Petroleum Planning & Analysis Cell

Ministry of Petroleum & Natural Gas

# 24th PPAC Foundation Day Report

## Thursday 3rd April 2025



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# Dialogues on Energy Security & Transition


Petroleum Planning & Analysis Cell (PPAC), an attached office of the Ministry of Petroleum and Natural Gas came into being in 2002 after the dismantling of the Administered Pricing Mechanism (APM) in the petroleum sector. Oil Coordination Committee (OCC) was abolished and PPAC was created. Shri Ram Naik, the then Hon'ble MoPNG inaugurated PPAC at SCOPE Complex, Lodhi Road, New Delhi.

The mission of PPAC since its inception has been "To be the most authentic official source for data and policy analysis on the hydrocarbon sector in the country." It works to strengthen the data system by adopting the latest techniques and best practices. PPAC aims to render effective assistance to the M in the discharge of its responsibilities, monitor and analyse developments in the domestic oil and gas sector. It also undertakes analysis of domestic and international energy markets. The organisation in its 23 years history has worked to develop a cooperative framework for exchange of information and conduct of studies with other countries and international organisations in the energy sector.


PPAC started to celebrate its Foundation Day in small way since the year 2023. The objective of the event since beginning has been to encourage dialogue among the stakeholders to help the country to achieve the goal of energy independence and energy security. This year on its 24th Foundation Day, PPAC assembled all its stakeholders from Oil & Gas sector. The event was attended by senior leadership of the sector along with their teams.

The 24th Foundation Day was inaugurated by Hon`ble Minister of State, Petroleum & Natural Gas and Tourism on 3rd April 2025 at Convention Centre, Scope Complex, New Delhi and about 350 delegates from the sector attended. The day long programme discussed the theme through four panel discussions and two executive dialogues.

PPAC thanks all the stakeholders and the industry leaders who have been supporting it in achieving its vision to serve the sector on the path of Viksit Bharat in 2047.

This report detailing the key outcomes has been developed for the benefit of the stakeholders with the help of PPAC Knowledge Partner M/s Deloitte and M/s ET EnergyWorld. My compliments also to PPAC officers, Mr Priyanshu Raparia, Mr Surya B Mall and Mr K Vikrant Rao who drafted this report.

**Director General**
**Petroleum Planning & Analysis Cell**

# Inaugural Session

PPAC celebrated its 24th Foundation Day on 3rd April 2025 with daylong discussions and deliberations. The programme was inaugurated by the Hon'ble Minister of State for Petroleum & Natural Gas and Tourism, Shri Suresh Gopi, at SCOPE Complex, New Delhi.



The Director General, PPAC, welcomed the Hon'ble Minister and all delegates representing various stakeholder organizations. In his address, he shared the vision behind instituting the Foundation Day celebrations and highlighted the significance of collaborative stakeholder engagement in advancing India's energy goals.

Addressing the gathering, the Hon'ble Minister stated, *"India is the fastest-growing major economy, and energy plays a vital enabling role in driving growth across all sectors."*

India stands at a pivotal moment in its energy transition. As the third-largest consumer of energy and home to nearly 18% of the global population, the country is poised to be a key driver of global energy demand growth.


This strategic position, coupled with the global imperative to address climate change, presents both significant challenges and transformative opportunities. As the world's fifth-largest economy, with a GDP exceeding $3.7 trillion, India is steadily advancing towards its target of becoming a $5 trillion economy.India is the fastest-growing major economy, and energy serves as a critical enabler of growth across all sectors. The oil and gas sector alone contributes nearly 15% to the Gross Value Added (GVA) of the country's core industries, playing a pivotal role in driving employment, attracting investment, and ensuring fiscal stability.

He commended PPAC for its critical contribution to India's energy journey, highlighting its role in supporting the Ministry and the sector through the provision of reliable data and insightful policy analysis.

The inaugural session was attended by senior officials from the Ministry of Petroleum & Natural Gas, including Ms. Kamini Ratan Chauhan, ASFA, MoPNG, and Ms. Varsha Sinha, Secretary, OIDB, along with senior management from leading oil and gas companies and other key stakeholders.

# CEO Panel: Future-Ready Oil and Gas Industry: Challenges & Opportunities on the Road to 2047

The oil and gas industry continues to be a cornerstone of India's energy security and economic growth. However, as the nation advances towards *Viksit Bharat 2047*, the sector faces a dual challenge: ensuring energy security while transitioning towards cleaner and more sustainable operations.


## Discussion Points

- The role of India's OGMCs in the energy transition, balancing energy security and sustainability through diversification and decarbonization.
- Opportunities in biofuels and hydrogen as future fuels, alongside electrification.
- Challenges in the shift to future fuel Retailing (Land Requirements, technological advancements, infrastructure development & Investment Gaps etc.)
- Policy & Financial Enablers for a Future-Ready Industry. (Favourable Policy Frameworks, Financing Mechanisms etc.)

India's oil and gas industry is gearing up to remain resilient, relevant, and responsive amid evolving global energy dynamics, increasing sustainability imperatives, and ambitious national goals. As India progresses on its path to Viksit Bharat by 2047, the sector must navigate the dual imperative of safeguarding energy security while **accelerating the energy transition.**

The event featured a high-profile panel discussion on the theme *"Future-Ready Oil & Gas Industry: Challenges & Opportunities on the Road to 2047."* The panel brought together the leadership of India's major oil and gas companies across the upstream and downstream segments.
Distinguished panelists included Mr. Arun Kumar Singh, CMD, ONGC; Mr. A. S. Sahney, Chairman, IOCL; Mr. Vikas Kaushal, CMD, HPCL; Dr. Ranjit Rath, CMD, Oil India Limited (OIL); Mr. Harish Mehta, CEO & MD, Jio-bp; and Mr. Prasad K. Panicker, Chairman, Nayara Energy. The session was expertly moderated by Mr. Sudheer Pal Singh, Editor, ET Energy.

Several key insights and strategic perspectives emerged from this high-level panel discussion.

### 1. Navigating a Mixed Global Energy Landscape

The current global energy landscape is characterized by a slowdown in oil demand growth and a rebalancing of supply dynamics. In India, oil demand continues to rise at a steady

rate of 3–4% annually, primarily driven by growth in the gasoline and aviation sectors, while diesel demand has largely plateaued. At the global level, a surplus production capacity of nearly **9 million barrels per day** has resulted in a "problem of plenty."

In contrast, natural gas continues to gain prominence as a growing energy source, with India placing strategic focus on expanding gas infrastructure—ranging from domestic exploration and LNG imports to the accelerated development of the City Gas Distribution (CGD) network.

### 2. Domestic Exploration and Strategic Autonomy

India's pursuit of energy independence makes domestic exploration a strategic imperative rather than a matter of choice. At a time when the world is witnessing a trend toward deglobalization, India is actively opening up new sedimentary basins through initiatives such as the Open Acreage Licensing Policy (OLAP), including exploration in technically challenging ultra-deepwater regions.

State-owned enterprises are actively forging collaborations with global oil majors, such as Petrobras, to leverage advanced technologies and expertise for unlocking India's untapped hydrocarbon reserves.

### 3. Investing in Capacity, Infrastructure, and Resilience

To ensure energy availability and affordability, public sector refiners are increasing refining capacity by over **20%** within the next two years. Simultaneously, they are investing in electric mobility infrastructure (e.g., **10,000+ EV charging stations**), battery swapping, and renewable power integration into operations.

To ensure energy availability and affordability, public sector refiners are set to increase refining capacity by over **20%** within the next two years. At the same time, they are making significant investments in electric mobility infrastructure, including the deployment of over **10,000 EV charging stations**—alongside initiatives in battery swapping and integration of renewable energy into their operations.

India's oil and gas sector is transitioning into an integrated energy ecosystem, where conventional fuels increasingly coexist with electricity, biofuels, and emerging alternatives like hydrogen.

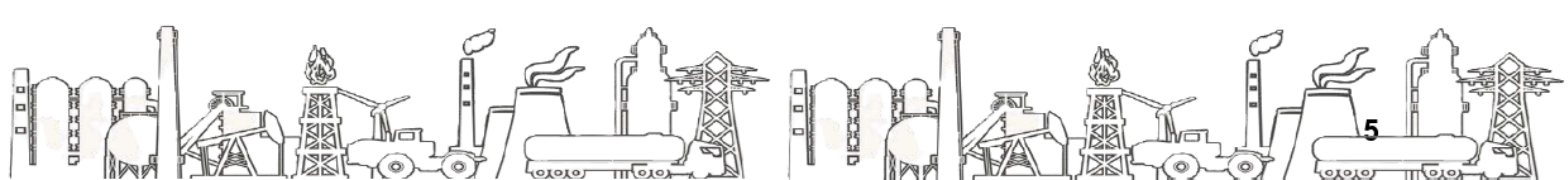
### 4. Energy Transition as an Enabler of Energy Security

Energy transition and energy security are not conflicting goals—in fact, they are deeply interconnected. Diversifying away from oil dependence through green hydrogen, electric vehicles, and biofuels not only strengthens energy security but also supports India's commitment to global climate goals.

- **Green hydrogen**: IOCL is setting up one of the country's largest green hydrogen plants at 10,000 TPA.
- **Ethanol blending** has nearly reached 20% with plans to scale further.
- **CBG and SAF (Sustainable Aviation Fuel)** were identified as high-potential segments, particularly in light of India's anticipated surge in aviation fuel demand.

### 5. Changing Customer Expectations and Retail Evolution

The traditional fuel retail model is being transformed. Today's customers expect more than just fuel, they demand complete **energy and service experience**, including:



- Differentiated fuel options (green diesel, ethanol blends),
- Ancillary services (grocery, grooming, oil changes),
- Digital payments and loyalty integration.

Fuel stations are evolving into **energy stations ,** offering petrol, diesel, EV charging, CNG, and battery services under one roof.

### 6. Technology, Efficiency, and Regulation as Enablers

Technology plays a decisive role in shaping exploration, operations, and customer experience:

- Advanced seismic imaging and AI are improving exploration success.
- Enhanced recovery techniques and digital twins are improving efficiency and cost competitiveness.
- The sector is moving from a "30% efficiency" paradigm to significantly higher energy extraction and process optimization.

In terms of regulation, India now offers one of the most liberal exploration and production (E&P) frameworks globally, with minimal taxation on new fields—creating a highly conducive environment for investment. The forthcoming introduction of carbon markets is expected to further reshape industry incentives and transform the energy economics landscape.

### 7. Balancing Profitability with Sustainability

A key theme that emerged was the financial tightrope companies must navigate—balancing short-term profitability from core fossil fuel operations with long-term investments in sustainability. As the energy transition accelerates:

- Core businesses will continue to fund clean energy investments.
- Government support, especially through pricing, tax benefits, and policy incentives, will be crucial to scale emerging technologies.

The transition is expected to be gradual but inevitable, requiring adaptive strategies and collaborative ecosystem development.

### 8. Vision 2047: The Energy Company of the Future

By 2047, today's oil companies are expected to transform into diversified energy enterprises, seamlessly operating across fossil fuels, renewables, hydrogen, and digitally enabled energy services.

India's distinctive energy demands, coupled with its demographic dividend, present both a significant challenge and a transformative opportunity.

- Technology, collaboration, and strategic planning will be the key enablers for companies to thrive in the evolving energy landscape..
- A **resilient, agile, and innovation-driven oil and gas industry** will be essential to realizing the vision of Viksit Bharat 2047.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24th पी पी ए सी स्थापना दिवस
PPAC Foundation Day
3rd April 2025
Convention Centre, SCOPE Complex, New Delhi


Sh. Harish Meht
- Strategy &

# Panel: Energy Security in Vision of Viksit Bharat 2047


Energy security is a cornerstone of India's vision to become a Viksit Bharat (developed nation) by 2047. As the centenary of independence approaches, the focus must be on building energy systems that are **affordable, accessible, clean, and resilient**—capable of supporting a high-growth, inclusive, and equitable economy.

## Discussion Points

- Ensuring a diverse supply of crude oil and natural gas is critical for our nation's energy security, safeguarding against geopolitical risks and enhancing our resilience to market fluctuations.
- Diversification of the energy mix (expanding renewable energy sources, strengthening natural gas infrastructure, accelerating the green hydrogen economy, etc.).
- Given the importance of renewables in the energy mix in the future, there is a shift in the focus of OGMCs to increase the share of renewables in their portfolio.
- The role of biofuels and energy efficiency is key in reducing the country's import dependence. Diversification to coal gasification for hydrogen generation, as well as for advanced biofuels.
- Strengthening energy infrastructure and resilience (expanding strategic petroleum reserves, implementing energy storage solutions and smart grids, modernizing transmission and distribution networks, etc.).

The panel chaired by Prof Rangan Banerjee. Director IIT Delhi and speakers included Mr Abhay Bakre, Mission Director, National Green Hydrogen Mission; Mr Prabh Das, CEO, HMEL; Mr Subhash Kumar, Director General, ACE and Dr Ritu Mathur, Director, TERI and moderated by Mr Deepak Mahurkar, Leader Oil & Gas, PwC.


The panel was chaired by Prof. Rangan Banerjee, Director, IIT Delhi, and featured distinguished speakers including Mr. Abhay Bakre, Mission Director, National Green Hydrogen Mission; Mr. Prabh Das, CEO, HMEL; Mr. Subhash Kumar, Director General, ACE; and Dr. Ritu Mathur, Director, TERI.

The following key takeaways emerged from the discussions moderated by Mr. Deepak Mahurkar, Leader – Oil & Gas, PwC.

### 1. Evolving Energy Security: From Scarcity to Strategic Planning

Over the past decades, India has made substantial progress in enhancing energy reliability. Incidents of blackouts, fuel shortages, and inconsistent access have significantly declined. Today, the focus has evolved towards securing long-term energy independence—particularly in the context of volatile geopolitics, shifting global supply chains, and ongoing realignments in the global energy landscape.

By 2047, India can—and must—achieve energy independence through a strategic blend of diversified energy sources, enhanced domestic exploration, accelerated renewable energy deployment, and improved demand-side efficiencies.

### 2. Diversified Fuel Mix: All Options on the Table

It is important to underscore the need for a multi-source, technology-agnostic strategy. India must avoid the premature exclusion of any energy source and instead adopt a flexible, inclusive framework that encompasses:

- **Renewables** (solar, wind, bioenergy),
- **Fossil fuels** (with improved efficiency and carbon mitigation),
- **Green and blue hydrogen**,
- **Nuclear power** (including small modular reactors),
- **Energy efficiency** as the "fourth fuel".

India currently generates approximately **26% of its electricity from non-fossil sources**, with ambitions to significantly increase this share by 2047. However, with oil imports accounting for nearly 88% and gas imports around 50% of total consumption, reducing import dependency remains a pressing challenge.

### 3. Technology and Innovation as Enablers

Technology was highlighted as a decisive force in shaping India's energy future. The country has leapfrogged in areas like solar panel efficiency, grid integration, and electrification. Emerging frontiers include:

- **AI and sensors** in energy forecasting and distribution,
- **Distributed energy systems**,
- **Solid-state batteries** and ultra-fast charging,
- **Green hydrogen** and its derivatives (e.g., methanol, SAF),
- **Carbon capture and utilization**.

India's innovation ecosystem—driven by collaboration between academia, industry, and startups—was highlighted as a key enabler of the country's energy transition.

### 4. The Role of Green Hydrogen and Biofuels

The country is building capacity for both production and application of hydrogen in mobility, steel, chemicals, and power sectors. By **2040**, green hydrogen could contribute **at least 10% of India's total energy basket**.

Biofuels, including ethanol, compressed biogas (CBG), and sustainable aviation fuel (SAF), were also seen as high-potential contributors—particularly for transport and aviation, where demand is expected to grow rapidly.

### 5. Macroeconomic Outlook and Energy Intensity

India, currently a $4 trillion economy, accounts for **6.5% of global energy consumption** and approximately **7% of global carbon emissions**. As the country aspires to become a **$20–25 trillion economy by 2047**, its energy demand is expected to double or even triple—placing energy availability, affordability, and sustainability at the heart of its development trajectory.

Natural gas, with a 30–35% lower carbon footprint than oil, is expected to play a critical transitional role—particularly in hard-to-abate sectors. However, as highlighted during the discussion, electric vehicles (EVs) are only truly sustainable when powered by a **green grid**, reinforcing the imperative of parallel efforts toward grid decarbonization.

### 6. Institutional and Infrastructure Preparedness

India's extensive fuel distribution infrastructure—reaching every corner of the country—was recognized as a strategic asset. This nationwide network can be

effectively leveraged to support the rollout of emerging fuels such as bio-CNG, hydrogen, and EV services.

### 7. Transition with Pragmatism, Not Perfection

**The energy transition must be pragmatic**—neither rushed nor bound by ideological rigidity. The path to Net Zero will be a **hybrid** one, carefully balancing the country's development priorities with its climate commitments. India's approach will be:

- Guided by national circumstances,
- Built on energy affordability for all,
- Driven by economic competitiveness.

India's energy transformation is not merely a necessity—it is a strategic advantage that offers the potential to achieve energy independence, climate resilience, and inclusive growth by 2047. Realizing this vision requires a development pathway that embraces a diverse mix of fuels and technologies across different stages of the transition, promotes innovative and scalable business models, considers social and environmental impacts beyond traditional financial metrics, and moves beyond siloed, sector-specific approaches through integrated and collaborative policymaking.

# Panel: Pioneering the Future of Sustainable Energy with Biofuels & Hydrogen


As the world transitions towards clean energy, biofuels and hydrogen have emerged as pivotal solutions for a sustainable future. For India, harnessing these energy sources aligns with our vision of *Viksit Bharat 2047*, ensuring energy security, reducing carbon emissions, and fostering industrial innovation. The panel explored the transformative potential of biofuels and hydrogen in driving the next phase of India's energy transition.

### Discussion Points

- The role of biofuels in India's current and future energy mix, with the country having achieved nearly 20% gasoline blending ahead of the target date.
- Sustainable Aviation Fuel (SAF) as a value-added product to position India as a net exporter.
- The country's challenge in charting a roadmap for diesel blending.
- Advanced biofuels and e-fuels – technology advancements and commercial production, including coal gasification.
- Hydrogen as the fuel of the future (industrial and transport applications, hydrogen as a fuel in internal combustion engines).
- The role of carbon pricing in making biofuels more affordable.

The panel, chaired by Dr. Sangeeta Kasture, Scientist Grade 'G', MNRE, featured esteemed speakers including Mr. Deepak Srivastava, Director (BR), MoPNG; Mr. Alok Sharma, Director R&D, IOCL; Mr. Satinder Pal Singh, Managing Director – India, LanzaTech; and Mr. Vijay Nirani, Managing Director, TruAlt. The discussion was moderated by Mr. Sanjay Sah, Partner, Deloitte, and led to the following key takeaways:

1. India has abundant biofuel feedstock capable of replacing a significant share of fossil fuel imports. The ethanol success story continues, with potential to scale up blending and even explore exports.
2. Biofuels aren't just about carbon savings — they're social transformers, as was evident from the farmers' lives that have been enriched owing to the new fuels. Dr. Sangita Kasture aptly summarized in the form of Six E's: **Energy Security, Employment, Emerging Technology, Ecology, Entrepreneurship, Equity**
3. To scale up renewables share as part of primary energy from **16% to 40% by 2050**, we must focus on:

a. Aggregating disaggregated feedstock like Municipal Solid Waste
b. Rationalization of equipment costs via tax reforms
c. Leveraging full value chain for biofuels (e.g., conversion of biomass to hydrogen)
d. Using innovations like **carbon capture** and pretreatment in case of CBG
e. Ensuring better economics with scaleup in Hydrogen production

4. A fuel-specific roadmap with appropriate pricing and policy support is critical to encourage long-term investments.

5. Through initiatives like the **Global Biofuel Alliance (GBA)**, India has the potential to lead the segment globally — setting the benchmark for innovation, collaboration, and sustainable energy leadership.


# Panel: Financing Mechanisms for Energy Transition


India's energy transition is key to its net-zero 2070 goal, requiring major investments in renewables, grid modernization, and clean technology. With a 500 GW non-fossil fuel target by 2030, diverse financing mechanisms—government incentives, private investments, multilateral funding, and carbon markets—are crucial. Initiatives like Productivity Linked Incentive, Viability Gap Funding, Green Energy Corridor, and Green Bonds support clean energy expansion, but high costs, policy uncertainties, and financial risks remain challenges. Blended finance, ESG investments, fintech, and PPPs are emerging as vital tools to mobilize sustainable capital for India's clean energy future.

### Discussion Points

- Role of Policy and Regulation (Impact of initiatives like PLI, VGF, REC, and CCTS on clean energy financing.)
- Mobilizing Capital (Public-private investments, green bonds, FDI, and multilateral funding from agencies like World Bank and ADB.)
- Carbon Markets and ESG Financing (Opportunities in carbon trading, ESG-driven investments, and corporate sustainability.)
- Challenges in Clean Energy Financing (High capital costs, financial risks, policy uncertainties, and risk mitigation strategies.)
- Fintech and Innovative Finance (Green banking, digital platforms, blockchain, and crowdfunding for renewables.)
- Future Roadmap (Blended finance, strengthening PPPs, and scalable financing for the net-zero transition.)

The panel agenda covered this very important topic of financing mechanisms for energy transition. The panel included Mr Pradip Kumar Das, CMD, IREDA, Ms Rajasree Ray, Economic Advisor, MoEFCC, Ms Vibhuti Garg, Director, South Asia IEEEA and Ms Pravina Rai, MD & CEO, MCX. The engaging discussion was moderated by Mr Gurpreet Chugh, ICF. The following key points emerged from the discussion.

"India's renewable energy industry has recorded historic growth in the past ten years. This has been made possible by a passionate, committed and disciplined approach of the Government of India."


The critical role of financing in enabling India's energy transition journey as it aims for Net Zero by 2070. With clean energy now entering the energy system at an unprecedented scale, how India can mobilize the estimated **$200 billion annually** required to transition its energy sector—equivalent to 5–6% of the national GDP.

## 1. The Scale of the Financing Challenge

India requires massive capital inflows—approximately ₹17.5 lakh crore annually—to meet its clean energy targets, including 500 GW of non-fossil capacity by 2030. This amount far exceeds traditional public funding avenues and must be complemented through **private investments, institutional capital, and international financing.**

Interestingly, India's household savings (~$200 billion/year) are of a similar scale, highlighting the importance of creating mechanisms that attract and redirect domestic savings toward green investments.

## 2. Policy, Global Alignment, and Domestic Resilience

India's commitment to global climate accords, particularly the **Paris Agreement**, forms the policy backbone for its energy transition. Despite international fluctuations (e.g., the US policy shifts), India has stayed the course through:

- Domestic climate actions are financed largely through internal resources.
- Nationally Determined Contributions (NDCs) aligned with low-carbon economic pathways.
- Flexibility in implementation based on national circumstances and development priorities.

Government-led schemes and policy clarity have played a pivotal role in attracting investment and reducing investor risk perception.

### 3. Capital Sources and Financial Instruments

How clean energy projects are financed in India:

- **30% through equity**, with significant FDI and private capital inflow.
- **70% through debt**, sourced from:
  - NBFCs (largest share),
  - Bond markets (including masala, and transition bonds),
  - Banks (surprisingly, only about 14%).

Innovative instruments such as sovereign green bonds, sustainability-linked loans, blended finance, and concessional capital are increasingly being utilized to de-risk projects.

### 4. Supporting Emerging Technologies

While **solar** and **wind** are now mature technologies with decreasing investment risk, emerging technologies like **green hydrogen, battery storage, pumped hydro, and carbon capture** face challenges in securing financing due to:

- Lack of proven returns,
- Rapidly evolving cost structures,
- Limited policy certainty.

### 5. MSMEs and Inclusive Financing Models

Small businesses and MSMEs often struggle with traditional balance sheet financing. The session emphasized the need to:

- Innovate with cash-flow-based lending models (e.g., using GST data, invoice history),
- Improve creditworthiness through digital infrastructure,
- Foster platforms for peer-to-peer energy trade and rooftop generation.

Corporate governance and credit transparency were identified as key factors in improving access to sustainable finance, especially for newer players in the clean tech space.

### 6. Managing Risk Through Derivatives and Market Mechanisms

Risk management emerged as a major theme. Volatility in energy prices and uncertainty in project revenues can deter investment. Thus, there is a growing call for:

- **Commodity and energy derivatives** (electricity, gas, carbon) to hedge pricing risk,
- Development of **carbon markets** (including domestic trading platforms) to incentivize emissions reduction and monetize decarbonization,
- Enhancing **financial infrastructure** to support long-term, predictable cash flows.

## 7. Institutional Strength and Global Integration

Domestic institutions such as **IREDA** and specialized NBFCs have led from the front, with over 90% of their growth in green finance occurring in the last decade. Their experience shows that:

- **Strong corporate governance**, predictable regulatory frameworks, and
- **Defined green taxonomies** are essential for scaling up sustainable finance.

**India's energy transition is financially achievable**, but it requires:

- **Blended and innovative finance models**,
- **Risk-adjusted investment frameworks**,
- **Policy and regulatory certainty**, and
- **Inclusive approaches** that support both large-scale and decentralized clean energy deployment.

India's unique advantage stems from its rising energy demand, demographic dividend, and a steadily improving investment ecosystem. With the right financial architecture, it has the potential not only to meet its 2070 Net Zero targets but also to emerge as a global leader in clean energy financing.

# Executive Dialogue: Advancements in Refining for the Future: An Indian Perspective


The first Executive Dialogue featured Mr. Anuj Jain, Senior Director, KBR Technologies, and Mr. Rajesh Agarwal, Executive Director, CHT, engaging in a focused discussion on advancements in refining. The dialogue centered on innovation, integration, and sustainability as critical pillars for meeting future energy demands.

In the context of India's rising energy needs and strong commitment to decarbonization, the session underscored the importance of strategic transformation in the refining sector—through the adoption of advanced technologies, diversification of feedstocks, and enhanced utilization of indigenous capabilities.

## Key Takeaways:

### 1. Bottom-of-the-Barrel Upgradation and Feedstock Utilization

India's refining industry is actively exploring advanced pathways for bottom-of-the-barrel conversion to maximize value. Technologies such as Lean Crackers, Propane Dehydrogenation (PDH), offer flexibility in utilizing varied refinery feedstocks. The integration of these systems, including advanced FCC configurations and swing unit capabilities, enables refiners to pivot between fuels and petrochemical outputs based on market demands.

### 2. Petrochemical Intensity and Swing Refinery Concept

With petrochemical demand rising in parallel with population growth, the Indian refining sector is rapidly integrating petrochemical production into existing operations. The concept of "swing refineries" — capable of switching between fuels and petrochemicals — was strongly advocated. This adaptability is seen as vital in a world affected by geopolitical shifts and evolving energy policies.

Multi-feed and flexible operation capabilities are increasingly being seen as essential features of next-generation refineries.

### 3. Emphasis on Indigenous R&D and Commercialization

India's public sector refiners — IOCL, BPCL, and HPCL — have made significant progress in developing in-house R&D capabilities, with multiple pilot plants

established over the last decade. However, the session emphasized the need to take these innovations beyond pilot scale by pushing towards commercialization, licensing, and broader deployment.

### 4. Green Hydrogen Integration and Energy Transition

Green hydrogen was identified as a key pillar of India's decarbonization strategy. With 35–40% of the current energy mix coming from renewables, green hydrogen presents a natural extension for refinery integration — not only as a process fuel but also in mobility and chemical production. However, cost remains a critical barrier. The industry is optimistic that advances in electrolyzer efficiency, durability, and scale will drive costs down, making integration economically viable in the near future.

### 5. Co-Processing and Renewable Feedstocks

The growing emphasis on bio-refineries and renewable feedstocks comes with challenges. Variability in bio-feed compositions affects processing conditions and catalyst performance. However, co-processing solutions — particularly in FCC units — are being trialed successfully. Feed characterization, catalyst selection, and operational flexibility will be key to scale these solutions commercially.

Technologies for Sustainable Aviation Fuel (SAF), such as HEFA (Hydroprocessed Esters and Fatty Acids), alcohol-to-jet, and synthetic fuel via $CO_2$ utilization were discussed as emerging opportunities with high integration potential.

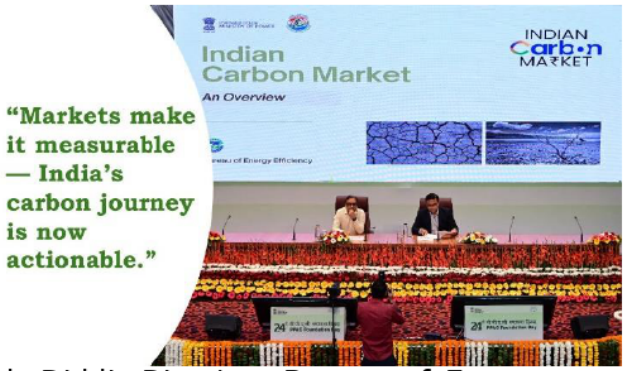
### India's Energy Landscape and Future Outlook

India's refining capacity has expanded significantly from a single unit at independence to 23 refineries. With energy demand projected to grow by 4–5% annually, an additional 40 million tons of oil equivalent will be required each year.

### Conclusion


India's refining sector stands at a pivotal moment in its journey toward sustainability, energy security, and global competitiveness. The way forward lies in synergizing indigenous technology, flexible operations, advanced process integration, and a bold push for commercialization. As India moves towards its energy transition goals, refiners will need to act as innovation leaders — transforming challenges into opportunities through collaboration, agility, and long-term strategic thinking.

# Executive Dialogue: Carbon Markets in India


In another Executive Dialogue, Mr. Saurabh Diddi, Director, Bureau of Energy Efficiency (BEE), shared his insights on *"Carbon Markets in India"* in conversation with Mr. Rohit Kumar, Secretary General, CMAI.

With climate change no longer a distant threat but a daily reality, this session underscored how India is translating policy into platforms, and intent into implementation. The carbon market is not just an environmental tool — it's a signal of India's readiness to lead with accountability and innovation.

From Policy to Platform: India's Carbon Market is Here Starting with the 2022 amendment to the Energy Conservation Act, India has built a robust framework for a national carbon credit trading system. All major regulations and procedures — from sector selection to credit issuance — are now in place. The final step? A public-facing portal, launching by December 2025.

- Built to Scale: Strong Governance Backbone
  The market is overseen by a National Steering Committee (chaired by the Ministry of Power), with BEE as the administrator and CERC regulating trading. Technical committees across sectors ensure benchmarks are both fair and ambitious.

- Offset Mechanism: Open for All
  Beyond compliance, a voluntary offset mechanism welcomes projects in renewables, agriculture, forestry, waste, and hydrogen. Approved methodologies and project registration rules are already live, enabling broader participation.

- A Market-Driven Climate Tool
  The Indian Carbon Market will create economic incentives for decarbonization, reward innovation, and foster a culture of measurable action. It's not just a regulatory measure — it's a climate-smart market transformation.

- As India builds its low-carbon future, the carbon market offers a bold, transparent, and scalable solution to align industry with climate ambition.

# Closing Session


The event concluded with a thought-provoking address by Dr. Pallavi Jain Govil, Director General of Hydrocarbons (DGH), who called upon all stakeholders in the oil and gas industry to unite in shaping a secure and sustainable energy future for the nation. She underscored the need to strike a balance between market-driven business models and ensuring affordability and access to clean energy for all citizens.

She commended PPAC for its pivotal role in providing robust and reliable data to both the industry and the government, noting that informed decision-making today is impossible without accurate data. She also appreciated the diverse range of subjects addressed during the day-long event.

# Award Ceremony: PPAC Greenfinch Data Excellence Award

PPAC has long upheld its vision "To be the most authentic official source for data and policy analysis on the hydrocarbon sector in the country." As we celebrate our 24th Foundation Day, we reaffirm our commitment to excellence and transparency in data management.
In alignment with this vision, PPAC has launched the "PPAC Greenfinch Data Excellence Awards". This award seeks to honour organizations that excel in upholding the following core pillars of Data Quality demonstrating exceptional practices in ensuring their data is of the highest quality and reliability.
The awards are branded as "PPAC Greenfinch Data Excellence Award" inspired by the Greenfinch bird which not only has colours matching PPAC logo but also symbolises transformation, advancement, efficiency, resilience, and teamwork.

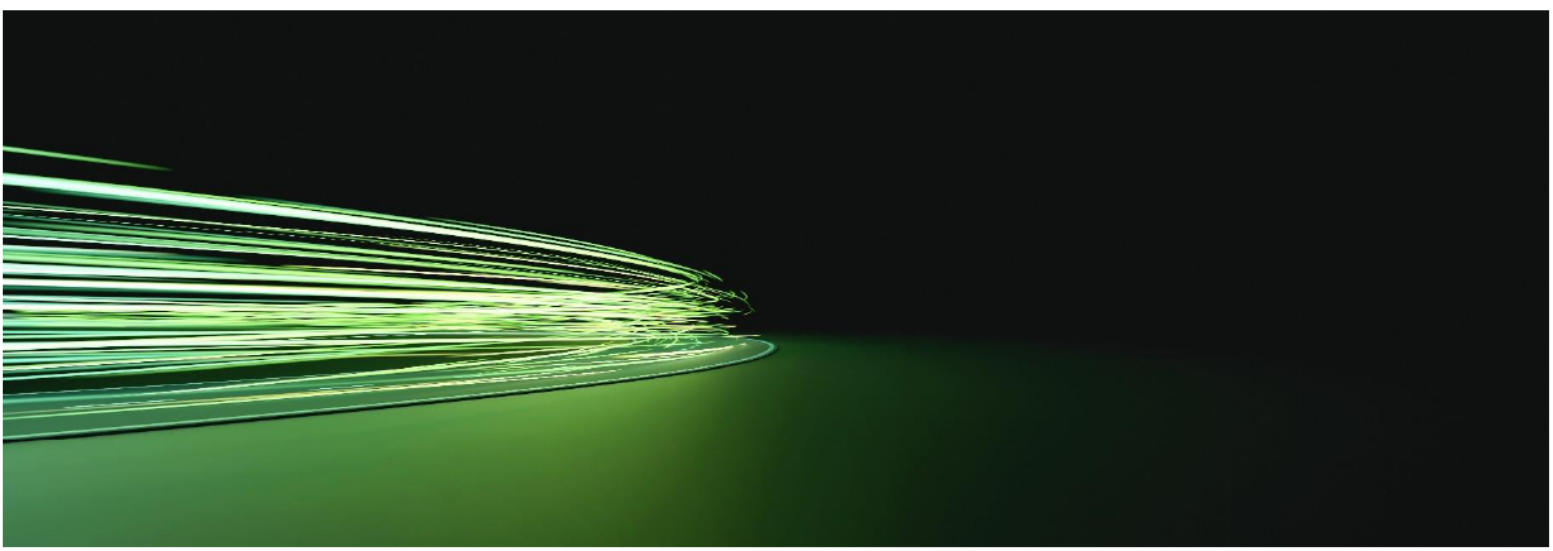
The winners of inaugural awards which are focused on downstream data were M/s Indian Oil, M/s Hindustan Petroleum, M/s Bharat Petroleum and M/s GAIL India. The awards were handed over by DG, DGH along with CMD, ONGC and DG, PPAC.




**Dialogues on Energy Security & Transition**


***Silver jubilee foundation day next year.***

***Looking Forward But Staying in the Momentum.....***



**Petroleum Planning & Analysis Cell**
Ministry of Petroleum & Natural Gas, Government of India
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**For suggestions on report, please contact.**

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