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OPTIMISING COAL PRODUCTION AND PRODUCTIVITY

COAL PRICING AND FINANCING

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India to become a Developed Nation by 2047 is Achievable: Exponential Growth of Power Supply Holds the Key (Part – II)

R.V. SHAHI

The long-term projections, at the draft stage, made by the Central Electricity Authority, in respect of installed capacity for each of the technologies would, in effect, mean a per capita consumption less than 4,000 kwhr in 2047. As already highlighted earlier, the capacity under different technologies such as Thermal Power, Hydro Power, Solar Power, Nuclear Power, etc., though when aggregated, highlights a much larger installed capacity, it is the power generation which influences the per capita power consumption. Since the Plant load factor or the capacity utilisation factor differ from each other in relation to capacity, in ultimate analysis, based on profile of installed capacity, the projected power generation will need to be worked out. The aspirational target for a developed India, by 2047, will need much more of power than the projections which have been provided by the Central Electricity Authority (CEA).

CEA Projection (Draft) in GW			
	FY - 2024	**FY - 2032**	**FY - 2047**
Coal	217	259	235
Gas	25	25	10
Nuclear	8	20	54
Hydro	52	68	99
Bio-Mass	11	16	23
Wind	46	122	435
Solar	82	365	1187
Fossil	242	284	245
Non-Fossil	199	591	1798
Total	441	875	2043
PSP	5	27	116/703
BESS		47/236	360/1984

Approximately 7,000 kwhr of per capita power consumption by the year 2047 can be an aspirational target, even though it places India, in respect of this factor, only at par with China's per capita power consumption as of now. Given below are the projected per capita power consumption targets based on 7% growth and also based on 6% growth. It will be advisable to work along 7% growth with the objective that it is achieved and puts India among the developed nations category. It needs to be recognised, however, that availability of power and its supply in a reliable manner, no doubt, does lead to several consumption sectors planning their growth agenda, yet governments proactive policies and actions for various sectors of economy are equally essential to generate demands and consumption of power.

Target Per Capita Power Consumption (KWhr)	
7% Growth	**6% Growth**
1300	1300
1823	1739
2557	2328
3587	3116
5030	4169
7055	5579

With the per capita power consumption targets mentioned above it should be possible to arrive at the power generation targets keeping in view the population growth. Structuring the power sector profile to deliver the expected power generation will need to be an analytical exercise incorporating all the assumptions associated with different types of capacities delivering the kilowatt hours of power. Some of the principles that will need to be kept in mind would include the proportion of renewables vis-à-vis power expected from Thermal and Nuclear. Global experience indicates that a disproportionately high proportion of renewable capacity would lead to a challenging situation of managing the Grid besides the cost implication inasmuch as in case of renewable power the actual cost is significantly higher than the apparent cost.

It needs to be reiterated that in order to address the climate change concern, it would be essential for India to harness available renewable power potentials to the extent possible. However, the path to be followed will need to be moderated in a manner that the projected capacity profiles are aligned to the principle indicated above. This approach will not only take care of the impact and challenges associated with variable generation matching with load, but also the challenges associated with development of associated transmission infrastructure.

The growth strategy in the power sector should be structured on the basis of following broad approaches:

- The fast changing technological trends, particularly during last two decades, indicate that any longer time vision to be developed may be a challenge in view of uncertainties caused by ever evolving technological disruptions. In coming few years, time band of even two decades to focus on might get shorter. Hence, the approach should factor in the consequences of such likely developments.

- Power Sector Profile will have to undergo substantial changes, not only on account of intra-sector re-distribution of proportions of various sub-sectors (for example fossil versus non-fossil power), but also on account of re-distribution within overall energy sector. For example, Attempts for significantly changing the heavy dependence on import of petroleum fuels will need shift of consumption from petroleum to power – in transport, in rural agriculture, and also in industry. Strategic shifts being contemplated by various Government Departments and also major industries may be required to be aggregated to appropriately incorporate in medium and long term power sector growth.

- Starting with mid 80's, globalisation emerged as an important fulcrum for the industry, trade, and business developments in which mutual interdependence evolved as an important consideration for national and regional planning. The experiences of last few years indicate that this approach will need review and regional and local considerations, particularly in the context of energy security, may become an important factor.

- Climate change debates have been having considerable influence in the national and regional planning of economic and industrial developments in which experiences indicate that developing and underdeveloped countries have suffered enormously under the burden of these debates. Inertia of thoughts, over a long period, have had adverse impact on their economic and energy development programmes. Though India took a very strategic position right in the initial stage of these debates, and enunciated the principle of "Common and Differentiated Responsibility" to address climate change concerns, in effect, its developmental path did get affected due to various factors. The latest COP29 deliberations, concluded recently, further reinforce that developing and under developed countries have to be serious about the pace of their economic growth and be not unduly influenced by these deliberations. India's response has been adequate, may be a bit on higher side, with the resultant consequence of relatively lower economic growth.

- The present thrust in the power development programmes with renewables at the Centre stage should continue with full commitment. Solar and Wind in the forefront together with technological developments and domestic manufacturing, Bio-Mass, Bio-Gas, and Hydrogen, must be facilitated to occupy a much higher space subject only to two considerations – (a) while the full potentials should be harnessed, the pace needs to be fixed considering the requirement of balancing the variable load and generation path including also the cost impact of such variations, and (b) expansion should keep pace, by and large, with the progress of domestic manufacturing capability.

- Solar Power programmes could be planned on the twin approach of Ultra Mega capacity at

select locations together with large scale dispersal across the country as decentralised generation, particularly in rural areas. Gratifyingly this approach, which was discussed a few years ago, has been embraced by a number of States.

- The present provision of Rural Electrification Policy to enable generation and distribution of power up to 1 MW in rural areas not requiring license to distribute could be amended to raise the limit to 5 MW, so that required momentum is achieved in accelerated development of Solar facilities in rural areas under this dispensation. Large Thermal Power Companies may be obligated to develop renewable generation of at least equal amount of power they have or would have on Thermal Power.

- National level debates during last few years on Nuclear Power capacity, highlighting concerns of very slow growth over last sixty years have culminated into consensus followed by Governments clear thinking on the need for rapid expansion of Nuclear Power capacity through a number of agencies, going beyond Nuclear Power Corporation. Joint Venture with Public Sector Companies, Public Sector Companies on their own, Small and Medium Reactors even by private sector are some of the conclusions which are taking shape for gradual implementation. The objective is that Nuclear Power should occupy a reasonable proportion in the overall power profile of the country. While these developments are obviously going to contribute toward carbon free power generation in a significant way, the availability of Nuclear Fuel, and its dependence on import will need to be properly evaluated. The success on Pressurised Fast Breeder Reactor (PFBR) research when commercialised will definitely address the Fuel availability challenge. Till then a fast but careful expansion will be the right strategy.

- India has harnessed over 50,000 GW of Hydroelectric capacity. Though the remaining potential is of the order of 100 GW, it is believed that 50 GW of these can be harnessed in next ten to fifteen years. Initiatives to drive these to happen and policy changes facilitating these to happen should receive urgent consideration. Process of faster clearances, regulation on tariff determination with clarity, long term financing may need to be re-visited to provide required momentum on Hydro Project development.

- Hydro potentials in Bhutan and Nepal are such that these could be developed to meet their own power needs and yet leave a large scope for export to India. In the wake of Solar Power development programmes, these Hydro potentials in Nepal and Bhutan are indeed quite relevant and are of interest to India's programmes on Solar Power expansion. Recent developments and initiatives to embark upon Pump Storage Hydro Projects to provide the required back up for solar capacity expansion have picked up momentum. What is needed is to bring about consensus across the States to provide the required cooperation in the matter of clearances and other supports, and also develop understanding with the financial sector to support this initiative. Large solar developers may be obligated to develop Pump Storage Projects as a back-up, so that to a great extent a major part of challenge of load-generation variability is addressed.

- It appears reasonable to assume that Coal will continue to be relevant in overall profile of India's power sector, though the proportion of generation will drastically go down. In the next ten to fifteen years there appears to be no need for slowing down the capacity addition programme, particularly keeping in view the phasing down and phasing out progressively of old and inefficient power plants. India does not have much of Petroleum and Gas expansion possibility. In fact, in both these sectors the net production growth has been nil or negative. Coal is the only main energy resource in the country. Despite pressures from all sides, it might be advisable to continue, keeping in mind the overall requirement of enhancing per capita power consumption and, hence, per capita income of the country. These conclusions would, however,

be subject to review keeping in view the overall developments in the energy sectors from technology front of view. Continuing with Coal on the above approach should be subject of the following considerations.

- Thermal Power Plants should be asked to prepare definite programmes for reductions in Heat Rates (this means more efficient power generation from carbon emission point of view).

- There should be tough norms on flexible operations of power plants – to back down considerably when needed. Even if it requires certain retrofitting the same should be enforced with required regulatory intervention and consequent commercial consideration.

- Principle of encouraging Pit Head Power capacities should be a preferred option.

- Carbon Capture and Utilisation (CCU) may be made a medium and long term task for the Thermal Power generators.

- For the Coal producers and suppliers time bound programmes on Clean Coal Technologies (Washed Coal, Coal Gasification) should become enforceable agenda with penalty for non-compliance.

- The Coal Cess which was introduced in 2014-15 and later changed to GST should be passed on as a fund for Coal and Power Sector to take care of additional requirements of Clean Coal Technologies, flexible operations in Power Plants, CCU, and additional transmission to back up solar expansion.

Petroleum sector may consider major diversification for Battery manufacturing, production of Hydrogen, and EV Charging manufacturing and facilities. Large scale Bio-Gas production can be another area to reduce dependence on import. Perhaps a target of reducing import dependence from 85% to 75% in ten years, 75% to 65% in the subsequent ten years and so on could be a challenge which the sector could consider to address. Massive Initiatives will be needed to reduce import. These should aim at shifting large consumers of petroleum files to other energy forms Transport and Industry sector could be serviced with alternate energy options. The challenge for Petroleum Companies would call for commensurate response through technology developments and adaptations of global advancement advancements.

Power Sector growth aimed at making India a developed nation by 2047 will need, as explained, a growth rate of 7% leading to per capita power consumption of the order of 7,000 Kwhr. This will obviously require massive investments to be contributed by Government, Public Sector, and Private Sector. Confidence level of Banking Sector will need to be enhanced considerably, so that the finances do not stand in the way of moving forward on the targeted path. Power Sector of India will need to perform in a, manner, quite different from what has been demonstrated so far so as to fetch the financial support needed for these expansions. Reform of Distribution Sector, including its opening up, would be an important expectation, but a major challenge. Policy and Regulatory uncertainties also do create, quite often, a question mark in the development strategies of Corporate Sector, and more importantly of the Banking Sector. Frequent changes do provide a degree of unpredictability. These are important requirements if the type of growth projectile which is being suggested has to be achieved.

These will be discussed in the Third Part of this paper.

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From the Desk of the Honorary Secretary General

Dear Colleagues

I am happy to share with you the November Issue of Total Energy. This issue covers the Proceedings and Recommendations of the 23rd India Power Forum 2024 held on 21st October 2024 on the theme "Towards Net Zero Compliant Power Sector for Developed India" and important events of the month.

As per the deliberations in the conference, I am happy to share with you that as per Chairman, CEA, our thermal capacity shall peak at 280 GW and our peaking will happen in 2034-35. Chairman, CEA had noted that they would be reworking on the energy target every year. Further, nuclear will grow by more than 8 time by 2047 and considering the sharp fall in prices of storage battery, battery storage energy system will provide 80 per cent of the storage required by 2047 and 20 per cent shall come from pump storage plant.

However, I would like to add here that recently a Report by United Nations Environment Programme has painted a grim picture of the efforts or lack thereof, by countries to tackle greenhouse gas emissions so far.

The Emissions Gap Report 2024 highlighted that global greenhouse gas emissions set a new record of 57.1 gigatons of CO2 equivalent (GtCO2e) in 2023, an increase of 1.3% year-on-year. This was significantly higher than the 0.8% average rise between 2010 and 2019.

More worryingly, the report noted, the current climate promises by countries are not sufficient and may put the world on track for best case global warming of 2.6 degrees Celsius this century. The report also said that despite COP's repeated requests to strengthen the 2030 target of a 42% decline in emissions compared to 2019 levels to limit global warming to 1.5 degrees Celsius, there has been no meaningful progress.

IEF recently on 30th November organized a webinar on "Resource Adequacy Planning and Its Implementation by Discoms". The proceedings and recommendations will be covered in the next issue.

29th Conference of the Parties (COP29) was also held this month from 11th to 22nd November 2024 in Baku, Azerbaijan. The states assembled for the first day of the UN Climate Change Conference reached a consensus on standards for projects to qualify for carbon credits under Article 6.4 of the Paris Agreement, UN Climate Change reported. This step is a good move toward making Article 6.4 work as intended, but more needs to be done to ensure strong and effective implementation.

UN Climate Change Executive Secretary Simon Stiell highlighted that the new finance goal agreed at the UN Climate Conference in Baku is an insurance policy for humanity. "This deal will keep the clean energy boom growing and protect billions of lives. It will help all countries to share in the huge benefits of bold climate action: more jobs, stronger growth, cheaper and cleaner energy for all. But like any insurance policy – it only works – if the premiums are paid in full, and on time." He acknowledged that no country got everything they wanted, and that the world leaves Baku with a mountain of work to do.

India alone needs over $1 trillion in based on its climate-mitigation needs from its current Nationally Determined Contributions (NDC) spread over a five-year period. The country is working on a new NDC, due by February 2025, and it is unclear what shape that will take and how much India will need.

During this month, RIL signed an MoU to invest Rs 65,000 crore in setting up of 500 CBG plants in Andhra Pradesh. RIL said it has launched the first commercial-scale CBG plant in Barabanki, UP, and plans to expand to 25 CBG plants across India, with a goal for 100 CBG plants in the next five years. UP is also the chosen-ground for RIL's only other competitor in the CBG segment, Adani Total Gas, which has so far supplied 208 tonnes of CBG to GAIL from its Barsana unit in the State.

The entry of large industrial houses augur well for development of bio-gas sector.

With best wishes

K S Popli

Dedicated Task Force to Be Formed to Achieve 500 GW by 2030: Union Minister Pralhad Joshi

Union Minister of New and Renewable Energy **Shri Pralhad Joshi** announced that a dedicated task force with all stakeholders will be set up by the Ministry of New and Renewable Energy (MNRE) in collaboration with the Ministry of Power to achieve the goal of 500 GW by 2030. The Minister was addressing the valedictory session of the two-day Chintan Shivir event organised by MNRE in Bhubaneswar, Odisha.

The Union Minister emphasized the need to install 288 GW of renewable energy capacity over the next six years, requiring a substantial investment of ₹42 lakh crore, including transmission infrastructure. This requires all stakeholders to work together to solve the various challenges in the RE sector, he said.

Union Minister Joshi highlighted that the event brought together 117 industry leaders and 67 representatives from states and PSUs, with participation from 12 major renewable energy-producing states. He reiterated India's commitment to the "Panchamrit" goals announced by Prime Minister Narendra Modi, emphasizing the 2030 target of 500 GW of renewable energy capacity.

The Minister also said that MNRE will organize hackathons for startups in the RE sector, with assured offtake to promote indigenization of renewable energy technologies and solutions. A new Joint Centre of Excellence for R&D will also be established in collaboration with the Ministry of Power to foster innovation and technological advancements in the RE sector. The Minister called for the early finalization of Power Purchase Agreements (PPAs) and strict enforcement of Renewable Purchase Obligations (RPOs) to ensure the success of renewable energy projects.

Shri Joshi noted Odisha's immense renewable energy potential, with 140 GW of solar capacity and significant opportunities in green hydrogen, owing to its long coastline and port infrastructure. The Centre aims to develop Odisha as a major hub for renewable energy and explore the scope of green hydrogen production in the state. The potential for floating solar panels in Odisha will also be explored, he said. He also highlighted that a 6,000 MW manufacturing capacity for production of solar modules, solar cells & ingot-wafer at Dhenkanal District, Odisha with expected investment of around Rs. 9,000 crore is being set up by an agency. He also said that another agency is setting up 1,000 MW manufacturing capacity for production of solar modules & cells, at Infovalley-II, Khorda, Bhubaneswar, Odisha, with expected investment of around Rs. 730 crore.

Union Minister Joshi also highlighted that PM Surya Ghar Yojana will achieve over 5 lakh installations by the end of November 2024. He added that suggestions to expand the Production Linked Incentive (PLI) scheme for the domestic manufacturing of solar modules and cells are being considered.

Concluding his address, the Minister said, "We leave this Shivir not only with a stonger sense of purpose but also with a more refined and comprehensive roadmap than we had two days ago".

Deputy Chief Minister of Odisha Shri Kanak Vardhan Singh Deo stated that the Government of Odisha stands with the Union Government in meeting the 'Panchamrit' targets set by Prime Minister Shri Narendra Modi.

Secretary MNRE Shri Prashant Kumar Singh noted that the Chintan Shivir enabled the successful exchange of ideas and that the Ministry is committed to strong inter-ministerial coordination to solve the various challenges in the sector. Principal Energy Secretary Odisha Shri Vishal Kumar Dev also addressed the event. Additional Secretary Shri Sudeep Jain extended a vote of thanks to all stakeholders who attended the session.

The two-day Chintan Shivir 2024 kicked off with full vigour on November 14, 2024, at Bhubaneswar,

Odisha, discussing the critical challenges in the RE sector as outlined by Union Minister Shri Pralhad Joshi in his inaugural address. Over two days, 17 sessions encompassing a range of critical topics such as solar and wind energy deployment, green hydrogen, energy storage, land evacuation and transmission planning and policy development, were held to achieve ambitious goal of 500 GW of non-fossil fuel energy by 2030. These sessions were attended by leading decision-makers, financial institutions, industrialists, CEOs, and key officials from central and state governments who are integral to India's renewable energy journey.

NTPC focusing on mega projects in quest for 60 GW solar dream

NTPC will focus on gigawatts (GW)-scale solar power projects and limit wind and battery storage projects to 10% of the green portfolio, company chairman Gurdeep Singh said recently, even as the Rs 10,000 crore IPO of its green arm NGEL got subscribed 33% on the opening day.

Unfazed by the market slide following Donald Trump's election as the next US president, he said the perception of IPO valuation being 'punchy' was misplaced. "We had consulted with 100s of stakeholders and investors, who expected a higher price band, which we moderated as per (post-Trump) market conditions."

"NTPC enjoys special relationship with states, a privilege that helps clear land hurdles, a key concern for solar projects, which few others can claim. We have the experience, operating capacity and project pipeline. There is clarity on all aspects of our roadmap," he said.

On the focus on large solar projects, he said as a pure power producer building them in solar parks make more sense for us as aggregators set up the pooling station on site. "For projects of 100-200 MW, we would have to wait in queue for connectivity."

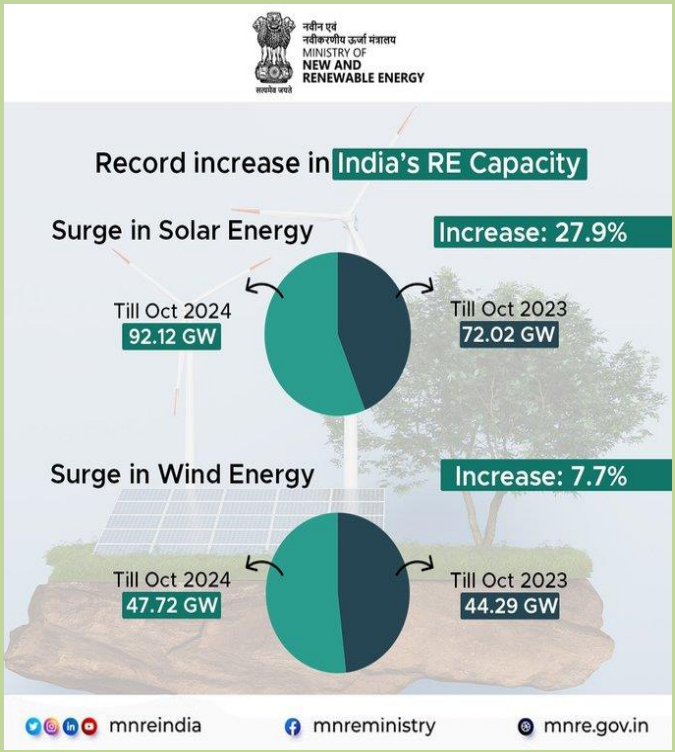
NTPC aims to ramp up renewable capacity to 19 GW by 2027 after nearly doubling the present capacity of 3.5 GW to 6 GW by 2025. 2032. which will make up nearly 45% of its total power generation capacity, and nearly double the present capacity of 3.5 GW to 6 GW by 2025.

India's Renewable Energy Sector Achieves Significant Growth

RE Capacity Increases by 24 GW, Solar by 20 GW

The Ministry of New and Renewable Energy (MNRE) has released its latest data, highlighting substantial growth in India's renewable energy sector from October 2023 to October 2024. This progress underscores India's commitment to achieving its clean energy targets in line with the 'Panchamrit' goals set by Prime Minister Shri Narendra Modi.

India's total renewable energy installed capacity increased by a staggering 24.2 GW (13.5%) in a year, reaching 203.18 GW in October 2024 from 178.98 GW in October 2023. This significant rise aligns with India's ambitious targets in the field of RE sector. Including nuclear energy, the total non-fossil fuel capacity rose to 211.36 GW in 2024, compared to 186.46 GW in 2023.



Solar and Wind Power Surge

- Solar Power: The solar sector saw a remarkable increase of 20.1 GW (27.9%), growing from 72.02 GW in October 2023 to 92.12 GW in October 2024. The combined total solar capacity, including projects under implementation and tendered, now stands at 250.57 GW, a significant rise from 166.49 GW last year.

- Wind Power: Wind energy also demonstrated steady growth, with installed capacity increasing by 7.8%, from 44.29 GW in October 2023 to 47.72 GW in 2024. Total capacity in the pipeline for wind projects has now reached 72.35 GW.

Capacity Additions

From April to October 2024, India added 12.6 GW of renewable energy capacity. In October 2024 alone, 1.72 GW was installed, marking an accelerated shift towards renewable energy.

The renewable energy projects under implementation and tendered saw significant expansion, with 143.94 GW under implementation and 89.69 GW tendered as of October 2024. This is a notable increase from 99.08 GW under implementation and 55.13 GW tendered as of October 2023, ensuring consistent progress towards India's clean energy targets.

Hydro and Nuclear Contributions

As of October 2024, large hydro projects contributed 46.93 GW to India's renewable portfolio, while nuclear power capacity contributed 8.18 GW. These contributions strengthen the diversity and resilience of India's renewable energy mix, supporting the country's comprehensive approach to green energy transition.

SECI signs MoU to promote Green Hydrogen initiatives

Solar Energy Corporation of India Ltd (SECI), under Ministry of New and Renewable Energy, signed a MoU with H2Global Stiftung to establish a collaborative framework to promote Green Hydrogen initiatives. This aims to enhance knowledge exchange on market-based mechanisms and foster cooperation between India and importing countries, thereby contributing to the global advancement of the green hydrogen economy.

The MoU was signed by Shri Sanjay Sharma, Director (Solar), SECI, and Dr. Susana Moreira, Executive Director, H2Global, on 19th November 2024 in the esteemed presence of Mr Timo Bollerhey, CEO (HintCo), Mr Markus Exenberger, Executive Director (H2 Global Foundation), Shri Prashant Kumar Singh, Secretary (MNRE), Shri Abhay Bhakare, Mission Director (NGHM), Dr Prasad Chapekar, DS (MNRE) and Shri K R Jyothi Lal, ACS Kerala.

This collaboration offers India the opportunity to work on joint tender design concepts, particularly in structuring joint tenders that aligns with India's ambition to become export hub of Green Hydrogen and its derivatives. The cooperation may provide valuable insights into global hydrogen market dynamics, including trade logistics and stakeholder engagement, which can be instrumental in furthering India's green hydrogen initiatives.

COP29 climate agreement a boost for India's carbon market ambitions

India's plans to set up a carbon market received a boost at the 29th Conference of the Parties (COP29) in Baku, Azerbaijan, after the United Nations Framework Convention on Climate Change (UNFCCC) ratified key rules for a global carbon trading mechanism at this UN-sponsored climate event, officials said.

Recently, states assembled for the first day of the UN Climate Change Conference reached a consensus on standards for projects to qualify for carbon credits under Article 6.4 of the Paris Agreement, UN Climate Change reported.

This agreement enables climate action by increasing demand for carbon credits and ensures that the

international carbon market operates with integrity under UN supervision. It also guarantees that emission reductions and removals are real, additional, verified, and measurable.

“This step is a good move toward making Article 6.4 work as intended, but more needs to be done to ensure strong and effective implementation,” said Dhruba Purkayastha, director - growth and institutional advancement, at New Delhi-based think tank CEEW.

India has faced delays in defining the terms, structure, and compliance measures for a carbon trading market, with Indian officials projecting a start date for the market by late 2025 or 2026. This would be three years after the government authorised the Bureau of Energy Efficiency to create an enabling mechanism. Officials attributed part of India’s delay to the non-finalisation of rules under Article 6 of the Paris Agreement. Article 6-compliant markets are expected to channel more investment to developing countries and enable them to target mitigation efforts where costs are lowest.

Article 6, proposed in the 2015 UN Paris Agreement, is an international framework that allows countries to achieve national emission mitigation targets via a market-based mechanism in which the private sector plays a key role. It aims to unlock climate finance based on a uniform global framework agreed upon by all nations. These measures are intended to help nations set up domestic carbon markets with a global reach. Key Sections of this Article are 6.2, 6.4, and 6.8, covering non-market approaches.

Article 6.4, approved, establishes a carbon crediting mechanism at the UNFCCC level, with operational rules and processes developed by a supervisory body and ratified by states. These credits can be used to meet nationally determined contributions (NDC) targets and by companies for compliance purposes, though they cannot be double-counted. If an Indian company uses credit for compliance, it cannot also be used by India for its climate mitigation targets under its NDC.

Simon Stiehl, chief of UN Climate Change, listed finalising Article 6 as a key negotiating priority at COP29. The full functioning of Article 6 will advance the realisation of NDCs, submitted by nations to the UN every five years, by reducing implemen-tation costs by $250 billion per year through cross-border cooperation.

The parties still need to agree on the remaining building blocks of Article 6, including Article 6.2 and the final elements of Article 6.4.

Climate Action Network (CAN) criticised framing Article 6 as part of the climate finance solution. CAN argued that countries like the UK and the US are pushing Article 6 as a major achievement, similar to the loss and damage fund agreed upon at COP28 in Dubai, but Article 6 push is not.

“Carbon markets can help to some extent in facilitating investments, but for a country like India, whose needs are vast, they are playing a limited role so far in financing India’s energy and clean industrial transition,” said Jagjeet Sareen, partner and global climate co-lead at Dalberg Advisors.

UN Climate Change has assessed the climate finance needs of 98 nations at around $500 billion annually. By pushing a $250 billion figure via Article 6, wealthier countries may be seeking to partially offset their funding commitments, explaining the urgency with which Article 6 was operationalised.

The build-up to this long-delayed agreement included an October meeting hosted by Azerbaijan, where the supervisory body for Article 6.4 proposed a set of standards for the article. ‘Sectors with $4.3 trn in debt face increased risk of environmental credit’

Sixteen sectors with $4.3 trillion in rated debt face heightened environmental credit risk, according to the latest heat map report by Moody’s Ratings. Sectors exposed to very high or high environmental credit risk account for 5.1 per cent of total rated debt, up from 3 per cent in 2015 at the time of the Paris Agreement’s unveiling. The new heat map report includes 90 sectors accounting for about $84 trillion in rated debt and explores their exposure to five different environmental risks.

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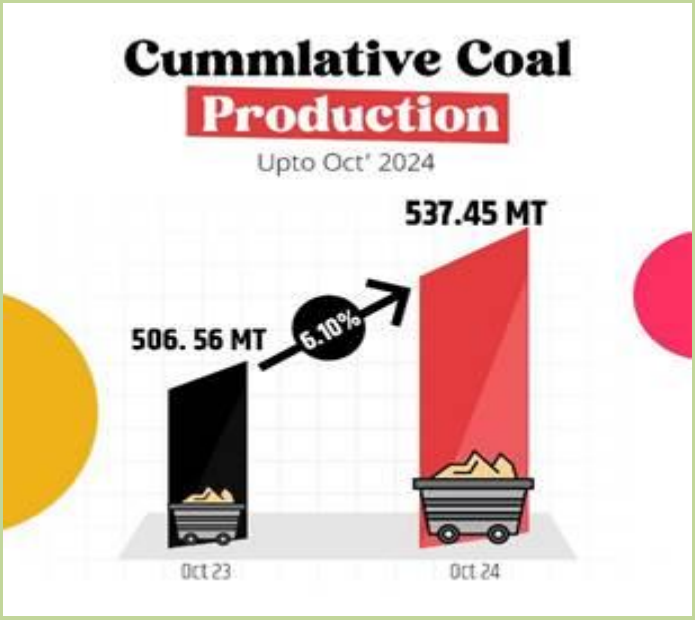
Overall Coal Production in October 2024 Touches 84.45 Million Tonne

The Ministry of Coal has achieved a notable upswing in overall coal production during October 2024, reaching 84.45 million tonnes (MT) and surpassing the 78.57 MT of the corresponding month last year, registering an increase of 7.48%. Coal production from captive and other entities also showed substantial growth, rising to 16.59 MT in October 2024 compared to 11.70 MT in the same period last year, reflecting a remarkable growth rate of 41.75%. The Cumulative coal production for the fiscal year up to October 2024 reached 537.45 MT, an increase from 506.56 MT during the same period in FY 2023-24, representing growth of 6.10%.



Additionally, coal dispatches witnessed a significant boost in October 2024, reaching an impressive 82.89 MT, showcasing a 4.60% increase over the 79.25 MT recorded in October 2023. Coal dispatch from captive and other entities also grew to 16.18 MT in October 2024, compared to 11.83 MT in October 2023, representing growth of 36.83%. Cumulative coal dispatch (up to October 2024) has risen to 571.39 MT in FY 2024-25 as compared to 541.51 MT during the corresponding period in FY 2023-24, reflecting growth of 5.52%.

The Ministry of Coal remains committed to ensuring a reliable coal supply to meet India's energy demands, with continued focus on boosting production, streamlining logistics, and supporting the nation's energy goals.

Coal Ministry Signs Agreements with Successful Bidders of 3 Coal Blocks

Two Coal Blocks Auctioned on Day 2 of 10th Round of Commercial Coal Mine Auction

Ministry of Coal has executed the agreements for 3 coal blocks with successful bidders on November 22, 2024. The event marked the successful auctions of 104 coal blocks till date since the launch of commercial coal mining in the country by Prime Minister Shri Narendra Modi. All these three coal blocks are fully explored coal blocks.

Secretary, Ministry of Coal, Shri Vikram Dev Dutt, along with Additional Secretary & Nominated Authority Ms. Rupinder Brar, handed over the agreements to the successful bidders of three coal blocks. During the occasion both officials assured full support & cooperation from the Ministry to ensure the smooth operationalization of the blocks. Shri Dutt emphasized the Ministry's commitment to facilitating the successful implementation of coal mining projects, which are expected to contribute significantly to India's energy security and economic growth.

The blocks for which these Coal Block Production and Development Agreements have been executed are Meenakshi and Rampia & Dip Side of Rampia coal blocks. The Successful Bidders include Hindalco Industries Limited and Jhar Mineral Resources Private Limited respectively.

The total annual revenue generation from these 3 coal blocks under commercial auctions is estimated at ~Rs. 2,709.95 crores considering production at aggregated Peak Rate Capacity level of ~27.00 MTPA. Once these blocks are fully operational, they are expected to generate employment for ~36,504 persons directly and indirectly and total investment of ~Rs 4,050 crores will be expended to operationalise these coal blocks. With the execution of CMDPAs for these 3 coal blocks, CMDPAs have been signed for 101 coal mines auctioned under commercial coal auctions.

Further, in the ongoing e-auction of 10th round, the Second day witnessed the auction of 2 coal blocks. The results for Day 1 are as under:Both the coal blocks are fully explored coal blocks. The total geological reserves for these 2 coal blocks are 180.26 Million Tonnes and Peak Rated Capacity (PRC) is 2.10 MTPA.

The results for Day 2 are as under:

S. No.	Name of the block	State	PRC (mtpa)	Geological Reserves (MT)	Closing Bid Submitted by
1	Bundu	Jharkhand	1.00	102.268	S M Steels and Powver Limited
2	Gare Palma IV-5	Chhattisgarh	1.10	77.990	Sarda Energy and Minerals Limited

These two coal blocks upon operationalization will generate Annual Revenue of ~Rs. 339.06 crores calculated at PRC of these coal blocks. These blocks will attract capital investment of ~Rs. 315.00 crores and will provide employment to ~ 2,839 people.

Five Coal Mines put up for Auction on Day One of 10th Round of Commercial Coal Mine Auction

Ministry of Coal had launched the auction of coal mines for commercial mining under 10th round on June 21, 2024. After evaluation of bids, forward e-auctions for nine mines commenced from 21.11.2024.

On the First day, 5 coal mines were put up for auction. One of the five coal mine is fully explored coal mine while 4 coal mines are partially explored coal mines. The total geological reserves for these 5 coal mines are 2,630.77 Million Tonnes. Cumulative Peak Rated Capacity (PRC) for these coal mines is 12.00 MTPA.

S. No.	Name of the Mine	State	PRC (mtpa)	Geological Reserves (MT)	Closing Bid Submitted by
1	Marwatola South	Madhya Pradesh	NA	126.300	Mineware Advisors Private Limited
2	New Patrapara South	Odisha	12.00	720.870	NLC India Limited
3	Sarai East (South)	Madhya Pradesh	NA	128.600	ACC Limited
4	Gawa (East)	Jharkhand	NA	55.000	Shreeji Nuravi Coal Mining and Trading Private Limited
5	Bartap(Revised)	Odisha	NA	1600.00	JSW Energy Utkal

These coal mines upon operationalization will generate Annual Revenue of ~Rs. 1106.91 crores calculated at PRC of these coal mines (excluding Partially Explored coal mines). These mines will attract capital investment of ~Rs. 1800.00 crores and will provide employment to ~ 16,224 people.

Coal Import by Domestic Coal Based Thermal Plants and Non-regulated Sector Declines during April to September 2024

Coal Import by Domestic Coal Based Thermal Power Plants Drop by 8.59% in April-September 2024

Non-Regulated Sectors See 9.83% Decline in Coal Imports during April-September 2024

The import of coal by non-regulated sectors (NRS) and domestic coal-based thermal power plants (for blending) declined by 9.83%, dropping to 63.28 MT during April to September, 2024, from 70.18 MT in the same period last year, and by 8.59%, falling to 9.79 MT from 10.71 MT, respectively. This demonstrates an increased reliance on domestic coal supplies for these sectors. However, there has been a rise in the import of coking coal, essential for the steel industry, and coal for imported coal-based (ICB) power plants, which are not substitutable by domestic coal.

The overall coal imports during April-September 2024 increased marginally by 1.36%, reaching 129.52 million tons (MT) compared to 127.78 MT in the corresponding period of the previous year.

In terms of value, overall imported coal during April-September 2024-25 stands at Rs. 1,38,763.50 Crore, a decrease from Rs. 1,52,392.23 crore during the same period last year. This reduction has resulted in huge savings of Rs. 13,628.73 Crore demonstrating a more cost-effective approach to coal procurement.

The Ministry of Coal remains committed to reducing dependency on imported coal where feasible, by ramping up domestic production and streamlining logistics. At the same time, imports of non-substitutable coal are strategically maintained to support critical industries like power and steel.

The Ministry reiterates its focus on ensuring energy security and cost efficiency while advancing towards the vision of Atmanirbhar Bharat. The commitment to energy security and economic efficiency remains paramount as we move forward.

Coal India Ltd under the Aegis of Ministry of Coal receives Green World Awards 2024 in London

Coal India Limited (CIL) under the aegis of the Ministry of Coal, has been conferred with the esteemed Green World Environment Award in the Corporate Social Responsibility (CSR) category along with the distinguished tile of Green World Ambassador. Ministry of Coal has overall responsibility of determining policies and strategies in respect of mining of coal and other minerals in large interest of the country.

This prestigious international award has been given to CIL for exemplary work in the field of CSR i.e Thalassemia Bal Sewa Yojna for permanent curative treatment of more than 600 Thalassemia patients through stem cell transplant also known as Bone Marrow Transplant (BMT).

CIL, in 2017 became the first Public Sector Undertakings to take up the CSR project for curative treatment of Thalassemia through BMT operations across the country. Under this scheme, financial assistance upto to Rs.10 lakh is provided by CIL for the BMT. As of now 17 prominent hospitals across India is partnering for this Thalassemia Bal Sewa Yojna.

Director (Personnel/IR), CIL, Shri Vinay Ranjan, received the Green World Awards 2024 during much-awaited presentation ceremony at The Orangery, Kensington Palace, London on 18th November, 24. The award was given by The Green Organization, which began in 1994 and is an independent, non-political, non-profit environment group, dedicated to recognizing, rewarding and promoting environmental best practices and CSR around the world. Receiving the award, Shri Vinay Ranjan said that this award inspires us all to take action, protect environment, and ensure a sustainable future for generations to come.

CIL, living up to its Corporate Citizenship role, is one of the largest spenders in the country under Corporate Social Responsibility (CSR). Coal India as a corporate entity contributes to the country's social development apart from its core role as energy provider.

CIL produces over 80% of India’s overall coal and contributes to 70% of the total coal-based power generation in the country. The company contributes to 55% of total power generation and meets 40% of the primary commercial energy requirements of the country.

CIL has adopted multiple measures to improve environment, such as expanding green cover over its mined-out areas, creating eco-parks and tourism spots, and providing mine water to lakhs of villagers for domestic and agricultural use.

Ministry of Coal Reviews Status of 127 Captive/Commercial Coal Blocks

In a significant stride towards strengthening India's energy security and advancing the vision of Viksit Bharat, the Ministry of Coal conducted a comprehensive review of 127 coal blocks on 13th and 14th November 2024. The review meeting was chaired by Additional Secretary and Nominated Authority, Smt. Rupinder Brar. The review encompassed 64 producing coal blocks and 63 non-operational captive/commercial coal blocks which are in advanced stages of operationalization, spanning Arunachal Pradesh, Assam, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, and West Bengal.

The review of 64 producing blocks showcased remarkable progress in India's journey towards Atmanirbhar Bharat in the energy sector. These blocks achieved an impressive production of 100.08 MT as of November 8th, 2024, marking a substantial 33.35% increase from the previous year. Demonstrating robust operational efficiency, the total dispatch reached 107.81 MT, recording a significant 34.38% year-on-year growth. This achievement underscores India's growing capability in managing its domestic coal resources efficiently, with 55 blocks already in production, one block commencing operations this year, and nine more poised to begin production in FY 2024-25.

During the crucial meeting, special emphasis was placed on strengthening the First Mile Connectivity, production optimization, and transportation infrastructure, aligning with the government's vision of modernizing the mining sector. Additional Secretary and Nominated Authority urged state government officials and allottees to accelerate the operationalization process, emphasizing its critical role in India's energy security framework.

The Ministry of Coal, as a key driver of India's energy independence, remains steadfast in its commitment to ensuring reliable coal supply. This commitment is fundamental to powering India's ambitious journey towards becoming a developed nation by 2047, as envisioned in the Viksit Bharat. Through strategic planning and efficient execution, the Ministry continues to strengthen India's energy backbone, fostering sustainable economic growth and reinforcing the nation's path towards self-reliance in the energy sector.

Ministry of Coal Receives Strong Industry Participation in Financial Incentive Scheme for Coal Gasification Projects

The Ministry of Coal (MoC) has received an enthusiastic response to the Financial Incentive Scheme aimed at promoting coal gasification projects, marking a significant milestone in India’s transition towards a sustainable, low-carbon future. The due date for submission of proposals for Category- I & III was on November 11, 2024, and the opening of technical proposal on November 12, 2024, saw robust participation from industry players, indicating growing confidence in the potential of coal gasification as a key enabler of India’s transition towards clean coal.

A total of five submissions were received—three in Category I (Government Public Sector Undertakings or Joint Ventures of PSUs) and two in Category III (Demonstration Projects/Small-Scale Plants). The level of engagement reflects the increasing recognition of coal gasification as a diversification strategy for the future of India’s coal sector.

Addressing the event, Smt. Vismita Tej, Additional Secretary (MoC), underscored the significance of this initiative, highlighting that the robust participation

in the scheme reflects the increasing enthusiasm for coal gasification and the industry's commitment to investing in cleaner, more efficient technologies. She assured participants that the Ministry of Coal remains committed to collaborating with all stakeholders, addressing any concern in its journey toward a sustainable future.

The Financial Incentive Scheme, supported by a substantial financial commitment of ₹8,500 crore, is part of India's broader strategy to achieve 100 million tonnes (MT) of coal gasification by 2030. This initiative is set to harness India's vast domestic coal resource in a more environmentally responsible manner, contributing to the nation's energy transition while advancing its climate goals.

Further, the submission deadline for Category II (Private Companies or Government Public Sector Undertakings) has been extended to January 10, 2025, and the Ministry is actively seeking broader participation from stakeholders in this category to further strengthen the momentum of the initiative.

Coal Production from Captive/Commercial Mines Crosses 100 MT

As per the Ministry of Coal's latest figures as of November 8, 2024, India's coal production from Captive and Commercial mines has exceeded 100 Million Tonnes (MT) marking a significant milestone in the nation's journey towards Prime Minister Narendra Modi's vision of Viksit and Atmanirbhar Bharat, as it has been reached nearly 100 days earlier than the previous financial year, which was achieved in January 2024.

The production from captive/commercial coal mines during the period of 1st April 2024 to 8th November 2024 is 100.08 MT whereas the total production during the same period in FY 2023-24 was 75.05 MT indicating a year-on-year growth of 33%. Similarly, the total dispatch from captive/commercial coal mines during the period of 1st April 2024 to 8th November 2024 is 107.81 MT whereas the total dispatch during the same period in FY 2023-24 was 80.23 MT indicating a year-on-year growth of 34%. Notably, the share of captive and commercial coal mines in India's total coal production has been steadily increasing, reflecting the success of reforms in the coal sector and strengthening the nation's path toward self-sufficiency in energy resources. The Coal Ministry is optimistic about reaching a production target of more than 170 million tonnes from captive and commercial coal blocks in 2024-25.

This achievement demonstrates India's growing capabilities in the coal sector and represents a significant advancement in the country's progress toward energy independence and economic growth, aligning perfectly with the government's Viksit Bharat 2047 goals. The increasing share of captive and commercial coal production in the country's total coal output underscores the success of policy reforms and private sector participation in this crucial sector. The Ministry of Coal continues to focus on maintaining this growth while ensuring environmentally responsible mining practices.

Coal India Steps into 50th Year

Continuing to meet India's coal requirement and bolstering the energy sector, the state owned Coal India Limited (CIL) stepped into its 50th year of inception on 1st November 2024. CIL came into being on 1st November 1975 as an apex holding company of the nationalized coking coal (1971) and non-coking mines (1973).

Congratulating Coal India, Union Minister of Coal and Mines, Shri G Kishan Reddy said, "As Coal India enters into its Golden Jubilee Year with many milestones under its belt, I convey my best wishes to the company. Coal is yet to peak to its full potential in India. Indigenous production is vital to avoid expensive imports. Coal India has to ramp up production to higher levels in future with equal importance to people oriented social responsibility, welfare and safety".

It had been an eventful near five-decade journey for CIL. The company braved many changes and challenges, trials and tribulations but managed to deliver what was expected of it. From a pure play coal producing company, Coal India is now diversifying into solar power, pithead power stations, coal gasification and critical minerals in the National interest.

Central Electricity Authority approves the Uniform Protection Protocol for users of the Indian Grid for implementation on Pan India basis

National Power Committee (NPC) in consultation with RPCs prepared the Uniform Protection Protocol for users of Indian Grid for implementation on Pan India basis. The same was approved in 15th National Power Committee Meeting held on 14.11.2024 at Nagpur, Maharashtra under the chairmanship of Shri Ghansyam Prasad, Chairperson, CEA.

The meeting was attended by high level dignitaries of Power sector : Shri Hemant Jain, Member (GO&D), CEA, Shri Mr. S R Narasimhan, Chairman & Managing Director of Grid-India, Chairpersons of Regional Power Committees/Technical Coordination Committees of RPCs, Member Secretaries of RPCs and NPC, and Representatives from CTU and CEA. As per IEGC, 2023 , a uniform protection protocol to be there for the users of the grid for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system.

The Uniform protection protocol aims to ensure Grid stability, reliability, security and also greatly supports the Government of India's vision for integration of 450 GW Renewable Energy into the National Grid by 2030 and ambitious target of 2100 GW of Renewable energy by 2047.

Key features of the Uniform Protection Protocol:

1. Applicability: The Uniform Protection Protocol shall be applicable to all Regional entities, State/Central/Private Generating Companies/ Generating Stations, SLDCs, RLDCs, CTU, STUs, Transmission Licensees and RPCs, connected at 220 kV (132 kV for NER) and above.

2. General Philosophy of Protection System: The General Philosophy of Protection System covers the Objective, Design Criterion and other details.

3. Protection Schemes: This Protocol addresses the protection requirements for thermal and hydro generating units, renewable energy generations (REGs), battery energy storage system (BESS), substations, transmission lines, and HVDC terminals.

4. Monitoring and Audits:

o Disturbance Monitoring, Analysis, and Reporting: The Purpose is to ensure that adequate disturbance data is available to facilitate Grid event analysis. The analysis of power system disturbances is an important function that monitors the performance of protection system, which can provide information related to correct behavior of the system, adoption of safe operating limits, isolation of incipient faults.

o Protection Audits: As per the Central Electricity Authority (Grid Standards) Regulations, 2010, IEGC Grid Code Regulations 2023 and approved SOP for Protection System Audit.

o Performance Monitoring: Monthly submission of protection performance indices by users/entities to RPCs and RLDCs.

5. Compliance Monitoring: Non-compliance is reported to RPCs, and unresolved violations are escalated to the Commission for suitable directions.

During this meeting, various other key issues of Indian Power Sector such as transition to Five (5) minute Interface Energy Meters along with AMR system for PAN India, Unified Accounting Software for Energy Transactions, SOP for VOIP connectivity, Unified Real Time Dynamic State Measurement (URTDSM) project phase-II, MPLS Technology in ISTS Communication, Solution towards SCADA & Real Time data mismatch, Establishment of State-of-the-Art National Unified Network Management System (N-UNMS) in main & backup configuration integrating all the regional UNMSs, SOPs for Protection Audit, GD/GI/Tripping, Communication Audit of substations, Communication system outage planning of Indian Power System were also deliberated and further course of actions decided.

Inauguration of first trilateral power transaction – from Nepal to Bangladesh through the Indian Grid

Union Minister for Power and Housing & Urban Affairs, Shri Manohar Lal, jointly inaugurated the

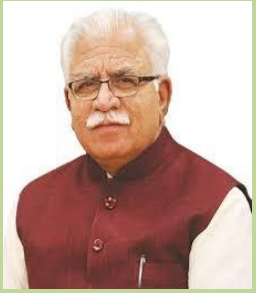
power flow from Nepal to Bangladesh, along with Md. Fouzul Kabir Khan, Adviser, Ministry of Power, Energy and Mineral Resources, Government of Bangladesh and Mr. Dipak Khadka, Minister of Energy, Water Resources and Irrigation, Government of Nepal through a virtual event hosted by the Ministry of Energy, Water Resources and Irrigation, Government of Nepal. This historic occasion marks the first trilateral power transaction which has been carried out through the Indian grid.

2. The Government of India had announced its decision to facilitate the first trilateral power transaction from Nepal to Bangladesh, through Indian grid with an export of upto 40 MW of power during the visit of the former Prime Minister of Nepal, Mr. Pushpa Kamal Dahal 'Prachanda' to India from 31 May to 3 June 2023. During the visit, both sides had expressed their commitment towards greater sub-regional cooperation, including in the energy sector, which would lead to increased inter-linkages between the economies for mutual benefit of all stakeholders.

3. Subsequently, a tripartite power sales agreement between NTPC Vidyut Vyapar Nigam, Nepal Electricity Authority and Bangladesh Power Development Board was signed on 3 October 2024 in Kathmandu.

4. The start of this power flow from Nepal to Bangladesh through India is expected to boost sub-regional connectivity in the power sector.

Union Minister Shri Manohar Lal chairs Conference of Power Ministers of States & UTs in New Delhi



The conference of Power Ministers of State/ UTs was held on 12th November 2024 in New Delhi. Shri Manohar Lal, Union Minister of Power and Housing and Urban Affairs chaired the conference. Minister of State for Power and NRE Shri Shripad Yesso Naik was also present in the conference. Chief Minister of Jammu & Kashmir, 3 Deputy Chief Ministers and 12 Power Ministers of States attended the event along with Principal Secretaries of States, Secretary (Power), Secretary (MNRE) and UTs.

During the Conference, detailed deliberations were held with focus on operational performance and financial viability of DISCOMs, review of RDSS, best practices in implementing Smart Metering, Electricity (Rights of Consumers) Rules, PM-Surya Ghar Yojna, Resource Adequacy plan, energy storage, Renewable Energy, National Transmission Plan, EV charging infrastructure, listing of State GENCOs / TRANSCOs / DISCOMs, Carbon Markets, National Green Hydrogen Mission etc. The States provided their inputs and suggestions on each of these pertinent issues.

During the conference, States of Madhya Pradesh and Assam also made a presentation on best practices in Smart Meter.

In his address, Shri Manohar Lal, Hon'ble Union Minister of Power and Housing & Urban Affairs, welcomed all the dignitaries. He highlighted that today the peak Demand is as high as 250 GW has been effectively met by Collective efforts. However, in view of growing demand, efforts are required to increase the capacity.

He pointed out that financial viability of Distribution Sector is another concern, vital for the overall growth of power sector in the country. He mentioned that ACS-ARR gap has improved to Rs. 0.21/kWh in FY 2023-24 as per provisional accounts from Rs. 0.45/kWh in FY 2022-23.

He emphasized that the States need to ensure timely payment of Government dues and Subsidies. For Government Dues States may establish Centralized mechanism for payment of Govt. dues and all Government offices should be brought on prepaid Smart meter by March 2025. States were asked to work on ways to reduce the DISCOM debts.

He mentioned that to promote smart meters, 5% rebate may be provided by States to prepaid consumers and must do effective consumer engagement.

He further mentioned that DISCOMs need to make efforts for expeditious implementation of works sanctioned under RDSS.

While launching the Phase -II of Powerthon, Hon'ble Minister mentioned that this would help in bringing innovative solutions based on AI, for problems currently being faced by the DISCOMs. Through a competitive process, 40 potential technology solutions will be incubated with a total financial support of up to Rs. 37 Cr. under Powerthon-II and assistance of up to Rs 6 Cr shall also be provided to DISCOMs for scaling up the solutions already identified in Phase 1.

It was mentioned that a combined Ranking Methodology has been developed for ranking of DISCOMs to create healthy competition. The first ranking to be published by January 2025.

Hon'ble Minister emphasized DISCOMs should effectively implement Rights of Consumers under the Electricity Rules and should provide compensation to the consumers for deficiencies in services. He also mentioned that DISCOMs should promote the roof top installation under PM Surya Ghar Yojana.

He mentioned that with the growing power demand, there is a growing need for investment in the sector and also a need to improve the operational efficiencies of the utilities in the sector for which States may identify and take up utilities for listing.

It was mentioned that Resource Adequacy is critical to meet the growing power demand and States need to tie up capacity as per the Resource Adequacy plan. States may also optimise their power purchase based on complementarity of demand. Further, contingency plan to be also made for meeting the peace load during high demand period.

It was mentioned that Ministry of Power to work with Ministry of Coal on rationalisation of linkage of coal sources to thermal plants. For efficient disposal of fly ash, back filling of abandoned coal mines needs to be taken up at the earliest. It was also suggested that National merit order despatch may be followed so that overall cost of supply to DISCOMs could be reduced.

Hon'ble Minister mentioned States should focus on Nuclear based Power Plant. Capacity likely to grow from 8GW to 20 GW by 2032. States which are away from the coal sources should consider setting up of Nuclear Power Plants at the sites where coal based thermal power plants have completed their life.

Hon'ble Minister emphasized that States should also take up Pumped Storage Projects (PSPs) and Battery Energy Storage Systems (BESS) in Renewable Energy rich areas which would help in meeting peak demand in non-solar hours and in better integration of RE resource in grid. He also stated that states should focus on PSP. He also highlighted that Capacity is to grow up from around 5GW to 27 GW by 2032. He mentioned that the Ministry is supporting installation of BESS capacity of 12 GWh under the Viability Gap Funding Scheme and that States should avoid levying any water-cess charges and other such charges on Power Generation.

He mentioned that today India has the largest synchronised grid, but robust transmission system needs to be in place for evacuation of the renewable power as per planned capacity. Comprehensive plan is also needed for intra-state transmission for atleast 10 years in line with ISTS transmission lines. States to identify transmission projects for Green Energy Corridors Phase-III and adopt revised guidelines for payment of compensation in regard to RoW for transmission lines and resolves pending RoW issues at the earliest.

He further mentioned that the States should adopt the SLDC workforce adequacy guidelines and undertake necessary restructuring of their Load Despatch Centres.

Further, he mentioned that use of technology should be leveraged in the Power Sector and necessary cybersecurity guidelines to be adhered to by the States. Demand Forecasting to be taken up on priority by the States taking into account the dynamic demand growth owing to rising economy.

Further, he mentioned that all States should ensure flexible operation of their coal-based power plants up to 40%.

In his closing remarks, Hon'ble Minister of State for Power & NRE mentioned that Government of India is committed to achieving 500 GW of non-fossil fuel power by 2030, enhancing energy storage solutions, and integrating more renewable energy into the grid.

A comprehensive plan has already been finalized to address transmission requirement for evacuation of RE. However, in order to bring renewable energy to consumers, a comprehensive plan for intra-state transmission is also needed. He requested States to periodically evaluate the development progress of their downstream networks to ensure alignment with the Interstate Transmission System (ISTS) network.

Secretary (Power) Shri Pankaj Agarwal in his address highlighted the major concerns in the Power Sector. He urged the States for continued support in implementing the reform measures so as to make the Power Sector viable. He requested the States for timely implementation of the works under RDSS which would help make the Distribution Sector operationally efficient. Further, he also urged the States for implementation of the Resource Adequacy Plan and to resolve pending issues in ongoing projects in the Generation and Transmission Sector.

India's energy demand to grow 5.5% in FY 2025

India's power demand is projected to grow around 5.5% in fiscal year (FY) 2025 with incremental capacity addition ranging 32 gigawatts (GW) to 35 GW, according to India Ratings and Research (Ind-Ra).

The expected demand is lower than the previous fiscal year's 7.4% and FY 2023's 9.7%.

Ind-Ra said extreme weather conditions witnessed in the first half of FY 2025 led to volatility in energy demand in the first and second quarter. All-India peak demand had reached an all-time high of nearly 250 GW in May 2024, up about 13% from a year ago.

"However, the demand moderated significantly during August-October 2024 with temperatures cooling down following a better monsoon during the year and also due to a moderation in the industrial activity," the company said.

Ind-Ra said renewable energy will lead capacity additions, with its share reaching 23% in FY 2025. Currently, there are nearly 80 GW of under-construction solar, wind and solar-wind hybrid capacities, and another 95 GW under various stages of development.

The agency expects 28 GW to 30 GW of renewable energy capacity addition this fiscal (11 GW achieved in the first half of FY 2025), largely under solar.

Proposal for construction of 186 MW Tato-I Hydro Electric Project in Arunachal Pradesh approved

The Cabinet Committee on Economic Affairs, chaired by the Prime Minister Shri Narendra Modi has approved investment of Rs.1750 crore for construction of Tato-I Hydro Electric Project (HEP) in Shi Yomi District of Arunachal Pradesh. The estimated completion period for the project is 50 months.

The project with an installed capacity of 186 MW (3 x 62 MW) would produce 802 Million Units (MU) of energy. The Power generated from the Project will help improve the power supply position in the state of Arunachal Pradesh and will also help in balancing of the national Grid.

The Project will be implemented through a Joint Venture Company between North Eastern Electric Power Corporation Ltd. (NEEPCO) and the Government of Arunachal Pradesh. Government of India shall extend Rs.77.37 crore as budgetary support for construction of roads, bridges and associated transmission line under enabling infrastructure besides Central Financial Assistance of Rs.120.43 crore towards equity share of the State.

The state would be benefitted from 12% free power and another 1% towards Local Area Development Fund (LADF) besides significant infrastructure improvement and socio-economic development of the region.

There will be significant improvement in infrastructure, including the development of around 10 kilometres of roads and bridges, for the project which shall be mostly available for local use. The district will also benefit from the construction of essential infrastructure such as hospitals, schools, vocational training institutes like ITIs, marketplaces, playgrounds, etc. to be financed from dedicated project funds of Rs.15 crore. Local populace shall also be benefitted from many sorts of compensations, employment and CSR activities.

India Set to Increase Sedimentary Basin Exploration to 16% by 2025, Aims for 1 Million Sq. Km by 2030: Shri Puri

"Energy today has become the spinal cord for economic growth and development," said Shri Hardeep Singh Puri, Minister of Petroleum & Natural Gas, during the inaugural ceremony of GEO India 2024, India's premier South Asian Geosciences Conference and Exhibition in Greater Noida recently. In his keynote address, Shri Puri highlighted the critical importance of energy in driving economic progress, especially in a country like India, where the demand for energy is increasing rapidly in line with its growing economy.

The Minister expressed his delight at being part of the event, which brings together leading experts from the Exploration and Production (E&P) sector both from India and abroad. GEO India 2024, organized by the Association of Petroleum Geologists, India, is the sixth edition of the conference and exhibition, with the theme "Exploring New Dimensions of Energy Dynamics."

With India's fuel demand growing at three times the global average, Shri Puri highlighted that 67 million people visit petrol pumps every day in India. This surging demand is expected to drive 25% of the global increase in energy consumption over the next two decades. "Balancing the trilemma of availability, affordability, and sustainability is not only a priority but a commitment that we are meeting head-on with a focus on exploration, production, and energy security," he said.

India's energy landscape is rapidly evolving, with the country boasting 651.8 million metric tons of recoverable crude oil reserves and 1,138.6 billion cubic meters of recoverable natural gas reserves within its sedimentary basins. Despite these abundant resources, a significant portion of India's exploration potential remains untapped. Shri Puri pointed out that when the current government took office in 2014, only 6% of India's sedimentary basins had been explored. Today, this figure has risen to 10%, and with further exploration activity under the Open Acreage Licensing Policy (OALP) rounds, this is set to increase to 16% by 2025. By 2030, the government aims to expand the nation's exploration acreage to 1 million square kilometers, further bolstering India's energy security.

The Minister also outlined several significant reforms implemented under the current government to stimulate growth in India's energy sector. Key reforms include simplifying the approval process for exploration and production activities, reducing 37 approval processes to just 18, of which nine are now available for self-certification. Additionally, the introduction of the Oilfields (Regulation and Development) Amendment Bill in 2024 ensures policy stability for oil and gas producers, allows for international arbitration, and extends lease periods. Furthermore, the government has reduced "No-Go" areas in the Exclusive Economic Zone (EEZ) by almost 99%, opening up vast new areas for exploration.

Shri Puri also highlighted the shift from the previous regime's Production Sharing Contracts (PSCs) to the new Revenue Sharing Contracts (RSCs), which provide greater clarity and predictability for investors. He emphasized the establishment of a Joint Working Group (JWG) comprising stakeholders from private E&P companies, National Oil Companies, the Ministry of Petroleum and Natural Gas (MoPNG), and the Directorate General of Hydrocarbons (DGH) to address industry concerns and improve the ease of doing business.

Another key area of focus has been improving access to data concerning India's sedimentary basins. The government has made significant strides in facilitating data availability through initiatives like the National Seismic Programme (NSP) for onshore areas, EEZ surveys for offshore areas, and the opening up of previously unexplored regions such as the Andaman Basin. Shri Puri noted that the government is also making data more accessible to international companies by setting up a new data centre at the University of Houston, enabling foreign firms to view critical geological data with ease.

The recent Open Acreage Licensing Policy (OALP) bidding round IX marked a historic milestone, with

136,596 square kilometers of exploration area offered in 28 blocks across 8 sedimentary basins. Notably, 38% of the area offered in this round had previously been classified as “No-Go” areas. The round saw a strong response, with a total of 60 bids received for the 28 blocks, reflecting heightened interest from both Indian and foreign companies. The average number of bids per block increased to 2.4, compared to just 1.3 per block in the previous round. Looking ahead, Shri Puri expressed optimism about India’s energy future, particularly in the field of green hydrogen. With projects focused on hydrogen blending in natural gas pipelines, the localization of electrolyser technologies, and the promotion of bio-pathways for green hydrogen production, India is positioning itself as a future global leader in green hydrogen production and exports. The Minister emphasized that green hydrogen is seen as the fuel of the future, and India is committed to becoming a global hub for its production.

“I have great faith in the innovative minds of geoscientists to lead an energy revolution in India, ensuring energy security for every citizen and meeting future challenges,” Shri Puri said.

Shri Puri encouraged the participants of GEO India 2024 to continue fostering innovation, embracing sustainability, and collaborating to address the challenges of the future.

India's petroleum imports rise 7.7% in FY25, domestic crude production declines

India's petroleum imports increased by 7.7% during April-October FY 2024-25, with liquefied petroleum gas (LPG), petcoke, and lubricants being the key contributors, as per data released by the Petroleum Planning and Analysis Cell (PPAC). However, in October 2024, imports saw a marginal decline of 2.2% compared to the same month last year.

The country’s crude oil imports rose by 3.5% in the first seven months of FY 2024-25 and by 4.2% in October 2024 compared to the corresponding period last year. The net import bill for October 2024 stood at $10.6 billion, lower than $11.8 billion in October 2023, reflecting reduced global crude prices, which averaged $75.66 per barrel in October 2024 compared to $91.05 in the same month last year.

Domestic crude production faces challenges
Domestic crude oil production in October 2024 fell by 4.9% year-on-year to 2.4 million metric tons (MMT). Among producers, Oil India Limited (OIL) accounted for 0.3 MMT, ONGC produced 1.6 MMT, and private operators contributed 0.5 MMT.

Refineries, however, processed 21.3 MMT of crude oil in October 2024, registering a 3.6% increase compared to the same month last year. Public Sector Units (PSUs) processed 14.1 MMT, while private refiners handled 7.2 MMT. The cumulative crude processing during April-October FY 2024-25 grew by 2% year-on-year.

Petroleum product output and consumption
Petroleum product production for October 2024 rose by 5.2% year-on-year to 23 MMT, with diesel comprising 41% of the output. Other key products included motor spirit (16.8%), aviation turbine fuel (6.6%), and LPG (4.5%). For the April-October FY 2024-25 period, petroleum production grew by 2.8%.

India’s petroleum consumption reached 137.6 MMT during April-October 2024-25, marking a 3% yearon-year increase. The consumption of motor spirit grew by 7.4%, LPG by 6.6%, and aviation turbine fuel (ATF) by 10.2%. Petroleum consumption in October 2024 alone increased by 2.9% to 20 MMT compared to October 2023.

LNG imports and natural gas trends
LNG imports surged by 10.5% in October 2024 to 2,932 MMSCM, and cumulative imports for AprilOctober FY 2024-25 were 22.2% higher at 22,085 MMSCM. Natural gas consumption in October 2024 rose by 4.2% year-on-year to 6,005 MMSCM, with cumulative consumption for April-October 2024-25 showing an 11.2% increase.

However, gross natural gas production for October 2024 fell by 1.6% year-on-year to 3,111 MMSCM. Cumulative production for April-October FY 2024-25 was slightly higher, at 21,271 MMSCM, representing a 1.1% growth compared to the previous year.

Minister Hardeep Singh Puri outlines vision for India's energy sector, emphasizing 3 key principles: availability, affordability, and sustainability

“India is poised to become the third-largest economy in the world within the next five years and a developed nation by 2047,” stated Shri Hardeep Singh Puri, Minister of Petroleum and Natural Gas, in his address at the 12th Public Sector Enterprises (PSE) Summit, organised by Confederation of Indian Industry (CII) here today. Reflecting on India’s transformation from a fragile economy in 2014 to the world’s fifth-largest economy today, Shri Puri highlighted the role of Public Sector Enterprises (PSEs) in driving the nation’s remarkable economic growth and advancing its sustainable energy future.

Shri Puri underscored that India’s trajectory toward becoming a global economic powerhouse is rooted in robust reforms and the dedication of its PSEs. He praised the resilience and performance of Public Sector Enterprises over the last decade, noting that their contributions have been integral to India’s economic stability and progress. “As we look to the future, the next few years will be critical in laying the groundwork for India’s next leap forward,” he said.
The Minister shared several key statistics illustrating the remarkable performance of India’s Public Sector Enterprises. The net worth of Central Public Sector Enterprises (CPSEs) has increased by 82%, from Rs 9.5 trillion in FY14 to Rs 17.33 trillion in FY23. The contribution of CPSEs to the national exchequer—through excise duties, taxes, and dividends—has more than doubled, rising from Rs 2.20 lakh crore in FY14 to Rs 4.58 lakh crore in FY23.

The Minister outlined a vision for India's energy sector, emphasizing three key principles: availability, affordability, and sustainability. “Sustainability is the cornerstone of our energy strategy and aligns directly with our larger vision of transforming PSEs into engines of sustainable growth,” he said.

A prime example of India’s focus on sustainability, Shri Puri highlighted the significant progress in bioethanol blending. “From 1.53% in 2014, ethanol blending has surged to 15% in 2024, with the government advancing the target of 20% blending to 2025—five years ahead of schedule,” he said. The Minister also revealed that discussions have already started on developing a roadmap for the post-2025 phase i.e. after attainment of 20% ethanol blending target, ensuring continued growth in the bioethanol sector and advancing India’s renewable energy goals.

On the subject of fossil fuels, the Minister acknowledged that while India is steadily transitioning to cleaner energy sources, fossil fuels will continue to be part of the energy mix for the foreseeable future. He highlighted that the government's approach would be to balance the energy transition while ensuring energy security, stability, and affordability for all citizens.

Shri Puri also highlighted the major reforms in the Exploration and Production (E&P) sector, which have opened up significant new areas for oil and gas exploration. “We have reduced No-Go areas in Exclusive Economic Zones (EEZ) by 99%, allowing for the largest-ever offering of 1,36,596 square kilometers in a single bid round under the Open Acreage Licensing Policy (OALP). Of these, 13 blocks, covering 51,405 square kilometers, were previously classified as ‘No-Go’ areas,” he explained. The Minister also emphasized India’s growing potential in green hydrogen, noting that the country’s local demand, production capacity, and consumption patterns make it an ideal candidate to become a global leader in green hydrogen production. He also touched upon the integration of Artificial Intelligence (AI) in India’s energy systems, citing technological innovation as a key driver of efficiency and sustainability.

The Minister congratulated the CII for its efforts in empowering Public Sector Enterprises through organizing summits that provide a platform for collaboration and knowledge exchange. "These summits enable PSEs to share experiences, challenge norms, and find solutions for future challenges," he said. He emphasized the importance of collective efforts from all stakeholders to build a future where India's PSEs stand as pillars of excellence, integrity, and progress, guiding the nation towards sustainable growth.

India to achieve net carbon zero emission target by 2070

Union Minister for Petroleum and Natural Gas Hardeep Singh Puri has said through biofuel blending, the country could save 91,000 crore rupees on the import bill and this money could be utilized for the benefit of the agricultural sector. Inaugurating the 27th Energy Technology Summit in Bengaluru recently, he said India has achieved the second position in biofuel blending globally. He expressed confidence that India will achieve the target of 20 percent biofuel blending by next year, much ahead of schedule.

As our refineries takes to green energy, the country will succeed in the goal towards green hydrogen, the Minister said. The Minister said India's energy demand will grow by two and a half times by 2047.

Speaking at the event Shri Puri highlighted India's remarkable progress in the refining sector, which has transformed from a position of deficit in 2001 to becoming a global refining hub and net exporter of high-quality petroleum products. "India has witnessed a spectacular growth in the refining sector over the years," said Shri Puri. "From a deficit scenario in 2001, the country achieved self-sufficiency in refining, and today, India is a major exporter of quality petroleum products." He added that India has become the fourth-largest refining nation worldwide, with a capacity of 256.8 Million Metric Tonnes Per Annum (MMTPA), following the United States, China, and Russia. He further noted that, in line with India's strategic energy goals, efforts are underway to expand the refining capacity to 310 MMTPA by 2030.

He said the country will have to double the efforts to achieve the net carbon zero emission target by 2070. Energy security, sustainability and technology innovation should go hand-in-hand to achieve the targets in the energy sector, the Minister said. The three-day Energy Technology Meet has been organized by the Centre for High Technology and Indian Oil Corporation Limited.1200 participants are attending the Meet, in which 60 papers will be presented.".

PNGRB, MoEF&CC plan big push for natural gas with industry-friendly measures

In a bid to make natural gas a cornerstone of India's clean energy transition, the Petroleum and Natural Gas Regulatory Board (PNGRB), along with the Ministry of Environment, Forest and Climate Change (MoEF&CC) and state governments, is planning a host of measures to promote its adoption in industries and commercial establishments. By reducing emissions by up to 27% compared to petroleum products, natural gas not only cuts pollution but is also cheaper and more efficient, making it an attractive option for industries.

"Industries transitioning to natural gas will benefit from measures like relaxed inspection schedules, reduced compliance frequency, and lower regulatory burdens," said A Ramana Kumar, Member, PNGRB in an interview recently. "These steps aim to ease the shift to cleaner fuels while ensuring businesses experience fewer disruptions in operations."

Simplifying compliance to boost adoption

To encourage natural gas adoption, PNGRB is working to extend inspection intervals and relax mandatory regulatory requirements for industries. This is expected to reduce operational bottlenecks, making the transition more appealing and cost-effective. The board is also collaborating with state governments to rationalize VAT rates, which currently vary widely. States like Maharashtra and Goa have reduced VAT on Piped Natural Gas (PNG) and Compressed Natural Gas (CNG) to 3%-4%, while Gujarat and Karnataka have capped it at 5%. "VAT reductions are already delivering cost benefits to end-users, and we are encouraging other states to adopt similar policies," Kumar added.

Push for GST inclusion

A major initiative under consideration is the inclusion of natural gas in the Goods and Services Tax (GST) framework. Kumar explained, "Bringing natural gas under GST will streamline taxation and significantly lower costs, making it a more attractive fuel choice for industries."

In Major Push for Nuclear Power, India Asks States to Set Up Reactors

India has ambitious plans to set up nuclear reactors across the country, especially in states where thermal power plants have either completed its life, or where access to coal is a challenge.

With its focus on clean energy, India aims to reduce its dependence fossil fuels, and for this, the central government has now asked states to set up nuclear power plants.

India's Power Minister, Manohar Lal, recently chaired the Conference of Power Ministers of States & Union Territories where he asked states that are distant from coal resources to set up nuclear-based power plants. The move has also been made keeping in mind the rapidly-growing demand for electricity in the country.

In the Union Budget, the central government had proposed to partner with private investors to set up small-scale nuclear reactors to meet its growing energy demands.

"States should consider setting up nuclear power plants at the sites where coal-based thermal power plants have completed their life," the Union Minister told state governments as per a statement issued by the Centre.

The minister also asked states to identify power utilities and list them on the stock exchange to meet its investment targets in the power sector. Asking states to ramp up its renewable energy capacity, the minister emphasised on the need to improve transmission systems in order to achieve that.

Many foreign power plant builders have stayed away from building atomic and nuclear plants in India because of stringent laws over compensation as well as very strict rules and regulations imposed by New Delhi in the event of an accident, mishap or leak.

India currently has 24 nuclear power plants in operation. All of them are run and maintained by the Nuclear Power Corporation of India Limited or NPCIL, which comes under the Department of Atomic Energy. NPCIL is a government-owned public sector undertaking or PSU, headquartered in Mumbai.

India's current power generation from nuclear plants is around 8 gigawatt. New Delhi has ambitious plans to increase this to more than 20 gigawatt by 2032.

Being the only G20 nation to achieve its climate goals ahead of its deadline, India aims to add 500 gigawatt of renewable energy to its grid by 2030. Prime Minister Narendra Modi has also pledged to make India a nation with net-zero carbon emission by 2070.

India Urged to Secure Nuclear Fuel Supply

Key Points from the Statement: Security of Supply Chains: The MEA Special Secretary stressed the necessity for India to secure stable and dependable supply chains for nuclear fuel. As the country continues to expand its nuclear energy capacity, ensuring consistent and safe access to fuel sources becomes a crucial element in achieving energy security. Dependence on Imports: India’s nuclear power industry is largely dependent on importing uranium and other nuclear fuel sources. With growing energy demands and nuclear power plants any disruption in these supply chains could impact the country’s energy mix and long-term sustainability. Strategic Partnerships: The MEA official highlighted the importance of fostering international strategic partnerships with uranium-rich nations to secure uninterrupted fuel supplies. Collaborating with global suppliers and ensuring mutual trust is vital to ensuring the smooth running of India’s nuclear power plants. Nuclear Energy Expansion Plans: India’s nuclear energy ambitions are a key part of its strategy to diversify its energy mix and reduce dependence on fossil fuels. The country aims to increase its nuclear power capacity significantly over the next few decades, contributing to its clean energy targets and climate commitments. Challenges in Global Supply Chains: The Special Secretary also addressed the challenges posed by global political and economic instability, which can affect the availability and pricing of uranium. In this context, securing reliable and diversified supply chains is crucial to prevent disruptions in nuclear power generation. Domestic Production Efforts: While global supply chains are a critical part of India’s nuclear fuel strategy, there is also an emphasis on

increasing domestic production capabilities, such as uranium mining and processing, to reduce reliance on imports in the long term. Conclusion: India's energy security depends heavily on securing stable and diversified nuclear fuel supply chains. The MEA Special Secretary's statement underscores the need for strategic international collaborations, investment in domestic production, and forward-thinking policies to mitigate supply risks. With growing nuclear energy projects in the pipeline, ensuring reliable fuel sourcing will be vital for meeting India's energy goals and reducing its dependence on non-renewable energy sources.

NTPC may invest Rs 4 lakh crore in nuclear power over two decades

NTPC Ltd, India's largest power producer, plans to invest ₹3-4 lakh crore in nuclear power, aiming for 20 GW capacity by 2047. A joint venture with NPCIL will kickstart the initiative with the 2,800 MW Mahi Banswara project. NTPC also targets 60 GW of renewable energy by 2032, with a significant investment planned for solar, wind, and green fuels.

CORE POWER and Westinghouse join forces to develop floating nuclear power

Under the agreement, the companies will work towards advancing the design of the FNPP using the eVinci microreactor and its heat pipe technology which is expected to improve reliability while transferring heat from the nuclear core to a power conversion system, eliminating the need for water cooling and the associated recirculation systems.

Floating nuclear power plants are said to be **"A GAME-CHANGING APPROACH"** to deploying nuclear energy to islands, ports, coastal communities, and the maritime industry as they can be centrally manufactured and easily transported to operation sites, combining nuclear technology with shipyard efficiency.

According to Westinghouse, the eVinci microreactor, which will be used in the plant design has a few moving parts, working essentially as a battery, providing versatility for power systems ranging from several kilowatts to 5 megawatts of electricity.

It requires minimal maintenance and can operate for eight years at full power before refueling. It can also produce high-temperature heat suitable for industrial applications, including alternative fuel production such as hydrogen, and has the flexibility to balance renewable output.

In addition to advancing the floating nuclear power plant design, the companies plan to collaborate on developing a regulatory approach to licensing the plant systems.

Edited & e-printed by **Mr K S Popli, Hon. Secretary General, IEF**
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PROCEEDINGS OF 23RD INDIA POWER FORUM ON

'TOWARDS NET ZERO COMPLIANT POWER SECTOR FOR DEVELOPED INDIA'

(21ST OCT 2024)

India is at a critical juncture in its path toward sustainable development, with the power sector playing a pivotal role in achieving its ambitious net-zero targets. As the third-largest emitter of greenhouse gases globally, India's commitment to reducing its carbon footprint is not only vital for its national agenda but also crucial for meeting global climate objectives. India's energy demand is expected to increase substantially by 2047, driven by economic growth and urbanization. This growth necessitates a major shift in the energy mix, with a stronger focus on expanding renewable energy sources like solar, wind, and nuclear power while maintaining a balance with existing coal-based infrastructure. The forum emphasizes that, while coal will continue to play a key role in the short term, achieving net-zero emissions will require significant advancements in low-carbon technologies, efficient coal usage, and the development of alternatives like green hydrogen and Compressed Biogas (CBG).

India Energy Forum organized 23rd India Power Forum, on the theme "TOWARDS NET ZERO COMPLIANT POWER SECTOR FOR DEVELOPED INDIA", on 21st Oct 2024. This provided a platform to discuss the strategies and innovations required to transform India's power sector and support its long-term vision of VIKSIT BHARAT @2047.

The 23rd India Power Forum serves as a platform for industry leaders, policymakers, and private stakeholders to collaborate on these challenges and innovations. The Forum's deliberations are expected to provide a little more inputs in shaping India's energy policy towards net zero.

1.1. Key Speakers

Inaugural Session

- Shri K S Popli, Hon. Secretary General, IEF & Former CMD, IREDA
- Dr H L Bajaj, Chairman, Power Group, IEF, Ex Chairperson, CEA
- Shri R V Shahi, President, IEF & Former Secretary, Ministry of Power, GoI
- Shri Rakesh Jha, Partner, BDO India
- Shri Anil Razdan, Past President, IEF and Former Secretary, Ministry of Power, GoI
- Shri Ghanshyam Prasad, Chairperson, CEA
- Shri Satish C Sharma, Convenor, Power Group, IEF

Session 1:
CEOs Roundtable on "Towards Net Zero Compliant Power Sector For Developed India"

- Dr Neeraj Sinha, Adviser/Joint Secretary, Office of the Principal Scientific Adviser to the GoI, Cabinet Secretariat
- Shri Praveen Gupta, Member (Thermal), CEA
- Shri Vibhav Agarwal, CEO Power, Vedanta
- Shri R K Chaudhary, CMD, NHPC
- Dr V K Garg, Former Chairman, JERC for Goa & UTs and Former CMD, PFC
- Shri Satyanarayan Goel, CMD, IEX
- Shri R K Porwal, Director, GRID INDIA

Session 2:
"Hydro Power and Energy Storage with special emphasis on "Pumped Storage Projects"

- Shri Neeraj Verma, CGM (I/C), THDCIL
- Prof Arun Kumar, IIT Roorkee
- Mr. Deepak Pandey, Founder Chairman & MD, GP Eco Solutions
- Mr. Sandeep Batra, NHPC
- Shri P M Nanda, Greenko

Session 3:
"Role of Nuclear, Renewables, Hydrogen Fuels and AUSC Technology towards Net Zero Compliant Power Sector for Developed India"

- Dr Mohammad Rihan, DG, National Institute of Solar Energy
- Shri A V Krishnan, Dr Raja Ramanna Chair Professor, NIAS
- Shri Ajay Shankar, Distinguished Fellow, TERI and Ex Union Secretary, GOI
- Shri Pradip Das, CMD, IREDA
- Shri Sanjay Bansal, GM, BHEL
- Shri Pramod Kumar Mishra, Addl Vice President, BRPL
- Dr R R Sonde, Sr Professor Emeritus, BITS Pilani, Goa Campus

Summary & Concluding Remarks

- Shri Satish C Sharma, Convenor, Power Group, IEF, **Ex-Director (Technical), THDC India Ltd**
- Shri K S Popli, Hon. Secretary General, IEF & Former CMD IREDA
- Shri R V Shahi, President, IEF & Former Secretary, Ministry of Power, GoI

INAUGURAL SESSION

The inaugural session commenced with the lighting of ceremonial lamp by the chief guest, Shri Ghanshyam Prasad, Chairperson, Central Electricity Authority, and other dignitaries commencing the opening of gateway to India's energy transition. This session gave the directions towards strategies for driving the power sector towards the theme of the conference.

1.2. Introductory remarks by Shri K S Popli, Secretary General, IEF & Former Chairman and Managing Director (CMD), IREDA Ltd.

Shri K S Popli kick-started the 23rd India Power Forum by stressing the critical role of the power sector in India's Net Zero target for 2070. With 76% of the country's emissions linked to energy production and consumption, and the power sector contributing nearly 40% of it, decarbonizing this sector is vital to meet national climate goals.

Shri Popli outlined three key challenges on the road to decarbonization:

1. **Renewable Energy Manufacturing**:

   Shri Popli highlighted the strides being made to reduce India's dependence on imported equipment from China. In his address, he apprised the gathering about the government policies and Production Linked Incentive (PLI) schemes, informing that "the production of solar modules in India has reached rated capacity of almost 50 GW and will scale up to 60-70 GW in the next two years. India is on track to become self-sufficient in solar manufacturing, with a goal of 80 GW in solar cell capacity and 40-60 GW in polysilicon and wafer production." He further added that India should have no difficulty meeting its target of 1,200 GW of solar by 2047, despite challenges like land and integration.
2. **Hard-to-Abate Sectors**: In sectors such as steel, where emissions are difficult to reduce, green hydrogen is emerging as a crucial solution, particularly for units producing steel through Direct Reduced Iron – Electric Arc Furnace (DRI-EAF) route. Shri Popli shared that green hydrogen will soon be supplied to at least two or three steel plants, with pilot projects already in progress. He also highlighted the aim of India to produce 5 million tonnes of green hydrogen by 2030, driven by expanding electrolyzer capacities.
3. **Energy Storage**: Shri Popli highlighted the importance of energy storage in balancing renewable energy generation. He emphasized that falling battery prices have made storage solutions more affordable. "Battery prices have fallen to $78 per kWh, making it competitive for large-scale storage needs," he remarked.

Shri Popli also mentioned the **biogas sector** as a promising area for development, with initiatives like the Sustainable Alternative Towards Affordable Transportation (SATAT) scheme. He suggested that with the integration of compressed biogas (CBG) into the gas grid, India will be able to save $29 billion in LNG imports by 2047, as targeted. In closing, he expressed optimism about India's path forward,

stating that with these challenges in check, the country is well-positioned to meet its energy and climate goals.

1.3. Welcome Address by Dr H L Bajaj, Chairman, Power Group, IEF, Ex Chairperson, Central Electricity Authority (CEA)

Upon welcoming all the distinguished guests, dignitaries, and participants in the conference, Dr. H L Bajaj emphasized the urgent need for action to address climate change. He referenced the recommendation of Intergovernmental Panel on Climate Change (IPCC) to limit global temperature rise to 1.5 ºC compared to the pre-industrial era, warning that failure to reduce emissions could lead to a 2.0-3.7 ºC temperature increase, with severe global consequences.

Dr. Bajaj highlighted India's commitment to achieving Net Zero emissions by 2070 and stressed that this ambitious target would be unattainable without a significant increase in the use of renewable and nuclear energy. He explained that reducing reliance on fossil fuels and coal across various sectors while also enhancing carbon sinks is essential to meet these goals.

"India's development vision of Viksit Bharat @2047, which envisions the country becoming a developed nation by 2047, requires a transformation in the power sector. This transition will necessitate an expansion of energy generation to support the country's growth and modernization. With this in mind, the India Energy Forum organized the seminar to bring together industry leaders and policymakers to discuss strategies for creating a Net Zero Compliant Power Sector as part of India's broader push towards a developed and sustainable future," he said.

1.4. Theme Presentation by Shri Rakesh Jha, Partner, BDO India

Shri Rakesh Jha, Partner at BDO India, delivered a significant presentation on India's energy sector transition amidst the global climate crisis, focusing on the country's efforts to balance economic growth and sustainability. His address highlighted the nation's critical role as the **third-largest emitter** of greenhouse gases globally, with **3.5 GtCO2e** of emissions in 2022, largely driven by the **power sector** accounting for **40%** of these emissions. Despite these numbers, India's **per capita emissions** of **2.4 tonnes** remain well below the global average of 6.3 tonnes, reflecting the country's progress towards emission reduction.

India's Growing Energy Demand: Mr Jha highlighted that India's energy demand is projected to grow **3.6 times** by 2047, rising from 618 Mtoe in 2022 to **2,200 Mtoe**. To meet this demand while addressing climate goals, India's energy mix will undergo significant changes. While **coal** is expected to remain a significant part of the energy portfolio, its share in the power generation capacity will decrease from 53% in 2022 to **26% by 2047**. Renewables, particularly **solar and wind power**, are set to expand substantially, projected to reach **1,200 GW and 436 GW**, respectively.

Mr Jha emphasized the growth of **nuclear energy**, set to rise from **6.8 GW to 54 GW by 2047**, as well as advancements in **energy storage technologies** like **Battery Energy Storage Systems (BESS)**, which will be crucial for grid stability as renewable capacity increases. "The declining costs of BESS are making it increasingly competitive, essential for India's journey toward a net-zero power sector," he stated.

Shifting Emission Patterns and Cleaner Technologies: By 2047, India's **GHG emissions intensity** is expected to reduce significantly, from **18.23 kg CO2e per INR 1,000** in 2022 to **9.52 kg**. This reduction is driven by a shift toward **cleaner transportation**, **renewable energy**, and sustainable practices in agriculture. However, Mr Jha warned that **industrial emissions** are expected to grow by **1% CAGR**, underlining the urgent need for cleaner technologies in the industrial sector.

Power Sector Transformation: Mr Jha also highlighted the **transformation of India's power generation**. By 2047, **renewables** are expected to account for **68%** of the installed capacity, while **coal's share** will reduce. "This aligns with the government's target of 500 GW of non-fossil electricity capacity by 2030," he noted, further emphasizing India's investments in technologies such as **Advanced Ultra-Supercritical (AUSC) technology**, **carbon capture**, and **co-firing** with low-carbon fuels to modernize coal plants.

Infrastructure Modernization and Emerging Technologies: To support this energy transition, India will require extensive upgrades to its **transmission and distribution infrastructure**. Mr Jha pointed out that the length of transmission lines and transformation capacity has grown significantly, but further expansions and modern **smart grid** technologies, such as **AI**, **blockchain**, and **IoT**, will be essential for efficiency and reliability.

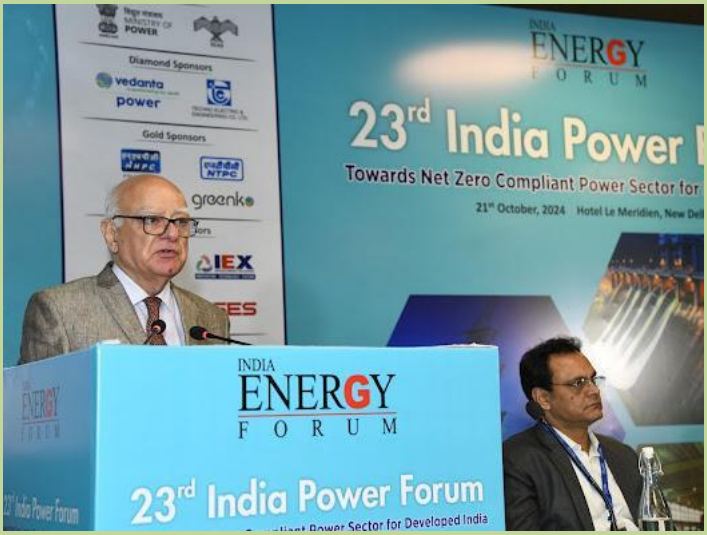
In conclusion, he stressed the importance of **strategic investments** and **collaborative efforts** to achieve India's vision of **net-zero emissions by 2070**, emphasizing that these changes are crucial for ensuring India's **sustainable energy future** and its leadership in the global low-carbon economy.

1.5. Address by R V Shahi, President, IEF & Former Secretary, Ministry of Power, GoI

In his address at the 23rd India Power Forum, Shri R V Shahi highlighted the crucial role that power consumption plays in determining a nation's development status. “If India has to be a developed nation, it has to increase its per capita power consumption,” he remarked, noting that India ranks 129th out of 200 countries in per capita power consumption. This low ranking underscores the need for India to expand its power generation and supply to match the levels seen in developed nations. However, Shri Shahi cautioned that this goal is not without challenges. While India must strive to boost its power supply, it must also meet its carbon emission responsibilities. He emphasized that India’s policies should reflect a “**common but differentiated responsibility”** toward climate goals, advocating for a balance between energy growth and environmental sustainability. Shri Shahi called for policy clarity and predictability to send the right signals to the industry. “The policy directions should be predictable, and clarity should be there for its longevity,” he said, stressing the need for coherence between energy policies and long-term goals.

Shri Shahi also emphasized the importance of **energy storage and nuclear power**, noting that nuclear energy, particularly **Small Modular Reactors (SMRs)**, should be opened for both private and public sectors to explore. He further highlighted the role of **pumped storage** as a reliable option in balancing energy supply and maintaining grid stability, urging immediate action on this front.
His address called for a comprehensive and balanced approach to power generation, where reliance on renewable energy is tempered with strategic investments in coal, nuclear, and energy storage to meet India's future needs.

1.6. Presidential Address by Shri Anil Razdan, Past President, IEF and Former Secretary, Ministry of Power, GoI



In his Presidential Address, Shri Anil Razdan highlighted the complexities surrounding India's journey towards energy sustainability and economic growth. He posed a critical question: **"We know we have to change, but how do we change?"**, emphasizing that while the need for energy transition is clear, the path is filled with uncertainties. Shri Razdan acknowledged India's rapid economic growth and rising aspirations, but also pointed out the country's dependence on technology and financial resources from other nations. He stressed that India has a **"right to grow and a right to consume more energy,"** yet the means to achieve this while managing climate goals remains unclear. He expressed concerns about the global effort to curb temperature rise, stating that the current trajectory points towards a **2.4°C increase**, far above the desired targets.

He discussed the plateauing of fossil fuel consumption, noting that while it won't disappear anytime soon, the world must remain realistic about its continued role in energy systems. However, Shri Razdan highlighted the growing **demand for air conditioning** as populations in developing countries like India seek more comfort in the face of rising temperatures. He shared a revealing statistic from the IEA: while 90% of households in the U.S. and Japan have air conditioners, India sits at only 20%. As temperatures rise, this gap will likely close, leading to increased energy consumption.

Shri Razdan also touched on the evolving landscape of renewable energy (RE) and fossil fuels, noting that the decreasing prices of fossil fuels might make competition with renewables tougher. He stressed the need for **nuclear power** as a solution but lamented the slow pace of its development. The concept of **Small Modular Reactors (SMRs)**, while promising, raises concerns about safety and ownership in the current geopolitical climate. He suggested that companies like **NTPC and NPCIL** could collaborate to push forward nuclear projects in India. He also highlighted **electric vehicles (EVs)** as a critical area for the future but noted that India's progress is lagging behind countries like China, where EV sales have reached 50%. While India is making strides with two-wheelers, the broader transition to EVs is hindered by inadequate infrastructure, such as **recharging facilities**.

In conclusion, Shri Razdan called for collective action, underscoring the role of forums like the India Power Forum in shaping policy and driving change. **"Ultimately, the government is you and me,"** he remarked, emphasizing the need for joint efforts in addressing the challenges of India's energy transition.

1.7. Inaugural Address by the Chief Guest, Shri Ghanshyam Prasad, Chairperson, CEA

In his inaugural address, Shri Ghanshyam Prasad highlighted the ambitious journey India has to undertake to meet its energy goals by 2047. Acknowledging the uncertainty of the path ahead, he emphasized that India's energy transition requires adaptability and innovation to meet the evolving needs of a rapidly growing economy. Shri Prasad addressed the question of why India set a 2070 deadline for achieving Net Zero, calling it a **"carefully considered decision"** that provides India with the flexibility to achieve its targets without the risk of defaulting, unlike other countries that have faltered on their global commitments. He noted that while significant progress has been made in the renewable energy (RE) sector, India's approach to energy must take into account **"India-centric facts"** such as its fast-growing economy and the aspirations of its consumers, along with global sustainability goals.

One of the key areas of focus for Shri Prasad was the **need for a certification mechanism** to ensure that energy labeled as "green" is verifiable. He highlighted ongoing efforts with the European Union to develop such certification systems, which are critical as India increases its reliance on renewable sources. He also pointed out the importance of optimizing India's power transmission systems, specifically through initiatives like **General Network Access (GNA)** and **dual connectivity**, which can help improve efficiency by allowing different energy sources to share transmission networks.

He emphasized the importance of innovative solutions for integrating renewable energy with existing power structures, citing the **Ukrainian crisis** as an example of how India's power exchange system demonstrated resilience during global disruptions. The chairperson also outlined the **challenges** ahead, including the need for massive capacity and storage solutions, particularly as India works toward its Net Zero goal. He proposed a **three-pronged approach**: focusing on resource adequacy, dynamic revisions of energy plans, and collaboration with manufacturers to reduce dependence on foreign technology. Shri Prasad stressed the importance of **indigenous development** of resources, particularly in technology and manufacturing, and called for stronger collaboration between academia, industry, and commercial organizations to accelerate innovation.

Energy efficiency and conservation were other critical points in his address. Shri Prasad argued that while per capita consumption is often used as a measure of progress, India's success should be measured by how effectively it manages energy efficiency. He noted that as a growing economy, India has the advantage of implementing these measures more effectively than developed nations. Finally, Shri Prasad highlighted the **importance of hydro energy** and the potential of **pumped storage projects**, which, though lagging due to cost constraints, present a valuable indigenous resource that requires policy incentives to fully realize its potential. He concluded by emphasizing the need for **dynamic decision-making** and swift policy action to ensure India's energy goals are met on time.

1.8. **Vote of Thanks by Shri Satish C Sharma, Convener of the Power Group IEF, Ex-Director (Technical), THDC India Ltd.**

Shri Satish C Sharma expressed his proud privilege and honour to present the vote of thanks.

He specially thanked **Shri Ghanshyam Prasad**, Chairperson, CEA, and Chief Guest of the Inaugural Function for having graced the occasion and delivering the inaugural address and sharing his knowledge on the theme of the conference.

Shri Sharma expressed gratitude to **Shri R V Shahi**, President IEF, for joining online and delivering his special address expressing his most insightful views on the theme.

Shi Sharma also thanked **Shri Anil Razdan**, Past President, IEF, for delivering the presidential address and setting the tone of the conference.

He thanked **Dr. H L Bajaj**, Chairman of the Power Group, IEF, for his welcome address, and **Shri K S Popli**, Secretary General, IEF, for his introductory remarks.

He also thanked **Shri Rakesh Jha**, Partner, and his whole team of BDO India, for the theme presentation as the knowledge partner.

Shri Sharma expressed his special thanks to all the **sponsors** for their support, and who's contributions played a vital role in bringing the event to life.

Finally, he thanked all **speakers**, **guest invitees** and **members of IEF** for their engagement and enthusiasm for being a part of this 23rd India Power Forum.

SESSION 1: CEOS ROUNDTABLE ON "TOWARDS NET ZERO COMPLIANT POWER SECTOR FOR DEVELOPED INDIA"

Chaired and Moderated by Shri Anil Razdan, Former Union Secretary, Minister of Power, GoI

Distinguished Panelists:

- **Dr Neeraj Sinha**, Adviser/Joint Secretary, Office of the Principal Scientific Adviser to the GoI, Cabinet Secretariat
- **Shri Praveen Gupta**, Member (Thermal), CEA
- **Shri Vibhav Agarwal**, CEO Power, Vedanta
- **Shri R K Chaudhary**, CMD, NHPC
- **Dr V K Garg**, Former Chairman, JERC for Goa & UTs and Former CMD, PFC
- **Shri Satyanarayan Goel**, CMD, IEX
- **Shri R K Porwal**, Director, GRID INDIA

The CEOs Roundtable at the 23rd India Power Forum, chaired and moderated by Shri Anil Razdan, Former Secretary, Ministry of Power, GoI, brought together industry leaders to discuss strategies for achieving a Net Zero-compliant power sector in India. Shri Razdan opened the forum by emphasizing the critical need for swift action to meet India's ambitious climate goals, stating, **"The government cannot do everything alone; private sector participation is crucial."** He acknowledged that while the private sector is willing to invest, a return on investment is essential to drive meaningful engagement in the transition towards clean energy.

- **Dr Neeraj Sinha**, Adviser/Joint Secretary, Office of the Principal Scientific Adviser to the GoI, Cabinet Secretariat

The discussion first shifted to **Dr. Neeraj Sinha**, Adviser/Joint Secretary, Office of the Principal Scientific Adviser to the Government of India. Dr. Sinha outlined three potential pathways for India to achieve Net Zero, stressing the importance of a balanced approach rather than reliance on a single solution.

First, Dr. Sinha suggested **going fully green** by promoting renewable energy. However, he noted that the complexities of India's energy landscape make it necessary to pursue a **"basket of options"** rather than depending solely on renewables.

Second, he explored the idea of **continuing business as usual (BAU)**, wherein India continues to burn coal, citing the country's vast reserves. He acknowledged the challenge of **carbon capture, utilization, and storage (CCUS)** technologies as a means to mitigate emissions, but raised concerns about the feasibility, cost, and uncertainty of storing carbon in geological formations. He also touched on the possibility of converting captured CO_2 into useful chemicals but cautioned that **"it is easier said than done."**

Finally, Dr. Sinha advocated for the **efficient and environmentally benign use of coal**. He highlighted India's leadership in **Advanced Ultra-Supercritical (AUSC) technology** for thermal power generation, which allows coal to be used more efficiently with lower emissions. India's advancements in this area, including work on high-temperature materials for boiler tubes and turbine blades, are groundbreaking. **"We aim to implement this technology not only for India but also for our neighboring countries that rely on coal,"** Dr. Sinha stated, pointing out that upgrading older subcritical plants to AUSC would significantly reduce emissions.

While acknowledging that R&D for these technologies is costly, Dr. Sinha emphasized the potential for India to be a global leader in cleaner coal technology. **"The first use of any technology must be supported by the government,"** he said, advocating for state backing to make these initiatives scalable. He concluded with optimism, stating that India could **"lead the world rather than follow"** in cleaner thermal power generation, marking a significant step toward a Net Zero-compliant power sector.

- **Shri Praveen Gupta**, Member (Thermal), CEA

Shri Praveen Gupta, Member (Thermal) of the Central Electricity Authority (CEA), provided critical insights into the future of thermal power in India's energy transition. Highlighting the rapidly growing energy demand, he emphasized that the country's peak electricity demand and energy requirements are projected to increase significantly, with a Compound Annual Growth Rate (CAGR) of 5-6% over the coming decades. Shri Gupta pointed out that India's updated Nationally Determined Contribution (NDC) aims to reduce the emissions intensity of its GDP by 45% by 2030 (from 2005 levels) and achieve 50% of its installed power capacity from non-fossil fuel sources. Despite the growth of renewable energy, he stressed the continued importance of thermal power, projecting an increase in thermal capacity from **243 GW in 2024 to 250 GW by 2047**. However, **"Variable renewable energy (RE) is expected to make up 70% of the energy mix by 2047,"** he noted, adding that this projection is driven by complex simulations run on supercomputers accounting for numerous variables.

He also addressed operational challenges in managing coal and gas plants, particularly the need for **frequent ramp-up and ramp-down operations** due to fluctuating demand, as well as **partial load operations**. Gupta noted that coal plants will require **retrofits and renovations** to remain efficient, with a **phasing plan for R&M (Renovation & Modernization)** across three phases, based on the lifespan of the units. He also acknowledged the **limited availability of domestic gas,** and the difficulties gas plants face in providing peak support during critical periods. Shri Gupta also proposed a strategy for **Carbon Capture, Utilization, and Storage (CCUS)** to reduce carbon emissions, positioning CCUS as a crucial part of India's energy future. He called for setting up CCUS infrastructure in the country to capture emissions from existing thermal plants.

He concluded by discussing **Resource Adequacy (RA)**, a system aimed at ensuring sufficient energy resources to meet demand reliably and sustainably. He emphasized that India's peak demand and energy requirements are expected to **triple by 2047**, underlining the critical role that thermal power will continue to play alongside renewable energy in the nation's evolving energy landscape.

- **Shri Vibhav Agarwal**, CEO Power, Vedanta

Shri Vibhav Agarwal, addressed the crucial role of private capital in India's energy transition, emphasizing the need for a stable regulatory environment to attract investment. **"Private capital is always looking for returns, and we are married to economics,"** Shri Agarwal remarked, stressing that for the private sector to engage in public-private partnerships (PPP), projects must offer clear economic benefits. Shri Agarwal criticized the frequent litigation in PPP projects, as litigation often hinders progress and impacts profitability. He pointed out that while **thermal power** is expected to play a significant role in India's energy transition, regulatory uncertainty remains a major concern.

His concerns extended to decision-making processes, noting that **"people with no stake"** are often in charge of making critical decisions, while funding agencies are increasingly reluctant to finance thermal power projects. He called for a **"cohesive approach rather than a fragmented one,"** to ensure that private companies are not put at a disadvantage in the rapidly evolving energy landscape.

In conclusion, Shri Agarwal stressed the importance of making projects attractive to the private sector, emphasizing the need for regulatory certainty and support to drive private investment in India's power sector. **"Let there be an environment of encouragement, not discouragement,"** he urged, underscoring the need for a collaborative effort between regulators, investors, and the government to achieve the country's energy goals

- **Shri R K Chaudhary**, CMD, NHPC

Shri R.K. Chaudhary emphasized the importance of the intermediate milestones on India's path to achieving net-zero emissions. Referring to the **Panchamrit Initiative**, Shri Chaudhary outlined the ambitious target of generating **500 GW from renewable energy sources** by 2030, noting that India has already crossed the **200 GW** mark, with **300 GW** remaining to be achieved.

NHPC, along with its subsidiaries, is set to contribute significantly to this goal, with plans to add **50 GW of capacity** in the next 5-6 years. Shri Chaudhary expressed confidence in NHPC's

ability to achieve this through **indigenous capacity development** under the **Make in India** initiative, highlighting the importance of self-reliance in reaching renewable energy targets.

However, he acknowledged key challenges in the journey ahead:

1. Difficulties in signing Power Purchase Agreements (PPAs)
2. Transmission issues
3. The need for large storage capacities, including Pumped Storage Projects (PSP) and Battery Energy Storage Systems (BESS).
4.

Shri Chaudhary reiterated the critical role of **hydropower** in India's decarbonization strategy, underlining its importance in providing clean energy and supporting the transition to a sustainable future. **"Hydropower is a key component in decarbonization,"** he stated, positioning NHPC at the forefront of India's renewable energy efforts.

- **Dr V K Garg**, Former Chairman, JERC for Goa & UTs and Former CMD, PFC

In his address, **Dr. V.K. Garg**, emphasized the need for innovative financing mechanisms to support India's energy transition, drawing from discussions spanning from COP21 to COP27. He highlighted the consistent use of terms like **new instruments, innovative finance, cheap finance through concessions and grants**, and **green financing** in global climate negotiations.

He noted that the Indian government identified a key solution—**green bonds**, which can be deployed for renewable energy, energy efficiency, and alternative fuels, particularly effective until 2030-2035. However, beyond this period, he stressed the need for **strategic, systemic, and sustainable emission reduction initiatives**, which would require extensive **R&D support from the government** until the market is mature enough to take over.

Dr. Garg also introduced the concept of producing **green hydrogen from agro-waste** as a future focus area and underscored the importance of addressing the interconnected issues of **fuel, food, and water**.

Another crucial area he highlighted was **transition finance**, pointing out the importance of creating an environment that fosters **market security, ease of doing business**, and trust for investors to encourage long-term financial commitment. **"There must be trust and market security for investors,"** he emphasized, advocating for a collaborative approach between the government and private sector to drive the energy transition forward.

- **Shri Satyanarayan Goel**, CMD, IEX

In his address, **Shri Satyanarayan Goel**, emphasized that **ensuring energy security** is crucial for India's future. He proposed several key suggestions to bolster the energy sector:

1. **Market Integration for Renewable Energy (RE)**: He stressed the importance of seamlessly integrating renewable energy into the system through a **'liquid market'**, which would facilitate smooth trading and integration of RE capacity.
2. **Contract for Defence (CFD)**: Shri Goel suggested implementing CFDs to ensure reliable energy sources, especially during peak demand times.
3. **Merchant Capacity Addition**: He encouraged the addition of **merchant capacity** to meet the growing demand and support market-based price discovery.
4. **BESS and Pumped Storage**: Battery Energy Storage Systems (BESS) and **pumped storage** were highlighted as critical focus areas for storing excess renewable energy and addressing intermittency issues.
5. **Demand Shifting**: He proposed **demand shifting** strategies to optimize energy use, especially during off-peak hours.
6. **Time of Use (TOU) Tariff**: Finally, Shri Goel recommended the introduction of **TOU tariffs**, which would encourage consumers to shift their usage to off-peak periods, thereby balancing the load and reducing the strain on the grid.

Shri Goel's comprehensive suggestions aim to enhance energy security, improve market mechanisms, and optimize energy consumption as India moves towards a more sustainable power sector.

- **Shri R K Porwal**, Director, GRID INDIA

In his address, **Shri R K Porwal**, highlighted the critical importance of **grid stability and reliability** as India transitions towards integrating more renewable energy. He stressed that maintaining a stable grid requires flexibility at multiple levels to effectively manage the increasing integration of renewable resources.

Shri Porwal discussed some of the key challenges faced during renewable energy (RE) integration, noting that the solution lies in improving grid flexibility. He pointed out that strategies like the integration of various energy sources would not only stabilize the grid but also enhance its reliability. To illustrate the importance of grid stability, he mentioned a notable incident on June 17, when around 16 GW of power was lost in the northern region due to the over usage of air conditioning, leading to a voltage drop in the system. Shri Porwal emphasized that such incidents must be carefully managed and mitigated through concerted efforts

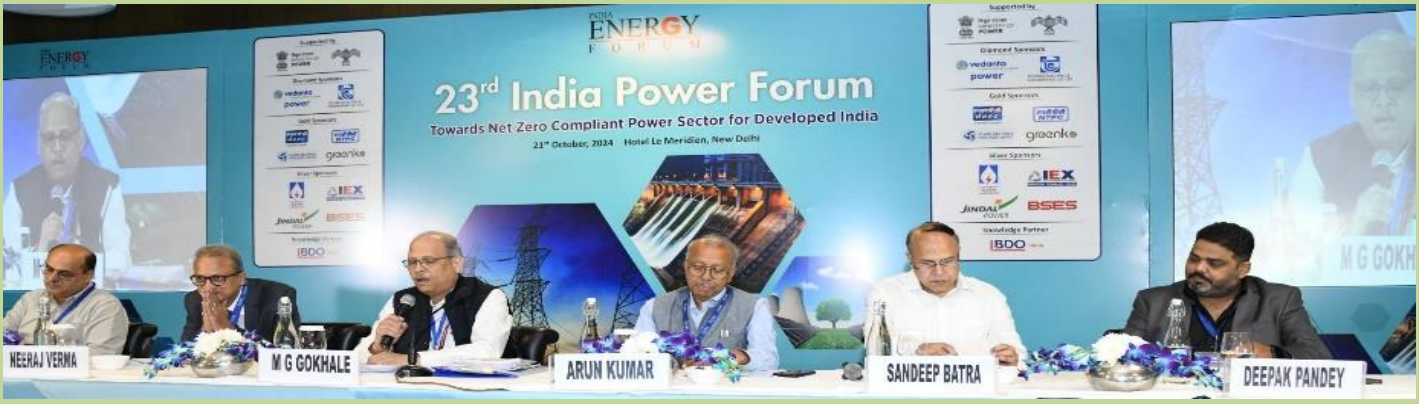
and infrastructure enhancements. He also mentioned that large data centers, resource flexibility, and diverse storage systems would play an essential role in balancing the grid and ensuring resilience as India continues its energy transition.

Key takeaways from the session

- Private sector participation is essential for India's clean energy transition; return on investment is crucial.
- Multiple pathways for achieving Net Zero were discussed, including fully green energy, continued coal use with CCUS, and efficient coal usage with AUSC technology.
- Thermal power remains critical, with capacity expected to grow to 250 GW by 2047 despite a shift towards renewables.
- Challenges for thermal plants include the need for ramp-up and ramp-down operations and retrofitting for efficiency.
- CCUS is viewed as a vital part of India's energy future, requiring infrastructure development.
- Private sector concerns include regulatory uncertainty and the need for stable, cohesive policies to attract investment.
- Hydropower and renewable energy will play a significant role, with NHPC aiming to add 50 GW in the next 5-6 years.
- Innovative financing mechanisms like green bonds and transition finance are crucial for driving energy projects.
- Green hydrogen from agro waste was proposed as a future focus area for sustainable fuel production.
- Energy security and market integration for renewable energy were stressed, with solutions like BESS, pumped storage, and TOU tariffs proposed.
- Grid stability is essential as renewable energy integration increases; flexibility and resilience in grid operations are needed.

SESSION 2- HYDRO POWER AND ENERGY STORAGE WITH SPECIAL EMPHASIS ON "PUMPED STORAGE PROJECTS"

Chaired and Moderated by Shri M G Gokhale, Member (Hydro), CEA



Distinguished Panelists:

- **Shri Neeraj Verma**, CGM (I/C), THDCIL
- **Prof Arun Kumar**, IIT Roorkee
- **Shri Deepak Pandey**, Founder Chairman & MD, GP Eco Solutions
- **Shri Sandeep Batra**, Group General Manager (Civil), NHPC
- **Shri P M Nanda**, Executive Vice President, Greenko Group

The session began with **Shri M G Gokhale** setting the context around the topic. He provided an overview of the current scenario in hydro power and storage systems and points out that while there are hydro capacities, such as the 1.45 GW **from the Sardar Sarovar project**, operational issues have hindered their full utilization. Solar energy is emerging strongly, but wind energy hasn't seen similar growth. Shri Gokhale stresses the critical need for Pumped Storage Projects (PSPs) to balance the grid , advocating for substantial annual additions to PSP capacity to support energy transition and grid stability.

Looking ahead, Shri Gokhale outlines an ambitious plan to rapidly **increase PSP capacity to 40 GW by 2030**, a significant leap from the current 4.7 GW. He acknowledges the challenges but remains optimistic, citing the proactive involvement of private developers and feasible timelines. He projects that by 2030-31, around **12 GW of hydro capacity** could be added, with further expansions from

projects like **Dibang potentially bringing an additional 20 GW**. This strategic expansion is seen as crucial for providing both peak power and supporting the broader energy transition.

- **Shri Neeraj Verma**, CGM (I/C), THDCIL

Following the context setting, **Shri Neeraj Verma**, emphasized the **future role of Pumped Storage Projects (PSP**). He stated his remarks by sharing the presentation and thanking the forum for allowing to share his thoughts. He outlined the need of PSP and hydro power in the future energy as well as net zero commitment. His session covered the following key points:

- He outlines the topics of his presentation, including the status of development from 2032, capacity addition, peak demand, and need for energy storage.
- As of 2024, India's energy capacity is 452 GW, with plans to nearly double it by 2032, focusing on increasing renewable energy (RE) and decreasing fossil fuel reliance.
- Only 33% of India's **hydro potential** has been harnessed, with significant targets set for future development, including **87 GW by 2047** while current **PSP capacity is 4.7 GW, with a potential of 181 GW.**
- India aims to achieve **50% non-fossil fuel capacity by 2030** and net-zero emissions by 2070, with significant contributions from hydro and PSP.
- Various types of energy storage systems, including **high-power superconductors**, batteries, and thermal storage are discussed for their roles in balancing the grid and supporting renewable integration.
- The Government of India's holistic approach to support hydropower and PSP, aiming to ensure **energy security** and **integration of renewable energy**.
- Shri Verma provides examples, such as Japan's energy management, to illustrate the importance of interconnection and variability management in the energy grid.
- **Transition** from **fixed to variable speed machines** has **improved efficiency to over 79%.**
- He also highlighted the future outlook by stating **Round-The-Clock (RTC**) **power purchase agreements**, **relaxing intra-state transmission charges**, **Re-designing of approval and clearances** process, and **Exemptions from Free power obligations**.

Q & A

On the question of cost competitiveness of Hydro power Shri Verma responded by mentioning the project life of 40 years making it competitive with battery storage, which typically lasts 8 to 10 years. Although the current setup does not include power storage capabilities, it can store energy for days, weeks, or even months, depending on weather conditions. Despite these costs, the project offers multiple benefits, especially when considering its long-term viability.

- **Prof Arun Kumar**, IIT Roorkee

Prof Arun Kumar emphasizes the critical need for energy storage solutions to support continuous power availability, moving away from long shutdowns. He highlights the advantages and challenges of both battery storage and Pumped Storage Projects (PSPs). While battery costs are decreasing, there are uncertainties about future supply conditions. **PSPs**, though often overlooked for their long completion times, **offer significant benefits in the long run**. Prof. Arun stresses the importance of considering long-term solutions and not dismissing PSPs due to their initial challenges. He also points out the **necessity of developing robust business models and financial frameworks** to support these projects. The key points of his insights are:

- Recognize the decreasing costs but emphasize the uncertainties in **future supply** caused by the limited availability of **optimal materials** in battery storage.
- Highlight the long-term benefits and the need for policy makers to consider these despite their longer completion times.
- Stress the importance of developing sustainable business models and financial frameworks for energy storage projects.
- **Encourage policy makers to resolve existing issues** rather than avoiding them, and to **support both battery and PSP solutions.**
- Mention the success of the Gujarat model in implementing storage solutions and suggest it as a reference for future projects.

- **Shri Deepak Pandey**, Founder Chairman & MD, GP Eco Solutions

Shri Deepak Pandey began his remarks by expressing his gratitude to the forum for allowing him the opportunity to share his thoughts. He highlighted the current reliance on lithium-based battery storage, which depends heavily on imported components. He pointed out that lithium, while currently the most stable and advanced technology, poses future supply challenges due to its limited availability and dependency on countries like Australia and China. Instead, he suggested that the **Government of India** should explore and **promote new technologies** that utilize more readily available resources within the country.

One such technology is **supercapacitors made from graphene**, which is **abundant in India**. Supercapacitors offer several advantages, including being **100% biodegradable** and having a longer **lifespan of over 25 years**, potentially extending to 45 years. They also have a small component of

tantalum, which enhances their efficiency to around 99%, significantly higher than lithium batteries. Additionally, **supercapacitors have a faster response time** and fewer disposal issues compared to lithium batteries.

- **Shri Sandeep Batra**, Group General Manager (Civil), NHPC

Shri. Sandeep Batra began by expressing his enthusiasm for Pumped Storage Projects (PSPs) but also shared several concerns. He emphasized that PSPs are site-specific, and their efficiency and cost-effectiveness can vary greatly depending on the location. He stressed the importance of central agencies, rather than state agencies, taking a close look at these projects to ensure thorough and accurate studies are conducted. Mr. Batra highlighted that while **hydro projects offer many benefits**, they must be **developed and operated responsibly** to maintain public and governmental trust. He also pointed out the need for **careful planning regarding the integration and retirement of older plants**, as well as the amount of storage required at different stages. The key points from his address is as follows:

- Emphasize that **PSPs are highly dependent on their location** for efficiency and cost-effectiveness.
- Highlight the need for central agencies to conduct thorough studies and rankings of potential sites.
- Note that hydro projects provide significant benefits but must be developed responsibly.
- Stress the importance of planning for the integration and retirement of older plants and determining storage needs.
- Emphasize the need to **maintain trust by constructing and operating projects** in a **sustainable and transparent manner.**
- Acknowledge the historical challenges faced by hydropower due to climate change and the need to address these issues proactively.

Q & A

On the question of categorization of the Pumped storage project as they are not generating station Mr. Gokhale responded in the forum by a detailed explanation of the operational dynamics of Pumped Storage Projects (PSPs), distinguishing between on-river and off-river systems. He highlighted that ‘on-river’ PSPs have both turbine and pumping modes, with pumping requiring more power. ‘Off-river’ and closed-loop systems, which are not connected to any river, also require significant pumping power. According to Central Electricity Regulatory Commission (CERC) regulations, 75% of the power used for pumping must be returned as generated power. This generation typically occurs during peak demand times, such as mornings and evenings, when electricity rates are higher.

Mr. Gokhale highlighted the cost differences between PSPs and hydro projects, noting that PSPs cost around ₹5-6 crore per MW, while hydro projects cost about ₹12 crore per MW. Although PSPs consume more power for pumping than they generate, they play a crucial role in balancing the grid

during peak times. He emphasized the importance of considering the aggregate benefits of PSPs, especially during high-demand periods like the monsoon season.

Following Mr. Batra's address, Mr. Gokhale invited Mr. PM Nanda from Greenko to share his insights with the forum. He emphasized the importance of hearing Mr. Nanda's valuable input on the execution of Pumped Storage Projects (PSPs) and the necessary policy changes from an industrial perspective. Mr. Gokhale highlighted that Mr. Nanda's thoughts would be crucial for accelerating PSP development and requested the audience's attention for this important discussion.

- **Shri P M Nanda**, Executive Vice President, Greenko Group

Shri. P M Nanda began his address by affirming the suitability and quality of Pumped Storage Projects (PSPs) for energy storage. He outlined the **four critical stages involved in executing PSP** and **hydro projects: policy and guidelines, clearances and approvals, arranging finance, and implementation**. Nanda highlighted the significant progress made in policy and guidelines since 2018, particularly with the "**Pinnapuram project**", which marked the beginning of PSPs in the private sector. He noted that many policies and guidelines are now in place, facilitating smoother project execution.

Mr. Nanda emphasized the importance of clearances and approvals, acknowledging that substantial work has been done in this area as well. However, he identified **arranging finance as a more complex challenge**. He proposed the need for **risk-sharing mechanisms** or **risk compensation frameworks** to encourage **financiers to invest in PSP projects**. Mr. Nanda suggested that monetization of storage services and civil services should be considered to make these projects viable. He referenced a recent policy from the UK that sets a minimum monetization floor for PSPs, ensuring a baseline profit for project developers. He recommended a similar approach in India, with normative tariffs or contracts for difference to provide financial security and boost investor confidence.

On the implementation front, Mr. Nanda pointed out that PSPs, often located in geologically stable areas, face fewer uncertainties compared to traditional hydro projects. He stressed the **importance of flexible decision-making within contractual provisions to expedite project completion**. He shared an example from a project where quick decision-making allowed for the deployment of additional resources to address geological variations, highlighting the need for such flexibility in the public sector as well.

Mr. Nanda also called for **future-ready PSP guidelines and policies to meet India's long-term zero-carbon goals.** He suggested that PSP projects should be designed to handle higher power absorption during the day and longer dispersion times, reflecting the unique solar intensity and energy needs of India. He emphasized that while India started late in PSP development, it is crucial to plan for future requirements to ensure the country meets its zero-carbon targets by 2060 or 2070. Mr. Nanda concluded by stressing the need for **innovative thinking and proactive policymaking to**

support the rapid development of PSPs, ensuring they are equipped to meet future energy demands.

Key takeaways from the session

- Pumped Storage Projects (PSPs) are essential for grid stability, balancing, and peak demand management as India transitions to a renewable-focused energy system.
- Expanding PSP capacity from 4.7 GW to 40 GW by 2030 is crucial to support India's energy transition; private sector involvement and realistic timelines are key to meeting these targets.
- PSPs provide significant long-term benefits compared to quicker-deploying battery storage systems, emphasizing the need for sustainable business models and financial frameworks for energy storage.
- New energy storage technologies, such as graphene-based supercapacitors, offer promising alternatives to lithium batteries, providing local resource availability, efficiency, and biodegradability.
- Government incentives and risk-sharing mechanisms are critical to drive investment in PSPs and emerging energy storage technologies, with policies playing a central role in enabling development.
- Strategic planning and sustainable development of PSPs and hydro projects are essential, including thorough site studies, transparent project execution, and robust business models to balance immediate needs with long-term sustainability in India's net-zero transition.

SESSION 3- ROLE OF NUCLEAR, RENEWABLES, HYDROGEN FUELS AND AUSC TECHNOLOGY TOWARDS NET ZERO COMPLIANT POWER SECTOR FOR DEVELOPED INDIA

Chaired and Moderated by Dr. Ravi B Grover, Member, Atomic Energy Commission

Distinguished Panelists:

- **Dr. Mohammad Rihan**, DG, National Institute of Solar Energy
- **Shri A V Krishnan**, Dr Raja Ramanna Chair Professor, NIAS
- **Shri Ajay Shankar**, Distinguished Fellow, TERI and Ex Union Secretary, Govt of India
- **Shri Pradip Das**, CMD, IREDA
- **Shri Sanjay Bansal,** GM, BHEL
- **Shri Pramod Kumar Mishra,** Addl Vice President, BRPL
- **Dr R R Sonde,** Sr Professor Emeritus, BITS Pilani, Goa Campus

The session discussed the '**The Role of Nuclear, Renewables, Hydrogen Fuels, and AUSC Technology Towards a Net Zero Compliant Power Sector for a Developed India**'. The Speakers discussed advancements and future prospects of nuclear energy, the current and potential of renewable energy sources, the role of hydrogen fuels in achieving a sustainable energy sector, and the significance of Advanced Ultra-Supercritical (AUSC) technology in reducing carbon emissions from thermal power plants.

The session Started with the opening remarks by **Dr Grover** who gave the background of topic by highlighting the current developments and Challenges. He emphasized the importance of progressing towards a net zero power sector for a developed India. He highlighted recent advancements in the nuclear sector, including the completion of a 700 MW unit at Rajasthan, which achieved criticality in September 2024 and is expected to be commercial by the end of the year. Another unit is set to come online in 2025, marking significant progress in nuclear technology.

He also mentioned the approval of **a joint venture between NPCIL and NTPC** to construct **four 700 MWe units at Mahi Banswara in Rajasthan**. Additionally, he discussed the **Bharat Small Reactor**, a 220 MW pressurized heavy water reactor, which has garnered interest from private companies for use as captive power plants. This reactor features several improvements aimed at reducing land requirements.

Dr. Grover stressed the need for development-led transition to achieve net zero by 2070, balancing decarbonization with economic growth. He cited studies from the UK and India to illustrate the complexity of this challenge and called for more comprehensive studies to inform future policymaking. He also highlighted the importance of system costs and the need to monetize attributes like resiliency and flexibility in power generation. Concluding his remark, Dr. Grover welcomed Dr. Mohammad Rihan who is currently heading National Institute of Solar Energy (NISE) under the Ministry of New and Renewable Energy to share his insights with the forum.

- **Dr. Mohammad Rihan**, DG, National Institute of Solar Energy

Dr. Mohammad Rihan began his address by emphasizing the critical role of the power sector in achieving decarbonization. He appreciated the initiative of the forum for organizing the session and highlighted the importance of solar energy in the transition to a net zero power sector.

Dr. Rihan noted that the initial focus on renewable energy was driven by the need to supplement limited fossil fuel resources. However, the current emphasis has shifted **towards eliminating coal usage** entirely due to its carbon dioxide emissions. He highlighted the **rapid growth of solar energy in India**, from **10 MW in 2011 to around 90 GW currently**, with a target of **300 GW by 2030**. He also mentioned the significant increase in solar module manufacturing capacity, now at 60 GW, with further expansion expected.

Despite these advancements, Dr. Rihan acknowledged the **challenges posed by solar energy**, particularly its **availability only during the daytime**. He discussed the "**duck curve**" challenge, where there is a dip in grid demand at sunrise and a spike at sunset. To address this, he proposed a combination of **storage solutions**, **better forecasting, and innovative demand-side management (DSM).** He emphasized the need to shift energy loads to daytime to reduce storage requirements, using techniques like time-of-day tariffs.

Dr. Rihan also highlighted the potential of electric vehicles and green hydrogen production to utilize excess solar energy during the day. He mentioned the importance of integrating solar energy with wind and water resources to create a balanced energy mix. Additionally, he pointed to futuristic concepts like peer-to-peer energy trading as important developments in the sector.

- **Shri A V Krishnan**, Dr Raja Ramanna Chair Professor, NIAS

Shri. A V Krishnan who represented National Institute of Advanced Studies focused on the role of nuclear energy, with some discussion on hydrogen, in India's power sector. He highlighted India's position as the third-largest producer of electricity globally and discussed the **challenges and opportunities in reducing carbon emissions** and reorganizing the electricity mix to achieve energy security and sustainability. Mr. Krishnan shared the presentation and the key point from his address is as follows:

- India being **3rd largest producer of electricity with CO2 emissions** per unit of power being higher than the global average, necessitating a reorganization of the electricity mix.
- India's installed capacity is around 449.5 GW, with coal still dominating the energy mix with 76-77% that is almost stable.
- **Current nuclear power capacity is 8,180 MW, with plans to triple this by 2047** and the Challenges include identifying suitable sites for new nuclear plants due to stringent requirements.
- **Small Modular Reactor (SMRs) flexibility and lower Capex costs** which can be used to repurpose old coal plants, utilizing existing infrastructure to reduce costs and improve efficiency.
- Growing public support for nuclear power, driven by climate change concerns, is crucial for the expansion of civil nuclear energy.
- Hydrogen generation through electrolysis can complement energy storage solutions, reducing the need for batteries and lowering costs.
- **Steel and aluminium sectors** are moving towards green power to maintain **competitiveness and avoid fossil fuel taxes,** requiring continuous 24/7 power, making small modular reactors (SMRs) a viable option.
- The Guru Nanak Dev thermal plant in Panipat is being repurposed for SMRs, with ongoing studies and validations to ensure feasibility and safety.
- The demand for hydrogen has increased significantly, with a push for green hydrogen production despite challenges related to water scarcity and infrastructure needs.

- **IGCC (Integrated Gasification Combined Cycle)** plants, which are carbon capture-friendly and can produce grey hydrogen, are being explored for **higher efficiency**, with a long-term goal of **transitioning to green hydrogen**.
- Material development is a significant challenge in **AUSC Technology** due to the need for specialized, commercially unavailable materials, with ongoing R&D efforts crucial for overcoming these challenges.

- **Shri Ajay Shankar**, Distinguished Fellow, TERI and Ex Union Secretary, Govt of India

Shri. Ajay Shankar began his address by emphasizing the urgency of achieving net zero emissions, highlighting the critical need to **limit global warming to 1.5 degrees Celsius**. He pointed out that **decarbonizing the electricity sector**, which contributes over 40% of total carbon emissions, is a **"low-hanging fruit" due to the decreasing costs of renewables and storage solutions**. He advocated for aggressive movement on storage technologies, similar to the push for solar energy a decade ago.

Mr. Shankar also discussed the **success of electric vehicles (EVs)** in India, noting that the country is becoming a global leader in electric surface transport. He stressed that **achieving 50% decarbonization** quickly and cost-effectively is possible **through electrification and renewable energy**.

For hard-to-abate sectors like cement and steel, he suggested leveraging India's national hydrogen mission and public procurement to develop green technologies. He also mentioned the potential benefits of Europe's carbon tax on imports, encouraging India to support its industries in becoming green to maintain competitiveness.

- **Shri Pradip Das**, CMD, IREDA

Shri. Pradip Das started his address as representing a leading green finance company. He highlighted the significant role of the renewable energy sector in India's journey towards becoming a developed economy by 2047. He noted that the sector is largely risk-free and rewarding, provided there is disciplined project development and proactive financial solutions.

Mr. Das discussed the transition from small hydro to small nuclear reactors, reflecting on his unique experience in both nuclear power and renewable energy sectors. He pointed out that **technological constraints in the renewable industry are typically resolved in the initial stages, making the sector more stable and bankable over time.**

He stressed the importance of government support and simple policies to facilitate investment in renewable energy projects. He mentioned that the **Government of India** is working on making **new and emerging technologies bankable through subsidies and supportive policies**. This is crucial because private sector developers are more likely to invest in projects that are financially viable.

Mr. Das projected that **India would require around ₹30-32 lakh crore in investment by 2030** to meet its energy needs and global commitments. He highlighted that a significant portion of this investment is expected to come from the debt market and non-banking financial companies (NBFCs). He noted that **NBFCs have played a crucial role in financing renewable energy projects** and are expected to continue doing so.

He also touched upon the importance of understanding the nuances of the sector and the challenges faced by developers. He emphasized the need for a collaborative approach between developers and lenders to ensure timely and effective financial solutions.

Q & A

On the question “how the private investment would be sustained once government incentives are withdrawn given the context that 80% Given that 80% of investment in the renewable sector is by private industry, how do you foresee future private investment once government incentives are withdrawn, especially considering the need to monetize characteristics like resiliency and stability in solar energy?” by Dr. Grover, Mr Das responded by noting that government incentives were crucial 10 to 15 years ago but are no longer necessary for solar energy, as competitive bidding has led to fair and competitive prices. He emphasized that government support is essential during the infancy stage of any sector, similar to how parents support a child. As the sector matures, private sector participation increases, and government involvement decreases. He mentioned that the government has already announced capital subsidies for emerging technologies like green hydrogen. Mr. Das reiterated that the government’s role is to ensure a smooth transition from infancy to adulthood for the sector, after which the private sector should take over.

- **Shri Sanjay Bansal,** GM, BHEL

Mr. Sanjay Bansal discussed the advancements in **Advanced Ultra-Supercritical (AUSC)** technology, emphasizing its role in improving efficiency and reducing emissions in power generation. He highlighted the **collaborative efforts of Bharat Heavy Electricals Limited (BHEL), NTPC, and the Indira Gandhi Centre for Atomic Research (IGCAR)** in **developing this technology** under the National Mission on Clean Coal Technologies. The key takeaways from Mr. Bansal presentation is listed below:

- **AUSC technology increases steam temperatures and pressures**, enhancing turbine cycle efficiency, resulting in reduced coal consumption and lower CO2 emissions, with a typical 800 MW AUSC plant reducing coal consumption by around 300,000 tonnes annually.
- The National Action Plan on Climate Change identified clean coal technologies as a priority, leading to the formation of a consortium of BHEL, NTPC, and IGCAR to develop AUSC technology, with support from the Government of India.
- IGCAR focused on developing high-alloy materials capable of withstanding elevated temperatures and pressures, while BHEL designed and manufactured critical components like boilers and turbines using these advanced materials.
- A **demonstration plant will be set up at NTPC's Korba site**, utilizing existing infrastructure to showcase the feasibility and benefits of AUSC technology in a real-world setting.
- **Key challenges** included **developing new design criteria, welding technologies, and material selection**, with extensive R&D conducted to establish material properties and ensure the reliability of components.
- AUSC technology offers better resource utilization and significant emission reductions, with advancements also having potential applications in other industries, such as nuclear and defense.
- The **Government of India has provided budgetary support for the project**, emphasizing the importance of indigenous manufacturing and technological self-reliance.

- **Shri Pramod Kumar Mishra,** Additional Vice President, BRPL

Mr. Pramod Kumar Mishra, representing BRPL, began his address by highlighting the company's achievements and initiatives towards achieving net zero emissions. He focused on the practical steps that distribution companies (DISCOMs) can adopt to fast-track their contributions to a greener power sector, emphasizing the importance of grassroots implementation and mass movement. The key points from his address are as follows:

- **BSES ensured uninterrupted power supply during the G20 summit using grid supply** and is moving towards a greener power portfolio, aiming for 50% renewable energy integration.

- BSES promotes solar energy at the grassroots level to avoid extensive network capacity additions, currently having 166 MW of solar capacity with plans to increase this further.
- Major electrification projects for the Delhi Transport Corporation are underway, with 500 MW of load expected in the next two years, and **all BSES fleet vehicles are now electric**, setting a benchmark for the industry.
- Distribution of **64 million LED bulbs and replacement of street lights with LED lights to reduce energy demand**, along with the promotion of smart plugs for demand-side management and subsidized AC and fan schemes to reduce peak demand.
- Implementation of programs comparing customer bills to encourage energy-saving habits, resulting in significant demand reduction.
- **Implementation of battery storage solutions** to support overloaded distribution transformers and a virtual power project combining solar and battery storage to enhance grid stability and efficiency.
- Leveraging digital platforms for stakeholder engagement and education to fast-track renewable energy projects.

Key takeaways from the session

- Hydrogen generation via electrolysis complements traditional energy storage, reducing costs and preventing renewable energy curtailment.
- Small Modular Reactors (SMRs) provide continuous power, crucial for industries transitioning to green energy.
- Green hydrogen production faces challenges but is advancing with IGCC plants offering efficiency improvements.
- AUSC technology enhances turbine efficiency, reduces coal consumption, and lowers CO2 emissions.
- Collaboration between BHEL, NTPC, and IGCAR drives AUSC development with government support.
- Real-world demonstration of AUSC technology at NTPC's Korba site highlights its broader industrial applications.

Summary and concluding remarks

- Shri Satish C Sharma, convenor of the power group gave the gist of discussions held in each session of the daylong proceedings of the 23rd India Power Forum. He gave an account of the key points emerged out of deliberations held by each speaker in the respective session. The key recommendations emerged from

the deliberations have been separately listed in report. He appreciated the interest shown and insightful lively deliberations held during each session by respective speakers.

- Sh. K S Popli, Hon. Secy. General, IEF briefed on the emerging scenarios and thanked the galaxy of the speakers who contributed and attended the conference by taking out their valuable time from their busy schedule. He thanked the whole team of BDO, the knowledge partner who prepared the theme paper which would be very useful reference documents. While concluding he appreciated the contributions of the organizing committee and leadership provided by Dr. H L Bajaj, chairman of the Power Group and Sh. R V Shahi, President IEF. At the end of he requested Sh. R V Shahi to give his impressions and word of wisdom.

- Sh. R V Shahi, President, IEF said that summarizing has been well articulated. He expressed that concerted views have come and the way the technologies changes frequently, we have to be dynamic and reorient ourself as ultimately technology will decide the future dynamics. We should be sensitive towards the manufacturing and financial sectors as well by having objective views and move forward. For Hydro Pump Storage Plant, the whole country is moving forward and any leniency in decision making, the financial sector would get stressed. Sh. Shahi was appreciative of the Govt. Systems being quite sensitive and dynamic in implementing the decisions. While concluding he said very lively set of discussions have taken place and all have been highly educated and conveyed his thanks to everyone.

RECOMMENDATIONS

Key Recommendations from the 23rd India Power Forum on “Towards Net Zero Compliant Power Sector for Developed India”

Transition to Renewable Energy

- **Expand Renewable Energy Sources**: Accelerate the deployment of solar PV, solar thermal, and offshore wind energy. Invest in research on geothermal, tidal, and marine energy to enhance efficiency and reduce costs.
- **Accelerate Renewable Energy Expansion:** Building on progress from the 2009 solar mission, aim for 500 GW to 1200 GW of renewable energy capacity by 2047.
- **Leverage Hydropower**: Utilize hydropower as a key component in India’s decarbonization strategy, offering clean energy and supporting grid stability.

Modernizing Thermal Power

- **Deploy Advanced Ultra-Supercritical (AUSC) Technology**: Improve thermal power plant efficiency with AUSC to lower emissions.
- **Retrofitting and Emission Control**: Upgrade plants with emissions controls, such as FGD systems and Carbon Capture Utilization and Storage (CCUS) and explore co-firing with low-carbon fuels.
- **Phasing Out Inefficient Plants**: Gradually retire the oldest and least efficient thermal plants to support a cleaner energy mix.

- **Thermal Power Capacity**: Limit thermal capacity to 280 GW by the mid-2030s to encourage a shift towards renewables.

Advancing Nuclear Power

- **Promote Innovative Reactor Designs**: Support indigenous designs like PHWR-700 and explore Small Modular Reactors (SMRs) for reliable power keeping in mind components of energy security.
- **Digitalization in Nuclear**: Integrate AI/ML and advanced control systems in nuclear plants to enhance efficiency and safety.
- **Leverage Nuclear Technology for Grid Reliability**: Expand nuclear capacity with new 700 MW units and Bharat Small Reactors through NPCIL-NTPC joint ventures.

Green Hydrogen: Emerging Technology

- **Explore Green Hydrogen from Agro-Waste**: Promote green hydrogen production from agro-waste, addressing interconnected issues of fuel, food, and water.
- **Enhance Production Efficiency:** Implement Integrated Gasification Combined Cycle (IGCC) technology to improve operational efficiency and carbon capture capabilities.

Transmission and Distribution Modernization

- **Coordinated Grid Management:** Adopt a coordinated approach to grid development involving key stakeholders for resilience and flexibility.
- **Expand Green Corridors**: Develop extensive green corridors for high renewable energy shares in the grid.
- **Advance Transmission Infrastructure**: Implement HVDC transmission for efficient long-distance power transfer. Integrate smart grids, AI-driven monitoring, and predictive maintenance across the network.
- **Deploy Microgrids and Distributed Energy Resources (DERs)**: Expand microgrids and DERs with advanced Distributed Energy Resource Management Systems (DERMS) and cyber-physical systems for localized energy resilience.

Strengthening Policy and Financing Mechanisms

- **Implement Carbon Taxes**: Introduce carbon taxes to incentivize low-carbon technologies and emissions reductions.
- **Ensure Policy Consistency**: Maintain clear and stable policy communication to support renewable and nuclear energy investments, attracting private sector participation.
- **Encourage Private Sector Participation:** Attract private sector investment by ensuring return on investment and offering regulatory certainty in clean energy projects.
- **Innovative Financing**: Deploy mechanisms like green bonds to fund renewable energy, energy efficiency, and alternative fuel initiatives.

Skilled Workforce Development

- **Establish Skilled Workforce Development Centres (SWDCs)**: Develop centres to train the workforce in renewable technologies, advanced grid management, and other critical sectors of the clean energy transition.

Circular Economy and Sustainable Practices

- **Integrate Circular Economy Practices**: Adopt circular practices to minimize waste, promote resource efficiency, and maximize the lifecycle of energy-related resources.

Comprehensive and Long-Term Planning

- **Set a Target for Emission Peaking:** India should target emission peaking by 2034-2035 to align with rapid technological advancements and renewable transition goals.
- **Strategic Emission Reduction Initiatives Post-2035**: Focus on systematic, sustainable emissions reductions, supported by extensive R&D as market maturity increases.
- **Conduct Comprehensive Studies**: Perform in-depth studies to address the complexities of achieving net zero, providing data-driven insights to inform future policy and planning.

Hydropower and Pumped Storage Projects

1. Policy and Regulatory Support

- **Streamline Approval and Clearance Processes:** Simplify approval and clearance processes for hydropower and PSP projects to accelerate project timelines.
- **Encourage Round-the-Clock (RTC) Power Purchase Agreements:** Promote RTC agreements to ensure a stable hydropower supply, effectively balancing renewable generation with demand.
- **Facilitate Relaxed Transmission Charges:** Implement favorable intra-state transmission charge policies for hydropower, making it more competitive and efficient.
- **Consider Exemptions from Free Power Obligations:** Evaluate exemptions from free power obligations for selected hydropower projects to improve scalability and economic feasibility.
- **Develop Centralized Oversight for Site-Specific PSP Projects:** Appoint a central agency to manage site-specific assessments and feasibility studies, ensuring reliable project evaluations.
- **Create Future-Ready PSP Guidelines and Policies:** Design guidelines for PSPs that align with India's zero-carbon goals and address needs such as increased daytime power absorption and extended dispersal periods.

2. Financial and Investment Mechanisms

- **Develop Financial Frameworks and Risk-Sharing Mechanisms:** Establish financial models, including risk-sharing or compensation frameworks, to attract investments and ensure financial security for PSP projects.
- **Implement Normative Tariffs and Contracts for Difference:** Introduce baseline tariffs or contracts for difference, inspired by international examples, to provide stability for investors in PSPs.
- **Monetize Storage and Civil Works:** Explore monetization avenues for storage services and associated civil works to improve project viability and offer alternative revenue streams.

3. Technological and Operational Enhancements

- **Explore and Promote Indigenous Technology for Energy Storage:** Invest in and promote technologies like graphene-based supercapacitors, which offer rapid response times and lower environmental impact compared to conventional battery storage.
- **Incorporate Flexible Contractual Provisions:** Integrate flexibility within PSP contracts to adapt to project requirements and expedite completion.
- **Encourage Continuous Development and Support for Battery and PSP Solutions:** Recognize the complementary roles of battery storage and PSPs and encourage innovative business models and policies to support both solutions.