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International Integrated **Energy** Special Issue

# Oil Gas & Power

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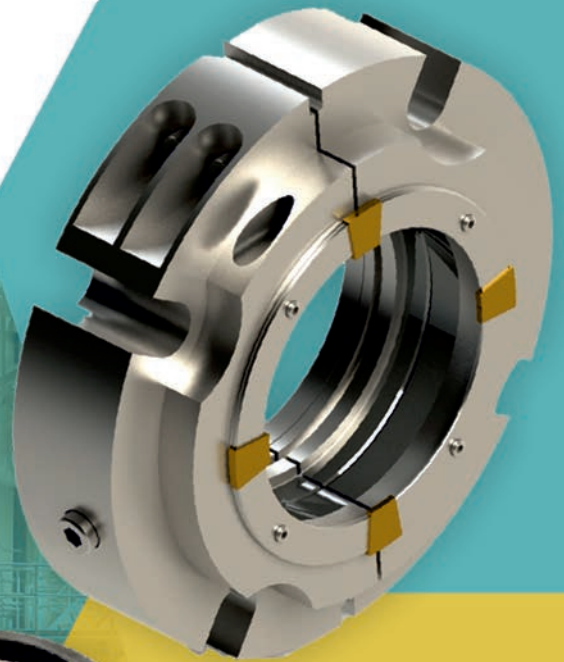
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# Oil Gas & Power

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## AD INDEX

Aeron Composite Pvt Ltd.....	7
Dynamic Forge & Fittings (I) Pvt Ltd .....	5
Sealmatic India Ltd. ....	2
UNP Polyvalves .....	3

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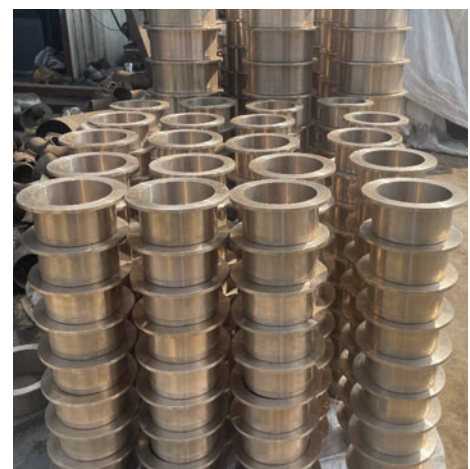
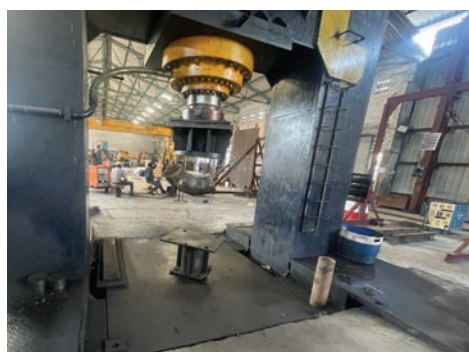
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# CONTENTS

## INTERVIEW

### Bringing Decarbonization to Life: Innovative Solutions for Sustainable Growth 22



**Andrew Howell**  
EVP- Technology  
KBC (A Yokogawa company)

## GUEST COLUMN

### Repurposing the current Natural Gas Network for Hydrogen 27



**Akhil Mehrotra**  
Managing Director  
Pipeline Infrastructure Limited

## FEATURES

### Asset Integrity of Reciprocating compressor valves leveraging Technology 16



**SS Dayal**  
General Manager- CMRO Reliability  
BPCL



**K Pradeep**  
Senior Manager- CMRO Reliability  
BPCL

### Asset Integrity Will Boost Energy Sector Capacity to Meet Today's Challenges 19



**Mahendra Attarde**  
Department Manager- Mechanical  
Burns & McDonnell India Power Group  
Burns & McDonnell Engineering India Pvt Ltd



**Vijay Jadhav**  
Section Manager- Mechanical  
Burns & McDonnell India Power Group  
Burns & McDonnell Engineering India Pvt Ltd

### Energy Efficiency through Energy Management Solutions 31



**C V Ramanan**  
Business Head  
Energy Management Solutions  
Thermax Ltd.

### Technologies for Increasing Resilience of Pipeline Infrastructure 34



**Biswabhusan Mohanty**  
Head Maintenance  
Dhamra LNG Terminal Pvt Ltd  
(subsidiary of Adani Total Pvt Ltd)

### A synergy of Blue Hydrogen and LNG Regasification Plant : A Novel Approach 37



**Dattesh Kondekar**  
Joint General Manager  
Process & Technology Dept  
Technip Energies India Ltd

## NEWS

08

## PRODUCTS

41

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## Prime Minister Lays foundation Stone of Petrochemicals complex of Petronet LNG



**Dahej, Gujarat:** Honourable Prime Minister Shri Narendra Modi laid the foundation Stone of petrochemicals complex of Petronet LNG at Dahej worth more than ₹ 20,000 crores and said that it will help boost hydrogen production and demand for polypropylene in the country. Reiterating the young demographics of India, the Prime Minister said that today's inaugurations are for their present and today's foundation stones guarantee their bright future.

The Prime Minister laid the foundation stone of Petrochemicals complex of Petronet LNG including Ethane and Propane handling facilities worth over ₹ 20,600 crores at Dahej, Gujarat. Setting up of the Petrochemicals complex in the proximity to the existing LNG regasification terminal would result in significant savings in the CAPEX and the OPEX cost of the project.

## Cabinet approves signing of Memorandum of Understanding between India and Bhutan on General Supply of Petroleum, Oil, Lubricants and related products from India to Bhutan

**New Delhi, India:** The Union Cabinet chaired by the Prime Minister, Shri Narendra Modi, today has given its approval of signing of MoU between the Government of India and the Royal Government of Bhutan on General Supply of Petroleum, Oil, Lubricants (POL) and related products from India to Bhutan.

It aims to benefit India and its citizens with improved economic and commercial linkages with Bhutan irrespective of any gender, class or income bias, particularly in the area of hydrocarbon sector.

**Benefit:** The Memorandum of Understanding will promote bilateral trade in the hydrocarbon sector and will ensure secured and long term supply of petroleum products to Bhutan. Since, exports play crucial role in realizing Aatmanirbhar Bharat. The MoU will give thrust towards self-reliant India. The MoU will be a strategic fit as Energy Bridge in India's Neighbourhood First Policy.

## Rashmi Govil takes over as Director (HR) of Indian Oil Corp Ltd



**Rashmi Govil has taken charge as Director (Human Resources) at IOCL** according to an official statement from the organisation. Prior to this, she was serving as Executive Director (HRD & Employee Relations) at the IOCL's corporate office.

Rashmi Govil joined IndianOil in 1994 and has nearly three decades of rich experience in various facets of the human resources function. She is a seasoned professional with an MBA specializing in HR and a Postgraduate Diploma in Finance.



## PM witnesses the historic “Commencement of Core Loading” at India’s first indigenous Fast Breeder Reactor (500 MWe)

**Kalpakkam, Tamil Nadu:** In a historic milestone marking entry into the vital second stage of India’s three stage nuclear program, Prime Minister, Shri Narendra Modi witnessed today, commencement of “Core Loading” at India’s first indigenous Fast Breeder Reactor (500 MWe) at Kalpakkam, Tamil Nadu.

The Hon’ble Prime Minister took a tour of the Reactor Vault and the Control Room of the Reactor. He was briefed about the salient features of this reactor.

India has developed comprehensive capabilities spanning the entire spectrum of the nuclear fuel cycle. Government had approved in 2003, the creation of Bhartiya Nabhikiya Vidyut Nigam Ltd (BHAVINI) to construct and operate India’s most advanced nuclear reactor-Prototype Fast Breeder Reactor (PFBR).

In line with the true spirit of Aatmanirbhar Bharat, PFBR has been fully designed and constructed indigenously by BHAVINI with significant contribution from more than 200 Indian industries including MSMEs. Once commissioned, India will only be the second country after Russia to have commercial operating Fast Breeder Reactor.

Upon completion of the core loading, the first approach to criticality will be achieved, leading to generation of power subsequently.

Notably, despite the advanced technology involved, both the capital cost and the per unit electricity cost is comparable to other nuclear and conventional power plants.

## Measures by Government shall lead to three-fold increase in Natural Gas consumption by 2030



**New Delhi, India:** In a significant stride towards achieving 100% coverage of country’s area for the development of City Gas Distribution (CGD) network, the Petroleum and Natural Gas Regulatory Board (PNGRB) hosted a Concluding Ceremony for the 12<sup>th</sup> CGD Bidding Round.

The event was inaugurated by Shri Hardeep Singh Puri, Minister for Petroleum and Natural Gas & Housing and Urban Affairs, in the presence of Shri Tarun Kapoor, Adviser to Prime Minister, Dr Anil Kumar Jain, Chairperson, PNGRB, Board Members and Secretary of PNGRB. There was a large presence of key stakeholders from the oil and

## Mundkur S Kamath is appointed as MD of MRPL



**Mundkur S Kamath has assumed charge as Managing Director (MD) of Mangalore Refinery and Petrochemicals Limited (MRPL).** Prior to this appointment, he was serving as Executive Director (Refinery), MRPL.

Prior to his appointment as Executive Director (Refinery) of MRPL on June 1, 2022, he was serving as Group General Manager (Technical Services) at MRPL.

MS Kamath is an alumnus of Manipal Institute of Technology (MIT) and TA Pai Management Institute (TAPMI), Manipal.

gas sector of the country and the successful bidders of 12th CGD Bidding Round.

During the event, Shri Hardeep Singh Puri distributed the Letter of Intent to successful bidders of 12th CGD Bidding Round for their respective Geographical Areas. The Minister acknowledged the efforts of MoPNG, PNGRB and the successful bidders towards building a robust oil and gas infrastructure. Minister highlighted that the Government has set an objective to invest \$67 Billion in the natural gas sector in the next six years in order to provide Natural Gas to the end consumer at stable price. He further stated that in the recent years, support has been provided through policy and Regulatory framework for promotion of Natural Gas in the country.

## PM inaugurates, dedicates to nation and lays foundation stone for multiple development projects worth more than ₹ 56,000 crores

**Adilabad, Telangana:** The Prime Minister, Shri Narendra Modi inaugurated, dedicated to the nation and laid the foundation stone of multiple developmental projects related to power, rail and road sectors worth more than Rs 56,000 crores in Adilabad, Telangana today.

Addressing the gathering, the Prime Minister said that the land of Adilabad is becoming a witness to development projects related not only to Telangana but to the entire country as more than 30 development projects worth more than Rs 56,000 crores are either being dedicated to the nation or their foundation stones are being laid today. These projects include many projects related to energy,

environment sustainability and road connectivity in the state.

The Prime Minister noted that the Central Government and the state of Telangana have both completed almost 10 years and said that the government is providing all possible assistance to the state to realize the dreams of its citizens. Even today, the Prime Minister informed, the 800 MW capacity NTPC Unit 2 has been inaugurated today which will further boost the electricity generation capacity of Telangana. He also mentioned the completion of electrification of Ambari - Adilabad - Pimpalkhuti rail lines and the foundation stone laying for two major National Highway projects in Adilabad, Bela and Mulugu.

The Prime Minister underlined that these modern rail and road projects of today will give momentum to the development of Telangana as well as the entire region, while also reducing travel time, encouraging tourism and creating countless employment opportunities.

## Promoting Clean Coal Technology: Coal Gasification

**New Delhi, India:** The Ministry of Coal, Government of India, is steadfast in its efforts to promote coal production and ensure surplus supply, while transitioning towards cleaner energy alternatives like solar, wind, and hydroelectric power, recognizing the need to address environmental concerns and reduce carbon emissions. At the forefront of promoting clean coal technology, particularly coal gasification, the Ministry aligns with the Government's vision of fostering a resilient and sustainable energy ecosystem.

## Rajendra Prasad Goyal takes additional charge as NHPC CMD



**RP Goyal presently serving as Director (Finance) of NHPC Limited, has been given additional charge of NHPC's CMD post. According to a notification from the Ministry of Power, Minister of Power and New & Renewable Energy has conveyed to entrust the additional charge of the post of CMD of NHPC to Goyal for a period of six months with effect from March 1st, 2024, till a full-time incumbent is selected, or until further orders, whichever is the earlier.**

*RP Goyal has experience of more than 34 years in NHPC Ltd. in the core areas of Finance with in-depth understanding and vast knowledge of financial, contractual and regulatory issues involved in construction as well as operations of hydro projects.*

Coal plays a pivotal role in India's energy system, accounting for nearly 70% of the total electric generation. It is also a critical input in various industries such as steel, sponge iron, cement, and paper. And because of initiatives like 'Make In India,' the Ministry anticipates increased demand and higher economic growth projections.

To introduce clean coal technologies, the Government has launched several clean coal initiatives, including the Coal Gasification Mission. It aims to gasify 100 million tonnes of coal by 2030 through surface coal/lignite gasification projects. The Ministry highlights collaborative efforts in advancing Surface Coal Gasification (SCG) projects in Coal India Limited (CIL) coalfields. Notably, strategic bilateral agreements were executed in October 2022, including a Memorandum of Understanding (MoU) between BHEL & CIL, as well as an MoU between IOCL, GAIL & CIL, aiming to foster cooperation and expertise in driving the implementation of SCG projects.

To support these initiatives, a financial assistance scheme has been proposed to promote Coal/Lignite Gasification Projects by Government PSUs and the Private Sector, with an allocation of ₹ 8500 crores for incentives towards coal gasification projects. The scheme aims to demonstrate the financial and technical viability of gasification projects, accelerate markets for downstream products, and create an additional value chain in the economy for coal.

## Coal Sector Aims to Ramp up Renewable Energy Capacity to Over 9 GW by 2030

**New Delhi, India:** In alignment with the Prime Minister's 'Panchamrit' announcement during COP-26 and to progress towards the goal of net zero carbon emissions by 2070, Ministry of Coal has taken significant steps for promoting renewables initiatives towards reducing carbon footprints.

With a keen focus on enhancing renewable energy capacity, the Ministry has set ambitious net-zero electricity consumption plan for Coal/Lignite PSUs. Recognizing the pivotal role of renewables in mitigating environmental impact, the Ministry is actively promoting the deployment of both rooftop solar and ground-mounted solar projects across mining facilities. Furthermore, innovative plans are underway to develop solar parks within the reclaimed mining areas as well as other suitable lands, leveraging underutilized land resources for sustainable energy generation. This strategic initiative is aligned with the government's updated NDC target to achieve 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.

In order to minimize the carbon footprints of mining, the Ministry of Coal has issued directives to coal companies to accelerate the adoption of solar energy solutions. This includes the installation of rooftop solar panels on all government buildings and the establishment of solar projects in de-coaled areas and other suitable lands, effectively harnessing solar potential in previously utilized spaces.

## KBC Welcomes Takayuki Matsubara as New Chief Executive Officer



**KBC (A Yokogawa Company) announces the appointment of Mr. Takayuki Matsubara as its new Chief Executive Officer and member of the KBC board of directors effective January 1, 2024. With more than three decades in the process automation industry, Matsubara stands as an accomplished leader with significant global business background, including marketing and sales. His track record involves driving growth and innovation across industries such as energy, petrochemicals, materials, pharmaceuticals, and water.**

*"We are delighted to welcome Matsubara as our new CEO. With his extensive business experience and proven leadership, he's the perfect fit to expand KBC in a rapidly evolving solutions market," said Dr. Yu Dai, Chairman.*

Presently, the combined solar capacity installed by leading coal companies, including Coal India Limited (CIL), NLC India Limited (NLCIL), and SCCL, stands at approximately 1700 MW, supplemented by an additional 51 MW from wind mills. Looking towards the future, the coal sector aims to ramp up renewable energy capacity to over 9 GW by the year 2030, signalling a profound commitment to sustainability and environmental stewardship.

### Prime Minister of India lays foundation stone for 2,880 MW Dibang Multipurpose Hydroelectric Project of Arunachal Pradesh



**Lower Dibang Valley, Arunachal Pradesh:** The Prime Minister of India Shri Narendra Modi laid the foundation stone of 2,880 MW Dibang Multipurpose Hydropower Project of NHPC Limited in Lower Dibang Valley district of Arunachal Pradesh, at a Viksit Bharat Viksit North East Program in Itanagar, Arunachal Pradesh on March 9, 2024. The Prime Minister inaugurated, dedicated to the nation and laid the foundation stone for multiple development projects worth about ₹ 55,600 crores in Manipur, Meghalaya, Nagaland, Sikkim, Tripura and Arunachal Pradesh. The development projects of today encompass sectors like rail, road, health, housing, education, border infrastructure, IT, Power, oil and gas, among others.

Addressing the gathering, the Prime Minister mentioned work commencing in Dibang Multipurpose Hydropower Project in Arunachal Pradesh and Solar Power project in Tripura said "Dibang dam will be India's highest dam"

To be built at a cost of more than ₹ 31,875 crores, the Dibang project will be the highest dam structure in the country. It will generate electricity, help in flood moderation and lead to employment opportunities and socioeconomic development in the region.

The 2,880 MW Dibang Multipurpose project would come up near Munli village in Lower Dibang Valley District, Arunachal Pradesh. The project will have a 278-metres-high dam, which would be the highest Concrete-Gravity Dam of India. The Dam is planned to be constructed with Roller Compacted Concrete (RCC) technique and it will be the highest RCC Dam of the World. The Dibang Dam aims to place a peak of more than 5 lakh cubic metres of concrete in one month, which will be the first in the world.

### NTPC signs agreement with Rajasthan Rajya Vidyut Utpadan Nigam (RVUNL) for adding supercritical units and reducing electricity generation cost of Chhabra Thermal Power Plant



**New Delhi, India:** NTPC and its renewable energy arm NGEL have each signed a non-binding Memorandum of Understanding (MoU) with Rajasthan Rajya Vidyut Utpadan Nigam Limited (RVUNL) in Jaipur on 10th March 2024.

The MoU between NTPC and RVUNL is to explore opportunities for adding supercritical units to the existing Chhabra Thermal Power Plant. Additionally, the parties aim to implement measures to enhance efficiency and reduce the power generation cost of the plant's existing units. The MoU also includes the undertaking of 15-year to 20-year annuity-based Renovation and Modernization (R&M) of old thermal units of RVUNL, by NTPC or its affiliates. The MoU was signed by Mr R Sarangapani Executive Director (BD, IBD & Consultancy), NTPC and Mr Devender Shringi C&MD, RVUNL.

## REC Limited to finance power & infrastructure projects in Rajasthan worth ₹ 20,000 crores annually for next six years



**New Delhi, India:** REC Limited, a Maharatna CPSU and leading NBFC under the Ministry of Power, has signed a Memorandum of Understanding (MoU) with the Government of Rajasthan, to finance projects across power and non-power infrastructure sectors. Under this agreement, REC Limited will provide loans of up to ₹20,000 crores annually for the next six years to various departments, undertakings, institutions and schemes of the Government of Rajasthan.

With this MoU, there is expected to be a rapid increase in projects related to the state's infrastructure sector, such as power projects, metros, roads & highways, airports, IT infrastructure, oil refinery, steel infrastructure, ports & waterways, fibre optics, telecom, health sector, tourism infrastructure, agriculture and other infra projects. This collaboration underscores REC's commitment to supporting the development of both power and non-power infrastructure in Rajasthan, thereby contributing to the state's economic growth and prosperity.

On the occasion, MoUs worth ₹1.6 lakh crores were signed with the Govt. of Rajasthan, by Central Public Sector Undertakings (CPSUs) under the Ministry of Power and Ministry of Coal. These agreements marked a substantial commitment towards bolstering infrastructure development and driving economic growth in the region.

## Union Minister Pralhad Joshi Releases 'PM Gati Shakti- National Master Plan in Coal Sector'



**New Delhi, India:** Union Minister of Coal, Mines and Parliamentary affairs Shri Pralhad Joshi released "PM Gati Shakti-National Master Plan in coal sector" at a function in Ministry of Coal today. PM Gati Shakti-National Master Plan aimed at offering in-depth insights into the coal sector through the geospatial layers available on the Ministry of Coal page of the PMGS-NMP portal. This significant event highlights the government's commitment to infrastructure development and integrated planning.

In his address, Shri Pralhad Joshi emphasized the importance of the PM-Gati Shakti National Master Plan, marking a significant shift in our approach to planning and executing infrastructure projects. He further said that The PM Gati Shakti National Master Plan, a comprehensive GIS-based platform, brings together various ministries to facilitate synchronized planning for the movement of people, goods, and services, leveraging knowledge, technology, and innovation to drive economic growth and development.

Highlighting the significance of the PM Gati Shakti National Master Plan, Shri Amrit Lal Meena, Secretary, Ministry of Coal stated in his keynote address that its release will empower all stakeholders with crucial information for planning and executing activities within the coal sector, thereby enhancing the ease of doing business and ensuring timely project execution. This initiative aligns with the vision of 'Atmanirbhar Bharat' by promoting cost efficiencies, minimizing disruptions, and fostering inclusive growth.

## **NTPC Group crosses 400 Billion Units (BU) of power generation in 2023-24, surpassing electricity generated in previous year**

**New Delhi, India:** NTPC Group has crossed the mark of 400 Billion Units (BU) of total electricity generation in the current financial year, on 13th March 2024. During FY 2022-23, the company had generated 399.3 BU.

This milestone has been achieved with an average Plant Loading Factor (PLF) of 77.06% for NTPC's coal stations, till 13th March 2024 in the current financial year.

Earlier during the year, the company recorded highest ever single-day power generation of 1,428 Million Units on 1st September 2023. The stellar performance of NTPC units is a testimony to the expertise of NTPC engineers, and its Operation & Maintenance practices and systems.

While the installed power capacity of NTPC is 75.4 GW, 18 GW capacity which includes 5 GW of renewables is under construction. The company is committed to achieve 60 GW of Renewable Energy capacity by the year 2032.

## **SJVN gets Letter of Intent from Gujarat Urja Vikas Nigam Limited for 200 MW Solar Project**

**Kachchh, Gujarat:** NHPC Limited, India's premier hydropower company and a central public sector enterprise under the Ministry of Power, has won the bid to develop a 200 MW capacity Solar Power Project to be set up in the 1,125 MW RE Park of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda in Kachchh district of Gujarat.

The project will generate about 473 million units of electricity in the first year of commissioning and the cumulative energy generation from the project over a period of 25 years would be about 10,850 million units. NHPC will develop the project on a build-own-and-operate basis at a tentative development cost of ₹847 crores.

The e-reverse auction for the project was conducted by Gujarat Urja Vikas Nigam Limited on 2nd March 2024 and the Letter of Intent has been issued by it on 14th March 2024. The project has been secured at a tariff of ₹ 2.66 per unit and will be completed in a period of 18 months.

## **PNGRB organises mega-stakeholder interaction on Hydrogen transmission in Natural Gas Pipelines and City Gas Distribution Networks**

**New Delhi, India:** Petroleum and Natural Gas Regulatory Board (PNGRB) is progressing on the task of transporting Green Hydrogen through Natural Gas transmission lines by blending hydrogen with Natural Gas. PNGRB is considering Natural Gas Transmission lines as a first choice for the transportation of Green Hydrogen as currently total 33000 KM of Natural Gas Transmission pipelines network has been authorised, out of which 24000 KM is operational and rest is under-construction.

These Natural Gas pipelines will bridge the gap between regions with rich renewable energy resources (having high supply of Green Hydrogen) and Hydrogen consuming centres such as Fertilizer plants, Refineries and Heavy Iron & Steel Industries.

As per outcomes of draft study report, the total Hydrogen demand in India is expected to increase from current demand of 6 – 7 MMTPA to 16 – 18.5 MMTPA by 2040. Major contributors of this projected demand will be from Ammonia, Refineries and Transport sector. The study also suggested blending limits for various components such as for transmission pipeline, compressors, gas turbines, gas meters, domestic appliances, CNG vehicles, and other associated equipment and fittings etc, used in the Natural gas pipelines and City Gas distribution networks. Beyond these blending limits study also projected additional CAPEX & OPEX requirements towards equipment and fittings.

## **NLC India Green Energy Limited (NIGEL) Signs Power Purchase Agreement with Gujarat Urja Vikas Nigam Limited (GUVNL) for 600 MW Solar Power Project**

**New Delhi, India:** NLC India Limited (NLCIL) has incorporated a wholly owned subsidiary NLC India Green Energy Limited (NIGEL) to carry out future Renewable Energy Projects. The subsidiary will focus specifically on Renewable Energy projects and thus leveraging the expertise to its benefits.

NLCIL has won 600 MW Solar Power Project tender in the GSECL Khavda Solar Park, floated by GUVNL through competitive bidding process. In line with the



policy of developing RE projects under the green energy wholly owned subsidiary (WoS), the project development has been vested with NIGEL.

As a first initiative, NIGEL has signed the Power Purchase Agreement (PPA) with Gujarat Urja Vikas Nigam Limited (GUVNL) for the proposed 600 MW Solar Power Project at Khavda Solar Park, Bhuj District, Gujarat. The entire power from the project will be procured by GUVNL with the PPA tariff for the electricity from the project at ₹2.705/kWhr. The annual generation of electricity is set at 1,577.88 MU (Million Unit), with a cumulative electricity generation of 39.447 BU (Billion Unit) in its lifetime. The project is set to offset approximately 35.5 Million Metric Tons of Carbon dioxide emissions during its entire life.

## EverEnviro adopts EUSUSO - Denmark's ECOGI Technology across MSW based CBG plants



**Mumbai, India:** EverEnviro Resource Management Pvt Ltd, India's leading compressed bio gas developer through its associate partner Thermax Bioenergy Solutions

Pvt Ltd (TBSPL) has inked an MoU with European Sustainable Solutions ApS (EUSUSO-Denmark). This aims to integrate EUSUSO's patented Gemidan Ecogi technology in EverEnviro's upcoming MSW based CBG plants across India to boost CBG production. The MoU was signed in the presence of Hon'ble Danish Foreign Minister Mr Lars Lokke Rasmussen.

European Sustainable Solutions ApS is a technology leader in waste management, bioenergy and green fuel production in Europe. The Danish urban municipal waste management handling technology is one of the most advanced in Europe. Gemidan Ecogi technology has shown promising results in Europe by effectively optimising the pre-treatment phase in CBG plants. With an efficiency rate of 99.996%, this technology ensures careful segregation of organic and inorganic waste components and thereafter converts the organic constituents into bio-pulp that can be directly sent for biogas production.

## Sterlite Power Successfully Concludes Refinancing of LVTP Green Energy Corridor Project

**Gujarat, India:** Sterlite Power, a leading power transmission developer and global products and services provider, announced the successful refinancing of the Lakadia-Vadodara Transmission project loan within 12 months of the project becoming fully operational in January 2023. The new financing from HDFC Bank, IIFCL and Bank of Baroda will enable prepayment of the existing project loan of approximately ₹ 1840 crores.

The new refinancing secures a reduced interest rate of ~8.25% p.a.p.m, a significant improvement over the previous terms. The overall tenure of the facility is ~18 years. As the first private sector inter-state power transmission asset to secure such favourable refinancing terms, this accomplishment reflects the keen interest of financial institutions in supporting power transmission projects that offer stable, long-term cash flows. ■

## Asset Integrity of Reciprocating compressor valves leveraging Technology

**A**sset integrity refers to the ability of an asset to perform its required function effectively and efficiently while safeguarding health, safety and the environment. It involves maintaining the physical condition, reliability and functionality of assets throughout their lifecycle. This can include regular inspections, maintenance and monitoring to ensure that assets meet performance standards and regulatory requirements.

It also encompasses a comprehensive approach to risk management, including identifying potential threats, implementing preventive measures and responding to issues promptly. It often involves the use of technologies like sensors and data analytics to monitor asset health in real-time. The goal is to optimize performance, extend the lifespan of assets and minimize the likelihood of failures or incidents that could impact safety and productivity.

BPCL Mumbai Refinery at Hydrocracker Unit has three MUG (make up gas) Reciprocating compressor with 3 stages having 6 cylinders. Each cylinder consists of 2 suction valves and 2 discharge valves. That is, 12 Suction valve + 12 Discharge valves with total of 24 valves per Compressor & Driver Rating: 4.2 MW, 333RPM

We incurred a total maintenance expenditure of ₹10.2 Crores on the equipment with an annual spent of ₹63.5 Lakhs per Annum. Major contributors were replacement of compressor valve and outage due to high discharge temperatures.

The failure rate and service rate of these Valves are very high and the details of maintenance history for last 6 months is provided below

There is approximately 18 valve replacement in 6 months i.e., 36 valves per year. Meaning every two years all three compressor valves (72 Nos.) are replaced.

Asset integrity and root cause analysis are closely linked in ensuring the reliability and longevity of assets. When a failure occurs, root cause analysis is employed to identify the underlying reasons for the failure. This analysis involves investigating factors such as design flaws, material issues, human error or external influences.

By understanding the root causes of failures, organizations can develop strategies to prevent similar issues in the future. Integrating this knowledge into asset integrity management allows for the implementation of targeted

S. No.	Date	Tag	Cylinder	Type	North/South	No. of Valves
1	22.09.2020	K203A	2A	Suction	North/South	2
2	22.09.2020	K203A	2B	Suction	North/South	2
3	01.10.2020	K203A	3B	Discharge	North/South	2
4	01.10.2020	K203A	3A	Suction	North/South	2
5	12.10.2020	K203B	1B	Suction	North	1
6	12.10.2020	K203B	3B	Suction	North	1
7	28.10.2020	K203C	1A	Suction	South	1
8	30.12.2020	K203B	3B	Suction	South	1
9	30.12.2020	K203B	1A	Discharge	South	1
10	13.01.2021	K203B	2A	Discharge	South	1
11	04.02.2021	K203B	2A	Suction	South	1
12	22.03.2021	K203C	1B	Discharge	South	1
13	22.03.2021	K203C	3B	Discharge	North/South	2
<b>Total Replacement in 6 months</b>						<b>18</b>



maintenance, monitoring and improvement measures. This proactive approach enhances the overall resilience and performance of assets while reducing the risk of recurrent failures.

However, when dealing with persistent root causes, leveraging technology developments & innovations become crucial for enhancing reliability and asset integrity. By embracing technology, organizations can move from reactive to proactive maintenance strategies. Predictive analytics & online machine diagnostics systems, for example, can forecast potential failures based on data patterns, allowing for timely interventions and minimizing downtime. This approach not only improves the overall reliability of assets but also optimizes maintenance costs and extends the operational life of equipment.

Hence, we started looking for solutions that are superior & proven technology. In the endeavour for New technology, we looked in to various innovative solutions and straight flow Modular valves was found to be a promising technology that cater to high Reliability, availability, ease of maintenance, increased efficiency, reduce power consumption and tolerant to dirty gas/liquid.

### The difference in Plate type valve and straight flow modular type valves are as follows:



- We do not need to service our valves as frequently as we do plate valves. In a typical hydrogen application at a refinery, the service interval for our valves is about 5 years. The service interval for the plate valves is 6 months.
- There is no machining involved during servicing. All we do to service our valves is to replace the old modules with new modules. It can be done easily at site. we don't need to send valves off site to be machined on CNC machines. In many cases, if the valve seat or guard of a plate valve has been nicked

by a broken spring, it cannot be repaired – it has to be replaced. So, the service time & cost will be quite high. However, we also need to consider the actual time expense of our own personnel inspecting the valves first, packing and transferring these valves out, then receiving them back in, inspecting and putting them back into inventory.

- This straight flow type metal valve housings do not wear out – they are warranted for 10 years, but in reality, they have lasted the life of the compressor in other installations. We should never have to buy a set of valves for this compressor again – The only valve expenses are the expense in replacing the modules every 5 – 7 years. With plate valves, during every service, it is likely that some valve seats and guards are being replaced while others are being repaired and every time, the valve plate and springs are replaced. On average, we replace the plate valves every 2-3 years (works out to about more than 17% replacement at every 6-month service).
- There is estimated 4 – 6 % improvement in flow, which may enable us to eliminate starting the 3rd compressor. All this saves power and improves reliability and cost. The cost of operation of a compressor and all the ancillary equipment that is involved.
- For the same flow, we would be saving 4 -6% in power and estimate the cost of the valves is recouped in anywhere from 11 months to 1.5 years based on this alone.
- Because of the service interval of 5 years instead of 6 months, we would be preventing 9 shutdowns every



# FEATURES

5 years. Every time we open a compressor to service the valves, we have emissions. There is an amount of hydrogen in the compressor and a portion of the pipeline that will escape when the compressor is opened. Also, during start up, before bringing the compressor on line, we may have to start up with Nitrogen, purge, flare, etc. All this has a cost to it. We can avoid 9 of these events every 5 years with these valves.

**The technology was Installed and Commissioning on 4th July 2023. After installation Performance evaluation was carried out 3 different method to assess the benefits and following is the Summary of the performance Evaluation report by OEM as per real time data furnished by BPCL:**

- Method A evaluates the impact of installing New valves in Unit A on the entire HCU compressor system by comparing data when Unit A was operating. The average flow, average current, and specific power before and after the New valve installation are analysed. After the implementation, there was a 7.29% improvement in specific power.
- Method B compares Unit A and C before New valve installation and Unit A and B with New valves in Unit A. By running Unit A with New valves at 100% load and Unit B with OEM at 82% load to achieve the similar flow as before with OEM valves in two units at 100% load, a specific power improvement of 11.21% is achieved. ROI calculations based on specific power improvement indicate potential savings ranging from ₹6.1 crore to ₹7.46 crore, depending on the electricity rate used.
- Method C compares data when the combined throughput is similar before and after the NEW

valve installation. The power reduction achieved to maintain the same throughput is calculated, showing an average decrease in power consumption of 7.12%. ROI calculations based on power saving indicate potential savings ranging from ₹3.9 crore to ₹4.8 crore, depending on the electricity rate used.

## Conclusion

Overall, the ROI analysis suggests that implementing NEW valves in Unit A has resulted in significant improvements in specific power and potential cost savings in energy consumption.

However, the intangible benefit are as follows: High reliability with 24,000 hours of run life; Reduction in Downtime for valve maintenance to 24 hours; Spare inventory saving due to high interchangeability; No Valve replacement for minimum 20 years; Zero machining requirement for maintenance. ■



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# Asset Integrity Will Boost Energy Sector Capacity to Meet Today’s Challenges

For electric utilities, nothing is more important than the assets that safely deliver reliable power to customers. As utilities cope with new and rapidly evolving power system demands, asset integrity management systems (AIMS) are key to continued safe and resilient operations.

An uninterrupted energy supply is of the utmost importance to the power industry as the world’s demands are expected to increase due to population growth and emerging power-intensive industries such as data centers.

If these new demands are to be met without overburdening the capacity of existing equipment, new measures will be needed to increase operational efficiencies, mitigate risks and optimize preventive maintenance strategies. These steps must be taken while minimizing planned outages of key assets, achieving sustainability, public health and environmental goals.

## Asset Maintenance Strategies

Asset integrity management in the energy industry requires the systematic planning, use and maintenance of physical assets such as turbines, transmission lines, transformers and a host of other assets throughout their service lives. Effective asset management strategies can improve productivity, reduce maintenance costs and enhance reliability of equipment — all as part of a strategy to help utilities utilize resources more efficiently.

See Figure 1 for an overview of the progression of asset maintenance strategies.

Integrating assets is critical to successful business outcomes, yet many companies take an ad hoc approach to the process. International standards widely used throughout the power industry should be considered for programs that can improve decision-making, mitigate risk and reduce total cost of ownership.

## Early Warning Signs of Asset Deterioration

Although there may be a variety of indicators of imminent failure or loss of efficiency of key operating assets, there are a few of the primary warning signs (see Figure 2). The key indicators are as follows:

- **Underproduction:** Underperforming assets struggling to meet the design parameters is an early sign of underproduction.
- **Plant Equipment and Infrastructure Deterioration:** Physical signs of equipment and infrastructure deterioration can include corrosion, leakage, and structural damage to equipment and infrastructure.
- **Rules, Regulation & Compliance Issues:** Noncompliance with industry regulations and environmental standards can be a clear sign of asset under performance. Frequent violations, fines or sanctions may indicate operational problems.

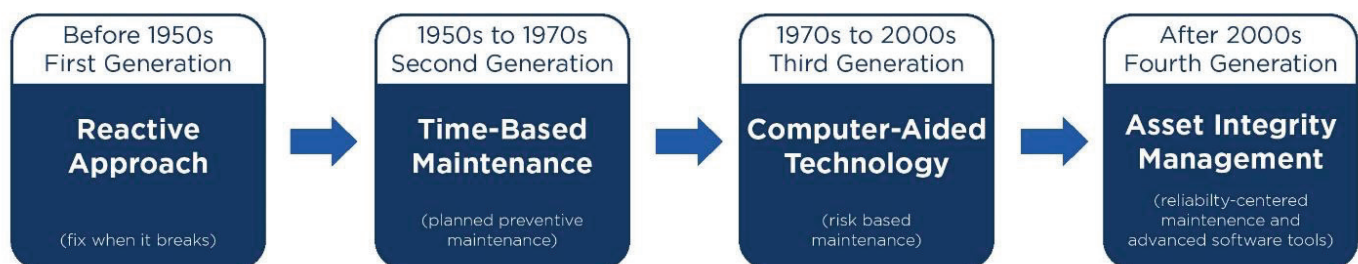


Figure 1: Evolution of Assets Maintenance strategies

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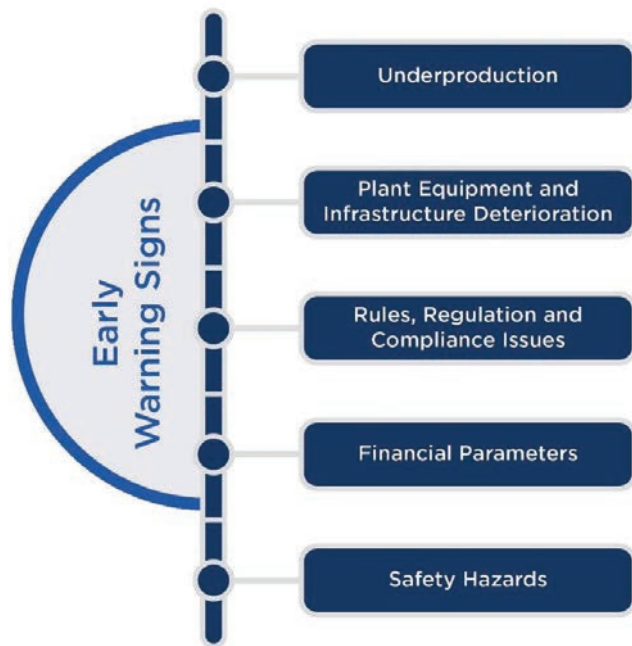


Figure 2: A number of indicators should be monitored to detect losses of key assets.

- **Financial Parameters:** Analyzing financial indicators such as return on investment (ROI), net present value (NPV), and operating costs can reveal early signs of asset underperformance.
- **Safety Hazards :** The occurrence of safety hazards, such as leaks, fires or accidents, is a significant warning sign. These incidents not only pose severe safety risks to personnel, but also can result in costly damage and reputational harm.

## What are Asset Integrity Challenges in Energy Sector?

These challenges are commonly faced within today's energy industry:

- Deteriorating infrastructure and an aging workforce.
- Failure to keep pace with technological advancements.
- Need for more robust data management and analytics.
- Cybersecurity threats.
- Compliance with rules and regulations.
- Sustainability and environmental concerns.

While most utilities have methods and techniques to manage and protect their assets, modifications

may be necessary for improvements needed to meet constantly evolving energy demands. Some new technology-based strategies to be considered include:

- Predictive maintenance.
- Digital twins.
- Drones and robotics.
- Internet of Things (IOT) and sensor networks.
- Field service management.
- Strategic asset integrity.
- Capitalizing on digital integration.

## Predictive Maintenance

Predictive maintenance is an advanced technology that uses data analytics, sensors and other tools to monitor assets to determine the optimal times for maintenance. This strategy allows companies to take preventive action before failures occur, which can save time and money.

By harnessing data analytics, organizations can also gain valuable insights into their energy consumption patterns, identify areas of inefficiency and proactively manage their energy resources for maximum efficiency. By leveraging previous energy consumption data — with real-time information from transmitters, sensors and smart energy meters — organizations can generate accurate predictions about their future energy requirements and implement proactive measures to reduce waste and maximize efficiency.

Recent studies show that maintenance costs typically decrease by 20%-25% and equipment availability increases from 10%-20% for energy facilities that have implemented predictive maintenance programs.

## Digital Twins

A digital twin plays a key role in asset management by creating a virtual replica of a physical asset. It is an up-to-date and accurate copy of the asset, thus making it easy to attach real-time data to the 3D model using remote sensing technology. This attribute allows the digital twin to change in real-time along with its physical counterpart.

By simulating digital assets, the data triggers the future predictive algorithm where the digital twin can offer agile, comprehensive and operational understanding based

on the operating environment. This boosts productivity, encourages effective decision-making and helps to achieve strategic goals of maximizing safety, reliability and profitability.

## Drones and Robotics

Drones and robots have become essential tools in modern industrial and energy asset management. Drones can perform remote inspections of critical equipment such as pipelines for signs of corrosion or damage, while drones and robots can monitor air quality and emissions at energy facilities.

## Internet of Things

IoT is a system of interconnection of devices and sensors that collect and share data about the equipment or facility. IoT solutions utilize both cloud computing and edge computing to collect data on turbines, pumps, compressors and other equipment to collect data on vibration, temperature and pressure. This data could be transmitted to a central monitoring system, where it could be analyzed for signs of potential problems.

## Integration of Field Service Management With Asset Integrity

By integrating the field service management solution with the assets, utilities can streamline their daily operations and reduce/troubleshoot any potential challenges that may arise. This helps to improve operational efficiencies by providing accurate updates to technicians in real time.

## Strategic Asset Integrity

Strategic asset integrity involves developing long-term maintenance and operation plans and strategies for managing assets across the entire power plant. This involves considering factors such as asset life cycle, risk, performance and financial considerations. Strategy and planning determine the policies to be adopted, define goals to be targeted and make sure actions are aligned with organizational goals.

## Capitalizing on Digital Integration

Advanced digital technologies help to integrate software applications such as big data analytics, cloud technologies, artificial intelligence and machine learning.

To capitalize on this digital integration, companies must start by implementing a comprehensive digital strategy aligning with their business goals. By integrating digital technologies into their core operations, energy facilities can improve asset management procedures, optimize processes, reduce costs, deliver superior customer experiences and open new chances for efficiency gains by embracing these developments.

Implementation of a strategic asset integrity approach aligned to optimize emerging technologies is a pathway to help the energy industry meet today's imperatives for 24/7 plant operations. Strategic initiatives enable better planning and a proactive approach that eliminates the inefficiencies caused by reactive responses to unexpected challenges. Optimizing maintenance schedules, streamlining workflows, and maximizing operational efficiency can deliver higher productivity levels and capitalize on utilization of assets to their full potential ■

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## Bringing Decarbonization to Life: Innovative Solutions for Sustainable Growth



**Andrew Howell**

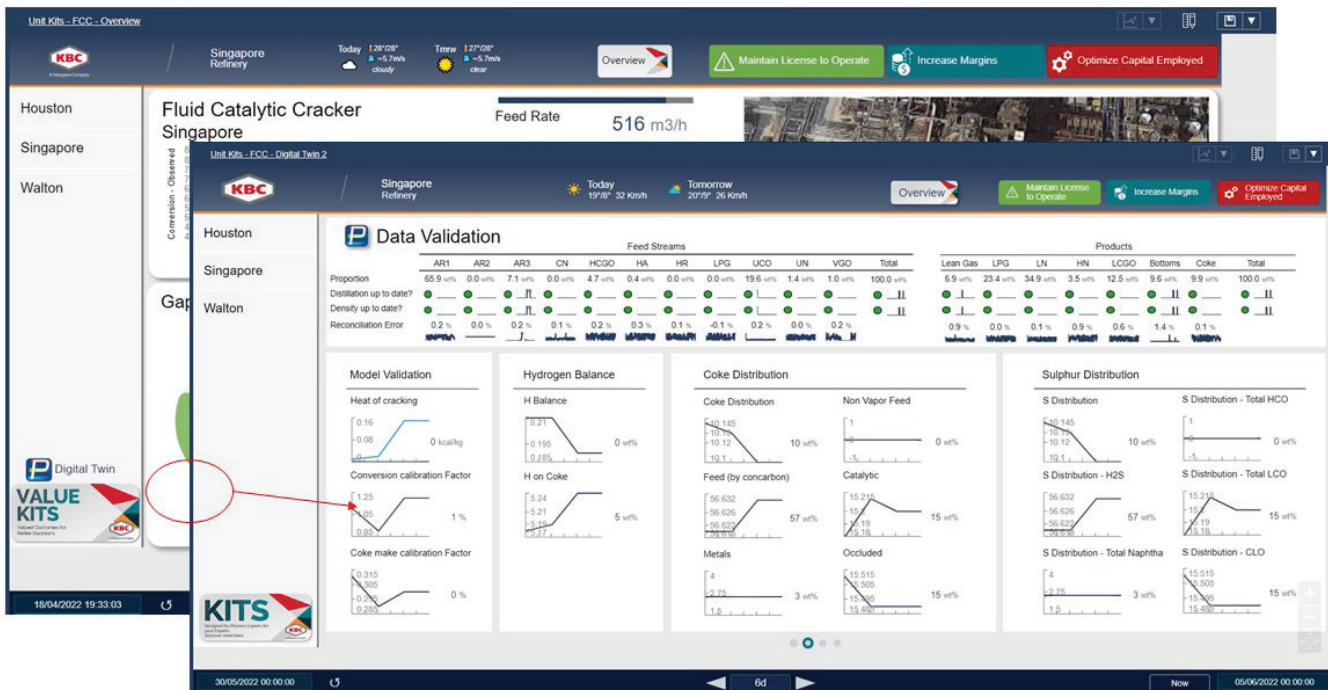
EVP- Technology  
KBC (A Yokogawa company)

*Andrew Howell, EVP- Technology at KBC (A Yokogawa company) in this exclusive interaction with Oil Gas & Power shares the decarbonization dilemma and key strategies to sustainable growth in the digital age and dives into the world of decarbonization. He shares the benefits of digital twins, examines the role of artificial intelligence, and highlight how refiners are successfully embracing these technologies for emissions reduction.*

**According to the IEA, global carbon dioxide (CO<sub>2</sub>) emissions from energy combustion and industrial processes grew 0.9%, or 321 Mt in 2022, to a new all-time high of 36.8 Gt. Given 2050 as the global net zero target, what are the key challenges that need to be addressed specifically across industrial processes?**

Asset owners face a difficult decision when choosing the path to net zero. There are lot of different technical

processes that could be chosen to reduce emissions, but the financial risk associated with capital investment in these projects are risky. However, doing nothing is the worst decision one could make and is in fact catastrophic, and society will simply not allow you to operate if you are not taking action towards net zero. We all have seen the action on climate change and the demands from society against climate change causing activities. It is an absolute given that our industry sector



has got to play its part in moving towards net zero and that's going to be a condition of operating in the new world.

India, among other nations, is playing a key role in developing these technologies for decarbonization. However, what operators and companies need to get is a sensible, costed, and risk-assessed net zero roadmap and that's the key to moving forward. It's a roadmap with the different options that are available and it's a roadmap that will remain live and will change over time as we begin to understand decarbonization and decarbonization options. There isn't one size fits all. Collaboration is needed between companies, the operators, governments. The governments need to setup the right environment to reach net zero.

### How different are the challenges in brownfields and greenfield projects and how different are these in different geographies?

The geographical concerns regarding decarbonization are one of the most interesting, aspects of the entire problem globally. We are governed by legislation which is very specific to countries or regions and access to capital, technical skills, and cultural leadership. Our industry in hydrocarbons does have a very global effort

towards achieving net zero and although that does vary significantly from country to country and company to company, there is a lot of sharing even in countries with differences in economic development, energy sources and political landscape happening currently. There is strong collaboration between prospective vendors and operators in specific countries like the US and members of the European Union who have been sort of the historical largest emitters of greenhouse gases due to their industrialization and economic growth over time.

All countries are investing in decarbonization and sustainability. We in the industry need to ensure technology is available to all countries in a cost-effective way, no matter how big or small they are. Governments also need to play their part, having a good energy policy, a solid energy mix, and their own net zero roadmap.

In India, the conditions are good. The government is supportive as well as privately owned oil industry are all investing in decarbonisation initiatives, looking at alternatives, adopting a mixed energy portfolio, and engaging companies like KBC. The differences worldwide are smaller in decarbonization strategy than perhaps in the economic ones. Technology is being adopted almost everywhere.

**Cost is a big challenge; affordability is a big challenge. How does one address these issues?**

Revolution is expensive. There must be an energy mix, and it's called transition for a reason, and it will go as fast as legislation, economics, public policy determines it. The key thing is this technology needs to be available to everyone quickly. We need to test it and collaborate, particularly on data, simulation models, etc. However, we lack the skilled workforce that we once had. Digital technologies, including artificial intelligence, can fill these gaps. Much of the required capital investment can be cut if we combine digital transformation and energy transition.

The short answer is governments need to make the environment & sustainable approaches financially acceptable to the oil industry through legislation grants, tax breaks, etc to drive the sustainability in the industry and then on industry side, we need to adopt digital technologies in parallel with energy transition plans to make the new units, hydrogen units, ammonia units, biofuel units.

**What are the anticipated challenges and that you're seeing and how is your group preparing to offer solutions ?**

If we look at the way the oil industry operates, it's all about our biggest asset: people. In people area we already knew a decade ago that there was a crew change going on. There were more retirements out of the oil industry and less new people coming in because oil industry is not as appealing as it was for young engineers. Climate activism is also making them question whether they want to work in the industry. Then COVID-19 accelerated that problem, industry had less access to people, less access to skills.

We've to become less conservative in the oil industry, we need to speed up the energy transition and take a bit of risk on some of these new technologies share that risk with other countries and companies and try to sort of cut short the processes and deliver effectively.

So, we're in a situation now where the industry has the biggest challenge of its history: energy transition from hydrocarbons to mixed fuels and renewables and yet we have the smallest pool of skills and expertise we've ever had available.

We at KBC think the industry needs to make this challenge appealing to the smartest brains on the planet to join the industry to drive that change through. We've got good renewable technology, but it's not as tried and tested as historically hydrocarbon technology. So, a lot of challenges and a lot of effort from companies to continue to test the technology and make sure it works on biodiesel, biofuels, e-fuels, renewables, hydrogen, ammonia, et cetera.

We've to become less conservative in the oil industry, we need to speed up the energy transition and take a bit of risk on some of these new technologies share that risk with other countries and companies and try to sort of cut short the processes and deliver effectively.

**KBC has a boutique of technologies and services that it can offer to the industries. How do you expect these demands to pan out and which ones are the most in demand ?**

We have a lot of consulting and software solutions that are grouped into specific areas. Our focus includes energy transition, where we develop novel decarbonization technology roadmaps, analyse costs, and implement solutions. For energy optimization, we offer energy management technology that can be deployed onsite or in the cloud to measure your current performance, prediction, and adjustments to meet your energy goals.

In process optimization, technology and consulting has advanced in the last four or five years. We leverage advanced technology such as digital twins to create digital representations of assets, which can then optimize process to minimize your energy footprint. Additionally, our other solutions cover asset management for reliability and maintenance, as well as streamlining operational performance.

KBC's digital twin technology can model biofuels within the refinery alongside traditional hydrocarbon operations. With value chain technology, we can track the molecules' origin and optimize the processes that favor biofuels. If governments worldwide enforced energy policies that support biofuels, our digital transformation capabilities



would ensure the biodiesel plant is optimized, to meet the increasing demand for biofuels, particularly in India.

### Which markets and technologies will drive the growth of KBC Global?

KBC's consulting business is very engaged with operators on working out the options for way forward and we've had a large growth in the company from working with the oil industry to embrace that challenge and really try to solve that challenge. Now implementing energy optimization, energy minimization technologies can be done in the cloud, and we manage that from KBC's data centres for oil companies all around the world, report their energy consumption, report their emissions. Report their improvements in both of those things that they can then report to the government.

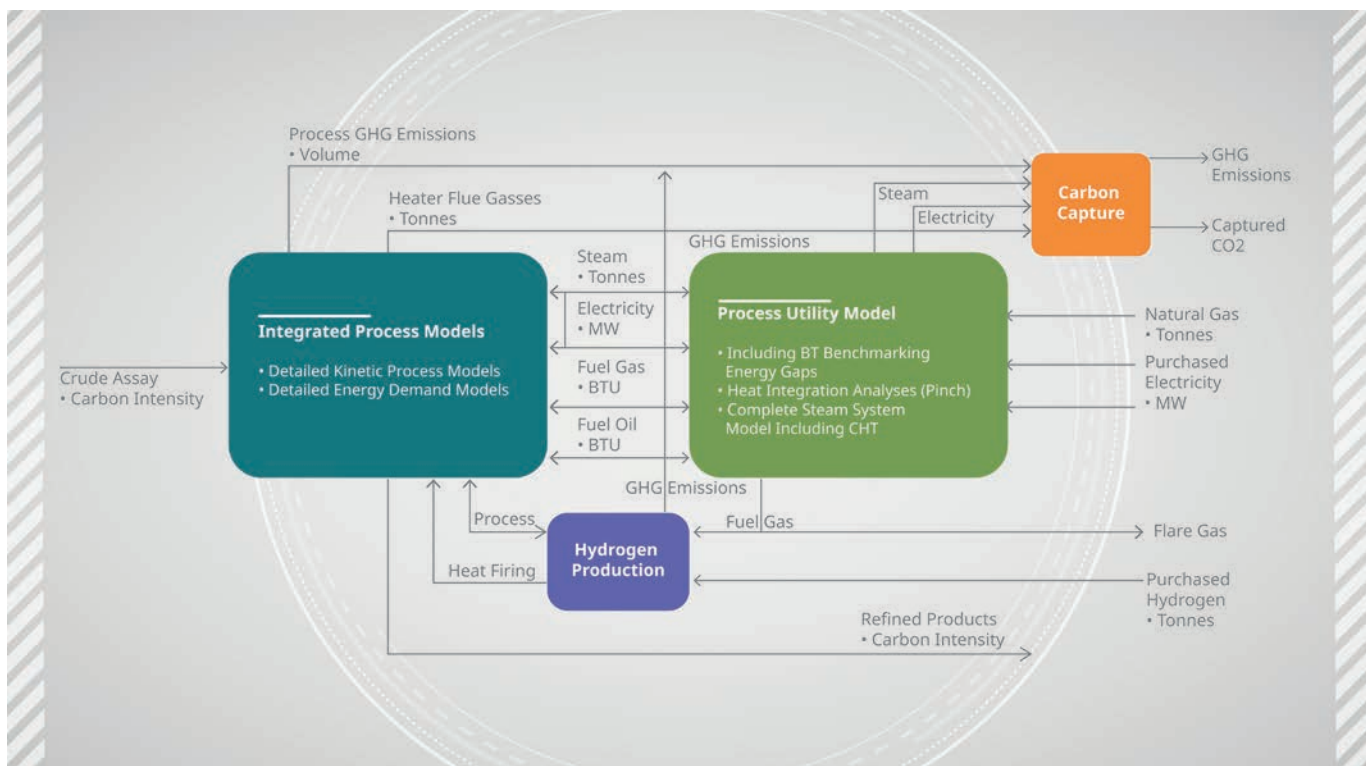
Then another area of growth is in the digital twin area where using AI to really optimize the hydrocarbon and renewable processes. If we look beyond that the bigger automation of these plants is a very large growth area for KBC and for our parent company the industrial automation leader Yokogawa, and we've implemented a number of very large automation projects in India. These projects are in upstream and downstream around measuring more values in offshore platforms, pipelines, gas plants, refineries, petrochemical units, and then putting the technology in place to optimize them, close that loop

and make the actions and that's a mix of automation, simulation and artificial intelligence.

### How can KBC help the global south industries drive their vision for growth ?

The biggest challenge for the human race now is how do we continue to supply energy demand versus not burning hydrocarbons and not burning coal. We know that countries rely on very different energy sources based on their geographical location, their access to natural resources, their energy infrastructure depends on that. In some countries like Canada, there's abundant renewable hydroelectric power, UK has access to wind power and then if you're in Middle East, there's access to solar energy. So, it does differ depending on where you are from what is the best energy mix, but the key thing is you need have to have an energy mix and whether that's hydrocarbons, renewal, nuclear, or all of those things, it's important to have a strong energy mix. Oil industry needs to ensure and lobby the governments to work in collaboration with the industry to make sure that that energy policy is sensible.

Producing biofuels and e-fuels in the same in refining complexes is turning them into energy centres and not just refineries. In many such aspects India is ahead of a number of refineries in the UK because the refineries in India are bigger and process more oil and are more



profitable so, they can fund such upgrades, self-fund it faster. Whereas in the UK, we've got to rely on investment from banks who take longer to make that decision for hydrocarbon companies. So, I think in some aspects the global South is in a better position because its operations are much more resilient than in the North, but as I said earlier, there is a fantastic share, cultural sharing of learnings across the world. This is leading to renewables, biofuels, ammonia, hydrogen implementation in many, many places around the world. In some aspects, countries like India are in a better position than countries like the UK at this present moment.

As we get into biofuels, the problem is not technology or financing, it is access to farming land. To produce that amount of biofuel the amount of feed to the units will be different depending on what country you're building and construction industry around the world needs to adopt much more green practices, the finance and investment community need to understand that the hydrocarbon industry does need funding to be able to make these changes or they'll never happen. I think these challenges are shared very strongly around the world. So, I don't think the gap between China, India, U.S., U.K. and Middle East is that big. Actually, I think we share a lot in decarbonisation. We share the same problems; we share the same challenges and we're sharing the same solutions.

Our KBC group in India is some of the best in KBC at a number of solving a number of these challenges because they've had access to customers in India that that are really pushing ahead with that. So, I think economically and financially things are very different worldwide. But in terms of solving the decarbonisation challenge, we are all working together very much at the same level and great to see leadership in India driving it.

### **What are some of the new technologies in the pipeline, investment plans at KBC?**

We invest heavily in technology and in our people. With 15 years in India, we have built a strong presence in process simulation, value chain optimization, energy minimization, and advanced process control. Our focus lies in understanding new technologies around net zero roadmaps, decarbonization, process simulation, digital twins, and energy management.

In terms of investment, we're one of the first companies to deliver a set of bioreactor simulations in our process simulator. We use artificial intelligence prioritize model accuracy. This approach is crucial as maintaining model integrity manually is challenging and prone to errors. By using AI, we keep our models up to date, matching real-world conditions means you've got confidence in the forecasting. Our investment focuses on advanced bioreactor technology and artificial intelligence to keep these digital twins online. Additionally, we invest in our IT infrastructure.

Our parent company, Yokogawa, has the Yokogawa Cloud which is a very sophisticated digital platform structure that KBC uses. This platform allows us to monitor those assets alongside the oil company so they can be monitored at the customer site in India or the HQ, allowing us to provide data cyber security and expert support.

Our focus remains on investing resources to enhance our technical reactor technology and adopting artificial intelligence to optimize these digital twins and energy management systems. Additionally, we invest in digital platforms to allow collaboration from India to Houston. ■

## Repurposing the current Natural Gas Network for Hydrogen



**AKHIL MEHROTRA**

Managing Director  
Pipeline Infrastructure Limited

The article explores India's energy transition amid economic growth and rising greenhouse gas emissions. It emphasizes natural gas's role in grid balancing and decarbonization alongside renewable energy expansion. Proposals to repurpose existing gas pipelines for green hydrogen transportation face technical and economic hurdles. Efforts are underway to establish guidelines for safe hydrogen transportation. The article urges collaborative efforts to accelerate the adoption of green hydrogen and natural gas as transitional fuels, echoing the vision for a cleaner, self-sufficient future, championed by former President APJ Abdul Kalam.

India is not only the 5<sup>th</sup> largest economy in the world but also the 3<sup>rd</sup> largest greenhouse gas emitter. The GDP of India is expected to grow at 7-8% for next two decades and to support this growth, energy will have to play a key role. The current energy mix for the country is dependent on fossil fuels like Oil, coal, and gas. But, the Government of India has made great strides in moving towards renewable energy sources to help limit the increase in global temperature to 1.5 degrees (as compared to the pre-industrial levels) as per COP commitments. However, India must keep finding sustainable ways to grow.

As the world deals with the energy trilemma of energy security, affordability and sustainability, India is working towards revamping its energy mix, of which natural gas is an essential element. India is now the world's largest producer of renewable energy with 42% of installed capacity sourced from clean and sustainable options while marching towards the nation's goal of producing 500 GW renewable energy, much before its committed deadline of 2030. The power produced from renewable energy is however intermittent in nature. Grid balancing would require either storage solutions or gas playing its role (as gas based peaking generation) in balancing the grid. Gas will also play a vital role in decarbonising the economy being the main fuel for cooking, commercial & industrial applications, and transport.

India has got a large gas pipeline network of more than 22,000 kms and another 11,000 kms under construction. Pipelines are the safest and the most reliable way of transporting clean fuel like natural gas to the remotest parts of the country (including hinterland where no other fuel currently reaches on a continuous basis) which is being achieved by most of the country being covered by City Gas Networks.

There are multiple issues being faced by the country like finding sustainable forms of energy which can be achieved by sourcing additional energy from bio sources and Green Hydrogen. Other issue is the gas pipeline network of the country is underutilized and measures need to be taken to make the network viable as a preferred infrastructure for transport of energy.

To meet the energy trilemma and find newer sources of energy, Government of India introduced "National Green Hydrogen Policy" which exemplifies the country's determination to promote low-emission fuels.

### **Role of Green Hydrogen and Gas Pipelines in Energy Transition**

Hydrogen, hailed as a material clean energy and net-zero technology, is being evaluated across the globe for its viability as a blend with natural gas. Most of the talk today is around production of Hydrogen, however how swiftly it can reach the consumption centres will determine its quick adoption as a fuel. Different nations across the globe have initiated review of their existing natural gas pipeline networks and develop a roadmap for the transportation of Hydrogen through blending in natural gas networks. Technological advancements, regulatory landscapes, and potential challenges are examined to discern whether Hydrogen blending is not just a theoretical concept but a pragmatic step towards a low emission future.

Pipelines have always been one of the key assets for energy security of the country. Pipelines have high reliability in terms of product delivery to customers and hence the most preferred means for transport of energy. While green Hydrogen can be transported through tankers but transporting green Hydrogen in bulk is only viable through pipelines. With the current gas infrastructure underutilized it makes an economic sense to repurpose the current transmission and distribution network of the country to transport and distribute green Hydrogen.

As per DNV whitepaper on repurposing onshore pipelines for Hydrogen, to reach the targets of the Paris Agreement, Hydrogen will need to meet around 15% of world energy demand by 2050. This forecast indicates that this demand can be met only if we have transportation infrastructure available for the same. Pipelines will be a key element for this transition as the H<sub>2</sub> can be transported through dedicated H<sub>2</sub> pipelines or can be blended with Natural Gas for further end use.

On August 4, 2023, PNGRB via its press release have also indicated that "The Natural gas pipelines network has the potential for transporting Hydrogen from producing locations to consumption areas, and the use of Hydrogen blended Natural Gas in City Gas Distribution (CGD) networks reduces emissions" and accordingly have partnered with the world bank to prepare a road map for Hydrogen Blending in Natural Gas.

There have been similar studies carried out by different nations across the globe for review of their existing pipeline networks and prepare a roadmap for the transition.

As per the European Hydrogen Backbone (EHB), which comprises 33 European network operators with infrastructure covering 24 EU member states plus Norway, the United Kingdom, Switzerland, and Ukraine, who have studied and prepared a road map to help transport Hydrogen in Europe have identified a total network of 53,000 KM by 2040 and more than two thirds of the same could consist of existing gas pipelines which indicates the potential of utilizing the existing pipeline network for this energy transition.

There have been various studies and pilot project under progress in India and across world wherein Hydrogen Blending with Natural Gas is initiated to ensure seamless Transportation of Hydrogen through existing pipeline network. Europe has an advanced natural gas network as compared to various other regions across the world and as per the technical paper "Extending the European Hydrogen Backbone", repurposing of existing pipelines could be 0.2 to 0.6 M Euro /km whereas the building of new pipelines could be 1.4 to 3.4 M Euro /km. This is a substantial saving and therefore several European countries are interested in blending Hydrogen to existing natural gas pipelines or repurposing the existing pipelines to transport 100% Hydrogen.

## Challenge in repurposing of Existing Pipelines

Pipelines are considered a cost-effective method for transporting Hydrogen over longer distances, replicating the current natural gas supply chain. Across the world, there are dedicated Hydrogen pipelines in operation today which are primary for captive utilization. The transport of Hydrogen via pipelines is not new and has existed, limited to captive use largely within the petrochemical and fertiliser industry. However, the volume being transported is small, low stress conditions and the risk is confined to within the facility. With transportation being assessed through cross-country pipelines, it poses' greater risk and hence a detailed assessment needs to be performed prior to actual implementation of Hydrogen Blending or transportation.

## The key challenges involved in repurposing the existing network includes

- Hydrogen embrittlement
- Fatigue cracking
- Toughness degradation
- Gas velocities
- Different Metallurgy of various equipment's in the complete transmission network

EXISTING CODE (ONSHORE TRANSMISSION PIPELINES)	NATIONALITY	HYDROGEN ALLOWED FLUID?	MATERIALS REQUIREMENTS DEFINED?
BSI PD 8010-1 Pipeline systems - Part 1 Code of Practice, Steel pipelines on land	United Kingdom	Yes	No
ASME B31.8 Gas transmission and distribution piping systems	United States	No	No
ASME B31.12 Hydrogen piping and pipelines	United States	Yes, 10-100% hydrogen	Yes
EN 14164 Petroleum and natural gas industries pipeline transportation systems	European Committee for Standardization (CEN)	Yes	No
NEN 3650/51	The Netherlands	Yes	No
ISO 13623 Petroleum and natural gas industries - pipeline transportation systems	International Organization for Standardization	Yes	No
IGEM/TD/1 Edition 6 steel pipelines for high pressure gas transmission supplement 2	United Kingdom	Yes	Yes
AS/NZS 2885.1 Pipelines gas and liquid petroleum, Part 1: Design and construction	Australia and New Zealand	No	No
Z662 Oil and gas pipeline systems	Canada	No	No
DVGW G 409, 2020 Conversion of high-pressure gas steel pipelines for a design pressure of more than 16 bar for transportation of hydrogen	Germany	Yes	Yes

## GUEST COLUMN

- Metering systems upgradations with different blends of Hydrogen
- Downstream customer requirements

In addition to the above technical challenges, the most important challenge will be cost economics as Green H<sub>2</sub> should be available at competitive pricing so as the operators get due benefit of this energy transition.

### Mitigation & Forward Path

The current technical codes and standards provide limited guidance on blending or repurposing of existing pipelines. Various industry standards govern the construction and operation of natural gas pipelines, along with local regulations. The codes that are currently in place (refer table below) provide limited guidance on the design and use of Hydrogen in existing pipelines.

The commonly cited design practices for Hydrogen pipelines are based on the ASME B31.12 standard. However, some ASME requirements are likely to be conservative as they are based on sour service (containing Hydrogen sulphide (H<sub>2</sub>S)) design guidance. These requirements are then challenging to achieve for existing natural gas transmission pipelines.

Hence to address the various challenges and use the existing networks, there have been efforts being put in by joint industry projects aimed to develop guidelines and standards which will enable safe transportation of the H<sub>2</sub> through pipelines. These guidelines will consider all the aspects ranging from metallurgy, testing, Pipeline Integrity Management etc. and enable smooth transition.

### Conclusion

Natural Gas when blended with green Hydrogen can not only decarbonize the gas chain, but also help in giving support to transport green Hydrogen by utilizing the current infrastructure. This will help green Hydrogen achieve its objective of being the fuel of choice and natural gas acting as a transition fuel. Nonetheless, much work is pending in this direction including testing, setting standards, and developing an eco-system for use of blended fuel.

As stated by our ex-President Shri APJ Abdul Kalam "Let us sacrifice our today so that our children can have a better tomorrow", this is the time where we all need to put our best foot forward so as to provide a better, cleaner, and self-dependent future for our next generation. ■

## Quarterly Energy Industry Publication for the Professionals from Energy Industry

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# Oil Gas & Power



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# Energy Efficiency through Energy Management Solutions

One of the most compelling conditions under which society in general and businesses in particular operate is the changing dynamics of energy. Not a day goes without some development in this area. In the world which is intertwined any geographical disturbance creates reactions across the energy domain.

Ever evolving technology and perpetual quest for clean, abundant source of energy are opening doors to continuously changing plant operating conditions. Further, set against the backdrop of global energy transformation, Sustainable Development Goals are being adopted by responsible industries globally pledging to “green” their businesses and reduce their energy footprint.

Every business is expected to navigate simultaneously these changes and calibrate their strategies while keeping a hawk’s eye on cost competitiveness too.

It is in this context Thermax has embarked upon “Energy Management Services” focussing specifically on reduction in Specific Energy Consumption (SEC) across various industrial sectors. Recognising customer’s need and the acknowledging their challenges in capital allocation across various initiatives, Thermax offers flexible business models to ensure that energy optimisation opportunities are not handicapped by operational exigencies.

## The need for EMS

The demand for energy management solutions has surged globally due to several compelling factors:

- **Complex Setups:** Phased plant expansions necessitated incremental addition of equipment often lacking co-ordinated operations.
- **Fuel Price Fluctuations:** Rising fuel prices and reduced grid prices with increased raw material costs intensify the need to optimize captive power plant costs.

- **Part Load Running:** Fluctuating market demands force plants to operate at part load conditions, increasing power and utility costs.
- **Decarbonization:** Intense market competition propels corporations to focus on decarbonization.
- **Government Push:** Stringent regulations and policies mandate reductions in specific energy consumption and water consumption.
- **Industrial Heating Requirements:** While power can be met through Renewable sources and others, heat which constitutes over 50% of total energy requirement can’t be optimally met through RE electricity. It is thus imperative to adopt suitable solutions to weave renewable fuels into this simultaneously taking care of emissions and energy.



## End-to-End Energy Management Solutions for Chemical Industry

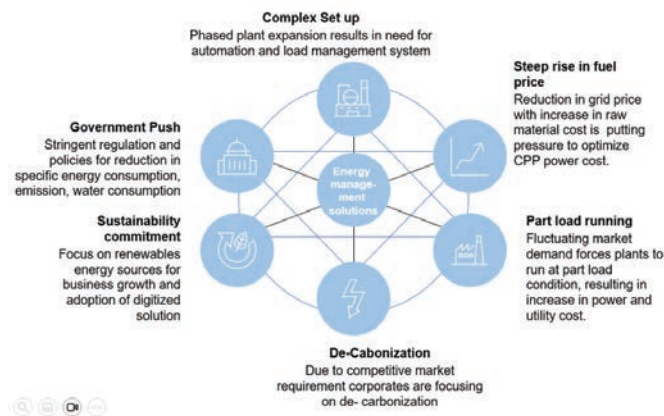
Thermax EMS stands as one-stop solution provider for end-to-end energy management, offering guaranteed savings for plants across diverse chemical industry segment. The journey begins with a meticulous plant assessment through walk through & digitized audits followed by baselining.

The solution modelling and implementation phase encompasses detailed gap analysis (Benchmark or Targeted SEC fig. vs actual SEC fig), selecting the best-

# FEATURES

fit solutions and seamless execution aiming to reduce the overall energy spend for clients and improve SEC (Specific Energy Consumption). Process concludes with asset management, showcasing tangible savings through demonstrations.

EMS solutions are product as well as technology agnostic. The best Product in the industry is used to achieve results. Energy Efficient solutions are offered beyond our existing product range, showcasing our ability to adapt and innovate beyond the conventional.



## Unlocking Efficiency: EMS themes for Chemical Industry

**Inhouse Captive / Cogeneration Power Plant:** EMS concentrates on station heat rate improvement by various levers like Regenerative Heater, Heat Pump, SCAPH, Boiler efficiency improvement, HTA addition, turbine upgradation and retrofit, Vacuum Improvisation etc to achieve a remarkable 3%-5% heat rate improvement.

**Process Heating:** EMS optimizes energy needs in utility generation aspects, like steam, hot water, and thermal oil. Feasibility of Heat Pump, Hybrid Heat Pump as well as chiller heat pump, for Boiler feed water as well as few hot water applications in process, ensuring fuel consumption reduction. The application of flue gas heat recovery, condensing economizers, fuel shift studies, exploration of alternate fuels, and the integration of microturbines against Pressure Reducing Stations further exemplify the energy efficiency in the process heating domain.

**In the Process Cooling & HVAC:** EMS concentrates on increasing the process cooling efficiency through the applications such as Closed Loop Cooling Towers, Adiabatic Coolers and Evaporative Condensers taking advantage of ambient conditions and ensures optimal

equipment performance, upgradation of refrigeration plants with lower GWP/ natural refrigerants. Basis commercial feasibility changing over from VAM to Compression cycle or vice versa. Providing IAC (Inlet air cooling) for ISO rated compressors as debottlenecking activity.

**Within the domain of Compressed Air:** EMS concentrates on heat recovery in multistage compressors unit, interstage cooling, centralisation vs decentralisation approach, ring main system, unique magnetic bearing-based compressors, or blowers as replacement to old non energy efficient setup.

**Within the domain of electrical systems:** EMS advocates the strategic replacement of inefficient IE1 & IE2 non flameproof continuous duty motors with higher efficiency IE4/IE5 motors. This transition, within the 0.75 kW to 75 kW capacity range, effectively addresses concerns regarding initial costs and ongoing expenses while maintaining product quality. Additionally, the implementation of a Coordinated Master Control System stands out as a pivotal strategy, ensuring seamless integration and control for multiple utility assets to function basis the plant load fluctuations. Whether ever possible we offer ORC based power generation under ESCO offering.

Debottlenecking of Process/equipment for higher Productivity: through right operating parameters along-with right selection of the utility generation equipment we have witnessed major productivity gain in the process / sub sections of process. CLCT, Heat Pump & redesigning the chilled water operating parameters has given us early success in achieving this debottlenecking. The change in operating parameters helped us to reduce batch cycle time and hence improved SEC. This unique application based solutioning lever is very effective for entire chemical industries and have very quick returns as well.

Overall Heat & Mass Balance: Through unique Pinch technology and right product selections we can improve the internal process heat recovery and reduce SEC of the Plant.

## Data based Approach: The Digital Revolution

As the saying goes "In God we trust, for everything else we need Data", EMS embodies this principle while approaching industrial solutions.



Establishment of a clear baseline data, coupled with measurement and verification, forming the digital plant framework solution offers insights into operation of plant along with proportionate utility consumption. This integration of utility data and Overall Equipment Effectiveness (OEE) in processes forms the base for our solutions, strategically aligned with Key Performance Indicators (KPIs). This helps in targeted achievements, including specific energy consumption reduction, enhanced productivity, cycle time reduction, waste reduction, consistent quality, forecasting, benchmarking, golden batch and real-time comparisons with actual ongoing operation's data.



Data driven interventions often results in increased plant availability (>99,8%), reduced SEC (2~5%) and reduction in operational manpower (~10%)

The impact of digital technology, when brought to scale, is profound. According to estimates, scaling digital technologies could slash emissions by up to 20% by 2050 in the highest-emitting sectors, including Chemical Plants. EMS leverages digital platforms to monitor real-time utility and process performance data, utilizing Artificial Intelligence (AI) and Machine Learning (ML) solutions for informed decision-making.

## Conclusion

### Paving the Future of Energy Management

In the evolving energy management landscape, Thermax's EMS solutions emerge as right Energy Partner through its focus on SEC reduction, Productivity & digital solution towards OEE.

EMS, as a strategic partner, commits to delivering end-to-end solutions. From plant performance assessments to implementing efficiency improvements and utility retrofits, our services aim to curtail overall energy expenditures and improve Specific Energy Consumption (SEC) figures.

Anchored in a business model driven by tangible savings and backed by our experience in utilities for over half a century, these solutions empower clients to meet decarbonization and sustainability targets while achieving notable SEC reductions. This commitment extends across diverse business models, including CAPEX, ESCO (Pay as you Save), and SaaS-based digital solutions, ensuring sustainable and efficient future. ■

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## Technologies for Increasing Resilience of Pipeline Infrastructure

Pipelines are the preferred choice for transport for Oil & Gas and Chemicals. The total Pipeline laid across the world has crossed more than 2.2 million kilometers, almost 6 times the distance between earth and moon. As per different market analysis groups, Pipeline infrastructure may grow at 6-7% year-on-year in the next 10 years. Pipeline transport is not only economical but also environmentally friendly compared to other modes of transport. However, Pipeline infrastructure is capital intensive, requires time to set up, and needs to be maintained properly; there are dividing opinions regarding the safety aspect when compared to other modes of transport. Day by day Technology is evolving to address the various challenges faced by Pipeline industry and helping to make the infrastructure resilient.

**T**he history of transport has been replete with technological innovations. Humans have transformed transport coming a long way since 3500BC when single wheel trolley was first invented. Evolution of technology have helped to find better ways to transport goods by road and rail on land, and ship on water ways, to pipelines for both land and water. Today Pipelines have become one of the most important ways to transport be it on land or in water. Technology have helped Pipelines connect cities, countries and even continents seamlessly.

### Phases of Pipeline infrastructure

Pipeline infrastructure creation and operation may be divided broadly into the following phases:

- Planning and Design
- Construction
- Operation and monitoring

Let us look at few challenges in these phases and different technologies to tackle these.

### Planning & Design

Planning phase is crucial to decide the optimum route and capacity based on capital requirement, constructional constraints, safety, reliability, maintainability, and operability. Designers face various challenges attributed

mainly related to the terrain, soil condition, water table, etc. Accurate data regarding the Geotechnical features help in predicting the Pipeline environment precisely like the Soil Properties, Static Loads, Live/Dynamic Loads, Buoyancy, thermal conditions, and Geotechnical hazards (like seismic activity, slope failures, volcanic hazards, ground movements, etc.). Technological advancements in big data, computing capabilities, and analytics are helping to predict precisely thereby reducing the unknowns and helps in optimizing the design.

Scientists are continuously working on the Material of Construction both on the primary material and on the coating material. Development of primary materials of construction has not been very significant in last few decades compared to development in coating material side. Advanced coating materials are being developed for easy and reliable application. Also, few developers are taking trial with self-healing coatings. In recent times internally coated pipelines have also found significant use in pipelines to tackle internal corrosion. However, recoating the internal surface, on welding location, with consistency and reliability has remained a challenge, posing a risk of accelerated corrosion on welding areas of the internally coated pipelines.

### Construction

Pipelines pass through all around the Globe be it on land or inside water bodies and the variety of location pose unique challenges related to execution and quality control.

## Quality control and Quality assurance Technologies in Pipeline Industry

- X-Ray Fluorescence (XRF)
- Optical Emission Spectrometry (OES)
- Phased Array Ultrasonic Testing (PAUT)

Horizontal Directional Drilling (HDD) has become a game changer to tackle difficult terrains like river crossings, mountain terrains, etc. The HDD industry has become highly competitive with developments to increase drilling range (length and diameter), handle diverse soil conditions, and reduce cost. In recent times successful HDD for more than 4kms stretch has been possible due to technological advancements.

Deployment of automated robotic welding has seen increase in the Pipeline construction during the last decade. This helps to improve productivity and consistency of welding during pipeline construction and can be deployed in difficult conditions.

Quality control and Quality assurance are important for the pipeline industry in regard to base material, welding, and coating. X-Ray Fluorescence (XRF) and Optical Emission Spectrometry (OES) technology are being used successfully and extensively for Positive Material Identification by NDT at site by analyzing chemical composition. Ultrasonic techniques have advanced exponentially in last few decades for Weld Quality identification. Phased Array Ultrasonic Testing (PAUT) is fast becoming the preferred choice because of safety, speed, consistency, and economy of scale. Digital Radiography is also developing fast to become economical and safer.

### Operation and monitoring

Pipelines are susceptible to different failure/deterioration modes because of the environment and the internal fluid. Also, the pipelines may get physically damaged due to unwanted human activity or natural calamity. Monitoring the pipeline during operation phase against these threats becomes crucial for the integrity and safety of the pipeline. Monitoring pipeline networks becomes challenging because of the vastness of their spread and most of them being underground or submerged in water.

Cathodic protection systems (CP system) have been used since long time to protect the pipelines from outside corrosive environment. Monitoring CP system has remained challenge in remote areas till the development of wireless and GPS technology. These are being used extensively for CP system monitoring and alarm triggering now a days. Thanks to the development of affordable renewable energy technology Impressed current CP systems can be used even at remote locations.

Fiber Optic (FO) technology has proved to be a game changer to detect leakages and other physical interference. These systems are versatile and may be used on a buried or unburied pipeline. The FO system can be deployed on large spans of pipeline looking for vibration and temperature changes. These are preferred choices for designers owing to low energy demand and accuracy of detection. Coupled with wireless and GPS technology they are fast becoming an integral part of all pipeline networks.

Intelligent pigging systems coupled with a variety of probes and sensors are well capable of detecting and measure corrosion, metal loss, cracks, dents, deformations, etc. Modern intelligent or "smart" pigs are highly sophisticated instruments with cutting edge electronics and sensors to collect various forms of data during their trip through the pipeline. Smart pigs use nondestructive examination techniques such as ultrasonic testing, magnetic flux leakage testing, etc. for inspection independently and simultaneously with cleaning activity.

There are pipelines without pigging provision making internal inspection nearly impossible. Wireless Robotic inspection have come to rescue at many places where pigging is not an option. Capability with respect to span and sizes are increasing day by day. Long Range Ultrasonic Thickness (LRUT) technology is also fast becoming affordable for deployment in buried pipelines to scan a section of interest. Specialized UT sensors

## Monitoring Technologies in Pipeline Industry

- Cathodic Protection (CP) Systems
- Fiber Optic (FO) Technology
- Smart Pigs
- Long Range Ultrasonic Thickness (LRUT) technology

## FEATURES

are also available for permanent installation on pipeline with the lead coming outside of the external coating or insulation.

It is important to record and analyze the vast amount of data coming both in real time and in batches. Advancements related to data warehousing and computational capabilities are helping companies on both fronts. Big Data analysis and advancement in analytics is helping pipeline industry to not only monitor in real time but also predict any abnormal situations.

### Conclusion

The pipeline industry is leveraging available technologies to reduce capital cost and improve operating capabilities by monitoring conditions in real time. Advanced analytics coupled with cutting edge electronics and sensor are helping the industry predict deterioration in pipeline infrastructure. Pipelines are ideal candidates to have digital twins with all the technology around. Close collaboration between pipeline industry and technology developers for specific applications will accelerate the evolution helping the pipeline industry increase safety, reliability, and economics. ■



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## A synergy of Blue Hydrogen and LNG Regasification Plant : A Novel Approach

*Due to climate change, the recent natural devastations occurring throughout the globe is the utmost prioritized issue to combat by finding novel solutions. Fossil fuels are sources for acclimate change that needs to be curtailed up to a maximum extent. Replacing complete fossil fuels with green technologies in the near term is very challenging and it's also difficult to predict up to what extent this replacement is possible. However, integration of different processes and increasing efficiency of processes can reduce energy consumption and hence fossil fuel consumption.*

**P**roducing Blue H<sub>2</sub> from Syngas efficiently is indeed a costly affair. This is where Synergy of Blue H<sub>2</sub> & LNG Regasification plays a pivotal role in achieving this target in a cost-effective manner. The LNG regasification terminals are one of the major sources of natural gas supply for natural gas importing countries. These terminals have a considerable amount of unutilized cold energy that gets lost into the atmosphere while converting LNG to Regasified Natural gas. This source of cold energy can rather be utilized in a better way for Liquefying CO<sub>2</sub> from Syngas. The liquefied CO<sub>2</sub> can then be further disposed off in identified underground CO<sub>2</sub> storage reservoirs or can also be sold to liquid CO<sub>2</sub> consumers.

Installation of SMR based Hydrogen Generation units near the LNG plants is not only advantageous in producing Blue H<sub>2</sub> effectively utilizing LNG plant cold energy, but also provides low carbon Hydrogen for consumers by directly selling Blue hydrogen as well as by using the Hydrogen for blending with natural gas at the source i.e. at the gas terminal itself.

Climate change: The emission levels are more than 49% higher than in the preindustrial area. The increased greenhouse gas emission is responsible for Global warming and climate change. Climate change is now a reality and it is impacting our lives. The primary routes to mitigate climate change are

- a. Increase efficiency, and minimize loss of energy.

Both of these actions will reduce the consumption of fossil fuel

- b. CO<sub>2</sub> capture and Utilization or Storage.
- c. Use of alternate sources of energy like wind, Solar, Biomass etc

LNG: Liquefied Natural Gas is the liquefied form of Natural gas which is predominantly methane. Natural gas is liquefied for ease of transport from gas-rich countries. Huge volumes of gas are transported in the form of LNG and this LNG is again regasified to inject into the nation's gas distribution network.

At LNG regasification terminal, LNG is unloaded from LNG carrier ships to LNG storage tanks. The LNG from LNG storage tanks is pumped to LNG vaporizers where it is vaporized from ~ -160°C to the pipeline gas temperature.

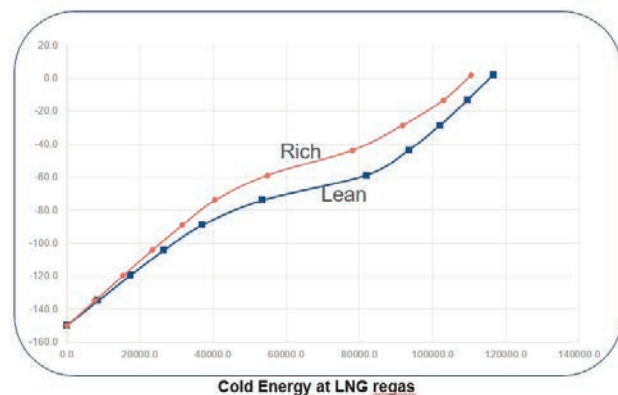


Figure 2: Cold Energy potential of LNG Regas Terminal

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India imported 24 MT of LNG in 2020. The cold energy available at different temperature levels for a typical 5 MMTPA LNG regas terminal is shown in Figure 2. This figure shows cryogenic heat of more than 60 MW is available, which can be utilized for any cryogenic applications like CO<sub>2</sub> liquefaction etc. In most of the LNG Regasification plants, Atmospheric air or seawater is used for the vaporization of LNG as heating media, where this cold energy is wasted, as these are the most cost-effective options.

Another important aspect of LNG terminals is that these are major sources of Natural Gas gas supply to the gas grid. The decarbonization activities when started at the source itself then it can help in decarbonizing downstream sector also.

Considering all challenges of Hydrogen blending with 15% of NG are mitigated in near future, and H<sub>2</sub> gas blending is required to be done, for 5 MMTPA LNG plant the hydrogen needed for 15% blending will be 110 KTPA Hydrogen production.

Hydrogen Generation Plant : Hydrogen Generation plants are used for hydrogen production by Steam methane reforming of Natural Gas. These kinds of hydrogen plants are provided in all the Oil refineries for hydrogen production. A typical scheme of hydrogen generation using Steam Methane Reforming process is as below.

In the SMR Process reforming reaction of Natural gas with steam occurs and it produced Synthesis

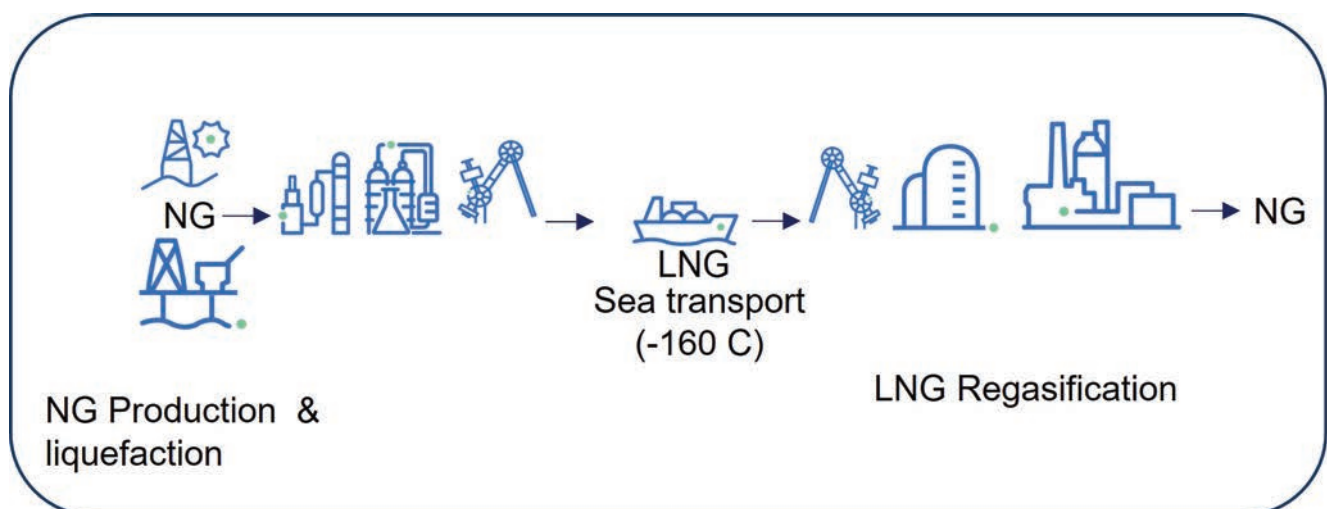


Figure 1 : Typical LNG supply chain

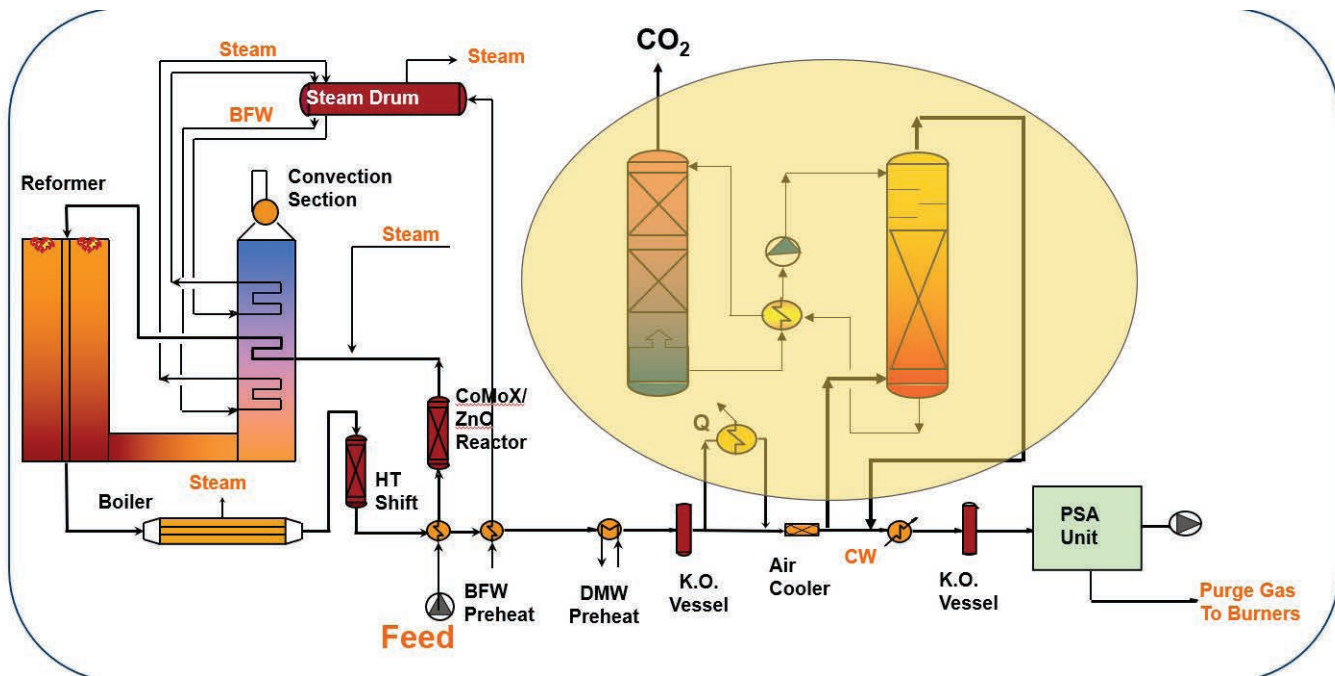


Figure 3 : SMR Hydrogen Generation plant with CO<sub>2</sub> capture

gas which is mixture of Hydrogen, Carbon Monoxide , Carbon dioxide and steam. This synthesis gas is further processed in the Shift reactor to produce more hydrogen by water gas shift reaction. Conventionally this Syngas is sent Pressure Swing Absorption (PSA) for purification for removing impurities like CO , CO<sub>2</sub> and high purity Hydrogen is produced. However, when CO<sub>2</sub> capture is intended additional step of CO<sub>2</sub> capture is added upstream of PSA for removal of CO<sub>2</sub> at high pressure, which is shown as encircled in Figure 3.

The captured CO<sub>2</sub> is fed to further treatment and utilization. Where the utilization is not possible the CO<sub>2</sub> liquefaction and transport for sequestration is done , while implementing CCUS.

It shall be noted that there are two sources of CO<sub>2</sub> in SMR hydrogen. The major part of CO<sub>2</sub> is from the process of hydrogen production as discussed above and the second part is CO<sub>2</sub> produced from the combustion of fuel. The process CO<sub>2</sub> is more than 70% of the total CO<sub>2</sub> produced from SMR hydrogen plant and easier to capture compared to the combustion CO<sub>2</sub>. The total CO<sub>2</sub> produced is about 9 to 10 kg per kg of Hydrogen production.

The Hydrogen production using fossil fuel but that avoids CO<sub>2</sub> emissions is called "Blue Hydrogen". Blue hydrogen is a low hanging fruit for the low emission cleaner fuel Hydrogen. Also, now with advancements in technologies it is possible to produce hydrogen using

Natural gas feed with less than 0.5 Ton CO<sub>2</sub> per Ton of Hydrogen production.

CO<sub>2</sub> capture have been a matured technology and is already proven in the industry. The challenges are coming for CO<sub>2</sub> evacuation i.e. CO<sub>2</sub> utilization and/or storage.

CO<sub>2</sub> Utilization and/or: CO<sub>2</sub> utilization i.e. producing valuable products from CO<sub>2</sub> is most desirable, however, it might not be economical all the time. CO<sub>2</sub> can be converted to valuable liquids like synthetic fuels petrol, Methanol, urea, synthetic natural gas, Olefins etc. However, these need considerable CAPEX and OPEX. Along with the utilization CO<sub>2</sub>, injection into the underground reservoirs is also being explored. The underground storage can be depleted oil and gas reserves, deep aquifers, or underground coal beds.

The CO<sub>2</sub> needs to be transported to the right consumer in an economical way. Liquefying CO<sub>2</sub> to reduce its volume so that higher amount of CO<sub>2</sub> can be transported using CO<sub>2</sub> carrying ships from marine ports to other marine port where CO<sub>2</sub> users like fertilizer plants can utilize or CO<sub>2</sub> can be transported by ships to the deep CO<sub>2</sub> underground reserves for CO<sub>2</sub> sequestration purposes.

Integration of LNG cold duty and CO<sub>2</sub> liquefaction: The cold energy available in the LNG plant is more than sufficient for the liquefaction of CO<sub>2</sub> produced from the 110 KTPA Hydrogen production plant mentioned in the

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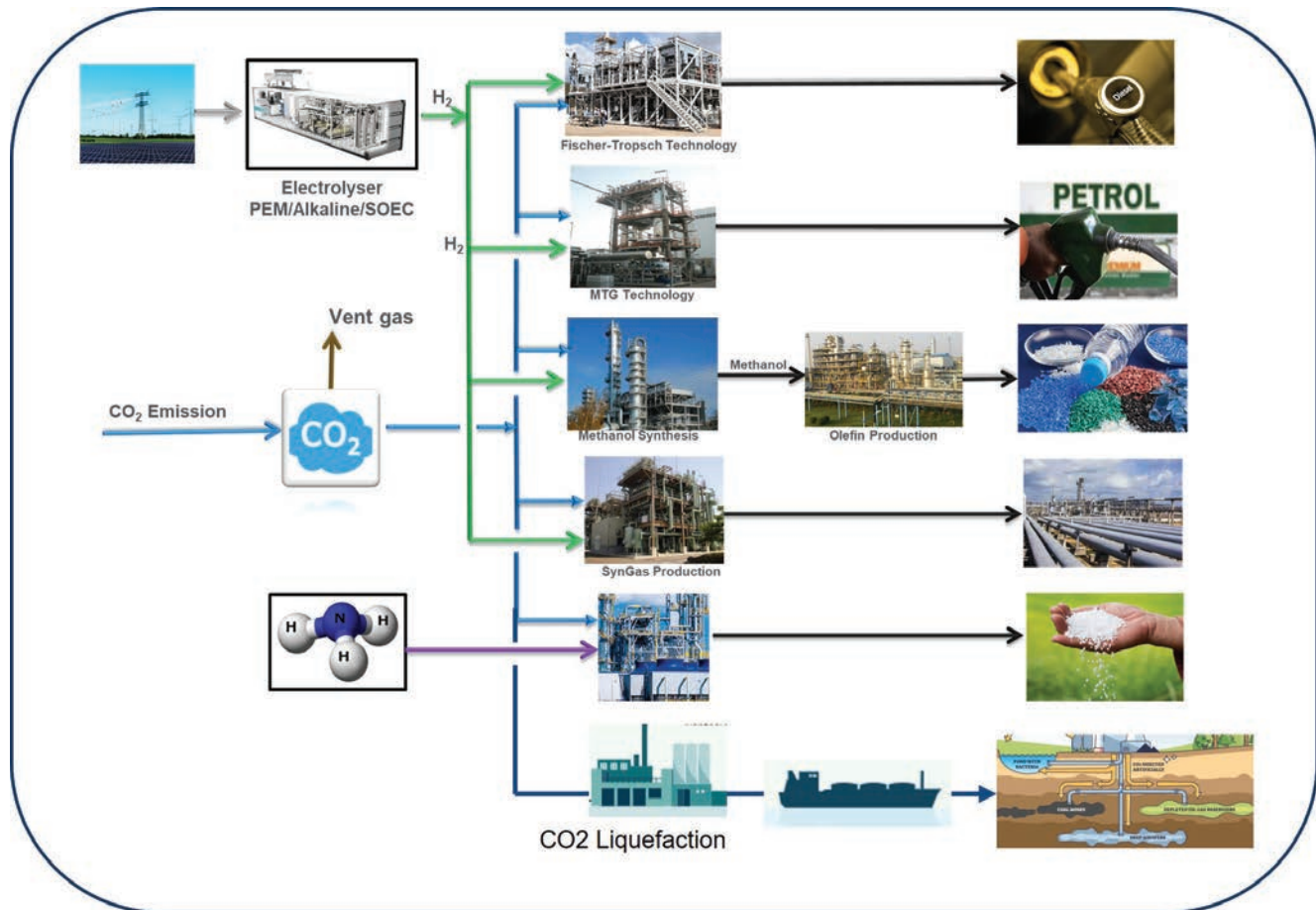


Figure 4 : CO<sub>2</sub> Utilization and Storage routes

above section. This hydrogen plant can consume about 10% of the available cooling duty for CO<sub>2</sub> liquefaction. Thus such integration not only saves power needed for CO<sub>2</sub> transport as well as it increases the efficiency of the LNG regasification unit.

With the government planning about CO<sub>2</sub> clusters and hubs in the future, if these CO<sub>2</sub> systems are integrated with LNG liquefaction plants, the cold energy of LNG can be efficiently used. This will serve a dual purpose one is saving the CO<sub>2</sub> refrigeration for CO<sub>2</sub> liquefaction and, the other is increasing the efficiency of LNG Regasification and hence reducing CO<sub>2</sub> emissions.

### Conclusion

LNG Regas plant has a considerable amount of cold energy which can be utilized for CO<sub>2</sub> liquefaction for facilitating the transport of CO<sub>2</sub> efficiently. When SMR Based Hydrogen unit is installed in the vicinity of the LNG Regas plant, cold energy integration with the LNG plant reduces the cost of 'Blue hydrogen.' This Blue Hydrogen can be used for H<sub>2</sub> blending in

pipelines or can be sold to nearby customers like steel-making plants. This approach not only contributes to the reduction of CO<sub>2</sub> emission from LNG plants due to increased efficiency but also reduced CO<sub>2</sub> emissions of the CO<sub>2</sub> liquefaction process. ■

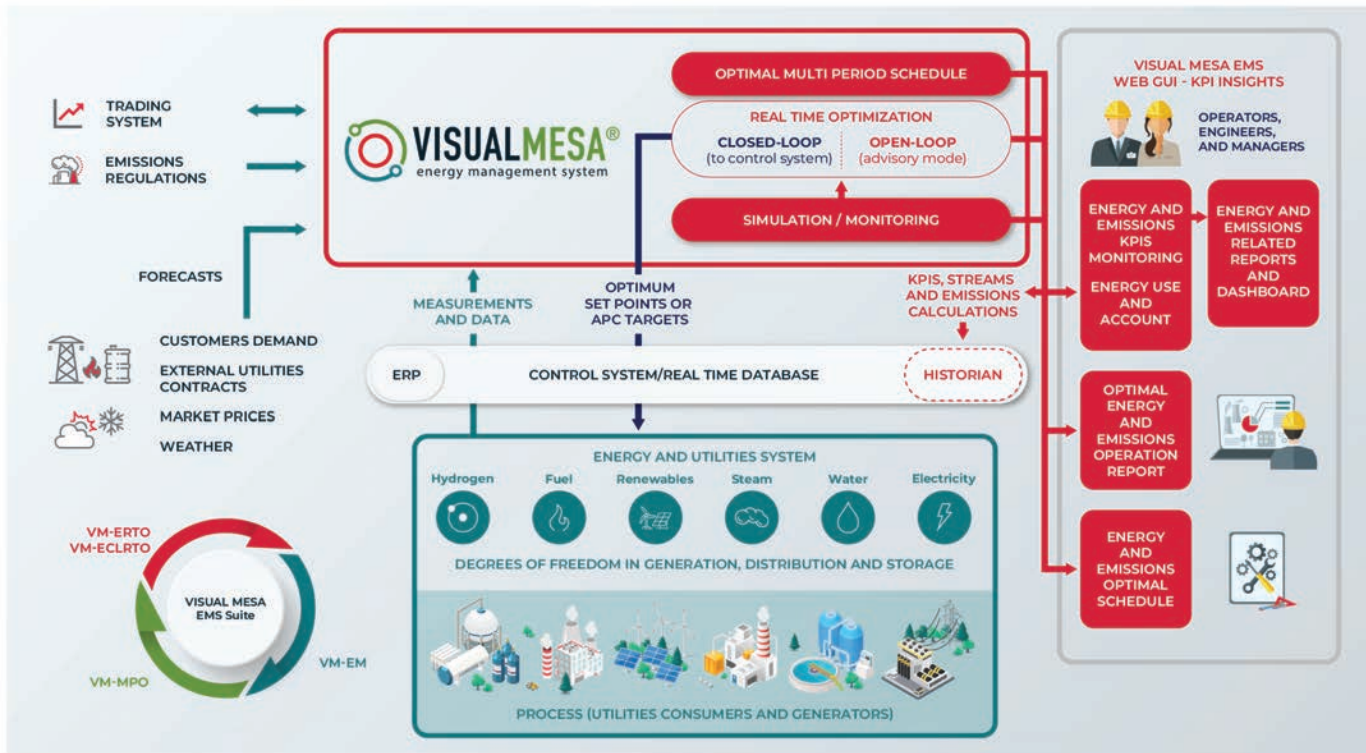


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## KBC Launches Visual MESA Greenhouse Gas Emissions Management Software



The figure above shows the overall Visual MESA EMS Applications working and interacting together

KBC (A Yokogawa Company) announces the launch of a revolutionary emissions management solution, Visual MESA® Greenhouse Gas Emissions Management for industrial process plants. Whether cloud-based or on-site, this technology integrates the emission management workflow across the entire plant to simplify reporting and reduce Scopes 1 and 2 emissions.

Visual MESA Greenhouse Gas Emissions Management software uses real-time emissions data to pinpoint critical operational areas that can improve the accuracy and frequency of greenhouse gas emissions (GHG) reporting. This information enables the plant to take strategic decarbonization actions, minimize emissions, and achieve sustainability targets.

<https://www.kbc.global/energy-transition/technology/visual-mesa-energy-management-system/>

### Quarterly Energy Industry Publication for the Professionals from Energy Industry



International Integrated **ENERGY** Special Issue

## Oil Gas & Power

To read OGP Issues **Digitally** scan QR Code



<https://jasubhaimedia.com/category/ogp/>

### Elliott Steam Turbine Generators



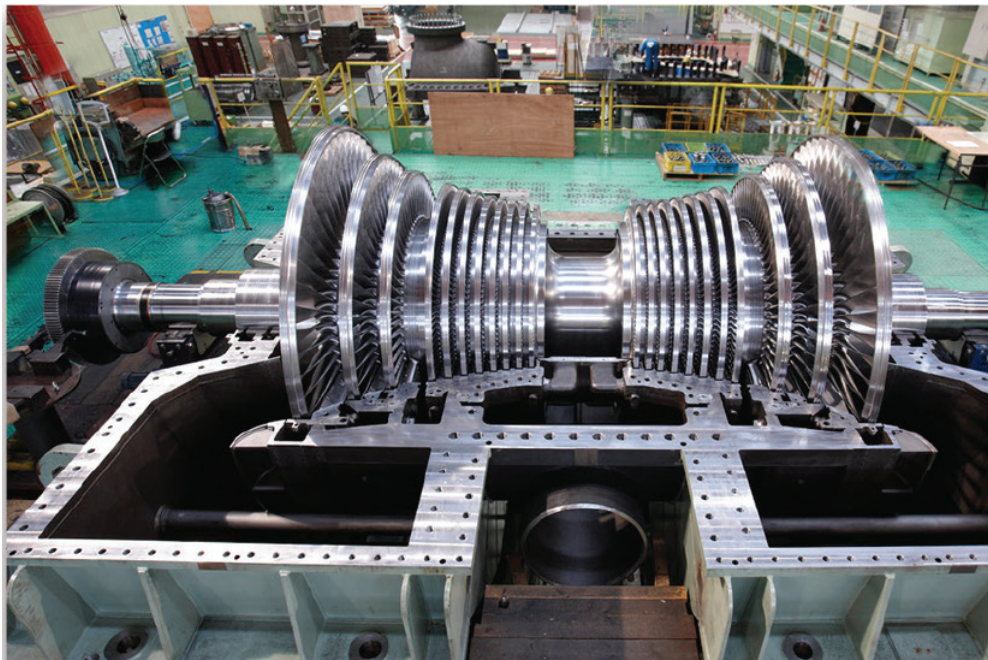
Elliott STGs provide the features and functionality that ensure accurate operation and control, simple, low-cost maintenance, and years of reliable service. Elliott STG Features: Power range from 50 kW to 50 MW; Synchronous or induction generator options; Standardized designs up to 3 MW for lower cost and faster delivery; Global engineering support from proposal through commissioning.

Elliott STGs are a complete package of: Steam turbine, Speed-reducing gear, Generator Integrated control

system, Lubricating system & Baseplate. Services offered are Installation and commissioning, Maintenance and operator training & Long-term maintenance programs.

<https://www.elliott-turbo.com/TurbineGenerators>

### Small-Medium Size Steam Turbines by Fuji Electric



Fuji Electric provides single cylinder and two-cylinder condensing steam turbines (40 MW to 300 MW), designed for small and medium scale power plants with reheat or non-reheat cycle.

The small-medium size steam turbines are well suited for a variety of applications such as fossil fuel power, biomass energy, solar thermal energy, etc. Small-Medium size steam turbine ensure a high efficiency and reliability for all types of thermal power plants.

Turbine Type: Condensing turbine, Single extraction

condensing turbine, Double extraction condensing turbine & Admission condensing turbine with Speed as 3,000 and 3600 rpm.

<https://americas.fujielectric.com/products/power-generation/small-medium-size-steam-turbine/>

# ANNOUNCING - 2026

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## World Meet of the **CHEMICALS, PETROCHEMICALS,** **BIOPHARMA & PROCESS** Industry in India



### 32<sup>nd</sup> International Exhibition and Conferences February-March 2026

Venue: Bombay Exhibition Center, Goregaon (East), Mumbai, India

#### Concurrent Events



#### Scope for ChemTECH World Expo 2026

- Plant Machinery & Industrial Consumables
- Engineering Consultants
- OEMs for Chemicals & Pharmaceutical Processing Equipment
- Metals & Metallurgy
- Bioprocessing Equipment
- Construction Services Providers
- Plant Maintenance Services Providers
- Logistics & Supply Chain Solutions Providers
- Instrumentation & Process Control
- Industry Automation (Process & Factory)
- Systems Integration & ERP Solutions Providers
- Water & Waste Water Treatment Consultants
- Environment Solutions Providers
- Waste Management Consultants
- Financial Institutions
- Fire & Safety Solutions Providers
- Material Handling Solutions
- Certification Bodies
- Welding Solutions
- Quality Health & Environment Solutions
- Analytical & Laboratory
- Packaging Materials, Machinery & Systems
- Business Consultants

#### Scope for Specialty Chemicals World Expo 2026

- Agrochemicals Intermediates
- Adhesives & Sealants
- Agrochemicals & Crop Protection
- Bulk Drugs & Intermediates
- Enzymes
- Colorants, Dyes & Pigments
- Cosmetics & Personal Care Ingredients
- Hygiene & Cleaning Chemicals
- Laboratory Chemicals
- Surfactants
- Water Treatment Chemicals
- Catalysts
- Electronic Chemicals
- Flavours & Fragrances
- Contract Manufacturers

#### Scope for Biopharma World Expo 2026

- Materials Processing
- Pharma Machinery
- Pharma Ingredients
- Plant Engineering, Process Plants & Equipment
- Laboratory & Analytical Solutions
- Process Measurement & Inspection
- Sterilization & Clean Room Solutions
- Biopharma R&D And Manufacturing
- IT Solutions
- Water & Waste Treatment Solutions

#### FACT & FIGURES 2024



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# Oil Gas & Power

World Expo 2025

5-7 March 2025

Venue: Hall 4, Bombay Exhibition Center, Goregaon (East), Mumbai, India



## Leaders of Oil Gas & Power World Expo 2025



**Mr. Pankaj Kumar**  
Director (Production)  
ONGC Limited & Chairman  
Oil & Gas World Expo 2025



**Mr. Rajeev Kumar Singhal**  
Director Business Development  
GAIL Ltd & Chairman  
Gas World Tech Expo 2025



**Mr. N Senthil Kumar**  
Director (Pipelines)  
Indian Oil Corporation &  
Chairman, Surface Engineering  
Coating & Corrosion Control 2025



**Mr. K. Shanmugha Sundaram**  
Director Projects  
NTPC Ltd. & Chairman,  
Power World Expo 2025



**Mr. Ranjay Sharan**  
Director Projects  
Nuclear Power Corporation Ltd &  
Chairman, Nuclear Energy World  
Expo 2025



**Mr. U K Bhattacharya**  
Former Director Projects,  
NTPC Ltd. & Patron,  
Power World Expo 2025



**Mr. R K Srivastava**  
Former Director Exploration & Addl  
Charge- CMD, ONGC Limited &  
Convener  
Oil & Gas World Expo 2025



**Mr. Rajeev Mathur**  
Director, Haryana City Group &  
Convener  
Gas World Tech Expo 2025

## EXHIBITOR GROUPS

### OIL & GAS

- Exploration & Production
- Oil Field Services
- Geographical and Seismic Surveys
- Drilling
- Sub Sea
- Transportation Storage & Infrastructure

### NATURAL GAS & LNG

- Natural Gas Marketing
- City Gas Distribution
- Transportation & Storage Infrastructure

### REFINING

- Oil Refining
- Marketing
- Petrochemicals Manufacturing
- Technology Licensors

### POWER

- Power Generation
- Technology Licensors

- Power Transmission & Distribution
- Infrastructure

### CLEAN ENERGY

- Renewables – Solar Wind & Hydro
- Hydrogen
- Biofuels
- Methanol
- Nuclear

### ENGINEERING SERVICES

- EPC services
- Project Management Consultants
- Engineering Services
- Construction

### SHIPPING MARINE & PORTS

- Shipping Services
- Ports
- Inland water ways
- Transportation Warehousing
- Supply Chain Management

- Material Handling & Supply Chain Management
- Logistics Services

### CORROSION CONTROL

- Surface Engineering
- New metallurgies
- Industrial Coatings
- Corrosion Control Technologies & Services

### PROCESS PLANTS & PLANT EQUIPMENT

- Distillation Columns
- Reactors
- Heat Exchangers, Cooling Towers & Boilers
- Storage Tanks
- Compressors, Pumps & Valves
- Plant instrumentation & automation
- IT Infrastructure & Digital Technologies

## CONCURRENT CONFERENCES

- Oil & Gas
- Natural Gas & LNG
- Refining & Petrochemicals
- Power & Coal
- Nuclear Energy
- Shipping, Marine & Ports
- Surface Engineering Coating & Corrosion Control
- Student Outreach Program

## FACTS AND FIGURES OIL GAS & POWER 2023



**3**  
DAY  
TRADESHOW



**201**  
EXHIBITORS &  
PARTNERS



**8897**  
VISITORS FROM  
28 COUNTRIES



**192**  
VIP GUESTS



**5**  
CONFERENCES



**853**  
DELEGATES



**147**  
SPEAKERS



**670**  
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