Had it not been for the untimely demise of scientist Homi Bhabha in 1966 at age 56, India may well have been powered by nuclear energy today. Geopolitical tensions shifted the focus from uranium to domestic coal, and in the 1970s, a fuel policy committee recommended a push towards coal to reduce dependence on foreign oil and contain the swelling oil bill.

At the time, many of India's coal mines were controlled by private operators — the Ramadhir and the Sardars — in Eastern India, but they were nationalised, leading to the creation of Coal India Ltd (CIL). Thermal power plants proliferated, and coal transport became a mainstay for Indian Railways.

By the 2000s, power demand surged, and private power generators complained of insufficient coal supply from CIL, threatening blackouts.

Partha Bhattacharya, former CIL chairman and managing director under whom the company had launched a blockbuster IPO, said that today's surplus coal supply is a result of lessons learnt from past policy mistakes.

"CIL grew at a modest 4-5 per cent, in line with economic growth and power demand in the early 1990s," Bhattacharya said. "But the electricity reforms of the 2000s, which saw the entry of private players in power generation, put pressure on coal supply. This was followed by amendments to the Coal Nationalisation Policy, allowing private miners to enter the field."

However, in 2012, the sector was rocked by a coal scam, one of India's biggest, around the allocation of coal blocks to private companies. Two years later, the Supreme Court cancelled all the 200-odd coal block allocations, forcing the sector to reset. A revised coal auction in 2015 under a new government opened the industry to private miners for captive use and commercial sale, ending CIL's 45-year monopoly.

Over the last decade, the share of private mining has slowly increased, and it contributed 100 million tonnes of coal by November 2024. To meet the rising demand, CIL has also

ramped up production, growing at 8-9 per cent in recent years, compared to 5-6 per cent previously.

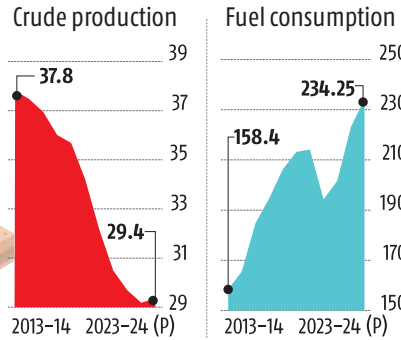
Bhattacharya is optimistic about India's coal supply. "The shortage is easing. Coal India is growing at an impressive pace, and several big players have entered commercial coal mining. Together, they can meet the country's needs."

However, with global pressure mounting to phase out fossil fuels, India faces increasing calls to reduce its reliance on coal. The government has resisted setting a definitive phase-out

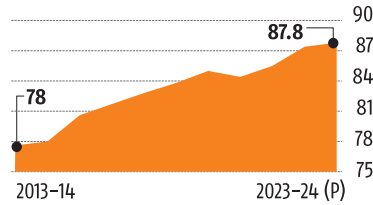
## MIXED BAG



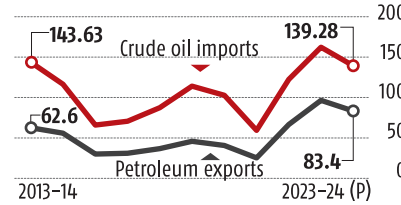
### Domestic output lags (in mt)



### Import dependency for crude (%)



### Trade stats (in \$bn)



FY23 and FY24 figures are Provisional

Sources: Petroleum Policy & Analysis Cell, Commerce Department

date, citing the country's growing energy demand and the historical responsibility of developed nations.

Bhattacharya believes coal will continue to grow in India, with production reaching 1.3-1.5 billion tonnes over the next 4-5 years before plateauing. He predicts that coal will support RE growth, with a more gradual phase-out beginning around 2047, by when India aspires to achieve developed-nation status.

### Homes & kitchens

The last two decades have seen significant strides in energy access through universal electrification and subsidised LPG cylinders.

Electrification of rural households has been a key electoral promise for political parties. National schemes such as the Accelerated Power Development and Reforms

Programme, Deen Dayal Upadhyaya Gram Jyoti Yojana, and Saubhagya were implemented to achieve universal access. On the ground, this often translated to promises of free electricity by local politicians.

Although all households are now connected to the national grid, the challenge of uninterrupted power supply remains. The Centre claims rural areas receive 18 to 20 hours of electricity per day, while urban areas get 22 hours. However, post-Covid, several states reported a reduction in power availability as state-owned power distribution companies (discoms) struggled with reduced revenue.

Among the most significant improvements in energy access has been the Pradhan Mantri Ujjwala Yojana (PMUY). Launched in May 2016, PMUY aimed to provide clean cooking fuel (LPG) to rural households that

previously relied on traditional fuels like firewood, coal, and cow-dung cakes. The scheme has garnered widespread support in rural India.

In its latest version, PMUY offers a targeted subsidy of Rs 300 per cylinder for up to 12 refills annually. As of November 1, 2024, 103.3 million households, about a third of India's 328.3 million, were PMUY beneficiaries. Of these, 20.3 million families availed more than six refills in 2023-24, government data shows.

### The colour of power

The power sector has seen regulatory transformations over the years.

"Between 2001 and 2003, the Electricity Act was finalised, followed by the introduction of competitive bidding frameworks for ultra-mega power projects and transmission contracts," said Sambitosh Mohapatra, leader of ESG, Climate & Energy at PwC India. "This opened the doors for private investment." Leading industry names made a beeline for the sector, investing in power generation, transmission and equipment manufacturing.

Parallely, power distribution reforms took shape. "We had four major discom reform schemes, starting with the financial restructuring plans in the early 2000s, and the Ujjawal Discoms Assurance Yojana in the last decade. Now we have the Revamped Distribution Sector Scheme," Mohapatra said. "Each tried to address a part of the problem, but nothing much came out of them except momentary relief for state-owned discoms." He added that the time had come to bring retail competition into power distribution, which would bring more efficiency to the sector.

Another ongoing transition is the shift towards greener energy. Traditionally, India's power system has been built around coal, with large hydropower projects providing balance. Gas-based power, started as a costly mega experiment, mostly failed.

The 2008 Paris Agreement on climate action spurred India's green energy ambitions. By 2010, the targets for RE expanded rapidly — from 20 gigawatt (GW) to 100 GW and then to 500 GW,

Mohapatra said.

However, the pace of RE absorption into the grid has been slower than expected, even though capacity additions have surged. Renewable energy is seasonal and unreliable, and energy storage remains costly. Discoms, facing financial pressures, prefer to buy thermal power despite RE becoming cheaper.

An analysis of government data shows that as of March 2024, India's installed capacity for renewable energy — mainly solar and wind — stood at 136 GW, up from 35 GW in 2014. Yet, RE accounts for only 12 per cent of India's electricity supply, with coal continuing to dominate.

Mohapatra emphasises the need for a recalibration of India's energy mix, calling for significant investment in nuclear energy, with a 20 to 30 GW capacity addition plan. The system has absorbed available RE over the past few years, but now it's saturated, he said. "Investment in transmission, energy storage, and decentralised solar must be prioritised to boost RE absorption."

As India targets developed-nation status by 2047 and a net-zero economy by 2070, the energy sector will be critical in achieving these goals. In the last 25 years, regulations have stabilised, global investments have flowed in, and each part of the energy supply chain is undergoing a transition.

For coal-bearing regions, a just transition will be essential as India eventually phases out coal. Meanwhile, the grid must be prepared for more RE. Innovations such as biofuels and electric vehicles are key components of the future, with energy access gradually giving way to energy security.

Rahul Munjal, CMD of Hero Future Energies and one of the earliest entrants in the Indian RE sector, echoes this sentiment. The country, he said, will achieve the next milestone of 500 GW of non-fossil fuel capacity by 2030. "The national green hydrogen mission will make India an energy exporter. By 2047, India will be energy-independent, significantly reducing its reliance on fossil fuel imports," Munjal said.

The past 25 years were about creating. The next 25 will be about transformation.

