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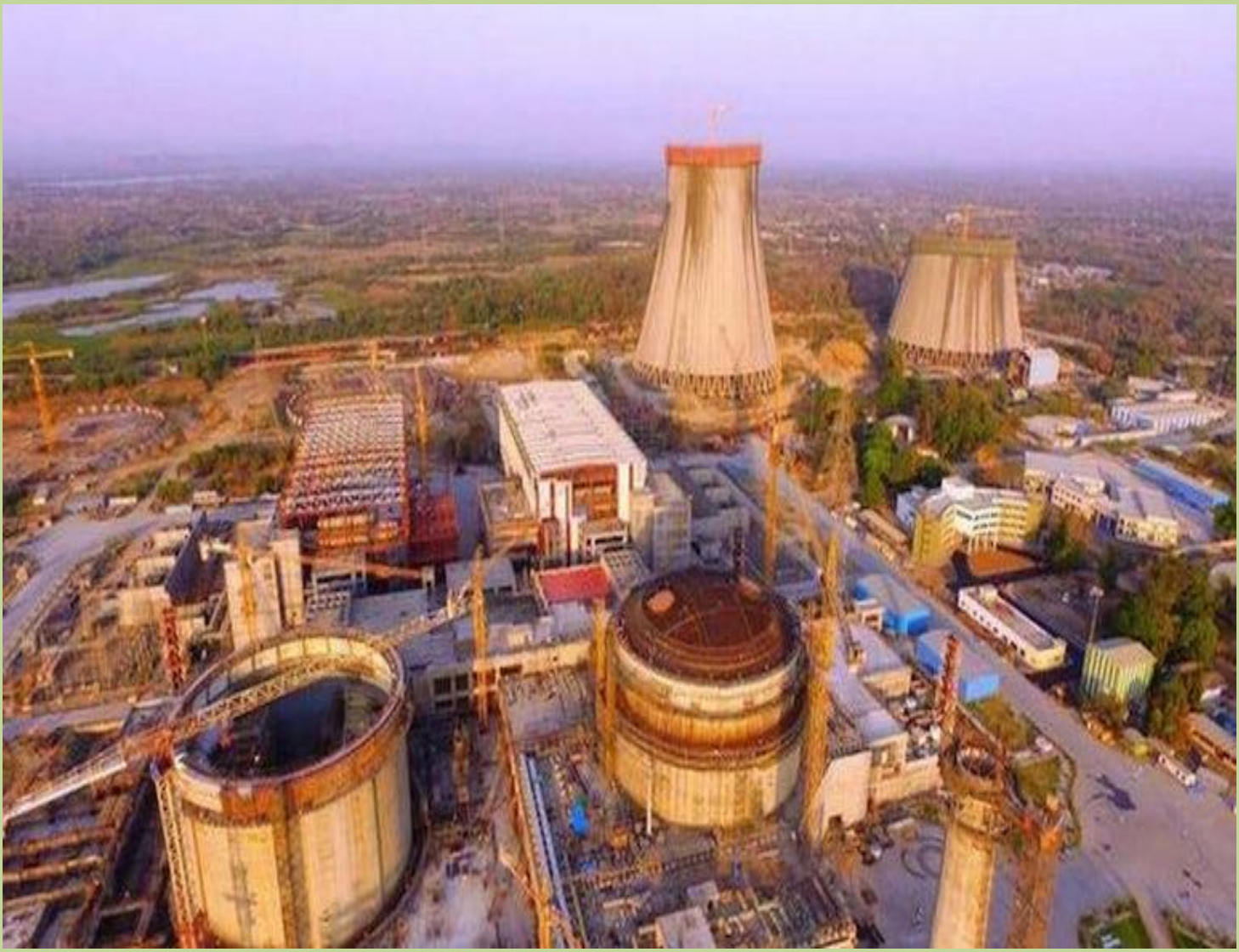

India Working on 10 New Nuclear Reactors

Targets Tenfold Capacity rise by 2047: PM

Geo Politics of Energy Transition

R.V. Shahi

The developed nations of the world – the initial G-7s countries - initiated and acquired maturity on economic development during eighteenth and nineteenth centuries. The development agenda, riding over enhancing energy production and consumption, was naturally focused on accelerated growth of energy leading to rapid rise in national income and per capita income. Exploring and researching various means of production of energy as the prime mover of economic development prevailed over various other items of agenda. It is only during the second half of the Twentieth Century, when the environmental and climate change issues started receiving greater attention post high amount of carbon emissions in the atmosphere. This happened particularly with greater degree of emphasis during the last 25 years of the twentieth century. Environmentalists and NGO's brought these issues predominantly, followed by the country's governance systems and corporates. It is during this period that the developing countries and under developed countries faced the consequences of these developments. They were confronted with the challenge of how to provide and enhance access to energy and thereby catch up on national GDP and per capita income.

The consequences of energy programmes in developed nations did get attention but their impact fell on the developing world affecting significantly their economic agenda. This gave rise to the Dilemma of Energy Access and Environmental Sustainability, which continued for a few decades. This has now been followed by the Trilemma of Energy access, Environmental Sustainability and Energy Security. The third element viz. energy security has arisen in the current century, more predominantly during last ten years when the global geo politics have witnessed a major shift. During 80's, in the last century, Globalisation emerged as a strong concept and got strengthened over several decades with the expected benefits of large-scale international cooperation in business and trade yielding benefits of industrial development and economic growth the world over. This process did offer substantial benefits, but these were also severely constrained, particularly for developing and under developed nations, under the expected agenda of environmental and climate change concerns.

During the initial years of this century the concerns regarding environmental sustainability became paramount which was further strengthened under COP Agenda. Following the Paris Agreement, different countries made commitments for Net Zero Targets – India committed Net Zero by 2070. The most important outcome which emerged was large scale assimilation of Renewable Energy, mainly Solar in the energy programme of different countries. This did have positive impact on climate change due to progressive replacement of fossil fuel-based electricity generation by carbon free power. RE Programme launched by India in 2015 was one of the most impressive initiatives together with the International Solar Alliance.

Following the Paris Agreement, a number of international developments took place, which became indicative of the need of how best every nation becomes self-contained rather than being over dependent particularly in respect of energy. This aspect of the need of energy security started getting more intense, and emerged as the most important area of concern. International diplomatic relations, combinations and groupings of various countries, sanctions on different countries on how to conduct their own international trade and business emerged as most dominant factor for energy and, therefore, for economic development

for any country. Different nations were still in the process of planning and evaluating various options for energy transition during the last ten years post Paris Agreement. The most recent developments relating to Trade and Tariff Policies of the US Government has brought the Geo Politics of Energy Transition at the center of energy management in the global context.

For India, obviously this has led to many more challenges of different dimensions. In the field of electricity, the last decade has witnessed exponential expansion of Renewable Energy capacity in the power sector profile of the country. The future growth trajectory till 2050 may be even sharper. While this will provide a highly positive impact on de-carbonisation of the energy sector, this is not free from the challenges, more particularly those created due to geo political situations. Manufacturing of Solar Systems, for which during the initial years India has been balancing its import with the domestic manufacturing of Solar Systems. However, substantial dependence still continues on import which has in the recent years become the subject matter of geo political dispensation. Efforts to minimize import dependence in manufacturing also face challenge of important minerals which need to be procured from outside. Obviously, no case can be, or need to be made to avoid import altogether. However, if the expansion targets are moving on a highly accelerated path, concern about import and, hence, the geo political dimensions in the current context become relevant.

Considering the power sector profile which will dynamically move away from fossil fuel-based power to Renewable Energy, the most important energy asset which India possesses, viz. Coal, has rightly attracted attention on its pre-combustion and post-combustion treatments to ensure that the carbon emission impacts are significantly reduced. A few years back when Solar Power provided an affordable range of cost of generation, it was felt that the decline of coal-based power could be made faster. However, the challenge of managing the Grid due to availability of Solar during day time and the need for larger amount of power into the system coupled with also the emerging geo political situation, it was felt that the Thermal Power would continue to play a significant role for a few decades till it is established that its decline could be made faster. The challenge posed by accelerated growth of Solar Power, and management of Grid requiring a pattern of load in the system, another major initiative which the country has taken is to plan a much larger growth for Hydro Power projects which will have the ability to provide for solution to manage the Grid despite the challenge of non-availability of Solar Power. This planning is being further strengthened by a large-scale development of Hydro Pumped Storage plants which will use surplus Solar Power during day time to pump and create the required water heads to run the PSP. It is estimated that the potential for PSP in the country is of the order of 215 GW, and currently about 10 GW projects are already in construction. Alternate solutions to provide storage power are also Battery Energy Storage System. This will, however, undergo a phase of dependence, in a significant way on import of many items in the domestic production process. It would have a geo political dimension, but it is understood that due to competition in the global market its availability would not pose a challenge.

Hydro Power Projects in India and Pumped Storage Plants, as mentioned above, will provide substantial comfort to the challenges of Renewable Energy – Solar and Wind Energy. To complement these efforts the initiatives of the Government to enhance energy cooperation with Bhutan and Nepal for developing Hydro Power Projects and entering into long term arrangement of Power Trading will also address the issues mentioned above. Recently, the Government of Bhutan have notified their revised Energy Policy which includes, for the first time, private Sector participation in development of Power Projects in Bhutan. Tata Power and Adani Power have signed MOU's for developing power projects aggregating to 5,000 MW each. In Nepal also a

number of power projects are being developed by Indian Companies which will have Power Trading arrangement with India. In all these cases interconnecting Transmission Infrastructure is being developed. These will definitely have positive impacts on the management of energy transition.

The biggest challenge in the energy sector is India's dependence on import for Petroleum products – Crude and Gas. These constitute more than 35% of the energy basket of India. Import dependence in respect of Crude is excessive – almost 88% of consumption, and in respect of Gas almost 50% of consumption. Despite efforts in the last ten years to reduce drastically the import of Crude, it has increased from 76% to 88%. In the Petroleum sector the geo political considerations are at their peak. As compared to all other issues of energy, this is most complex in the matter of geo political dimension. Several solutions are being attempted which include strong initiatives on Compressed Bio Gas and Bio Fuels. In the recent years, several incentives have been launched with a view to having accelerated growth of production in these fields. As mentioned, India possesses large amounts of Coal reserves which are also being considered for Coal Gasification, Coal Bed Methane etc. All these will have positive impacts in dealing with geo political challenges.

In the Petroleum sector, in addition to produce alternate substitutes, other important initiatives focus on consumptions with a view to replacing petroleum consumptions with other options. The country has launched a massive programme of Electrical Vehicles. In coming few years, the proportion of Petrol/Diesel based transport will substantially be reduced. During the last five years, almost 75% of Railway locomotives which were driven by Diesel have been replaced by Electrical locomotives. Rural agriculture is shifting rapidly from Diesel driven Pumps to Solar Pumps or Solar Powered Pumps. All these initiatives are going to substantially change the structure of import-based Petroleum fuels to these initiatives, thus, in-turn, providing positive solutions to geo political challenges.

Energy transition challenges are being faced by all the countries in the world. The nature and intensity of challenges may vary. Developed countries, whose per capita carbon emissions are excessively high, have formidable tasks of reducing them. Developing countries have access to energy, but have the task of enhancement of per capita consumption, have the real challenge. Creating and maintaining a right mix of energy options is a challenge for each of them. In the recent years, what has made these challenges quite different emanate from unpredictable and fast changing geo political situations. Mutual interdependence, including energy trading with other countries cannot be ruled out. However, to the extent the country is frequently confronted with unpredictable situations on energy front, these obviously need to be minimized. India's efforts in this regard are in the right direction. These approaches have been summarized in this paper. Since the Geo Politics, influencing Energy Transition, has emerged as an unparalleled major development, these will be supplemented with elaborations on evaluations of India's initiatives in subsequent articles.

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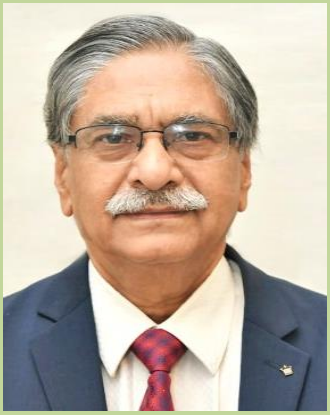

During the month of August 2025, we had two major events. The first was an online Webinar on "Energy Transition- With Focus on Petroleum and Gas Sector" organized on 22nd Aug. Besides IEF President, Chairman, IEF Vertical and Convenor of Petroleum & Gas Group, very elaborate coverage on the subject was made by distinguished invited speakers from Sparsh Himalaya University, Dehradun; Former DG, PPAC and CEO PIL, Brookfield- Canada, Detailed report is presented in the issue of Total Energy.

For India's run up to de-carburization, contribution of non-fossil based energy sources need to increase at a faster rate. India has already achieved 50% of power generation capacity target from non-fossil sources which is expected to grow to about 60% by 2030. Storage initiatives and technological developments in field of Battery Storage Systems and Pumped Storage are also being focused to provide grid stability and energy security from VRE sources.

IEF organized a webinar on BESS recently and followed it up by half day seminar on Pumped Storage Hydro Power Projects on 30th Aug 2025. For flexible energy, that can cater to Base Load and Peak Power requirements, energy storage capacity needs to be developed and installed to contribute to achieve net zero targets, else there will be increasing need on fossil fuel sources to meet peak demands. Chairman CEA, highlighted the current status and future plans for development and installation of PSP. He shared that potential of 214 GW has been identified from PSP and CEA is working on making the clearance process simpler and speedier. Senior Representatives from THDC, Greenko and BHEL shared their company's achievements and preparedness for PSPs. Detailed report will be shared in next issue of TE.

IEF has drawn an detailed program of online webinars and physical seminars covering entire gamut of total energy to debate current status, challenges in growth needed for meeting increasing energy demand and simultaneous decarburizing towards Net Zero. Besides VRE, large amount of Nuclear Energy is needed that can meet enhanced requirement of base load for grid stability. For achieving the target of 100 GW by 2047, NPCIL efforts need to be supported by Private Sector besides NTPC. However, that needs amendments in the prevailing Act. The awaited Bill on Nuclear Sector privatization has not been introduced in the monsoon session of Parliament. This subject is being debated with the industry and IPPs who have already shown interest. Amendments in the Act are expected to be placed in Parliament in the next session. IEF will organize a debate on the subject in the near future, specially on role of SMRs/BSRs for off grid requirements.

IEF, jointly with INS- Indian Nuclear Society is organizing a Colloquium – in hybrid mode - on '" 27th September 2025 at AERB Auditorium, Mumbai, Subject is: Significance of Safety Culture in Nuclear Industry. It will be addressed by Chairman AERB Dr DK Shukla, Dr Anil Kakodkar, President IEF, Chairman, Nuclear Group-IEF and President INS along with other senior officials of AERB and DAE. Online link will be shared with all IEF members to participate.

Such focused programs are planned by other Verticals also in their respective areas

S M Mahajan

India Becomes World's Third-Largest Solar Energy Producer, Surpasses Japan

India has officially overtaken Japan to become the world's third-largest producer of solar energy, according to Union Minister for New and Renewable Energy, Pralhad Joshi. Citing data from the International Renewable Energy Agency (IRENA), Joshi announced that India generated 1,08,494 gigawatt-hours (GWh) of solar power, surpassing Japan's 96,459 GWh.

IRENA, an intergovernmental agency that supports countries in their energy transition, tracks and analyzes global renewable energy developments. The agency's latest data highlights India's rapid growth in the solar sector, reflecting its significant strides toward clean energy.

Joshi credited the country's success to the leadership of Prime Minister Narendra Modi. In a post on social media platform X, he wrote, "Thanks to the visionary leadership of PM @narendramodi ji, India is leading the way in the global clean energy revolution."

This achievement comes as India aggressively pursues its renewable energy goals. The country is working toward installing 500 gigawatts (GW) of non-fossil fuel electricity capacity by 2030, under a multi-pronged clean energy strategy that includes solar, wind, hydro, and nuclear power.

India's rise in the global solar ranking underscores its role as a key player in the energy transition movement, reinforcing its commitment to combat climate change and promote sustainability.

India Awards 19 Green Hydrogen Projects with 862,000 Tonne Annual Capacity Under National Mission: Shripad Naik

India has taken a major leap forward in its clean energy ambitions, awarding 19 green hydrogen production projects totalling 862,000 tonnes per year under the National Green Hydrogen Mission. Speaking at the FICCI Green Hydrogen Summit 2025 in New Delhi,

Speaking at the FICCI Green Hydrogen Summit 2025 in New Delhi, Union Minister of State for Power and New & Renewable Energy, Shripad Naik, also announced that 15 companies have been selected to build 3GW of electrolyser manufacturing capacity, reflecting growing momentum in domestic supply chain development.

India's strategic push is designed to position the country as both a leading producer and trusted global supplier of green hydrogen.

"We aim to capture close to 10% of the global green hydrogen market," said Naik, referencing projections that global demand will exceed 100 million tonnes by 2030. He underscored that India's rapid growth in renewables—now totalling 237GW, with 119GW solar, 52GW wind, 49GW hydro, and 8.78GW nuclear—is forming the backbone of its hydrogen ecosystem. He reiterated India's 2030 target of 500GW non-fossil fuel capacity, requiring about 50GW of new additions annually, and noted that one of India's climate targets had already been met five years ahead of schedule.

The industry welcomed the announcements, citing unprecedented policy support. Rajat Seksaria, CEO of Adani New Industries and chair of FICCI's Green Hydrogen Committee, credited three milestones for boosting confidence: the PLI scheme for local manufacturing, the world's first green ammonia auction, and a consistent policy commitment. Meanwhile, Vipul Tuli, Chairman of Sembcorp India, pointed to recent global auctions where green

hydrogen outpriced blue hydrogen, signalling a cost competitiveness inflection point. He warned, however, against short-termism, urging focus on building long-term market structures instead.

The summit also highlighted growing international alignment. Dr. Ewa Suwara, Chargé d'affaires of the EU Delegation to India, confirmed that the second India-EU Green Hydrogen Forum held in Rotterdam this May has led to the formation of a Hydrogen Task Force, which will serve as a high-level platform for strategy coordination. Domestically, 15 Indian states have rolled out or are finalising green hydrogen policies, offering incentives for land acquisition, water access, renewable energy banking, and the creation of hydrogen hubs to drive industrial clustering and innovation.

The event also saw the launch of the FICCI-EY Green Hydrogen Report: India's Green Hydrogen Ecosystem, which outlines use cases, procurement models, and cost structures. The report calls for demand creation in hard-to-abate sectors like refining, steel, aviation, and fertilisers to ensure long-term market sustainability. Wrapping up the summit, Srivatsan Iyer, Global CEO of Hero Future Energies, praised the government's forward-looking stance and the private sector's growing readiness to scale.

Nearly $12.67 billion received as FDI in renewable energy sector: Minister

Nearly $12,674 million ($12.67 billion) has been received as foreign direct investment (FDI) in the renewable energy sector (as on March 31, 2025), the Parliament was informed recently.

Solar energy has emerged as the leading sector attracting the majority of such investment, while the western region of the country has received the highest share of FDI in this period, Minister of State of New and Renewable Energy and Power, Shripad Yesso Naik, said in a written reply in the Rajya Sabha.

Recognising the need to scale up investments in renewable energy to meet the national target of 500 GW of non-fossil fuel capacity by 2030, the government has undertaken various initiatives to attract both domestic and international capital which include permitting 100 per cent FDI under the automatic route and introduction of Climate Finance Taxonomy in the Union Budget 2024-25 for enhancing the availability of capital for climate adaptation and mitigation.

Earlier this month, India achieved a landmark milestone of 100 GW solar PV module manufacturing capacity, reflecting the country's rapid progress in building a robust and self-reliant solar manufacturing ecosystem, aligned with the national vision of Atmanirbhar Bharat and the global imperative for clean energy transition.

The government's commitment is to make India self-reliant in solar PV manufacturing and establish the country as a major player in the global value chain. India has also surpassed Japan to become the third-largest producer of solar energy globally, which is a significant development in the nation's clean energy development.

India produced 1,08,494 gigawatt-hours (GWh) of solar power, more than Japan, which produced 96,459 GWh, as per data from the International Renewable Energy Agency (IRENA). The installed wind energy capacity in India had reached 51.67 GW as of June 30 this year.

The country's wind energy capacity has been steadily growing over the last three fiscal years, from 2,275.55 MW added in 2023–2024 to 3,253.39 MW added in 2024–2025 and 1,637.02 MW of new capacity installed in the April–June quarter of 2025–2026.

Govt pushes local manufacturing for renewable energy growth

The government is working on multiple fronts to support domestic manufacturing of renewable energy equipment for capacity addition as well as creating its domestic demand, renewable energy secretary Santosh Kumar Sarangi said.

Speaking at a panel discussion on 'Advancing India's Green Transition: Aligning Policy, Innovation and Industry for a Net-zero Future', moderated by ET's Shilpa Samant, Sarangi said apart from the production-linked incentives (PLI) schemes, which include solar cells, ingot-wafers and polysilicon, the renewable energy ministry has brought an approved list of models and manufacturers (ALMM) for modules and cells, and for wind power equipment.

The ministry is in talks with the industry for such a list for ingot-wafers. "Once that comes, we will see some clear commitments on the part of the industry to set up ingot and wafer manufacturing in India and I am sure in course of time polysilicon as well is going to come on a big scale," Sarangi said.

JP Chalasani, CEO of Suzlon Group, said the new guidelines on wind power equipment manufacturing may help significantly increase domestic capacity even at sub-component levels. There's going to be a large capacity addition and a high probability of increase in exports, he said.

India has emerged as the world's fourth-largest in installed renewable energy capacity, with non-fossil fuel sources now making up half of its total installed power generation capacity.

Vaishali Nigam Sinha, cofounder of ReNew, said all steps are in the right direction to get to 500 GW by 2030, which is an ambitious milestone. "We are very optimistic and all stakeholders have achieved more than what was possible," she added.

Alternate demand centres

Reliable and consistent availability of renewable energy is likely to help meet the demand for data centres, industry experts said. According to Arunabha Ghosh, CEO of public policy think tank Council on Energy, Environment and Water, more options for offtake of clean energy such as data centres and electric vehicles are coming and it is not confined only to power distribution companies.

Vibha Dhawan, director general of policy research institute The Energy and Resources Institute (Teri), said technology advancement is likely to determine the right energy mix in the future, with green hydrogen and/or nuclear energy expected to get into the mix.

Power will always be available if there is a demand, Suzlon's Chalasani said. To maintain grid stability and still have affordable power, it is important to have a combination of solar, wind and storage, he added.

"It will never be one versus another. What will happen depending upon the different load profiles of some states is that the combination might change," Chalasani said. Sarangi said as far as demand from data centres and green hydrogen is concerned, there are technological solutions available today to provide them with renewable energy.

India’s solar module manufacturing capacity surges 100 GW in past two years: Report

India's solar module manufacturing capacity has surged to 100 GW over the past two years boosted by schemes like the Production Linked Incentive (PLI) and the Approved List of Models and Manufacturers (ALMM), said SBI Capital Markets in its latest report.

This domestic expansion has been met with equally robust demand, with solar additions in the last fiscal year (FY25) jumping 60 per cent to 24 GW, a growth that required an estimated 50 GWdc of modules.

However, the rapid capacity build up is raising concerns about a potential oversupply. With annual solar additions expected to stabilise at 40-50 GW, the 190 GW of capacity projected to be installed by 2027 could outstrip domestic demand.

"Players who want to take advantage of the lucrative market would look to set up onshore facilities, with a distinct advantage for early movers as the US market is also building up indigenous upstream capacity," added the report.

Cell and wafer bottlenecks

While module manufacturing is reaching maturity, a significant gap remains in the upstream value chain. India's solar cell capacity, at less than 30 GW, is far from sufficient. The new ALMM-II orders for cells, which mandates the use of domestically listed cells

for projects with bids submitted after August 31, 2025, is a significant policy intervention aimed at closing this gap.

The order is also set to open up the substantial Commercial & Industrial (C&I) market to domestic manufacturers by applying to projects benefiting from net metering and open access rules.

Planned capacity additions are expected to bring cell manufacturing closer to self-sufficiency in the medium term. In the interim, however, the higher price of domestically-sourced Domestic Content Requirement cells could temporarily inflate project costs and dampen bidding enthusiasm.

A key policy clarity, which exempts approximately 100 GW of projects bid out since December 2024, will provide a crucial buffer for the market to adjust without undue price spikes.

Polysilicon issue
Further up the value chain, the reliance on foreign, specifically Chinese, components is almost total. The target to achieve a 40 GW wafer capacity by March 2027 is an ambitious goal, but on-ground progress is moderate.

A government order mandating the use of blue wafers for cells to be classified as domestic is a positive step, but more concerted action is needed. The most critical and absent link in India's solar manufacturing chain is polysilicon. The analysis highlights that China's recent decision to shut down a third of its polysilicon capacity has caused a global price spike of 35-40 per cent While this has not yet affected module prices, it is eating into the margins of mid- and downstream players who are not vertically integrated.

Long-Term Questions
The superior growth and margin profile of Indian integrated manufacturers compared to their international counterparts is a direct result of this policy support and tight domestic supply-demand conditions in the cell segment. Standalone module makers, in contrast, may see more variable returns, pushing some to diversify into adjacent sectors like inverters, independent power producers, and battery storage.

India's geothermal opportunity as a renewable energy resource

As India accelerates its transition to clean energy, geothermal remains one of the underutilised renewable resources. Unlike solar and wind, which are intermittent and weather-dependent, geothermal offers stable, round-the-clock energy. It can be harnessed for electricity generation and direct space heating and cooling, applications that are especially relevant in India's diverse climatic landscape.

The country's geothermal potential, although not significant compared with solar and wind, has a power generation capacity of ~10,600 MW, according to the Geological Survey of India, which identified over 380 geothermal sites across India. These hotspots span the Himalayan belt (Ladakh, Himachal Pradesh and Uttarakhand), the Cambay Graben in Gujarat and regions in Chhattisgarh, Jharkhand and West Bengal. However, geothermal energy currently makes almost no contribution to India's energy mix.

Electricity generation: A missed opportunity
India's geothermal resources include high-temperature zones suitable for electricity generation, particularly in Ladakh's Puga Valley and Himachal Pradesh's Manikaran. These sites demonstrate subsurface temperatures exceeding 200 °C, which is ideal for conventional geothermal power plants. However, geothermal development in India is at a nascent stage, although several sites are under active exploration and feasibility assessment.

One of the barriers has been the need for a clear and supportive policy framework to guide geothermal development. In 2016, the Ministry of New and Renewable Energy (MNRE) released a draft National Geothermal Energy Policy, which proposed ambitious targets – 1 GW by 2022 and 10 GW by 2030 – and outlined incentives such as risk-sharing for drilling and grants for non-productive wells.

While the draft laid a strong foundation, a formal policy is yet to be finalised. Its implementation could help establish clear direction and incentives for wider

technology adoption, supported by aligned regulatory developments and investor confidence needed to scale geothermal energy in India. Renewed policy attention would help integrate geothermal energy into the country's broader clean energy and cooling strategies.

Developers face business ambiguity, limited R&D support and restricted access to financing and unlike solar or wind, geothermal exploration requires significant geological expertise, subsurface imaging and capital-intensive drilling, increasing the levelised cost of electricity generation.

Heating and cooling:
A practical entry point While geothermal electricity generation remains a long-term goal, direct-use applications offer a more immediate and practical pathway. Medium-temperature geothermal resources (70–120 °C), abundant in India, are ideal for heating and cooling.

In cold regions such as Ladakh and Himachal Pradesh, geothermal space heating has been proposed to reduce dependence on diesel and biomass for winter heating. Iceland remains a compelling example of geothermal potential, with over 90 percent of residential heating demand met through well-integrated district heating systems tailored to the local geology and climate.

Conversely, in India's hot plains, geothermal energy can power absorption chillers (Variable Absorption Machine (VAM)) for air conditioning and cold storage. Ground-source heat pumps, which utilise stable underground temperatures for efficient cooling, are already used in some Indian commercial buildings.

These applications are particularly relevant for commercial spaces, industrial clusters, data centres and smart cities. Integrating geothermal energy into infrastructure planning for industrial parks or urban developments could result in long-term energy savings and emissions reductions.

Global context and lessons
Globally, countries such as Indonesia, Kenya, Turkey, Iceland and the Philippines have successfully scaled geothermal energy backed by strong government initiatives and international collaborations. India can adopt best practices from policy frameworks, risk mitigation strategies and public-private partnerships.

For instance, Kenya, Indonesia and Turkey have established geothermal risk mitigation funds to cofinance exploratory drilling and reduce investor uncertainty. Meanwhile, the Philippines has enacted dedicated geothermal legislation to streamline licensing procedures and clarify resource ownership. India's 2016 draft policy hinted at similar mechanisms, but these proposals remain at an early stage and require further refinement and implementation.

A call to action: A multi-stakeholder strategy
To unlock India's geothermal potential, evolving the 2016 draft geothermal policy into a comprehensive strategy that reflects current technologies, market conditions and climate goals could be a timely move. Cross-sector collaboration between government, industry, and academia can support this by helping to set realistic capacity targets and streamline licensing and regulatory processes.

Promoting public-private partnerships, particularly for pilot projects in industrial parks, commercial districts and cold chains, can help demonstrate feasibility and generate momentum. International collaborations with countries experienced in geothermal energy, can also enable technology transfer and joint research, especially in regions with significant geothermal potential.

Looking ahead, geothermal energy could be integrated into infrastructure planning. As new smart cities and industrial zones emerge, assessing the viability of geothermal applications during the design phase could ensure long-term energy efficiency and climate resilience.

Finally, capacity building and technical skill development are critical for scaling geothermal technologies. State-level workshops, industry outreach and academic programmes can create a skilled ecosystem ready to promote geothermal energy in India. Programmes such as Alleviating Heat stress by Enhancing production of Affordable cooling Devices (AHEAD), supported by The

Department for Promotion of Industry and Internal Trade (DPIIT), are already emphasizing sustainable cooling technologies. Integrating geothermal into such developmental finance initiatives could accelerate innovation, de-risk investments and position India as a leader in climate-resilient infrastructure.

Conclusion:
The heat beneath our feet Geothermal energy holds a unique place in India's clean energy future. It can offer a reliable, renewable source of power and thermal energy access to certain regions of India, serving remote communities, industrial clusters and urban infrastructure alike.

Unlocking this potential requires policy and regulatory backing, innovative funding, coordinated efforts across sectors and a focus on technology development, transfer and R&D. Together, these actions can turn a long-neglected resource into a cornerstone of sustainable development.

Gujarat sees 50% surge in solar power, becomes India's fastest-growing state in FY25

Gujarat recorded a sharp 50 per cent surge in solar power generation in FY 2024-25, emerging as the fastest-growing state in India in terms of annual increase. The state generated 20,219.48 million units (MUs) of solar electricity in FY25, up from 13,468.91 MUs in FY24, according to data tabled in Parliament by the Union ministry of new and renewable energy.

Over just two years, Gujarat nearly doubled its solar output, which stood at 10,335.32 MUs in FY23, signalling its rapid transition to renewable energy. With this performance, the state now ranks second in the country in total solar power generation, behind Rajasthan, which recorded 49,101.62 MUs in FY25.

Policy support, favourable business conditions and growing industrial interest have all contributed to this momentum. Gujarat's Renewable Energy Policy and its focus on decentralised approach, which has led to the adoption of rooftop and solar park models, have played a key role in ramping up capacity.

Kunj Shah, chairman, RE committee, Assocham Gujarat State Council, said, "Residential rooftop solar adoption has seen a strong push, especially due to the PM Surya Ghar Yojana, which offers subsidies and soft loans through banks. Earlier limited to cities, rooftop installations are now gaining ground in rural areas as well. Industries too are increasingly adding captive capacity.

Global measures like the EU's Carbon Border Adjustment Mechanism (CBAM) have also nudged exporters to decarbonise, further accelerating the shift to solar." Industry players point to large-scale solar park investments across Kutch, Banaskantha and Patan districts as a major factor. Companies are setting up captive solar plants to meet their sustainability goals. Falling panel prices have made the switch to clean energy even more economically viable. Jai Prakash Shivahare, managing director, Gujarat Urja Vikas Nigam Ltd (GUVNL), said, "Gujarat's renewable energy policy is extremely enabling, especially for captive and third-party projects.

There are no capacity limits, and many industries are eager to utilise 100 per cent of their sanctioned allowance. Regions like Kutch and Banaskantha offer land availability, which is a major draw for solar park development."

"Gujarat's supportive policy ecosystem, with its skilled manpower, reliable vendors and suppliers, and lower operating costs, makes it an attractive state for RE developers. This allows companies to quote more competitive tariffs here," he further added. To support the growing capacity, GUVNL is also expanding transmission infrastructure via GETCO with a planned investment of ₹1 lakh crore.

Delhi's waste-to-energy plants compliant, pose minimal health risks: Report

All four waste-to-energy plants in Delhi located at Okhla, Ghazipur, Bawana and Tehkhand are largely compliant with regulatory norms and pose minimal

risk to public health and the environment, according to a joint report by the Central Pollution Control Board and Delhi Pollution Control Committee.

The report, filed before the Supreme Court and the National Green Tribunal, says all four plants operate with pre-processing facilities that raise the calorific value of waste above 1,500 kilocalories per kilogram, in line with the Solid Waste Management Rules, 2016. Stack emissions, including suspended particulate matter and heavy metals like nickel, meet stipulated standards, though dioxin, furan and cadmium plus thallium levels, exceed the norms at Bawana.

However, the estimated incremental cancer risk from dioxin emissions, even at that facility, remains well below the one-in-a-million threshold recognised by the United States Environmental Protection Agency.

Ambient air quality monitoring at the eight stations around the plants showed PM10 and PM2.5 occasionally breached the prescribed limits but were within the range seen across Delhi's 39 Continuous Ambient Air Quality Monitoring Stations (CAAQMS).

Elevated ozone and nickel levels were observed at some sites.

The report, however, notes that nickel exceedances are based on 24-hour data and not directly comparable with long-term averages and that the contribution of Waste To Energy (WTE) plants to these pollutants is negligible.

It calls for expanded nickel monitoring at Ghazipur and Bawana.

Regarding waste ash, bottom ash at three plants meets the norms, while fly ash meets the standards except in Bawana, where fly ash exceeds the norms for cadmium, manganese, lead and copper.

Leachate treatment data revealed that Bawana's treated effluent exceeds the norms for biochemical oxygen demand.

Ghazipur showed elevated levels of dissolved solids and chlorides, while Tehkhand reported exceedances for both chloride and phenolic compounds. Reuse practices also vary by plant.
Groundwater sampling detected cadmium, copper and lead within permissible levels across all the sites, though iron exceeded the limits in Bawana and Ghazipur.

Broader groundwater observations flagged exceedances in total dissolved solids, hardness, sulphates, nitrates and phenolic compounds around Bawana, Ghazipur and Tehkhand.

The report's modelled ground-level concentrations of particulate matter, sulphur oxides, nitrogen dioxide, dioxins and furans (both 24-hour and annual averages) are extremely low (under 0.05 microgramme per cubic metre) and well below the National Ambient Air Quality Standards.

Recently, the Central Pollution Control Board (CPCB) issued directions to ensure that all the WTE plants are equipped with real-time Online Continuous Emission Monitoring Systems and Online Continuous Effluent Monitoring Systems.

These systems must transmit data to the state pollution boards and the CPCB within three months. A draft guideline on municipal solid waste incineration-based WTE plants has also been posted for public consultation.

The report emphasises that if the stakeholders implement the recommended measures, including improved ash segregation, odour control, green belts and effluent treatment, the overall environmental and health impact of the WTE plants can be minimised. The report comes amid heightened court scrutiny of WTE projects. The Supreme Court has been issuing directions on segregation, monitoring and accountability relating to Delhi's waste management. In April, a bench led by Justices Abhay S Oka and Ujjal Bhuyan directed the CPCB to study the environmental impact of the WTE plants and framed waste segregation, especially at source, as crucial for curbing pollution. In a separate development in July, the Union Environment Ministry granted environmental clearance to a 30 megawatt WTE plant in Bawana, despite protests by nearby residents.

The Rs 660-crore project includes Rs 91.6 crore for pollution control and has provisions for wildlife conservation and healthcare outreach.

The residents criticised these assurances, citing air quality concerns and comparing the potential impact to the Okhla plant, which has long been a flashpoint of controversy.

The Supreme Court has sought a CPCB report on the plant's likely health and environmental impact.

Biomass co-firing by thermal plants saves over 35 lakh MT CO_2, stubble burning in Punjab down 80%

More than 35 lakh metric tonnes of carbon dioxide emissions have been saved through biomass cofiring by thermal power plants, while stubble burning incidents in Punjab have fallen by over 80 per cent between 2021 and 2024, according to the Commission for Air Quality Management (CAQM). As of mid-2025, 11 thermal power plants (TPPs) in the National Capital Region (NCR) and 71 nationwide have adopted biomass co-firing, resulting in savings of 25.79 lakh MT CO_2 in NCR and 34.77 lakh MT across the country. The biomass co-firing mandate, introduced in 2021, requires NCR plants to co-fire 5–10 per cent biomass with coal. In June 2025, CAQM extended the mandate to brick kilns in non-NCR Punjab and Haryana, targeting at least 50 per cent biomass use by November 2028.

Between 2021 and 2024, stubble fire counts in Punjab dropped from 71,304 to 10,909 and in Haryana from 6,829 to 1,315. Thermal power plants in Punjab have been using paddy straw as biomass fuel, creating additional income sources for farmers.

Delhi-NCR recorded an average AQI of 167 between January and September 2023, the second-best in six years. July 2025 saw an AQI of 79, the cleanest July in a decade. PM_{10} levels have declined by 15 per cent since 2017-18, and Stage III restrictions under the Graded Response Action Plan (GRAP) were lifted in early 2025 due to sustained improvement in air quality.

“CAQM’s impact in being able to address stubble burning and nudge incorporation of cleaner methods in areas such as thermal power generation has been a key step towards inculcating systematic changes,” said Dr. Ranjana Ray Chaudhuri, Associate Professor, TERI School of Advanced Studies. She called for advanced combustion techniques, carbon capture, renewable integration, and firm biomass supply chains to further cut emissions. Agricultural economist Deepak Pareek said, “By converting crop residue into biomass or biochar, farmers can unlock a powerful combination of economic and environmental gains. Biomass sales to industries like thermal power plants create new income streams, cut waste disposal costs, and replace polluting fossil fuels with renewable energy.”

Environmental expert Dr. Rajeev Sharma noted that CAQM’s measures, including support for pellet manufacturing, have increased biomass co-firing volumes in TPPs from 11.7 lakh MT in FY24 to 21.49 lakh MT by mid-FY26. CAQM has also implemented measures beyond the power sector, including mandatory dust control SOPs at construction sites, AI-based vehicle counting, drone surveillance, and public participation campaigns. The commission’s framework is being considered for replication in other high-pollution cities such as Bengaluru.

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Ministry of Coal Successfully Launches the 13th Round of Commercial Coal Mine Auctions

In a landmark step towards strengthening India's energy security and accelerating domestic coal production, the Ministry of Coal successfully launched the 13th Round of Commercial Coal Mine Auctions in New Delhi today. The event was graced by Union Minister of Coal and Mines, Shri G. Kishan Reddy, as the Chief Guest, and Minister of State, Shri Satish Chandra Dubey, as the Guest of Honour.

In his keynote address, Shri G. Kishan Reddy celebrated India's historic achievement of surpassing One Billion Tonnes (BT) coal production in FY 2025 a testament to the transformative reforms initiated under the visionary leadership of Prime Minister Shri Narendra Modi. He emphasized that since 2015, the coal sector has undergone a paradigm shift through transparent auction regimes, increased private sector participation, and technological modernization.

The Minister highlighted that the coal sector is emerging as a key champion of Atmanirbhar Bharat, with a transparent and inclusive auction system attracting new companies and junior mining firms, providing them fresh opportunities to enter the industry. With 134 mines auctioned across 12 rounds, attracting investments worth ₹41,600 crore and generating over 3.5 lakh jobs, we are reshaping India's energy landscape. The 13th Round introduces 14 coal blocks, further reducing reliance on imports and conserving foreign exchange. The transparent auction process has fostered healthy competition, compelling public sector undertakings (PSUs) to innovate and compete with private players, thereby enhancing operational efficiency and global competitiveness.

The Minister further stressed the need for diversification from conventional coal mining to cleaner use of coal through coal gasification. He emphasized that more than 40% of India's coal resources, approximately 370 billion tonnes, are deep-seated and currently unmineable through conventional methods. Underground Coal Gasification (UCG) represents a transformative approach, allowing these vast, untapped coal reserves to be converted directly into syngas underground. By harnessing coal in situ, this technology not only unlocks immense energy potential but also minimizes surface disturbance, reduces land use, and promotes cleaner, more sustainable coal utilization, marking a significant step forward in India's energy roadmap. He also highlighted the importance of coal production and urged the successful bidders to commence production ahead of schedule to avail incentives, while reaffirming the Ministry's commitment to progressive reforms, removal of bottlenecks, expediting clearances, and improving ease of doing business. Stressing that coal demand will continue to rise, he said India must plan ahead to enhance production from its vast reserves as the world's second-largest producer and consumer.

Highlighting the Prime Minister's vision of Reform, Perform, Transform, Shri Reddy underlined that the Ministry is driving reforms to ensure efficiency, transparency, and long-term sustainability. He also called upon stakeholders to offer constructive suggestions to further strengthen reforms and accelerate the sector's growth.

Shri Reddy also talked about the holistic approach in coal mining involving the community development and welfare of the local public. He emphasized, investing in coal today is investing in India's future. Every opportunity in the sector not only strengthens our energy security but also promises long-term growth, sustainable development, and a chance to be part of the nation's journey towards a self-reliant and prosperous energy landscape.

In his address Union Minister of State of Coal and Mines, Shri Satish Chandra Dubey, stated that with India surpassing One Billion Tonnes of coal production, the launch of the 13th round of commercial coal mine auctions marks another significant step towards energy self-sufficiency. He emphasized that a transparent auction mechanism, industry-friendly policies, and increased private

sector participation will not only enhance coal production but also attract investment, create employment opportunities, and accelerate infrastructure growth.

He emphasised the need for sustainable development including efficient mine closure practises, tree plantation for environment conservation and generating livelihood for local communities. He also highlighted the practise of Plantation drive under “Ek Ped Maa ke Naam” initiative started by Prime Minister and urged the participants to contribute in this initiative.

He also reiterated that ease of doing business remains a key focus area, aligning with the vision of ‘Atmanirbhar Bharat’ in the energy domain.

In his address, Shri Vikram Dev Dutt, Secretary, Ministry of Coal, provided a comprehensive overview of the sector’s transformation since introduction of CMSP Act, 2015 to the introduction of commercial coal mining in 2020. He lauded the achievement of 1 billion Tonne coal production and reaffirmed the Ministry’s commitment to faster mine operationalization, streamlined clearances, and enhanced logistics through coordination with MoEF&CC, Ministry of Railways, and State Governments.

Shri Dutt emphasized the strategic importance of coal gasification in India’s energy roadmap. These technologies offer cleaner alternatives to conventional coal combustion, enabling the production of syngas for use in power generation, fertilizers, and petrochemicals. They reduce carbon emissions, optimize resource utilization, and unlock value from deep-seated coal reserves that are otherwise uneconomical to mine.

Shri Dutt also elaborated on the current status of coal gasification in India. He noted that several pilot projects are underway, and the Ministry has launched an incentive scheme of Rs 8500 Crore to promote coal gasification, offering financial support and policy facilitation to eligible projects.

“We are actively supporting coal gasification through a dedicated incentive framework,” said Shri Dutt. Seven Projects have been selected for the incentive scheme. This will accelerate adoption, attract investments, and position India as a global leader in clean coal technologies.

He assured stakeholders of the Ministry’s full support in fast-tracking Environmental Clearances (EC) and Forest Clearances (FC), removing bottlenecks, and ensuring responsible mining practices. Environmental sustainability remains a priority, with a focus on afforestation, rehabilitation of mined-out areas, and stringent compliance measures.

Delivering the welcome address, Ms. Rupinder Brar, Additional Secretary and Nominated Authority, Ministry of Coal, highlighted the transformative impact of commercial coal mining in unlocking new opportunities for private players and fostering competition.

She also spoke that the Underground Coal Gasification represents a pioneering technology in coal utilization, enabling the conversion of coal directly into syngas while still underground. This process minimizes surface disturbance, reduces land requirement, and lowers the environmental footprint compared to traditional mining methods.

Highlighting the importance of UCG, Ms. Brar noted that India has vast coal reserves located at greater depths, which remain untapped due to technical and economic limitations of traditional mining. UCG offers a sustainable pathway to tap these reserves, ensuring energy security while aligning with the principles of responsible and cleaner coal utilization. The launch marks another major step towards unlocking new investment opportunities, ensuring responsible mining practices, and fostering greater participation in India’s coal sector. The event also featured the signing of agreements of previous tranche with successful bidders, reinforcing the Government’s commitment to transparency, efficiency, and private sector participation in coal mining.

As part of the 13th Round of Commercial Coal Mine Auctions, 4 coal mines are being offered under the Coal Mines (Special Provisions) Act, 2015 (CMSP) and 10 under the Mines and Minerals (Development and Regulation) Act, 1957 (MMDR). Out of the total mines, 10 are fully explored and ready for immediate

development, while 4 are partially explored, offering long-term investment opportunities and contributing to the growth of India's coal sector. In addition, three mines from previous round of commercial coal mine auctions are also being offered. The mines being auctioned are spread across coal bearing states of Jharkhand, Chhattisgarh, Odisha, Andhra Pradesh and Madhya Pradesh.

The 13th Round of Commercial Coal Mine Auctions is set to unlock new investment opportunities, enhance domestic coal supply, and contribute significantly to India's energy security. The Ministry of Coal remains dedicated to fostering growth, sustainability, and safety in the sector, ensuring that India continues to move toward a self-reliant coal economy while prioritizing environmental conservation and community welfare.

India to have 102 first-mile coal connectivity projects by FY30: Minister

The Ministry of Coal has planned to set up 102 first-mile connectivity (FMC) projects by FY30 to modernise coal evacuation in the country, the government said recently. Presently, 44 FMC projects having a capacity of 429.5 million tonnes per year (MTY) are operational.

An additional 58 projects will be made operational before FY30, Union Minister of Coal and Mines, G. Kishan Reddy, said in a written reply in Rajya Sabha. FMC projects modernise coal evacuation by replacing traditional road transport from mines with mechanised systems such as conveyor belts, rapid loading systems, and integrated coal handling plants.

These projects significantly reduce air pollution and greenhouse gas emissions by eliminating dieselbased truck movement. They enable faster, high-capacity, fully mechanised coal handling and loading, reducing bottlenecks and improving turnaround times.

"The total capital expenditure envisaged for the FMC projects is about Rs 31,367 crore. This investment covers mechanised coal handling plants, rapid loading systems, closed conveyor networks, integrated silos, railway sidings, and associated infrastructure to enable seamless mechanised coal evacuation," the minister informed.

"FMC systems preserve coal quality by minimising manual handling and limiting losses during transit. Operational and transportation costs are lowered through direct, energy-efficient conveyance to rail sidings or loading points. Reduced road traffic enhances occupational safety, lowers accident risks, and improves working conditions in mining areas," the minister added.

By FY 2029-30, upon completion of the above-mentioned projects, about 90 per cent of the total projected coal output from India's three major PSUs is expected to be transported using FMC.

Earlier this month, the government said a total of seven coal blocks have been successfully auctioned, comprising three fully explored and four partially explored coal blocks. These blocks are expected to generate an annual revenue of approximately Rs 719.90 crore (excluding partially explored blocks), likely to attract a capital investment of around Rs 787.50 crore, and create 7,098 employment opportunities.

India's coal imports rise in June quarter

The country's coal import rose 1.5 per cent to 76.40 million tonnes in the April-June period of the current fiscal, compared to 75.26 MT in the year-ago period, even as the government pushes to ramp up domestic production of the fossil fuel. The country's coal import in June also increased to 23.91 million tonnes (MT) over 22.97 MT in the corresponding month of the previous fiscal, according to mjunction Services Ltd, a B2B e-commerce platform and a joint venture between Tata Steel and SAIL. During April-June, non-coking coal imports were at 49.08 MT, almost flat compared to 49.12 MT imported during the same period in the previous fiscal. Coking coal import was at 16.37 MT during April-June 2025, up against 15.45 MT recorded for April-June 2024.

Of the total imports in June, non-coking coal imports stood at 14.85 MT, against 14.19 MT imported in

June last year. Coking coal import stood at 5.78 MT, against 5.45 MT imported in June 2024. State-owned CIL's coal production dropped by 8.5 per cent to 57.8 million tonnes in June from 63.1 MT in the corresponding month of the previous fiscal. The company, which accounts for over 80 per cent of domestic coal production, however, did not give a reason for the decline in coal production. According to industry analysts, coal production usually faces hindrances during the monsoon season. As a result, the output from mines is lower, which consequently affects the dispatch to power plants.

Coal Minister G Kishan Reddy had earlier said that the country will not face any shortage of coal in the upcoming monsoon season, as the government is well prepared to meet the demand across various sectors, including the power sector. The coal ministry had earlier said that it remains committed to achieving sustainable growth, improving coal availability, and reducing dependence on imports. With the positive momentum, the coal sector continues to play a pivotal role in powering India's growth story.

39 coal blocks in 5 states reviewed; 34.80 MT output in FY25, 10.80 MT so far in FY26

Captive and commercial coal blocks in five states, which together produced 34.80 million tonnes (MT) of coal in FY 2024-25, have recorded 10.80 MT output in the current fiscal up to July 31, 2025, the coal ministry said after a review meeting of 39 mines.

The review, chaired by Additional Secretary and Nominated Authority Rupinder Brar, assessed coal blocks allocated in Madhya Pradesh, Assam, Arunachal Pradesh, Telangana and Gujarat. Of the 39 blocks examined, 33 are in Madhya Pradesh, two in Assam, one in Arunachal Pradesh, one in Telangana and two in Gujarat

In Madhya Pradesh, 13 coal blocks are operational, of which nine are producing coal. Telangana has one operational producing block. The production from these blocks contributed to the overall FY25 output and the 10.80 MT produced so far in FY26.

The ministry said the operational performance of captive and commercial mines in these states has shown consistent progress, but stressed the need to expedite the operationalisation of the remaining 25 coal blocks to strengthen domestic coal supply, reduce import dependence and meet the country's growing energy requirements.

The meeting was attended by coal block allottees and senior officials from the central and state governments. Discussions focused on operational achievements, challenges in mine development, supply chain issues, and measures to improve production timelines.

"The ministry remains committed to advancing captive and commercial coal mining, ensuring uninterrupted coal production, and promoting efficient utilisation of resources," it said in a statement, adding that it is working with stakeholders to unlock the full potential of coal assets and contribute to the vision of a self-reliant Bharat.

India second in global coal mining pipeline with 329 MTpa capacity under development: GEM

Global Energy Monitor

India ranks second globally in terms of proposed coal mining capacity under development with 329 million tonnes per annum (MTpa), according to a new report by Global Energy Monitor (GEM). Of the 329 MTpa capacity, 163 MTpa is in the early planning stage, 90 MTpa has received permits, and 75 MTpa is currently under construction.

According to GEM's Global Coal Mine Tracker, the pipeline is geographically concentrated, with Jharkhand accounting for 106 MTpa, Odisha 92 MTpa, Chhattisgarh 50 MTpa, and Madhya Pradesh 44 MTpa—together making up nearly 90 per cent of the total capacity under development in India.

Globally, coal mining capacity under development stands at 2.5 billion tonnes per annum across 54 countries. China leads with 737 MTpa, followed by India (329 MTpa), Russia (274 MTpa), and Australia (232 MTpa).

The report highlights that approximately 74 per cent of India's coal mine capacity under development is

being pursued by government-owned entities. Coal India Limited and its subsidiaries are responsible for at least 79 MTpa, with South Eastern Coalfields Ltd (SECL) developing over 47 MTpa. Among private developers, the Adani Group is leading with about 32 MTpa.

India's current coal mining capacity is about 1.1 billion tonnes per annum, with production at approximately 900 million tonnes per annum. The government has set a target of achieving 1.5 billion tonnes of coal production by 2030.

However, the report notes that over 250 MTpa of the proposed capacity does not have a specific justification based on the demand from the power sector. India's thermal power plants operated at an average plant load factor of 69 per cent in 2023-24. As of April 2024, coal stockpiles stood at 46 million tonnes.

According to GEM, more than 80 per cent of coal capacity facing community opposition is located in Jharkhand and Chhattisgarh. Coal India mines account for a significant portion of these contested projects.

The report states that India's coal mine expansion may result in overcapacity and create a risk of stranded assets. It recommends improved transparency and regulatory scrutiny for proposed projects, especially those located in forested and densely populated areas.

Coal India Ltd clears way for sale of power in Exchanges

Coal India Limited (CIL) in order of policy shift has cleared the way for un-requisitioned surplus (URS) power generated by the thermal power plants that use CIL's linkage coal under long and medium term fuel supply agreements (FSAs), to be sold in the power market and exchanges with effect from 1 August 2025.

TPPs earlier that were serving power purchase agreements (PPAs) using CIL's linkage coal could sell the electricity generated only within the confines of the PPAs as the provisions disallowed the sale of power generated from long and medium term FSAs in the power market and exchanges.

With the revised SHAKTI policy, CIL has overcome the earlier provision of restricting the sale of power in the open market.

This would be applicable to all existing as well as future long, and medium term power FSAs and extends to all the power generators - Central and State Gencos, independent power plants. With the surplus power availability in the exchanges, ideally, the spot prices will be in check, leading to affordable power to all.

Earlier, CIL paved the way allowing supplies beyond Annual Contracted Quantity (ACQ) to TPPs of the country including IPPS, doing away with a provision which allowed coal supplies up to a maximum of 120% of ACQ.

For the current fiscal year CIL has around 650 million tonnes of FSAs in place for the power sector.

Coal India targets 900 MT supply for FY26

Coal India Ltd (CIL) has set a target to supply 900.24 million tonnes (MT) of coal in the current fiscal year (FY26), aiming for over 18 per cent growth from the previous year's achievements, according to news agency PTI.

CIL's management projects that roughly 74 per cent of its total coal dispatches will be consumed by the power sector alone.

The projected demand from the power sector for FY26 stands at 668.1 MT, and CIL aims to fully cater to the requirements of both power and non-regulated consumers, while also substituting imported coal wherever feasible.

Aligning with national energy goals
This aggressive growth roadmap aligns seamlessly with the government's objective of providing 24x7 power to every household. CIL also reconfirmed its plans to scale up production to 1 billion tonnes by 2028-29.

To sustain growth while simultaneously reducing its environmental footprint, CIL is prioritising selective mining, coal beneficiation, and blending. The company is also focusing on enhancing production from underground mines and diversifying into cleaner coal technologies.

"CIL intends to offer more coking coal to the steel sector and also supply coal for upcoming coal gasification projects," said the company.

Strategic investments
For FY26, CIL has invested ₹16,000 crore to maintain its impressive volume growth. Additional strategic investments are planned for railway infrastructure development, solar and thermal power projects, coalbed methane extraction, and the revival of fertiliser plants.

In the last financial year (FY25), India's total power generation grew by 5 per cent to 1,826 billion units (BU), with coal-based generation contributing 1,299 BU. Against a projected power sector demand of 661 MT, CIL supplied 616.17 MT, achieving a materialisation rate of approximately 93 per cent.

Coal supplies to the non-regulated sector surged to 145.3 MT, an increase of 8.1 per cent while e-auction bookings rose to 89.38 MT. However, the average e-auction premium moderated to 48 per cent from 72 per cent in the previous fiscal year.

Women in coal mining

Various significant women-led initiatives have been implemented to further our commitment to gender equity and institutional excellence and to enhance participation of women in the coal sector and the creation of leadership opportunities for them across the country in diverse field such as healthcare, technical, planning units, etc.

i) The all women led initiatives implemented and functional across different subsidiaries of CIL

ii) Coal India Limited (CIL) through its apex training institute, the Indian Institute of Coal Management (IICM), has launched **"**Jyoti – Rising Together, Leading the Way**"**, a flagship Women's Leadership initiative. This is a structured five-month women leadership journey designed to prepare female executives for higher responsibilities within CIL by strengthening competencies in communication, decision-making, emotional intelligence, negotiation skills, personal growth and leadership readiness.

iii) Female dependents are now considered for dependent employment upon death of the employee irrespective of their marital status which was not so earlier in the Coal India Limited.

iv) In order to encourage the increased participation of women in organizational matter and broader commitment of Coal India Limited towards gender sensitivity, equity and inclusiveness, it has been made essential in all Committees to include one representative of woman.

v) Bharat Coking Coal Limited (BCCL) has inaugurated its first centralized technical centre for the repair and maintenance of LED and solar energy equipment operated entirely by women technicians. The centre, based in Koyla Nagar, Dhanbad marks a pioneering step in bringing women into core technical operations traditionally dominated by male staff.

vi) Furthering its commitment to gender equity and institutional excellence across Coal India Limited & its subsidiaries, women employees are sent to underground training for acquiring Mining Sirdar Certificate of Competency.

vii) Women are encouraged to participate in rescue works and also imparted training in Rescue and Recovery work. Till date, 19 female employees from Western Coalfields Limited (WCL) and 9 women from Mahanadi Coalfields Limited (MCL) have been imparted training in Rescue and Recovery work.

viii) To safeguard women employees, Internal Complaints Committees (ICCs) have been constituted under the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013, (POSH Act). The committees are functioning for preventing, prohibiting, and addressing sexual harassment of women at the workplace.
This information was given by Union Minister of Coal and Mines Shri G. Kishan Reddy in a written reply in Rajya Sabha recently.

Peak power demand unlikely to touch projected 277 GW level on intermittent rains rain: CEA Chairman

Peak power demand is unlikely to touch the projected 277 GW this summer as intermittent rains have reduced the use of cooling appliances such as air conditioners, a top government official said on Friday. "No, I don't think that it (peak power demand) will go to that level now. If this kind of rain continues, then it will not reach," Ghanshyam Prasad, the Chairperson of Central Electricity Authority (CEA) told PTI on the sidelines of BNEF Summit in the national capital. The regulatory body chief was responding to a question whether the peak power demand would touch the projected level of 277 GW.

The CEA formulates short-term and perspective plans for the development of the electricity system, and coordinates the activities of the planning agencies. The government had projected 277 gigawatt (GW) of peak power demand for 2025-26. Various government sources had expected the peak demand to hit the 277 GW level by September. Prasad also said that 277 GW was not a target, but a projection made for a scenario where rains were insufficient. "We had kept our resources ready so that, if demand reached that level, we would be able to meet it." During this summer season, India has witnessed a top peak power demand of about 242 GW, he said, adding that in May 2024, it was 250 GW, which was an all-time high.

The previous all-time high peak power demand of 243.27 GW was recorded in September 2023. However, during this summer season (from April onwards), the record peak power demand was 242.77GW in June. "It did not happen as it rained and then you got a dry spell, so normally when there is a dry spell, your demand increases," he said. He further said that since it has been raining continuously this time, power demand has not picked up. April, May, June, and July witnessed widespread rainfall, which has continued into August. Normally, in the northern region, rains arrive after July, but this year they began much earlier and have persisted, he added.

CEA Releases Draft Revised Guidelines for Model Quality Assurance Plan In Power Sector

The Central Electricity Authority (CEA), under the Ministry of Power, issued draft revised guidelines for the Model Quality Assurance Plan (MQAP) for major equipment in the power sector in August 2025. The objective of the MQAP is to establish uniform and efficient quality assurance practices across manufacturers, suppliers, and utilities in India. The move is intended to reduce inconsistencies in quality assurance plans, save time and costs, and ensure reliable, high-quality, and economic power supply for consumers while supporting the country’s industrial growth.

The guidelines highlight that quality assurance is vital for preventing costly mistakes and mitigating risks, especially in the power sector, which serves billions of people daily. At present, different stakeholders follow varied quality assurance processes, leading to inefficiencies. The MQAP seeks to standardize procedures, minimize redundant testing, and optimize resources by specifying only the essential tests needed for major equipment used in generation, transmission, and distribution.

Three broad categories of tests are covered under the guidelines: Type Tests, which validate the design of equipment; Routine Tests, which check the operational performance of each manufactured unit; and Special Tests, which are conducted based on customer requirements. These tests are further divided into Factory Acceptance Tests (FAT), carried out before dispatch from the manufacturer’s site, and Site Acceptance Tests (SAT), conducted during installation and commissioning to ensure equipment has not been damaged during transport or storage.

The guidelines emphasize the purpose of uniform MQAPs, which include preparing efficient plans covering all critical tests, reducing redundant testing, optimizing Customer Hold Points (CHPs) for inspections, and relieving the burden on testing facilities by defining the validity of type tests. This approach is expected to significantly save costs and time for both suppliers and purchasers while ensuring consumer interests are protected.

The broad guidelines specify that all utilities, developers, and suppliers must follow the Model QAPs included in the annexures, which cover equipment in substations, switchyards, transmission lines, hydro power plants, thermal power plants, and distribution systems. Items not covered will require mutual agreement between manufacturers and purchasers. The guidelines also allow acceptance of test certificates for bought-out items after review and approval, while purchasers retain the right to request additional tests at their own cost if needed.

Manufacturers are required to maintain proper documentation, conduct periodic calibration of all testing instruments, and ensure compliance with national and international standards. No material will be dispatched before acceptance by authorized representatives, and any rectifications will need prior approval from purchasers. Additionally, the guidelines reaffirm adherence to CEA's technical standards for the construction of electrical plants, transmission, and distribution infrastructure.

By framing these draft revised guidelines, CEA aims to bring consistency, reliability, and efficiency into the quality assurance system for India's power sector. The approach is expected to strengthen consumer confidence, reduce project delays, and ensure optimal use of testing infrastructure, ultimately supporting the country's energy and economic growth.

India identifies over 200 GW pumped hydro storage potential, 8 GW under construction

India has identified a pumped storage potential of more than 200 gigawatts (GW) across the country, with approximately 8 GW currently under construction and 61 GW in various stages of planning and development, the Ministry of Power said.

The update was shared during a Consultative Committee meeting of the Ministry of Power, chaired by Union Minister for Power and Housing Affairs Manohar Lal. The meeting, held on August 4, focused on India's energy storage roadmap and future energy security. It was attended by Minister of State for Power and New & Renewable Energy Shripad Yesso Naik, MPs from the Lok Sabha and Rajya Sabha, senior ministry officials, Central PSUs, and experts from the Central Electricity Authority.

According to the Ministry, India already has an installed capacity of about 6.4 GW of pumped storage projects (PSPs). The Minister said the development of PSPs is being supported through various policy measures including full waiver of Inter-State Transmission System (ISTS) charges for projects whose construction is awarded by June 2028. The Ministry also highlighted that under its Viability Gap Funding (VGF) scheme, ₹9,160 crore has been earmarked to support 43 GWh of Battery Energy Storage Systems (BESS). This is being positioned as one of the largest BESS initiatives globally. The Minister said that promoting renewable energy with energy storage systems is necessary to ensure reliable supply by storing excess renewable generation for use during peak demand. He added that the government is committed to reducing the emissions intensity of GDP by 45 per cent from 2005 levels and achieving 50 per cent of installed capacity from non-fossil fuel sources by 2030.

Members of the committee appreciated the VGF scheme and the role of smart meters in improving service and reducing losses. They also praised the use of BESS for storing surplus renewable energy for use at other times of the day. The Union Minister instructed officials to take necessary steps to incorporate the suggestions made by members.

In his closing remarks, Minister of State Shripad Yesso Naik said India had already achieved 50 per cent of its installed electricity capacity from non-fossil sources, five years ahead of the 2030 target. He emphasized the role of Energy Storage Systems (ESS) in enabling a reliable and flexible power system across generation, transmission, distribution, ancillary services, and electric mobility.

BESS costs down by 80% over the last 10 years: Report

Battery Energy Storage Systems (BESS), operating without fixed contracts, known as merchant BESS, has seen their costs decline by 80 per cent over the past decade, according to a new report by energy think tank Ember. The cost of BESS has fallen from ₹79 lakh per megawatt-hour (MWh) in

2015 to just ₹17 lakh/MWh in 2025, the report noted. Ember's analysis says the reduction, coupled with a fivefold increase in potential revenues from market participation, has made merchant BESS a commercially viable and bankable asset for the electricity grid. Potential revenues have surged from ₹5 lakh /MWh in 2015 to ₹24 lakh/MWh in 2025. As a result, 2024 marked a significant turning point, with merchant BESS revenues surpassing costs for the first time.

"Merchant BESS has often been viewed as a low-return investment. But the changing dynamics of the wholesale power market, with rising price volatility, coupled with falling battery costs, have made it a commercially viable investment opportunity today," said Duttatreya Das, Energy Analyst at Ember and co-author of the report.

Das further said, "Battery systems charge when power is cheap and abundant - typically during sunny hours - and sell electricity back to the grid when demand surges and prices peak, making it well-suited to manage price volatility and generate handsome revenues while doing so."

Price volatility up
The report highlights a growing trend of increased price volatility in the day-ahead market (DAM) segment of India's power exchanges.

Peak prices are reaching new highs, while troughs are getting deeper, creating more opportunities for merchant batteries to generate value.

Data from 2022 to 2024 shows that electricity prices nearly hit the current cap of ₹10 per kilowatt-hour (kWh) in one out of every six hours. Conversely, average midday power prices in the summer months fell by nearly 20 per cent from 2022 to 2024, with prices even approaching zero on several days in the summer of 2025.

"Such market swings are no longer isolated events; they are becoming a regular feature on India's power exchanges," said Das.

He further noted, "price volatility is likely to keep increasing as India's power generation and consumption patterns change. Rising solar penetration will keep daytime prices low, while the rigidity of thermal plants means that they will operate at very low levels more often during the day and take time to power up and cater to the high evening demand."

The report concludes that as India's electricity system evolves to integrate more variable renewable energy, the case for investing in battery storage becomes stronger.

CERC Clears Tariff For 1200 MW Renewable Projects with Greenshoe Option Under SJVN Bidding

A recent order from the Central Electricity Regulatory Commission (CERC) has highlighted a major renewable energy initiative in India. The order, dated August 26, 2025, was issued in response to a petition filed by SJVN Limited. The petition sought the Commission's approval for the tariff discovered through a competitive bidding process for the supply of 1,200 MW of firm and dispatchable power from renewable energy projects connected to the Inter-State Transmission System (ISTS) with integrated energy storage systems. The project also carried a "Greenshoe Option," which allowed for an additional capacity of up to 1,200 MW.

SJVN Limited acted as an intermediary procurer and Renewable Energy Implementing Agency (REIA) on behalf of the Ministry of New and Renewable Energy. The company issued a Request for Selection (RfS) on March 27, 2024, to identify eligible power developers. The competitive bidding process followed the 2023 guidelines of the Ministry of Power and was conducted through a single-stage, two-envelope system, followed by an e-reverse auction. This ensured that the process remained transparent and in compliance with established norms.

In response to the RfS, nine bidders participated and collectively offered 2,160 MW, surpassing the initially tendered 1,200 MW. After the conclusion of the e-reverse auction, five bidders emerged successful for the initial allocation of 1,200 MW. Subsequently, SJVN extended the Greenshoe Option to these successful bidders, which permitted them to take on an additional 1,200 MW at the lowest discovered

tariff. All bidders accepted this option, raising the total awarded capacity to 2400 MW.

The successful bidders and their respective capacities under the initial 1,200 MW allocation included Hero Solar Energy Private Limited with 120 MW, Ganeko One Energy Private Limited with 140 MW, Juniper Green Energy Private Limited with 200 MW, Renew Solar Power Private Limited with 150 MW, and Avaada Energy Private Limited with the largest share of 590 MW. The agreed tariff for all companies was ₹4.25 per kWh, except for Avaada Energy, which initially quoted ₹4.26 per kWh. However, for the capacity allotted under the Greenshoe Option, Avaada was also given the tariff of ₹4.25 per kWh, in line with the terms of the bidding process.

SJVN also requested the Commission's approval for a trading margin of ₹0.07 per kWh to be charged to the buying entities. The CERC reviewed this request within the framework of the Trading Licence Regulations. The order observed that for long-term contracts, the trading margin is usually decided through mutual agreement between the trading licensee and the seller. However, in cases where back-to-back contracts do not include escrow arrangements or irrevocable, unconditional, and revolving letters of credit, the trading margin cannot exceed two paise per kWh, which amounts to ₹0.02 per kWh. In this case, the Commission concluded that SJVN would not be able to charge the higher margin of ₹0.07 per kWh.

The Commission's order was delivered after careful examination by members Shri Ramesh Babu V., Shri Harish Dudani, and Shri Ravinder Singh Dhillon. They confirmed that the bidding process was transparent and aligned with Section 63 of the Electricity Act, 2003. SJVN also provided a certificate from the bid evaluation committee confirming that the process complied fully with the guidelines. The Commission has now adopted the discovered tariffs for the projects, including the additional capacity under the Greenshoe Option.

SJVN has already signed Power Sale Agreements (PSAs) with Uttar Pradesh Power Corporation Limited (UPPCL) for 1,200 MW of power from the successful bidders. During the hearing, SJVN also confirmed that it would submit the remaining agreements as soon as they are executed. This order marks an important milestone for renewable energy expansion in India, ensuring large-scale integration of renewable power with storage into the national grid.

India's power demand rises by 2.4% in July: Crisil

After two consecutive months of decline, India's power demand witnessed a turnaround in July, growing by about 2.4 per cent year-on-year to reach 154 billion units (BUs), according to research agency Crisil. This increase, contrasting with the on-year degrowth observed in May and June, is largely attributed to a resurgence in industrial activity. As per the reports, the demand surge was met with ample supply, leading to a notable 23 per cent onyear drop in the average market clearing price in the real-time market (RTM), which settled at ₹3.83 per unit in July. A key highlight of the month was the generation mix. While thermal power generation saw a year-onyear decline, clean energy sources stepped up to fill the gap.

Major increases were seen in hydro and renewable energy generation. Higher rainfall levels boosted hydropower generation by an impressive 36 per cent year-on-year, while renewable energy sources contributed a 7.2 per cent on-year rise. The spread between RTM and day-ahead market volumes also narrowed significantly to 401 million units (MU) in July, a sharp contrast to the average of 2,529 MU recorded between June 2020 and July 2025. Looking ahead, Crisil Intelligence forecasts a moderated yet positive growth for the current fiscal year. The ratings agency estimates a 2.5-3.5 per cent on-year growth in power demand, projecting total consumption to be between 1,745-1,755 BUs..

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India's First Make-In-India Green Hydrogen Plant Commissioned at Kandla: PM Modi Lauds

The Deendayal Port Authority, Kandla, has commissioned India's 1st Make-in-India Green Hydrogen Plant in the port sector at Kandla. The Port Authority said, it is a powerful stride towards the Net Zero vision of Prime Minister Narendra Modi.

The plant was operationalised just four months after PM Modi laid the foundation for a 10 MW green hydrogen facility during his visit to Bhuj in May 2025.

With this, Kandla becomes the first Indian port to house a megawatt-scale indigenous green hydrogen facility, underlining Gujarat's growing role in renewable energy and sustainable infrastructure.
The plant was inaugurated by Union Minister for Ports, Shipping and Waterways, Sarbananda Sonowal on July 31, in the presence of Minister Shantanu Thakur, Ministry Secretary T.K. Ramachandran, DPA Chairman Sushil Kumar Singh, and other senior officials.

Highlighting the project's rapid execution, Sonowal praised the DPA for achieving a major engineering feat in record time.

"In just four months since the foundation stone of the 10 MW plant was laid, the first 1 MW module has become operational – setting a new benchmark for India's green hydrogen sector," he said.

The establishment of this green hydrogen plant is expected to play a pivotal role in reducing carbon emissions and promoting clean energy solutions in India's maritime and logistics sectors. The move aligns with the government's broader strategy to promote indigenous technology and foster green innovation in critical infrastructure.
India has committed to achieving Net-Zero carbon emissions by 2070 and is focusing on renewable energy, green hydrogen, and sustainable industrial practices to meet this ambitious target.

PM Modi lauds India's first green hydrogen plant in port sector in Kandla**:** Prime Minister Narendra Modi recently hailed a landmark step towards sustainability with the commissioning of India's first Make-in-India Green Hydrogen Plant in the port sector at Kandla, Gujarat. The project, undertaken by the Deendayal Port Authority (DPA), marks a major stride in the nation's efforts to achieve its Net-Zero emissions target.

In a post on X, the Deendayal Port Authority announced the development, stating, "Fueling Progress with Green Innovation! Deendayal Port Authority, Kandla proudly commissions India's 1st Make-in-India Green Hydrogen Plant in the port sector – at Kandla.

A powerful stride towards the Net Zero vision of our Hon'ble Prime Minister Narendra Modi." Responding to the announcement, PM Modi said, "This is a commendable effort, championing sustainability and powering our Net-Zero vision."

172 hydrocarbon discoveries in 10 years, 62 offshore, as Modi govt opens 'No-Go' Zones: Hardeep Puri

Union Petroleum Minister Hardeep Singh Puri on Sunday said that 172 hydrocarbon discoveries have been made over the past decade under the leadership of Prime Minister Narendra Modi, including 62 in offshore areas.

Taking to social media platform X, the minister highlighted that exploration efforts are now being expanded into regions previously designated as "No-Go" zones—an initiative made possible by what he described as PM Modi's bold and transformative policy decisions.

"Under the guidance of PM @narendramodi ji, 172 hydrocarbon discoveries have been made in the last decade, of which 62 are in marine areas. Now this figure will increase even faster because now we are

going for exploration in those areas also, where exploration has never been done before. Which once came under 'No Go' areas," he said in a post in Hindi.

"Modi ji's bold decision on these no-go areas is giving a new height to exploration & production," Puri added. Last week, the minister informed the Parliament that India is witnessing a renewed surge in oil and gas exploration with the opening of nearly one million square kilometres of erstwhile 'No-Go' offshore areas in 2022.

In a written response to a Rajya Sabha question, the minister stated that this action has opened up important exploration frontiers, particularly in deepwater and frontier areas like the Andaman-Nicobar (AN) offshore basin, and has played a key role in starting the current offshore activity momentum.

The minister emphasised the geological significance of the AN Basin, which is part of the Bengal-Arakan sedimentary system and sits where the Andaman and Nicobar Basins converge. Numerous stratigraphic traps that are favourable to the accumulation of hydrocarbons have been created as a result of the tectonic setting at the border between the Indian and Burmese plates.

The basin's closeness to established petroleum systems in North Sumatra and Myanmar adds to its geological promise. Following major gas discoveries in the South Andaman offshore Indonesia, the region has garnered renewed international attention, highlighting the region's geological continuity, the minister stated.

India's Ethanol Journey is Unstoppable: Hardeep Singh Puri

Hardeep Singh Puri, Minister of Petroleum and Natural Gas, said that "India's ethanol journey is unstoppable," while participating in a Fireside Chat Session on the sidelines of the Pioneer Biofuels 360 Summit.

Responding to a question on the success of the Ethanol Blended Petrol (EBP) programme, the Minister highlighted that ethanol blending gained serious momentum only after 2014, when Prime Minister Narendra Modi assumed office. In 2014, ethanol blending was merely 1.53%. By 2022, India achieved 10% blending, five months ahead of schedule. The original target of 20% blending (E20) by 2030 was advanced to 2025 and has already been achieved in the current Ethanol Supply Year (ESY). This success, the Minister noted, was made possible through sustained policy reforms such as guaranteed pricing for ethanol, allowing multiple feedstocks, and rapidly expanding distillation capacity across the country.

Dispelling misinformation and false narratives surrounding ethanol-blended fuel, Puri emphasized that there has not been a single case of engine failure or breakdown reported since E20 became a base fuel over the last 10 months. Citing Brazil's example, he said the country has run on E27 for years without any issues.

Some lobbies with vested interests are actively attempting to create confusion and derail India's ethanol revolution. However, such efforts will not succeed. The E20 transition is already firmly underway, backed by strong policy support, industry readiness, and public acceptance—and there is no turning back.

Elaborating on the benefits of E20, the Minister said it results into reduction in greenhouse gas emissions, improves air quality, enhances engine performance, and has already led to over ₹1.4 lakh crore in foreign exchange savings. He pointed out that 2G ethanol refineries in Panipat and Numaligarh are converting agricultural residues like parali and bamboo into ethanol, providing a win-win solution for clean fuel, pollution control, and farmer income. He further highlighted the remarkable growth of maize-based ethanol—from 0% in 2021–22 to 42% this year—calling it a transformational shift.

On the issue of Flex-Fuel Vehicles (FFVs), Puri said that the Indian automobile industry has already demonstrated its capability. Indian OEMs have begun rolling out prototypes for E85-compatible vehicles. Continuous consultations have been held with the Society of Indian Automobile Manufacturers (SIAM) and other major auto manufacturers, and the direction is clear—progressively moving towards

higher ethanol blends. The Ethanol Blending Roadmap (2020–25) has laid a strong foundation, and the successful rollout of E20—five years ahead of target—demonstrates both industry readiness and consumer acceptance. The country will now gradually scale towards E25, E27, and E30 in a phased, calibrated manner with the support of BIS standards and fiscal incentives.

The Minister stressed that ethanol blending is not just about mixing fuel—it is about empowering Annadatas by turning them into Urjadatas., reducing crude imports, saving foreign exchange, creating green jobs, and honouring India's climate commitments. Over the past 11 years, ethanol procurement has enabled ₹1.21 lakh crore income to farmers, reduced crude imports by 238.68 lakh metric tons, and saved ₹1.40 lakh crore in foreign exchange.

Speaking about India's efforts in Sustainable Aviation Fuel (SAF), Puri said the Ministry is working closely with oil marketing companies, airlines, and global technology partners to develop and scale up SAF. Like ethanol, India will adopt a phased approach to SAF adoption. A blending mandate has already been initiated, with a target of 1% blending for international flights by 2027, increasing to 2% by 2028, and scaling further as supply stabilizes. He also cited the example of the Indian Oil Corporation Ltd. Refinery in Panipat, which is using used cooking oil to produce SAF—showcasing India's innovative and sustainable pathway forward.

Hydrogen at $1 per kg can make India an energy exporter: Nitin Gadkari

Hydrogen today costs around $5 per kilogram and if India can bring this down to $1 dollar per kilogram, we won't just achieve energy independence, we can become a global exporter of clean energy, Union Minister of Road Transport and Highways, Nitin Gadkari, said recently. Highlighting India's leadership in renewable energy, Gadkari said that solar energy is the 'Sanjeevani Booti' for our planet and hydrogen is the fuel of the future. "I drive a Toyota Mirai, which itself means 'future' in Japanese, because I believe hydrogen will transform mobility and energy," he added.

Speaking at the 24th Darbari Seth Memorial Lecture, hosted by the Energy and Resources Institute (TERI) here, the minister emphasised that true progress lies in making "our villages stronger than our cities".

"With 80 per cent of people still connected to agriculture, we must diversify farming towards energy and power, invest in water conservation, and harness technologies like AI for rural prosperity. Jal, jameen, and jungle must remain the pillars of our growth model," he told the gathering.

The minister further stated that ethics, economy, ecology, and environment must move together — only then can development generate employment, alleviate poverty, and inspire pride and self-reliance. The 24th Darbari Seth Memorial Lecture was delivered by Ashish Khanna, Director General, International Solar Alliance (ISA), and presided over by Gadkari. India aims to capture nearly 10 per cent of global green hydrogen demand, which is expected to exceed 100 million metric tonnes by 2030.

According to Shripad Naik, Minister of State for Power and Renewable Energy, India has made substantial progress towards its ambitious green hydrogen production targets, with 862,000 tonnes per annum of production capacity already awarded to 19 companies under the National Green Hydrogen Mission.

The government has awarded 3,000 megawatts of electrolyser manufacturing capacity to 15 companies, marking significant industrial development in the sector.

Government takes multiple steps to safeguard citizens from impact of global crude oil price fluctuations: Petroleum Minister

Union Minister of Petroleum and Natural Gas, Shri Hardeep Singh Puri, in a written reply to a starred question in Lok Sabha recebtkt, stated that the Government is committed towards ensuring energy security, affordability and accessibility for every citizen. He highlighted that despite international

crude oil price fluctuations, domestic petrol and diesel prices have been reduced owing to various steps taken by the Government and Public Sector Oil Marketing Companies (OMCs).

The Minister Informed that prices of petrol and diesel are market determined and Public Sector OMCs take appropriate decisions on pricing. The prices of petroleum products in the country are linked to the international market, with India importing more than 85% of its crude oil requirements.

Crude oil prices (Indian basket) rose from \$55/bbl (March 2015) to \$113/bbl (March 2022) and further to \$116/bbl (June 2022), continuing to fluctuate due to geopolitical and market factors. However, domestically, petrol and diesel prices have reduced to Rs. 94.77 and Rs. 87.67 per litre respectively (Delhi prices) from Rs. 110.04 and Rs. 98.42 per litre in November 2021.

He stated that the Central Government reduced excise duty by Rs. 13/litre on petrol and Rs. 16/litre on diesel in two tranches in November 2021 and May 2022, fully passing the benefit to consumers. Some State Governments also reduced VAT to provide further relief. In March 2024, OMCs reduced retail prices of petrol and diesel by Rs. 2 per litre each. In April 2025, excise duty on petrol and diesel was increased by Rs. 2 per litre each, but this was not passed on to consumers.

Shri Puri informed that PSU OMCs have carried out intra-state freight rationalisation, benefiting consumers in remote areas by reducing petrol and diesel prices in far-flung regions. This has also reduced the difference between maximum and minimum retail prices within a state.

The Government also took several measures to insulate citizens from high international prices, including diversifying the crude import basket, invoking provisions of Universal Service Obligation to ensure availability of petrol and diesel in the domestic market, and augmenting domestic exploration and production of crude oil. Additionally, the Government is promoting ethanol blending and enhancing the share of renewable energy in India's energy basket.
Replying to a question on Government's strategy to promote alternative energy sources, Shri Puri stated that the Government is actively encouraging the adoption of CNG, LNG, Hydrogen, biofuels including ethanol, and electric vehicles.

The National Policy on Biofuels – 2018 had set a target of 20% ethanol blending in petrol and 5% biodiesel blending in diesel by 2030. This target was subsequently advanced to 2025-26. During the ongoing Ethanol Supply Year (ESY) 2024-25, Public Sector OMCs have achieved an average blending of 19.05% as on 31.07.2025, with 19.93% blending achieved in July 2025.

To promote biofuels, the Government has implemented initiatives such as the Ethanol Blended Petrol (EBP) Programme, Biodiesel blending programme, and the SATAT initiative for marketing Compressed Bio Gas (CBG) along with CNG.

PNGRB expands CGD network to 784 districts; sets 2034 target of 12.6 crore PNG connections

The Petroleum and Natural Gas Regulatory Board (PNGRB) recently said India's city gas distribution (CGD) network now covers 784 districts across 34 states and union territories, with a target of 12.63 crore piped natural gas (PNG) connections and 18,336 CNG stations to be achieved by 2034

According to PNGRB, 307 geographical areas (GAs) have been authorised, accounting for nearly the entire landmass of the country. The minimum work programme (MWP) also includes 5.46 lakh inchkm of pipeline infrastructure by 2034. The regulator said sustained engagement with state governments is critical to achieving these goals. "Over the past two years, continued engagement and dialogue with State government authorities have led to the formulation of State CGD policies across various states," PNGRB said in a statement.

So far, 11 states and UTs including Assam, Tripura, Tamil Nadu, Puducherry, Karnataka, Madhya Pradesh, Bihar and Rajasthan have notified CGD policies or directives, covering 55% of the population and 60% of households. These states have been assigned a minimum target of 7.85 crore PNG connections and 10,131 CNG stations by 2034. PNGRB said high and differential VAT rates continue

to be a challenge, with PNG prices ranging from ₹45/SCM in Tripura to ₹63/SCM in Uttarakhand, and CNG prices from ₹74.60/kg in Puducherry to ₹103.80/kg in Uttarakhand. Recently, Bihar cut VAT on CNG and PNG from 20% to 12.5% and lowered VAT on PNG for industrial use to 5%, while Chhattisgarh reduced VAT from 14.5% to 5%.

CNG vehicle registrations rose from 58.61 lakh in March 2023 to 81.95 lakh by March 2025, registering 25% growth in FY25 over FY24. About 1,206 new CNG stations were added in FY25, while 21 lakh new PNG connections were commissioned. Overall, gas sales rose 21% in FY25, contributing to an 11% increase in total consumption.

The regulator said discussions with states such as Tamil Nadu and Maharashtra are progressing for conversion of public transport fleets to natural gas. In Tamil Nadu, 1,000 buses of the Metropolitan Transport Corporation are planned for conversion to CNG, while Maharashtra is moving to LNG for its state road transport fleet.

ONGC lines up Rs 4,600 crore war chest to boost oil & gas production from eastern offshore fields

Oil and Natural Gas Corporation (ONGC) plans to invest over Rs 4,600 crore to drill more wells to increase production from its discovered fields, lay an offshore pipeline, and set up a gas processing facility in the coastal Konaseema district of Andhra Pradesh.

The public sector upstream oil giant sought the approval of the Ministry of Environment and Forests for the project and has been asked to carry out a biodiversity assessment to evaluate the impact of drilling activities and prepare an environmental restoration action plan to go ahead with the project, a senior official said.

The ONGC field is located 35 kilometres off the coast of Andhra Pradesh in water depths ranging from 300-3,200 metres. The discoveries of oil and gas in the block are divided into three clusters— Clusters 1, 2, and 3 across an area of 697 sq km.

ONGC has recently increased production from its flagship deep-sea project in the Krishna Godavari basin off the Andhra Pradesh coast, which will help augment the production of crude oil and natural gas The upstream oil company is focused on raising production in the second half of FY25 (2024-25) by reducing the turnaround time for opening wells, the official said.

"Three oil wells of A-field of deepwater block KG basin block KG-DWN-98/2 were opened on October 30, 2024, thereby enhancing total oil production to about 25,000 barrels of oil per day from eight flowing wells of cluster-II. The remaining five oil wells are planned to be opened shortly," ONGC said in an exchange filing recently.

In a significant development, ONGC and Oil India Ltd (OIL) have also launched an ambitious exploration campaign in the Andaman ultra-deepwater region. For the first time, drilling operations are targeting depths of up to 5,000 metres. One such wildcat well, ANDW-7, drilled in a carbonate play in the East Andaman Back Arc region, has yielded encouraging geological insights. These include traces of light crude and condensate in cutting samples, heavy hydrocarbons like C-5 neo-pentane in trip gases, the government had said.

These findings establish, for the first time, the existence of an active thermogenic petroleum system in the region, comparable to those in Myanmar and North Sumatra. While commercial reserves remain to be established, this campaign has validated the presence of a working petroleum system and laid the foundation for focused exploration in the area, Minister of Petroleum and Natural Gas Hardeep Singh Puri has told Parliament.

ONGC has made hydrocarbon discoveries in 20 blocks, with an estimated reserve of 75 million metric tonnes of oil equivalent (MMTOE). Oil India Ltd., on its part, has made seven oil and gas discoveries over the past four years, with reserves estimated at 9.8 million barrels of oil and 2,706.3 million standard cubic meters of gas, the minister stated.

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India working on 10 new nuclear reactors, targets tenfold capacity rise by 2047: PM

Prime Minister Narendra Modi recently said India is rapidly working on 10 new nuclear reactors and has set a target to increase the country's nuclear energy capacity tenfold by 2047. In his Independence Day address from the Red Fort, Modi said the government is taking major initiatives in the nuclear sector to meet the country's future energy requirements. "Work is progressing rapidly on 10 new nuclear reactors and, by 2047, we have pledged to increase our nuclear energy capacity tenfold... We are bringing major reforms in the nuclear energy sector," he said. The prime minister said the country remains dependent on other nations for petrol, diesel and gas, and spends billions of rupees on imports. He stressed the need to make India self-reliant in the energy sector.

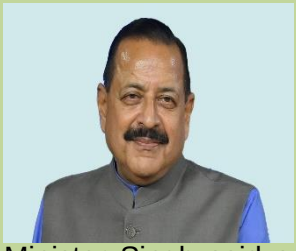
Highlighting the growth in renewables, Modi said solar energy capacity has risen 30 times in the past 11 years. He also mentioned efforts to build new dams for hydropower expansion and investments worth thousands of crores in the Hydrogen Mission.

Modi said the nuclear energy sector has been opened to private participation. According to government sources, India plans to end the state monopoly over uranium mining, imports and processing, while retaining control over reprocessing of spent uranium and management of plutonium waste.

The government aims to attract investment and allow foreign players to take minority stakes in nuclear power plants. If the 2047 target is met, nuclear power is expected to contribute about 5 per cent of the country's total electricity supply, according to official estimates.

India's Nuclear Energy Mission: Expanding capacity to 22 GW by 2032

Power minister Manohar Lal Khattar and minister of State for atomic energy Jitendra Singh recently jointly held a high-level meeting to discuss the 100 GW Nuclear Energy Mission. This meeting follows up on expanding the country's India's target of clean energy mix.



During the meeting, the roadmap to increase India's nuclear energy capacity from the current 8.8 GW to 22 GW by 2032 was reviewed.

Minister Singh said a strong and vibrant response came from industries towards the Bharat Small Modular Reactor (SMR) program, leading to an extension of Nuclear Power Corporation of India's request for proposal submission deadline to September 30, 2025 to encourage wider participation.

Singh further emphasised the government's commitment to handholding and creating awareness among private sector players. The power minister reiterated the importance of adhering to timelines and accelerating projects as per the established roadmap.

India set to ease entry of private firms into nuclear power generation

The government is working on rules that could open up nuclear power generation to private companies. It's a move that is aimed at strengthening India's clean energy goals under the Viksit Bharat 2047 plan, according to a report by *The Economic Times*.

Why it matters
Nuclear power in India is currently restricted to government-owned entities. Allowing private participation could help scale up capacity and cut project costs at a time when the country is racing to

meet growing energy demands while cutting emissions.

The Centre is considering specific eligibility criteria for private players keen to run nuclear power plants. These discussions include possible changes to key laws, including the Atomic Energy Act and the Civil Liability for Nuclear Damage Act, the news report said.

Both Acts were originally designed to support only state-led nuclear expansion.

Eligibility being planned
New regulations would include checks on financial and technical strength. Criteria could include:

- Consistent positive revenue over a defined period
- Prior experience in handling large-scale infrastructure
- Strong financial health and operational stability

However, these conditions will be formalised only after legal amendments are made and notified. The goal is to ensure only serious and capable companies enter the nuclear energy sector, *The Economic Times* mentioned.

Where India stands on nuclear energy
- 8.8 GW: India's current installed nuclear capacity
- 23: Number of operational nuclear plants, all run by the Nuclear Power Corporation of India Ltd (NPCIL)
- 22 GW by 2032: Short-term goal
- 100 GW by 2047: Long-term target under clean energy plans

Focus on cost, timelines
Last month, PK Mishra, principal secretary to the Prime Minister, highlighted that timely project execution, affordable financing, and involvement of private players are crucial to reducing electricity tariffs and ensuring the viability of nuclear energy projects.

Speaking at the valedictory function of the 68th batch of scientific officers at the Bhabha Atomic Research Centre (BARC) Training School, Mishra urged scientists to focus on innovation and cost-cutting approaches to help position nuclear power as the country's primary energy source.

Building small nuclear reactors
India is also working on three types of small modular reactors (SMRs), Union Minister Jitendra Singh told the Parliament last month.

These include:
- 200 MWe Bharat SMR
- 55 MWe SMR
- 5 MWth High Temperature Gas Cooled Reactor for hydrogen production
- All are being developed indigenously

He said that construction of demo units could begin within 60-72 months after project approvals.

NTPC to kick off work for new nuclear power plant in Rajasthan next month

Government-owned power giant NTPC Ltd will kick off its foray into nuclear power with the laying of the foundation stone for the construction of a 2,800 megawatt (MW) nuclear power plant at Banswara in Rajasthan next month, the company's Chairman and Managing Director Gurdeep Singh said here on Sunday.

The project will comprise four pressurised heavy water reactors (PHWRs) of 700 MW capacity each. "We will go very aggressive on nuclear. We plan to add 30 gigawatt (GW) nuclear power capacity by 2047," the NTPC chief said at the BloombergNEF Summit here. The Mahi Banswara project is a joint venture with Nuclear Power Corporation of India Limited (NPCIL), in which the NTPC holds a 49 per cent stake.

The NTPC plans to set up nuclear power projects both as part of the existing JV with the NPCIL as well as on a standalone basis. It plans to commission the first unit of the Rajasthan project in 2031, while the full plant is scheduled for completion in 2036. "By that time, we will take up many other plants, too.

We are in discussion with Tata Consulting Engineers, L&T, EDF, Rosatom, and Holtec and

a few international consultants," Singh said. The NTPC is keen to join hands with service and technology providers, and it is exploring many sites across the country, he added.

He said that India will be in a position to add around 10 GW of nuclear power generation capacity annually in the run-up to 2036-37, as work will be going on at three or four sites, and there is an exclusive mandatory zone for these nuclear power plants.

India's installed nuclear power capacity is expected to reach 22,380 MW by the year 2031-32 from 8,780 MW at present with the completion of the expansion plans that are currently being implemented, Minister of State for Atomic Energy Dr Jitendra Singh had informed Parliament recently.

Presently, the installed nuclear power capacity in the country comprises 24 reactors with a total capacity of 8,780 MW (excluding RAPS-1 (100 MW), which is under extended shutdown). In addition, a total capacity of 13,600 MW (including 500 MW PFBR being implemented by BHAVINI) is under different stages of implementation.

On the progressive completion of these expansion plans, the country's installed nuclear power capacity is expected to reach 22,380 MW by the year 2031-32, the minister said.

Indian Energy Giants Rally Behind Nuclear in Clean Power Push

India's top energy firms are advocating for nuclear power to decarbonize the world's third-biggest emitter, while cautioning that electricity from reactors needs to be affordable to substitute coal.

"Nuclear can't just be a fashion statement," Praveer Sinha, chief executive officer at Tata Power Co., said at the BNEF Summit in New Delhi. "It needs to replace coal-based power as a source of affordable power."

Atomic power is witnessing a revival globally due to its ability to deliver low-emissions energy. In India, the industry has gained momentum after the government earlier this year said it will amend rules to allow private firms and address liability clauses, which have long kept foreign technology suppliers away. The current law holds both plant operators and equipment suppliers liable for damages in case of an incident.

The other reason for the slow development of the sector has been the high cost, often a result of delays caused by public opposition and political concerns over such projects.

Sinha said the expansion planned in India and other parts of the world will provide economies of scale to bring costs down. Tata Power is "very keen to pursue nuclear."

The lack of business continuity and a shortage of skilled staff are also issues that should be at the top of the agenda for the industry, said Anil Parab, whole-time director at Indian engineering firm Larsen & Toubro Ltd. Even small deviations can push nuclear projects back by months and add to costs, he said, stressing the need for talent.

India currently has 8.8 gigawatts of nuclear generation, accounting for less than 2% of the country's total power capacity. The South Asian nation targets 100 gigawatts by 2047, the centenary year of its independence.

State-run NTPC Ltd., the country's largest power producer and coal consumer, said it aims to contribute 30% toward the country's 2047 nuclear goal. The New Delhi-based company is building its first atomic power plant in a joint venture with Nuclear Power Corp. of India in the state of Rajasthan.

The first of the four 700-megawatt units is expected to become operational in 2031, while the entire plant is likely to come online five years after that, NTPC Chairman Gurdeep Singh said at the BNEF Summit.

Towards an integrated approach to optimal low-carbon energy system design for net zero India

Rupsha Bhattacharyya[1,2], KK Singh[1,2], K Bhanja[2], RB Grover[1]
[1]Homi Bhabha National Institute, Mumbai – 400 094
[2]Bhabha Atomic Research Centre, Mumbai – 400 085

Development-led Transition to Net Zero

For policymakers and the broader public, achieving the goal of net zero by a target year has become synonymous with human efforts to mitigate the consequences of climate change. While achieving net zero is a scientific concept, it must be aligned with socio-economic realities, including the principle of an equitable burden across societies. The energy sector (including fossil fuel-based electricity production, domestic and industrial heating, and transportation) is known to be the main driver of greenhouse gas emissions. Therefore, a wide restructuring of how energy is currently produced and finally consumed is the essence of the energy transition. Energy availability, accessibility and affordability also determine the state of welfare and development of a nation. This means that emerging markets and developing economies like India must simultaneously address twin challenges - the development status-energy consumption linkage and the need for deep and economy-wide decarbonization. In short, India must formulate policies that result in a development-led transition.

India has set 2047 as her target year for becoming a developed nation and 2070 as its target year for achieving net zero emissions. A judicious assessment of India's clean energy choices and a practical plan for deploying low-carbon energy infrastructure are needed for attaining these objectives.

In a previous study, the authors estimated India's minimum low-carbon energy needs to support a very high level of development (such as that already attained by Nordic countries, Canada, and the USA) by 2070 to be approximately 24,000 TWh[1]. This assessment considered the various practical levers (and their combinations) available for decarbonizing various sectors of the economy, including widespread direct electrification of sectors such as transport, shifting away from coal and natural gas in industrial heating and chemical/metallurgical processes, switching to clean energy vectors and industrial feedstock mainly electrolytically produced hydrogen and abatement of unavoidable emissions from fossil fuel usage by carbon capture technology. A similar value of total final energy consumption for decarbonizing India is also projected in some other studies[2].

Development and decarbonization are possible even with a lower energy intensity of the economy by adopting clean final energy end-use technologies; this is because it involves shifting to inherently more efficient technologies in most cases. However, the end uses must be carefully chosen, particularly for synthetic energy carriers like hydrogen. Direct use of hydrogen as a clean feedstock must be prioritized in industries rather than using it in applications involving re-electrifying it (e.g., converting hydrogen to electricity through fuel cells)[3]. In other cases, where direct electrification is infeasible, hydrogen or its derivatives as an energy carrier can be an option for decarbonization (e.g., long-distance road transport, shipping, and aviation).

Integration of the Energy System through Electrification

Clean energy sources available at scale are hydro, nuclear, solar, and wind, and all of them produce electricity. Therefore, any future energy mix must rely on the use of electricity. It also implies that future energy systems and the economy at large will be more integrated through electrification, with stronger sector coupling than what exists in the present-day system, with multiple energy forms used in different sectors. This is illustrated in Figure 1 (adapted from authors' previous work[4]). The energy system planning must follow an integrated approach. Since lowering carbon emissions is the objective, the policy framework should use carbon emissions as the main criterion and otherwise be technology-agnostic. Our earlier study also established that energy demand for a developed India would not be met by renewables alone, based on the estimated maximum potential of solar, wind, hydro-electric generation, and biomass energy in India[1]. This reinforces the need to adopt an approach that is focused on lowering carbon emissions and is otherwise technology-neutral. Science to understand the sequestration potential of different carbon sinks is still evolving, effective

regulation of carbon offsets is likely to be problematic[5], and geological storage at scale is yet to be demonstrated. Therefore, there are apprehensions about the use of carbon dioxide removals, but for a country like India, they are unavoidable.

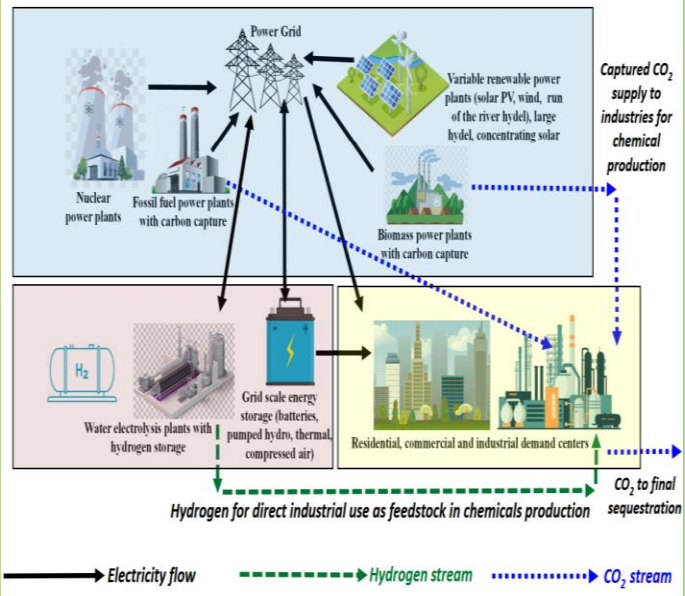


Figure 1. Representation of an integrated low-carbon energy system for net zero India (adapted version[4])

Balancing Demand and Supply

In general, energy system design is undertaken based on an optimization exercise that tries to determine the least cost electricity supply infrastructure to be built and operated to meet a stated cumulative demand and demand profile. Given the need to include more variable and intermittent generation technologies in the supply mix, such as solar PV and wind energy, to attain the clean energy targets, one must look at energy storage and beyond it to balance demand and supply. To address the decarbonization of industries which are difficult to directly electrify, energy conversion technologies such as water electrolysers to produce hydrogen must also be considered part of the clean energy infrastructure of the future. With a renewables-heavy supply system, the possibility of supply shortage due to weather conditions at certain times and the potential overproduction of electricity at some other times is enhanced.

Ensuring the reliability of supply to match instantaneous demand involves overbuilding the capacity on the energy supply side to some extent. This calls for ramping down baseload generators or curtailing renewable sources when the demand is low. This excess energy available in a day from a baseload generator could be between 5 to 15% of its rated energy output and for a generation mix with variable renewables, it could be as high as 20-34%[6]. The higher the share of renewables in the energy supply mix, the higher is the excess. This practice of ramping and curtailment is inefficient. To remove inefficiency, one must build infrastructure to make use of the excess energy.

The current approach is to manage excess energy generation through storage. Another facet of the current approach is to deploy dedicated clean electricity generators for hydrogen production. We recommend that the current approach be replaced by an approach based on using the excess energy by an optimally sized hybrid system of grid-connected water electrolysers with hydrogen storage and grid-scale batteries. Such a hybrid approach avoids power modulation and curtailment, and provides a system to manage surplus energy at a cost lower than what would be required when using only electrolysers or only batteries for enabling demand-supply balance[6]. The other advantage in this approach is that hydrogen produced from excess contributes towards meeting industrial requirements, thus reducing the need to build generation capacity dedicated only to hydrogen production. This spill-over benefit would not be available if only electricity storage is deployed to integrate higher shares of variable renewables into the generation mix. Next, we examine the design of the energy supply mix.

Multicriteria Assessment

The energy supply mix design exercise is naturally very country-specific and is influenced by domestic resources, including technology base and energy-related policies. The criteria to be considered in such an exercise are usually resource availability, siting and land availability, limits on emissions, ramping rates of various generation technologies, their technical minimum level of operation, system reliability, etc. Moreover, long-term clean energy system design must also factor in other aspects such as diversification of energy mix (which is directly related to energy supply security) and sustainability

of material use from a life cycle perspective. Many of these factors are difficult to represent as costs in an optimization exercise; yet, they must form part of the objective function that helps distinguish between the various possible generation mixes to identify the best option to be targeted by a nation. Thus, the energy system design problem requires a multicriteria optimization approach, and it is not just an economic cost-minimization exercise; the factors beyond economic costs necessarily must be integrated into the decision process. A study by Brook and Bradshaw has attempted to perform such an analysis to compare individual generation technologies on multiple aspects, using a scoring method to rank the alternatives[7]. However, a large country like India cannot base her supply side only on one technology, even when ranked the best and must have a diverse technology mix. Moreover, generation planning cannot be independent of the demand side characteristics. Therefore, an energy system planner must go for a multicriteria assessment of technology mixes rather than stand-alone comparisons of individual options.

Such a quantitative multicriteria assessment has been performed by the authors in a recently published study, taking the perspective of an energy system planner designing an optimal system while balancing multiple economic and environmental trade-offs[4]. In this study, independent and quantifiable criteria like total system level investment needs (in installed generation capacity plus balancing technologies), emissions intensity of power generation, generation mix diversity, land area requirement, water consumption and energy return on energy invested have been used to represent the attributes of an energy supply mix. Technology maturity was used to decide which options to include in the analysis. Material constraints have not been separately considered, but energy returned on energy invested is included to represent lifecycle material and energy uses by each generation technology. A linear, weighted average additive objective function is used to represent the trade-offs between these attributes (i.e., some which should be maximized and some which should be minimized), and the generation mix that maximizes the value of this function is considered optimal. Thousands of generation mixes have been evaluated, and different policy preferences and their impact on the optimal mix have also been studied by assigning different weightage to the energy system attributes.

Findings

The study[4] finds that under various policy preferences, the optimal low-carbon energy supply mix for India should include as much renewables and nuclear as is possible, based on today's available technologies, their techno-commercial attributes, and their upper limit of deployment, for a given land availability and project siting considerations. It is also seen that when land use efficiency is made a policy priority, the share of renewables is penalised drastically, leaving thermal (with carbon capture) and nuclear generation to compensate for their absence. The installed power generation capacity in 2070 rises 6 to 10 times over the currently available capacity of 473 GW(e), while enabling more than 85% reduction in carbon emissions intensity of electricity production from current values. The study also finds that a significant percentage of the daily domestic hydrogen requirement for industrial decarbonization can be met by dispatching the available excess power to grid-connected water electrolysers for producing hydrogen. This results in significant cost savings.

A few key energy policy-relevant findings from this study can be highlighted for India's clean energy system design:

- Electrification of all end uses is a sine qua non for transitioning to clean energy sources. The process of electrification should also be used to plan an integrated least-cost energy supply system.

- Adding nuclear capacity to the maximum extent possible (based on site availability considerations) is an essential and no-regrets course of action for India under all kinds of policy preferences, and it must play a much larger role than envisioned so far in India's clean energy transition. To enable nuclear to play a large role, there is a critical need for the nuclear sector to diversify beyond the reactor types currently deployed and associated fuel cycle technologies. Technologies to harness indigenous thorium resources should be prioritised, and this would mean developing molten salt reactors.

- Deep decarbonization, widespread electrification and ensuring energy adequacy and security in India are unlikely without the use of fossil fuels, as even the optimal supply mixes will still have 40-45% electricity derived from coal power plants. Thus, carbon capture technology must be made a research, development, and deployment priority for the Indian clean energy initiatives.

- India must also identify and secure supplies of critical minerals and technologies to indigenously develop its clean energy infrastructure, particularly for renewables and battery energy storage, which are still points of substantial import dependence today.

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Webinar on "Energy Transition - With Focus on Petroleum and Gas Sector"
22nd August 2025

The Petroleum and Natural Gas Vertical of India Energy Forum organized a Webinar on "Energy transition – With Focus on Petroleum and Gas Sector" on 22nd August 2025 at Webex.

Webinar was addressed by President IEF, **Shri RV Shahi**, setting theme for Petroleum and Natural Gas sector to reduce Oil and Gas imports at least by 10% from present level. He also gave reference of his book, "Energy Security and Climate change- 2010 Edition" where he mentioned that the Oil & Gas sector could have done better.

Chairman, Petroleum and Natural Gas Vertical, **Dr BS Negi**, presented his work done in 2021 about "India's Energy Basket 2030". He stated that the Primary energy in 2030 as computed by him to be 1216.45 Mtoe (51EJ) as against 813.5 Mtoe in 2019. In 2030, the share of Coal to reduce from 54.7 to 38.2%, and Oil from 30 to 25.4%. and the share of Gas to rise from 6.3 to 11% and renewables from 3.6 to 19%. However, the review in the year 2024 shows that the share of Coal has gone up and that of oil same as it should be theoretically but the share of Gas remained stagnated at 6.2% and Renewable remains at 6% as computed value of 12.3%. He also stated that if the foreign exchange out go of Rs 2042000 Cr is to be brought down, we need to adopt CBG, Bio Methinol, and augment renewables apart from increase of domestic Oil & Gas production.

Dr S. Pokhriyal, Professor, Sparsh Himalay University Dehradun, impessed upon the energy efficiency wherein only 42% of overall energy is converted to useful work remaining 58% goes to waste thereby increasing the entropy of the universe. He highleted the need for investment in energy transition and adoption of controlling Methane emission, increasing energy efficiency, use of CCUS and preventive maintenance.

Dr B Mohanty, Former Director General, PPAC, highlighted that there are slippage in the stated policies and targets are not followed vigoursly. We need a sound mechanism for follow up of the targets. The natural gas can be a bridge fule to trasition, for which the CGD is the most preferred segment. For this India needs additional 30000 km of pipeline network.

Dr Akhil Mehrotra, CEO PIL (Brookfield Canada) expressed that Renewables, Bio gas and Natural gas play very important role in energy transition. The driving factors for the transition are Control price volatility, LNG for long haul fleet,market reforms, GST on Gas, develop NG uses including gas-based power plants with improved heat rate.

The President, IEF, Shri R V Shahi in his concluding remarks appreciated the ideas shared by the speakers and advised to have another webinar on decreasing foreign exchange outgo by critically examining the domestic oil & gas production, import dependability and substitution of oil & gas by alternative resources.

Seminar on
'Pumped Storage Hydro Power Project'

30th August 2025, India International Centre, New Delhi

India Energy Forum organised a seminar on '**Pumped Storage Hydro Power Projects**' on 30th August 2025 at India International Centre, New Delhi.

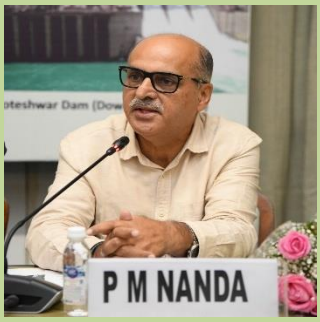
Shri Ghanshyam Prasad, Chairperson, Central Electricity Authority, and ex-officio Secretary to Govt. of India, virtually delivered his special address. He briefly enumerated the potential of PSPs in India (estimated 214 GW for on-river and off-river projects). He stated that presently 10 projects (9 on-river and 1 off-river) with 6,445.6 MW have been commissioned and 11 projects (4 on-river and 7 off-river) with 12,350 MW are under construction. He informed that 48 projects (2 on-river and 46 off-river) with 67,990 MW are under survey and investigation. He expressed that there has been rapid increase of renewable energy over the past few years which needs to be absorbed for utilization during the peak hours. The PSPs development present the most viable and reliable solution for integration of large Renewable Energy capacities. Shri Ghanshyam Prasad also informed that the Govt. of India has issued policy guidelines for accelerating the development of PSPs. He expressed concern for enhancing and expediting the matching transmission network for which necessary steps are being taken. Finally, Shri Ghanshyam Prasad reiterated the important role of PSPs development in energy transition.

Dr. H L Bajaj, Chairman, Power Group, IEF and former Chairperson CEA, delivered the welcome address.

Shri R V Shahi, President IEF and former Secretary Power, Govt. of India, delivered the presidential address elaborating on the requirement of faster development of PSPs. He expressed his firm view to accelerate the development of PSPs which are considered to be energy assets and an ideal complement to modern clean energy systems.

Shri Neeraj Verma, Executive Director, THDC India Ltd., had briefly given the progress on the development of Tehri Hydro Power Complex (2400 MW) having Tehri Dam & HPP (1000 MW) as upper reservoir, and Koteshwar Dam & HPP (400 MW) as lower reservoir with focus on 1000 (4x250) MW Tehri PSP, 2 units of which have been recently commissioned and balance 2 units of 250 MW each will be commissioned by October 2025/November 2025.

THDC had given the presentation detailing the execution of 1st variable speed machine installed in India. It covered various technical aspects and the challenges faced during construction and commissioning of the project.



Shri Praveen Nanda, Sr. Vice President, Greenko (pvt. sector), gave a presentation on the PSPs development, emphasising the execution of Pinnapuram PSP (off-river) in Andhra Pradesh. He informed the key considerations for selection of Pinnapuram PSP site having availability of solar and wind power in close proximity. The installed capacity of the project is 1,680 MW (6x240 MW and 2x120 MW). Shri Praveen Nanda elaborated on the special surface treatment of the dam with PVC geo-membrane (GSRD). He informed that all units have been commissioned.

Shri V S Rao, GM (Hydro), BHEL, also gave a presentation on the manufacturing readiness to meet the requirement for generating equipment supplies of development of PSPs in India as per CEA plans. He informed that BHEL has commissioned 48 pump-motor sets (3.4 GW) and further 53 pump-motor sets (7.1 GW) are under execution. He said that BHEL has annual manufacturing capacity of 2,500 MW for hydro sets at Bhopal. However, BHEL has 7000 MW annual manufacturing capacity for PSP and conventional hydro sets. He further informed that BHEL has strong manufacturing capabilities and is a Centre of Excellence for hydro machines. BHEL is participating in various IPPs PSP Tenders through indigenous developments.

Shri R V Shahi delivered his concluding remarks of the seminar proceedings. He appreciated the presentations given by THDC for on-river Tehri PSP 1,000 MW and Greenko for Pinnapuram 1,680 MW off-river PSP. He briefly mentioned that BHEL manufacturing capacity needs to be enhanced to match the PSP development as per the schedules envisaged by the CEA.

The seminar ended with a vote of thanks delivered by **Shri Satish C Sharma**, Convenor, Power Group IEF.

Full report of the Seminar will be published in the next issue of TOTAL ENERGY.

Glimpses of the Seminar on
'Pumped Storage Hydro Power Project'