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SPECTRUM

SPE Mumbai Section

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From the Desk of the Patron, SPE Mumbai Section

Pankaj Kumar,
Director(Production),
ONGC

Dear Friends and Colleagues,

As we navigate the evolving landscape of the global energy market, the discussions surrounding the future of fossil fuels and climate change have never been more pertinent. The outcomes of COP28 have set high expectations for our industry, and with COP29 approaching in Nov'24 at Baku, Azerbaijan, the dialogue around sustainable energy solutions continues to intensify.

At ONGC, our vision by the end of 2030 is both ambitious and clear. We aim to strengthen our core business while exploring new opportunities that align with global sustainability goals. ONGC in alignment with India's global commitment has committed for Net Zero in Scope 1 and Scope 2 emissions by 2038. Despite the significant strides in renewable energy, fossil fuels will remain a critical component of the global energy mix for the foreseeable future. This reality underscores the importance of our dual focus: advancing production efficiency and embracing sustainable practices.

India's energy demands are projected to grow faster than those of any other major economy, driven by robust economic growth. According to the IEA's India Energy Outlook 2021, our primary energy demand is expected to nearly double by 2040. This growth presents both challenges and opportunities. For ONGC, it means enhancing our production capabilities while reducing our environmental impact and diversifying in the core-related areas.

Technological innovation is at the heart of this transformation. Initiatives like Darpan are revolutionizing our operations by digitizing oil fields, thereby improving efficiency and reducing carbon intensity. These advancements are crucial as we strive to meet the growing energy demands sustainably.

We are also committed to reducing our carbon footprint with focus on achieving zero flaring and methane emissions by 2030 and integration of technologies such as Carbon Capture, Utilization, and Storage (CCUS). These technologies enable us to mitigate environmental harm while continuing to meet the world's energy needs. However, such advancements require substantial investment and collaboration across the industry.

In light of these technological and environmental shifts, the role of our workforce is evolving. The skills and competencies required for the future will be markedly different from those of the past. Continuous learning and adaptation are essential as we equip our teams to handle the complexities of modern energy production.

To the young professionals in the oil and gas industry, I offer this advice: embrace innovation and sustainability. Your expertise and commitment are vital as we transition towards greener energy solutions. Focus on developing skills in emerging technologies and sustainable practices. Your contributions will be crucial in shaping the future of our industry and ensuring energy security for the nation.
Moreover, as we work towards a sustainable energy future, we must not lose sight of our core mission: to provide reliable and affordable energy. Balancing these priorities is challenging but necessary. Our strategy involves diversifying our energy portfolio to include renewable sources while optimizing our fossil fuel production processes.

The path ahead requires us to be resilient and forward-thinking. By leveraging technological advancements and fostering a culture of innovation, ONGC is well-positioned to navigate the challenges and opportunities of the energy sector. Our commitment to sustainability, coupled with our drive for operational excellence, will guide us in this journey.

The Society of Petroleum Engineers (SPE) plays a crucial role in this transition. With its vast network and resources, SPE can facilitate meaningful collaboration and drive industry-wide progress towards sustainable energy solutions. SPECTRUM magazine by SPE Mumbai Section will further augment the sharing of knowledge to the larger public.

As we move forward, let us remain dedicated to our mission and united in our efforts to achieve a sustainable and prosperous future. Together, we can make a significant impact on the global energy landscape.

Wishing you all success and innovation in the times ahead.

Message - Hon. Secretary, SPE Mumbai Section

Greetings to all SPE Professionals of the Mumbai Section. Our section has continually been associated with the industry providing a platform for collaboration, sharing and dissemination of knowledge for enabling the oil and gas sector of the country as it grapples with issues of spiralling demand, stagnating domestic production and climate change.

Our Section has taken a number of steps towards knowledge sharing. The annual workshop on " Unlocking the Potential of Mature Fields: Future Energy Security" was organised in Mumbai in the week of 11-14 Dec 2023 which was attended by about 500 professionals and more than 20 companies from the oil and gas industry. Besides, the Section also conducted the SPE TechConnect on a monthly basis which had technical presentations by different companies on various topics related to application of cutting edge technologies in the oil and gas industry.

SPE Mumbai also had the privilege of hosting SPE President Mr. Terry Palisch in April 2024 and details of his visit is included in this edition. Besides, three Student Chapters were supported through technical presentation counselling and technical quizzes, winners being felicitated in SPE Tech Connect meeting. SPE Mumbai section also conducted Plantation drive in the suburbs of Mumbai and planted various exotic trees in the month of April' 2024.

SPE Mumbai, currently has 178 YP members which contribute more than 35% of the total section strength. Our section members are also actively involved in Question Writer Committee of Petrobowl, Young Member Engagement Committee and ATC Education, training and Professionalism Committee. Student lectures have been imparted by Student Chapter Liaison Chair , SPE Mumbai Sh PK Verma at MIT World Peace University, UPES Dehradun and Nowrosjee Wadia College

I am delighted to share that the Chairperson of the SPE Mumbai Section (Sh N K Mitra) has published book on "AI & Digital Technology for Oil & Gas Fields" covering the growing role of AI in the sector.

We are grateful to Patron, SPE , Mumbai Section, Sh Pankaj Kumar, Director (Production), ONGC for his continuous guidance and motivation due to which the membership of SPE Mumbai section continually showing an upward trend. We are continuing our efforts for further increasing the enrolment in SPE, Mumbai.

I am pleased to present our in-house magazine, SPECTRUM. This edition covers a wide range of topics, including future growth trends in the Indian energy sector, reduction of fossil fuel dependency in India through the use of hydrogen, a detailed case study on Fishbone stimulation technology and interview with Program Chairperson Sh Ravi Shankar, ED-Western Offshore, ONGC.

Finally, a hearty congratulations to the following recipients of SPE Regional awards:

- Nowrosjee Wadia College, Pune-SPE – SPE Excellent Chapter
- MIT-world Peace University, Pune- SPE Excellent Chapter
- S K Mazumder, Regional Production & Operation Award- South Asis and the Pacific
- Dr Rahul C Patil, SPE Public Service Award
- Md Imtiaz, Regional Completions Optimization and Technology Award - South Asia and the Pacific
- Bhimesh Vudathu, Regional Drilling Engineering Award - South Asia and the Pacific

I hope this edition of SPECTRUM provides you with valuable insights and is effective in enhancing your technical expertise.

Indian Energy Sector Future Growth Trend

N K Mitra
Chairperson
SPE Mumbai Section

The Indian oil and gas market is a dynamic sector poised for significant growth and transformation in the coming years. As of 2024, the market size stands at an estimated 38.12 Billion cubic meters, with projections indicating a rise to 49.12 Billion cubic meters by 2029, reflecting a robust Compound Annual Growth Rate (CAGR) of 5.20 percent during the forecast period (2024-2029). This anticipated growth follows a downturn primarily triggered by the outbreak of the COVID-19 pandemic, which led to regional lockdowns and a notable decline in demand for refined petroleum products. However, the market has shown resilience and has rebounded to pre-pandemic levels, signaling a promising trajectory ahead.

Factors driving growth

Several factors are expected to underpin the growth of the Indian oil and gas market in the coming years. One of the key drivers is the increasing capacity of natural gas pipelines, which facilitates the efficient transportation of gas across regions, thereby enhancing accessibility and utilization. Additionally, the rising demand for petroleum products, driven by various sectors, including transportation, industrial manufacturing, and residential consumption, is expected to fuel market expansion. The oil and natural gas industry is pivotal in the global energy landscape, serving as the primary fuel source and exerting considerable influence on the worldwide economy. The intricate processes and systems involved in the production and distribution of oil and gas necessitate sophisticated technology and substantial capital investments, underscoring the industry's complexity and significance.

Challenges ahead

Despite the promising growth prospects, the Indian oil and gas market is facing challenges that may impede its growth trajectory. A significant concern is the nation's heavy reliance on crude oil and natural gas imports to meet domestic demand. The implementation of liquefied natural gas regasification systems will partially help to increase gas availability in the Indian Market. This reliance exposes the market to fluctuations in global crude oil prices and geopolitical risks, which can adversely affect supply dynamics and market stability. The high volatility of crude oil prices particularly poses a significant challenge for stakeholders in the Indian oil and gas sector. However, these challenges can be mitigated with strategic planning and robust risk management measures to ensure the sector's secure and stable future.

Opportunities in the oil and gas sector

In the midst of these challenges, the Indian oil and gas market offers exciting opportunities for exploration and development. One particularly promising area is the gas hydrate discoveries in the Krishna-Godavari (KG) Basin. These discoveries have the potential to revolutionize natural gas production in the region and create economically viable extraction opportunities. If successfully extracted, gas hydrates could significantly boost production and enhance energy security for companies operating in the Indian oil and gas sector. This highlights the importance of technological innovation and exploration activities in driving industry growth and diversification, promising a bright future for the sector.

The Indian oil and gas market exhibits promising growth potential, driven by increasing pipeline capacity and rising demand for petroleum products. Despite challenges, including reliance on imports and price volatility, the industry remains resilient and poised for expansion. Furthermore, discoveries such as gas hydrates in the KG Basin present new opportunities for exploration and development, highlighting the evolving nature of the Indian oil and gas sector. As stakeholders navigate the complexities and uncertainties, strategic investments in technology, exploration, and infrastructure will be crucial in unlocking the market's full potential and ensuring sustainable growth in the years to come.

Renewable Energy

India is at the forefront of a transformative shift towards renewable energy. As of February 2023, its total capacity was 122 GW, marking a 15 percent year-on-year increase. While conventional sources, primarily coal, still dominate electricity generation at over 78 percent, the government aims to elevate renewable contributions to 50 percent by 2030. A comprehensive approach involving policy, technology, and infrastructure is essential to achieve this. This transition presents challenges, including financing hurdles and grid integration issues.

However, strategic government initiatives, such as the PLI (Production Link Incentive) Scheme and energy storage mandates, demonstrate a commitment to overcoming obstacles and fostering a sustainable green energy landscape.

Regarding conventional energy sources, coal has been a leading source of electricity generation in India for decades. However, the growing inclination for clean energy is boosting the development of various renewable energy sources.

Establishing an efficient and integrated green energy grid nationally requires detailed planning and considerable resources. With a comprehensive approach coupled with policy, technological, and regulatory measures, authorities can strategize an effective plan for developing an integrated green energy grid for efficient electricity transfer across regions.

A reliable and reasonable energy grid would need significant investment in infrastructure and advanced technology, supportive policies for energy storage systems, an inclusive policy and regulatory framework, and cooperation from various state governments.

The central government and the Ministry of New and Renewable Energy (MNRE) have been actively promoting renewable energy through various schemes and initiatives to boost adoption, consumption, and manufacturing. As of July 2023, India's installed renewable energy capacity was over 173 GW, 41 percent of the entire power capacity.

The PLI Scheme has helped emerging solar manufacturers like Grew develop technologically advanced manufacturing facilities in India.

Moreover, the government plans to register solar panels made only of domestically manufactured cells, wafers, and polysilicon under the Approved List of Models and Manufacturers in the coming years, which will tremendously boost the manufacturing of solar components in India.

In addition to policy support, the government is also developing the infrastructure required for grid upgrades and better inter-state coordination, which will efficiently respond to the increasing demand for green and clean energy.

One of the biggest challenges is financing solar or other renewable energy installations with high initial costs. Other significant challenges in the widespread adoption of renewable energy solutions include grid integration, inter-state policies and their coordination with national targets, infrastructure, and the intermittency of power generation from renewable sources.
The government is implementing schemes to address these challenges, including the development of energy storage systems, grid upgrades, and the improvement of state policies for solar, wind, and other renewable energy sources. In the Indian context, the demand for fossil fuels may persist for another 35 years until sustainable alternative energy, such as green hydrogen, solar, wind energy, and electric vehicles, become dominant in the energy market.

Reducing Fossil Fuel Dependency with Hydrogen in India: One of the Path to Sustainable Energy

T K Sengupta
Ex-Director (Offshore)
ONGC

Introduction

The world population is increasing at a fast pace despite many measures adopted by several countries. The current world population is around 8 billion, which is expected to grow to around 9.7 billion plus post 2050. With the increase in world population, the corresponding energy demand is also rising at a fast pace. To meet this growing energy demand, the fossil fuels play a major role. However, the exploration, production & use of fossil fuels are increasing the environmental pollution, resulting in global climate change. In order to reduce the use of fossil fuels, the emphasis & focus is to generate energy from alternative renewable sources like Wind, Solar, Tidal, Wave, Geothermal, Biogas etc. Though there are limitations in generating and storing these kind of alternative energies due to seasonality, storage challenges, and transportation of energy etc, the current focus is on using Hydrogen fuel as a sustainable energy solutions. Hydrogen may be a promising alternative to fossil fuels due to it's high calorific value and abundance availability in nature all the time. As India faces challenges of energy security, environmental sustainability, and economic growth, harnessing hydrogen presents a compelling opportunity to address these issues simultaneously.

The Promise of Hydrogen

Hydrogen is the most abundant element in the universe and emits only water vapor when used in fuel cells or burned in combustion engines, making it a clean energy carrier. These characteristics positions hydrogen as a pivotal player in decarbonizing various sectors of the economy, including transportation, industry, and power generation. The significant advantages of hydrogen as a clean fuel, possible production from multiple sources and high efficiency makes it truly promising.

Advantages of Hydrogen Adoption

E**nvironmental Benefits:** Hydrogen, when produced using renewable sources like solar or wind power, offers a carbon-neutral or even carbon-negative pathway. This helps in mitigating climate change impacts and improving air quality, crucial for populous Indian cities battling severe pollution.

Energy Security: By diversifying its energy sources, India can reduce its reliance on imported fossil fuels, thereby enhancing energy independence and resilience to geopolitical uncertainties.
Industrial Applications: Hydrogen can be integrated into industrial processes such as steel production, refineries, and chemicals manufacturing, offering cleaner alternatives to current practices reliant on fossil fuels.

Challenges and Roadblocks

Production Costs: Currently, hydrogen production is more expensive than traditional fuels due to high electricity costs and technological limitations. However, advancements in electrolysis and renewable energy technologies are steadily driving down costs.

Infrastructure Development: Establishing a hydrogen infrastructure, including production, storage, transportation, and refueling stations, requires significant investment and coordination among stakeholders.

Safety :

(i)Handling Hydrogen: Hydrogen, being highly inflammable can easily ignite. Special equipment and laid down safety procedure are required to minimize risk for safe handling & storage.
(ii)Hydrogen Embrittlement: Due to its atomic structure, it tends to react with metals and embrittles them, resulting in a high risk on structural integrity of the container or equipment.
(iii)Safety in Transport: Due to its low energy density, it poses a challenge in long distance transport and needs specialized material for pipelines or containers.

Hydrogen is gaining significant traction globally as countries strive to meet their climate goals. Technological advancements in hydrogen production, including the creation of highly effective electrolysers and hydrogen fuel cells, are reducing costs and enhancing practicality. Countries like Japan, Germany, and Australia are dedicating substantial resources to hydrogen infrastructure development, setting high standards that India can emulate.

1**.Case Studies of Hydrogen Implementation**

a) Case Study 1- Japan's Hydrogen Society: Japan has been at the forefront of developing a hydrogen-based society by investing in hydrogen-powered vehicles, fueling stations, and residential fuel cells. The country's goal is to establish itself as a global leader in hydrogen technology and share its knowledge with the rest of the world.
b) Case Study 2- Europe's Hydrogen Strategy: The European Union has implemented a comprehensive approach to hydrogen production that emphasizes the use of green hydrogen and incorporates hydrogen into industrial processes. The HyNet North West project in the UK and the Hydrogen Valleys initiative in the Netherlands are among the key projects under this strategy.

2.Economic Impact Analysis

Shifting towards a hydrogen economy can encourage economic growth by fostering the emergence of novel industries and employment prospects. As per the Hydrogen Council's estimation, the hydrogen economy might yield revenues surpassing $2.5 trillion and generate around 30 million job opportunities internationally by the year 2050. In India's case, building a robust hydrogen sector could attract substantial foreign investment and diminish the financial burden associated with fossil fuel imports.

3.Technological Advancements in Hydrogen Production and Storage

The latest progress in hydrogen production, like the proton exchange membrane (PEM) electrolysis and solid oxide electrolyzer cells (SOECs), has greatly improved efficiency. Moreover, advancements in hydrogen storage technology, including the development of innovative materials for hydrogen tanks and underground storage solutions, are working to overcome safety and logistical obstacles.

4.Role of Policy and Regulatory Support

Effective policy and regulatory frameworks are critical for accelerating hydrogen adoption. Incentives such as subsidies for green hydrogen production, tax breaks for hydrogen infrastructure, and mandatory hydrogen blending in natural gas pipelines can drive industry growth. Countries like Germany and South Korea have implemented robust hydrogen policies that India can emulate.

5. Public Awareness and Education Campaigns

To achieve widespread adoption of hydrogen technologies, it is necessary to secure public acceptance. By conducting educational campaigns that emphasize the environmental and economic advantages of hydrogen, as well as safety measures, it is possible to foster public trust and support. Engaging communities and forming alliances with educational institutions can also play a critical role in this process.

6. Integration with Other Renewable Energy Sources

Hydrogen can enhance the stability and dependability of the energy supply by working in conjunction with other renewable energy sources. For example, excess electricity generated by solar and wind power can be utilized to produce green hydrogen, which can then be stored and used during times of low renewable energy generation. This integration has the potential to improve grid stability and energy security.

India's Energy Landscape: Challenges & Future Energy Scenario

India, with its burgeoning population and rapid industrialization, faces significant energy demands that are primarily met through fossil fuels. This dependency not only contributes to air pollution and greenhouse gas emissions but also exposes the country to volatility in global oil and gas markets. At present, India is importing 87% of Crude Oil of its demand & 45% of its Natural Gas. The annual domestic production of crude oil is around 29 MMT of Oil & 34 BCM of Natural Gas. India, being the third largest Oil consumer in the world, expects a multifold rise in demand for oil & gas till 2030, posing challenges for environmental pollution and a significant expenditure on the import bill.

The Government of India, to overcome this challenge, has multi-pronged strategies, which consists of
(i) More emphasis on Exploration & Production reforms and encouraging FDI in exploration from Indian sedimentary basins
(ii) Targeting to achieve 500 GW of renewables capacity, and
(iii) 1 billion tonnes reduction of cumulative emissions etc. Transitioning to hydrogen could reduce these risks while enhancing energy security.

After the COP21 in Paris in 2016, the Paris Agreement was adopted amongst 195 countries on climate change where mitigation, adaption and finance are covered. Again, on a significant move during the COP26 conference in Glasgow in 2021 where the discussion was to secure net zero by mid-century by the nations, Hon'ble Prime Minister of India declared its vision to achieve NetZero by 2070. Immediately after that in 2022 during 75th Independence Day address, Prime Minister Sh. Narendra Modi announced the National Hydrogen Mission with an aim of making India a hub to produce and export of Green Hydrogen. This has laid the foundation of focusing on Green Hydrogen in India.

India's Hydrogen Roadmap

India has recognized the potential of hydrogen and has begun developing a comprehensive roadmap to integrate hydrogen into its energy mix:

National Hydrogen Energy Mission: National Green Hydrogen Mission aimed to promote Hydrogen production and utilization across various sectors and make India a hub for the production and export of green energy. The major emphasisis towards (A) Demand creation by focussing on (i) Export Markets (ii) Substituting Imports & (iii) Domestic Demand & (B) Incentivising Supply by focussing on Strategic Interventions for GH2 Transition . To incentivise the supply it is planned to give direct financial incentivises for (i) Electrolyser Manufacturing (ii) Green Hydrogen Production.

Accordingly the Key Enablers of National Green Hydrogen Mission are (i) Resources (ii)R&D (iii) Ease of Doing Business (iv) Infrastructure & Supply Chain (v)Regulation & Standards (vi) Skill Development & Public awareness.

The expected deliverables targeted by 2030 are the following: -
(i)To produce 5 million tonnes of Green Hydrogen through a 60 GW electrolyser capacity .
(ii)The worlds largest production of Green steel at 15-20 million tonnes by 2030
(iii)The world's largest electrolyser annual manufacturing capacity of 25 GW by 2028
(iv)50 MMT CO2 annual emissions averted
(v)Around 8 lakh crore investment

Partnerships and Collaborations: Engaging with international partners for technology transfer, knowledge sharing, and joint research and development initiatives.

Financial Incentives: Offering subsidies, tax breaks, and other financial incentives to promote hydrogen infrastructure development and adoption.

Conclusion

Hydrogen holds immense promise as a clean, versatile, and sustainable energy carrier that can help India reduce its fossil fuel dependency and achieve its climate goals. However, realizing this potential requires concerted efforts from government, industry, and academia to overcome technological, economic, and regulatory challenges. With strategic investments and supportive policies, India can lead the way in harnessing hydrogen for a greener and more resilient energy future.
By embracing hydrogen, India not only addresses its energy challenges but also contributes to global efforts towards a sustainable and low-carbon future. The journey towards a hydrogen economy is undoubtedly challenging but offers substantial rewards in terms of environmental stewardship, economic growth, and energy security for generations to come.

Data Source :- 1) Niti Aayog Presentation & Document

Interview - ED-Western Offshore, ONGC

Ravi Shankar
ED Western Offshore
ONGC

Q. What key issues will you emphasize as ED Western Offshore of ONGC and what mitigation strategy will you take to counter the challenges?

As ED-Western Offshore of ONGC, my focus will be on several critical areas to ensure sustained growth and operational efficiency:

1. Fast track Monetization: The priority will be to quickly monetize any exploratory additions by utilizing existing facilities wherever possible or conceptualizing new facilities when necessary. The focus will be on minimizing the time gap between accretion and production, ensuring swift and efficient transition from discovery to revenue generation.
2. Project Implementation for Asset Growth: Focus will be faster project execution through breaking projects into manageable segments, and ensuring rigorous oversight with a dedicated project management execution.
3. Technology Adoption: I will strongly inculcate environment and support for the integration of emerging technologies, such as well intervention, completion techniques, AI etc., by setting/executing pilot programs to keep our operations at the cutting edge.
4. Optimising Surface Facility Operations: Implementing predictive maintenance technologies and conducting regular performance reviews will ensure that surface facilities operate with minimum downtime and maximum output.
5. Material Management Optimization: Enhancing material management process at Western Offshore Level, Inventory management, reducing costs and ensuring timely resource availability will be an area which will require a lot of attention and coordinated effort from all stakeholders.
6. Integrated Digitalisation of Offshore Logistics: The focus will be on digitalising the system for consolidated information and well informed decision. Improvement in operational coordination across the offshore network will be reviewed frequently.
7. Cost Management and OPEX Optimization: Implementing a cost management framework, streamlining processes, and operational efficiency, resource distribution based on potential of reservoirs will be to ensure high production while optimizing operational expenses.

These initiatives will drive the Western Offshore's performance, ensuring both growth and efficiency in our operations. By addressing these key issues with comprehensive mitigation strategies, ONGC can navigate challenges effectively, enhance operational efficiency, and sustain long-term growth in the dynamic energy landscape.

Q. How is technology reshaping skill profiles of ONGCians in 2024 and beyond?

Technology is significantly reshaping the skill profiles of ONGC employees, or "ONGCians," in 2024 and beyond, primarily through advancements in digital tools, automation, and new energy technologies. Here are some key ways technology is driving this transformation:

Digitalisation and Automation Skills: ONGCians are increasingly becoming proficient in digital tools and platforms. This includes the ability to work with advanced data analytics software, digital twins for reservoir modeling, and real-time monitoring systems. The adoption of AI and machine learning technologies is necessitating the development of skills in these areas. With the centralization of data and the use of advanced data management tools, ONGCians are expected to have strong skills in data integration, data quality control, and real-time data analysis. ONGCians are leveraging these technologies for predictive maintenance, exploration, production optimization, and risk assessment.

Specialized Training Programs: To support this technological transition, ONGC has established various institutes and training programs focusing on both fundamental and applied research. These include the Institute of Drilling Technology, the Geo-data Processing and Interpretation Centre, and the Institute of Production Engineering and Ocean Technology. These centres offer certified training programs in drilling, well control, seismic data processing, geotechnical and structural engineering, flow

assurance, artificial lift and more.

Focus on Renewable and Clean Energy: ONGC is also expanding its focus to include clean and renewable energy technologies. ONGC Green energy, a wholly owned subsidiary of ONGC was formed in Feb-2024. The company will engage into the business of energy value-chains viz. renewable energy (solar, wind, hybrid, hydel, tidal and geothermal etc.), bio-fuels/ bio-gas business, green hydrogen and its derivatives like green ammonia, green methanol, storage, carbon capture utilisation and storage and LNG business.

Aligned with projections for India's energy requirements, ONGC is preparing to broaden its business scope into sectors such as Petrochemicals, Solar Energy, Wind Energy, Green Hydrogen, Compressed Biogas (CBG), and Biofuels.

Leadership and Management Development: Alongside technical skills, ONGC is investing in leadership and management development programs. These programs are designed to prepare employees for senior-level business positions by assessing and developing critical competencies.

By integrating these new technologies and training programs, ONGC is ensuring that its workforce is well-equipped to handle the evolving demands of the energy sector, maintaining its competitive edge in both traditional and new energy markets.

Q. What key technology challenges do you see for the Exploration & Production of Western Offshore Field in the next ten years? Are you of the opinion that ONGC planned investments and existable technology can increase ONGC production.

The Exploration and Production (E&P) of Western Offshore fields face several key technological challenges over the next decade:

Reservoir Management and Optimization: Maximizing recovery from mature and complex reservoirs with declining production rates requires enhanced reservoir simulation models, AI-driven reservoir management tools, and real-time data analytics for optimizing production and improving reservoir characterization.

Cost Efficiency and Operational Excellence: Maintaining cost efficiency amidst fluctuating oil prices and operational complexities necessitates automation and robotics for operational tasks, IoT-enabled sensors for asset monitoring, and predictive maintenance algorithms to minimize downtime and reduce operational costs.

Environmental and Safety Standards: Ensuring stringent environmental compliance and safety standards in offshore operations requires monitoring systems for environmental impact assessment, advanced blowout prevention systems, and automated safety protocols. Integration of digital twins for predictive maintenance and risk mitigation is also essential.

Aging Workforce: As experienced professionals retire, there will be a need to attract and train new talent to fill the gap. This includes ensuring that the new workforce is equipped with the necessary skills and knowledge to handle advanced technologies and complex operations.

Energy Transition and Sustainability: Adapting to global energy transition trends towards cleaner energy sources involves investing in renewable energy integration solutions such as offshore wind farms, carbon capture and storage (CCS) technologies, and hydrogen production facilities.

These technological advancements are crucial for overcoming the challenges and ensuring the efficient and sustainable development of Western Offshore fields.

Regarding ONGC's planned investments and available technology to increase production:

Collaboration with global technology providers:

ONGC is seeking partnerships with internationally proven Technical Service Providers to raise oil and gas production from its flagship matured Mumbai field in the Arabian Sea. This collaboration aims to apply best-in-class reservoir management technologies and adopt globally best operational and management practices. Mumbai High is one of the prime assets of ONGC and significant upside is still to be unlocked here . The identified service provider would carry out a comprehensive review of field performance and identify improvements in wells, reservoirs including water injection, and facilities management (WRFM).

Time-lapse seismic technology:

ime lapse seismic provides invaluable insights into the dynamic behaviour of mature oil and gas fields. By comparing multiple seismic surveys acquired at different times, operators can better estimate bypassed oil with reduced uncertainty and extend field life by making informed decisions. Encouraging results were obtained after time lapse seismic survey in D1 field which helped in unlocking major prolific reservoir zones. Similar surveys are underway in other major fields of Western Offshore for promising results.

In conclusion, while there are significant challenges in Western Offshore E&P, ONGC's strategic investments in technology and its continued focus on innovation position it well to enhance production capabilities over the coming decade. Continued adaptation to technological advancements and sustainable practices will be crucial in achieving long-term growth and operational excellence in offshore fields.

Q. Which regions show the greatest recovery from the recent downturns in Oil production of ONGC Western Offshore?

The recovery across ONGC's Western Offshore fields has been driven by strategic investments, project implementation, technology adoption, and the implementation of enhanced recovery methods. Key areas have benefited from redevelopment projects, improved stimulation techniques, and targeted production optimization strategies.

Every oil and gas field naturally goes through a lifecycle of development, plateau, and eventual decline in production, which is a well-known phenomenon in the industry. However, the growth continues through the monetization of new discoveries and by mitigating decline rates with initiatives such as drilling infill wells and enhancing recovery factors. A few years ago, low gas pricing rendered several projects unviable, but the current optimistic scenario with stronger oil and gas prices, along with the recent support from the Government of India—such as the 20% incremental price incentive for gas—provides a much-needed boost. This favourable environment is expected to increase both production and profitability.

Numerous projects that were previously unviable have now received approval and are expected to generate revenue phased within the next 1 to 5 years. The development of Discovered Small Fields (DSF) will not only enhance production but also serve as a testament to ONGC's capability to efficiently develop discrete fields. This initiative is expected to add significant revenue to the organization, while also contributing to the government's revenue through increased production.

Implementation of new projects, application of innovative techniques, coupled with a strategic approach to maximizing recovery from mature fields, is going to be central to this recovery. Continued investments in development projects are expected to not only sustain but enhance production across these regions in the future.

Q. Normally the Petroleum Industry is considered a blue-collared industry. Talent in number and quality has been a concern. More so in talent retention. Any message for the today's young energy professional on India's Energy sector's growth prospects? What can young E&P professionals do to help?

To today's young energy professionals entering India's petroleum sector, here's a message on the growth prospects and their role in shaping the industry's future:
Growth Prospects in India's Energy Sector:

India's energy sector, particularly in Oil and gas, presents significant growth opportunities driven by increasing energy demand, infrastructure development, and government initiatives like Atmanirbhar Bharat. As the economy expands, so does the need for skilled professionals to innovate and drive sustainable energy solutions.

Role of Young E&P Professionals:
Innovation and Technology Adoption: Embrace innovation and new technologies such as AI, IoT, and renewable energy solutions. These innovations can enhance exploration efficiency, optimize operations, and promote sustainable practices. Invest in continuous learning and skill enhancement. Stay updated with industry trends, technological advancements, and global best practices to remain competitive in the evolving energy landscape.

By embracing these principles and actively contributing to the growth and sustainability of India's energy sector, young professionals can not only advance their careers but also play a pivotal role in shaping a brighter and more resilient future for the industry and the nation as a whole.

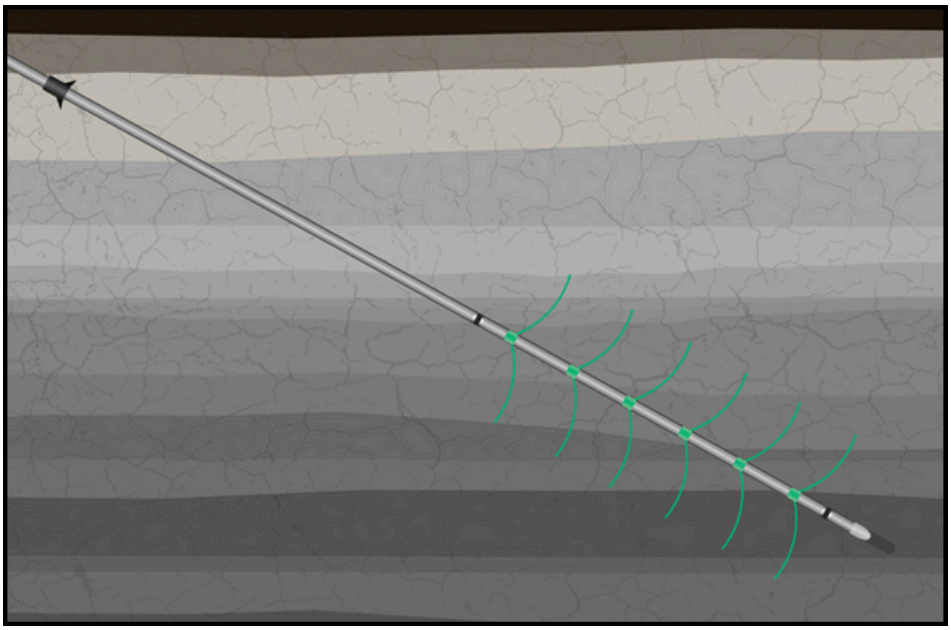
First deployment of Fishbones stimulation technology in India yields manyfold production increase

Aditya Mukherjee
Business Development Manager
S K Oilfield

Fishbones stimulation technology has seen rapid uptake especially in the North Sea and in the Middle East region over the last several years. There are two versions of the technology for stimulation of open hole wells in carbonate and clastic formations. The Fishbones Jetting technology for carbonates comprises subs contains four needles up to 12-meter-long with jet nozzles in the front that jet out from the liner in an acid pumping operation. The needles are phased 90 degrees for coverage in all directions. Several subs can be spaced out for targeted stimulation of desired intervals. Acid is evenly distributed between the needles ensuring uniform distribution of the acid while the needles penetrate the formation (mechanical diversion). The needles activate simultaneously, ensuring an efficient stimulation operation.

Fishbones stimulation technology was deployed first time in India in an appraisal well in the Mumbai Offshore basin in 2022. The reservoir is characterized as a layered limestone formation with low permeability (<2mD average), poor vertical permeability (0.1 kv/kh) and low porosity (6%-12%) with some natural fractures present. Previous wells in the field were stimulated by acid bullheading and did not show sustainable rates.

A slanted (60 deg) 6" open hole section was drilled through two reservoir objects. A 4 ½" liner was installed in the open hole with a liner hanger set inside the previous casing. Six Fishbones subs were spaced out to stimulate the lower reservoir object across a 150- meter interval. A pre-determined volume of 15% HCl was pumped from a stimulation vessel to jet the Fishbones laterals and to stimulate the reservoir.



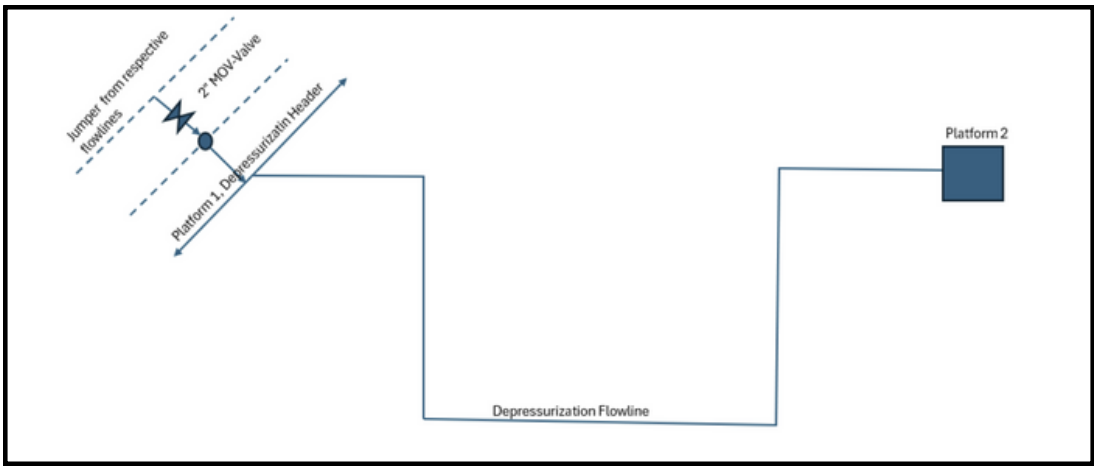
After the Fishbones installation, a production flow test was performed. The well was tested to rates multiple times higher than the offset wells, both initial and stabilized rates, confirming very encouraging results from this first deployment of the technology in India. The rates justify field development. The well was subsequently plugged and abandoned.

Depressurization, Scrapping, Pressurization Simulation for Flow Lines

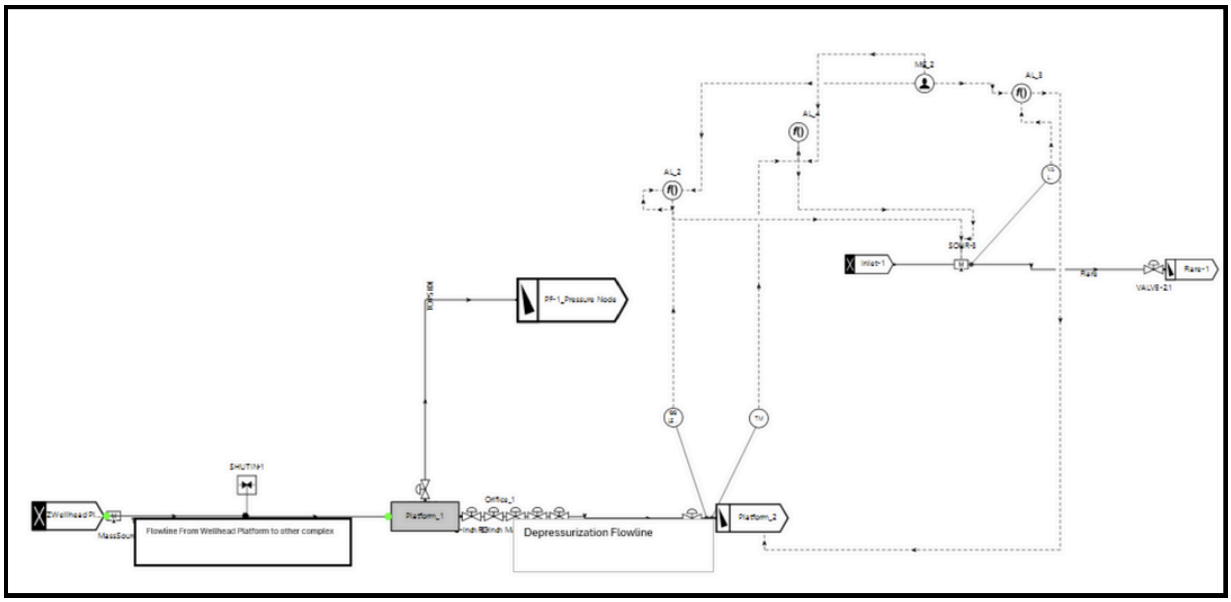
Purvi Shukla & Deepesh Khandelwal, SLB

Software used: OLGA Multiflash (The fluid was characterized using this tool to generate thermos physical properties (PVT file) for simulation model) Steady state simulation and Case Matrix: The OLGA steady state model was made using the input data like: pipeline id, od, wall thickness, wall properties, bathymetry

I

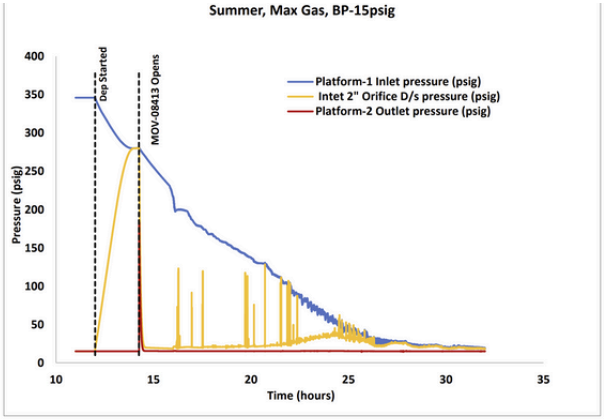


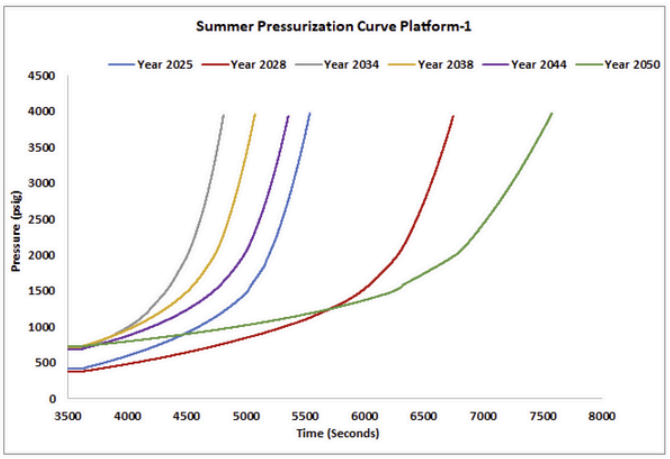
The project objective was to run depressurization, scrapping and pressurization simulation for flowlines. The wellhead platform under scope was upgraded (with ESP) with additional jumper line with choke valve will be installed on same platform to allow the depressurization of those flowlines through depressurization flowline. The scope also aims to provide pressurization study which will act as guidance for ESD and HIPS setpoint.



Initially the 8-inch flowline was isolated and the normal production through the flowline happens through the sperate production flowline to platform 2. The initial conditions of 8-inch flowline is unknown. Hence to predict the initial condition of 8-inch line before depressurizing the flowline is estimated. Two scenarios were considered one case initializing the depressurization flowline with 100% gas and 2nd case considering the depressurization flowline partially filled with liquid. The flare back pressure is also not known and hence the outlet pressure for depressurization flowline has been sensitized to flare pressure (50 psig) and normal operating pressure (300 psig). To initiate the depressurization simulation the steady state simulation was performed for worst case scenario ensuring the flow happens through topside from modelling perspective and the inlet valve at the 8-inch depressurization line is closed.

To initiate the depressurization simulation the flow at the the wellhead platform was reduced to zero and topside valve was closed the simulation was stabilized to reach thermal ambient conditions. To initiate the depressurization simulation the valve at the inlet of depressurization was opened in a way that the maximum mixture velocity should not exceed the 10 m/s. The outlet of depressurization flowline is connected to test separator. The gas at the outlet of the test separator is transported to the flare through Knock Out Drum. The valve opening was controlled in a timely manner ensuring the maximum velocity constraint is not breached and the line was depressurized. The depressurization time is reported.





Pressurization simulation: The pressurization simulation was performed which act as guideline to ESD and HIPS set point. The steady state simulation was performed for various conditions like max liquid flow, min GOR etc. To perform the pressurization simulation the valve at the outlet of the flowline was closed and the mass source keep flowing as per the normal steady state case. The pressure trend at the inlet was reported.

As the flowline length is sufficient hence, we have enough PST time to safeguard the pipeline in pressurization case scenario

Endurance Hydraulic Screen® : Positive compliance with strong wellbore support delivering installation efficiency, flexibility and reliability

Himanshu Jain
Country Operations Manager - Completion Tools, Halliburton

OVERVIEW

An open hole wellbore is often the architecture of choice for completing a sandstone reservoir as it can provide low skin values to help achieve maximum flow performance of the reservoir. It is also typically associated with deviated and horizontal trajectories tapping into narrow hydrocarbon-bearing formations to achieve maximum contact within the pay zones.
Endurance Hydraulic Screen® delivers a new level of sand control completion with full reservoir compliance and positive wellbore support while providing unprecedented installation simplicity, flexibility and life of well reliability.

HYDRAULICSCREEN TECHNOLOGY

Endurance Hydraulic Screen removes the annular gap between the screen and open hole, providing a positive compliant sand control solution. Hydraulic activation pressure radially extends the screens to conform to the borehole geometry in a fast, safe and reliable manner. This unique and proven technology brings major operational efficiencies using a single-trip installation process, standard tubular base pipe in both solid and pre-drilled base pipe versions and provides rapid screen activation against the wellbore. It also significantly reduces operational challenges and risks typically associated with traditional methods such as mechanically expanded screens, and gravel-packing operations.

FEATURES

» Positive compliant sand control
» Effective wellbore support
» Solid and pre-drilled basepipe geometry
» EquiFlow® ICDs/AICDs compatible
» SmartWell® system capable
» Zonal isolationand multi-zone capability

BENEFITS

»Single-trip installation with record time savings (no expansion trip, no need for wash pipe)
»Rapid, safe and reliable activation method for wellbore compliance
» Positive wellbore support for life of well
»Inner strength to support much higher geo-mechanical loads than conventional.
expandable and chemically-activated screens
» Reservoir management with full with full inflow control capability

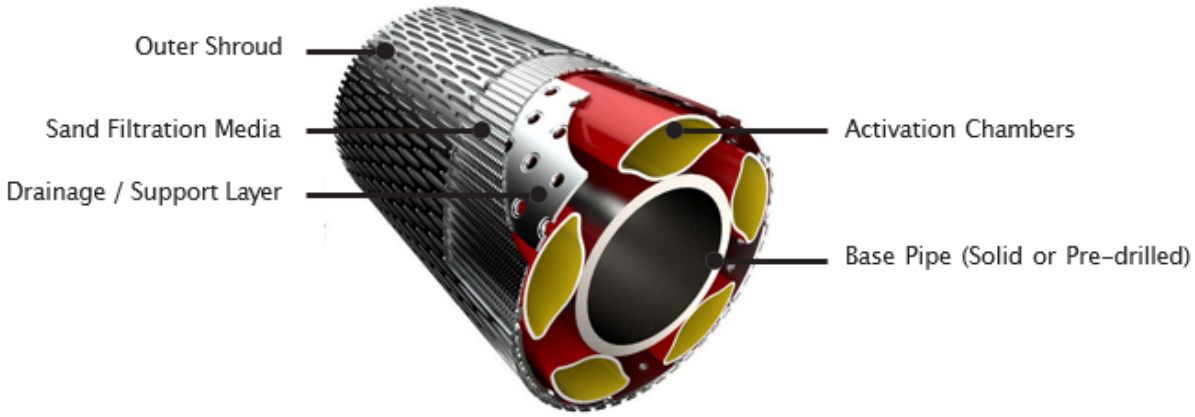
LIFE OF THE WELL PERFORMANCE

Activated with surface applied pressure, hydraulic Screens can be set simultaneously in a single trip, providing positive wellbore support for the life of the well. Maintaining active wellbore contact helps reduce deformation of the near wellbore and associated stress regime, preventing the mobilization of problematic sands, preventing screen plugging, and removing erosion concerns to provide long-term performance and reliability.

The inner strength of the system is derived from the base pipe platform. Qualification testing has proven that the Endurance Hydraulic Screen can provide mechanical collapse strength beyond API base pipe ratings with the hydraulic collapse values exceeding 5,000 psi as per ISO-17824. This helps dramatically increase the capability of supporting high depletion and geo-mechanical loading scenarios during the life of well.

INCREASED RESERVOIR PERFORMANCE

With the simplicity of the Endurance Hydraulic Screen architecture, other technologies can be combined to increase, enhance and add longevity to reservoir performance. Compartmentalization of the open hole can easily be accommodated in order to provide zonal isolation and/or reservoir management for both producer and injector wells, oil or gas. EquiFlow® ICDs/AICDs can be easily integrated to increase hydrocarbon production through the deferral/ reduction of unwanted fluid production, while real-time control can be accommodated with SmartWell® system technology incorporated within the base pipe of Endurance Hydraulic Screen. All of these solutions can also be deployed through multilaterals for enhanced reservoir contact, including FlexRite® multilateral junctions.



Endurance Hydraulic Screen® Specifications

Size (in.)	Screen OD (in.)	Openhole Size (in.)	Max. Activation Range (in.)
6 5/8	7.750	8.500	10.000
4	5.250	6.000	6.700

Both systems available in solid and pre-drilled basepipe versions

Business Opportunities with Coal Gasification

Rajib Roy
Petroleum Engineer, ONGC

Objectives

To achieve 100 MT coal gasification by year 2030.
a) Reduction in emissions intensity of Gross Domestic Product (GDP) by 33 to 35 percent by 2030 from 2005 level

b) Achieving about 40 percent cumulative electric power installed capacity from nonfossil fuel-based energy resources by 2030

c) Creating an additional carbon sink of 2.5 to 3 billion tonnes of carbon dioxide equivalent through additional tree & forest cover by 2030

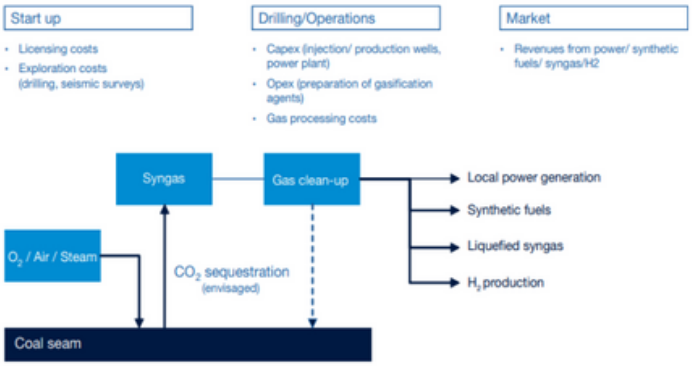
Coal Gasification & its Opportunities

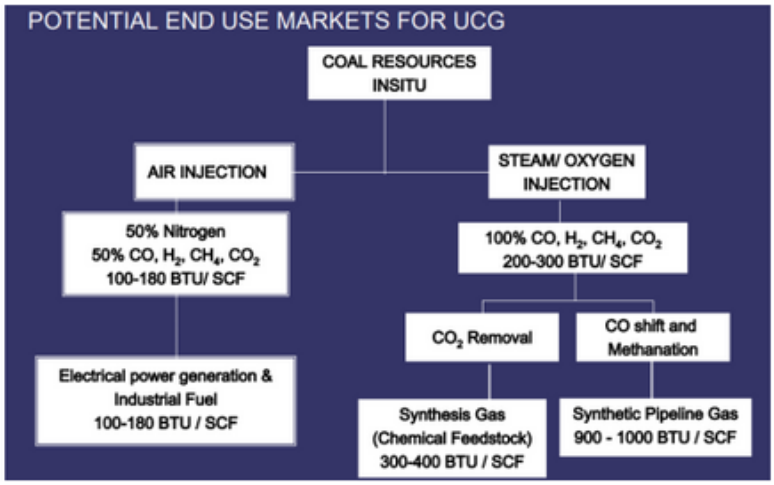
Hydrogen production by coal gasification is capable of separating and recovering CO2. At the same time attracting attention as one of key technologies for achieving a hydrogen society.

Coal gasification means the complete conversion of coal into gas using heterogeneous gas solid reactions. The main process is the reaction of the carbon of coal with steam, at pressures below 10 MPa and temperatures above 750°C, to form a “synthesis gas” containing mainly CO and H2 with smaller amounts of CO2 and CH4, depending on process conditions.

Coal gasification takes place in the presence of a controlled 'shortage' of air/oxygen, thus maintaining conditions to reduce the coal to gas. The process is carried out in an enclosed pressurized reactor, and the product is syngas (a mixture of CO + CH4 + H2). The gas is cleaned and then can be burned with either oxygen or air, generating products at high temperature and pressure. A gas turbine is used to generate electricity, with waste heat being used to raise steam for a secondary steam turbine, thus the term combined cycle. Not only efficiencies are raised in doing so – thereby reducing emissions of CO2 – but pollutant emissions are also significantly reduced, even compared to advanced conventional technologies, with 33% less NOx , 75% less SOx and almost no particulate emissions.

Syn Gas produced from Coal gasification is usable in producing Synthetic Natural Gas (SNG), low carbon-dense energy fuel (methanol & ethanol), ammonia for fertilizers and petro-chemicals. These products will help move towards self-sufficiency under Atmanirbhar Bharat Abhiyaan.



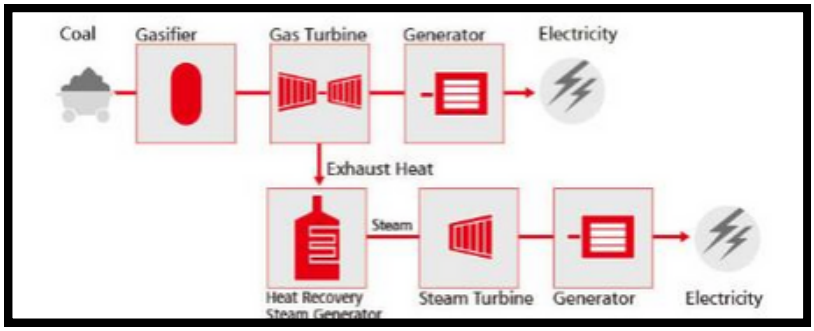


Under the process of UCG, gasification of coal happens in-situ by controlled burning. About 350 m3 gas can be produced per tonne of coal. By products of significant commercial value will be hydrocarbons, phenols, anhydrous NH3 and clean water. UCG overcomes hazards of underground and open cast mining operations. In UCG process, ash/ slug removal is not required as they remain in the cavities. Cost of production for this energy resource

could be as low as US$ 1.0-1.5 per MMBTU.

Monetisation of Underground Coal Gasification (UCG)

Integrated Coal Gasification Combined Cycle (ICGCC) is a new technology for the generation of electricity. Advanced Integrated coal Gasification Combined Cycle (A-IGCC) and Integrated coal Gasification Fuel Cell Combined Cycle (IGFC), which recuperate the exhaust heat from gas turbine and solid oxide fuel cells as heat source of endothermic gasification technology, are promising technologies because higher thermal efficiency is expected than that of conventional coal-fired power generation systems.



Rank of Coals & their uses

Coal rank	Typical characteristics	Uses
Lignite (also known as Brown Coal)	• Appearance: Soft, brown • Carbon content: Low, 20-35% • Water content: 30-60% • Oxygen content: High, up to 30%	• Steam-electric power generation • Jet – ornamental sone
Sub-bituminous	• Appearance: Dull black, waxy • Carbon content: 35-45% • Water content: Up to 15-25%	• Steam-electric power generation • Source of light aromatic hydrocarbons for the chemical synthesis industry
Bituminous	• Appearance: Dense, black, frequently containing bands with brilliant colours • Carbon content: 45-86% • Water content: 3-15%	• Steam-electric power generation • Heat and power applications in manufacturing • Some bituminous coal can be used to make coke
Anthracite	• Appearance: Dense, hard, shiny • Carbon content: High, more than 86% • Less than 1% of world's total reserves	• Residential and commercial space heating • Some metallurgical applications
Graphite	• Appearance: Black to grey, hard, opaque, metallic earthy lustre	• Pencils • Lubricant (when powdered)

A promising opportunity for CBM Reservoir

During underground coal gasification the carbon in the coal seam is converted into gases while high heat energy is released. As a result of burning, new cavities are created in the coal seam. These cavities will modify the porosity and permeability field dramatically. The modified permeability field will then affect the gasification. It is apparent that UCG is a coupled phenomenon involving hydrological, chemical, thermal and mechanical processes.

Technical Analysis

Typical Coal properties: Coal → H2 + CmHn + Char(C)

UCG syngas is similar in many ways to syngas from surface gasifiers. The primary components are H2, CO, CO2, CH4, and H2S. The pressures and temperatures of produced gas are similar, at 30-50 bars for a 300-500m deep seam, and 500-800ºC outlet temperatures for sub-bituminous coals and up to 1000ºC for bituminous coals.

Syngas can be used to produce Gaseous Fuels such as Hydrogen, Substitute Natural Gas (SNG or Methane), Di-Methyl Ether (DME), Liquid Fuels such as Methanol, Ethanol, Synthetic diesel and Chemical and Petrochemicals like Methanol derivatives, Olefins, Propylene, Mono-Ethylene Glycol (MEG), nitrogenous fertilizers including Ammonia, DRI, Industrial Chemicals along with Power Generation.

Economic Analysis

The commercial viability of accessing that potential successfully appears to require a four key components. First, it requires integration of three fields of knowledge: (1) high level of chemical engineering finesse, (2) operational skills and knowledge such as drilling and completion planning and execution, and (3) strong geoscience understanding including hydrology and geo-mechanics. Project teams that have succeeded historically have worked these three disciplinary issues well. Second, it requires the design and management of commercial facilities within the variability of UCG syngas streams. Third, modern operators must conform to a high level of environmental protection, including management of subsidence and avoidance of groundwater contamination. Unfortunately, there have been no pilots or commercial projects that combine UCG and CCS, and almost no coupled simulation or engineering analysis.

Based on the calculated capital investment and product cost, the internal rate of return of UCG-H2 with different capture rate is determined, and the application prospect in different periods is investigated with IRR of 12% as standard. In the initial stage of hydrogen energy industry with hydrogen market price less than 1.5 RMB/Nm3, SCG-H2 with or without CCS possesses no economic feasibility as its product cost greater than market price, so is UCG-H2 with 90% capture rate, as its IRR only reaches 9.7%, lower than the standard of 12%. However, when hydrogen energy industry develops to mid-term stage with hydrogen target price of about 24 INR /Nm3 , for SCG-H2, only the case of without CCS is economically feasible, while UCG-H2 with or without CCS are all economically feasible. Based on seven different global case studies average production cost of hydrogen in this process is INR 170 per kg of hydrogen.

The product cost of UCG-H2 decreases with the increase of coal seam thickness, while the variation trend of IRR is just the opposite. Besides, when coal seam thickness is less than 2.1 and 2.3 m respectively, the product cost of UCG-H2 in the case of without CCS and with 80% CR becomes higher than that of SCG-H2 with same CCS configuration. From the perspective of IRR, when hydrogen energy industry enters the mid-term stage from the initial stage, UCG-H2 without CCS will no longer be limited by the minimum coal seam thickness of 3.9 m, and the minimum coal seam thickness required for UCG-H2 in the case of with 80% CR decreases significantly from 9.8 m to 2.7 m. As for energy efficiency, benefiting from higher methane yield, UCG-H2 without CCS achieved energy efficiency of 44.88%, higher than 43.58% of SCG-H2 without CCS.

Estimated cost required for UCG power plants

Coal Conversion Technologies appears to have great promise in a carbon-constrained world for commercial and economically competitive power and fuel production. While UCG appears to be commercially viable in many countries and contexts, there remain several key scientific and technical gaps. These gaps could be addressed in a short period of time with an accelerated research program that uses existing knowledge, planned commercial tests, and advances in engineering and earth science simulations to accelerate and disseminate learnings.

SPE President maiden visit to India

The esteemed World President of SPE, Terry Palisch, graced the premises of IPEOT, ONGC, Panvel on 29 April 2024 during his maiden visit to India. His arrival was accorded with a warm reception by HOI-IPEOT Rajiv Nischal and Chairperson of SPE Mumbai Chapter NK Mitra who presented Mr. Palisch with a sapling as a welcome gesture.

The event commenced with an address by Mr. Nischal, who expressed his gratitude for Mr. Palisch's visit and provided an overview of his notable accomplishments. He also highlighted the capabilities and achievements of IPEOT, setting a positive tone for the gathering.

Chairperson of the SPE Mumbai Chapter, Mr. Mitra, also provided valuable insights into the dynamic activities and achievements of the SPE Mumbai Section. He illuminated the audience on the significance of the roles played by notable colleges affiliated with the SPE Student Chapter under the SPE Mumbai Section, emphasizing their integral role within the SPE community.

Mr. Palisch addressed the gathering, offering a comprehensive overview of diverse facets within the energy industry.

Touching upon pivotal energy milestones, global consumption trends, and the future trajectory of the energy landscape. His emphasis on the necessity for energy sources that are accessible, affordable, reliable, and sustainable underscored the ongoing industry challenges and opportunities.

Highlighting the advantages of SPE membership and the plethora of technical resources available to members, Mr. Palisch urged attendees to adopt a mindset of continuous learning and active participation in SPE events for networking, collaboration, and knowledge dissemination.

SPE President appreciation letter for IPEOT, ONGC

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2024 SPE President
Terry Palisch

7 May 2024

(via email: nischal_rajiv@ongc.co.in)

To: **Mr Rajiv Nischal**
Executive Director – Head of Institute
Institute of Production Engineering & Ocean Technology (IPEOT)
ONGC

Heartfelt Thanks and Appreciation

Dear Rajiv,

I would like to thank you again for hosting me and my delegation at IPEOT on the 29th of April 2024. As the SPE President, I am highly appreciative of the support you and ONGC have given us.

Please do not hesitate to reach out to us if there is anything we can do for you.

Till we meet again.

Sincerely yours,

Terry Palisch

Terry Palisch
2024 SPE President

By copy:

Niladri Kumar Mitra, Chairman SPE Mumbai Section nildari.k.mitra@gmail.com
Tinku Nischal, Secretary SPE Mumbai Section nischal_tinku@ongc.co.in
Manav Kanwar, Membership Chairperson, SPE Mumbai Section
manav.kanwar@skoilfield.com
Justin Kijam, Senior Regional Manager, SPE jkijam@spe.org

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