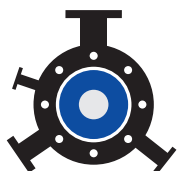


# CHEMICAL ENGINEERING WORLD

www.jasubhaimedia.com



**PTFE LINED SYSTEMS**  
VALVES | PIPES | FITTINGS | COATINGS

www.ptfeindia.com

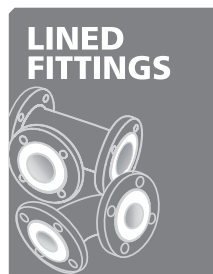
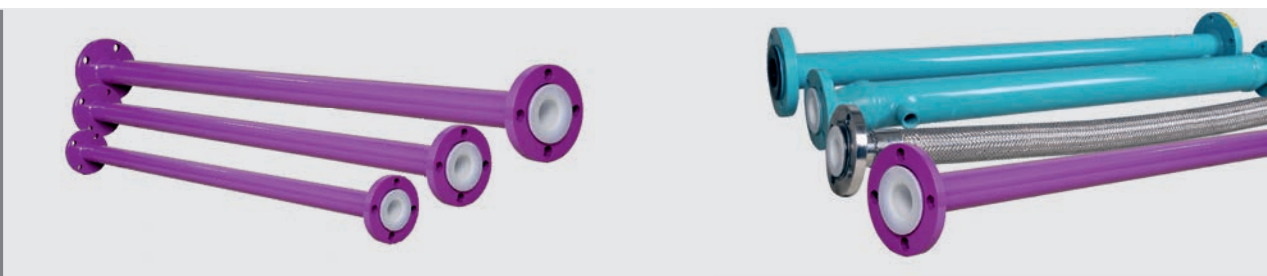
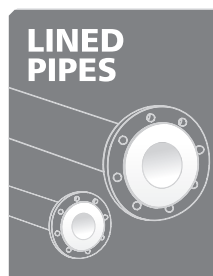
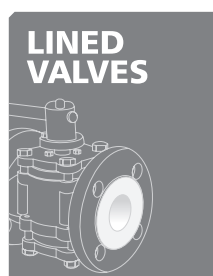
| PTFE | PFA | FEP | ETFE  
| PVDF | ECTFE | PP | HDPE



**APPLICATOR**

a Global Trusted Brand

**YOUR SUSTAINABLE BUSINESS PARTNER**  
IN FLUOROPOLYMER LINED PRODUCTS SINCE 1994



Material options available on customer request from world renowned fluoropolymer suppliers



**HI-TECH APPLICATOR**

1102-B, Phase-3, G.I.D.C. Ind. Estate, Vatva, Ahmedabad - 382 445, Gujarat - India.  
+91 79 4030 7621 / 2583 3040 / 2589 1740 | +91 97370 46491 | hitech@ptfeindia.com





# A — WORLD — LEADER — IN — REFINERY — RESIDUE — — SOLIDIFICATION — AND — — HANDLING — SOLUTIONS —

Granulation, solidification and handling systems for bitumen, asphaltene/pitch and coal slurry.

- Rotoform granulation – direct from the melt.
- Premium quality granules of uniform shape and stability.
- Flaking of asphaltene/pitch.
- Automatic block forming and packing systems for bitumen.
- Downstream storage and handling.

[ipco.com/bitumen](http://ipco.com/bitumen)

ipco



# CHEMICAL ENGINEERING WORLD

[www.jasubhaimedia.com](http://www.jasubhaimedia.com)

## Charting a Path to India's Thriving Chemical Industry

**Suresh Prabhu**

Hon'ble former Union Minister, Government of India,  
Chief Patron and Honorary Ambassador for  
Chemtech World Expo 2024



**ChemTECH**  
WORLD EXPO 2024

ChemTECH World Expo 2024  
March 4-7 2024  
Venue: Bombay Exhibition Center,  
Goregoan (East), Mumbai, India.

Supported by



**CHEMTECH  
FOUNDATION**  
1974-2024

Inspiring Intelligence...  
..Igniting Innovation





**sealmatic®**



# MECHANICAL SEALS

Oil & Gas  
Refinery  
Petrochemical  
Chemical  
Power

Fertiliser  
Pharmaceutical  
Paper  
Aerospace  
Marine

## Sealmatic India Ltd.

Bldg A, Indiplex IV, Survey No-12, Hissa No-9A,  
Village Ghodbunder, Shanti Vidya Nagri Road,  
Mira Road (E). Thane - 401104. India.

T : +91 22 50502700  
E : info@sealmaticindia.com



sealmaticindia.com



# India's Largest Processor of FLUOROPOLYMERS



Chemours Co FC LLC - Delaware appoints Horizon Polymer as **TEFLON®** Licensing Partner for India Under Trademark license agreement to promote and sell PTFE/PFA/FEP Lined Piping products using **TEFLON®** PTFE/PFA/FEP Fluoropolymer.

TEFLON and Teflon diamond brand logo are registered trademarks of The Chemours Company FC, LLC used under license by Horizon Polymer Engineering Pvt. Ltd.

## Horizon Polymer Eng Pvt. Ltd.:

204, Sumer Kendra, Pandurang Bhudkar Marg, Worli, Mumbai - 400018. India

Contact: +91 22 24965031-36 | Fax: +91 22 24961073

Email: [vp@horizonpolymers.com](mailto:vp@horizonpolymers.com)



**CHEMICAL ENGINEERING WORLD**  
**RNI REGISTRATION NO. 11403/66**

**CHAIRMAN**

Maulik Jasubhai Shah

**PUBLISHER & CEO**

Hemant K. Shetty

**EDITOR**

Mittravinda Ranjan

**CREATIVES**

Arun Parab

**GENERAL MANAGER SALES**

Prashant Koshti

Amit Bhalerao

**BRAND MANAGER**

Sudhanshu Nagar

**SALES**

Godfrey Lobo

Chandras M Amin

Yonack Pradeep

The Publishers and the Editors do not necessarily individually or collectively identify themselves with all the views expressed in this journal. All rights reserved. Reproduction in whole or in part is strictly prohibited without written permission from the Publishers.

Single Copy Price: ₹ 150/-,

Annual Subscription: ₹ 1620/-, Foreign: USD 180

**PLACE OF PUBLICATION**

**JASUBHAI MEDIA PVT. LTD.**

210, Taj Building, 3<sup>rd</sup> Floor, Dr. D. N. Road, Fort,  
Mumbai 400 001, Tel: +91-22-4037 3636

**Registered Office:** 26, Maker Chambers VI, 2nd Floor,  
Nariman Point, Mumbai 400 021, INDIA.

Tel.: 022-4037 3737 Fax: 022-2287 0502

**E-mail:** sales@jasubhai.com

Printed and published by Mr Hemant K. Shetty on behalf of  
Jasubhai Media Pvt. Ltd., 26, Maker Chamber VI, Nariman Point,  
Mumbai 400 021.

Printed at The Great Art Printers, 2 5, S A Brelvi Road,  
Fort, Mumbai 400 001.

Published from 3rd Floor, Taj Building, 210, Dr. D N Road,  
Fort, Mumbai 400 001.

Editor: Ms. Mittravinda Ranjan, 3rd Floor, Taj Building, 210,  
Dr. D N Road, Fort, Mumbai 400 001.

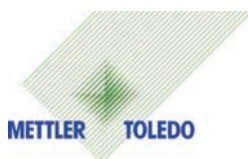
## AD INDEX

Aeron Composite Pvt Ltd .....	19
Dip-Flon Engineering & Co. ....	Inside - II
Dynamic Forge & Fittings (I) Pvt Ltd.....	17
Ferolite Jointings Ltd. ....	15
Hi-Tech Applicator .....	1
Horizon Polymer Engineering Pvt Ltd .....	5
HRS Process Systems Pvt. Ltd .....	9
IPCO Process & Belt Technology India Pvt Ltd .....	2
Kaf Seal Inc .....	23
Mettler Toledo .....	11
Mist Ressonance Engineering Pvt Ltd .....	7
Pesticides Manufacturers & Formulators Association of India .....	27
Sealmatic India Ltd. ....	4
Tapflo Fluid Handling India Pvt Ltd .....	13
UNP Polyvalves.....	21
VEGA India Level and Pressure Measurement Pvt. Ltd .....	25

## IMPACT FEATURE



**Need Valve Servicing? 66**



**Intrinsically Safe  
Weighing in Classified  
Hazardous Areas 67**

**NEWS 10**

**PROJECT UPDATES 68**

**PRODUCTS 71**



# Mist Ressonance Engineering Pvt. Ltd.



## LOUVER TYPE MIST COOLING SYSTEM

### A SUPERIOR ALTERNATIVE TO CONVENTIONAL COOLING TOWERS

MCS works with a green energy initiative & is the most sustainable system with Fan- less Design.

Non moving parts, Fin-fill less design/ choke-less design of nozzles makes MCS totally maintenance free.

Due to Fine Mist Creation, huge surface area is available for heat transfer & hence direct saving of 100% on Fan power is achieved.

Rugged structure with HDGI MOC & FRP casing, Saran3 PVC Nozzles, ensuring a life of 15 years plus.

Terrace Top design for space constraint.



"Assured Approach of 1°C to WBT "  
**Not a miracle, a reality!**

Over  
400  
installations

## INDUCED DRAFT MIST COOLING TOWER

### FILL LESS TECHNOLOGY



Approach to WBT of 3°C with temperature drop of 10°C.

IDMCT operates without Fills ensuring maintenance free operation for lifetime even for contaminated water application.

Due to Fine Mist Creation, huge surface area is available for heat transfer & hence direct saving of 30 to 50% on Fan power is achieved.

Rugged structure with Pultruded FRP / HDGI MOC with FRP casing & Stainless Steel 304 Nozzles, ensuring a life of 15 years plus.

IDMCT requires same or less area as compared to any conventional Induced Draft Cooling Tower.



# CONTENTS

## INTERVIEW

### Charting a Path to India's Thriving Chemical Industry 30



**Suresh Prabhu**

Hon'ble former Union Minister, Government of India,  
Chief Patron and Honorary Ambassador for  
Chemtech World Expo 2024

## GUEST COLUMN

### The Other Way Around: A Virtuous Circle to Decarbonize 35



**Prasad Chandragiri**

Head of Innovation and Strategy,  
Projects & Energy Solutions Business  
Thermax Ltd

### Applications for Artificial Intelligence in EPC Industry 38



**Rupchand Lohana**

Head of Central Digital SCM  
L&T Energy – Hydrocarbon

### Diversifying India's Natural Gas Infrastructure 42



**Satinder Pal Singh**

Chief Executive Officer  
Adani Total Pvt. Ltd. & Dhamra LNG Pvt. Ltd.

## FEATURES

### Power-to-X: Opportunities, Challenges and Global Adoption 46



**Mithu Saha**

General Manager - Energy Transition  
Worley

### Energy Efficient Refining Technologies 49



**Shyam kishore Choudhary**

AVP, Head – Process & Technology  
Technip Energies

### AI - accelerator to a greener future? 54



**Graham Faiz**

Head of Growth and Innovation -  
UK & Ireland, Energy Systems, DNV.

### How oil and gas firms are transforming their work models to manage market challenges 57



**Fernanda Martins**

Industry Director  
Energy and Emerging Markets  
AVEVA

### Optimize Flow Loop Processes to Significantly Improve Energy Efficiency 60



**Pieter Teesink**

Engineering Director  
Energy Advantage Program  
Flowserve Corporation

### Refinery-Petrochemical Integration: India 63



**Rohan Manjarekar**

Assistant Manager  
Burns & McDonnell Engineering India



**Kaivalya Save**

Assistant Chief Engineer  
Burns & McDonnell Engineering India





# SAVINGS & EFFICIENCY FOR FERTILIZER PLANTS

Our customers reap the reward of increased productivity by strengthening fertilizer production with Ecoflux\* heat exchangers. Call us today for efficiency consultation for your plant!

- Heating / Cooling of water
- Condensate Heat Recovery
- Co2 Cooler
- Air Cooler
- Natural Gas Heater
- Sulphuric Acid Cooler
- Vacuum condensate
- Ammonia Refrigeration Condenser
- High Pre. Hydrolyser Pre heater
- Reboiler
- Vaporizer
- Steam Generator

**HRS Process Systems Ltd.**  
201/202 Karan Selene, 851, Bhandarkar Institute Road,  
Pune 411 004, Maharashtra - India  
Ph.: +91-20-2566 3581/6604 7894 & 95 | [info@hrsasia.co.in](mailto:info@hrsasia.co.in)  
[www.hrsasia.co.in](http://www.hrsasia.co.in)



## India is encouraging flex-fuel vehicles to drive adoption of biofuels



Hardeep Singh Puri, Minister of Petroleum & Natural Gas and Housing & Urban Affairs

**New Delhi, India:** India with its vibrant entrepreneurial spirit and booming start-up ecosystem, has witnessed emergence of many unicorn start-ups that are reshaping our economy and markets, said Hardeep Singh Puri, Minister of Petroleum & Natural Gas and Housing & Urban Affairs. He said that India ranks 3rd globally in terms of the unicorn count and has over 100 unicorns with a combined valuation of USD 347 billion. The Minister was speaking at ENRich 2023, the 14th edition of the KPMG's Innovation and Energy Conclave.

Under the "Start-up India" initiative launched by Prime Minister Shri Narendra Modi, the Minister said that the

Ministry of Petroleum & Natural Gas had directed the Oil and Gas PSUs to facilitate/ create an innovative ecosystem and promote Start-ups in the fields such as IOT in Upstream/ Midstream/ Downstream operations, Digitalization of business processes, Green Fuels, Alternative Energy etc.

"The PSUs of Oil and Gas Sector have created startup funds aggregating to ₹ 405 crore. 232 startups have been funded by Oil and Gas PSUs with a disbursed value of ₹ 208 crore", he emphasized. The Minister recalled some examples of successful startups including Bandicoot, a robotic scavenger, developed by Genrobotic Innovations, who were provided grants, mentor support and specific technical assistance by BPCL under Project Ankur, to improve the working conditions of sanitary workers. Puri lauded Vasitars Private Limited-a technology-based company funded by IOCL that provides complete in-situ Composite Repair Solutions to all kind of damage scenarios in transmission pipelines by using Patent Registered innovation Nano Filler Reinforced Polymer Composite Wrap to Repair Corroded Pipelines. He said that this project holds the promise of revolutionizing pipeline repair in India.

Highlighting the significance of the theme of the KPMG's conclave- 'Growing with Less', the Minister said

## Anuj Jain takes over as Director (Finance) of Indian Oil



**Anuj Jain** has taken over as the Director (Finance) on the Board of Indian Oil Corporation (IndianOil). Prior to this appointment, he was serving as the Chief General Manager (Finance) at the Company's Refineries Headquarters. A Chartered Accountant, Jain brings with him a rich experience of over 27 years with the energy major, at its refinery & marketing locations and Corporate Office. His expertise spans functions like corporate finance, treasury & fund management, supply chain optimisation, pricing, shipping, and taxation, among others.

Jain has also helmed the finance function in Lanka IOC PLC., a subsidiary of IndianOil, and served as a Board Member and a member of the Audit Committee for Ceylon Petroleum Storage Terminals Limited (CPSTL), a key petroleum entity in Sri Lanka. Notably, Jain has been at the forefront of formulating pivotal business strategies, ensuring smooth transition in the evolving energy landscape.

IndianOil is a diversified, integrated energy major, ranked 94th in the Fortune-500 list for 2023. As India's largest refinery and fuel retailer, the Company has a vast network of over 60,000 plus customer touchpoints, bolstered by over 70.0 million metric tonnes per annum (MMTPA) of refining capacity and more than 19,000 Km. of cross-country energy pipelines. For the financial year 2022-23, IndianOil recorded revenue from operations amounting to ₹9,34,953 Crores and a net profit of ₹8,242 Crores.



## Ensure Reliable, Safe & Intelligent Drum-Filling Maximize Output by reducing Overfill



METTLER TOLEDO offers a complete line of liquid filling systems. Our new i-Series DFS are perfectly engineered to meet customers liquid filling needs in today's industrial environment. It is designed for Easy Operation, Reliable Results & Increase Productivity.

**Innovative solution for Harsh Industrial Applications offers  
advanced filling & State of Art Data Handling.**



Eco Single Drum Filling System



Multi Drum Filling System

Write to us  
at [sales.sales@mt.com](mailto:sales.sales@mt.com) or  
Call Toll Free at 1800 22 8884 / 1800 10 28460  
or visit us at [www.mt.com](http://www.mt.com)

**METTLER TOLEDO**

For More Information





that the theme perfectly synergizes with Indian ethos of living in harmony with our surrounding ecosystem. The Minister said that India's energy demand will continue to provide fuel for future economic growth, as it grows exponentially: India is world's 3rd largest consumer of oil, 3rd largest LPG consumer, 4th largest LNG importer, 4th largest refiner, 4th largest automobile market.

India will account for 25% of global energy demand growth over the next two decades, he added. Noting the role of energy industry in India's journey of decarbonization, he mentioned about the commitments of oil and gas public sector companies to achieve their net zero emissions - scope 1 and 2 during the period 2038 - 2046.

## ONGC installs CO2 core flood apparatus

**New Delhi, India:** Oil and Natural Gas Corporation (ONGC) has identified Carbon Capture, Utilization, and Storage (CCUS) as a fundamental component of its energy transition strategy. ONGC's in-house Institute of Reservoir Studies (IRS) in Ahmedabad is at the forefront of this effort. In line with ONGC's visionary Net-Zero 2038 initiative (Scope-1 and Scope-2), IRS has achieved



The CCUS CO2 Core Flood Apparatus

a significant milestone by successfully installing and commissioning a cutting-edge Carbon dioxide (CO<sub>2</sub>) Core Flood Apparatus.

This state-of-the-art apparatus is a vital addition to IRS's Gas Injection & CCUS Laboratory. It enables advanced studies and experiments related to CCUS, positioning IRS as a key player in the development of CCUS technologies. The newly acquired CO<sub>2</sub> Core Flood Apparatus is designed to replicate underground reservoir conditions, allowing for physical simulation and assessment of CO<sub>2</sub> behavior in reservoir rocks, quantifying incremental oil recovery, and evaluating

## Bani Varma appointed as Director (Industrial Systems & Products), BHEL



*Bharat Heavy Electricals Limited (BHEL), Bani Varma, has assumed charge as Director (Industrial Systems & Products) of the Public Sector Engineering and Manufacturing Enterprise. Prior to this, Varma was spearheading BHEL's Transportation Business segment as well as the company's Electronics Division (EDN) manufacturing unit at Bengaluru. Varma is an Electrical engineering graduate from the Delhi College of Engineering and started her career with BHEL as an Engineer Trainee in the company's Industry Sector vertical in 1990. During her 33 years of holistic, diversified and hands-on experience in the energy, industry and transportation segments, she has developed a comprehensive set of competencies in areas of strategic management, business development, project execution, change management and human resource management.*

*As Head of BHEL's Transportation Business & Systems Group, she was responsible for BHEL's diversification initiatives in the rail transportation business and strategised to secure the prestigious Vande Bharat trains manufacturing cum maintenance order for the company. Apart from this, as head of EDN, she was responsible for engineering and production of BHEL's power & defence business related control equipment and propulsion electrics for Indian Railways. She successfully turned around the unit leading it to profitability after sustained losses.*

*She has also handled various key positions in the company including Corporate Strategic Management, Project Management, Marketing of Industrial Products (Electrical), Captive Power Plants, etc. She has provided support for the organisation's strategic initiatives as well as for achieving operational targets by coordinating with various stakeholders of BHEL. Varma has also played a pivotal role in formulation and implementation of the development plan for BHEL's new growth areas and in driving BHEL's transformation initiatives across functions and verticals.*





QUALITY OF  
SWEDEN

Tapflo Group is an independent, family owned, Swedish manufacturer and global supplier of Air operated diaphragm pumps, centrifugal pumps and other industrial process equipment.

# tapflo®

## Tapflo IBC Mixing Station

### Masterful Mixing, Minimal Effort

#### Applications

- » Liquids < 20,000 cP viscosity
- » Containing particles or powders



**MIXING**  
in an IBC has never  
been so easy!

#### Alternative Mixing Stations



Mobile Mixing Station



Drum Mixing Station



Stationary (fixed) Mixing Station

#### Other Tapflo products



Electrically operated  
pumps



Sanitary pumps



Pump with  
built-on dampener



CTX  
centrifugal pumps



CTM magnetic drive  
centrifugal pumps



CTI & CTH  
centrifugal pumps



PT peristaltic pumps

» All about your flow®

Tapflo Fluid Handling India Private Limited | [www.tapflo.in](http://www.tapflo.in)

Office No 207, Amar Neptune | Baner, Pune 411045, INDIA Tel: +91 7767014104 E-mail: [ac@tapflo.in](mailto:ac@tapflo.in)

sequestration potential. Key features of this equipment include precision control, high-quality imaging, and real-time monitoring of pH and density, providing invaluable insights in real time. The apparatus is constructed from corrosion-resistant Hastelloy material, ensuring longevity and reliability even in carbon dioxide-rich environments. With an operational range of up to 150 degrees Celsius and 10,000 psi pressure, it can withstand extreme conditions, furthering our understanding of CCUS processes and optimizing schemes.

IRS has a rich history of conducting laboratory and numerical simulation studies related to CCUS for ONGC's fields. It is multidisciplinary team, including Reservoir Engineers, Geologists, Geophysicists, and Chemists, along with existing laboratory facilities, has paved the way for in-depth research in this field. Core flooding, a crucial component of CCUS project design, provides essential laboratory data for the tuning of numerical simulators.

## India's steel and cement industries need ₹ 47 lakh crore to go net-zero: CEEW

**New Delhi, India:** India's existing steel and cement plants, which play a vital role in the country's economic development, will require ₹ 47 lakh crore (USD 627 billion) in additional capital expenditure (CAPEX) to achieve net-zero carbon emissions, according to independent studies by the Council on Energy, Environment and Water (CEEW) released. India is the second-largest producer of steel and cement in the world but both are emission-intensive processes making these hard-to-abate industries. The studies—which are the first-of-its-kind calculation of the cost of decarbonising these industries—also pointed out these two sectors will need ₹ 1 lakh crore each year in additional operational expenditure (OPEX) to go net-zero.

The CEEW analyses, funded by 'bp', an integrated energy company, also found that an 8–25 per cent reduction in steel emissions and 32 per cent reduction in cement emissions is possible without any price increase by adopting efficient technologies such as waste-heat recovery and energy efficient drives and controls. Moreover, a 33 per cent reduction in the combined carbon emissions of the steel and cement industries could be achieved with just 8.5 per cent of the total additional CAPEX and 30 per cent of the additional annual OPEX. This reduction can be done without considering the need for carbon capture and with the requisite supply of alternative fuels and raw materials.

Dr Arunabha Ghosh, CEO, CEEW, said, "Decarbonizing India's steel and cement industries will not only help it meet its climate ambitions but also make its industries market competitive and future-ready in a world with increasingly sustainability-driven regulations. CEEW's pioneering work with these marginal abatement cost (MAC) curves provide the necessary foundation to quantify the potential for emissions mitigation from these heavy industries and the associated costs. Such analysis is necessary to help inform policies and systematically pursue India's net-zero targets in pursuit of Decarbonization without deindustrialization." CEEW's assessment indicates that the Indian steel industry emitted 297 million tonnes of CO<sub>2</sub> in 2021-22 in crude steel production. That translates to an average emission intensity of 2.36 tCO<sub>2</sub>/tcs (compared to the world average of 1.89 tCO<sub>2</sub>/tcs). The cost of producing this steel would increase with the tightening of emission intensity limits. The study found that depending on the production route taken, technology chosen, and the prevailing costs of carbon capture, utilization, and storage (CCUS), near net-zero steel could be 40–70 per cent more expensive than current costs. Here, CCUS will be critical for decarbonizing the steel industry with the potential to abate as much as 56 per cent of the emissions generated from the sector. But CCUS is still in its nascent stages and will need to be tested at scale before implementation. The Indian cement industry is among the most energy-efficient in the world. However, apart from the use of fossil fuels, carbon emissions are inherent to the production process due to limestone processing. CEEW assessment indicates that the industry emitted 218 million tonnes of CO<sub>2</sub> while producing 337 million tonnes of cement in 2018-19. Here too, carbon management mechanisms have the potential to abate a major share of emissions, but the cost is higher than other alternatives such as energy efficiency, use of alternative fuels and raw materials and reduction in clinker factor. The study shows that about 50 per cent of cement plants in India need access to CO<sub>2</sub> pipelines for carbon capture and storage. These pipelines can be constructed using existing natural gas pipelines' right-of-way. Without such pipelines, these plants cannot opt for CCS.



# Ferolite



An ISO 9001:2015, IATF 16949:2016, ISO 14001:2015, ISO 45001:2018 Certified Company

**100% Asbestos Free**

**Complete Range of Gasket Materials,  
Gland Packings, Rope & Wiping Pads**

**Non Asbestos Jointing Sheets for Industrial  
Gasket Applications**



**Non Asbestos Gland Packings  
& Ropes**



**Wiping Pads for Wire Galvanizing Industries**



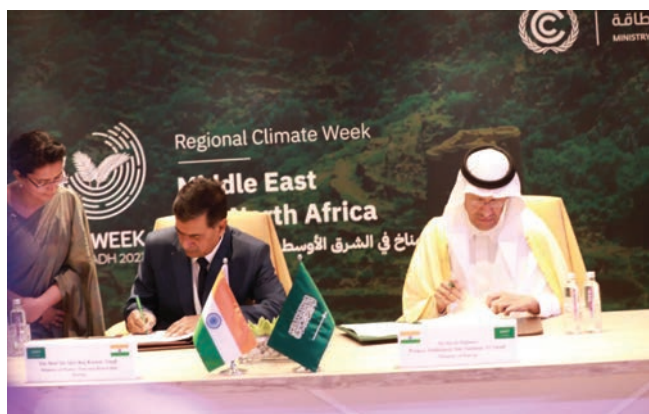
**PTFE Thread Seal Tape**



C-178, Site No.1, B.S. Road Indl. Area, Ghaziabad - 201 001 U.P. (INDIA)  
Ph.: +91 120-4051500, 2700291, 2702655 (D) Fax : +91-120-4051550  
E-mail : [sales@ferolite.com](mailto:sales@ferolite.com), [dgmsales@ferolite.com](mailto:dgmsales@ferolite.com) Website : [www.ferolite.com](http://www.ferolite.com)



## India and Saudi Arabia sign MoU in Green / Clean Hydrogen and Supply Chains



**New Delhi, India:** India and Saudi Arabia have signed a Memorandum of Understanding in Riyadh in the fields of Electrical Interconnections, Green / Clean Hydrogen and Supply Chains. The MoU was signed between the visiting Union Minister for Power and New & Renewable Energy, Government of India, Shri R.K. Singh and the Minister of Energy, Government of Saudi Arabia, Mr. Abdulaziz bin Salman Al-Saud on the sidelines of the MENA Climate Week in Riyadh.

This MoU aims to establish a general framework for cooperation between the two countries in the field of electrical interconnection; exchange of electricity during peak times and emergencies; co-development of projects; co-production of green / clean hydrogen and renewable energy; and also establishing secure, reliable and resilient supply chains of materials used in green / clean hydrogen and the renewable energy sector.

It was also decided between the two energy ministers that B2B Business Summits and regular B2B interactions between the two countries will be conducted to establish complete supply and value chains in the above-mentioned areas of energy sector cooperation.

Earlier, an Indian delegation led by the Union Minister for Power and New & Renewable Energy, Government of India, Shri R.K. Singh participated in the High-Level Segment of the Middle East and North Africa (MENA) Climate Week 2023, which is being held in Riyadh, Saudi Arabia during October 8 - 12, 2023. MENA Climate Week 2023 will discuss climate solutions ahead of COP28 and is being hosted by the government of the Kingdom of Saudi Arabia. This important event brings together a diverse group of stakeholders to discuss many topics,

including the Global Stocktake, and the economic and energy security aspects of climate action in the context of the Paris Agreement. It provides a valuable opportunity to share insights and best practices, and to develop ambitious climate strategies for the rest of this critical decade.

## Aramco advances development of emissions reduction solutions



Ahmad Al Khowaiter, EVP  
Technology & Innovation, Aramco

**Dhahran, Saudi Arabia:** Aramco, one of the world's leading integrated energy and chemicals companies, is further advancing the development of emissions reduction solutions including lower-carbon hydrogen, Direct Air Capture (DAC) of carbon dioxide, a novel approach to CO<sub>2</sub> storage that involves

turning carbon dioxide into stone, and the harnessing of geothermal energy. The projects support Aramco's ambition to achieve net-zero Scope 1 and Scope 2 greenhouse gas emissions across its wholly-owned and operated assets by 2050, as well as the Kingdom of Saudi Arabia's 2060 net-zero ambition. Details of the projects were disclosed on the sidelines of MENA Climate Week 2023, which is taking place in Saudi Arabia from October 8 to 12.

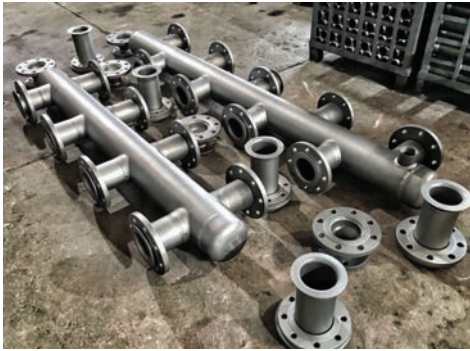
Ahmad Al Khowaiter, Aramco Executive Vice President of Technology & Innovation, said: "These projects highlight just some of the innovative ways that Aramco aims to help mitigate greenhouse gas emissions and address climate change. We are working on multiple fronts, partnering with leaders in a variety of fields, in an effort to advance technology solutions that have the potential to make a real impact. This includes new and groundbreaking approaches that align with our vision of a circular carbon economy, as we strive to meet the world's energy needs both now and in the future."

Following the success of a pilot project in Denmark, Aramco is in the process of signing an engineering agreement with Topsoe, a leader in energy-efficient technologies, to construct a lower-carbon hydrogen demonstration plant at the Shaybah Natural Gas Liquids (NGL) recovery plant, in Saudi Arabia. It is expected to

## Manufacturer of Piping Products (Pipe Fittings), Hot Induction Bends & Piping Spools.



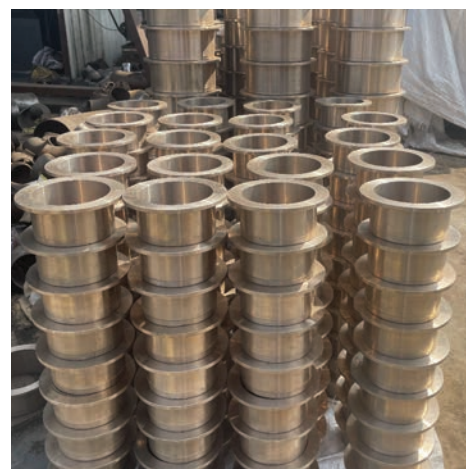
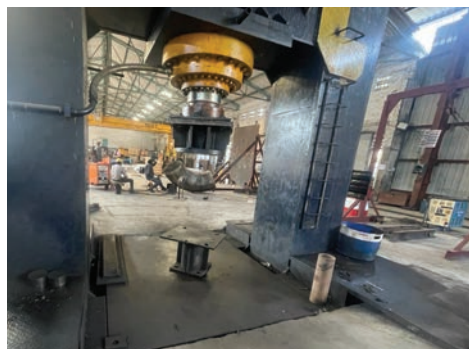
Dynamic Forge & Fittings (I) Pvt Ltd is committed to satisfy the various needs to customers have been part of our role in the Industry, since our inception in 2009 as a manufacturer of Piping Products, Hot Induction Bends and Piping Spools in accordance with National & International.



India's largest  
**Industrial Pipe Fittings**  
**Manufacturer**  
in Stainless Steel,  
Alloy Steel  
& Carbon Steel



Simplify your  
**Bending & Piping**  
requirements  
with us



### Dynamic Forge & Fittings (I) Pvt Ltd

Corporate H.O. :  
619/620, 6<sup>th</sup> Floor, Prasad Chambers, Tata Road No. 2, Opera House  
Girgaon, Mumbai - 400 004. India, Tel: +91-22-23855158/2385 5159  
Fax: +91-22-23855559, Email: info@dynamicforge.com

Plant :  
Plot # 237, GIDC, Umbergaon, Dist. Valsad, Gujarat - 396171, India  
Tel: +91-260-2562013, Email: works@dynamicforge.com

[www.dynamicforgefittings.com](http://www.dynamicforgefittings.com)



have a production capacity of six tons of hydrogen per day and use renewable electricity in electrified steam reforming of hydrocarbons to produce lower-carbon hydrogen for use in power generation, with resulting CO<sub>2</sub> being captured and sequestered. Aramco is also collaborating with Siemens Energy to develop a DAC test unit in Dhahran, Saudi Arabia, with the capacity to capture up to 12 tons of CO<sub>2</sub> per year. The test unit, which is expected to be completed in 2024, is intended to pave the way for a larger pilot plant that would have a CO<sub>2</sub> capture capacity of 1,250 tons per year. In addition, Aramco has successfully piloted a novel CO<sub>2</sub> sequestration solution using in situ mineralization, which involves dissolving CO<sub>2</sub> in water and injecting it into volcanic rocks in Jazan, Saudi Arabia. The process permanently converts CO<sub>2</sub> into carbonate rocks and the pilot team involved representatives from Aramco and the King Abdullah University of Science and Technology. Several innovative technologies were developed and deployed in the pilot, to help increase efficiency and reduce cost.

## Birla Carbon acquires Nanocyl for Lithium Ion Batteries



Dr. Santrupt Misra, Group Director, Birla Carbon; Director, Chemicals & Director, Group H.R., Aditya Birla Group

**Mumbai, India & Marietta, USA:** Birla Carbon, one of the leading manufacturers and suppliers of high-quality carbon solutions, completed the acquisition of Nanocyl SA, a worldwide leader in multi-wall carbon nanotubes (MWCNT's) based in Sambreville, Belgium. The acquisition expands Birla Carbon's presence in the Energy

Systems market, creating a leadership position in material critical to Lithium Ion battery performance along with other conductive applications.

Speaking about the acquisition, Dr. Santrupt Misra, Group Director, Birla Carbon; Director, Chemicals & Director, Group H.R., Aditya Birla Group, said, "Birla Carbon has been nurturing a number of innovation opportunities in its effort to realize its multi-prong sustainability agenda. The acquisition of Nanocyl is a clear step towards executing its strategy in that

direction. We hope that this partnership will enable Birla Carbon to be a significant player in the emerging energy systems space. He further added, "Aditya Birla Group has been concentrating on investing in sustainability and circularity-driven initiatives led by innovation in order to be future-ready. The same is in line with our Purpose: to enrich lives by building dynamic and responsible Businesses that "inspire" trust."

John Loudermilk, President and Chief Executive Officer, Birla Carbon, said, "We are thrilled to welcome Nanocyl into the Birla Carbon family. Laurent and his experienced team have been pioneers in the field of carbon nanotubes that provide unique performance characteristics for a wide range of applications, most notably energy systems such as lithium-ion batteries." He further shared, "Birla Carbon's commitment to driving growth through innovation in sustainability aligns well with the potential for MWCNTs to enable the electrification of the transportation industry, deliver enormous environmental benefits, and prevent climate change. We are committed to partnering with our growing family of customers to create unprecedented value with the expanded carbon portfolio of products and technologies."

Laurent Kosbach, Chief Executive Officer, Nanocyl, stated, "We are proud of our journey to develop and commercialize MWCNT's successfully over the past 20 years as an entrepreneurial start-up, with the support of our current partners and investors. However, with growing needs for our products, the time has come to join a Global industry leader in order to maximize the synergies and the potential of these materials across many end uses." Mr. Kosbach continues, "Birla Carbon's R&D expertise, portfolio of products, and market experience will enable Nanocyl and our products to reach their full growth potential"

## Honeywell and Granbio to produce Carbon-Neutral Sustainable Aviation fuel

**Mumbai, India:** Honeywell and GranBio Technologies announced that they will combine Honeywell's ethanol-to-jet (ETJ) technology with GranBio's cellulosic ethanol AVAP® technology to produce carbon-neutral sustainable aviation fuel (SAF) from biomass residues at GranBio's forthcoming U.S. demonstration plant. GranBio's patented AVAP process converts biomass, including forest and agricultural residues, to pure low-cost, low-carbon-intensity sugars, lignin, and nanocellulose. The cellulosic sugars are converted to



More than  
**750+**  
Satisfied  
Clients

## CORROSION FREE COMPOSITE SOLUTIONS



**FRP CABLE  
MANAGEMENT SYSTEMS**



**FRP GRATINGS**



**FRP HANDRAIL**

Approved with all major  
consultants and EPC  
Contractors for Chemical  
and Process Plants



Corrosion/Chemical  
Resistance



Flame Retardant



100% Non-Metallic

### MANUFACTURER OF FIBERGLASS / FRP / GRP

Cable Trays | Gratings | Structural Profiles | Ladders | Cable Cleats | Fencing | Handrails  
Staircases & Platforms | Safety Marker line



[www.aeroncomposite.com](http://www.aeroncomposite.com)

### AERON COMPOSITE PVT. LTD.

Reg. Off.: Plot. No. 30/31, Saket Industrial Estate, Opp. HOF Furniture,  
Sarkhej-Bawla Highway, Moraiya-382213, Ahmedabad, Gujarat - INDIA  
T : +91-90331 58500 | F : +91-79-26561238 | M : +91-99099 44817  
E : sales@aeroncomposite.com, info@aeroncomposite.com

**Dealers & Distributors Inquiry Solicited**

both SAF, through Honeywell's ETJ technology, and biochemicals, through a separate process.

Using forest biomass-derived ethanol from the AVAP process, jet fuel produced from Honeywell's ethanol-to-jet fuel process can reduce greenhouse gas (GHG) emissions to net zero on a total lifecycle basis, compared to petroleum-based jet fuel<sup>1</sup>. "Combining our biorefinery expertise with Honeywell experience in developing and scaling fuel technologies will help ensure SAF supply goals while supporting GranBio's mission to provide integrated value chain solutions throughout the world for net zero SAF from biomass," said Bernardo Gradin, GranBio CEO. "The AVAP technology has great potential, depending on feedstock and plant configuration to allow carbon negative SAF with current life cycle analysis." "Plus, in addition to vast forest and agricultural residue available for feedstocks, there is an enormous potential to retrofit idle pulp and paper facilities in the U.S., revitalizing forestry value chains and rural manufacturing with great social, environmental, and economic impact," Gradin added.

"GranBio's low carbon feedstock coupled with Honeywell's SAF expertise will help decarbonize air travel," said Barry Glickman, vice president, general manager, Honeywell Sustainable Technology Solutions. "Our advanced ETJ process is ready-now and builds upon Honeywell's near twenty years' experience in renewable fuels. Honeywell's renewable fuels solutions, including ETJ, incorporate integrated, modular designs, that enable producers like GranBio to build new SAF capacity more than a year faster than is possible with traditional construction approaches." GranBio's AVAP aims to enable worldwide net zero SAF production by utilizing abundant, low-cost biomass feedstocks and diversification of income streams through value-added products beyond SAF, providing significant cost advantage as compared to other SAF producers. GranBio's subsidiary AVAPCO was selected by the U.S. Department of Energy to receive an USD 80M grant to support the demonstration plant that will produce ~2 million gallons per year of SAF upon start-up in 2026.

Honeywell now offers solutions across a range of feedstocks to meet the rapidly growing demand for renewable fuels, including SAF. In addition to Honeywell UOP Ecofining, Honeywell's renewable fuels portfolio includes ethanol to jet technology and the recently announced Honeywell UOP eFinishing, which converts green hydrogen and carbon dioxide into eFuels.

## PCG to construct Asia's Largest Advanced Chemical recycling plant



**Kuala Lumpur:** PETRONAS Chemicals Group Berhad (PCG), has reached the final investment decision (FID) to construct Asia's largest advanced chemical recycling plant with a capacity of 33 kilo-tonnes per annum (ktpa). The plant which will be located in Pengerang, Johor, is targeted to be operational by the first half of 2026. The FID announcement also saw the signing of the Technology License Agreement (TLA) between PCG's subsidiary and Plastic Energy Limited (Plastic Energy) and awarding of the Engineering, Procurement and Construction (EPC) to Mutiara Etnik Sdn. Bhd.

As part of PCG's New Plastics Economy agenda to support the transition towards a circular economy and contribute to a sustainable plastics ecosystem, the plant will unlock plastics waste chemical recycling capabilities in Malaysia through the conversion of end-of-life plastics into pyrolysis oil or TACOIL™, which can be used as chemical feedstock towards the production of sustainable plastics.

"Through the advanced chemical recycling plant, we envision driving innovation across the plastics value chain while creating opportunities for all parties, from waste collectors to manufacturers, to jointly contribute to the circular plastics economy. This enables us to propel the nation's aspiration in phasing out single-use plastics, in line with Malaysia's Plastic Sustainability Roadmap 2021-2030, while fulfilling the growing demand from major brands for sustainable packaging," said PCG Managing Director / Chief Executive Officer Ir. Mohd Yusri Mohamed Yusof. Plastic Energy will be providing the chemical recycling technology for the plant through its patented TAC process, which heats mixed post-consumer plastic waste in the absence of oxygen. This process then produces hydrocarbon vapours, that are condensed into pyrolysis oil or TACOIL™ which can



# VALVE SOLUTIONS FOR CORROSIVE APPLICATIONS



**UNP Polyvalves**

Manufacturer of PFA/FEP/PTFE Lined & Plastic Valves,  
Pipes & Pipe Fittings



## LINED VALVES



### CASTING OPTIONS AVAILABLE

ASTM A216 GR. WCB  
ASTM A351 GR. CF8/CF8M  
ASTM A494 GR. 4A (CD3MN)  
HESTALLOY C - 276

### LINING OPTIONS AVAILABLE

PFA, FEP  
PVDF  
ETFE (TEFZEL)  
ANTISTATIC PFA (CONDUCTIVE)

SIZE RANGE : **MANUAL VALVES** : ½" to 24" | **ACTUATED VALVES** : ½" to 24"



### VADODARA - OFFICE & FACTORY

5 to 12 PR Industrial Estate, Por GIDC - Kashipura Road,  
Moje : Kashipura - 391 243, Dist. Vadodara. INDIA  
Phone: +91 70434 30467/77, 70430 20707  
Email : sales.baroda@polyvalve.com

### MUMBAI - THANE

207, Orion Business Park, Next to Cine Max, Kapurbawdi,  
Ghodbunder Road, Thane (W) - 400 607. INDIA.  
Phone: +91 22 2589 6422, 2589 6524 /25  
Email : sales.thane@polyvalve.com

[www.polyvalve.in](http://www.polyvalve.in)  
[www.polyvalve.com](http://www.polyvalve.com)



be used as a substitute for hydrocarbon feedstock in the production of food-grade recycled plastics. "After starting our collaboration with PCG back in 2019, we are pleased to be chosen as the technology provider for their new chemical recycling plant in Malaysia. Together we share a common goal to reduce plastic pollution in Asia by increasing the amount of plastic waste that can be recycled, and expanding recycling infrastructure in the region," said Carlos Monreal, Chief Executive Officer of Plastic Energy.

"We are excited to be the EPC partner for this groundbreaking project by PCG. We have always been committed to excellence in every project we undertake, and we will ensure that this plant will meet PCG's expectations," said Datuk Surendran Menon, Managing Director of Mutiara Etnik. The advanced chemical recycling plant will benefit Malaysia's plastics value chain beyond closing the loop of the plastics life cycle by creating an ecosystem that promotes the transition to a circular economy.

### Linde starts up New Air separation Unit in Hyderabad

**Hyderabad, India:** Praxair India Private Limited (a Linde company) announced the commencement of commercial production at its air separation unit (ASU) at Patancheru in Hyderabad, Telangana on October 14, 2023. This plant will be producing in total 250 tonnes per day of gases including liquid medical oxygen, nitrogen and argon, catering to the requirements of healthcare, pharma and other industrial sectors of the region. The construction of this ASU project was completed within an 18-month timeframe, starting April 2022, when Linde received official approval from Government of Telangana. "The new Hyderabad ASU provides us with a manufacturing base in the key market of Telangana and will reduce dependency on supply from other states," said RC Kaushik, Head of Sales, Healthcare & AT, Linde - India. "With the startup of this plant we will be well placed to match the growth expectations in this region and also cater to our healthcare customers and the expanding pharma sector in the state more effectively and efficiently." "We were focused on completing the construction within the stipulated 18-month timeframe, despite challenges along the way which impacted the import of critical equipment," said Anirudh Gharote, Executive Director, Praxair India Pvt Ltd. "We are proud that we were able to keep our commitment to the Government."

### National Investment and Infrastructure Fund (NIIF) launches USD600 million India-Japan Fund

**New Delhi, India:** The National Investment and Infrastructure Fund (NIIF) has entered into collaboration with the Japan Bank for International Cooperation (JBIC) to launch a USD 600 million India-Japan Fund (IJF) with JBIC and Government of India (GoI) as anchor investors. This joint initiative signals a key dimension of collaboration between the two countries in an area that is a shared priority viz. climate and environment. The India-Japan fund (IJF), the NIIF's first bilateral fund, will have a 49% Indian government contribution to the target corpus and JBIC will provide the remaining 51% of the total. India Japan Fund seeks to be "partner of choice" to further promote Japanese investments in India. It will concentrate on investing in environmental sustainability and low carbon emission initiatives. The setting up of India Japan Fund represents a key milestone in the strategic and economic partnership between the Government of Japan and Government of India.

### EU shelves REACH regulation on toxic chemicals

**Germany, Europe:** The European Commission has put off the amendments of REACH chemical safety legislation and refuses to provide the European Parliament with a firm timeline for its submission. The Commission's chemicals strategy for sustainability, which strives for "a toxic-free environment," included 2020 as the deadline for the REACH review, however due to the growing challenges and BASF's continuous insecurities, because of rising energy prices and environmental concerns, it has been postponed until the end of 2023. Since then, Conservative members of the European Parliament claim that the review has now been indefinitely put on hold. German politician from European People's Party (EPP), are happy that there is no date for REACH. However immense pressure was laid by the Green and left-wing legislators to offer a "concrete timeline" on paper for the pending Green Deal legislation. Šefčovič Commission's new vice-president, was evasive, stating "preparations will continue" on the plan. The Commission is carefully analyzing all the aspects of the reviews as he articulated the Legislatures that work on REACH is ongoing and the proposal will be tabled "when it's ready." The European Commission declined to confirm whether REACH was now formally off the table when questioned.



**KAF SEAL INC.**

## Pumps & Valves Applications



**PTFE Envelope Gaskets**



**PTFE Flat Gaskets**



**PTFE Tri-clamp Sanitary Gaskets**



**FEP-PFA Encapsulated O-rings**



**Compression Rings & Guide Rings**



**PTFE Bellows**



**PTFE Seals for Aseptic Valves**



**Trunnion & Floating Seats**



**Chevron Packings**



**Energized Seals**



**Spiral wound Gaskets**



**Kammprofile Gaskets**



**Ring Joint**

Contact us : +91 9323684474, 7400050022

Email us : [kafseals@live.in](mailto:kafseals@live.in)  
Website : [www.kaf-vulcanindia.com](http://www.kaf-vulcanindia.com)



## Fischer Tropsch's discovery could improve fuel production

**Washington, USA:** A fundamental discovery about the Fischer Tropsch process, could someday allow for more efficient fuel production. It is an adjuvant reaction used in the industry to convert coal, natural gas or biomass to liquid fuels. Unknown self-sustained oscillations in the Fischer Tropsch process were discovered previously by researchers of Washington State University. They found that unlike many catalytic reactions which have one steady state, this reaction periodically moves back and forth from a high to a low activity state.

"Usually, rate oscillations with large variations in temperature are unwanted in chemical industry because of safety concerns," said corresponding author Norbert Kruse, a Distinguished Professor in WSU's Gene and Linda Voiland School of Chemical Engineering and Bioengineering. "In the present case, oscillations are under control and mechanistically well understood. The process uses a compound to convert two simple molecules, hydrogen and carbon monoxide, into long chains of molecules – the hydrocarbons that are used widely in daily life. The researchers demonstrated the reaction in a lab employing a frequently used cobalt catalyst, conditioned by adding cerium oxide, and then modeled how it worked. With such a basis of understanding, both experimentally and theoretically, the approach in research and development can be completely different and now having a knowledge-based approach, this will help us enormously."

## Market for Crop Protection Chemicals to reach USD 79.9 billion

**Colorado, USA:** The market for crop protection chemicals was estimated to be worth USD 45.7 billion in 2022 and is projected to reach USD 79.9 billion by 2032 with a CAGR of 5.8%, according to Data Horizon Research. The agricultural sector approved around 800 different chemically active substances for crop protection applications around the world. Farmers are offered lucrative chemicals to increase yield and quality along with simplified harvesting methods, classified as herbicides, insecticides, and fungicides. The synthetic chemicals and the seed treatment segment dominated. It aimed to eradicate wide range of weeds and diseases and target crop fortification from the commencement of the life cycle respectively. Due to the widespread utilization and modern methods, Asia Pacific tops the

chart and expects further growth. Europe is expanding rapidly in spite of strict governing laws on insecticide and pesticide. Of late, Syngenta debuted Victrato, a ground-breaking seed treatment for quality production and targets nematodes and significant soil-borne fungi. With the aim to develop more energy-efficient electrical weeding technology, Tenacious Group, and IP Group invested AUD 1.4 million in Azaneo as a part of a pre-seed round. BASF SE acquired exclusive L-glufosinate ammonium technology from AgroMet as they excel in developing very concentrated weed control solutions.

## Specialty gases market set to reach USD 16.2 billion by 2028

**Dublin, Ireland:** The market for specialized gases has expanded significantly, and it is expected to rise from USD 10.5 billion in 2022 to USD 16.2 billion by 2028 considering many important variables, according to "Specialty Gases Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028" report. Specialty Gases have diverse applications driven by essential purity. This demands exact control over gas composition. These gases maintain levels of purity which is more than 99.999%. They are essential to a variety of sectors, including industry, environmental monitoring, pharmaceuticals, healthcare, and scientific research. Zero gases used for environmental monitoring and process gases used in semiconductor production are amongst the many. In the industrial, research, and medical segments, their distinctive qualities give them an edge. In an effort to meet the need for zero-carbon fuels, Air Products and AES Corporation recently announced a project for a green hydrogen manufacturing facility in Texas. The facility producing OCI's blue ammonia will receive clean hydrogen and other industrial gases from Linde.

## Global Phase Transfer Catalyst (PTC) market size expected to reach USD 2037.7 Million in 2032

**Vancouver, Canada:** Vancouver, Canada: According to the most recent report by Emergen Research, the global Phase Transfer Catalyst (PTC) market size has plunged from USD 1,217.6 Million in 2022 and is expected to reach USD 2037.7 Million in 2032 to an anticipated growth of 5.3% CAGR during the forecast period. PTC is a kind of heterogeneous catalysis that enables reactants to move across phases as the reaction is happening in an organic manner.



PRECISION,  
SIMPLICITY, COMPATIBILITY.  
**THE 6X®**

The new 6X radar level sensor is so easy to use, it's simply a pleasure. Because we know customers value not just 'perfect technology', but also making everyday life better and less complicated. We wouldn't be VEGA if measurement technology was our only value.

**VEGA. HOME OF VALUES.**

[www.vega.com/radar](http://www.vega.com/radar)

**VEGA**



The healthcare industry uses PTC catalyst for manufacturing of pharmaceutical medications and activation of compounds besides agrochemical production. Development of PTC, which is predicted to propel market revenue growth has been the need of the hour as it is environment safe and naturally occurring. However, one important aspect that may limit the growth of market revenue is the accessibility of inexpensive industrial catalysts that are readily available and less expensive than other PTC compounds. The phosphonium salts category is anticipated to account for the largest revenue share in the global PTC market. The amalgamation of complex molecules with complex structures used in modern drug research and development (R&D) gives PTC a better advantage. The North America market is expected to account for largest revenue share in the global PTC market during the forecast period, according to report.

## Global fermentation chemicals projected to increase

**Vancouver, Canada:** Major factors driving the fermentation chemicals market revenue growth is the increasing focus on bioavailability enhancement. This value is projected to rise from USD 71.16 billion in 2022 at a rate of 6.7% during the planned period, as per the Emergen Research analysis. End-use businesses are switching from petrochemical-based products to fermented bio-based substitutes like ethanol and biogas mainly due to the global awareness on environmental hazards. In 2022, the nutritional & pharmaceutical segment contributed to sales significantly however even compounds suited to particular dietary and medical requirements is made possible by fermentation. Since pharmaceutical and nutritional industries are becoming extremely concerned about sustainability, fermentation is thought to be a more sustainable and ecologically benevolent way to make chemicals and medications. Bioremediation efforts along with production of biofuels are a major factor driving the revenue growth. In both cases enzymes play a major role. In 2022, the Europe contributed suggestively to the total market share due to the demand for bio- based goods. Nonetheless, market for fermentation chemicals is fairly fragmented worldwide, with a significant number of large and medium-sized companies accounting for most of the market's revenue, identifying the leading players as BASF SE, Novozymes, DuPont, DSM, Amano Enzyme Inc.

## Indian manufactured Hydrogen equipment market to be worth USD 45-50 billion by 2030



Jill Evanko, founding member, IH2A

**Mumbai, India:** Industry body India Hydrogen Alliance (IH2A) has published a Hydrogen Equipment Manufacturing and Services report that estimates the addressable market for Indian-manufactured hydrogen equipment to be worth USD 45-50 bn

by 2030. This market assessment includes all hydrogen production plant equipment, including electrolyser and balance-of-plant equipment that can be deployed in India, and exported from India to the Asia, Middle East and Africa region, building India as a supply chain hub for future green hydrogen projects. The estimated USD 45-50 bn hydrogen equipment and services market assessment is split 34% for electrolyzers' stacks, 62% for Balance of Plant equipment and 4% for specialist Engineering Services. The report makes the case for India to leverage its competitive advantage on manufacturing and engineering design to create a regional supply chain hub for hydrogen plant equipment in the country. Jill Evanko, Chief Executive and President, Chart Industries and founding member, IH2A, said, "India has the potential to become a regional supply hub for hydrogen production plants, playing to its competitive position in engineering design, manufacturing and services. This is a significant opportunity that will require large-scale manufacturing build out and investments, for electrolyser stack manufacturing and Balance of Plant equipment such as compressors, storage tanks, transformers, rectifiers, air separation Units, and hydrogen pipeline infrastructure. Project developers and equipment majors are waiting to hear from the government on demand aggregation and secured offtake for early projects before they commit large CAPEX investments. The estimated USD 45-50bn equipment market opportunity is achievable and could turn India into a global supply chain hub in the developing green hydrogen economy." Amrit Singh Deo, Senior Managing Director, FTI Consulting, and IH2A Secretariat lead, said, "Hydrogen equipment represents a significant export opportunity for India.

Organisers



PESTICIDES  
MANUFACTURERS & FORMULATORS  
ASSOCIATION OF INDIA

*Announce its 19<sup>th</sup> Edition of Flagship Event*



## INTERNATIONAL CROP-SCIENCE CONFERENCE & EXHIBITION

PMFAI's Prestigious Event Since 1997



**ON 8<sup>TH</sup> & 9<sup>TH</sup> FEB 2024,**  
JW MARRIOT, MARQUIS HOTEL, DUBAI

**ICSCE- Exclusive Event on Agri Inputs – Connects Agribusinesses  
for Knowledge sharing and B2B**

*For more details contact:*

**adeshpande@pmfaiindia.org / events@pmfaiindia.org**



**www.pmfaiindia.org**



**SCALE@  
CHEMTECH**  
World Expo 2024

4<sup>th</sup>-7<sup>th</sup> March 2024

An Expo for Global Climate  
Tech Start-Ups and Industry  
Stakeholders to form  
Collaborative Partnerships

Presented by



**SPECTRUM  
IMPACT**

Impact driven family office  
with collaborations across  
the globe

Organized by



Expertise in creating platform  
for business interactions and  
strategic alliances

Find out solutions for scaling your technology which can then be  
adopted by nations in the Global South to tackle climate change.

**www.chemtech-online.com/scale/**



The export market for Balance of Plant equipment is larger than the market for electrolyser stacks, and India should focus on being the preferred equipment supplier to all key hydrogen projects in the region over the next decade. This is an opportunity for government, industry and investors to work together and turn India's competitive advantage on industrial manufacturing and engineering talent to its advantage. India should move quickly before other jurisdictions to build a hydrogen supply chain hub." The Hydrogen Equipment Manufacturing and Service market assessment report has been proactively prepared by India Hydrogen Alliance (IH2A), with support from industry to develop the hydrogen economy in India.

## China to dominate ABS capacity additions in Asia by 2027

**London, UK:** According to Global Data's recent report, China is forecast to register the highest acrylonitrile butadiene styrene (ABS) capacity additions in Asia, contributing about 96% of the region's capacity additions by 2027. China leads with the largest capacity additions, with a capacity of 4.43 million tonnes per annum (mtpa) from ten planned and announced projects. ABS is a polymer that finds wide application in various end-user industries such as automotive, construction, packaging, consumer goods, and electronics. The high demand for ABS in China's growing economy makes it the largest ABS producer and consumer in the world. In China, the main capacity addition will be from an announced project, Zhejiang Petrochemical Daishan ABS Plant 2, with a capacity of 1.20 mtpa. It is expected to commence production of ABS in 2027. Two planned projects, INEOS Styrolution Ningbo ABS Plant and Shandong Yulong Petrochemical Longkou ABS Plant follow next, with a capacity addition of 0.60 mtpa each. They are expected to commence operations in 2023 and 2024, respectively. Guangxi Changke New Material Company Fangchenggan ABS Plant, an announced project, is the third highest contributor in the country, accounting for a capacity addition of 0.50 mtpa. The plant is expected to commence production of ABS by 2025.

## Clariant inaugurates Daya Bay Exolit OP flame retardant plant

**Muttenz, Switzerland:** Clariant, a sustainability focused specialty chemical company, marks another milestone in its China Strategy with the official opening of its new state-of-the-art production facility for halogen-free



flame retardants in Daya Bay, Huizhou. The CHF 60 million investment into the plant's first production line will provide local customers with access to innovative and sustainable Exolit OP flame retardants and related technical expertise to support the significant growth of engineering plastics applications in E-mobility and electrical & electronic segments. A second line is under construction and expected to be onstream during 2024, representing a further CHF 40 million investment.

"With this world-class manufacturing plant, we strengthen our leading position and global competence in innovative and sustainable fire safety solutions. We have the proximity to better service customers in China and across the Asia Pacific region behind the innovative components, devices and systems advancing technological developments in e-mobility, infrastructure, 5G communications, energy delivery and more. Local production means we can improve cooperation and design tailored solutions to their developing needs as well as significantly reduce delivery lead times," comments Angela Cackovich, President of BU Adsorbents & Additives, and Clariant EMEA Region. The new plant will produce Clariant's global range of patent-protected organophosphorus flame retardants and supplements the capacity of Clariant's two Exolit OP plants in Knapsack, Germany. The team at the One Clariant Campus in Shanghai will support customers in the joint development and in-application testing of flame retarded solutions.

Angela Cackovich continues: "Brands and equipment manufacturers are switching to non-halogenated flame retardants to address the challenges of increasing safety, sustainability and technical performance requirements in E-mobility and Electronics. For engineering plastics, our Exolit OP solutions can help fulfil needs for application safety improvements and the reliability of maintaining mechanical, electrical and fire retardancy performance properties over a product life cycle and after recycling. The new flame retardant plant

is operated by a 100-strong team of local employees and is located within the Huizhou Daya Bay Economic and Technological Development Zone (Daya Bay Chem Park) in Guangdong Province. Clariant's Daya Bay site utilizes green electricity, enabling a significant reduction in Scope 2 (CO<sub>2</sub>) emissions, and is also home to its Care Chemicals Ethoxylation plant, which is currently undergoing a CHF 80 million expansion.

## Evonik further expands production capacity for gas separation membranes



Christian Kullmann, Chairman of Board, Evonik

**Schörfling/Lenzing, Austria:** Evonik will further expand capacity for production of its SEPURAN hollow fiber membranes in Schörfling and Lenzing, Austria. The specialty chemicals company already put into operation a new hollow fiber spinning facility in Schörfling at

the beginning of the year. On the occasion of today's ceremonial opening of this plant, Evonik Chief Executive officer Christian Kullmann announced the construction of a further production line: "We are going full throttle for the green transformation and are investing a mid-double-digit million euro amount as the next step to grow our membranes business." Construction in Schörfling and Lenzing is scheduled to start in early 2024, with completion planned for the first half of 2025.

The growth of the membrane business clearly follows the Group's strategy. "We invest in innovative green technologies that offer superior sustainability benefits to our customers," says Kullmann. "The dynamic development of the membrane business shows that the green transformation is underway and that we are playing a key role in it." By 2030, Evonik aims to increase the proportion of revenue generated by Next Generation Solutions to more than 50 percent from currently 43 percent. Next Generation Solutions are products with demonstrably superior sustainability benefits. With membranes for the treatment of biogas and the extraction of hydrogen, for example, Evonik is making an important contribution to the defossilization of the energy industry. The trend towards renewable energy is driving the steadily growing demand in the

membrane business.

At the heart of Evonik's SEPURAN® membrane technology are fine hollow fibers based on a high-performance plastic that can withstand extreme pressure and temperature loads. The upcoming capacity expansion includes construction of an additional plant for spinning hollow fibers and the expansion of the infrastructure necessary for producing membrane modules at the Schörfling site. The neighboring site in Lenzing will expand production of the required raw material (high-performance plastic). "The planned production expansion for SEPURAN® membranes will create around 50 new jobs in Lenzing and Schörfling," says site manager Jean-Marc Chassagne. "The investment strengthens the site's importance on international markets. With the innovative technology from Upper Austria, Evonik is driving the global transformation toward a sustainable gas economy." Evonik's production in Schörfling at the Attersee is already powered entirely by renewable energy. Nothing but green electricity from wind, hydropower, or biomass fuels the production facility for SEPURAN® membranes. Since the beginning of 2022, the specialty chemicals company is also covering 100 percent of its gas requirements with biomethane from regional production. By switching to environmentally friendly energy, Evonik is reducing its direct CO<sub>2</sub> emissions in Upper Austria by around 5,000 metric tons a year. Since the first products were presented in 2011, Evonik has steadily developed the SEPURAN® membranes business. Within twelve years, it became a globally recognized technology leader for efficient gas separation. To date, Evonik has supplied membranes to more than 1,000 reference plants worldwide for the biogas market alone. ■



# Charting a Path to India's Thriving Chemical Industry

**Suresh Prabhu, Hon'ble former Union Minister, Government of India, Chief Patron and Honorary Ambassador for Chemtech World Expo 2024**, shares insights on India's burgeoning chemical industry, international partnerships, and future prospects. He discusses India's potential growth and emphasizes the significance of environmental regulations and the need for integrated chemical processing plants to secure India's leadership in the sector in an exclusive interaction with **Mittravinda Ranjan**



### SURESH PRABHU

Hon'ble former Union Minister, Government of India,  
Chief Patron and Honorary Ambassador for  
Chemtech World Expo 2024

**Recent McKinsey report has predicted that India's share in the global chemical sector could triple to 10 to 12 percent by 2040. In your view, what would it require to realize the projected growth?**

The data speaks volumes, underscoring the immense potential of India's chemical industry, attributable to the intrinsic dedication of the Indian workforce. Visionary pioneers have meticulously advanced various facets of chemistry, propelling it from local origins to the global stage, where multinational corporations now express keen interest. India has maintained a leadership position for an extended period, and the time has arrived to reap the rewards of these past endeavors while further augmenting our potential.



**India Day Seminar, Celebratory Concert, and Strategic Diplomatic Engagements Shine in Austria :** (L to R) Mr Maulik Jasubhai, Mr Suresh Prabhu, H. E. Mr. Jaideep Mazumdar & Mr Hemant Shetty at India day Seminar in Vienna, Austria.



Mr Suresh Prabhu & Mr Maulik Jasubhai with H. E Mr Peter Launsky-Tieffenthal (L) and H.E Ambassador Gilles Pécout (R)

A prominent global challenge facing chemical manufacturers is the rigorous enforcement of environmental regulations aimed at achieving decarbonization and net-zero goals. Despite a growing demand for chemicals, manufacturers grapple with compliance issues, as evident in Europe, where chemical production has downsized. On a positive note, Indian chemical manufacturers view these challenges as opportunities, leading to the emergence of "Europe plus one" in India. These external factors offer favorable conditions for the chemical industry's growth.

Foremost in my perspective is the need for the industry to establish integrated chemical processing plants. These facilities enable chemical manufacturers to efficiently and effectively produce a wide spectrum of chemicals across the value chain. By investing in such integrated chemical processing plants and chemical parks, India can position itself as a global leader in the chemical industry.

We must also foster the creation of additional industrial parks and integrated chemical complexes, similar to those successfully established in Gujarat. These locations permit companies to set up integrated plants or concentrate on specific value chain segments based on their unique requirements. Building upon the success of chemical industrial zones in Gujarat, the government should replicate these zones in other regions of India, streamlining the registration process with pre-approved clearances to attract investment. Collaboration between the government and the industry is essential to form an integrated regulatory approach. This involves cooperation among all levels of government, from the grassroots to the national level, to ensure a seamless and efficient experience when establishing and operating businesses in India. By fully capitalizing on these opportunities, we can pursue a larger economic platform, spurred by the forward-thinking nature of the Indian entrepreneurial spirit.

Water emerges as the next significant challenge in India. While we require chemicals for water purification, their improper use can lead to pollution. When planning chemical estates, we must account for the water needs of the chemical industry and enforce stringent environmental regulations. The conventional concept of Common Effluent Treatment Plans, relevant two and a half decades ago, must evolve to a more advanced level. India already possesses technologies capable of converting waste into raw materials, promoting closed-loop practices and fostering a more sustainable chemical industry. Streamlining registration processes and securing clearances for project implementation, along with the creation of comprehensive chemical industry zones with pre-existing approvals, represent essential steps to attract investment and expedite project realization.

Crucially, government support to intensify efforts in promoting exports from India can significantly enhance international growth opportunities.





The Ambassador of Iran to India expresses interest to explore business potential: With H. E. Dr Eraj Ilahi, The Ambassador of Republic of Iran in India

**How should our industry confront the emerging competition posed by six global clusters, including China, Germany, Indonesia, Saudi Arabia, South Korea, and Vietnam?**

It's essential to remain vigilant, as all these nations are diligently fostering their domestic chemical sectors. During my recent visit to Vietnam, I gained valuable insights into the various initiatives the government has implemented to boost chemical cluster development. Germany, a longstanding leader in the chemical industry and one of the largest globally, is intensifying government efforts to support its chemical sector. Despite its relatively small size, South Korea boasts a highly advanced chemical industry.

To navigate this competition, we must assess our performance sector by sector and identify the obstacles hindering the Indian chemical industry from reaching its full potential. Overcoming these challenges will necessitate a comprehensive approach, combining policies, support, and fiscal measures to address these issues effectively.

**Considering that India is expected to become a USD 850-1000 billion chemical market by 2040, what kind of opportunities will international companies have in India that they can leverage?**

There has been a significant shift in how the Indian market is now perceived. In the past, it typically involved small-scale manufacturing to initiate trade. However, the landscape has transformed with the advancements in the chemical industry. India possesses the essential

elements: a skilled workforce, cutting-edge technology solutions, machinery production capabilities, and ongoing equipment development, all effectively managed for decades. India's ecosystem encompasses diverse dynamics that should not be overlooked.

Furthermore, the Indian Government has shown a strong commitment to foreign direct investment (FDI) by permitting 100 percent investments through a direct route. International investors should not merely view India as a domestic market but also as a global manufacturing hub. India's strategic geographic location offers proximity to emerging Asian markets, the Far East, and the Middle East, facilitating the sourcing of feedstock and processing for export to international markets. In my perspective, India should be regarded as a robust growth partner, providing an attractive package that includes a well-established market, substantial growth potential, a skilled workforce, and access to emerging markets for production and global export.

**What is your observation on the Carbon Border Adjustment Mechanism (CBAM) and the EU's new Foreign Subsidies Regulation that has recently come into effect? To what extent is this likely to impact the Indian chemical sector, and how can the impact be minimized?**

The Indian chemical industry needs government support to overcome the challenges it faces while complying with WTO regulations. We cannot afford hidden subsidies, and this is neither our intention nor policy. However, the chemical industry faces certain



Meeting with Mr. Lukas Prokes, Acting Deputy Minister for European Union & Foreign Trade, Czech Republic (top) and Mr Jan Kubata, Deputy MD, Czech Trade (bottom) to invite Czech pavilion

obstacles, such as higher input costs like power and regulatory issues. If the government works with the industry to address these obstacles, we can avoid having to provide subsidies for manufacturing and other additional costs. Hence if we try to neutralize the hurdles with the corporation of the government, we can save and help the industry to gain a competitive advantage over foreign competitors

**During recently concluded G 20 Summit, India has signed historic agreement on enhanced cooperation with Saudi Arabia. How should India look at Saudi Arabia & the Middle East for synergistic partnerships?**

Saudi Arabia is actively expanding its industrial presence on a significant scale. Notably, it's home to some of the world's largest chemical companies, such as SABIC and Saudi Aramco, which are integral to the entire value chain, spanning from exploration to refining and contributing substantially to the country's

exports. Saudi Arabia is actively seeking foreign involvement to stimulate the growth of its domestic industry. India already shares political alliances and economic strategic partnerships with Saudi Arabia. In my opinion, it's now crucial to formulate sector-specific strategies for closer collaboration with Saudi Arabia. In the Middle East, India has previously entered into a Comprehensive Economic Partnership Agreement (CEPA) with the UAE, and our industry should explore collaborative partnerships with other Gulf Council of Cooperation members. This approach can harness the complementary strengths of our respective countries to drive industrial growth effectively.

**As the Chief Patron and Honorary Ambassador for Chemtech World Expo 2024, you have led very successful meetings in Russia, Czech Republic, France and Austria from where we are getting good response. What is the scope of synergistic partnerships for the international companies with India's industry?**

I take great pride in my association with Chemtech and view it as my moral duty to uphold its mission. Under the leadership of Maulik Jasubhai, the current management team has propelled Chemtech to new heights. Over the course of its 50-year journey, Chemtech has made remarkable contributions, serving as a cornerstone for progress in the chemical processing industry and various other sectors, including philanthropy, business, and non-profit endeavors.

The eagerly anticipated ChemTECH World Expo garners international attention, with foreign nations demonstrating enthusiasm to showcase their products in India. This global participation is a source of pride and fosters enhanced understanding and collaboration. My



Meeting with H.E Mr. Hemant H. Kotalwar, Ambassador of India to Czech Republic to invite trade delegation of chemicals & biopharma industries



## INTERVIEW

travels to various countries, including Europe, the Middle East, and Russia, have been met with incredible support and a positive response. The upcoming destinations on the horizon, such as Korea and Japan, hold the promise of new business opportunities.

My worldwide interactions have expanded my horizons and transformed my perspective. For instance, our visit to the Czech Republic, a small country with a population of just a few million, unveiled an advanced chemical industry setup. It emphasized the growing importance of green chemicals, a pivotal part of the world's future. Even smaller nations like the Czech Republic are dedicated to the development of innovative and eco-friendly technologies. In light of these global trends, I firmly believe that the Indian industry must make substantial investments in research and development, focusing on long-term prospects.

Chemtech stands as a highly pertinent and promising platform for facilitating the next phase of our journey. It brings together all stakeholders in the chemical industry, both from India and abroad, for interactive sessions and collaboration. This particular edition of Chemtech, marking its 50th anniversary, could be the vanguard in reshaping and revitalizing India's chemical landscape for the next five decades. ■



With H.E. Mr Javed Ashraf, The Ambassador of India to French Republic to discuss India day Seminar in Paris



With Ms. Laurence Tubiana, President, European Climate Foundation to invite for Keynote Address



With Ms Gabriela Ramos, Assistant Director- General for Social & Human Sciences, UNESCO



With Business France leadership team to invite French Pavilion



H.E. Ms. Katharina Wieser, the Ambassador of the Republic of Austria to India, extended a warm welcome by hosting a high tea for Mr. Suresh Prabhu & Mr Maulik Jasubhai , Honorary Consul General of Austria In Mumbai at the Embassy of Austria

## The Other Way Around: A Virtuous Circle to Decarbonize



**PRASAD CHANDRAGIRI**

Head of Innovation and Strategy,  
Projects & Energy Solutions Business, Thermax Ltd

India's oil consumption is expected to rise from 5 million barrels/day (MBD) in 2020 to 7.2 MBD in 2030 and 9.2 MBD in 2050. Oil refineries are major consumers of energy and hence emitters of CO<sub>2</sub>, with complex refineries producing fuels emitting up to 0.2-0.3 tons of CO<sub>2</sub> per ton of crude processed, only counting Scope 1 emissions. These emissions can double or triple if a refinery is associated with petrochemical units. For any complex refinery, there are multiple CO<sub>2</sub> emission spots such as Hydrogen Generation Unit (HGU), Fluid Catalytic Cracking (FCC), Crude Distillation Unit (CDU) / Vacuum Distillation Unit (VDU), Power/Co-Gen Plant (PP/CGP) and Heaters.



**T**hough the downstream refining and petrochemical industries resolve to reduce CO<sub>2</sub> emissions along with an objective to increase their production capacity with multiple new facilities. The question that arises is how these two contradictory objectives can work in tandem with each other.

The Paris Agreement set ambitious goals with respect to reducing global warming and in the Paris Agreement concertation, governments have acted, as have major oil and petrochemical companies. Once finalized, the Indian Carbon Market will help India in achieving the Nationally Determined Contributions goal of reducing the Emissions Intensity of the GDP by 45 percent by 2030 against 2005 levels. Most major oil and petrochemical companies have set similar goals with some aiming for net zero CO<sub>2</sub> emissions by 2050.

Determining which roadmap to adopt to decarbonize an existing oil refinery is a complex exercise. It is technically possible to decarbonize an oil refinery by implementing any of these 4 levers: Energy Efficiency, Electrification, Green H<sub>2</sub> and CO<sub>2</sub> capture and Utilization (CCU). Petrochemical space can be decarbonized by using biomass/biochemical as feedstock. On the other hand, the cost of decarbonizing the refinery needs to be considered with the only anticipated benefit being Carbon Credits or government grants/incentives, the monetary value of which is subject to varying dynamics.

Thermax has conducted multiple desktop studies investigating the effects of a number of decarbonization options:

- CCU including converting CO<sub>2</sub> with hydrogen to e-methanol, 3G-ethanol, SNG or chemicals,
- Bio-chemicals like Ethylene Oxide (EO) / Ethylene Glycol (EG) from Bio-ethanol,
- Blue and Green H<sub>2</sub> from alternate feedstocks like biomass.

Additionally, Thermax's Energy Management Services (EMS) team is extensively working with customers on ESCO models where an emphasis on energy efficiency and plant performance is addressed.

**Hydrogen** is the pathway for a cleaner energy future. Hydrogen is a high density energy carrier for thermal energy, or as a feedstock for industrial processes. So, the production of hydrogen is a key consideration for its role in the evolving energy system and its potential impact on mitigating GHG emissions. The hydrogen market is

large with each million ton per annum (MMTPA) capacity of a refinery requires nearly 15,000 Nm<sup>3</sup>/hr of hydrogen. 46% of the global H<sub>2</sub> production today is consumed by refineries and another 49% by ammonia and methanol production.

The SMR process and the hydrocarbon feedstock is the common factor in the production of hydrogen for refineries, ammonia, and methanol. The intervention of Green H<sub>2</sub> in refineries would enable this hydrocarbon feedstock to be diverted to cracker units for production of high-value revenue streams like Propylene, Maleic Anhydride, MEG, etc. in petrochemical units and industrial plastic parks like the one conceptualized for IOCL Paradeep.

The bottlenecks for Green H<sub>2</sub> are the following:

- Economic viability
- Round-the-Clock Green Power

The significant cost for Green H<sub>2</sub> production is the energy cost and following which the H<sub>2</sub> produced is not competitive against current H<sub>2</sub> sources. Therefore, the need for alternate sources for non-fossil based H<sub>2</sub>. The feedstock for renewable H<sub>2</sub> needs to be extended to other sources like biomass.

The gap between Green H<sub>2</sub> and Grey H<sub>2</sub> needs to be bridged through a transitional H<sub>2</sub> source. That's how Blue H<sub>2</sub> can become a bridge for this gap by introducing a CO<sub>2</sub>Capture step in the conventional SMR process to remove the CO<sub>2</sub> and stored underground or utilised for producing other products.

For Process Industry in general, which use coal as a fuel, **Coal Gasification** with an integrated CCU unit can cater to the Blue H<sub>2</sub> requirement till Green H<sub>2</sub> sources are viable. Thermax has developed a Coal Gasification technology solution that is unique for its capability to handle high-ash Indian coal. Primary chemicals from HGU generated syngas include H<sub>2</sub>, methanol, ammonia. These chemicals can alternatively now be produced from Coal through the gasification pathway or through CCU pathways. For example, the Jamnagar refinery of Reliance Industries has a 10 MTPA of petcoke gasification facility for syngas generation and its use in power generation and downstream products.

**CCUS or CO<sub>2</sub> Capture, Utilization & Storage** has a critical role to play in decarbonizing the industrial sector, which is hard to electrify and hard to abate, due to the use of fossil fuels not only as a source of energy but within the process itself. India's current CO<sub>2</sub> emissions from



refinery –and petrochemicals are nearly around 200 MTPA and are expected to grow significantly at a CAGR of around 6%.

**Biofuels** are regarded as a Greener alternative for producing sustainable and synthetic fuels. Ethanol is one of the principal biofuels, which is produced by the fermentation of sugars by yeasts. Currently, about 12% Ethanol Blended Petrol has already been achieved, and the target is to reach 20% by 2025. To expand Ethanol production capacity, all possible pathways have opened up - from feedstocks such as sugar syrup, molasses, grain, maize etc (1G ethanol), from non-food based feedstocks such as agro-wastes, energy crops etc. (2G ethanol), and from industrial waste gases (3G ethanol) has to be expanded at a large scale.

The aviation sector is gaining a larger attention for decarbonization. **Sustainable Aviation Fuel (SAF)** is a drop-in fuel and is the most feasible element to decarbonize the aviation sector with multiple underlying principles on synthesis. Among alternate pathways for SAF, Ethanol-to-SAF is the most promising. The SAF produced from ethanol is rich with 99.8% of iso-paraffin and allows blending up to 50% v/v. Hence, biomass is the future syncrude for producing sustainable and synthetic fuels.

Ethanol from biomass is also raising interest from petrochemical and chemical industries who are shifting toward **bio-chemicals** as an avenue for decarbonization,

starting with Ethylene, EO and EG manufacturers. Thermax has been working on these prospects to create value propositions for customers in their decarbonization journey.

**Electrification** is definitely the strongest pillar for decarbonization. Thermax recently launched Thermotron, an electric boiler for process heating applications. Moving ahead the space for electrification will advance with a larger pace and scale to meet the requirements of all heavy industries.

#### Conclusion:

Based on the CO<sub>2</sub> emission intensities for various process units in the refinery and petrochemical sector, Blue H<sub>2</sub> and Green H<sub>2</sub> will be the first levers for decarbonization after energy efficiency. HGU/SMR must be integrated with a CO<sub>2</sub> capture unit to reduce a significant CO<sub>2</sub> footprint. Captured CO<sub>2</sub> can further be utilized to produce revenue streams like methanol, 3G-ethanol, SNG, acetic acid, and DHA fatty acids.

Bio-assisted processes are to be put into practice for greener products. For instance, a mixture of CO<sub>2</sub> and H<sub>2</sub> in the presence of certain biological stains can produce acetic acid and DHA Omega-3s fatty acids. These high-value chemicals can ensure the economic viability of these technologies. Similarly, biofuels which are regarded as a sustainable syncrude will help in decarbonizing the transportation and aviation industry. ■



## Applications for Artificial Intelligence in EPC Industry



**RUPCHAND LOHANA**

Head of Central Digital SCM,  
L&T Energy – Hydrocarbon

**Rupchand Lohana** emphasizes about the Digitalization playing important role in Engineering, Procurement & Construction (EPC) sector. He gives a brief insight, about how Artificial Intelligence tools could boost its growth.

**C**hatGPT was launched on 30th November 2022. By January 2023, it became the fastest-growing consumer software application in history, gaining over 100 million users in less than 2 months. Artificial Intelligence (AI) went from being a looming threat to an immediate disruptor across sectors. The sheer capacity of a Large Language Model (LLM) such as ChatGPT or any other variant, to ingest and process significant amount of data has bolstered new use cases for analytical as well as generative purposes across data formats viz. text, voice, image, and video. A case study from Gartner highlights the growth of generative AI from 2010 to 2022.

Today, LLMs can imitate human like responses with much faster speed and a wider knowledge base, but they still require supervision and review. Also, it does not get irritated with more corrections, iterations, and repetitions.

LLMs trained on publicly available data are now readily available using websites such as ChatGPT and BARD. Almultiple has listed many generative tools that provide output in the form of Visuals (Image, Video and Designs), Audio (Voice, Music), Text, and Code in multiple programming languages. These use cases are taking off, being perfected at a rapid pace, and have already started threatening many jobs.

Use cases based on internal or private data (which is confidential, better structured, relevant, and important) are more complex. Tools such as Microsoft Copilot can create a quick presentation or draft email, based on existing email trails, prompts or other available data. However, these are just pre-cursors to the wave of new applications which are being developed and could improve productivity significantly. All major software



Figure 1: AI image generated from 'https://www.fotor.com/images/create' with prompt 'Engineer reviewing drawing in front of refinery.'

providers, including Microsoft, Amazon, Google, etc. are now providing tools and platforms capable of using generative AI based use cases, which could ingest additional unstructured data and churn out relevant output. Even product focused companies like SAP, are now providing tools for quick code generation to reduce development cycles.

Traditionally, the EPC industry lags other industries in terms of digitalization levels. This is partially due to unstructured data and voluminous documents. However, generative AI tools could significantly change the same and help EPC companies accelerate this journey. Some of the potential use cases for EPC industry are listed below:

#### General Communication

- Drafting appropriate responses with improved reference, based on trailing correspondence.
- Drafting legal correspondence to letters based on contract clauses and annexures.

#### Knowledge Management

- Creating project closeout reports based on available documentation.

- Providing fairly accurate search results based on previous project data or standard operating procedures, even for complicated inputs in natural language.
- Responding to open ended questions and providing situational guidance to aid decision making.

#### Proposals

- Summarising scope of work from voluminous bid documents.
- Creating high level parametric comparison of complex bid packages.
- Identifying cost elements
- Identifying project risks
- Extracting list of equipments
- Quick scheduling for project completion.

#### Engineering

- Creating a new 3D model based on similar packages in past projects.
- Drawing preparation based on unstructured inputs.
- Intelligent Robotic Process Automations (RPA) can



## GUEST COLUMN

replace rule based or visual object-based RPAs. AI may handle these intuitively to handle variations in the process.

- Design optimisation e.g., designing structure with least weight, reduced material waste.

### Procurement

- Creating technical bid evaluations quickly based on offer documents.
- Negotiating with the suppliers based on existing data for standard/ off-the-shelf items.
- Identifying patterns and clusters in spend data.
- Identifying governance lapses and aiding in fraud detection.
- Raising queries for identified deficiency during invoice processing.

### Fabrication / Construction

- Creating of fabrication drawings based on 3D models.
- Video analytics for identifying number of people in given area, stationary or moving or in certain position. See figure 2 below
- Autonomous Welding robots with limited human inputs
- Autonomous hydra cranes / warehousing robots for material handling

- Facial recognition for automated attendance and productivity measurement.
- Testing knowledge levels of workmen. Providing interactive platform for their training.

### Project Management

- Creating new project plan based on previous plans. Currently, most plans are created by copying old plan and intelligently modifying them takes lots of time. AI can do the same with minimal efforts.
- Creating of weekly project reports based on significant data inputs across systems and reading information received in emails.
- Enable near real time dashboards.
- Identifying potential risks in real time and trigger timely notifications.
- Provide data promptly for decision making. Reduce number of search results to few most relevant.

**Reducing Concurrency:** Lots of rework happens in EPC primarily due to concurrent Engineering, Procurement and Construction phases. Use of AI could compress the schedule for each phase in project (E, P, C) and reduce concurrency / overlap. This will result in significant reduction in rework and corresponding increase in productivity.

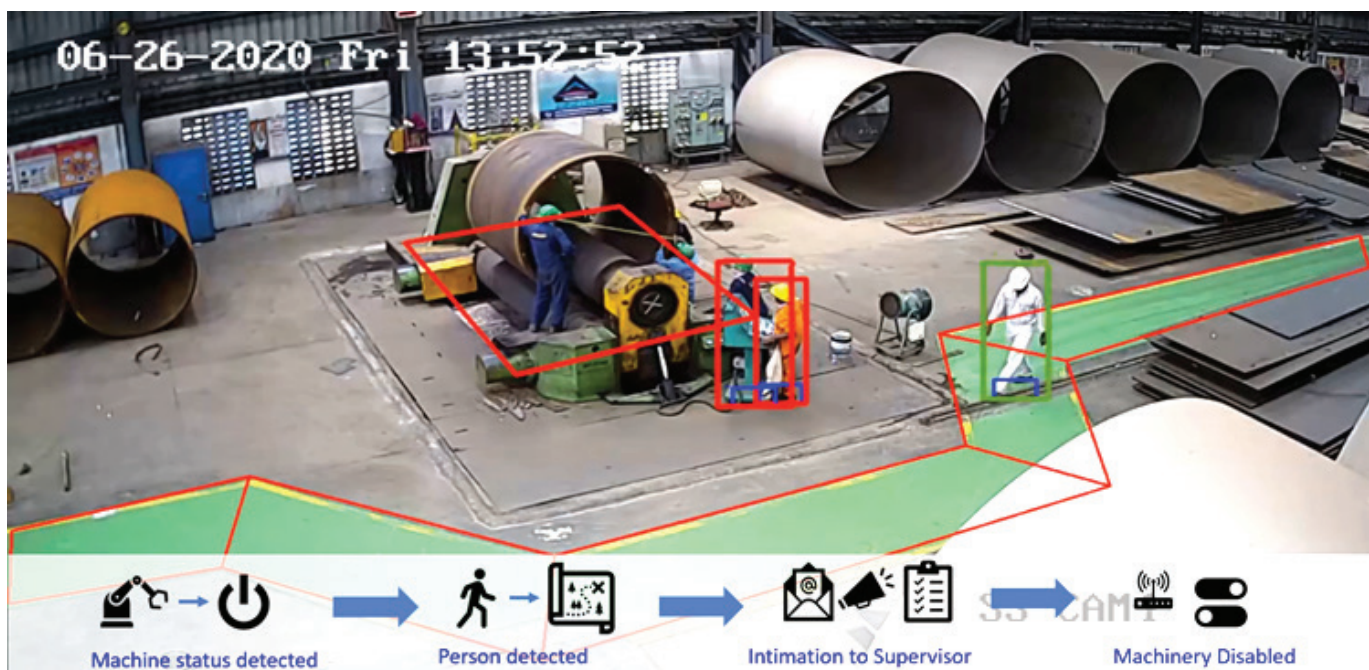


Figure 2: Identifying people not on the safe path and / or not wearing Personal Protective Equipment using AI based Video Analytics in real time.

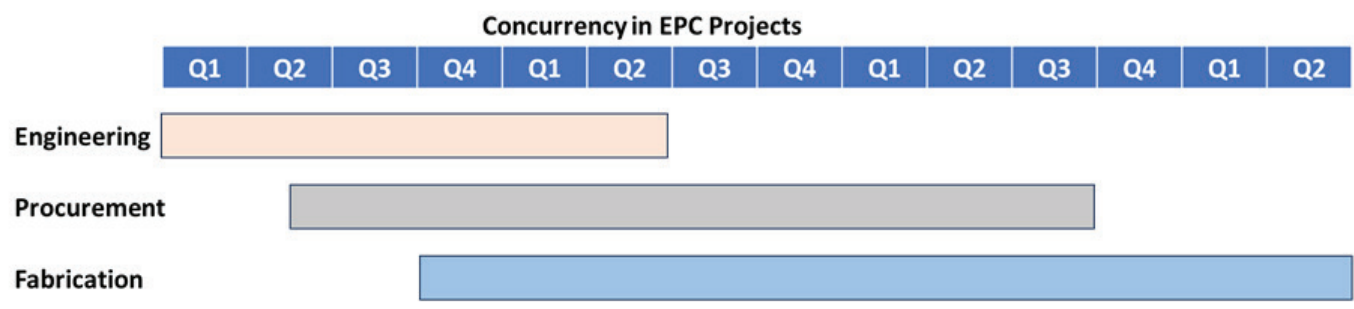


Figure 3: Csoncurrency in EPC Projects

Developments such as Amazon warehousing robots or Tesla’s Full Self Driving (FSD) cars are recent examples of AI integration with physical assets. The end user needs limited instructional programming capability to operate them. Soon, AI will be able to operate equipment such as robotic welding machines, cranes etc., with limited supervision. Such use cases may give boost to Construction Productivity in projects, which has not improved significantly in last 2 decades.

More such use cases are emerging at an exponential pace. However, it is important to understand the risks associated with use of Generative AI including lack of transparency, accuracy, bias, intellectual property infringement, cybersecurity lapse and frauds. Also, sometimes you may unconsciously share confidential data with generative AI models that may get integrated in the public training dataset.

Productivity improvements may also mean less new jobs, and more work being done with a smaller number of people. However, we cannot wish away progress and turn a blind eye to technology, which will find its way irrespective of artificial barriers or fear mongering. It is important to embrace the situation and adapt new working styles. Few steps that can be taken are:

**Skill Development**

Workforce should be made aware of these tools and trained for its use. Further, these technologies can be used for more effective and personalised training.

**Data Infrastructure**

Trained AI models can segregate useful data, like wheat from the chaff and overcome the ‘Garbage In, Garbage Out’ (GIGO) principle. But even with such advancements, data needs to be relevant. Irrelevant data could mean inaccurate results which would be difficult to validate,

believe or interpret. Thus, AI models need to be validated with an expert review, especially for critical situations.

**Integration with Existing Processes**

It is important to identify correct use cases (or bottlenecks) within existing setup and use AI to resolve them. IT industry is evolving to support quick deployment of generative AI tools within existing setups.

**Change Management**

Changing anything needs effort and it is important to focus energies on the correct use cases. Extensive testing and validation may be required as part of pilot projects.

Thanks to improved productivity, AI will drive growth due in near future. Contractors will benefit from implementation of such technologies and pass on some of these benefits to project owners. Hence, owners should nudge EPC contractors to use these technologies to improve the industry.

We are at the inflection point with advent of Generative AI. As AI exhibits more humane traits, it will quickly assimilate into our work. Generative AI swill not just transform EPC, but every sector soon. So, keep your senses sharp and learn to navigate the future with this revolutionary technology. ■



# Diversifying India's Natural Gas Infrastructure



**Satinder Pal Singh**

Chief Executive Officer

Adani Total Pvt. Ltd. & Dhamra LNG Private Limited

During March-May 2023, the Dhamra LNG Terminal and Jagdispur-Haldia-Borkaro-Dhamra Pipeline successfully completed construction, commissioned and started operations, a first in India's eastern region. This article provides a behind the scenes perspective to what went into delivering this project and examines the strategic relevance of this infrastructure to India becoming a gas driven economy.

Natural Gas is the cleanest burning fossil fuel. It is accordingly considered globally as a 'transition fuel' - from more polluting fossil fuels to renewable sources of energy. There is lively debate as to how long this 'transition' will last but nobody disagrees that Natural Gas will play a growing role for the next several decades and help nations move further along their journey towards net zero.

## Present scenario

India aims to achieve a 15% share for Natural Gas in its primary energy mix by 2030 from the current share of under 6%. This is an enormous undertaking requiring several techno-commercial and regulatory challenges to be overcome. As per an India Energy Outlook report (2021) published by the International Energy Association, India's total primary energy demand in 2019 was 921 million tons of oil equivalent (mtoe), in which the share of Natural Gas was 55 mtoe. This primary energy demand is estimated to escalate to 1237 mtoe by 2030 and if India is to achieve the 15% Natural Gas share, demand would triple to 186 mtoe. To put this in perspective, investments in Natural Gas storage and transportation of the order of INR 1,20,000 crores would be required in the next ten years to help achieve this target.

India imports nearly half of the gas (in the form of LNG) it consumes and looking at our upstream prospects, the share of LNG is expected to grow in the years ahead.

Accordingly, critical alignment with several exporting projects internationally would also be essential to secure stable long-term supply to help achieve our 15% share target.

As of March 2023, total re-gas capacity from the existing six operational terminals located in western and southern India was 42.5 mtpa. Considering average prevailing utilisation rates in the country of LNG terminals, this an increase of between 40-60 mtpa in regasification capacity by 2030. Commissioned Natural Gas trunk pipelines stood at 18000 kms covering mainly the western, northern and small parts of the southern and eastern regions.

## Dhamra LNG

This terminal comprises of relevant marine infrastructure provided by Dhamra Port for safely berthing a wide range of LNG vessels, an LNG jetty, two full containment storage tanks of 1,80,000 m<sup>3</sup> storage capacity each, Shell Tube Vaporizers that can re-gasify up to 6.5 mtpa LNG at peak capacity, three gas engines of 9.65 MW capacity each to operate the terminal in island mode and a send out pipeline to connect to the nearby GAIL national transmission system. Indian Oil and GAIL as users of the terminal for will transport natural gas to for its captive use and marketing to other industries & city gas distribution companies in the region.





Dhamra LNG Terminal journey has its genesis in Adani Ports and SEZ (APSEZ) acquiring Dhamra Port in 2014 which lead to an investment decision for Dhamra LNG terminal in June 2017. This was the first investment for an import and regasification terminal by a private company in India. In October 2018, Adani and TotalEnergies (a French energy major) executed a 50:50 JV agreement to develop a LNG business in India and neighbouring countries which included development of this terminal. This JV has truly benefitted from the unbeatable Adani expertise in infrastructure development and TotalEnergies LNG experience and global access.

Having awarded EPC contracts, the terminal development commenced in March 2018. It was immediately obvious that developing the massive LNG tanks would be a different experience from that in existing terminals as the load bearing capacity of the soil on the eastern coast of India is typically lower. This required longer and more numerous piles at Dhamra and was one of our earlier challenges. The project was in full swing when COVID-19 struck, imposing restrictions which disrupted our man-material movement. After the first wave, it was prepared and fared much better during the second wave as we had stockpiled material and adjusted worker rota to cater for pandemic induced disruptions. Not to mention the endurance against highest Cyclones like Yaas and Amphan.

Atmanirbhar concept was at core of the LNG project execution philosophy, evidenced in the selection of EPC contractors. Apart from all civil and marine works being executed by local contractors, Dhamra LNG is the first terminal where our home-grown EPC – L&T, executed the challenging tank contract, thereby strengthening its credentials for other tenders globally.

Safety remained an unwavering focus for the team during the construction phase and in the final tally we compared favourably with HSE statistics when benchmarked with other LNG terminals globally.

The moment of truth arrived on Odisha Divas – 1st April 2023, when the TotalEnergies sourced, QatarGas delivered, Milaha Ras Laffan arrived at the anchorage of Dhamra Port. Fantastically assisted by Dhamra Port's powerful tugs, the berthing operation endured challenging wind conditions to present a perfect berthing of the first LNG vessel on the shores of Eastern India. Milaha's partial load of 26,50,000 MMBtu would be used to cool down and maintain the terminal to a cryogenic state at ~-160oC and conduct requisite performance tests to prove up the

design parameters. The ship stayed alongside for only 13 days – well within our planned laytime of 15 days.

The terminal was formally declared commissioned on 21 May 2023 and since commissioning, Dhamra LNG has already received four more cargos and is expected to make a strong ramp in the coming 12 months or so.

### **Jagdispur-Haldia-Bokaro-Dhamra pipeline (JHBDPL) Hinterland connectivity**

The evacuation of gas in the pipeline started on 18th April 2023 through the Jagdispur-Haldia-Bokaro-Dhamra pipeline (JHBDPL). JHBDPL is connected to national grid with connection to HVJ pipeline connecting North and West India, also in northeastern part it is connected to the Indra Dhanush pipeline network connecting the seven sister states of northeast region. The network developed by GAIL which spans over 3500 kms is another infrastructure milestone as this network and Dhamra LNG were virtually commissioned simultaneously – a first in the annals of developing Indian gas infrastructure. The terminal via this pipeline will act as a primary source of Natural Gas to the states of Odisha, Bihar, Jharkhand and Uttar Pradesh. Natural gas will be supplied primarily to refineries in eastern regions and will also cater to brownfield fertiliser plants. Supply from this terminal to this pipeline network will not only enhance energy security, but food security as well because Natural Gas is the primary feedstock for fertilizer production.

### **What does this development mean for our country**

Dhamra LNG is India's seventh operational import terminal and first in the eastern region. With a peak capacity of 6.5 mtpa, we have added around 15% to





the country's regasification capacity. On standalone basis, if the nameplate capacity is added into country's gas consumption (which could be easily achieved once connectivity to Paradip and Haldia refinery is completed), it would advance the share of natural gas to ~8% in the primary energy mix. Equally and if not more importantly, this terminal allows gas to flow from the east to the west and vice versa for the first time in our history.

The flexibility that this brings, gives us considerable leverage when sourcing cargos and weathering disruptions. During the recent Biparjoy cyclone for instance, users of Gujarat based terminals had used supplies from Dhamra terminal to cater demand in west and north India. Supply sources towards the eastern part of India including Australia, Malaysia and Indonesia will save on shipping costs when supplying to Dhamra. The North Indian gas market can now be accessed by both eastern and western LNG terminals providing choice and diversification opportunities to buyers.

There is very low penetration of Natural Gas in East India largely on account of lack of supply caused in turn by non-availability of infrastructure. Dhamra LNG has changed that as it now becomes the primary source of Natural Gas for 35% of the Indian population on account of its proximity to these markets. Having such proximity also means less transportation cost caused by compression requirements when moving gas over long distances.

Dhamra LNG also provides the opportunity to become a regional supply hub because of its ability to re-load shipments. Bangladesh has been long trying to develop LNG infrastructure on its western shore. Dhamra offers a ready alternative both via pipeline connectivity and break bulking. The truck loading bays will offer opportunities for potential buyers who desire Natural Gas but are not on the growing Indian gas pipeline network.

## Summing up

All in all, Dhamra LNG terminal and JHBDPL offers much needed local infrastructure, diversification and new ways of receiving gas to a large part of the Indian market. This is a small but important step in our country's transition to a gas-based economy and I salute the courage, vision and determination of everyone who has worked tirelessly to make this a reality! Going forward, world class operation standards, throughput, continuing with record setting HSE standards remain our priority. ■



## Power-to-X: Opportunities, Challenges and Global Adoption

**Mithu Saha** explores the role of Power-to-X (P2X) technologies in addressing the challenges of renewable energy integration, decarbonization, and achieving a net-zero carbon emissions future. He also emphasizes about the present demand scenario of Power-to-X technology and countries that have emerged as leaders in incorporating and advancing P2X technologies.

**T**here is a revolutionary concept gaining traction as key to the transition of a more sustainable energy landscape. Power-to-X (P2X). The term encompasses a diverse set of technologies that share a common goal: to convert surplus renewable energy into various forms of energy carriers. These energy carriers include hydrogen, synthetic fuels, and chemicals.

The core principle behind P2X is to capture and convert excess renewable energy generated during periods of high production. The energy carriers provide a mechanism to store energy and make it available when demand exceeds supply.

The value of P2X is its ability to address some pressing challenges associated with renewable energy sources. The greatest qualms opponents of renewable energy cite are intermittency, and storage. Wind and solar, the most used renewable energy generation types, rely on certain weather conditions. Storing excess energy when weather conditions are optimal is critical for a reliable energy supply.

By transforming surplus renewable energy into energy carriers, P2X effectively serves as a bridge between intermittent renewable energy sources and consistent energy demand. This not only enhances the reliability and stability of the energy grid but also creates new opportunities for sectors that traditionally rely on non-renewable energy sources.

In theory it sounds good, but, does Power-to-X provide real hope for us to save our planet, or is it just a pipe dream?

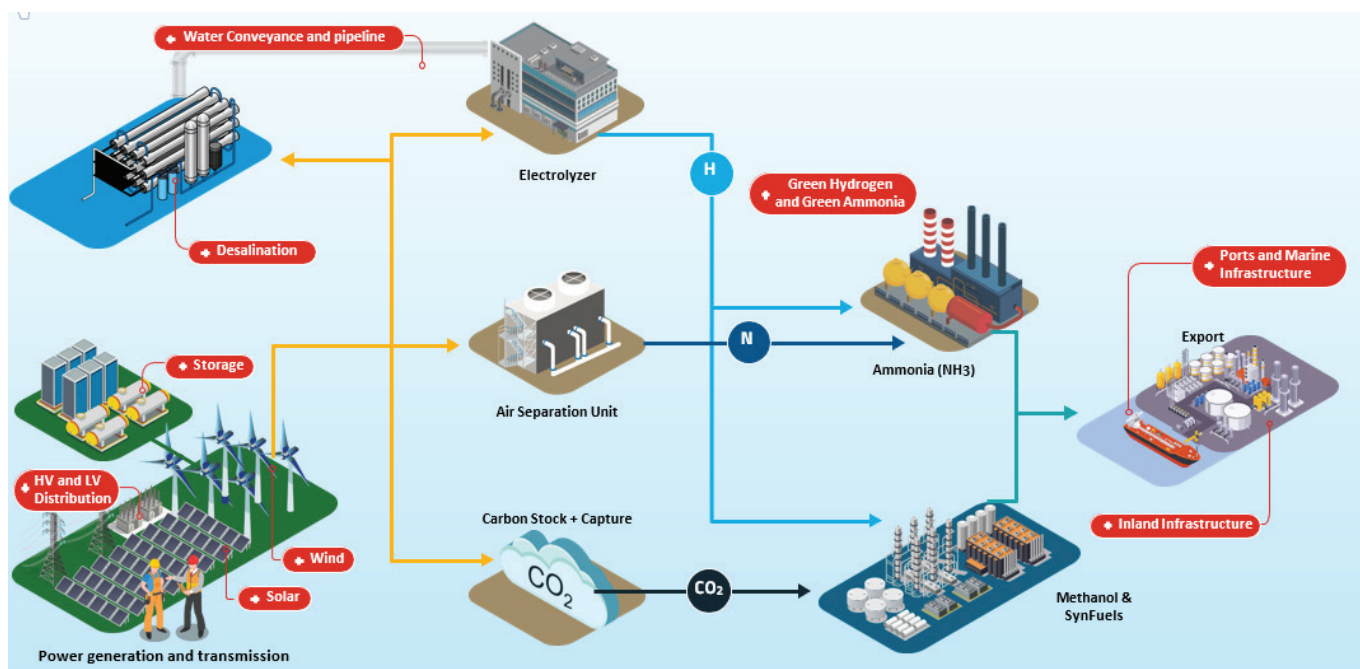
### How does Power-to-X help in decarbonization and how will it help to achieve Net-Zero?

We have been made increasingly aware of the detrimental effects emissions pose to the climate and in turn our environment. Renewable energy reduces carbon emissions from electricity generation. However, certain sectors such as heavy industries, aviation, and shipping find it challenging to directly integrate renewable energy into their operations. P2X offers players in these sectors a solution to their overarching mission of decarbonization and ultimate goals to achieve net-zero.

By producing energy carriers like hydrogen and synthetic fuels through P2X technologies, heavy industry sectors can transition away from carbon intense fuels. Hydrogen, for instance, can be used as a clean fuel for industrial processes and transportation, emitting only water vapor during combustion. Similarly, synthetic fuels derived from P2X can replace traditional fossil fuels, mitigating greenhouse gas emissions. As P2X relies on renewable energy sources, the production and utilization of these energy carriers significantly reduces overall carbon emissions, thus advancing the goal of achieving net-zero carbon emissions.

### What are the opportunities and challenges in Power-to-X?

One of the primary advantages of P2X is its potential to create a symbiotic relationship between renewable energy generation and energy-intensive sectors. However, the path to realizing opportunities comes with its share of challenges. The efficiency of the electrolysis process, a central component of many P2X technologies, remains a concern.



## Opportunities

- **Integration of Renewables:** Power-to-X efficiently manages the intermittent nature of renewable energy, enabling the storage of excess energy for later use or transport.
- **Emission Reduction:** By producing hydrogen and synthetic fuels using renewable sources, Power-to-X substantially curbs carbon emissions, especially in sectors with limited electrification potential.
- **Energy Storage:** This technology provides a viable energy storage solution, mitigating peak demand or low renewable energy generation periods.
- **Holistic Energy Approach:** Power-to-X facilitates the convergence of electricity, transportation, and industrial domains, enhancing overall energy system efficiency.
- **Export Potential:** The exportation of synthetic fuels or hydrogen bolsters energy security and economic growth on the global stage.
- **Enhanced Energy Security:** Power-to-X diminishes reliance on imported fossil fuels, bolstering energy security for nations.

## Challenges

- **Economic Viability:** The technology often demands significant initial investments due to energy-intensive processes and necessary infrastructure.

- **Efficiency Concerns:** Inherent energy losses during conversion processes may impact the overall efficiency of Power-to-X systems.
- **Infrastructure Complexities:** Establishing the required infrastructure for hydrogen or synthetic fuel production, storage, and distribution poses intricate technical and financial challenges.
- **Resource Constraints:** The availability of essential raw materials, such as carbon dioxide and water for synthetic fuel production, could be limited in specific geographical regions.
- **Regulatory Hurdles:** Insufficient policy and regulatory frameworks, including the absence of carbon pricing mechanisms, might hinder the widespread adoption and scaling of Power-to-X.
- **Technological Maturation:** Certain conversion processes, like large-scale electrochemical synthesis, are in nascent stages and necessitate further research and refinement.
- **Competition with Alternatives:** Other clean energy technologies, notably battery storage, may compete for investments and attention, impacting Power-to-X's growth trajectory.

## The present demand scenario of Power-to-X technology

Demand for P2X technologies is steadily rising as both governments and corporations strive to reduce their



## FEATURES

carbon footprints and transition to lower-emission energy sources.

The adoption of renewable energy, particularly solar and wind power, creates situations where excess energy is produced during peak periods. This surplus energy can be harnessed through P2X technologies, providing a viable solution for storing and utilizing this energy at a later time.

Industries that are difficult to electrify directly, such as steel manufacturing, aviation, and heavy transportation, see P2X as a critical avenue for decarbonization. Governments and policymakers are recognizing the potential of P2X and are crafting supportive policies, incentives, and funding mechanisms to encourage research, development, and deployment of these technologies.

### Which countries are leading the Power-to-X revolution?

Several countries have emerged as leaders in incorporating and advancing P2X technologies. Germany, known for its Energiewende (energy transition) policy, is at the forefront of P2X innovation. The country is investing in research and development to improve P2X efficiency and exploring various applications, including hydrogen production for transportation and industrial use. Denmark, with its substantial wind energy capacity, is leveraging P2X to convert excess wind energy into hydrogen and other energy carriers.

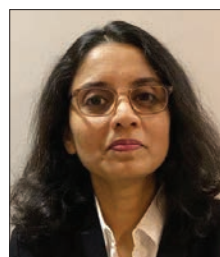
Norway is also making strides in P2X, capitalizing on its hydropower resources to produce clean hydrogen. Japan and South Korea are investing in P2X research to diversify their energy sources and reduce reliance on imported fossil fuels. The Netherlands is actively exploring P2X solutions to address challenges in achieving their emission reduction targets.

India is also not far behind. With India's NDC target of making 50% of its electricity from non-fossil source by 2030, there is huge impetus in the growth of renewable energy mainly in solar and wind. This growth along with various other government policies are attracting major investments in P2X.

### Power-to-X a tangible pathway toward a sustainable energy future

P2X technologies hold the potential to revolutionize the way we produce, store, and consume energy. Simultaneously addressing the challenges of intermittency, storage, and decarbonization, P2X will make a significant contribution to global efforts to combat climate change and achieve net-zero.

As governments, industries, and researchers collaborate to overcome technical hurdles and optimize P2X processes, the vision of a cleaner and more resilient energy landscape is steadily becoming a reality. P2X is indeed a real hope, an essential tool to ensure a more sustainable and prosperous future for generations to come. ■



### Author

**Mithu Saha**  
General Manager - Energy Transition  
Worley

## Energy Efficient Refining Technologies

Refinery sector is regarded as the leading energy consuming industry that shares 33.1% of the total energy consumption in industrial sectors in India. Shyam Choudhary emphasizes about the significant challenges for the energy efficiency of refineries and common methods used in refineries for energy optimization.

Energy is one of the key resources for a country's economic growth and development. In a world that is increasingly becoming resource constrained, the emerging challenge for a country like India is to strike a balance between trying to catapult the country to the next level of economic growth and at the same time negate the challenges arising out of increased energy uses.

India is the third-largest energy consumer in the world after China and the United States and the most populous

country, with 1.4 billion people. India's energy needs continue to grow as a result of population growth and modernization and is expected to double by 2040.

The country's energy consumption is projected to reach 1,500 million tonnes of oil equivalent (MTOE) by 2040, up from 849 MTOE in 2019. This rapid growth has further increased the importance of efficient use of energy. Due to this, the energy intensity of various industries has come under special focus and oil refineries are one of them.

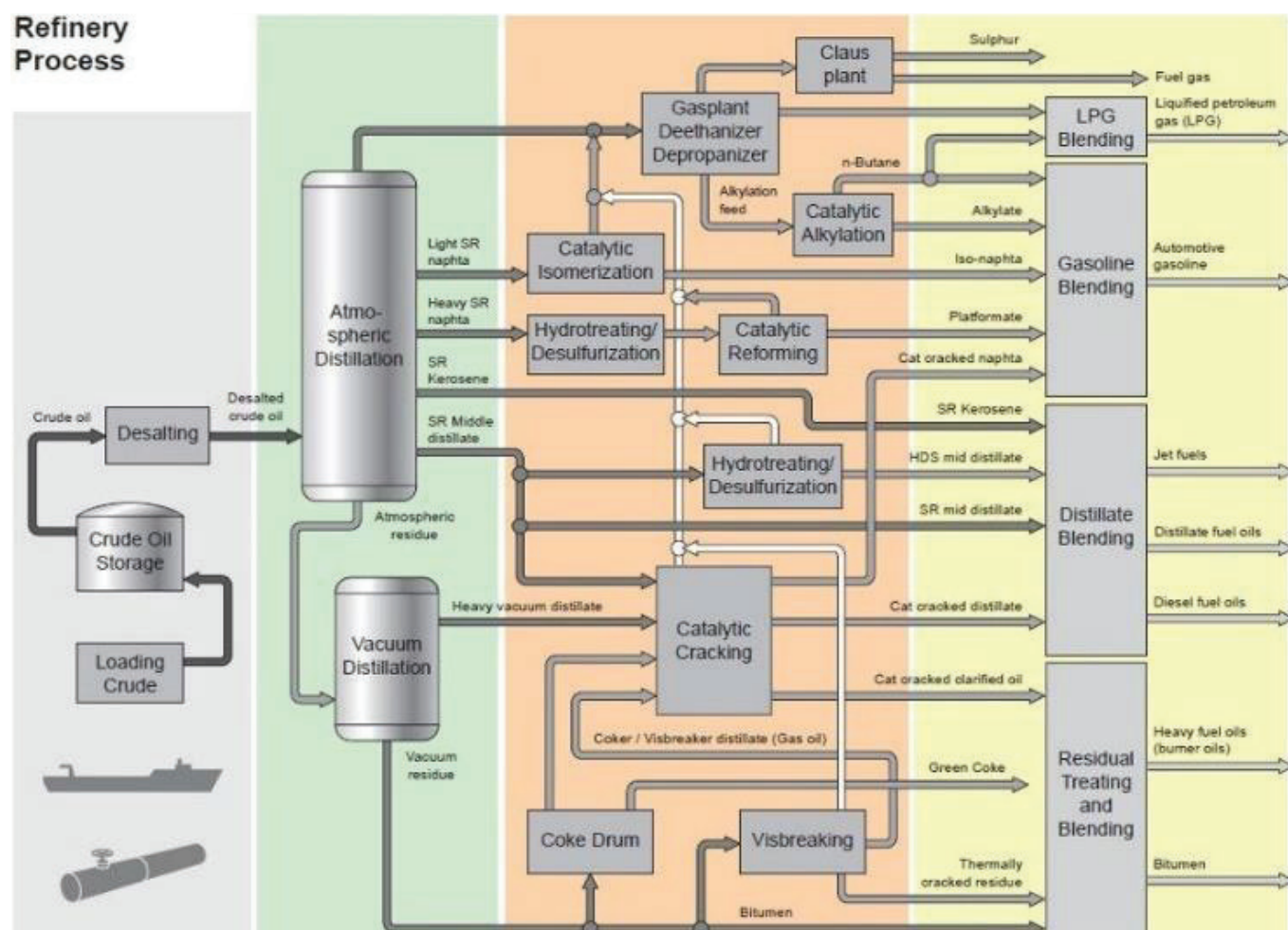


Fig.1: Typical Refinery Configuration



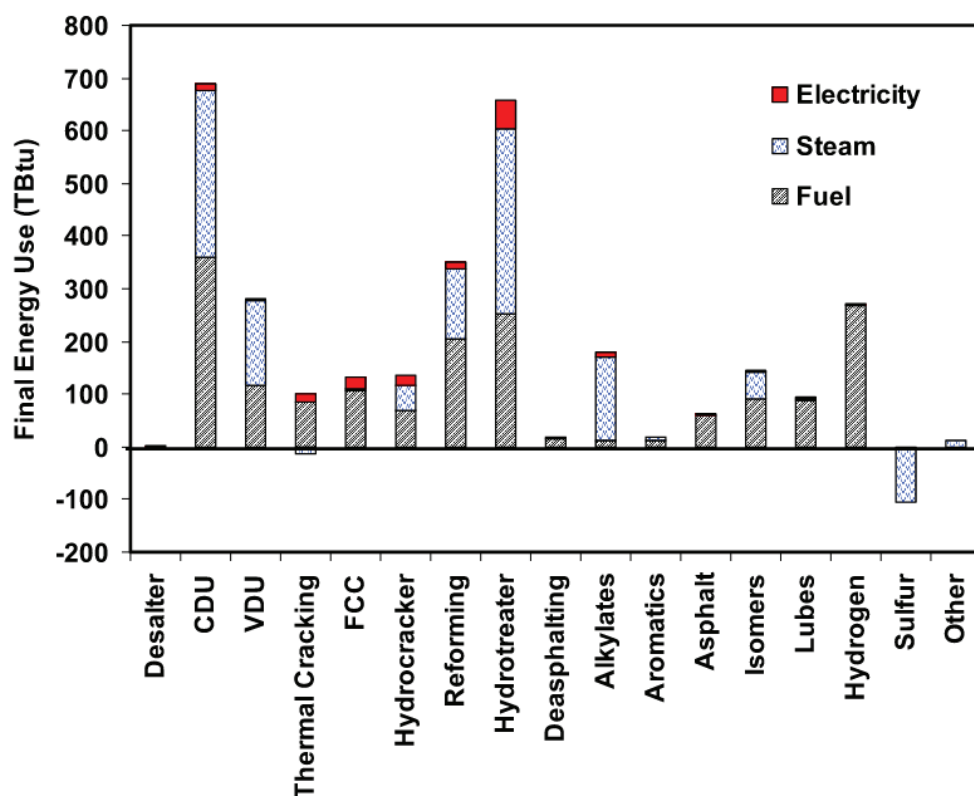


Fig.2: Estimated Energy Use by Refining Process

Stringent environmental regulations are also prompting an additional incentive to save energy and adopt energy efficient practices to reduce carbon footprint.

## Today's Refineries

Modern refineries are highly complex and integrated, separating and transforming crude oil into a wide variety of products, e.g. transportation fuels, residual fuel oils, lubricants, and many other products (see Fig. 1). In the present refineries, hydrocarbon compounds are not only distilled but are also converted and blended into a wider array of products.

Different conversion processes are available using thermal or catalytic processes, e.g. catalytic reformer, where the heavy naphtha, produced in the crude distillation unit, is converted to gasoline, and the Fluid Catalytic Cracker where the distillate of the vacuum distillation unit is converted to gasoline. Newer processes, such as hydrocrackers, are used to produce more light products from the heavy bottom products. Finally, all products may be treated to upgrade product quality (e.g. sulfur removal using a hydrotreater). Side processes that are used to condition inputs, produce hydrogen or by-products include crude conditioning (e.g. desalting), hydrogen production, power and steam production, and asphalt production.

## Energy Use in Refinery

Today's refineries process various types of crude oil from different sources. Over the past years, there has been an overall trend towards more heavy crudes and higher sulfur content. The changing nature of crude oil inputs and the increasing demand for low-sulfur fuels present significant challenges for the energy efficiency of refineries. To address these challenges, refineries need to adopt a range of strategies to optimize their operations and reduce energy consumption. Furthermore, operational factors like capacity utilization, maintenance

practices, as well as age of the equipment also affect energy use in a refinery from year to year.

Major energy consumer processes in a typical refinery are crude distillation, hydrotreating, reforming, vacuum distillation, and catalytic cracking. Hydrocracking and hydrogen production are growing energy consumers in the refining industry.

Figure 2 depicts an energy balance for refineries that is based on publicly available data on process throughput (EIA, 2002), specific energy consumption (Gary and Handwerk, 1994; U.S. DOE-OIT, 1998; U.S. DOE-OIT, 2002) and energy consumption data (EIA, 2001; EIA, 2002). The energy balance is an estimate based on publicly available data and is based on many assumptions on process efficiencies and throughputs.

In 1960s, energy conservation was a relatively simple economic issue. Refinery energy-efficiency was decided primarily in the design phase, and by optimizing between energy and investment costs of heat and power recovery equipment. However, refinery design guidelines changed as fuel prices increased and more energy-efficient designs replaced older, less efficient designs.

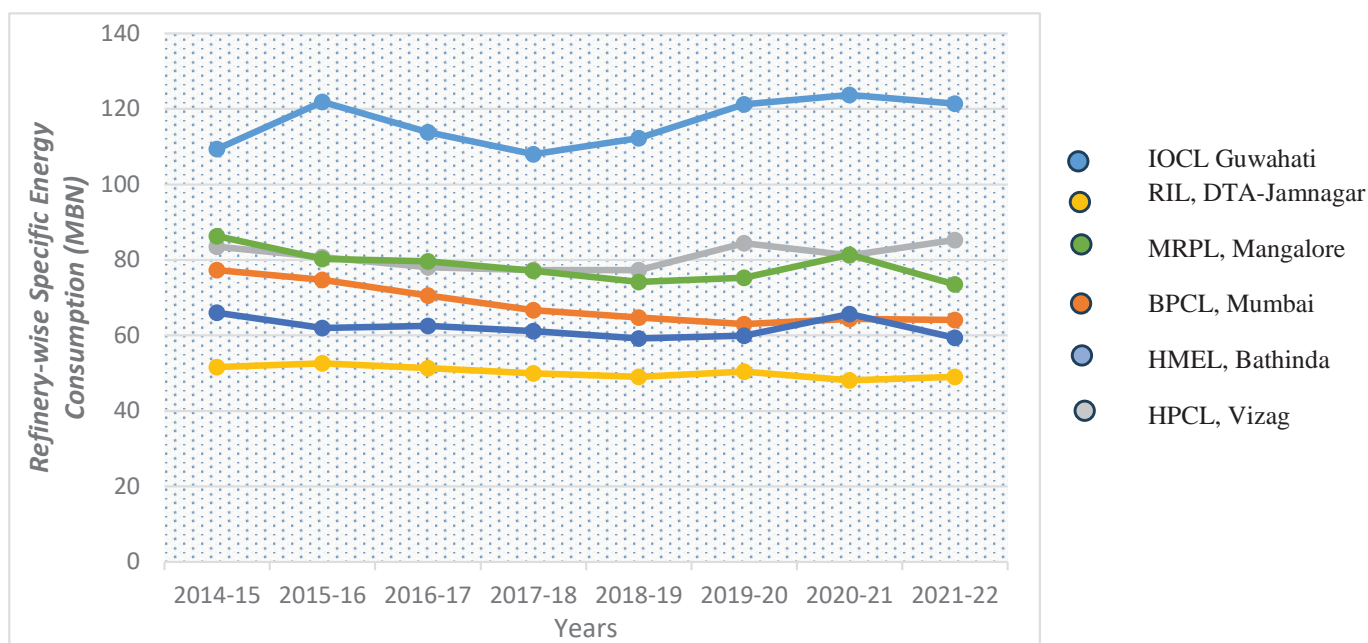


Fig.3: Specific Energy Consumption of Indian Refineries

New technologies that matured in the 1980s, such as the industrial gas turbine and pinch technology, made significant impacts but for a relatively short period.

For example, preheat trains were designed for an approach temperature of about 60°C in the 1960s. This optimum then decreased to about 20°C in the 1970s and early 1980s. This decrease offered large scope for improvement. Today, the optimum approach is likely to be 35–40°C. Thus, revamping a preheat train in the 1980s allowed three times more energy savings than in the 1990s.

### Energy Efficiency

The refining industry can be classified as energy inefficient. Therefore, the energy efficiency of an average refinery is relatively low, and the scope for improvement is high.

Refinery energy performance can be assessed in terms of the 'best technology' (BT) index of the site. This index is the ratio of the refinery total energy consumption (including fuels, FCC coke, and power import) to the sum of BT energy consumption allowances (standards) for each process unit and for the off sites (mostly followed for European & US refineries).

The BT standards have been developed by fundamental analysis and design studies on individual process units. They take into consideration the key process parameters affecting energy consumption, such as actual feed quality, conversion, and fractionation performance.

The industry BT average is about 195 per cent. Thus, it can be said that the refinery industry as a whole is 95 per cent energy inefficient. The reasons usually cited for this condition are as follows:

- Units were designed when the cost of energy was low.
- Phased expansion – new units were built stand-alone and not heat-integrated with older units.
- Utility systems were seldom modified/optimized when onsite expansions were made.
- Capital savings – units were designed for minimum investment cost.
- Refineries rely on power import and have low in-house power generation efficiency.

Together with the refinery's relative energy inefficiency goes an equally inefficient environmental performance. Directionally, reduced energy consumption results in reduced air emissions.

Figure 3 shows the specific energy consumption of Indian refineries in MBN (net energy consumption of in Million British Thermal Unit (MMBTU) per thousand barrels of crude processed).

According to a report by the Ministry of Petroleum and Natural Gas, the average energy consumption per barrel of crude oil processed in Indian refineries is around 6.5 GJ/barrel, which is higher than the global average of around 5.5 GJ/barrel.



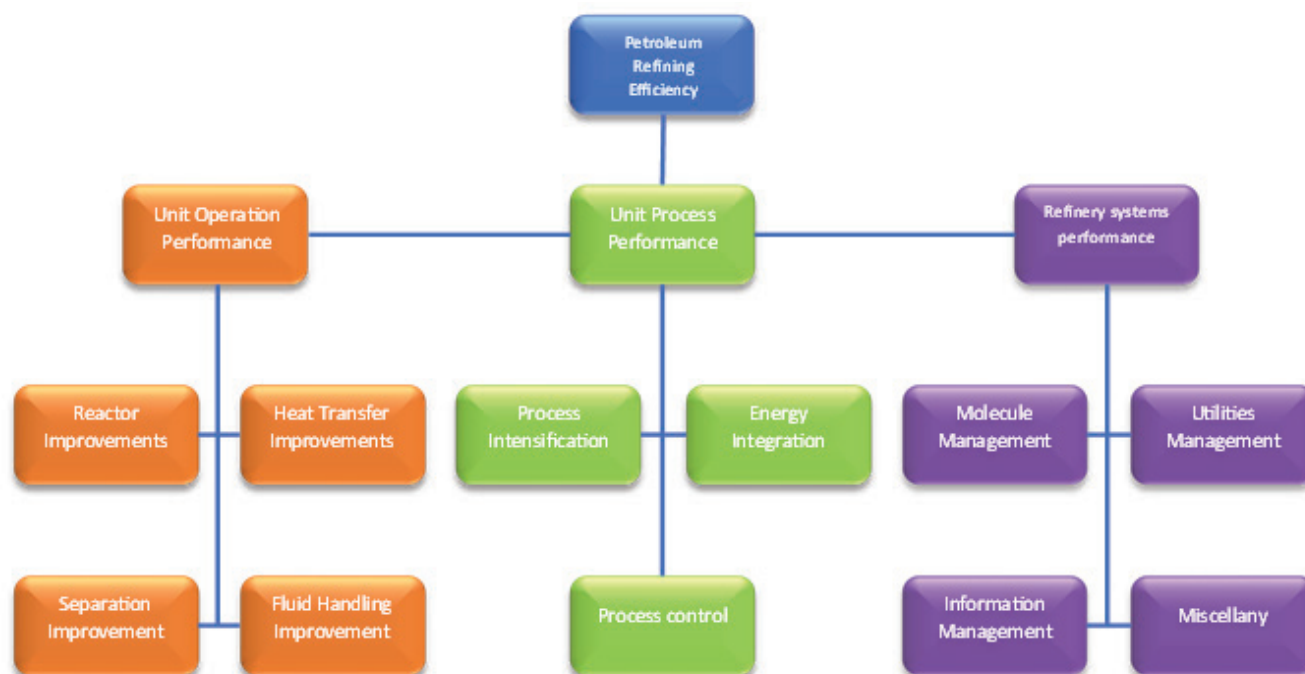


Fig.4: Categories for Efficiency Improvement

## Energy Management Opportunities

A large variety of opportunities exist within refineries to reduce energy consumption while maintaining or enhancing the productivity of the plant.

Major areas for energy efficiency improvement are utilities, fired heaters, process optimization, heat exchangers, motor and motor applications, and other areas. Of these areas, optimization of utilities, heat exchangers and fired heaters offer the most low-investment opportunities.

Implementation of an organization-wide energy management program is one of the most cost-effective ways to bring about energy efficiency improvements. An energy management program creates foundation for improvement and provides guidance for managing energy throughout an organization. In companies without a clear program in place, opportunities for improvement may be unknown or may not be promoted or implemented because of organizational barriers. These barriers may include a lack of communication among plants, a poor understanding of how to create support for an energy efficiency project, limited finances, poor accountability for measures or perceived change from the status quo.

## Categories of Energy Management Opportunities

When efficiency improvement is undertaken for any refinery, all processes and their interactions must be

considered. Further, the efficiency of a process is not limited to only in terms of energy, but also in terms of mass and information. Though these three efficiencies are distinct they are also highly correlated. Improved mass efficiency will improve energy efficiency, and the collection and transmission of data enables process optimization and controls to be used to improve both.

Therefore, the efficiency improvement and optimization measures for a refinery can be broadly categorized into 3 categories as described in Figure 4.

## Common Optimization Methodology in Refineries

Pinch technology and Cogeneration are the two most common methods used in refineries for energy optimization.

**Pinch Technology:** Pinch technology refers to the use of potential synergies that are inherent in any system that consists of multiple components working together. In plants that have multiple heating and cooling demands, the use of process integration techniques may significantly improve efficiency. This methodology involves the linking of hot and cold streams in a process in a thermodynamic optimal way. The pinch approach has been extended to resource conservation in general, whether the resource is capital, time, labor, electrical power, water or a specific chemical species such as hydrogen.

Process integration analysis of existing refineries and processes should be performed regularly, as continuous changes in product mix, mass flows and applied processes can provide new or improved opportunities for energy and resource efficiency.

**Cogeneration:** Combined heat and power (CHP), or cogeneration, is comprised of not one technology but several combined technologies, which, when employed together, generate electricity and heat energy in a single integrated system. In refineries today, the most common components of an efficient cogeneration system have been identified as:

- The industrial gas turbine
- Heat recovery steam generators (HRSG)
- Back pressure and condensing steam turbines.

The gas turbine burns natural gas to produce electricity and expels hot exhaust to the HRSG. The HRSG then recovers the heat from the exhaust to make steam and may even fire additional fuel to enhance steam production. The portion of this steam is utilized in turbine and then let down to the steam header pressure.

**Advance Process Control:** APC is a powerful tool for improving the energy efficiency of refineries, and it can help to reduce operating costs, improve product quality, and enhance the environmental performance of the refinery.

Advanced process control (APC) is a technology that uses mathematical models and algorithms to optimize the performance of industrial processes. APC systems are designed to monitor and control key process variables in real-time, such as temperature, pressure, flow rate, and chemical composition, to ensure that the process operates at maximum efficiency and quality.

APC can be implemented to improve the energy efficiency of refineries in the following ways:

- Optimizing process parameters
- Reducing energy waste
- Improving heat recovery
- Reducing emissions

## Conclusion

Energy-efficient refining technology is closely linked with carbon emissions because the refining process is energy-

intensive and requires a significant amount of fossil fuels to operate. Energy-efficient refining technology can reduce the amount of energy required to refine crude oil into usable products, which in turn reduces the amount of fossil fuels burned to generate that energy. This reduction in fossil fuel consumption leads to a corresponding reduction in carbon emissions, which are a major contributor to climate change.

Most petroleum refineries can economically improve energy efficiency by 10-20% by adopting energy efficient measures. Improved energy efficiency may result in co-benefits that far outweigh the energy cost savings and may lead to an absolute reduction in emissions.

Although technological changes in equipment conserve energy, changes in staff behavior, adopting efficient practices and attitude can also have a great impact; staff should be trained in both skills and in implementing the company's general approach to energy efficiency in their day-to-day practices.

By adopting these changes, the industry will not only reduce their environmental impact but also improve their operational efficiency and competitiveness in the global market ■



## Author

**Shyam kishore Choudhary**  
AVP, Head – Process & Technology  
Technip Energies

### AI – accelerator to a greener future?



With a few weeks of the year still to go, artificial intelligence (AI) can already stake a good claim to be the phrase of 2023. It is now a well-established household name, in no small part due to concerns about the potential for the technology to generate thoughts of its own, replace jobs and spread disinformation. Such worries are certainly not without merit, and they broadly represent the hopes and fears of many. In short, the future is not what it used to be. **Graham Faiz** talks about how Artificial Intelligence will make a significant contribution to future energy system.

**N**evertheless, the emergence of AI comes at something of an opportune moment as humanity grapples with one of its most pressing challenges – climate change. The end goal is clear – to slash carbon emissions and reach net zero – but there needs to be a constant within that: an affordable and secure energy system.

The pandemic and Russia's invasion of Ukraine have tested the limits of many countries' energy systems. The pressure to digitally overhaul the sector to guard against recurring challenges is mounting, and that depends on innovative, disruptive technology.

As such we find ourselves at a critical juncture, where we must look the remarkable potential of AI right in the face and consider its integration into our energy

systems so it may be a boon, rather than a peril. The energy transition demands it.

#### **A whitepaper to light the way**

Part of the unease around AI undoubtedly comes from the fact that it is difficult to accurately define; how can you classify something that is constantly evolving and growing? The term 'artificial intelligence' was first coined by pioneering computer scientist John McCarthy in 1953 as "the science and engineering of making intelligent machines" – a definition so broad it encompasses almost all modern computing.

In becoming the highest trending Google search globally over the past year, responsive chatbot system ChatGPT has opened our eyes to the wider possibilities of the technology. Within the energy space, AI has the



potential to unpick many of the complexities arising from the transition to a low carbon energy system.

To better understand how AI can be harnessed as an asset, DNV recently published a dedicated whitepaper, entitled 'AI Insights: Rising to the Challenge Across the UK Energy System'. Launched to coincide with the SPE Offshore Europe 2023 conference in Aberdeen, it features contributions from leading organisations and individuals at the forefront of understanding and implementing AI-technologies for the sector.

### Barriers to use of AI

Understandably there is still a degree of trepidation in the oil and gas sector about the adoption of AI, and a degree of healthy scepticism can act as a good safeguard. Having learned safety lessons the hard way, the industry has a natural aversion to risk, and while this is generally the right approach, it can act as barrier to new ways of working.

In our conversations, we found that there is a culture element around the discipline of engineering, one that has an aversion to risk and a low tolerance to error. Key to AI machine learning models is that data science involves measuring test error and being explicit about it.

Subsequently, when this then comes to the adoption of new technologies, the flagging of an error margin can have a negative impact on the receptiveness of companies. When compared to current ways of working and manual work by engineers, where there is perhaps no way of measuring performance, new algorithms can be held to a higher standard than the existing process.

There is a general consensus that data and culture barriers are also slowing project owners and developers' adoption of innovative technology, to the detriment of the energy transition. There are economic factors to consider too. In our research, we found that companies have struggled to establish full cost benefits and what the savings are going to be in the embracing of digital technologies.

Then there is the skills gap that is hampering the growth and development of much of the energy system at the moment. There are a limited number of people who understand both AI and the complexities of the energy sector, let alone how the two fit together. Bridging that gap need not be difficult, but it will require communication and, most importantly, time, the latter of which is often at a premium.

It may sound like a simple solution to a complex problem, but collaboration is key in developing a more rounded knowledge of energy systems and AI's place within them. Sharing knowledge and data will only aid our understanding of dense challenges, and while there is a new willingness within the sector to work together, there is certainly room for improvement.

### Overcoming unease and building trust

Effectively harnessing AI's potential to support the UK's transition hinges on a concerted investment of both thought and time. There are a myriad obstacles - whether technical, cultural or somewhere in between - to overcome, but they all have one common root: a lack of trust.

DNV's 2022 report 'Assurance in the Digital Age' found that trust gaps emerge and widen as the development of technology outstrips regulation and standardisation. Building faith is a prerequisite for unlocking the advantages of AI, and that in turn requires responsible use of this great tool. To access the potential value there is a need for a comprehensive trust framework that encompasses technology, users, and the environment.

Given assurance has been our core business since 1864, DNV has a big part to play here in building trust in AI systems by evidencing, assessing and evaluating the technology and its uses. The philosophies and processes to assure technologies are well established, and good practice in software development is also mature. However, AI systems present unique challenges and are inherently opaque in operation. An independent voice is essential to build a strong bed of trust.

Regulation and independent assurance are the primary instruments by which we establish trust in the energy system and the technologies that underpin it. Health and safety in the oil and gas industry is a clear cut example of this. In the wake of the Piper Alpha oil platform explosion in the North Sea, which claimed the lives of 167 men, the UK Offshore Safety Case Regulations were implemented, prompting a step-change in safety offshore. A critical aspect of said regulations is the requirement for independent verification: establishing trust through oversight.

Typically though, regulation has been reactive rather than proactive, and governments across the world are already playing catch-up with AI technology. As digital technologies spreads across borders, it will become



increasingly hard to regulate, meaning efforts to build trust become fragmented. This is changing though – the UK is hosting an international AI safety summit in November – and guidance designed to shape the use of the burgeoning technology in critical industries is taking shape.

### **The end goal is clear, the path less so**

More and more people now believe that AI has the potential to make a significant contribution to our future energy system; highlighting solutions by painting a fuller picture. Identifying an ideal path to said solutions is still up for debate though, and differing schools of thought are emerging. While the best route remains unclear, inspiration can provide the required first steps, and our whitepaper contains several examples of AI applications in the energy system that should give us heart. One key area is around grid, where data driven decision making can help to balance the intermittency of renewable sources like wind and solar by mapping supply and demand.

DNV is proud to be at the vanguard of digital technology,

building on our 150 years and counting of preserving life, safeguarding property, and protecting the environment. In addition to our established guidelines, standards, and best practices spanning various industries such as maritime and energy, we have expanded our scope to include recommended practices for ensuring the integrity of digital assets. With vigilant oversight, DNV believes that AI has the potential to become an integral cog in facilitating the transition to a cleaner and more sustainable energy system. ■

### **Author**



**Graham Faiz**

Head of Growth and Innovation -  
UK & Ireland, Energy Systems, DNV.

## How oil and gas firms are transforming their work models to manage market challenges



Digital transformation is the key to thriving in a volatile world. The oil and gas (O&G) sector faces mounting challenges amid a changing world. Market uncertainty and pricing volatility are plaguing the industry, making it difficult for companies to plan and execute accordingly. **Fernanda Martins, Industry Director, Energy and Emerging Markets, AVEVA** talks about digital transformation in oil and gas companies led by the latest advances in cloud, Artificial Intelligence (AI), and Industrial Internet of Things (IIoT).

Ongoing geopolitical events have fractured already-fragile supply chains, while the hangover of the global pandemic has reshaped worker dynamics and reduced the available workforce.

What's more, amid an ever-stricter climate for environmental regulations, companies must stay ahead of mandates and public and industry pressures to meet new ESG targets.

Given the rocky economic climate market of the last few years, many O&G firms have been reluctant to invest in capital upgrades or digital infrastructure to

increase efficiencies. But today's wafer-thin margins and high stakes are now acting as a propellant for energy companies to seek out technological solutions for complex challenges.

Across the world, O&G firms are finding success through the digitalization of work. Fresh ways of working with technology, based on common data platforms, advanced analytics and global visibility, are helping companies become more profitable.

According to LNS Research's recent "Industrial Transformation in 2021: Getting Real" report, half of





## FEATURES

industrial enterprises report they have embarked on a digital transformation journey, and these programs are yielding very real benefits. LNS found that leaders in digital transformation are 72% more likely to have increased revenues by more than 10% and 57% more likely to have reduced the Cost of Goods Sold (COGS) by more than 10%.

Through the adoption of digital tools, companies are able to leverage their own industrial data and turn that information into innovative insights. This value-added data then enables companies to:

- Speed time from concept to full-capacity production
- Empower the workforce
- Optimize the value chain to create more agile operations
- Enable reliable, efficient, and safe operations
- Meet sustainability and decarbonization objectives.

### Optimized operations through digitization

To accelerate their transformation, forward-looking O&G companies are leveraging digital initiatives powered by the latest advances in cloud, artificial intelligence (AI), big data, digital twin, and industrial Internet of Things (IIoT). Built on open, agnostic industrial software design principles, O&G companies are using these technologies to overcome key challenges, while improving sustainability and the profitability of their businesses.

By digitalizing work, O&G companies can drastically improve collaboration and efficiency, prioritize capital spending, and build more agile operations that can withstand market shifts. Because digital work allows workers to complete tasks from anywhere across different sites and locations, operators can accomplish more than just solving problems. Through digital workflows they can improve overall efficiency, use the remaining time to innovate, and help companies build resilience against workforce disruptions and attract a new generation of workers.

Not only do digital tools enhance enterprise-wide collaboration, but they can also seamlessly unify operations and supply chains, breaking down silos while opening new pathways for information flow. By centralizing operational insights and visualizations, operators can collaborate on the same information at the same time to identify weak spots in the business and work together to improve efficiency and profitability.

Shared data aligned with advanced analytics improves

the transfer of institutional knowledge and empowers the workforce. Even when workers are away or retire, new workers can make informed decisions by accessing information in a central digital repository, with contextualized operational data and AI-based guidance.

Digitalization likewise improves sustainability initiatives and regulatory compliance. Software applications can optimize operations, streamline environmental reporting, and maximize energy usage.

### Becoming agile and resilient

With reliable operational data and accurate models, companies can optimize every part of the value chain. From process optimization, to inventory management and supply and demand balance, they can uncover new opportunities that lead to greater profitability.

Agile operations start with quality data and integrations – and that requires a convergence of engineering, operations, and information technology. By creating one single source of truth for real-time operational data and contextualizing that information alongside engineering, performance, and financial data, teams can use AI-powered tools to run real-time comparisons and simulations to find new efficiencies.

### BP: A digital success story

Global energy giant BP's downstream business processes 1.7 million barrels per day in eight refineries around the world. Unfortunately, the company's outdated technology wasn't intuitive and made it difficult to share best practices across locations. Teams were also unable to quickly make decisions to reflect market changes, leading to lost opportunities and benefits. As part of its Digital Innovation Program, BP opted to review its global downstream supply chain management process to enable more agile operations.

BP deployed a series of digital cloud technologies to maximize margin capture, efficiency, and sustainability. One of the solutions was used to optimize the production planning of its downstream business, which allows teams to quickly run complex analyses and analytics using accurate, real-time data. By simplifying and standardizing its supply chain management, BP has fostered better collaboration and planning, which has increased overall agility, significantly reduce crude purchase time and improving the modelling of CO<sub>2</sub> emissions.



Overall, BP has significantly improved margins, made better, faster decisions, increased planning and analysis accuracy, and decreased the time it takes to analyze information from hours to minutes.

### Going green with ease

Sustainability and decarbonization are key drivers for the O&G industry. As companies look to reach net-zero targets by 2050, they must increase compliance with energy transition mandates and open up new value chains for carbon and hydrogen.

Reaching these goals and complying with new market demands requires companies to reshape business models, increase investment in ESG programs, and bolster decarbonization initiatives. To succeed, O&G companies need to modernize facilities and increase visibility across the value chain.

Access to reliable data, optimization models in the cloud and enhanced KPI visualization gives companies the operational intelligence they need to boost the value chain, reduce emissions, and innovate to reach energy targets.

### Thriving in a new age

Through digital initiatives powered by the latest technology enablers, O&G companies can build industrial information infrastructure and upgrade engineering and operations applications to accelerate value creation.

They can then visualize and share industrial data within their teams and value chain partners. By undertaking these initiatives, O&G firms of the future can streamline engineering cycles, achieve operational excellence, and empower their workforces to drive the circular economy and ensure profitable, sustainable operations. ■



### Author

**Fernanda Martins**  
Industry Director  
Energy and Emerging Markets, AVEVA



# Optimize Flow Loop Processes to Significantly Improve Energy Efficiency



A typical processing plant such as an oil refinery can incorporate hundreds or thousands of pumps. They consume as much as 60% of the facility's energy usage.

That's why a major oil and gas company partnered with Flowserve to evaluate their situation and develop a plan to address potential energy cost savings within various refining processes at one of its production facilities in Western Europe. The total electrical power consumption of the pumping systems in the study was approximately 40,000 MWh per year.

Together, we conducted a pilot project that analyzed actual operating data for 15 critical service, high-energy pump flow loops. The pumps and control valves in these systems had been supplied by Flowserve and other flow control equipment manufacturers. The study found that by modifying the flow control equipment, overall flow loop efficiency (or specific energy) could be improved and thereby significantly reduce the customer's operating costs and improve their carbon footprint.

When the plant operator completes implementation of the recommendations, energy consumption of this equipment will be reduced by approximately 35% from

the prior year. Payback on the investment in equipment upgrades is comfortably within the plant's threshold for return on investment (ROI).

## Understanding performance for a broad range of equipment

In a consultative approach, Flowserve specialists partnered with the refinery operators to undertake an operational assessment of the installed flow control equipment. A systematic data-driven evaluation process along with Flowserve's engineering expertise allowed us to identify and achieve significant improvements in overall flow loop efficiency.

## Calculating hidden costs and quick ROI

Flowserve analyzed two years of performance data from the refinery's pumps and control valves and studied the pump flow loops to identify opportunities for improvement that met the refinery operator's minimum ROI targets.

In instances where process data was not available, our experts utilized proprietary analysis tools to estimate the process performance data.



## Energy savings of 35% annually

Within eight weeks, Flowserve proposed solutions that would result in an overall annual energy savings of 35%.

The study included a review to determine whether any of the pumps were “bad actors”, which meant they were operating with frequent repair events, negatively impacting maintenance costs, disrupting plant operations, and potentially risking production. Our experts recommended corrective actions that would address the bad actors we had identified and enable them to operate more reliably.

## Comprehensive turnkey solution

The proposal presented a complete, turnkey solution from Flowserve, which included:

- Data gathering and solution analysis and definition
- Program management to align execution timing with the site
- Delivery of all necessary equipment modifications
- Testing to verify efficiency gains
- Monitoring program (reference ISO 50001 energy management program requirement on monitoring to maintain gains) to measure and track efficiency loss over time



The monitoring program was RedRaven from Flowserve, which enables companies to realize the full benefits of the internet of things (IoT) and predictive analytics to continuously monitor efficiency performance.

The program management approach categorized equipment upgrades in terms of when the modifications could be implemented (i.e., during normal operations, during routine maintenance cycles or wait for turnaround) to enable seamless execution within normal refinery operations.

## Accelerate your energy transition plan

Optimizing pump efficiency is an increasingly important consideration toward the achievement of sustainability goals. The Energy Advantage Program from Flowserve offers a suite of solutions focused on enabling significant efficiency, reliability, and carbon reduction improvements from the optimization of flow control loops.

The Energy Advantage Program can quickly enable your company to start achieving operational cost objectives and accelerate progress toward realizing your decarbonization goals. Partner with Flowserve to implement the program and then monitor the savings on an ongoing basis to ensure that your company continues to meet energy efficiency targets.

Flowserve specialists share our unparalleled experience in implementing solutions to optimize pump efficiency around your process needs.

## Methodology used

Flowserve uses a systematic process and data-driven approach to identify and prioritize opportunities for efficiency and operational gains. Flowserve combines the system-level understanding of flow control component interaction with OEM product expertise for each of the main components to identify and act on energy optimization opportunities in flow loops.

A customized contracting and execution model can then be developed to implement solutions, delivering

Refinery pump assets	Annual energy cost savings estimates (millions)
1,000	€2.5 to 5
2,000	€5 to 10
3,500	€9 to 18

*Source: Flowserve internal research (2022) based on 60% of pumps being operational, an average rated power of 50 kW for refinery pumps, 8,500 operating hours, 20 to 40% savings potential, 80% successful assessments at €0.06/kWh*



fast results while aligning schedules to achieve minimal impact to normal site operations. Adjusting and monitoring resultant savings is important to maintain achieved results.

These are a few of the best practices identified in the pilot study conducted by Flowserve in partnership with this large refinery operator.

A significant reduction in operational expenses can be achieved; Flowserve typically estimates 20 to 40% energy savings for similar projects. Using the results of this pilot project, the annual energy cost saving range potential for your company's project can add up to millions.

### Commitment to energy transition

At Flowserve, our approach to energy transition begins and ends with our purpose: to make the world better for everyone. We understand that when we enable our customers to tackle climate change and address increasing energy demands through our innovative flow control solutions, we can make the world better — now and for generations to come.

Our approach is threefold. We are diversifying, decarbonizing, and digitizing to support the global energy sector's transformation toward low-carbon sources.

### Diversification

Our innovative portfolio of flow control solutions and services will support energy systems around the world

to diversify the energy mix and adopt cleaner sources of energy.

### Decarbonization

We will support the reduction of energy-related CO<sub>2</sub> emissions across the mix of energy sources through our innovative portfolio of flow control solutions and services.

### Digitization

We will enable improvements in efficiency, productivity, sustainability, and safety of energy systems around the world through our digital solutions and services. ■

### References

*U.S. Environmental Protection Agency, "Energy Efficiency Improvement and Cost Saving Opportunities for Petroleum Refineries," An ENERGY STAR® Guide for Energy and Plant Managers, Document Number 430-R-15-002, February 2015, [https://www.energystar.gov/sites/default/files/tools/ENERGY\\_STAR\\_Guide\\_Petroleum\\_Refineries\\_20150330.pdf](https://www.energystar.gov/sites/default/files/tools/ENERGY_STAR_Guide_Petroleum_Refineries_20150330.pdf) (accessed January 21, 2022).*



### Author

**Pieter Teesink**  
Engineering Director  
Energy Advantage Program  
Flowserve Corporation



# Refinery-Petrochemical Integration: India



*Refineries have traditionally been designed to maximize fuels as final products. These products have primarily meant gasoline, diesel, and jet fuel. However, this process has generally resulted in underutilization of opportunities to extract higher-value products. Going back 30 years, the priorities of refiners have been to provide these traditional fuels. However, balance naphtha has emerged to provide an alternate business model. That's the reason refiners should be thinking seriously about integrating petrochemicals into refineries.*

**T**oday, as India looks toward a future of steadily declining consumption of hydrocarbon-based fuels, due to fair consideration being given to climate impact, other products such as petrochemicals deserve a look.

Global warming and depleting resources of crude oil — expected to decline in India by 2040 have already given impetus for finding alternate energy sources other than conventional refinery products i.e. Petrol and Diesel.

## Petrochemical Growth

What are Petrochemicals? Petrochemicals are chemical products derived from petroleum.

**Following are some examples:**

- **Ethylene:** Used in paper, consumer electronics, detergents, footwear, and adhesives.

- **Propylene:** Used in paints, furniture, textiles, pharmaceuticals, and food packaging.

- **Benzene:** Creates pharmaceuticals, furniture, electronics, and food packaging.

Based on various market research, the petrochemical industry is expected to expand at a compound annual growth rate (CAGR) of 6.0% to 8.0% from 2023 to 2030.

The integrated complex provides optimum molecule management for a better return on investment. The utilization of byproducts from fuel processes to produce other chemical products is already resulting in growth of the petrochemicals industry. The growth in the number of end products resulting from crude processing is improving refinery margins and shows signs of continued enormous growth over the coming years.

The overall Indian economy stands to be a big winner from this pivot towards petrochemicals as integrated refining and petrochemicals would drive down the need to import



## Factors Defining the Evolution of Indian Refineries

Search for alternate fuel		
Petrochemical growth		
The dynamics of the downstream market	Premium available in olefins vis-à-vis transportation fuels	<ul style="list-style-type: none"><li>· Stability over value chain</li><li>· Flexibility to the dynamic market demand and prices</li></ul>
	<ul style="list-style-type: none"><li>· Feedstock and product flexibility</li><li>· Absorption of return streams</li></ul>	Capital, OPEX and resource optimization
	Upgrade low value refinery streams to high value products	
Advances in refining technologies		

these products. Petrochemical feedstock accounts for about 12% of global oil demand currently. This share is expected to increase over the near and intermediate terms as demand increases for plastics, fertilizers, and many other petroleum-derived products.

Various established refiners/ companies are already working towards identifying technologies that could deliver improved performance and efficiency across the oil and gas value chain. This drives the technological advancement and Indian refiners needs to develop or adopt to these advances.

## Integration of Refineries and Petrochemical

Based on factors noted above, the current fleet of refineries in India will ultimately need to implement a road map to capture opportunities for petrochemicals integration. A few significant elements of that road map may include

- **Deploy Advanced Technology:** Conventional refineries were designed to withstand demand without consideration of future scope. However, current advanced technology can help to cope with future expansions.



- **Stream Selection:** In order to manage the product pool, the feedstock selection should be done in the conceptual stage.
- **Market Study:** Entering the market in the correct market cycle is very important. This entry timing is less important for refineries but highly important for petrochemicals.
- **Staggered Startup:** Due to differing needs, startups for refineries and petrochemicals need to be carefully planned upfront to manage utilities and product pools.
- **Correct Integration:** Most of the time, incorrect integration will reduce or eliminate economic viability of high-value products.

## Advantages of this Integration

- Upgradation of refinery streams to marketable products.
- Waste minimization.
- Savings on working capital.
- Higher monetary benefits.

## Key Questions for Informed Integration Decisions

With the improving economics of integration of petrochemical with refinery products, a few key questions need to be considered:

- What are the precise synergies that can be achieved?
- Will integration support the transfer of hydrocarbons, utilities, or both?
- How will olefins or aromatics be processed?
- What are the alternatives to the site in terms of displaced streams?
- Does integration offer the best economic solution?
- Is the asset in a cluster of industries that prohibits material changes to the feed/product/energy balance mix?
- Does the change make sense for the operation, or will it force others to spend more capital to change their business?

## Sustainability and Flexibility of Integrated Refinery and Petrochemical

The migration from refining-only to refining-plus-petrochemical operations is an option that should be considered by Indian refineries.

During the COVID-19 pandemic, for example, one refiner reduced fuel gas production and diverted feed towards raw material needed to produce LPG, masks, and PPE suits. This helped fill demand for urgently needed materials while maintaining business during the worst of the pandemic when demand for the product was high.

Accelerating demand for transportation fuels, and even higher demand for olefins, biodegradable detergents, and aromatics, will help refiners maintain margins while meeting emerging demands.

With the current growth of the Indian population and steady increases in purchasing power, demand for these products will push Indian refiners to expand more rapidly into production of petrochemicals.

## Conclusion

The migration of only refining to refining plus petrochemical is imperative considering high future consumer demand and high margins for refinery owners. Global demand for sustainable environmental practices and new products with lower carbon intensity means the time is right for Indian refiners to begin the transition with correct technology.

A rising middle class in India and China is driving high demand for petrochemical-based consumer products. It seems nearly certain that this pivot toward petrochemicals will be an increasingly significant factor for Indian refiners in the decade to come. ■

## Authors



**Rohan Manjarekar**  
Assistant Manager  
Burns & McDonnell Engineering India



**Kaivalya Save**  
Assistant Chief Engineer  
Burns & McDonnell Engineering India

### Need Valve Servicing?



***Keep your operations running smoothly with our top-notch valve servicing!***

**Experienced Experts:** Our skilled technicians have years of experience in servicing all types of valves, ensuring precision and reliability.

**Comprehensive Maintenance:** We inspect, clean, and calibrate valves to optimize performance and prevent costly downtime.

**Cutting-Edge Technology:** Utilizing the latest tools and techniques, we guarantee accurate diagnosis and efficient repairs.

**Quick Turnaround:** Minimize disruptions with our fast and efficient service, getting the systems back up and running in no time.

**Unmatched Quality:** Client satisfaction is our priority. We're committed to delivering exceptional results that exceed customer expectations.

Don't wait for a breakdown to happen. Contact us today and let our experts take care of your valve servicing

needs. Increase productivity, save on maintenance costs and stay ahead of the competition!

***For Details Contact:***

Nandkishor Tawde.

Marketing Head-Valves.

Interocean Bulk Trading LLP. 609, Eco star ,  
Vishweshwar Nagar, Off. Aarey Road,  
Goregaon (East), Mumbai – 400063.

Landline: +91 9136944500 / 501,

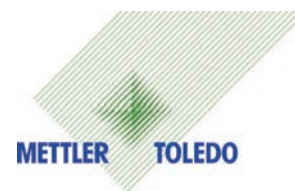
Cell : + 91 9987766732.

Email ID: [nptawde@interoceanventures.com](mailto:nptawde@interoceanventures.com)

Website: [www.interoceanventures.com](http://www.interoceanventures.com) ■



## Intrinsically Safe Weighing in Classified Hazardous Areas



IND256x offers an economical and versatile weighing solution for classified areas thanks to its reliable, intrinsically safe design. With a built-in wireless option and integrated power supply or external battery, it reduces installation costs and gives you the freedom to adjust your workflow on demand.

### Intrinsically safe and secure design

IND256x is globally approved for hazardous areas according to IECEx and ATEX standards for intrinsic safety, providing the same user-friendly look, feel and ease of operation as safe-area terminals. It is designed to operate safely in Zone 1/21 environments where explosive gases or dusts are present.

### Fast to install and easy to use

The built-in power supply and communication interfaces make installation and system integration fast and convenient. Due to this integrated design, floor space is better utilized, and maintenance activities are simplified. Compared to alternative protection methods, intrinsically safe design reduces downtime from maintenance cycles or equipment breakdowns significantly.

### Simplified maintenance and safety

Maintenance of explosion-proof solutions is time intensive due to required disassembly and assembly of large and bulky enclosures. All service procedures for Ex or flame-proof equipment must be followed meticulously; nevertheless, these are difficult tasks prone to error. IND256x's design assures safety while reducing cost of maintenance by up to 60% thus giving a boost to your equipment availability and operational efficiency.

### More Mobility in Your Ex-Area with the IND256x Terminal

#### Wireless communication

The Wi-Fi module simplifies communication in fixed installations by eliminating cabling that adds cost to installation and maintenance. In addition, improper cable routing can be a safety risk. IND256x eliminates these issues for increased cost effectiveness and safety.



### Battery powered

The Wi-Fi module option and external battery allow for complete mobile applications in hazardous areas giving you the freedom to adjust your workflow on demand. Increased flexibility in configurations allows easier adaptation to local site preferences.

### About METTLER TOLEDO

METTLER TOLEDO is a leading global supplier of precision instruments and services. The Company is the world's largest manufacturer and marketer of weighing instruments for use in laboratory, industrial and food retailing applications. METTLER TOLEDO also holds top-three market positions in several related analytical instruments and is a leading provider of automated chemistry systems used in drug and chemical compound discovery and development. In addition, the Company is the world's largest manufacturer and marketer of metal detection and other end-of-line inspection systems used in production and packaging and holds a leading position in certain process analytics applications. Additional information about METTLER TOLEDO can be found at [www.mt.com](http://www.mt.com)

For more information

[www.mt.com/IND256x](http://www.mt.com/IND256x)

Call us Toll Free -1800 22 8884 / 1800 10 28460 or

Email-[sales@mt.com](mailto:sales@mt.com) ■

### Haldia Petrochemicals to set up new chemical plants in West Bengal



Navanit Narayan, Whole Time Director and CEO, Haldia Petrochemicals Limited

**Kolkata, India:** Haldia Petrochemicals Limited (HPL) has consolidated its financial position and diversified its operations into new territories and product lines, embracing trading, speciality chemicals, and fuel retailing. HPL is setting up the first on-purpose Propylene plant in India based on Olefin Conversion Technology (OCT) and the largest Phenol in India at Haldia, West Bengal, becoming India's first integrated player in the Phenolics chain. HPL has been exploring the possibility of becoming a leader in the niche segment of speciality chemicals that have a high demand nationwide. Speciality chemicals have helped the company earn a revenue of ₹ 999 crore in FY23.

In addition, HPL is setting up the largest Phenol plant in the country, with a capacity of 300 KTPA Phenol and 185 KTPA Acetone. According to Navanit Narayan, Whole Time Director and Chief Executive Officer, of Haldia Petrochemicals Limited, "With the commissioning of these plants, the overall chemical business portfolio is expected to increase by an additional ₹. 5,000 crore. The company has ambitious targets to complete the project by Q1 2026".

The demand for petrochemicals is growing due to a large population base, favourable demographics, increasing economic growth, urbanization, and its positive impact on automobile production, construction, infrastructure, agrochemicals and pharmaceuticals. This proposed investment will likely be the largest in West Bengal in the chemical sector over the last two decades. It has also led to an increase in the number of ancillary units. "As the plans move towards fruition, there will be advancement

in areas such as digitization. This will generate direct and indirect employment in the downstream chemical industry. The total industrial scenario evolving around chemicals will witness tremendous growth within a very short period," Narayan added.

### Indian Biogas Association receives new investment worth ₹ 2,755 crore

**Mumbai, India:** The Indian Biogas Association (IBA) has received new investments worth ₹ 2,755 crore at the Renewable Energy India (REI) Expo 2023. The association has signed joint ventures (JVs), memorandums of understanding (MoUs) and received letter of intent (LoIs) commitments at Greater Noida from 4-6 October, 2023. The expo focuses on bio-energy, solar, and wind in the RE sector along with electric vehicles and battery storage, witnessed interest from companies from various countries like Germany, Sweden, and Italy at the event. The objective is to accelerate India's pledge towards net zero emission. The "Indian Biogas Association" (IBA) is the first nationwide and professional biogas association for operators, manufacturers and planners of biogas plants, and representatives from public policy, science and research in India. The association was established in 2011 and revamped in 2015 to promote a greener future through biogas. The motto of the association is "propagating biogas in a sustainable way".

### Bhageria Industries announces solar EPC project in Bahrain

**Mumbai, India:** Bhageria Industries Limited, a leading player in the Specialty Chemical & Renewable Energy Segment, announced its one turnkey international Solar Engineering, Procurement, and Construction (Solar EPC) projects with comprehensive Operation & Maintenance and Water Proofing in APM Terminal, Kingdom of Bahrain. Aggregating to a capacity of 11.40 MWp, this project has a total order value of ₹ 104.49 Crores (including comprehensive O&M and Water Proofing), without taking taxes into account. With this order wins, Bhageria Industries Limited will gain access to a large market that is full of dynamism, vibrancy and an untapped potential for renewable energy solutions that deliver positive impacts on both Indian and Bahrain Market.

This turnkey contract with APM Terminal, Kingdom of Bahrain entail design, engineering, supply, construction, erection, testing, and commissioning

with comprehensive Operation & Maintenance and Water Proofing for 10 years for this project. The APM Terminal, Kingdom of Bahrain Rooftop Project is slated for commissioning in next 8 (Eight) Months. The project is poised to contribute to the Bahrain's Clean Energy Strategy and affirm Bhageria Industries Limited's position as a trusted partner for delivering sustainable solutions. Suresh Bhageria, Executive Director & Chairman of Bhageria Industries Limited, expressed his satisfaction upon securing prestigious international contracts in Bahrain. He emphasized that this wins signify the company's entrance into global markets, marking a substantial stride toward realizing their vision of spearheading sustainable energy transitions on a global scale.

### **Petro Carbon plans to set up submerged arc furnace plant in West Bengal**

**Kolkata, India:** Petro Carbon & Chemicals will set up a submerged arc furnace (SAF) and chrome ore briquetting plant at Bardhanyaghata in Midnapore district of West Bengal. The new plant will manufacture ferro alloys and proposed project will spread over 10.29 acres of land parcel. Petro Carbon and Chemicals Private Limited (PCCPL) was incorporated on September 2007 and was subsequently acquired, revamped and upgraded in May 2008. Since then, the group has been successful in evolving PCCPL into a sizeable CPC player in the Indian market. Calcined Petroleum Coke (CPC) is the product from calcining raw petroleum coke (RPC). The raw coke is the product of the Coker unit in a crude oil refinery. CPC is used to make anodes for aluminium smelting and is also used in dioxide industry, steel and titanium.

### **Kerala govt to set up graphene production facility**

**Thiruvananthapuram, India:** Kerala government is planning to set up a graphene production facility. The Cabinet approved the proposal for ₹ 237 crore public-private partnership (PPP) mode. Kerala Digital University will be the implementing agency and Kerala Industrial Infrastructure Development Corporation (Kinfra) has been appointed as special purpose vehicle (SPV). Graphene is a material that is extracted from graphite and is made up of pure carbon.

Kerala Industrial Infrastructure Development Corporation is a government agency under the government of the Indian state of Kerala headquartered in Thiruvananthapuram. It undertakes development

of industrial estates to nurture industrialization in the state. Since its inception, KINFRA has mainly identified itself with land acquisition and development of industrial infrastructure in the form of parks, townships and zones. With the objective of boosting industrial growth, KINFRA has promoted the concept of theme parks, which have been set up for the exclusive growth and development of chosen and specified industrial sectors.

### **UP Govt approves Biogas and Biodiesel projects**

**Lucknow, India:** The Uttar Pradesh government has approved twelve bioenergy initiatives worth ₹ 550 crore. This approval is to expand its green energy portfolio and projects are focused on compressed biogas (CBG) and biodiesel. Uttar Pradesh is also attracting private sector interest due to the substantial potential in the sector.

Biomass, in the context of energy production, is matter from recently living organisms which is used for bioenergy production. Biomass has always been an important energy source for the country considering the benefits it offers. About 32 percent of the total primary energy use in India is still derived from Biomass and more than 70% of the country's population depends upon it for its energy needs, according to Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA). The vast majority of biomass used for bioenergy does come from plants. Bioenergy is a type of renewable energy with potential to assist with climate change mitigation. ■



# CHEMICAL ENGINEERING WORLD

[www.jasubhaimedia.com](http://www.jasubhaimedia.com)

Dynamic Platform

to

Connect with Chemical Industry Ecosystem

Direct Reach

to

**>200,000 Readers**

across

**>25 countries**

in **Print** and **Digital Version**



Contact: +91-22-4037 3636, Email: [sales@jasubhai.com](mailto:sales@jasubhai.com)  
Website: [www.jasubhaimedia.com](http://www.jasubhaimedia.com)



## Mass Extraction detects the smallest defect sizes with SpeedAir 3050 from Pfeiffer Vacuum



**Asslar, Germany:** Pfeiffer Vacuum, a leading provider of vacuum technology, introduces the new leak tester SpeedAir 3050, an all-in-one solution for nonporous pharmaceutical containers. SpeedAir offers a CCIT solution for a wide range of products: Whether the products are flexible or rigid, liquid or solid, the SpeedAir can swiftly and accurately test them all. Typically requiring only 30 - 45 seconds, this mass extraction instrument quickly and efficiently delivers results. With testing times as short as 30 - 45 seconds, it delivers reliable results, ensuring the integrity of pharmaceutical containers. Unlike alternative methods that focus on specific areas or access points, the SpeedAir provides a comprehensive global Non-Destructive Testing (NDT) approach for containers. It adheres to ASTM Standard F3287-17, demonstrating the capability in independent third-party labs to 1 micron using an air-based technology.

When it comes to liquid products, the SpeedAir stands out as the most sensitive air-based technology available today. Results are repeatable and reliable – eliminating risks associated with false negatives and positives. The SpeedAir is fully compliant with industry standards. It utilizes the USP <1207> recognized Mass Extraction technology and operates with FDA 21 CFR Part 11 compliant software, ensuring the testing processes meet the highest regulatory standards.

## DFPCL's PICKBRITE range of products helping enhance the performance of pickling process in stainless steel production

**Mumbai, India:** DFPCL's PICKBRITE pickling solution doesn't just improve the surface quality of stainless steel, but also enhances the efficacy of the process. That's not all – it also reduces the overall cost of the treatment and extends the life of the pickling bath solution. This can be corroborated further with the help of certain significant examples. A leading manufacturer of stainless-steel products having integrated manufacturing facilities, starting from a melting shop to finished stainless steel products in different forms like wires, wire rods, welding wires, flanges, fasteners and bright bars supplies their finished products to automotive, defence, mining and many more industries. It was facing several challenges during the pickling process – from handling of hazardous chemicals like hydrofluoric acid and nitric acid to additional burden on the wastewater treatment plant, and excess pickling acid sludge generation. Moreover, their process was experiencing lesser pickling bath life and higher chemical consumption per ton of stainless steel.

It was observed that the trials performed with DFPCL's PICKBRITE solution was a proven success in pickling efficacy, chemical consumption, quality of finished metal, pickling throughputs, effluent generation and more. Apart from the above-mentioned benefits, DFPCL's PICKBRITE solution reduced the bath preparation time and increased the bath throughput. Sludge removal from the pickling bath tank was much faster, while sludge handling was reduced. Furthermore, freshwater consumption for bath preparation and lime solution preparation also reduced by 33%. ■

Supported by



Ministry of Chemicals & Fertilizers  
Department of Chemicals and  
Petrochemicals, Government of India  
Department of Biotechnology  
Ministry of Science and Technology  
Government of India



Join us for  
50<sup>th</sup> Years  
Celebration

Most Defining & Powerful International Event for the  
Bio-Pharma Industry and Laboratory Technology, Analytix and Diagnostics



31<sup>st</sup> International Exhibition & Conferences

4-7 March 2024

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

Chairman

CAB BioPharma World Expo 2024



Dr Rajesh Gokhale

Secretary, DBT, Ministry of Science &  
Technology, Govt. of India

## BIO-PHARMA

### Manufacturing

- Vaccines
- Serums
- Biologics & Biosimilars
- Generics
- Bulk Drugs
- Drug Discovery & Development
- Drug Delivery
- Contract Manufacturers

### Equipment & Technology

- Pharma & Biopharma Processing
- Mixers & Blenders
- Agitators & Dryers
- Sterilizers & Autoclaves
- Homogenizers & Emulsifiers
- Instrumentation & Automation
- Lab & Analytical technologies
- Bioinformatics
- Packaging Machinery & Equipment
- Filtration & Separation

### Pharma Chemicals

- APIs & HPAPIs
- Fine & Specialty Chemicals
- Formulations

- Excipients
- Pharma Ingredients

### Research & Development

- Lifesciences
- Contract Research & Clinical Trials
- Contract Development & Manufacturing
- Research Institutes
- Academic Institutes
- Academic Institutions
- Government Institutions
- Testing & Inspection
- Intellectual Property Rights (IPR) & Legal Services

### Infrastructure & Logistics

- Biotech Parks
- Warehousing
- Cold chain logistics
- Supply Chain Management
- Logistics services
- Online distributors

## LAB ANALYTIX

### Laboratory Technology

- Laboratory furniture, equipment, machines
- Chemicals, Consumable, reagents, glassware
- Laboratory data system and documentation
- Laboratory automation
- Laboratory diagnostics
- Instruments for environmental labs
- Forensic lab instruments

### Analysis

- Chromatographs
- Spectroscopes
- Microscopes and imaging
- Analytical instrumentation and systems
- Instruments for physical and chemical analysis

### Quality control / Measuring & Testing

- Characterization and properties of materials
- Quality control for pharmaceutical industry
- Material testing

### Diagnostics

- Diagnostic Equipment and Reagents
- Diagnostic Technology & Devices
- IVD Medical Devices
- Clinical Diagnostic

### Biotechnology

- Biochemicals
- Bioinformatics
- Medicine and diagnostics
- Life Sciences



## Concurrent Events



## Co Operation Partners

Gold Partners



Bronze Partners



Organised by:



**Jasubhai Media Pvt Ltd**

Taj Building, 3<sup>rd</sup> Floor, 210, Dr. D N Road, Fort, Mumbai – 400 001, INDIA.

Tel: +91-22-4037 3636, Email: sales@jasubhai.com

Ahmedabad - 09833104834 | Bangalore - 09892644177 | Chennai - 09176963737

Delhi - 09891469629 | Hyderabad / Pune - 09822209183 | Vadodara - 09820544904

sales@jasubhai.com



www.chemtech-online.com



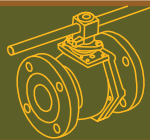
# SHIELDING AGAINST CORROSION

SINCE 1987

*Make Planet Green Again*



Quality is never an accident it is always the result of High Intention, Sincere Effort, Intelligent Direction and Skillful Execution.



## PTFE LINED VALVES



SWING CHECK VALVE



PLUG VALVE



BUTTERFLY VALVE



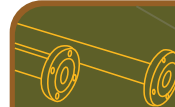
BALL CHECK VALVE



BALL VALVE



DIAPHRAGM VALVE



## LINED PIPES



SPOOL PIPE



DIP - PIPE



## LINED FITTINGS



BELLOW (PTFE)



EQUAL CROSS



ELBOW



EXPANSION BELLOW



REDUCING FLANGE



SIGHT FLOW INDICATOR



REDUCER



REDUCING TEE



INSTRUMENT TEE



## DIP-FLON ENGINEERING & CO.



B-413, B. G. Tower, Outside Delhi Gate, Shahibaug Road, Ahmedabad - 380004. Gujarat, INDIA.

Phone: +91-79-25624003, 25624169, Mobile: +91 - 9898794440 | Fax: +91-79-25625665

Email: [info@dipflon.com](mailto:info@dipflon.com) / [sales@dipflon.com](mailto:sales@dipflon.com) | Website : [www.dipflon.com](http://www.dipflon.com)



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



Ministry of Chemicals & Fertilizers  
Department of Chemicals and Petrochemicals, Government of India  
Department of Biotechnology  
Ministry of Science and Technology  
Government of India

Supported by



1974-2024

Inspiring Intelligence...  
..Igniting Innovation

Join us for  
**50<sup>th</sup> Years  
Celebration**



## 31<sup>st</sup> International Exhibition & Conferences

4-7 March 2024

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



LEADERSHIP FOR CHEMTECH 2024

More than 400 Exhibitors already confirmed



**Maulik Jasubhai**  
Chairman & Chief Executive  
Jasubhai Group & Chemtech Foundation  
Honorary Consul General of Austria in Mumbai



Patron & Brand Ambassador  
ChemTECH World Expo 2024  
**Shri Suresh Prabhu**  
Former Member of Parliament  
Government of India



Jury Chairman, Chemtech Leadership & Excellence Awards 2024  
**Dr. R A Mashelkar**  
Scientist, Former Director General,  
Council of Scientific and Industrial Research (CSIR)



Chairman  
CAB BioPharma World Expo 2024  
**Dr. Rajesh Gokhale**  
Secretary, DBT, Ministry of Science & Technology, Govt. of India



Chairman  
EPC World Expo 2024  
**Mr. B Narayan**  
Group President Projects  
& Procurement, Reliance Industries Ltd



Co-Chairman  
EPC World Expo 2024  
**Mr. Subramanian Sarma**  
Whole time Director & Sr. EVP Energy  
Larsen & Toubro Limited



Chairperson, Refining & Petrochemicals World Expo 2024  
**Ms. Sukla Mistry**  
Director (Refineries)  
Indian Oil Corporation Ltd



Co-Chairman, Refining & Petrochemicals World Expo 2024  
**Mr. Sanjay Khanna**  
Director (Refineries)  
Bharat Petroleum Corporation Ltd



Chairman,  
Specialty Chemicals World Expo 2024  
**Mr. Nadir Godrej**  
Chairman & Managing Director  
Godrej Industries Ltd



Key Member of Board  
Specialty Chemicals World Expo 2024  
**Mr. Rajendra Gogri**  
Chairman & Managing Director  
Aarti Industries Ltd



Convener  
Specialty Chemicals World Expo 2024  
**Dr. Raman Ramachandran**  
Director & Dean  
K J Somaiya Institute of Management



Chairman, CAB Chloralkali World Expo 2024  
**Mr. Jayant Dhole**  
Business Head & CEO, Global Chemicals,  
Fashion Yarn & Insulators  
Aditya Birla Group



Chairman, Industry Automation & Control and Pumps Valves & Fittings World Expo 2024  
**Mr. Rajeev Gupta**  
Director Projects, Engineers India Ltd



Chairman, CAB  
WaterEX World Expo 2024  
**Mr. P Raghavendra Rao, IAS**  
Chairman, Haryana State Pollution  
Control Board, Ex Secretary  
(Chemicals & Petrochemicals)



Convener  
WaterEX World Expo 2024  
**Ajay Popat**  
President  
Ion Exchange (India) Ltd



Chairman, SCALE 2024  
**Mr. Mirik Gogri**  
Head - Corporate Strategy  
Aarti Industries Ltd & Managing Partner  
Spectrum Impact

### EXHIBITOR GROUPS

- Chemical & Pharma Processing
- Process Plants & Equipment
- Thermal & Mechanical Processing
- Engineering Procurement & Construction
- Technology Licensors
- Project Management Consultants
- Refining
- Chemicals & Petrochemicals
- Specialty Chemicals
- Chloroalkali
- Fertilizers
- Water & Waste Management
- Environment Technologies & Services
- Digital Services
- Industrial Automation
- Instrumentation & Process Automation
- Electrical Equipment
- Research & Development

- Biotechnology
- Green Chemistry
- Banking Finance & Insurance
- Lab & Analytical Instruments

#### PHARMA & BIOPHARMA

- Ingredients
- Bulk drugs
- R&D
- Warehousing
- Cold chain
- Packaging
- Contract Research & Manufacturing

#### CLEAN ENERGY

- Hydrogen
- Biofuels
- Methanol

- Carbon Capture Utilization & Storage
- Renewables - Solar Wind & Hydro

#### LOGISTICS

- Logistics Services
- Containers
- Supply Chain Management
- Packaging
- Material Handling
- Storage & Warehousing
- Cold Chain Management

#### CORROSION CONTROL

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

#### Co Operation Partners

Gold Partners



BURNS & MCDONNELL



Bronze Partners

Organised by:

**Jasubhai Media Pvt Ltd**

[www.chemtech-online.com](https://www.chemtech-online.com)



Taj Building, 3<sup>rd</sup> Floor, 210, Dr. D N Road, Fort, Mumbai – 400 001, INDIA.  
Tel: +91-22-4037 3636, Email: sales@jasubhai.com

Ahmedabad - 09833104834 | Bangalore - 09892644177 | Chennai - 09176963737 | Delhi - 09891469629  
Hyderabad / Pune - 09822209183 | Vadodara - 09820544904