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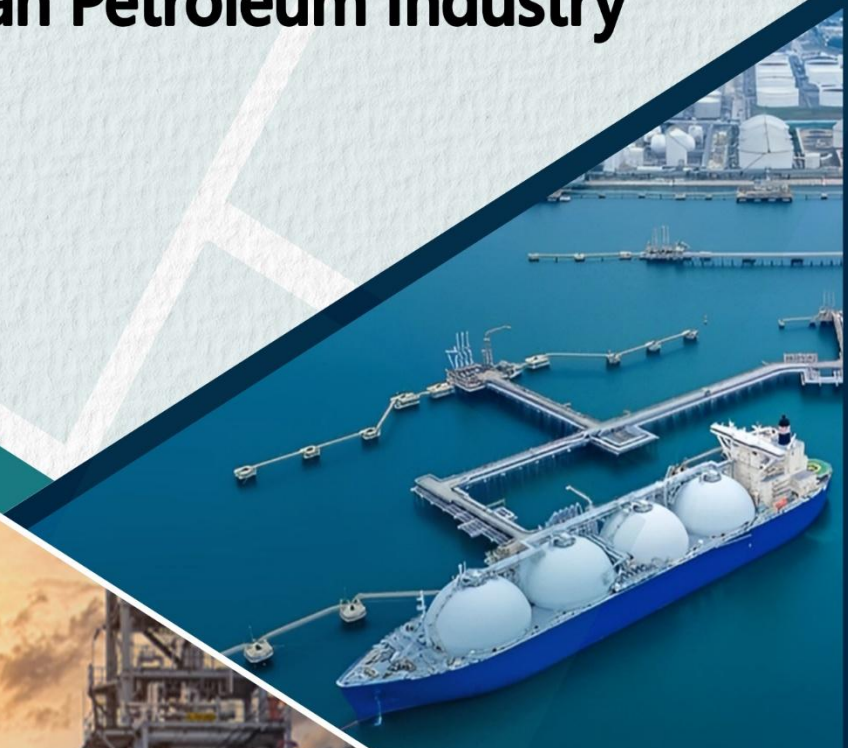
The Journal of Federation of Indian Petroleum Industry



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CONTENTS

Analysis of Failed Outlet Tubes of Continuous Catalyst Reforming Unit (CCRU) of a Refinery-*A Case Study*	7 - 16
Speedy Infrastructure Development in India: An Analysis of Challenges in the PMP Act	17 - 19
GIFT City: Unlocking Leasing Opportunities	20 - 22
Carbon Credit Markets: Opportunities for India's Oil and Gas Sector	23 - 27
Global Polyethylene flows Disrupted by Global Geopolitical Situation- An opportunity for India?	28 - 31

In This Issue

DG's Page

Refining

Pipeline Transportation

Finance

Carbon Credit

Petrochemicals

Events

New Appointments

Statistics

Editorial Board

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From the Desk of the

Director General

Greetings from Federation of Indian Petroleum Industry (FIPI)!

India's oil and gas sector is undergoing a significant change. As one of the world's fastest-growing major economies, the country's energy demand continues to rise due to industrial growth, urbanization, and expanding transportation needs. The IEA projects a significant increase in India's energy demand, particularly for oil and natural gas, due to economic growth and industrialization. India is expected to lead global oil demand growth with a projected increase of 1 million barrels per day by 2030.

To meet this energy demand, India has been continuously focussing to augment its oil & gas domestic production. The government is focused on boosting domestic exploration and production, while also updating the legal and policy framework to attract foreign investment and technical expertise. A key development in this effort is the Oilfields (Regulation and Development) Amendment Act 2025, which came into force on 15 April 2025 and introduced a more streamlined, centralized, and investor-oriented regulatory structure. The said Act aims to bring India's upstream oil and gas regulations closer to international standards and improve the overall ease of doing business for global investors.

I am delighted to mention that the recent Draft Petroleum & Natural Gas Rules 2025, released by MoP&NG is a significant step towards modernizing India's upstream oil and gas sector, thereby introducing investor-friendly policies for upstream sector, and promoting environmental sustainability. Key highlights include a stabilization clause to protect investors, provisions for shared infrastructure access, and the integration of renewable energy projects within oilfield blocks. These rules also emphasize greenhouse gas emission monitoring, carbon capture and storage, and site restoration.

In addition, the government's ongoing efforts to increase refining capacity and improve natural gas utilization infrastructure further enhance the investment landscape. For instance, India is aiming to increase its refining capacity to 310 million tonnes per annum by 2028. This expansion is creating demand for technology solutions, particularly in areas like refinery upgrades, emission control, and clean fuel development—areas where foreign expertise is critical.

Further, in the clean energy segment, the government's efforts have brought a new revolution of change through biofuels in India. India today stands strong as the third-largest biofuel producer in the world. The biofuel average blending has achieved a remarkable feat by reaching 19.9% this year, which was 1.4 % in 2014.

Another significant milestone is that India has successfully met peak power demand of 241 GW on 9th June, 2025. This achievement, underscores the nation's robust power infrastructure, with zero peak shortage reported. To this remarkable achievement, India achieved 50.08 per cent of its total installed electricity generation capacity from non-fossil fuel sources as of June 30, 2025—five years ahead of the 2030 target set under its Nationally Determined Contribution (NDC) targets to the Paris Agreement. This shows India's commitment towards environmental sustainability and climate change.

India is focused on advancing its green hydrogen goals, with key developments including the launch of the first operational green hydrogen plant at Kandla Port at Gujarat. It will be the first port-based green hydrogen plant in India to utilize indigenous electrolysers. Further, the recent launch of Green Hydrogen Certification Scheme for producers is a step towards creating a framework for certifying green hydrogen production and ensuring transparency, traceability, and market credibility. This shows India's determined efforts in achieving its production capacity target of at least 5 million metric tonnes per annum by 2030.

In a significant move towards promoting sustainable transport and domestic manufacturing, the PM Electric Drive Revolution in Innovative Vehicle

Enhancement (PM E-DRIVE) Scheme was launched last year. Recently, the government unveiled the scheme to provide financial incentives for purchase of electric trucks under the PM E-Drive initiative, where a sum of ₹500 crore has been set aside for 5,600 electric trucks. While diesel trucks, though constitute only 3% of the total vehicle population, they contribute about 42% of transport-related greenhouse gas emissions. Therefore, this pioneering scheme represents India's first dedicated support for electric trucks and will drive our nation toward sustainable freight mobility.

FIPI: Quarterly Activities (April-June 2025)

On 4th April, 2025, the 13th Convention of FIPI Student Chapters was held at Jawaharlal Nehru Technological University, Kakinada (JNTUK). The central theme of the Convention was "Intensifying Hydrocarbon Exploration in India with Greater Energy Efficiency and Accuracy." It was attended by more than 100 students from JNTUK, Kakinada including 72 participants, comprising 60 students and faculty members from 11 FIPI Student Chapters. The participating chapters were IIT (ISM) Dhanbad; Dibrugarh University, Assam; Pandit Deendayal Energy University (PDEU), Gandhinagar; Rajiv Gandhi Institute of Petroleum Technology (RGIPT), Jais Amethi; University of Petroleum and Energy Studies (UPES), Dehradun; Osmania University, Hyderabad; JNTUK, Kakinada; MIT-World Peace University (MIT-WPU), Pune; IIT Madras; Indian Institute of Petroleum and Energy (IIPE), Visakhapatnam; and IIT Guwahati.

Further, on 26th May 2025, FIPI in association with National Accreditation Board for Certification Bodies (NABCB) organized a half-day workshop on "Certification of SAF for the Oil Industry", at PHD House, August Kranti Marg, New Delhi. The workshop was attended by 44 participants from the oil and gas industry. Given the growing importance of SAF certification for the oil sector, there is a recognized need to understand the certification processes established by NABCB and its accredited certification bodies, hence the seminar was very informative for everyone.

Ongoing FIPI Studies

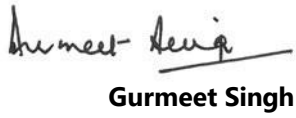
FIPI has carried out a study in knowledge partnership with M/s Grant Thornton on the functioning of all the Skill Development Institutes (SDIs) under the Ministry of Petroleum and Natural Gas. The Report has been submitted to MoP&NG.

FIPI is also coordinating a study by BCG for developing the Global Biofuel Alliance (GBA) under India's G20 Presidency. The focus of the study is on socialising the GBA and expanding its membership, creating GBA's foundational document, establishing core structures and driving implementation of biofuel initiatives. Phase 4 (April'25 onwards) of the study is currently in progress and is focused on setting up the GBA secretariat with focus on expansion in operations through hiring of key personnel, marketing agency, legal firm etc.

Conclusion

India's growing energy appetite makes it one of the most promising destinations for global investment in the oil and gas sector. Whether in exploration, refining, natural gas, or renewable integration, the Indian energy market offers not only scale and opportunity but also a supportive and a secure environment designed for strategic partnership and sustainable growth. The Indian oil and gas industry is thus well prepared to service the fuelling needs of this ever-expanding economy.

As we embrace the new financial year, I assure you that FIPI will be at the forefront advocating the industry issues while working closely with all stakeholders including Government in scripting the growth story of Indian oil and gas industry.



Gurmeet Singh

Analysis of Failed Outlet Tubes of Continuous Catalyst Reforming Unit (CCRU) of a Refinery-*A Case Study*

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Highlights:

- Short-term multiple tube failure of the outlet tube of Continuous Catalyst Reforming Unit (CCRU) of a Refinery
- Longitudinal Cracking
- Plastic Deformation
- Rolling Defect

Abstract:

Process industries, including refineries, often experience failures of tubes in various services. The commons reasons for failure include various forms of corrosion, improper selection of metallurgy and exposure to excessive temperature etc.

Recently multiple short term tube failures were observed after a short service in Continuous Catalyst Reforming Unit (CCRU) of a refinery. Detailed laboratory investigations including visual inspection, Visual Observation, Dye Penetrant Testing, Microstructural Analysis, Hardness Survey, EDX (Energy dispersive X Ray) Analysis were conducted to identify the root cause of the failure. The tubes failed by cracks having initiated from external surface. The results indicated lamination of slag / high temperature oxidation scale on external surface of the tubes by undue plastic deformation during rolling. The plastic deformation and grain flow were clearly indicated and manifested by strain hardening and high hardness (above than the specified limit) near to the (Outer Diameter) OD of the tube. The cracks initiated at the points of slag / high temperature oxidation scale lamination and further propagated in thickness / radial direction of the tube under operating stresses and resulted into leakage.

Keywords:

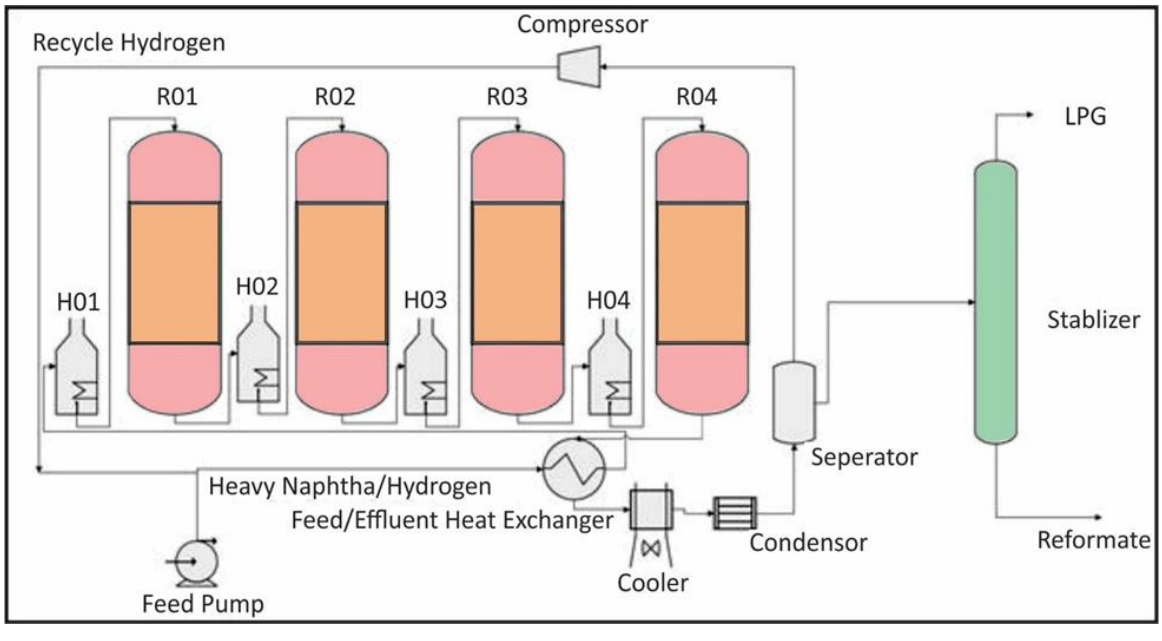
Oil and gas engineering, Continuous Catalyst Reforming Unit (CCRU), Outlet Tube, Plastic Deformation, Rolling Defect.

1.0 Introduction

Catalytic reforming Unit (CRU) of naphtha is a key process unit in refinery and petrochemical operations. Catalytic reforming is commonly referred to as *platforming*—a term derived from the use of platinum-based catalysts.

A typical configuration [1] of a catalytic reforming unit (Fig. 1) comprises a series of three to four fixed-bed reactors arranged sequentially. The process flow begins with a feed preheating stage utilizing a vertical heat exchanger with a large surface area to enable efficient heat recovery. This is followed by further heating in a charge heater system, before the feed enters the reactor train. After the reforming reactions, the reactor effluent is directed to a low-pressure separator, where a portion of the separated hydrogen is continuously recycled and mixed with fresh feed to maintain the necessary hydrogen-to-hydrocarbon ratio. The heavier hydrocarbon stream, known as reformate, is routed to a stabilizer column for separation. Reformate is withdrawn from the bottom of the column, while light hydrocarbons, primarily liquefied petroleum gases (LPG), are recovered from the overhead stream after condensation via a trim cooler and condenser. This process not only improves fuel performance but also contributes significantly to hydrogen generation for hydrotreating and other refinery operations.

Fig. 1: A Schematic configuration of a catalytic reforming unit (CRU)



Such units often experience failures of tubes in various services. The commons reasons for failure include various forms of corrosion, improper selection of metallurgy and exposure to excessive temperature etc.

Recently multiple tube failures were observed after a short service in outlet section of Continuous Catalyst Reforming Unit (CCRU) of a refinery. Considering the short-term failure, the study became prominent for analyzing the root cause of failure. Detailed laboratory investigation has been carried out on the presumably representative tube sample to assess the reason for failure. The investigations include visual inspection, Visual Observation, Dye Penetrant Testing, Microstructural Analysis, Hardness Survey, EDAX (Energy dispersive X Ray) Analysis.

2.0 Design Conditions

Background data on the split tube sample along with the design & operating conditions of the outlet tube of CCRU are given in Table 1.

Table 1: Operating and Design Parameters of the Failed Tube, CCRU

Parameter	Details
Design Temperature	630°C
Design Pressure	6.8 kg/cm2
Corrosion Allowance	0.75 mm
MOC	SA335GR5 Seamless
Tube OD	88.9 mm
Maximum tube metal temperature (actual)	596°C
Thickness	5.49 mm (min.)

3.0 Laboratory investigation

To assess the root cause of failure, various destructive & non-destructive tests were carried out. The details of the tests carried out and the observations made are enumerated as below:

3.1 Visual Observations

The sample photographs received were visually examined. The following observations were noted:

- There was no visible corrosion/ oxidation on either Inner Diameter (ID) or Outer Diameter (OD) of the tube.
- Visual examination of the sample shows several fine longitudinal cracks at OD Surface under close observation (Fig. 2-6).
- No longitudinal cracking (as observed on OD surface) could be observed at the ID Surface except one major crack at leaked location (where through cracks might have been propagated from OD to ID) (Fig.7-9).
- Thickness Survey at several locations indicated minimum and maximum thickness values of 5.51 mm and 5.65 mm respectively. No thickness loss was noticed.

Figs.2-6: Multiple Fine longitudinal cracks at the OD surface of the tube

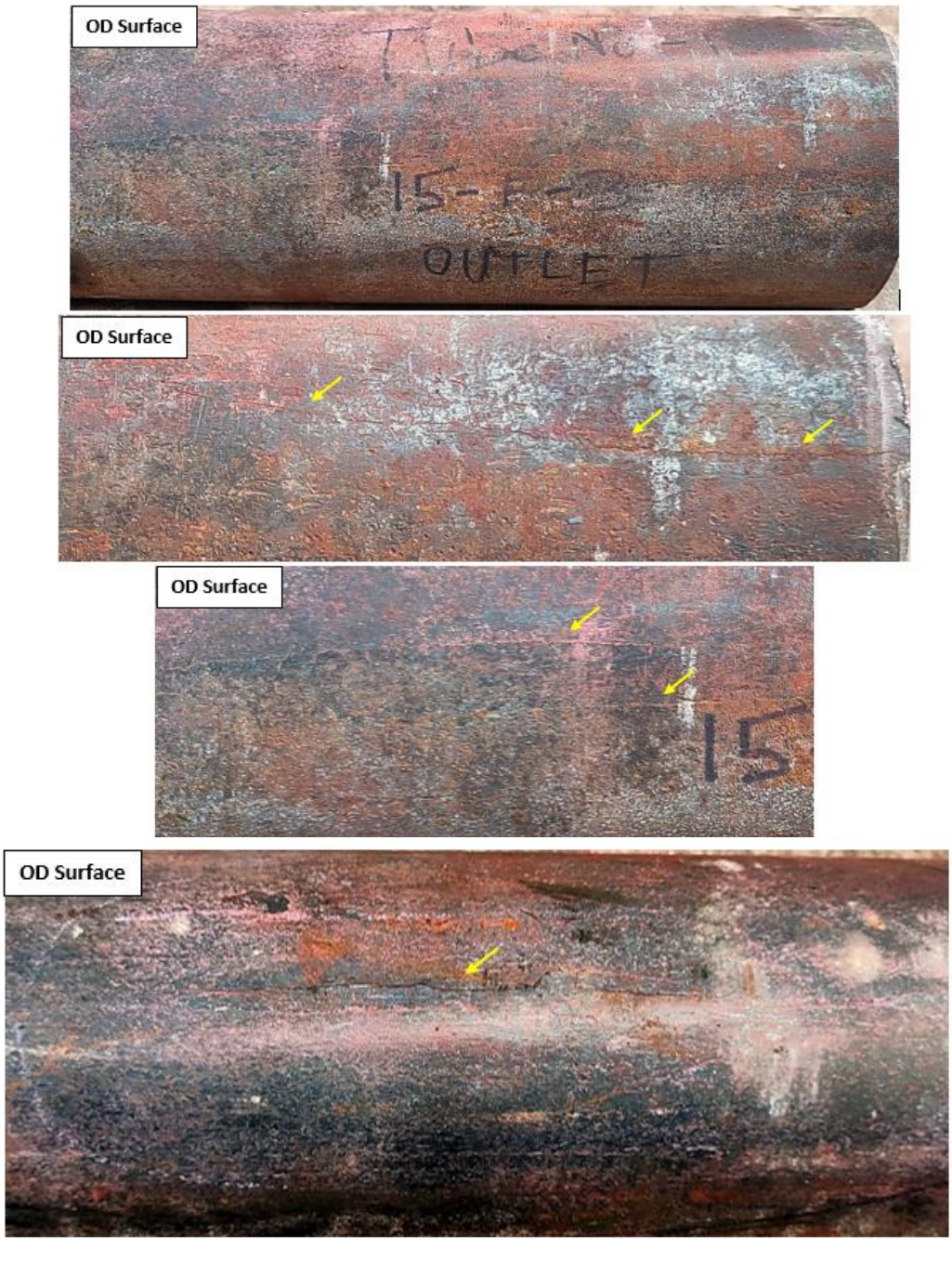


Fig. 7-9: ID Surface devoid of Fine longitudinal cracks except one major crack at the leaked location

3.2 Dye Penetrant Testing:

As observed visually, there were fine and tight cracks in longitudinal direction of the tube. Further to locate the distribution of cracks, Dye Penetrant (DP) Testing was carried out at OD and ID Surface of the tube. DP testing further revealed the presence of fine longitudinal cracks all along the periphery of the tube at the OD (Fig. 10-12). DP testing at the ID of the tube couldn't reveal the distribution of the crack along the ID surface except for the crack at the leaked location (Fig. 13-15).

Fig. 10-12: DP test images of the failed sample at the OD surface revealing numerous fine cracking in longitudinal direction

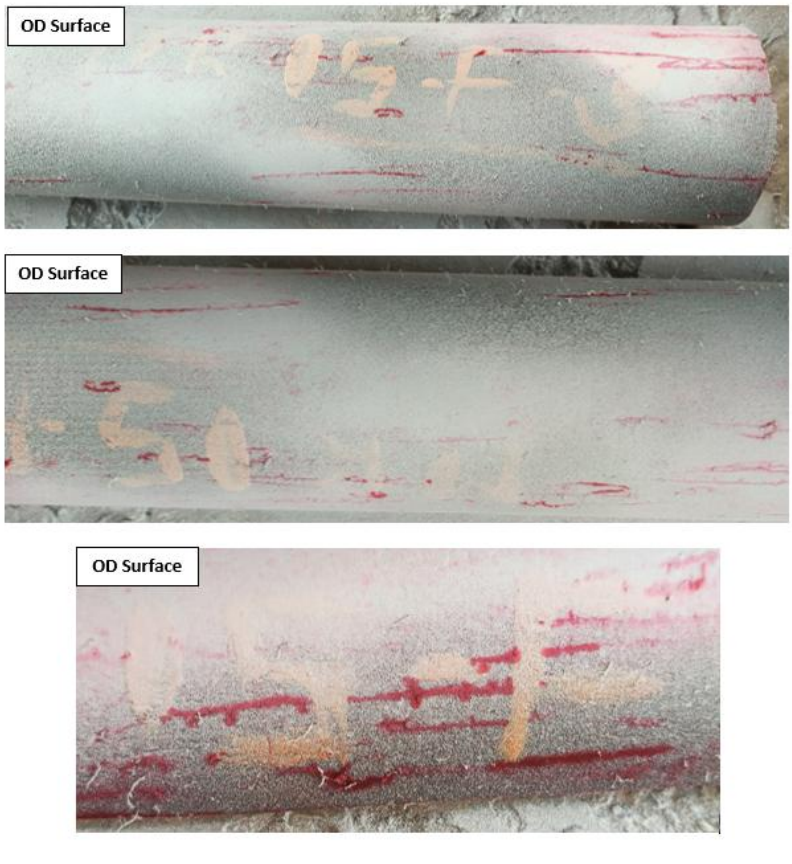
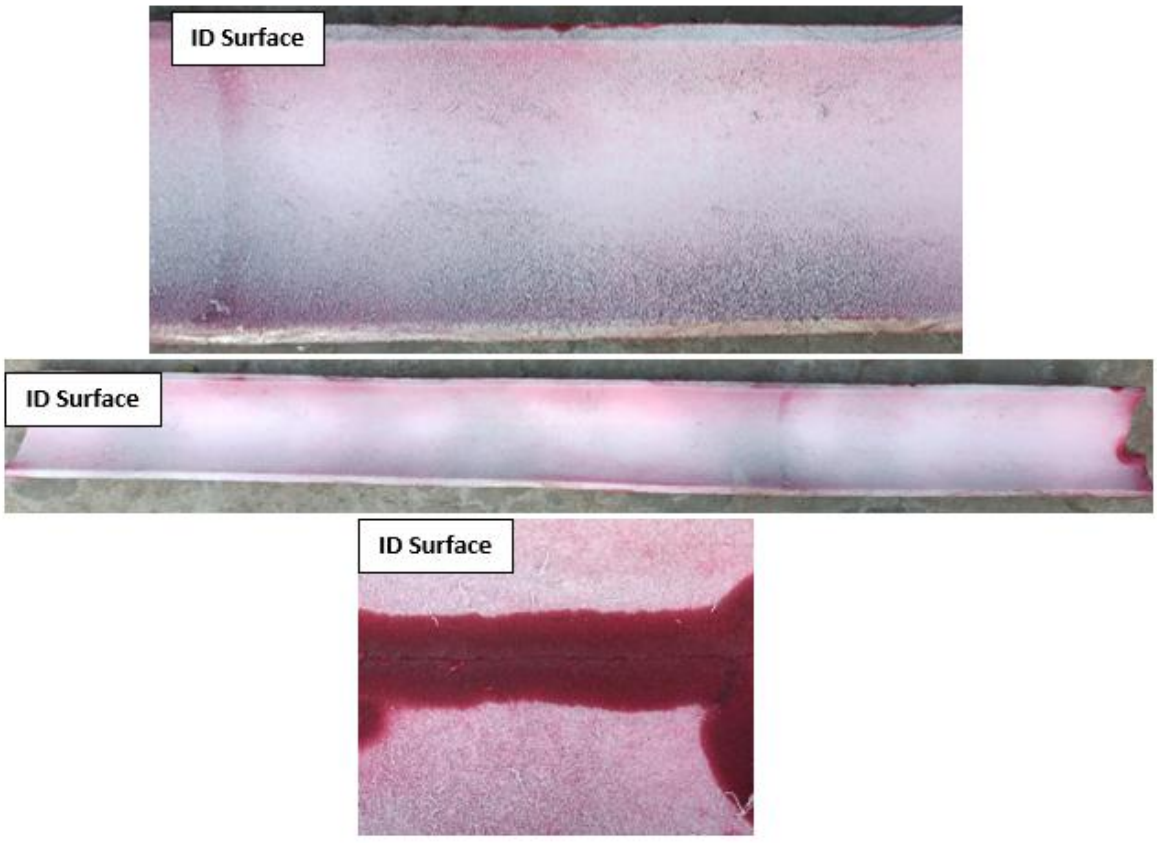


Fig. 13-15: DP test images of the failed sample at the ID surface showing absence of cracks except for one major crack at the leaked location.



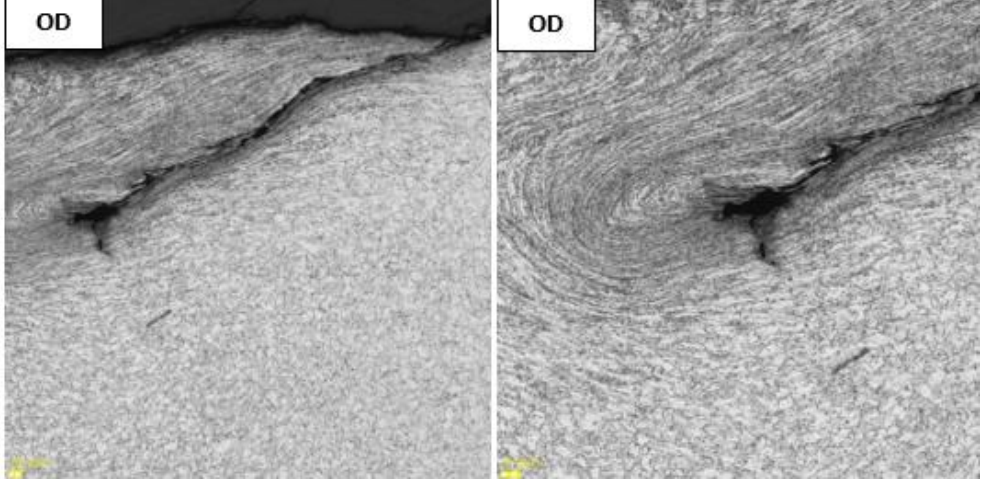
3.2 Optical Microscopic Examination:

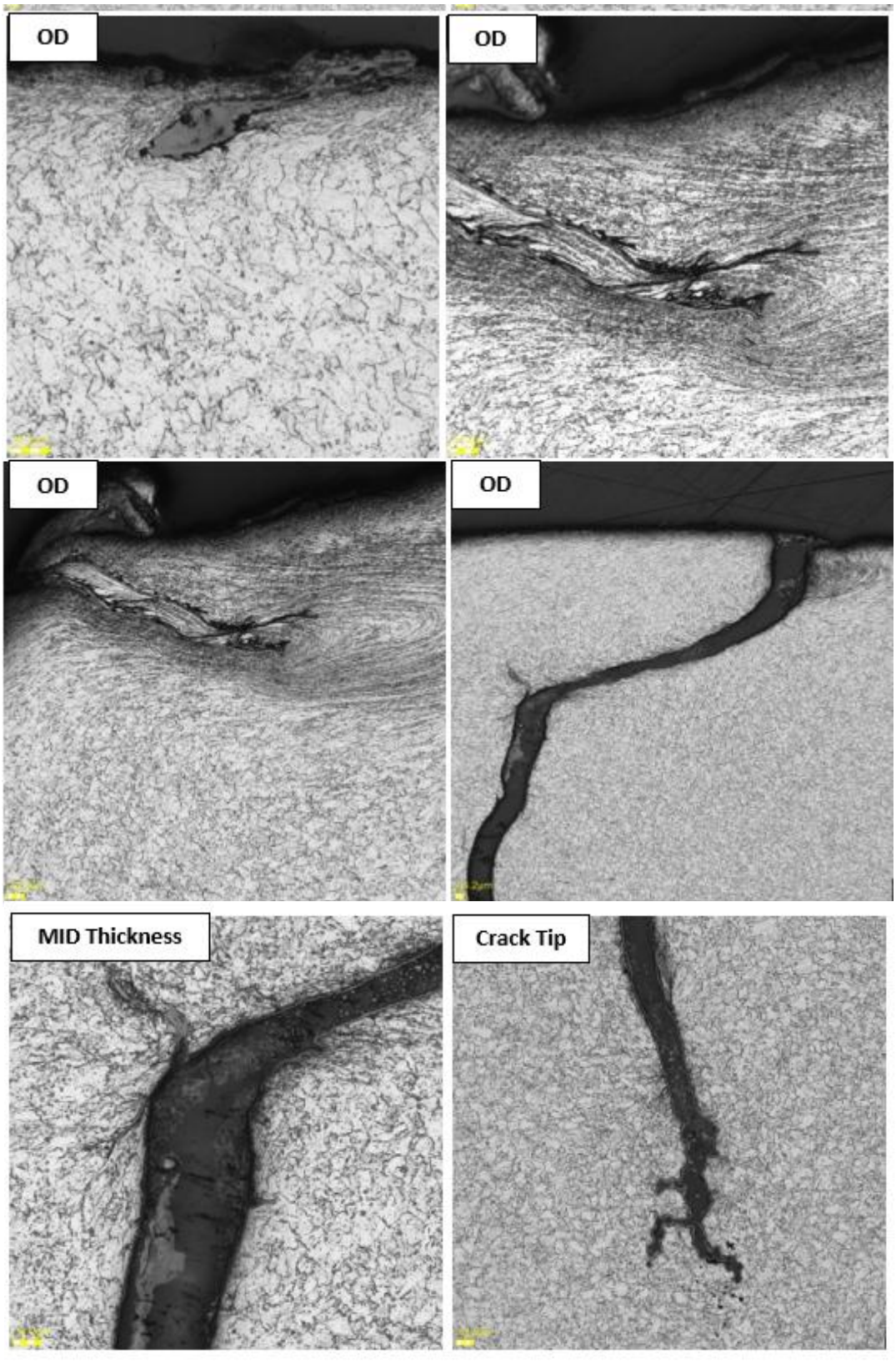
A small Circumferential Thickness (C-T) tube sample was taken from near as well as away from the leaked location of the tube. The samples were metallographically prepared to mirror finish and etched with 5% Nital solution (5% HNO_3 + Methanol) for revealing the grain boundaries.

On optical microscopic examination (Fig. 16-23) it is noticed that:

- There are multiple cracks initiating on the OD surface of the tube and propagating in the thickness direction towards ID of the tube.
- There is severe plastic deformation at the crack vicinity. The region is plastically deformed and there is grain flow on the contours of the crack.
- The crack also appeared to be filled with some oxide scales prima facie.
- The General Microstructure shows bainitic structure with dispersion of carbides in ferrite matrix typical of P5 Grade steels.

Fig. 15-22: Microstructures at different magnifications revealing multiple cracks initiating on the OD surface and its propagation towards ID





3.3 Hardness Survey

Both Macro-Hardness (Brinell Scale, 1 mm Dia. & 10 kg Load) and Micro-Hardness (Knoop Scale, 100 gm Load) examination were performed on the failed tube samples.

Macro-Hardness Results are summarized in Table 2:

Table 2: Macro-Hardness Results of ID, Mid & OD section of the tube

Tube Section	Hardness (BHN)
OD Section	197-224
Mid-Section	170-178
ID Section	166-178

Macro-Hardness Survey revealed the ID and Mid-section of the tube found to be within the maximum specified limit of 179 BHN. Whereas the Hardness of OD section observed to be higher than the maximum specified limit of 179 BHN.

Micro-Hardness examination was also carried out near the plastic flow region in the vicinity of the crack and away from the Plastically deformed region in the matrix.

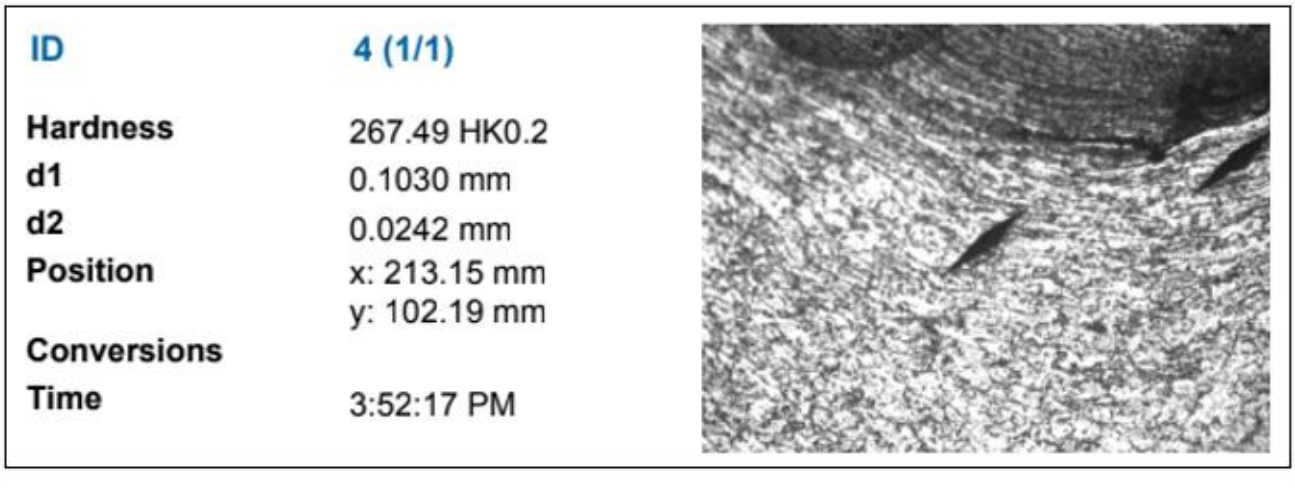
Micro-Hardness Results are Shown in the Table 3 and Fig. 24-25:

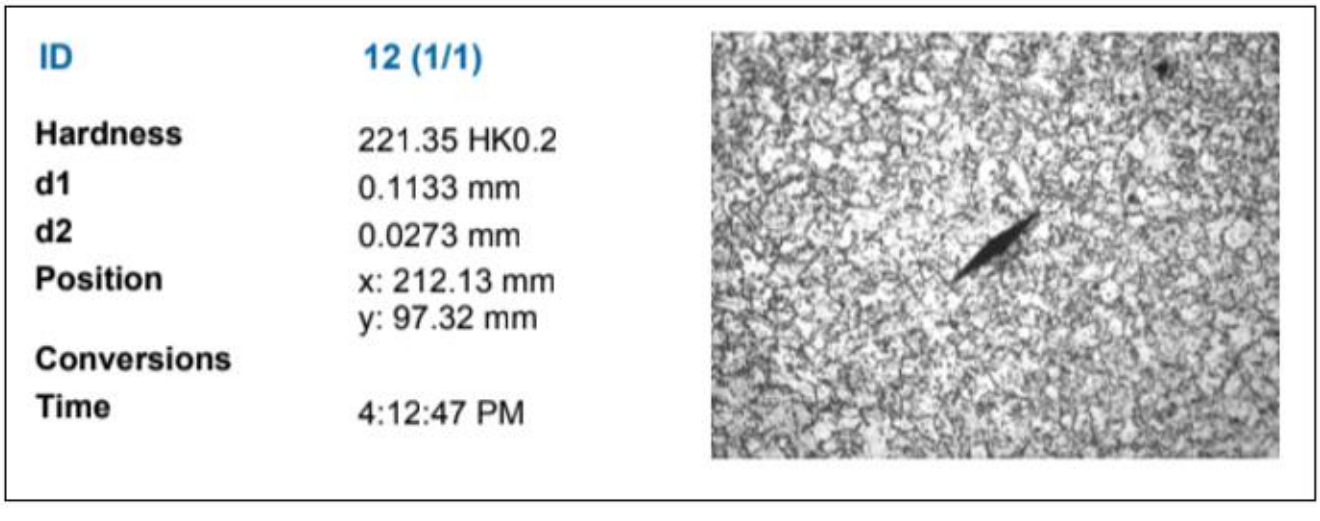
Table 3: Micro-Hardness values of Plastically Deformed region vis-à-vis away from the deformed region

Region	**Hardness (Knoop)**
Plastically Deformed/Grain flow/Near crack region	244-267
Undeformed region in the matrix	221-223

Micro-Hardness Survey revealed the Micro hardness values higher in the plastically deformed grain flow region.

Fig. 24-25: Knoop Indents near the Grain Flow region and normal matrix region





3.3 Energy Dispersive Analysis of X-rays (EDAX) Analysis:

As evident through the microscopic observation the cracks appeared to be filled with some oxide products. Therefore, a cut sample from near to the cracks in OD section of the tube was taken under Scanning Electron Microscope (SEM) for EDAX analysis.

EDAX Analysis of the filled crack revealed the presence of strong peaks of Fe, and O (Possibility of Iron Oxide scale due to high temperature oxidation during rolling/tube manufacturing).

EDAX Results are shown in Fig. 26-27 and Table 4.

Fig. 26-27: EDAX Analysis of the filled crack revealed the presence of strong peaks of Fe, and O

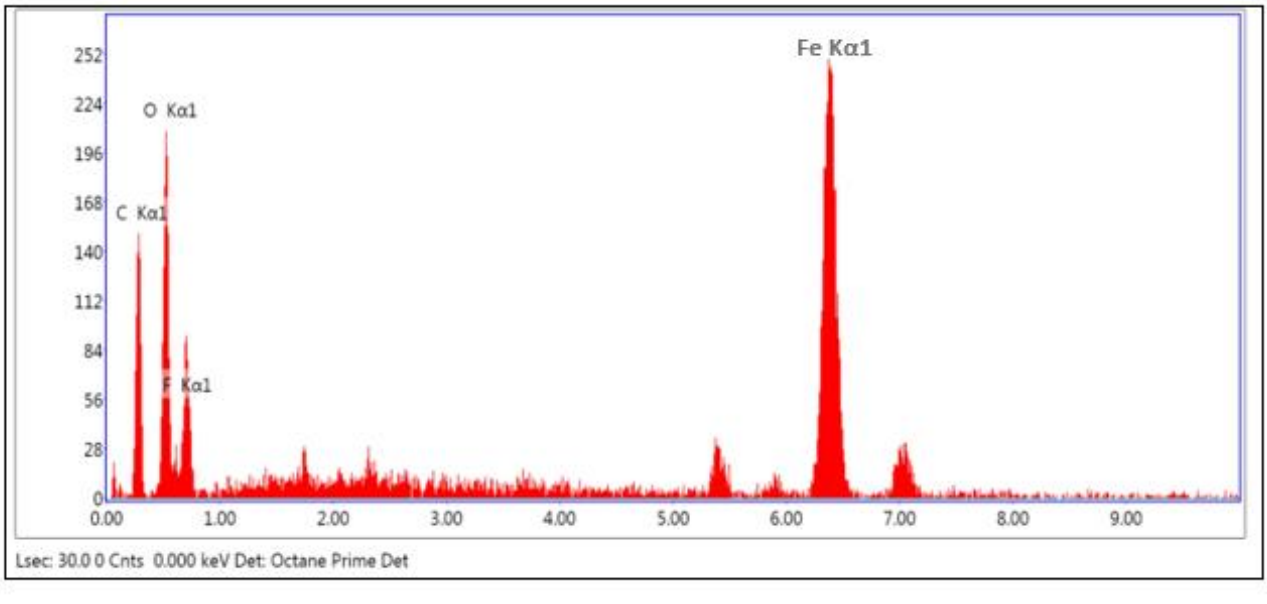


Table 4: EDAX Analysis results revealing % Fraction of Major Elements present in crack

Element	Weight %
C K	35.44
O K	38.33
Fe K	26.24

4. Results and discussion

Root cause investigation carried out on the representative tube sample from the outlet section of the CCRU unit revealed several notable findings.

Visual inspection confirmed the absence of any visible corrosion or oxidation on both the internal and external surfaces of the tube. However, the sample exhibited numerous fine longitudinal cracks along the OD surface and one major longitudinal crack along the ID surface. Thickness measurements taken at multiple locations showed thickness values ranging from 5.51 mm to 5.65 mm, indicating no appreciable material loss due to thinning. Dye Penetrant (DP) testing at the outer surface further corroborated fine longitudinal cracks at the OD surface, while the inner surface didn't reveal presence of such fine longitudinal cracks except for one major longitudinal crack at the leaked location.

Optical microscopic examination revealed general Microstructure to be bainitic structure with dispersion of carbides in ferrite matrix typical of P5 Grade steels. Multiple cracks were found originating from the OD surface and propagating inward toward the tube's ID surface. These cracks were associated with severe plastic deformation and localized grain flow around their contours, suggesting crack formation under mechanical and thermal stresses. The presence of oxide scales within the cracks implies exposure to elevated temperatures, either during or following crack initiation.

Macro-hardness testing revealed acceptable hardness levels at the mid-wall and inner diameter regions; however, the outer surface exhibited hardness values exceeding the specified maximum of 179 BHN. Micro-hardness mapping further showed elevated hardness within the plastically deformed regions surrounding the cracks.

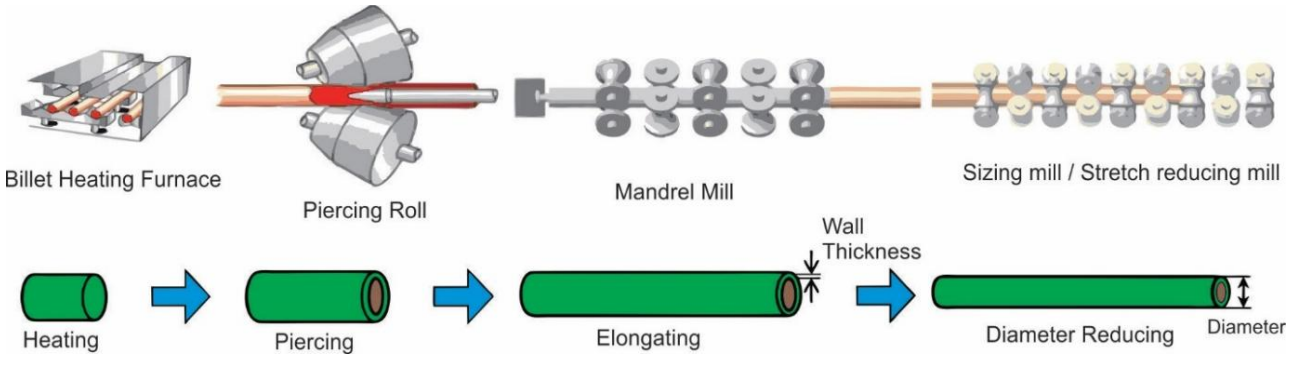
EDAX Analysis of the filled crack further confirmed the presence of strong peaks of Fe, and O (Possibility of Iron Oxide scale due to high temperature oxidation during rolling/tube manufacturing).

5. Literature Survey:

Seamless tube [2] or pipe is highly demanded in Refineries and petrochemical industries for sound mechanical properties and higher strength compared to welded pipes. Seamless tubes are manufactured by Mannesmann process (Fig. 28).

Mannesmann process [3] is a special process of metal forming which involves cavity formation in the center of the round billet and its propagation along the axis. The cavity is then expanded and sized in its internal diameter by plug. Rotating billet is subjected to repetitive compressive & tensile forces leading to beginning of void formation by tear before tip of the plug touches. Further, hot rolling is done at a temperature higher than the metal's recrystallization temperature.

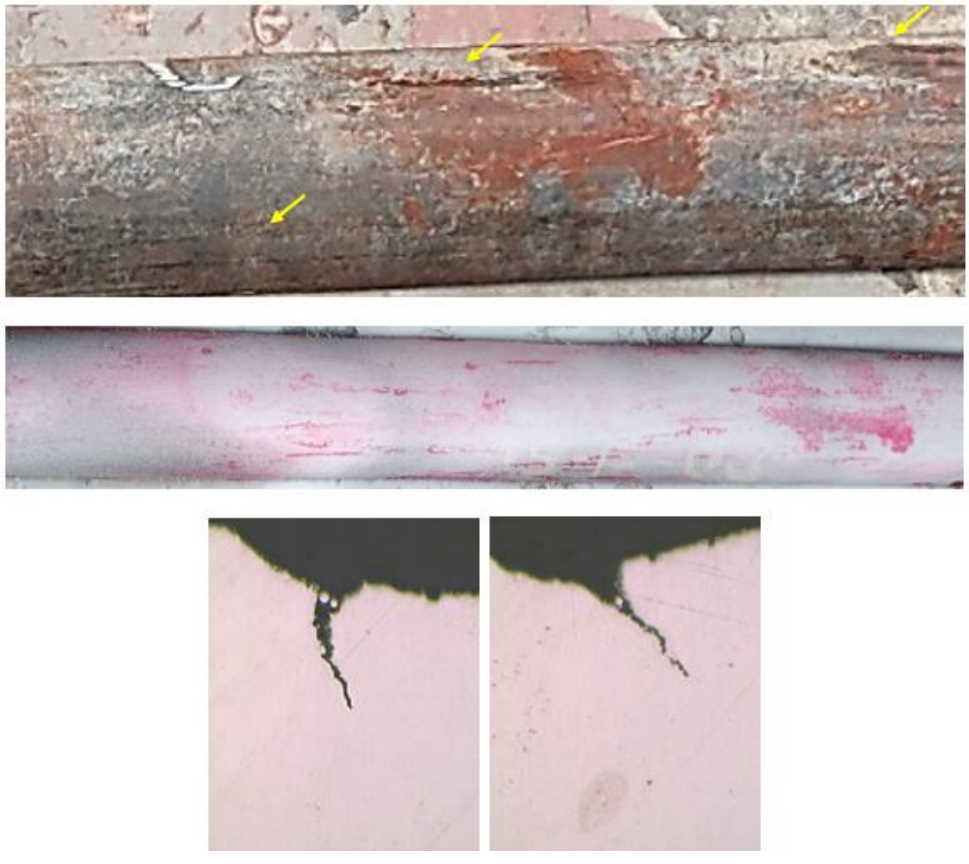
Fig. 28: Schematic of Mannesmann Process



Proper surface quality is an essential requirement of the production of seamless tubes. Monitoring the manufacturing process and assurance the adequate surface quality yields better results and minimizes defects. Soaking time and placed position of round billet inside billet heating furnace as per size of round billet also an important parameter for adequate surface finish. Improper soaking is one of several causes of lamination.

Moreover, quality of raw materials is also an important parameter. If hairy shrinkage cavities are present on the surface of rolled cast billet, then the possibilities of lamination also increase. Lamination is one of the very common defects which occurs during manufacturing (rolling/piercing) of seamless metallic pipes. A typical appearance of lamination defect [4] is shown in Fig. 29-32. It is a surface/sub-surface type defect that mostly occurs in longitudinal direction/ length direction of the pipe. Lamination mostly occurs on the outer diameter (OD) surface of the tube. If lamination depth is very shallow, it can pass through NDT and Hydro tests and may create failures/leakages during operations.

Fig.29-32: A Typical appearance of lamination defect in the seamless tube



6. Conclusion and Recommendation.:

Based on the Detailed Analysis through various Laboratory study the root cause of the failure of the tube is attributed to presence of lamination defect in the external surface of the pipe. Undue plastic deformation during rolling and impregnation of scales/slags of high temperature origin led to multiple longitudinal cracks.

These cracks were further propagated in thickness direction towards ID of the tube under operating stresses and caused failure/leakage [5]. The plastic deformation and associated grain flow were also manifested in terms of strain hardening /High hardness (above than the specified limit) near to the OD of the tube.

Thus, the Root cause of the failure is concluded to be the Defect of Lamination during Tube manufacturing.

To avoid such premature and unanticipated failures at Refinery units, comprehensive inspection of all tubes within a single heat/batch using advanced NDT techniques during manufacturing is recommended. This can further be enhanced by conducting Dye Penetrant tests on randomly selected samples to provide a more robust and reliable assessment of material integrity during tube manufacturing.

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Speedy Infrastructure Development in India: An Analysis of Challenges in the PMP Act

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Transportation of petroleum and petroleum products are key elements for India's rapid infrastructure growth which demands an efficient legal framework for swift project execution, maintenance and expansion thereof. Govt of India with a view to set up a mechanism for efficient and cheap means of transportation and distribution of petroleum and petroleum products enacted a statute known as Petroleum and Minerals Pipelines (Acquisition of Right of User in land) Act, 1962 (in short "PMP Act"). which deals with laying of pipelines for transportation of petroleum products, crude oil, and minerals. Though PMP Act was passed for effective acquisition of Right of User for laying pipelines, the said Act further to be amended to plug several loopholes and practical difficulties.

India's energy infrastructure is at a critical juncture, with ambitious plans to expand its natural gas pipeline network significantly under initiatives such as **"One Nation, One Gas Grid."** As per the latest data from the Petroleum and Natural Gas Regulatory Board (PNGRB) and International Energy Agency (IEA), India's **natural gas transmission network is expected to grow from the existing 23,750 km in 2024 to over 35,000 km by 2030**, with considerable capacity additions to meet rising domestic demand.

However, a persistent challenge threatening the pace and cost-efficiency of pipeline projects in securing the **Right of Use (RoU)** from land parcels under the PMP Act become a major bottle neck. Land acquisition for setting up infrastructure facilities for transportation of petroleum products and RoU disputes have become significant and common bottleneck instrumental for major delays in project execution, escalating costs, and jeopardizing India's energy transmission goals.

Scale and Growth of India's Gas Pipeline Network

As of December 2024, the operational natural gas pipeline network stood at approximately 23,752 km, managed predominantly by key players such as GAIL (11,007 km), GSPL (2,761 km), and PIL (1,483 km), among others. With ongoing construction projects, the network is expected to reach over 35,700 km by the end of the decade, including major projects like the Mumbai-Nagpur-Jharsuguda pipeline (1,750 km) and the North-East Natural Gas Grid (1,650 km).

Entity	Operational Length (km)	Under Construction (km)	Total Length (km)
GAIL	11,007	3,607	19,676
GSPL	2,761	100	2,861
PIL	1,483	0	1,483
IOCL	1,223	416	1,639
Others	7,278	5,259	12,537
	23,752	**9,399**	**33,151**

Source: PNGRB, IEA India Gas Market Report 2024

Key Legal and Procedural Challenges and Recommendations

1. ***Undefined Scope of Right of Use (RoU):***
   The Act does not specify the width of the RoU relative to pipeline diameter, creating ambiguity in enforcing Section 9[1] (illegal constructions within RoU). This legal uncertainty hampers clear demarcation and enforcement.

Recommendation: Introduce a standardized framework linking pipeline diameter to RoU width, supported by detailed rules for defining and measuring RoU extents. This will ensure consistent application and reduce disputes.

2. ***Executive Order & Compensation Complications:***

The Executive Order dated 28.08.2025 incorporates the PMP Act under Schedule IV of the Right to Fair Compensation and Transparency in Land Acquisition Act, thereby subjecting it to higher compensation norms. This significantly raises project costs and dilutes the original objectives of the PMP Act.

Recommendation: Undertake a legislative review to clarify the relationship between these Acts and consider amendments or policy directives to balance fair compensation with project viability.

3. ***Outdated Land Records & Notice Delivery Issues:***

Fragmented, incomplete, and outdated land records cause difficulties in issuing notices under Sections 3(1) and 6(1), often preventing rightful landowners from receiving timely information. This leads to compensation delays and project slowdowns.

Recommendation: Implement a comprehensive land record modernization initiative, integrating GIS-based digitized cadastral maps. Additionally, establish alternative and verified communication channels for serving notices to ensure due process like SMS or notices served to Gram Panchyat.

4. ***Gazette Notification Errors:***

Omissions of certain survey numbers during pipeline alignment notifications can cause future operational disputes and ownership conflicts. Currently, no formal rectification process exists.

Recommendation: Enact provisions allowing formal post-publication corrections of Gazette notifications, including post-operational or project termination declarations, to incorporate missing survey numbers transparently and lawfully.

5. ***Resistance from Landowners & Police Intervention:***

Frequent denial of access by landowners compels reliance on police support, adversely affecting local relations and project timelines.

Recommendation: Promote proactive stakeholder engagement, including community consultations and grievance redressal mechanisms prior to physical access. Explore mediation frameworks to minimize confrontations and build trust.

6. ***Project Delays – Case Study: Urja Ganga:***

The Urja Ganga pipeline project experienced over a one-year delay due to land and RoU issues, illustrating systemic procedural flaws impacting national infrastructure goals[2].

Recommendation: Develop a centralized project monitoring system with clear escalation channels for resolving land acquisition and RoU issues swiftly for example coming up with specialized tribunals or Fast-track courts which can help streamline processes for future projects.

7. ***Absence of Defined Compensation Timelines:***

The Act does not prescribe specific deadlines for compensation determination and disbursement, leading to indefinite delays and uncertainty.

Recommendation: Incorporate mandatory timelines for each stage of compensation from assessment to payment backed by enforceable penalties for non-compliance, ensuring timely justice to landowners.

8. ***Authority Remuneration & Administrative Gaps:***

Silence on remuneration and service conditions for Competent Authorities undermines administrative efficiency and accountability.

Recommendation: Establish clear guidelines on remuneration, service conditions, and capacity building for authorities overseeing the Act's implementation, enhancing motivation and performance standards.

9. **Non-entry of RoU in Land Records:**

No uniform procedure exists to record RoU acquisition in land revenue records, leaving pipeline rights vulnerable to encroachment and disputes.

Recommendation: Mandate legal provisions requiring registration of RoU in official land records with defined formats and procedures to secure pipeline corridors legally.

10. Barriers in Crossings (Roads & Railways):

Lengthy delays occur while obtaining permissions from road and railway authorities for pipeline crossings, hampering project progress.

Recommendation: Implement a single-window clearance system with defined timelines for all crossing approvals, coordinated at the central level to expedite project implementation.

Lessons from City Gas Distribution (CGD) in India: Domestic Framework as a Model

India's **City Gas Distribution (CGD)** framework, governed by the **Petroleum and Natural Gas Regulatory Board (PNGRB)** under the PNGRB Act, 2006, offers an alternate model for pipeline infrastructure development that emphasizes administrative efficiency, reduced litigation, and community engagement.

Unlike the PMP Act, CGD projects largely **avoid the acquisition of private land**. Operators are granted **authorizations for specific geographical areas**, and they primarily lay pipelines under:

- Municipal or public land (e.g., footpaths, road shoulders, public utility spaces),
- State highways or national highways through **MoUs with the Ministry of Road Transport and Highways (MoRTH)**,
- Canals and railways using licenses from the respective departments.

This approach significantly **reduces conflict** with private landowners. Where private land is unavoidable, CGD companies engage in direct negotiation with landowners or use existing local land lease mechanisms. Unlike the PMP Act, CGD entities rarely invoke statutory acquisition processes.

Salient features of CGD's land access model that could inform PMP Act reforms include:

- **Use of public right-of-way (RoW)**: CGD projects are often aligned along existing roads or public utility corridors, minimizing the need for land acquisition. A similar approach can be adopted for long-distance pipelines, particularly in rural and peri-urban areas.

- **Digitally mapped pipeline corridors**: PNGRB mandates operators to submit GIS-based pipeline maps and periodic project status updates. Such digitization improves transparency and can help align projects with public planning departments.
- **Municipal permit-based construction**: Instead of central notifications, CGD entities obtain RoU permissions from local bodies, which is faster, often less controversial, and fosters better coordination with urban infrastructure development.

- **Defined performance timelines**: CGD licenses come with strict performance obligations, including phased targets for pipeline laying and customer connections. These milestones, tied to financial penalties for delays, encourage efficiency and proactive dispute resolution.

Conclusion

While the PMP Act has played a pivotal role in India's energy infrastructure development, it now requires substantial legal and procedural reform to remain effective in today's context. Addressing ambiguities in RoU scope, updating administrative processes, enforcing timelines, and learning from the CGD framework can create a more balanced, transparent, and efficient legal regime that supports India's ambitious infrastructure goals while safeguarding stakeholder interests.

1 - 9. Restrictions regarding the use of land.—
(1)The owner or occupier of the land with respect to which a declaration has been made under sub-section (1) of section 6, shall be entitled to use the land for the purpose for which such land was put to use immediately before the date of the notification under sub-section (1) of section 3:Provided that, such owner or occupier shall not after the declaration under sub-section (1) of section 6—(i)construct any building or any other structure;(ii)construct or excavate any tank, well, reservoir or dam; or(iii)plant any tree,on the land.(2)The owner or occupier of the land under which any pipeline has been laid shall not do any act or permit any act to be done which will or is likely to cause any damage in any manner whatsoever to the pipeline.(3)Where the owner or occupier of the land with respect to which a declaration has been made under sub-section (1) of section 6,—(a)constructs any building or any other structure, or(b)constructs or excavates any well, tank, reservoir or dam, or(c)plants any tree,on that land, the court of the District Judge within the local limits of whose jurisdiction such land is situate may, on an application made to it by, the competent authority and after holding such inquiry as it may deem fit, cause the building, structure, reservoir, dam or tree to be removed or the well or tank to be filled up, and the costs of such removal or filling up shall be recoverable from such owner or occupier in the same manner as if the order for the recovery of such costs were a decree made by the court.

2 - GAIL's Urja Ganga Gas Pipeline Project Faces Delay Until March 2025," Construction World, 2025, https://www.constructionworld.in/energy-infrastructure/oil-and-gas/gails-urja-ganga-gas-pipeline-project-faces-delay-until-march-2025/58202 and https://www.procurementresource.com/news-and-articles/gail-urja-ganga-pipeline-progress-2025

GIFT City: Unlocking Leasing Opportunities

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I. Introduction

Gujarat International Finance Tec-City, commonly known as GIFT City, is an emerging central business district currently being developed in the Gandhinagar, which is part of the Ahmedabad Metropolitan Region in Gujarat, India. It stands as India's first operational greenfield smart city and International Financial Services Centre, promoted by the Government of Gujarat as a groundbreaking project. Since its inception, this emerging global financial centre has attracted over 550 companies and generated more than 20,000 jobs.

GIFT City is designed to facilitate a diverse range of opportunities primarily focused on financial services and businesses across sectors. Permissible activities include international financial services such as banking, insurance, broking, IT, legal and consultancy, trading and investment, leasing etc. These activities aim to create a vibrant ecosystem that fosters economic growth and attracts global investments.

Among its various permissible activities, leasing stands out as a significant sector poised for growth. This article delves into the frameworks governing ship leasing and the recent public consultation paper including draft notification issued for enabling operating lease including any hybrid of operating and financial lease of oilfield equipment as a financial product, highlighting their implications for the financial landscape in India.

II. Broad Overview of Ship Leasing Framework

On 23 June 2023, the International Financial Services Centres Authority (IFSCA) issued a circular on 'Framework for ship leasing'. This framework is designed for all finance companies and units registered within International Financial Services Centres (IFSC) that wish to engage in lease of ship or ocean vessel, engines of ship or ocean vessel, which include both operating and financial leases, as well as hybrid forms.

Key Definitions and Eligibility

The framework defines critical terms such as "financial lease" which involves transferring substantially all the risks and rewards incidental to the ownership of the asset involved, and "operating lease," which does not transfer substantial risks and rewards. Ship and Ocean vessels are also defined which inter alia includes Mobile Offshore Drilling units and Mobile offshore Units. The eligibility criteria for applicants include establishing operations within an IFSC in the form of a company, limited liability partnership, or trust, or any other form specified by IFSCA along with ensuring compliance with the Merchant Shipping Act of 1958 and other regulatory requirements.

General conditions under the framework

A. *Currency:* All transactions must be conducted in freely convertible foreign currency; however, administrative expenses may be settled in Indian Rupees (INR)
B. *Maintenance of Books:* Books of accounts should be maintained in any freely convertible currency as required
C. *Compliance Requirements:* Entities must adhere to all applicable statutory obligations, regulations, standards, policies, directions, and guidelines, including MSA, DGS guidelines, tax laws, and SEZ laws.

D. Report Submission: Within 15 days of finalizing annual financial statements, entities must submit the following to the IFSCA:

(i) Audited annual financial statements in USD
(ii) Confirmation of compliance with applicable regulations, circulars, guidelines, and directions issued by the IFSCA
(iii) Confirmation of compliance with capital requirements, along with relevant details
(iv) Information regarding any material regulatory actions taken against the Promoters, Key Managerial Persons, or individuals controlling the lessor, if applicable.

Incentives

A. Direct Tax Incentives:

(i) Tax holiday for 10 consecutive years within the first 15 years of operation for IFSC companies
(ii) Option to choose a concessional tax regime exempting them from Minimum Alternate Tax (MAT) provisions
(iii) Dividends paid to foreign companies by IFSC units taxed at a reduced rate of 10%

B. Indirect Tax Incentives:

(i) Exemption from Basic Customs Duty and Goods and Services Tax (GST) on the import of goods by IFSC company for authorized operations
(ii) Lease rental payments made to foreign companies by IFSC Co under lease in – lease out model exempt from GST under the reverse charge mechanism
(iii) Leasing equipment from IFSC companies to customers in India exempt from Basic Customs Duty. Such transaction shall only attract GST on lease rentals ie IGST on value of equipment shall be exempt

C. Corporate Social Responsibility (CSR): Eligible companies exempt from CSR contributions during their initial five years

D. Foreign Exchange Management Act (FEMA): FEMA regulations do not apply to transactions between foreign companies and IFSC entities, facilitating smoother cross-border operations.

Ship leasing activity is gradually making its presence in GIFT City, evidenced by the registration of 15 ship operating leases and the leasing of 13 assets. The remarkable tripling of total assets leased over the past year depicts the increasing demand for ship leasing services from this strategic hub. This growth trajectory not only reflects the opportunities within the sector but also emphasizes GIFT City's pivotal role in shaping the future of the ship leasing market.

III. Proposed enablement of Oilfield Equipment Leasing

On 07 March 2025, a draft notification was issued to seek public comments/suggestions on specifying "oilfield equipment leasing" as a financial product under the IFSCA framework. The IFSCA has invited comments/ suggestions on the proposed definition of 'Oilfield Equipment' and any additional regulatory enablement, if any.

Background

In general parlance oilfield equipment encompasses all tools and machinery utilized in various activities related to the exploration, extraction, drilling, and production of mineral oils and gas. The global oilfield equipment leasing market accounts reported volume of USD 102.18 billion in 2024 (as available in public domain). This market segment is anticipated to grow at a compound annual growth rate (CAGR) of 4.91% from 2024 to 2032, outpacing the growth rate of the global equipment leasing market. Both developed nations, such as the USA, UK, and Germany, and developing countries like China, have adopted oilfield equipment leasing models to enhance productivity, manage cash flow, reduce input costs, and access advanced technology.

In the Asia-Pacific region, jurisdictions like Labuan in Malaysia, Singapore, and Dubai have established a robust ecosystem for oilfield equipment leasing and rental. For instance, Malaysia's oil and gas equipment leasing market reached USD 370 million in 2022, supported by favorable tax incentives and regulatory frameworks.

India is heavily dependent on import of oilfield equipment for meeting its domestic requirement for production of oil and gas. Also currently, the Indian government has taken various steps to increase exploration and production activity in India and reduce import dependency which currently stands at 87%. Oil & Gas exploration area in India set to increase from 0.5 mn sq km (2025) to 1 mn sq km (2030). It is envisaged that due to increase in exploration activities in India, there would be demand for oilfield equipment that are required for exploration and other incidental activities connected with exploration and production of mineral oils, fossil fuels, etc. Accordingly, the import of such oilfield equipment would also increase in India.

Stakeholders have expressed interest in the permissibility of operating leases for oilfield equipment from GIFT City. Enabling operating leases as a distinct financial activity could

significantly bolster oil exploration in India and position GIFT-IFSC as a regional hub for oilfield equipment leasing services. To harness this growth potential and benefit the Indian economy, it is proposed to classify operating leases, including hybrids of operating and financial leases for oilfield equipment, as a recognized financial product.

Benefits of undertaking Oilfield Equipment leasing from GIFT City

From an industry perspective, the Oil & Gas sector stands to gain significantly from undertaking Oilfield Equipment leasing through GIFT City. In addition to the incentives mentioned above, following are certain illustrative benefits for the sector:

a) Transitioning from Capex to Opex Model*:* Leasing allows companies to minimize capital expenditures, freeing up funds for operational use. This shift from a Capex to an Opex model is particularly advantageous in the oil and gas industry, where capital investments can be substantial. Regular and predictable lease payments facilitate better budgeting and cash flow management compared to the hefty upfront costs associated with outright equipment purchases
b) Access to Cutting-Edge Technology: The oilfield sector is inherently technology-driven, and leasing provides companies with access to the latest equipment without necessitating a large initial investment. This enables firms to remain competitive by leveraging advanced technologies that enhance efficiency and productivity. Additionally, leasing agreements offer flexibility regarding lease duration and options for upgrading or replacing equipment, which is crucial in an industry characterized by varying project timelines and rapid technological advancements
c) Foreign Exchange Savings*:* Importing oilfield equipment through purchase can incur significant costs. Leasing reduces the outflow of foreign currency.

Proposed definition of Oilfield Equipment in draft notification

Oilfield Equipment is proposed to be defined as the set of goods mentioned in the list annexed to the table specified in the GST notification no. 3/2017-Central Tax (Rate) dt. 28-06-2017 [Concessional CGST rate for supplies to Exploration and Production] that will be utilised in the oilfield wherein, the expression 'Oilfield' shall be as defined in the Oilfields (Regulation and Development) Act, 1948. In view of above definition, certain recommendations/ suggestions are provided by the industry players for consideration before IFSCA.

Way forward

The draft notification for oilfield equipment leasing from GIFT City represent significant steps towards enhancing India's position in the global financial landscape. By formalizing these leasing practices, India aims to create a regulated environment that fosters growth and innovation in maritime and oil and gas sectors.

As a next step, industry players are required to undertake feasibility study/ analysis of existing business model to evaluate the new business model in IFSC and study the final operational framework and its relevance to the business model. Further, stakeholders are encouraged to engage with these initiatives to unlock the potential of leasing mechanisms, ultimately contributing to India's energy independence and financial sophistication.

The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. The views and opinions expressed herein are those of the author.

Carbon Credit Markets: Opportunities for India's Oil and Gas Sector

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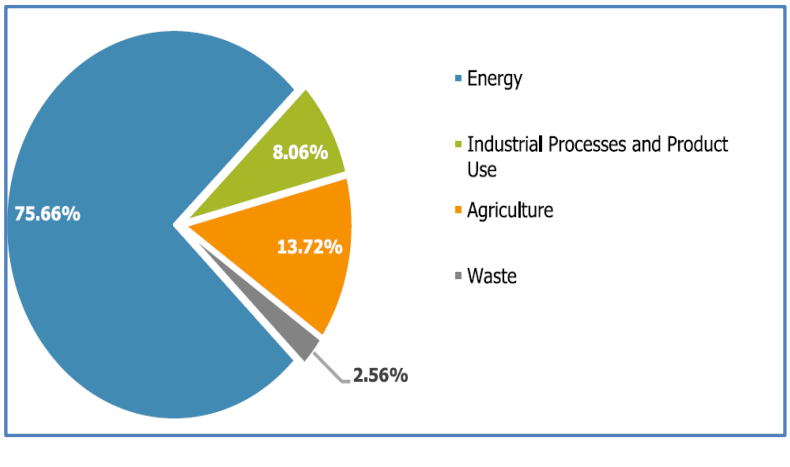
Abstract

India's commitment to achieve net-zero emissions by 2070 has catalysed the development of a domestic carbon credit market framework. The newly introduced Carbon Credit Trading Scheme (CCTS) – enabled by amendments to the Energy Conservation Act – aims to incentivize greenhouse gas (GHG) reductions through tradable Carbon Credit Certificates (CCCs). A carbon credit represents a reduction or removal of one metric ton of carbon dioxide (CO2) equivalent from the atmosphere, or the right to emit one metric ton of CO2. It's a tradable certificate, like a permit, that allows a company or individual to offset their emissions. This article reviews India's carbon market landscape and its implications for the oil and gas industry, drawing on the latest national emissions data and policy developments. The analysis details GHG emissions across the oil & gas value chain (upstream, midstream, downstream), examines India's emerging carbon trading mechanisms – including recent Greenhouse Gas Emissions Intensity (GEI) Target Rules, 2025 and the Indian Carbon Market (ICM) roadmap and projects India's total and sectoral emissions trajectory through 2040. This outlines practical strategies for the oil & gas sector to reduce emissions, generate carbon credits, and benefit from both compliance and voluntary carbon markets. The paper aims to be accessible to technical and non-technical readers by explaining key concepts and presenting data-driven insights and offering recommendations for industry stakeholders and policymakers.

Introduction

India is the world's third-largest emitter of greenhouse gases, contributing roughly 7%–8% of global GHG emissions[1]. This status reflects the country's rapid economic growth and heavy reliance on fossil fuels for energy. As of 2020, India's total GHG emissions (excluding land use and forestry) were about 2.96 billion tonnes of CO_2-equivalent ($MtCO_2e$). The energy sector is by far the dominant source, accounting for about 75.7% of national emissions in 2020. Agriculture is the second-largest contributor (13.7%), followed by industrial processes and product use (IPPU, 8.1%) and waste.

Figure 1: Distribution of GHG emissions in India (2020)



[1] *BP Statistical Review of World Energy Data 2024*

With agriculture contributing 13.7% of India's total GHG emissions, Methane from agriculture forms a major chunk of these emissions – particularly from rice cultivation & livestock. Methane's share in India's total GHG emissions (2020) is about 13.3%[2], making it a priority for emission reduction strategies (like alternate wetting and drying in rice fields, better livestock management, and improved manure handling). Methane is a potent GHG with a global warming potential ~28-34 times that of CO_2 over 100 years. Addressing methane from agriculture is critical for India's climate goals and directly ties to rural livelihoods and food security.

Within the energy sector, electricity and heat production (mostly from coal-fired power plants) are the largest emitters, while oil and gas operations – including petroleum refining and natural gas production – form a significant subset of energy-related emissions. Notably, India's oil & gas industry also contributes substantial methane through fugitive emissions: in 2020, total fugitive emissions were ~26.9 $MtCO_2e$, of which 38% came from oil and natural gas production and handling (the rest from coal mining)[3]. India's energy mix underscores the challenge of decarbonization.

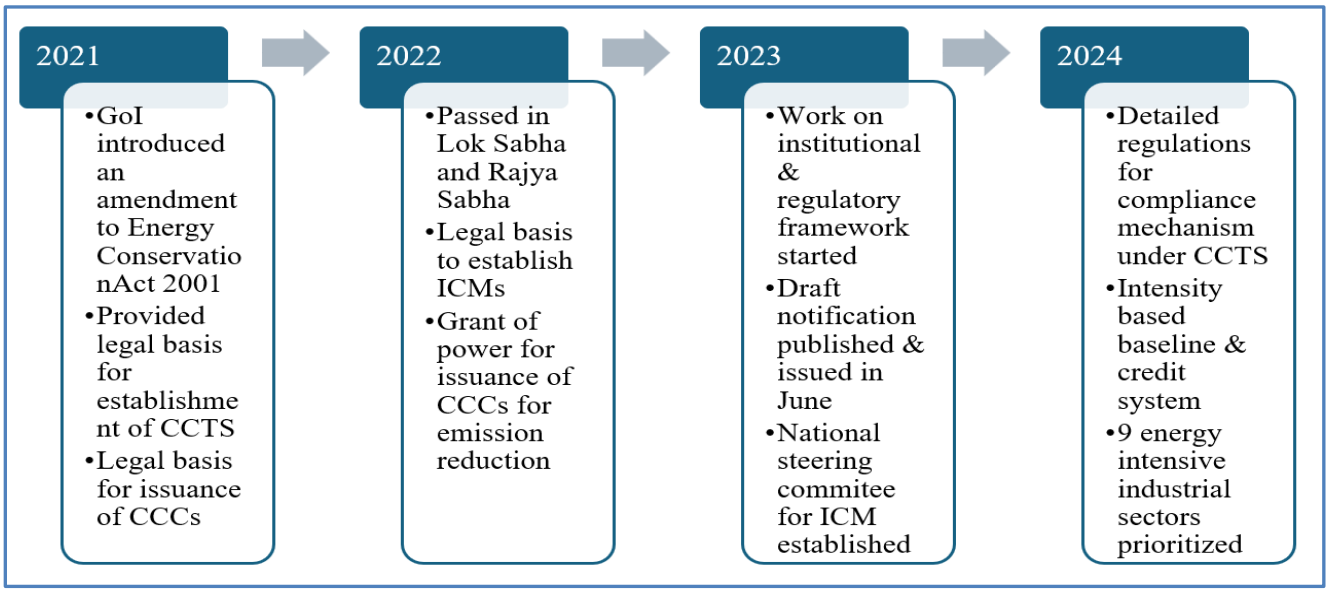
In response, India has made ambitious climate pledges under the Paris Agreement. Its updated Nationally Determined Contribution (NDC) commits to reducing the emissions intensity of GDP by 45% from 2005 levels by 2030, and to achieve about 50% of cumulative electric power installed capacity from non-fossil fuel sources by 2030. India also aims to create an additional carbon sink of 2.5–3 $GtCO_2$ through forest expansion by 2030. Achieving the 2030 goals will require significant deployment of clean energy and efficiency improvements across all sectors, including oil and gas.

One key policy tool to drive low-carbon investment is carbon pricing. India has historically engaged in carbon markets as a major supplier of credits under the Clean Development Mechanism (CDM) of the Kyoto Protocol, and more recently via voluntary carbon offset projects.

It emerged as one of the largest host countries for CDM projects, registering over 1,700 projects that spanned renewable energy, energy efficiency, methane avoidance, and industrial process improvements. These initiatives not only brought in significant foreign investment but also helped develop domestic expertise in carbon accounting, validation, and verification. This legacy positions India well to build its own robust carbon market infrastructure under the evolving domestic and international frameworks. Building on this experience, the Government of India is now developing a domestic carbon market framework to directly regulate and incentivize GHG reductions at home.

The cornerstone of this effort is the Carbon Credit Trading Scheme (CCTS), launched under amendments to the Energy Conservation Act in 2022. In parallel, India is formulating rules for integrating voluntary carbon markets and exploring linkages to international carbon market mechanisms under Article 6 of the Paris Agreement. Together, these initiatives form the roadmap for an Indian Carbon Market (ICM) that could play a pivotal role in meeting the country's climate objectives.

Exhibit 1: Evolution of India's Carbon Market



[2] *India's 4th Biennial Update Report dtd Dec 24 - Executive Summary*
[3] *India's 4th Biennial Update Report dtd Dec 24– Fugitive Emissions from Fuels (1.B) – Page 84*

This article examines the evolution of India's carbon credit markets and the opportunities they present for the oil and gas sector. We present an analysis of the oil & gas sector's emissions profile (upstream production, midstream processing/transport, and downstream refining/marketing), and discuss how carbon market instruments can incentivize mitigation in this sector. This paper will also project India's GHG emissions trajectory through 2040 under current trends, to contextualize the scale of reductions needed. Finally, we outline practical strategies and recommendations for oil and gas companies to participate in and benefit from carbon credit markets while aligning with India's low-carbon transition.

Emissions Profile of the Oil & Gas Sector

The oil and gas sector's emissions span multiple categories of India's GHG inventory. Upstream activities (oil and gas extraction and production) contribute through fuel combustion in operations, flaring of associated gas, and fugitive methane emissions from oil/gas wells, pipelines, and processing facilities. Midstream segments, such as natural gas processing plants and pipelines, also emit methane (from leaks and venting) and CO_2 from energy use. Downstream activities, notably oil refining and petrochemical manufacturing, are significant point sources of CO_2 due to the combustion of fuels in boilers and process heaters, as well as some process emissions.

According to BUR-4 (2024), within the energy sector category the sub-sector of *petroleum refining* alone accounted for around 6–7% of India's energy-sector CO_2 emissions in 2020. Power generation (electricity and heat production) by comparison was the dominant source, comprising roughly 90%+ of energy-sector CO_2 emissions. Thus, while oil refining is not the largest emitter, it is still a major industrial source included in the compliance market scope. In addition, fugitive emissions from oil and natural gas systems were about 10 $MtCO_2e$ in 2020, mainly methane. These arise from activities like venting of gas at oil wells, leaks in gas distribution, and maintenance-related releases. Fugitive emissions, though smaller in magnitude than combustion CO_2, are critical because methane has a high global warming potential and reducing leaks can often be cost-effective.

Downstream, the transportation sector (which consumes refined oil products) is another major emitter, though transport emissions are categorized under energy use (transport) rather than the oil & gas industry per se. Transport accounted for about 13% of India's total GHG emissions in 2020[4] largely from petroleum fuels in vehicles.

While these emissions are not directly assigned to oil companies in inventories, oil & gas firms are indirectly linked as the suppliers of fuel. This creates an opportunity: if the industry invests in cleaner fuels or electric mobility infrastructure, it could in the future generate credits for avoided downstream emissions, especially as policy evolves.

Upstream company operations emit CO_2 when running rigs, generators and processing equipment, often powered by diesel or gas. These direct emissions (Scope 1 for companies) are relatively smaller in the national context but significant within the carbon footprint of each barrel of oil or cubic meter of gas produced. There is also flaring of natural gas at oil fields, which converts methane to CO_2. India has been working to reduce routine flaring, but it still occurs at some sites, contributing to CO_2 emissions while wasting a potential energy resource.

In summary, the oil and gas sector contributes to India's GHG emissions through a mix of point-source CO_2 emissions (mostly from refining and gas processing) and diffuse methane emissions (from production and distribution). Tackling these emissions is an important part of India's mitigation strategy within the energy sector.

The new carbon market mechanisms explicitly include the oil & gas sector as a covered entity in certain respects. Additionally, oil & gas companies can engage in the voluntary market by financing offset projects. The breadth of emission sources across upstream to downstream means there are multiple avenues for reductions, from technology upgrades to operational changes.

India's Carbon Market Mechanisms and Policies

To drive emissions reductions, India is implementing a two-pronged carbon market structure: a Compliance Market under the CCTS, and a Voluntary Market for other reductions. The Carbon Credit Trading Scheme (CCTS) is an intensity-based trading system designed as a "baseline-and-credit" mechanism. Under CCTS, the government sets mandatory GHG emissions intensity targets for obligated entities – for example, tonnes of CO_2e per unit of output. Each year, companies must monitor and report their emissions and output. If they outperform (emit less than their target intensity), they earn Carbon Credit Certificates (CCCs) equivalent to the excess reduction. If they underperform (exceed the target intensity), they must purchase CCCs to cover the gap or face penalties. Each CCC represents 1 tonne CO_2e reduced or removed

[4]*Source: CSE, Data from India Fourth Biennial Update Report*

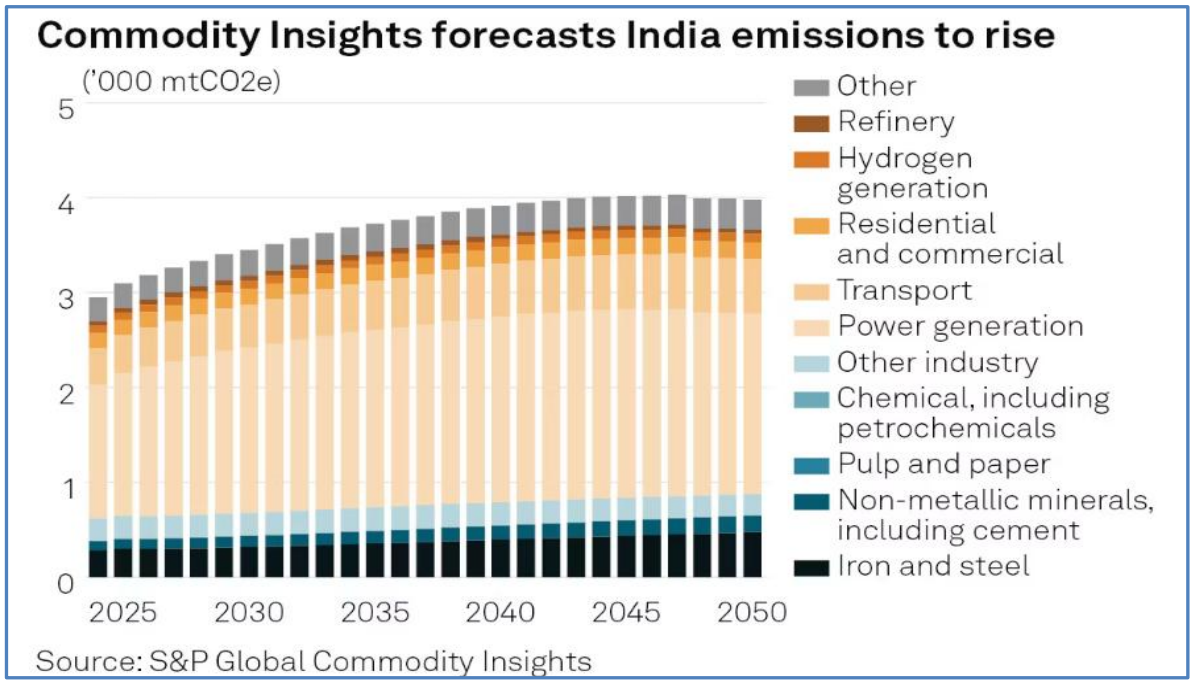
The CCTS builds on India's existing Perform, Achieve and Trade (PAT) scheme, which since 2012 has set energy efficiency targets for industries like power, cement, steel, etc. The plan is to transition the PAT scheme into the CCTS, expanding its scope to a broader carbon market. The BEE is also tasked with developing sector-specific emissions intensity trajectories to 2030 for each covered sector, aligning with India's NDC and considering technological potential and abatement costs.

In parallel with the CCTS rollout, India introduced the Greenhouse Gas Emissions Intensity Target (GEI) Rules, 2025 (draft as of April 2025). Under the GEI Target Rules, baseline emission intensities will be determined from 2023–24 data and targets set for 2025–26 and 2026–27.

India is also positioning to leverage international carbon market mechanisms. Article 6 of the Paris Agreement allows countries to cooperate via trading of mitigation outcomes (ITMOs). India could potentially sell credits overseas or buy cheaper reductions internationally to meet its goals, though its primary stance has been prioritizing domestic actions.[5]

India's future emissions trajectory will depend on the effectiveness of these policies and the pace of clean energy deployment. Under current policies – which include substantial renewables expansion and efficiency improvements, but not a cap on emissions – India's GHG emissions are projected to continue rising through the 2030s before plateauing or peaking around the 2040s.

The Indian government's own modelling, as reported by S&P Global, suggests overall GHG emissions might **peak in 2047** at about 3.9–4.0 $GtCO_2e$, with a 35% increase from current levels by mid-century[6].



Revenue and Credit Generation Potential for Oil & Gas Firms

One of the promises of carbon markets is that they can unlock economic value for emission reductions. For India's oil and gas sector, this translates to potential new revenue streams from selling carbon credits, as well as cost savings from avoiding future carbon liabilities. A recent industry analysis estimated that early-moving oil & gas companies in India could collectively generate on the order of USD $200 million per year by 2050 through trading carbon credits[7]. While $200 million is modest relative to the multi-billion-dollar revenues of India's major oil companies, it is a notable new income stream that can grow over time, especially as carbon credit prices increase.

Estimates suggest the market could grow at a compound annual growth rate (CAGR) exceeding 30% through 2030[8]. Such growth will be driven by increasing climate ambition, corporate net-zero commitments, and possibly international demand for credits.

[5]IETA Report – Developing an effective Carbon Market Framework towards achievement of Net Zero in India
[6] S&P Global Report dtd Nov 21 2024 by Abhijeet Thakkar and Yerlan Aubakirov: Charting the future of India's carbon market
[7] IETA Report – Developing an effective Carbon Market Framework towards achievement of Net Zero In India
[8] - https://www.grandviewresearch.com/industry-analysis/carbon-credit-market-report#

If these projections hold, oil & gas firms that build expertise in carbon markets early will stand to benefit significantly – both financially and in terms of reputational advantage. A specific area of opportunity is methane mitigation. Reducing methane emissions from oil & gas operations can generate high-quality credits (since methane avoidance has outsized climate benefits). Technologies like vapor recovery units, improved leak detection and repair (LDAR) programs, and plugging of fugitive leaks can yield credits relatively cheaply. Indian companies can also implement carbon capture and storage (CCS) at gas processing plants or refineries to earn credits for CO_2 permanently sequestered. While CCS is capital-intensive, it may become attractive if carbon credit prices rise enough or if there is support through climate finance.

Recommendations for the Oil & Gas Sector: Given the above, there are several strategic steps India's oil and gas companies should consider maximizing benefits from carbon markets:

- **Carbon Markets for offset of emissions**
  Oil & Gas companies can generate carbon credits by implementing greenhouse gas (GHG) reduction projects. These credits can then be sold on voluntary carbon markets. Other organizations can buy these credits to offset their emissions, achieve sustainability goals, and enhance their climate reputation. In turn, the seller—the Oil & Gas company—earns revenue that can be reinvested into further environmental initiatives.
- **Invest Early in Measurement Reporting & Verification (MRV) Systems:** Developing robust internal systems for monitoring and reporting emissions will be essential. This might include deploying digital sensors for real-time emissions tracking (for example, continuous monitoring of flue gases, drone-based methane leak detection) and software to manage carbon data. Early MRV implementation not only ensures compliance but can identify inefficiencies (energy losses, leaks) that, when fixed, save money and generate credits. It also positions companies to respond quickly as reporting requirements expand
- **Partner with Accredited Carbon Project Developers:** The carbon market has a technical side involving methodology selection, validation, verification, and credit issuance. Partnering with experienced carbon credit developers or consultants (such as those accredited with Gold Standard, Verra or as designated operational entities under UNFCCC) can help navigate the process efficiently
- **Set Up Internal Carbon Pricing and Carbon Teams:** It may be useful for companies to adopt an internal carbon price in their investment decisions. For instance, when evaluating a new project or a retrofit, factoring in a shadow price on carbon.
- **Engage in Policy Dialogue Proactively:** Industry associations (like FICCI, CII) and companies should actively engage with policymakers (MoEFCC, BEE, Ministry of Power) to share feedback on the carbon market's design and to advocate for supportive measures.

In conclusion, India's carbon credit market is more than just an environmental policy instrument; it is a framework to channel the country's entrepreneurial and technical capabilities towards a low-carbon future. The oil and gas sector, armed with its engineering expertise and financial heft, stands to gain by leading in this transition. By proactively reducing emissions and trading credits, oil and gas companies can turn the carbon market from a compliance cost into a competitive advantage. This proactive approach will not only help India inch closer to its net-zero 2070 vision but will also ensure that the sector remains resilient and relevant in a decarbonizing world. The journey has begun, and the coming decade will be critical in scaling up the carbon market's impact. With sound policy tweaks and committed participation, carbon credit markets can indeed become a key pillar of India's sustainable growth story.

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Global Polyethylene flows Disrupted by Global Geopolitical Situation- An opportunity for India?

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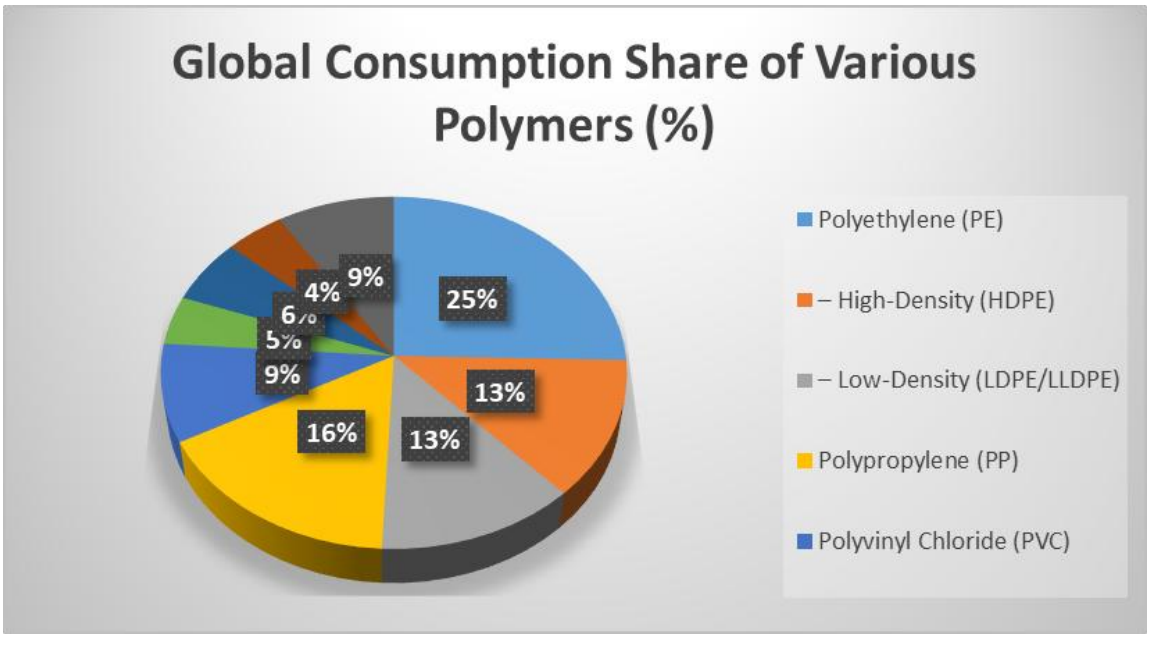
Background

Major refineries across the globe are pursuing for petrochemical integration. One of the key product emerging out of petrochemical plants is Polyethylene. Polyethylene forms 34% of global polymer consumption with High Density Polyethylene HDPE (17%), Linear Low Density Polyethylene LDPE/LLDPE (14%). High Density Polyethylene (HDPE) is vastly used in products like bottles, pipes & grocery bags while LDPE/LLDPE is vastly used in packaging films, squeeze bottles, wire and cable applications. Polyethylene is a major traded commodity globally. China is the largest importer of Polyethylene.



China is the biggest importer of Polyethylene in the world .

Being deficit in Polyethylene China imported around 14 million tons of PE during 2024:

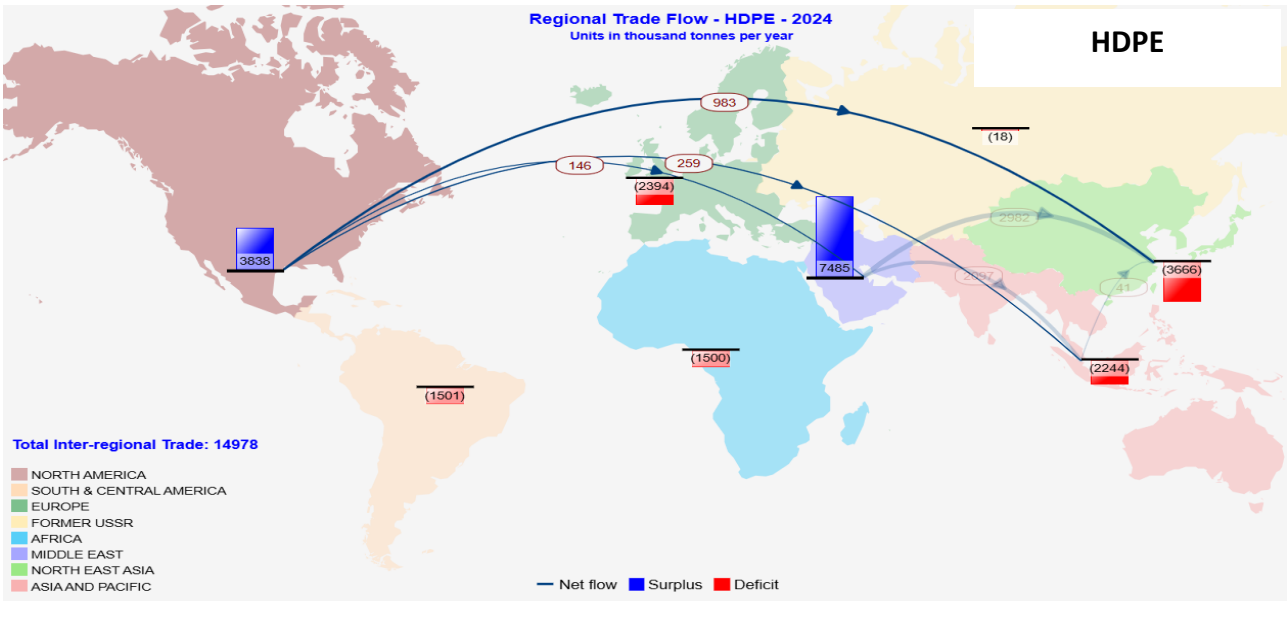
- 6 million tonnes of HDPE
- 5 million tonnes of LLDPE
- 3 million tonnes of LDPE

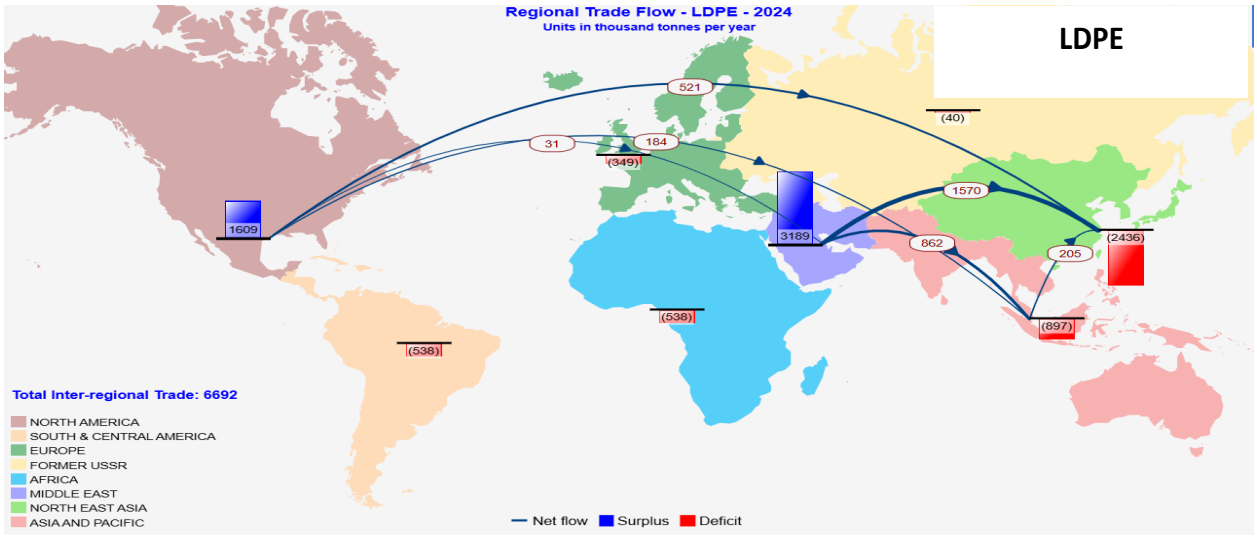
China's import (while analysing imports into China HS Codes 390120, 390110, 390190, 390140 have been considered) from various countries across the globe is tabulated in the table below:-

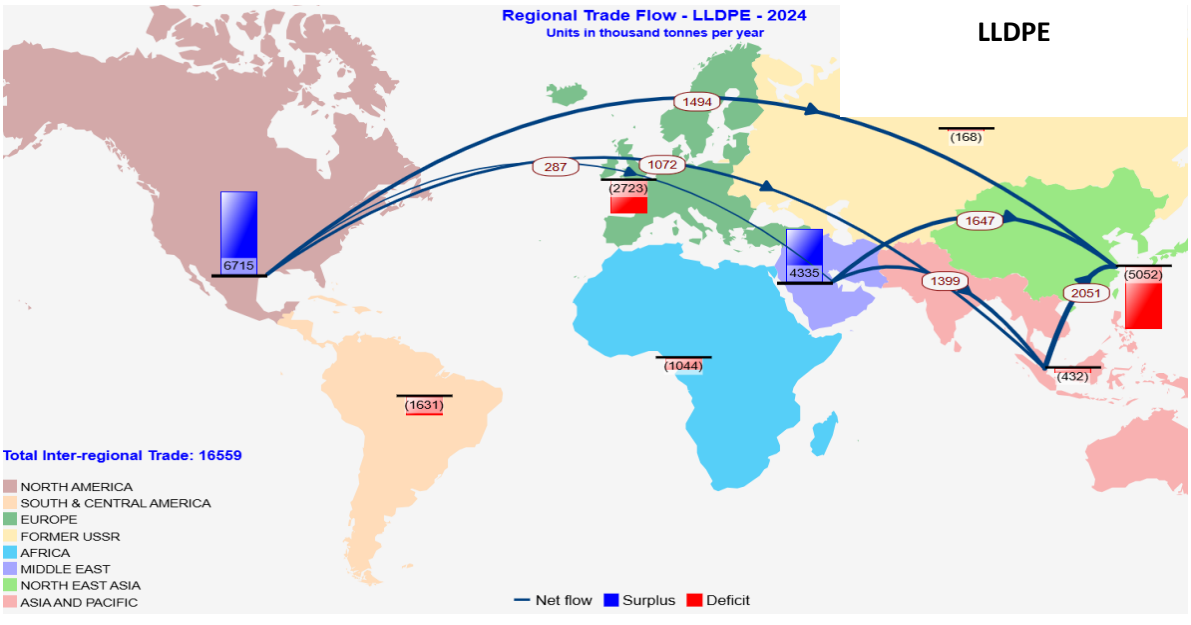
Country (MMT)	2020	2021	2022	2023	2024
USA	1.39	1.04	1.18	2.53	2.63
Saudi Arabia	3.78	2.70	2.77	2.51	2.38
UAE	1.92	1.86	1.93	1.60	2.16
Republic of Korea	1.90	1.79	1.65	1.55	1.68
Iran	2.31	2.33	2.03	1.29	1.33

Table1 - Source: -ITC Trade Maps, UN Comtrade

From the table it can be inferred that US emerges out to be the largest exporter to China. Thanks to the shale gas and ethane crackers, the USA has become a major PE producer and is one of China's top suppliers, surpassing traditional exporters from the Gulf.







- US & Middle East are in surplus whereas China is in Deficit
- US total PE surplus ~ 10 MMT, Middle east surplus ~ 15 MMT
- China deficit ~ 14 MMT
- Space created due to expected lower US imports to China will have provide opportunity to Middle Eastern players & Asian players including India

Trade war

Recent trade war between the world's two largest economies USA & China have disrupted polyethylene trade between them. The new tariff & counter tariffs have made imports and exports between these two nations economically unfeasible, forcing a shift in global supply chains. Every other day a new tariff number is announced by the two countries. In this scenario trade between the two countries is likely to be disrupted. This disruption will not only impact the trade flows between US & China but will also have ramifications for Asian & Middle eastern suppliers.

The USA accounted for 17% of China's total PE imports.

Interestingly, 35% of China's 5 million tons of LLDPE imports is m-LLDPE (**Metallocene LLDPE), mLLDPE** is a **special grade of Linear Low-Density Polyethylene** produced using **metallocene catalysts**. It represents an **advanced form of LLDPE** with **superior properties**, widely used in flexible packaging and films. It is mainly imported from Singapore, USA, and Thailand. The USA share was about 800 KT of M LLDPE (metallocene LLDPE) during 2024, and finding alternative suppliers for this much volume in the short term will be further tough task. (Source: -ITC Trade Maps, UN Comtrade & Indian oil internal analysis)

However, with tariffs now in place, this strong trade flow has come to a halt. In the short term, China is likely to experience a reduction in demand and may seek to replace the 2.6 million tons of U.S.

USA now faces the challenge of finding new buyers for its PE qty. which was exported to China. This shift will reshape global PE supply chains, affecting prices, logistics, and trade patterns.

Israel – Iran Conflict

In view of the recent geopolitical situation between Israel and Iran, in which Isreal has damaged major refining and petrochemical capacities of Iran. Several gas fields which have been feedstock source for Iranian petrochemical capacities have also been severely hit. From the table above it can be inferred that Iran has been a major Polyethylene supplier to China. However, due to the current situation it is highly likely Iranian exports to China shall be restricted for quite a few months. Disruptions caused by USA -China Trade war coupled with Israel-Iran conflict opens opportunities for other middle eastern suppliers, like UAE, Saudi Arabia, Korea. As per market sources many Chinese buyers have shifted to Korean suppliers as well as suppliers from UAE & Riyadh.

What opportunities lie for India?

While India might seem like a potential PE market, as India imports approx. 2.5 million PE every year. Most of these imports are from countries like Singapore, UAE & ASEAN countries. India's FTA'S with Singapore, UAE & ASEAN countries make import of products under HSN chapter 39 feasible and attractive in India. Details of prominent FTA's in HSN chapter 39 is shared in Table2 below.

LDPE is a major product which is imported in India, as production is far less than demand. In view of the upcoming PE capacities and newly functional capacities of polyethylene including metallocene based polyethylene in India, and the fact that imports in India have sustained in view of the prevalent Free Trade agreements the present scenario offers export opportunities to Indian Players.

Polymer	HSN code	Effective custom duty rate (Non-FTA Countries)	India's FTA with other countries (Effective duties applicable)					
			India-ASEAN (other than Singapore & Thailand)	India-Korea	India-Japan	India-Singapore	India-Thailand	India -UAE
LLDPE	3901 4010	7.5%	5%	5%	0	0	5%	TR of 50% in 5 years with specified year-wise TRQs
HDPE	3901 2000	7.5%	5%	7.5%	0	0	5%	TR of 50% in 5 years with specified year-wise TRQs

Table2
Legends Explanation: TEI - Tariff Elimination Immediate, TEP - Tariff Elimination Phased,
TR - Tariff Reduction, EXC - Exclusion List, TRQ - Tariff Rate Quota.

From the table below India's export to China is miniscule in comparison to world exports to China. India exports a miniscule 1% to Chinese polyethylene market. In view of the market scenario prevalent in India and geopolitical scenario, Indian Players have good opportunity to tap the vast Chinese market.

Country **(MMT)**	2020	2021	2022	2023	2024
USA	1.39	1.04	1.18	2.53	2.63
Saudi Arabia	3.78	2.70	2.77	2.51	2.38
UAE	1.92	1.86	1.93	1.60	2.16
Korea, Republic of	1.90	1.79	1.65	1.55	1.68
Iran	2.31	2.33	2.03	1.29	1.33
India	0.75	0.20	0.06	0.10	0.17

Table3 – Source: ITC Trade Maps, UN Comtrade

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Disclaimer: Authors' views are personal and do not represent the views of their organization.

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Workshop on Certification of SAF for the Oil Industry

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), is a global program aiming to address emissions from international air travel. As per CORSIA, International Sustainable and Carbon Certification (ISCC) is the agency recognized by the International Civil Aviation Organization (ICAO) to demonstrate compliance with sustainability, traceability Criteria and LCA calculation methodology for SAF (CORSIA Eligible Fuels) certification.

In India, the National Accreditation Board for Certification Bodies (NABCB) has signed a Memorandum of Understanding (MoU) with the International Sustainability and Carbon Certification (ISCC). Under this arrangement, ISCC will accredit certification bodies responsible for certifying Sustainable Aviation Fuel (SAF) produced by the oil industry.

Beginning from 2027, Indian airlines operating international flights will be required to comply with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). As a result, the Indian oil industry has begun investing in the development of SAF production capacity. A critical aspect of CORSIA implementation is the certification of SAF, ensuring it meets international sustainability standards.

Given the growing importance of SAF certification for the oil sector, there is a recognized need to understand the certification processes established by NABCB and its accredited certification bodies.

To address this need, the **Federation of Indian Petroleum Industry (FIPI) in association with NABCB organized a half-day workshop on "Certification of SAF for the Oil Industry" on Monday, 26th May 2025, at PHD House, August Kranti Marg, New Delhi**. The workshop was attended by 44 participants from the oil and gas industry.

Mr. Gurmeet Singh, Director General, FIPI, welcomed the gathering and expressed gratitude to the dignitaries and industry participants for their presence. The workshop was inaugurated by Dr. Alok Sharma, Director (R&D), Indian Oil Corporation Ltd., who delivered the Inaugural Address.

Mr. Rajesh Maheshwari, CEO of NABCB, set the context for the workshop and introduced the speakers from NABCB, who made a detailed presentation on the procedures for SAF certification.

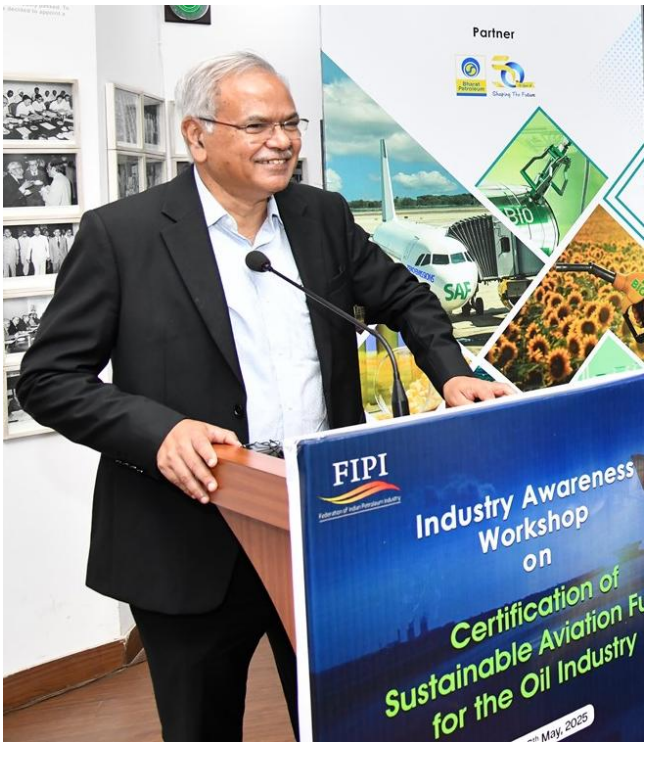
A representative from ISCC, Germany, joined virtually and conducted a comprehensive session on the CORSIA scheme, its implementation requirements, and responded to various queries from the participants.

Mr. Rajesh Maheshwari, CEO of the National Accreditation Board for Certification Bodies (NABCB), delivered the inaugural address

Mr. Dario Formenti, Senior Manager at ISCC, joined the session virtually and delivered a comprehensive presentation on the ISCC CORSIA Scheme, outlining its framework and certification requirements

All sessions were well-received and appreciated by the participants, reflecting the relevance and importance of SAF certification for the oil and gas sector.

Mr. Virendra Kumar Sharma, Assistant General Manager (CQR), COTECNA; Mr. M. K. Sikriwal, COTECNA; Mr. Ajay Sharma, Joint Director, NABCB and Dr. S. K. Chattopadhyay, Lead Assessor, NABCB made a detailed presentation



During the Valedictory Session of the workshop, Mr. P. S. Ravi, Director (Downstream), expressed his gratitude to the speakers and participants for their active involvement, which contributed in making the workshop highly interactive and successful.

The participants unanimously felt that FIPI should organize another workshop focused on the practical aspects of SAF certification procedures and processes, to further deepen industry understanding and readiness.

Events

13th Annual Convention of FIPI Student Chapters

The 13th Annual Convention of FIPI Student Chapters was held on April 4, 2025, at Jawaharlal Nehru Technological University, Kakinada (JNTUK). The central theme of the Convention was ***"Intensifying Hydrocarbon Exploration in India with Greater Energy Efficiency and Accuracy."***

The event was attended by more than 100 students from JNTUK, Kakinada including 72 participants, comprising 60 students and faculty members from 11 FIPI Student Chapters. The participating institutions included: IIT (ISM) Dhanbad; Dibrugarh University, Assam; Pandit Deendayal Energy University (PDEU), Gandhinagar; Rajiv Gandhi Institute of Petroleum Technology (RGIPT), Jais Amethi; University of Petroleum and Energy Studies (UPES), Dehradun; Osmania University, Hyderabad; JNTUK, Kakinada; MIT-World Peace University (MIT-WPU), Pune; IIT Madras; Indian Institute of Petroleum and Energy (IIPE), Visakhapatnam; and IIT Guwahati.

The convention commenced with the JNTUK anthem and the traditional lighting of the ceremonial lamp by the esteemed dignitaries. Prof. K.V. Rao, Adjunct Professor & Advisor, Department of Petroleum Engineering and Chemical Engineering, and Faculty Advisor, JNTUK FIPI Student Chapter, delivered the welcome address. He emphasized the importance of the convention in fostering academic collaboration, strengthening industry-academia engagement, and supporting the professional growth of students.

Following the welcome, keynote addresses were delivered by Mr. Deb Adhikari, Director (Exploration & Production), FIPI; Prof. CSRK Prasad, Vice-Chancellor, JNTUK, Kakinada; and Mr. Saloma Yomdo, Director (Exploration & Development), Oil India Ltd. They shared valuable insights into current trends, industry challenges, and future prospects in the oil and gas sector, underlining the critical role of innovation, sustainable practices, and collaborative efforts between industry and academia.

During the convention, IIPE Visakhapatnam was formally inducted as a new FIPI Student Chapter. This milestone reflects a continued commitment of FIPI in strengthening academic-industry partnerships and nurturing future leaders in the energy domain.

Distinguished industry experts, including Mr. Neeraj Sinha, Senior Executive Vice President & Head Exploration, Reliance Industries Ltd.; Mr. Ratnesh Kumar, Executive Director and Asset Manager, Eastern Offshore Asset, ONGC; and Mr. Santanu Mukherjee, Executive Director and Basin Manager, Cauvery Basin, ONGC, addressed the gathering. Drawing from their extensive and rich experience, they inspired the student participants by sharing the dynamic nature of the oil and gas sector, evolving technologies, operational challenges, and the strategic importance of the industry in powering India's economy in the coming decades.

Subsequently, the participating Student Chapters delivered presentations on their annual activities and on the convention theme. The presentations were evaluated by a distinguished jury comprising:

- Mr. Neeraj Sinha, Senior Executive Vice President & Head Exploration, Reliance Industries Ltd.
- Mr. Ratnesh Kumar, Executive Director & Asset Manager, Eastern Offshore Asset, ONGC
- Mr. Santanu Mukherjee, Executive Director & Basin Manager, Cauvery Basin, ONGC
- Mr. Deb Adhikari, Director (Exploration & Production), FIPI

FIPI Student Chapters provided excellent overview of their year-long activities, encompassing technical and strategic events, article and paper presentations, as well as various social initiatives. They also delivered compelling presentations on the convention's theme, offering valuable insights into the advanced technologies in strengthening hydrocarbon exploration and production. Both segments of the presentations were well-received and garnered appreciation from the audience and jury members alike.

After meticulous evaluation and deliberation by the Jury, the results were declared as follows:

Best Chapter Activities 2024: Dibrugarh University was declared the winner and awarded a trophy along with a cash prize of Rs. 50,000.

Best Theme Presentation: The Indian Institute of Petroleum and Energy (IIPE), Visakhapatnam was declared the winner and received a trophy and a cash prize of Rs. 50,000, while Pandit Deendayal Energy University (PDEU), Gandhinagar was the runner-up and awarded a trophy and a cash prize of Rs. 25,000.

The event concluded with a vote of thanks delivered by Ms. Ramya Atla, Student President, JNTUK FIPI Student Chapter. She expressed gratitude to the invited dignitaries, the FIPI team, participants, and student volunteers, particularly from JNTUK, for their contributions towards the successful execution of the convention.

NEW APPOINTMENTS

Dr. Ankur Baruah assumes charge as Director (HR) of OIL

Dr. Ankur Baruah has assumed charge as Director (HR) of Oil India Limited (OIL) on 16th April 2025. An engineer turned HR leader, Dr. Baruah holds an MBA degree in Human Resources, a PhD in Business Administration and prestigious certifications, including IPMA Project Management and Psychometric Testing accreditation.

Prior to his appointment as Director (Human Resources), he was serving as the Executive Director (Human Resources) in Oil India Ltd.

With three decades of professional experience spanning the full spectrum of HR and corporate leadership, Dr. Baruah is a recognized expert in manpower planning, talent acquisition, performance management, stakeholder engagement and change management. His strategic and innovative approaches have strengthened Oil India Limited's reputation as an industry leader in HR excellence.

A distinguished thought leader, Dr. Baruah has delivered keynote addresses and participated in high-profile panels at national and international forums. His contributions to the HR domain have earned him numerous prestigious accolades, including the Most Iconic HR Leader, the Topmost HR Leader in Asia and the HR Excellence Award.

Sachidananda Maharana assumes charge as Director (Finance) of NRL

Mr. Sachidananda Maharana has assumed charge as the Director (Finance) of Numaligarh Refinery Limited (NRL) with effect from 18th April 2025.

Mr. Maharana is a member of the Institute of Chartered Accountants of India (ICAI). Prior to joining the NRL, Mr. Maharana worked with Oil India Limited, a Maharatna PSU. Mr. Maharana has rich work experience of over 30 years in diverse areas of finance and accounting including treasury management, international fund raising, risk management, corporate accounts, investors' relations, business development, merger and acquisition.

NEW APPOINTMENTS

Subhankar Sen Takes Over as Director (Marketing) of BPCL

Mr. Subhankar Sen has taken over as Director (Marketing) of **Bharat Petroleum Corporation Limited o**n 14th July 2025.

Mr. Sen, a veteran of BPCL with over three decades of experience, has played a pivotal role in driving strategic transformation across key business verticals. His appointment marks a significant milestone in BPCL's journey towards innovation, customer-centricity and sustainable growth.

Over the years, Mr. Sen has held several critical leadership roles within the organisation. As Business Head – Retail (West), he led a major overhaul of BPCL's retail operations across fuel stations. Under his leadership, BPCL introduced new-age formats and enhanced customer engagement through digital-first initiatives. The launch of BeCafe, a modern café concept at fuel stations, added a fresh dimension to non-fuel retailing and enhanced the overall consumer experience.

Mr. Sen has been at the heart of BPCL's brand and loyalty journey, shaping not just products but the very way the company connects with its customers. As part of the core Strategy Team, he contributed to the development and execution of several flagship brands and customer-focused platforms, including Pure for Sure, Speed, PetroBonus, SmartFleet, BPCL-SBI Card, In&Out Stores, and UFill.

Recognized for his people-first leadership style, Mr. Sen is known for nurturing empowered teams, driving operational excellence, and responding swiftly to evolving market dynamics. His appointment as Director (Marketing) comes at a strategic inflection point as BPCL accelerates its efforts towards a digitally-enabled, sustainable, and consumer-driven future.

O P Sinha assumed charge as the Director (Exploration) of ONGC

Mr. O P Sinha assumed charge as the Director (Exploration) of the Energy Maharatna, ONGC, on 15 July 2025. An alumnus of the Indian School of Mines (ISM), Dhanbad, with a Bachelor of Technology in Petroleum Engineering, Mr Sinha has joined the Board with over 37 years of extensive experience in the Exploration & Production (E&P) sector.

Mr Sinha has served ONGC in various key capacities across the domains of exploration, field development, and reservoir management. His expertise spans many aspects of the reservoir engineering spectrum, from seismic interpretation to simulation and execution of field development plans.

Notably, Mr Sinha has played a pivotal role in reservoir management of both onshore and offshore fields, contributing to the design and implementation of Improved Oil Recovery (IOR) schemes, screening of Enhanced Oil Recovery (EOR) processes, and leading critical reservoir simulation studies.

As the Chief of the Institute of Reservoir Studies (IRS), ONGC's in-house center for IOR/EOR design in Ahmedabad, he spearheaded initiatives to expand EOR applications for production enhancement across ONGC-operated fields. In tune with the global energy transition, Mr Sinha had also been instrumental in conceptualizing projects on Carbon Capture, Utilization, and Storage (CCUS/CCS), aimed at reducing carbon emissions and aligning ONGC's operations with Net Zero targets.

With a deep understanding of subsurface complexities and a visionary approach to energy transition, Mr Sinha is poised to lead ONGC's exploration thrust into a new era of innovation and growth.

STATISTICS

INDIA: OIL & GAS

DOMESTIC OIL PRODUCTION (MILLION MT)

		2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25 (P)	
												% of Total
On Shore	ONGC	5.8	5.9	6.0	6.1	6.1	5.9	5.8	5.9	6.0	6.0	44.2
	OIL	3.2	3.3	3.4	3.3	3.1	2.9	3.0	3.2	3.3	3.4	25.3
	Pvt./ JV (PSC)	8.8	8.4	8.2	8.0	7.0	6.2	6.3	5.6	5.0	4.2	30.5
	Sub Total	**17.8**	**17.6**	**17.5**	**17.3**	**16.2**	**15.1**	**15.1**	**14.7**	**14.3**	**13.6**	**100**
Off Shore	ONGC	16.5	16.3	16.2	15.0	14.5	14.2	13.6	13.5	13.2	12.4	82.5
	OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pvt./ JV (PSC)	2.5	2.1	1.9	1.9	1.5	1.1	1.0	0.9	1.8	2.6	17.5
	Sub Total	**19.1**	**18.4**	**18.1**	**16.9**	**16.0**	**15.4**	**14.6**	**14.5**	**15.0**	**15.1**	**100**
Total Domestic Production		36.9	36.0	35.7	34.2	32.2	30.5	29.7	29.2	29.4	28.7	100.0
	ONGC	22.4	22.2	22.2	21.0	20.6	20.2	19.5	19.5	19.2	18.5	64.3
	OIL	3.2	3.3	3.4	3.3	3.1	2.9	3.0	3.2	3.3	3.4	12.0
	Pvt./ JV (PSC)	11.3	10.5	10.1	9.9	8.4	7.4	7.3	6.5	6.8	6.8	23.7
Total Domestic Production		**36.9**	**36.0**	**35.7**	**34.2**	**32.2**	**30.5**	**29.7**	**29.2**	**29.4**	**28.7**	**100**

Source : MoP&NG/PPAC

REFINING

Refining Capacity (Million MT on 1st April 2024)

Indian Oil Corporation Ltd.	
Barauni	6.00
Koyali	13.70
Haldia	8.00
Mathura	8.00
Panipat	15.00
Guwahati	1.20
Digboi	0.65
Bongaigoan	2.70
Paradip	15.00
Total	**70.25**
Chennai Petroleum Corp. Ltd.	
Narimanam	0.00
Chennai	10.50
Total	**10.50**
JV Refineries	
HMEL	11.30
JV Total	**11.30**

Bharat Petroleum Corp. Ltd.	
Mumbai	12.00
Kochi	15.50
Bina	7.80
Total	**35.30**
Hindustan Petroleum Corp. Ltd.	
Mumbai	9.50
Visakhapattnam	13.70
Total	**23.20**
Other PSU Refineries	
NRL, Numaligarh	3.00
MRPL	15.00
ONGC, Tatipaka	0.07
Total PSU Refineries Capacity	**157.32**
Private Refineries	
RIL, (DTA) Jamnagar	33.00
RIL , (SEZ), Jamnagar	35.20
Nayara Energy Ltd. , Jamnagar	20.00
Pvt. Total	**88.20**

Total Refining Capacity of India 256.82 (5.02 million barrels per day)
Source : PPAC

CRUDE PROCESSING (MILLION MT)

PSU Refineries	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25 (P)
IOCL	53.59	58.01	65.19	69.00	71.81	69.42	62.35	67.66	72.41	73.31	71.56
BPCL	23.20	24.10	25.30	28.20	30.90	31.53	26.22	29.84	38.40	39.50	40.43
HPCL	16.20	17.20	17.80	18.20	18.44	17.18	16.42	13.97	19.09	22.19	25.01
CPCL	10.70	9.60	10.30	10.80	10.69	10.16	8.24	9.04	11.32	11.64	9.43
MRPL	14.60	15.53	15.97	16.13	16.23	13.95	11.47	14.87	17.12	16.53	18.04
ONGC (Tatipaka)	0.05	0.07	0.09	0.08	0.07	0.09	0.08	0.08	0.07	0.07	0.07
NRL	2.78	2.52	2.68	2.81	2.90	2.38	2.71	2.62	3.09	2.51	3.07
Sub Total	**121.12**	**127.03**	**137.33**	**145.22**	**151.04**	**144.71**	**127.50**	**138.08**	**161.50**	**165.75**	**167.62**

JV Refineries	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25 (P)
HMEL	7.34	10.71	10.52	8.83	12.47	12.24	10.07	13.03	12.74	12.65	13.04
BORL	6.21	6.40	6.36	6.71	5.71	7.91	6.19	7.41	-	-	-
Sub Total	**13.55**	**17.11**	**16.88**	**15.54**	**18.18**	**20.15**	**16.26**	**20.44**	**12.74**	**12.65**	**13.04**

Pvt. Refineries	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25 (P)
NEL	20.49	19.11	20.92	20.69	18.89	20.62	17.07	20.16	18.69	20.32	20.49
RIL	68.10	69.50	70.20	70.50	69.14	68.89	60.94	63.02	62.30	62.69	66.18
Sub Total	**88.59**	**88.61**	**91.12**	**91.19**	**88.03**	**89.51**	**78.01**	**83.19**	**81.00**	**83.01**	**86.67**

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25 (P)
All India Crude Processing	223.26	232.90	245.40	251.90	257.25	254.38	221.77	241.70	255.23	261.41	267.33

Source : MoP&NG/PPAC

CRUDE CAPACITY VS. PROCESSING

	Capacity On 01/04/2024 Million MT	% Share	Crude Processing 2024-25 (P)	% Share
PSU Ref	157.3	61.3	167.6	62.7
JV. Ref	11.3	4.4	13.0	4.9
Pvt. Ref	88.2	34.3	86.7	32.4
Total	**256.8**	**100**	**267.3**	**100**

Source : MoP&NG/PPAC

POL PRODUCTION (Million MT)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
From Refineries	217.1	227.9	239.2	249.8	257.4	258.2	229.3	250.3	263.0	272.1	279.3
From Fractionators	3.7	3.4	3.5	4.6	4.9	4.8	4.2	4.1	3.5	3.5	3.2
Total	**220.7**	**231.2**	**242.7**	**254.4**	**262.4**	**262.9**	**233.5**	**254.3**	**266.5**	**275.6**	**282.5**

DISTILLATE PRODUCTION (Million MT)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
Light Distillates, MMT	63.2	67.1	71.0	74.7	75.4	76.8	71.4	76.5	76.2	83.1	82.6
Middle Distillates , MMT	113.4	118.3	122.5	127.5	130.8	130.2	110.7	120.2	130.4	134.7	137.6
Total Distillates, MMT	176.6	185.4	193.5	202.2	206.1	206.9	182.1	196.7	206.6	217.8	220.2
% Distillates Production on Crude Processing	**77.8**	**78.5**	**77.8**	**78.8**	**78.6**	**79.9**	**80.6**	**80.0**	**79.9**	**82.2**	**81.4**

PETROLEUM PRICING
OIL IMPORT - VOLUME AND VALUE

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24 (P)	2024-25 (P)
Quantity, Million Mt	189.4	202.9	213.9	220.4	226.5	227.0	196.5	212.0	232.6	234.3	243.2
Value, INR '000 Cr.	687.4	416.6	470.2	566.5	783.2	717.0	469.8	899.3	1260.9	1105.2	1160.6
Value, USD Billion	112.7	64.0	70.2	87.8	111.9	101.4	62.2	120.4	157.5	113.4	137.2
Average conversion Rate, INR per USD (Calculated)	61.0	65.1	67.0	64.5	70.0	70.7	75.5	74.7	80.1	82.9	84.6

OIL IMPORT - PRICE USD / BARREL

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24 (P)	2024-25 (P)
Brent (Low Sulphur – LS- marker) (a)	85.4	47.5	48.7	57.5	70.0	61.0	44.3	80.7	96.0	85.4	78.7
Dubai (b)	83.8	45.6	47.0	55.8	69.3	60.3	44.6	78.1	92.4	84.2	78.5
Low sulphur-High sulphur differential (a-b)	1.7	1.8	1.7	1.6	0.7	0.6	-0.3	2.7	3.5	1.2	0.3
Indian Crude Basket (ICB)	84.16	46.17	47.56	56.43	69.88	60.47	44.82	79.18	93.15	82.58	78.56
ICB High Sulphur share %	72.04	72.28	71.03	72.38	74.77	75.50	75.62	75.62	75.62	75.62	78.50
ICB Low Sulphur share %	27.96	27.72	28.97	27.62	25.23	24.50	24.38	24.38	24.38	24.38	21.50

INTERNATIONAL PETROLEUM PRODUCTS PRICES EX SINGAPORE, ($/bbl.)

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24 (P)	2024-25 (P)
Gasoline	114.3	95.5	61.7	58.1	67.8	75.3	67.0	47.5	89.7	107.2	93.9	85.4
Naphtha	100.2	82.2	48.5	47.1	56.3	65.4	55.1	43.9	79.9	78.4	69.5	72.2
Kero / Jet	121.2	66.6	58.2	58.4	69.2	83.9	70.4	45.8	87.3	125.5	103.6	92.1
Gas Oil (0.05% S)	122.0	99.4	57.6	58.9	69.8	84.1	74.1	50.0	90.2	132.8	104.9	92.7
Dubai crude	104.6	83.8	45.6	47.0	55.8	69.3	60.3	44.6	78.1	92.4	82.3	78.5
Indian crude basket	105.5	84.2	46.2	47.6	56.4	69.9	60.5	44.8	79.2	93.2	82.6	78.6

CRACKS SPREADS ($/ BBL.)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24 (P)	2024-25 (P)
Gasoline crack											
Dubai crude based	11.7	16.1	11.1	12.0	5.9	6.7	2.9	11.7	14.7	11.6	6.9
Indian crude basket	11.3	15.6	10.6	11.4	5.4	6.5	2.6	10.5	14.0	11.3	6.8
Diesel crack											
Dubai crude based	15.7	12.0	12.0	13.9	14.8	13.8	5.5	12.2	40.3	22.6	14.2
Indian crude basket	15.3	11.5	11.4	13.4	14.2	13.6	5.2	11.0	39.6	22.3	14.1

DOMESTIC GAS PRICE ($/MMBTU)

Period	Domestic Gas Price (GCV Basis)	Price Cap for Deepwater, High temp High Pressure Areas
1 - 31 October 2023	9.20	9.96
1 - 30 November 2023	9.12	
1 - 31 December 2023	8.47	
1 - 31 January 2024	7.82	
1 - 29 February 2024	7.85	
1 - 31 March 2024	8.17	
1 - 30 April 2024	8.38	9.96
1 - 31 May 2024	8.90	
1 - 30 June 2024	8.44	9.87
1 - 31 July 2024	8.24	
1 - 31 August 2024	8.51	
1 - 30 September 2024	7.85	
1 - 31 October 2024	7.48	10.06
1 - 30 November 2024	7.53	
1 - 31 December 2024	7.29	
1 - 31 January 2025	7.30	
1 - 28 February 2025	7.94	
1 - 31 March 2025	7.80	

Source: MoP&NG/PPAC/OPEC

GAS PRODUCTION

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
ONGC	21177	22088	23429	24677	23746	21872	20629	19969	19316	18792
Oil India	2838	2937	2881	2722	2668	2480	2893	3041	3090	3171
Private/ Joint Ventures	8235	6872	6338	5477	4770	4321	10502	11440	14032	14142
Total	**32250**	**31897**	**32648**	**32875**	**31184**	**28672**	**34024**	**34450**	**36438**	**36105**

		2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
Onshore	Natural Gas	8845	9294	9904	10046	9893	9601	10471	10368	9916	9423
	CBM	393	565	735	710	655	477	518	673	650	756
	Sub Total	9237	9858	10639	10756	10549	10078	10989	11042	10567	10179
Offshore		23012	22038	22011	22117	20635	18428	22869	23409	25871	25928
	Sub Total	23012	22038	22011	22117	20635	18428	22869	23409	25871	25928
	Total	32249	31897	32649	32873	31184	28506	33858	34450	36438	36106
	(-) Flare loss	1120	1049	918	815	927	721	727	786	721	512
	Net Production	31129	30848	31731	32058	30257	27785	33131	33664	35717	35594

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
Net Production	31129	30848	31731	32058	30257	27785	33131	33664	35717	35594
Own Consumption	5822	5857	5806	6019	6053	5736	5760	5494	5570	5548
Availabilty	25307	24991	25925	26039	24204	22049	27371	28170	30147	30046

AVAILABILITY FOR SALE

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
ONGC	16076	17059	18553	19597	18532	16972	15874	15519	14947	14486
Oil India	2314	2412	2365	2207	2123	1930	2190	2287	2368	2534
Private/ Joint Ventures	6917	5520	5007	4235	3549	3147	9307	10364	12832	13026
Total	25307	24991	25925	26039	24204	22049	27371	28170	30147	30046

CONSUMPTION (EXCLUDING OWN CONSUMPTION)

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
Total Consumption	46695	49677	53364	54779	58091	54910	59277	54817	61497	66745
Availability for sale	25307	24991	25925	26039	24204	22049	27371	28170	30147	30046
LNG Import	21388	24686	27439	28740	33887	32861	31906	26647	31350	36699

GAS IMPORT DEPENDENCY

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23 (P)	2023-24 (P)	2024-25 (P)
Net Gas Production	31129	30848	31731	32058	30257	27785	33131	33664	35717	35594
LNG Imports	21388	24686	27439	28740	33887	32861	31906	26647	31350	36699
Import Dependency (%)	40.7	44.5	46.4	47.3	52.8	54.2	49.1	44.2	46.7	50.8
Total Gas Consumption*	**52517**	**55534**	**59170**	**60798**	**64144**	**60646**	**65037**	**60311**	**67067**	**72293**

* Includes Own Consumption

Source: MoP&NG/PPAC

SECTOR WISE DEMAND AND CONSUMPTION OF NATURAL GAS

		2023-24 (P)	2024-25											
			Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
Fertilizer	R-LNG	18017	1448	1467	1467	1636	1543	1367	1522	1501	1498	1463	1324	1369	**17605**
	Domestic Gas	3029	189	192	204	166	206	289	282	254	268	294	241	291	**2876**
Power	R-LNG	2578	413	605	510	202	189	222	183	49	95	85	98	109	**2760**
	Domestic Gas	6504	532	641	607	521	506	490	491	439	477	481	455	477	**6117**
City Gas	R-LNG	3451	417	382	408	432	413	311	416	421	566	442	391	408	**5007**
	Domestic Gas	10041	789	897	829	829	810	948	854	777	743	885	857	886	**10104**
Refinery	R-LNG	3689	459	400	315	391	366	374	407	362	292	326	297	309	**4298**
	Domestic Gas	2147	168	92	151	130	129	119	116	121	120	129	105	121	**1501**
Petrochemical	R-LNG	1552	61	292	177	224	194	174	169	202	184	190	164	169	**2200**
	Domestic Gas	1115	56	28	113	59	66	65	40	192	134	143	124	136	**1156**
Others	R-LNG	3470	275	410	260	313	327	303	321	352	360	371	375	388	**4055**
	Domestic Gas	13169	1113	1199	1207	1217	1221	1091	1236	1116	1146	1023	899	1000	**13468**

Qty. in MMSCM Source: PPAC

2024 - 25 WORLDWIDE ACTIVE RIG COUNT

REGION	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
US	588	586	586	587	585	584	589	582	590	592	586	573	554
Canada	161	193	218	217	219	205	162	208	247	194	138	116	133
Latin America	161	154	160	157	155	146	137	132	130	131	130	136	143
Europe	119	118	115	121	122	118	120	120	121	121	126	123	125
Middle East	342	345	337	337	342	336	332	346	346	339	335	327	339
Africa	105	108	104	106	100	100	102	101	98	97	97	94	102
Asia Pacific[1]	152	135	138	148	154	141	141	129	134	135	127	130	128
India	78	74	77	78	77	78	77	77	76	76	76	76	76
TOTAL	**1706**	**1713**	**1735**	**1751**	**1754**	**1708**	**1660**	**1695**	**1742**	**1685**	**1616**	**1576**	**1600**

Source: Baker Hughes

[1] Excluding India's Rig Count

The total rig count may not sum precisely due to the rounding of figures

Member Organizations

S.No	Organization	Name	Designation
1	Adani Welspun Exploration Ltd.	Mr. Arvind Hareendran	Sr. Vice-President (Exploration)
2	ASAP Fluids Pvt. Ltd.	Mr. Vivek Gupta	Managing Director
3	Axens India (P) Ltd.	Mr. Siddhartha Saha	Managing Director
4	Baker Hughes, A GE Company	Mr. Neeraj Sethi	Country Leader
5	Bharat Petroleum Corporation Ltd.	Mr. Sanjay Khanna	Director (Refineries) with Additional Charge of Chairman & Managing Director
6	Bliss Anand Pvt. Limited	Mr. Vikas Anand	Managing Director
7	BP Exploration (Alpha) Ltd	Mr. Kartikeya Dube	Head of Country, bp India
8	Cairn Oil & Gas, Vedanta Ltd	Mr. Rakesh Agiwal	Chief Policy and Regulatory Officer
9	Central U.P. Gas Ltd.	Mr. Rajib Lochan Pal	Managing Director
10	Chandigarh University	Mr. Satnam Singh Sandhu	Chancellor
11	Chennai Petroleum Corporation Ltd.	Mr. H. Shankar	Managing Director
12	CSIR- Indian Institute of Petroleum	Dr Harender Singh Bisht	Director
13	Decom North Sea	Mr. Will Rowley	Interim Managing Director
14	Dynamic Drilling & Services Pvt. Ltd.	Mr. S.M. Malhotra	President
15	Engineers India Ltd.	Ms. Vartika Shukla	Chairman & Managing Director
16	Ernst & Young LLP	Mr. Rajiv Memani	Country Manager & Partner
17	ExxonMobil Gas (India) Pvt. Ltd.	Mr. Monte Dobson	Chief Executive Officer
18	FMC Technologies India Pvt. Ltd.	Mr. Arjun Kumar Rumalla	Managing Director
19	GAIL (India) Ltd.	Mr. Sandeep Kumar Gupta	Chairman & Managing Director
20	GSPC LNG Ltd.	Mr. Sanjay Sengupta	Chief Executive Officer
21	Goa Natural Gas Private Limited	Mr. Mohd Zafar Khan	Chief Executive Officer
22	Hindustan Petroleum Corporation Ltd.	Mr. Vikas Kaushal	Chairman & Managing Director
23	HPCL Mittal Energy Ltd.	Mr. Prabh Das	Managing Director & CEO
24	IIT (ISM) Dhanbad	Prof. Sukumar Mishra	Director
25	IMC Ltd.	Mr. A. Mallesh Rao	Managing Director
26	Indian Gas Exchange Ltd.	Mr. Rajesh Kumar Mediratta	Managing Director & CEO
27	Indian Oil Corporation Ltd.	Mr. A S Sahney	Chairman
28	Indian Strategic Petroleum Reserves Ltd.	Mr. L.R. Jain	CEO & MD
29	IndianOil Adani Ventures Ltd.	Mr. Anubhav Jain	Managing Director
30	Indradhanush Gas Grid Ltd.	Mr. Subrata Das	Chief Executive Officer
31	Indraprastha Gas Ltd.	Mr. Kamal Kishore Chatiwal	Managing Director
32	International Association of Drilling Contractors: IADC	Mr. Jason McFarland	President
33	International Gas Union	Mr. Milton Catelin	Secretary General

Member Organizations

S.No	Organization	Name	Designation
34	IPIECA	Mr. Brian Sullivan	Executive Director
35	IRM Energy Pvt. Ltd.	Mr. Manoj Kumar Sharma	Chief Executive Officer
36	Jindal Drilling & Industries Pvt. Ltd.	Mr. Raghav Jindal	Managing Director
37	Lanzatech Pvt. Ltd.	Dr. Jennifer Holmgren	Chief Executive Officer
38	Larsen & Toubro Ltd.	Mr. S.N. Subrahmanyan	CEO & Managing Director
39	Mangalore Refinery & Petrochemicals Ltd.	Mr. M Shyamprasad Kamath	Managing Director
40	Marine Solutionz Ship Management Private Limited	Mr. Sumit Kumar	Director
41	MIT World Peace University Pune	Mr. Rahul V. Karad	Executive President
42	Nayara Energy Ltd.	Mr. Prasad K. Panicker	Executive Chairman
43	Numaligarh Refinery Ltd.	Mr. Bhaskar Jyoti Phukan	Managing Director
44	Oil and Natural Gas Corporation Ltd.	Mr. Arun Kumar Singh	Chairman & CEO
45	Oil India Ltd.	Dr. Ranjit Rath	Chairman & Managing Director
46	Petronet LNG Ltd.	Mr. Akshay Kumar Singh	Managing Director & CEO
47	Petronet MHB Ltd.	Mr. Sudhir Kumar	Managing Director
48	Pipeline Infrastructure Ltd.	Mr. Akhil Mehrotra	Chief Executive Officer
49	Rajiv Gandhi Institute of Petroleum Technology	Prof. Harish Hirani	Director
50	Reliance BP Mobility Ltd.	Mr. Harish C Mehta	Chief Executive Officer
51	Reliance Industries Ltd.	Mr. Mukesh Ambani	Chairman & Managing Director
52	S&P Global Commodity Insights	Mr. Anupam Bagri	President
53	Seros Energy Private Limited	Mr. Devashish Marwah	CEO (Seros Well Services)
54	Shell Companies in India	Ms. Mansi Madan Tripathy	Country Chair
55	Siemens Ltd.	Mr. Guilherme Vieira De Mendonca	CEO (Siemens Energy - India)
56	SLB	Mr. Lalit Aggarwal	Manging Director
57	South Asia Gas Enterprise Pvt. Ltd.	Mr. Subodh Kumar Jain	Director
58	Sun Petrochemicals Pvt. Ltd.	Mr. Padam Singh	President
59	THINK Gas Distribution Pvt. Ltd.	Mr. Abhilesh Gupta	Managing Director & CEO
60	Topsoe India Private Limited	Mr. Alok Verma	Managing Director
61	TotalEnergies Gas and Power Projects India Pvt. Ltd.	Dr. Sangkaran Ratnam	Country Chair
62	University of Petroleum & Energy Studies	Dr. Ram Sharma	Vice-Chancellor
63	VCS Quality Services Pvt. Ltd.	Mr. Shaker Vayuvegula	Director
64	World LP Gas Association	Mr. James Rockall	CEO & Managing Director

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