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Indian chemicals and petrochemicals industry likely to reach USD1 trillion by 2040: JP Nadda

Mumbai, India: Jagat Prakash Nadda, Minister for Health & Family Welfare and Chemicals & Fertilizers, Government of India, emphasized the chemical and petrochemical industry's critical role in India's economy. "India's chemical and petrochemical industry is projected to surpass USD300 billion by 2028 and is on track to reach USD1 trillion by 2040," he said. Addressing the 'India Chem 2024', organized by the Ministry of Chemicals & Fertilizers, Government of India, jointly with FICCI, Nadda added that the growing Indian middle class will further boost the expansion of the Indian chemicals and petrochemicals. He stressed the importance of reducing reliance on imported feedstocks and focusing on alternative feed stocks like biomass, plastic waste, and green hydrogen. He reiterated India's commitment to sustainability, with companies adopting renewable energy and recycling practices, ensuring that India leads the global shift toward greener technologies. Hardeep Singh Puri, Minister of Petroleum and Natural Gas, Government of India, during the Roundtable on Petrochemicals said, "Chemical manufacturing hubs are seeing tremendous potential, and supporting government policies are in place, driving sustainable growth in the sector. With the support of domestic and international investors, along with other stakeholders, the petrochemical sector is poised to become a USD5 million economy in the coming years."

IndianOil, EverEnviro Resource Management to form JV for sustainable energy solutions

Mumbai, India: IndianOil has entered into a joint venture agreement with EverEnviro Resource Management Pvt. Ltd., a leading biofuels company in the country, paving the way for the formation of a 50:50 joint venture company dedicated to advancing biofuel adoption across the country. The joint venture will focus on integrating advanced biogas technologies to convert organic waste into Compressed Biogas (CBG), a cleaner and renewable energy source. This will significantly reduce greenhouse gas emissions while providing a sustainable alternative to traditional fossil fuels. By leveraging their combined expertise, IndianOil and EverEnviro aim to accelerate the deployment of CBG plants nationwide. These initiatives complement IndianOil's long-term low-carbon development strategy and achievement of operational Net Zero goal by 2046, which will also help in achieving the Net-Zero target for India by the year 2070. CBG offers numerous benefits to India and the environment. For the country, it promotes energy security by reducing dependence on imported fossil fuels and supports the rural economy by creating local employment opportunities.

Dow India appoints Siddhartha Ghosal as Country President

Dow Chemical International Private Limited (Dow India) has announced the appointment of Siddhartha Ghosal as its new country president, effective 1st January 2025. He will be taking over from Chandrakant Nayak who will be retiring by end of this year. Siddhartha will lead Dow India and India Sub-continent into its next chapter of growth and expansion in the material science, with a focus on innovation, customer centricity, sustainability and a diverse, inclusive workplace culture. Siddhartha is also the site director for Dow India Technology Centre at Juinagar, Navi Mumbai.

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Tata Chemicals announces financial results for quarter and half year ended Sep 30, 2024

Mumbai, India: Tata Chemicals Limited has declared its financial results for the quarter and half year ended September 30, 2024. On a consolidated basis, for the quarter, the income from operations stood at ₹3,999 crore as compared to ₹3,789 crore in Q1FY25 ('previous quarter'). EBITDA stood at ₹618 crore as compared to ₹574 crore in the previous quarter. PAT [before exceptional items and non-controlling Interest ('NCI')] from continuing operations stood at ₹267 crore as compared to ₹175 crore in previous quarter.

On a standalone basis, for the quarter, the income stood at ₹1,009 crore as compared to ₹1,047 crore in the previous quarter. EBITDA stood at ₹144 crore as compared to ₹235 crore in the previous quarter. PAT stood at ₹99 crore as compared to ₹256 crore in the previous quarter.

Commenting on the results, R. Mukundan, Managing Director & CEO, Tata Chemicals Limited, said, "Overall demand for soda ash, in India was stable, while some segments like container glass in Americas and Europe experienced muted demand. Unprecedented heavy rains in July and August impacted Mithapur operations leading to lower production as compared to the previous quarter, thus impacting margins. However, Company's overall performance was better as compared to previous quarter due to higher sales volume, coupled with higher realization of soda ash."

EEX, IGX and GIZ to jointly develop hydrogen trading market in India

Leipzig, New Delhi, Eschborn: The European Energy Exchange (EEX) and the Indian Gas Exchange (IGX), in cooperation with the Gesellschaft für Internationale Zusammenarbeit (GIZ), have agreed to support the development of the hydrogen trading market in India. This cooperation project takes place under the International Hydrogen Ramp-Up (H2Uppp) program, funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK), which aims to promote projects and market development for green hydrogen in selected emerging countries.

The collaboration will initially focus on gathering market insights, as well as on engaging and developing a local community in order to establish and develop this market in the future. The project parties will bring together stakeholders from production, trading, transport and consumption, including policy makers and regulators, and jointly build up an action plan with the mid-term goal to offer an index and trading services for hydrogen in India.

Ruturaj Govilkar joins Mott MacDonald as MD of South Asia Business

Mott MacDonald has appointed Ruturaj Govilkar as Managing Director of its South Asia business. Ruturaj will be responsible for further strengthening the consultancy's capability in the delivery of strategic infrastructure and advisory projects for key clients. He succeeds Ashley Taylor, who will continue to lead Mott MacDonald's global design centre as Managing Director. Previously Country Manager and Managing Director for India at Black & Veatch, he brings a wealth of expertise to the position, with over 32 years of experience in the engineering and construction industry.

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Meghmani Organics commences commercial production of three new products

Mumbai, India: Meghmani Organics Limited (MOL) has announced that the company has commenced commercial production of three new products at state-of-the-art manufacturing facility situated at Dahej. This move aligns with MOL's strategic initiative to increase its product basket by expanding into new age value added products for domestic as well as export markets. The three new products comprise Dinotefuran, Ethiprole and Flonicamid insecticides. MOL, a fully integrated diversified chemical company announced its financial results for the first quarter ended 30 June 2024 (Q1 FY25). Revenue from operations remained flat at ₹411.1 crore for the quarter under review. Meanwhile, EBITDA stood at ₹14.2 crore in Q1 FY25, increasing by 194 per cent YoY and 40 per cent on QoQ basis. Crop Protection reported net revenue and EBITDA of ₹272.6 crore and ₹11.3 crore respectively as compared to ₹300.2 crore and ₹0.5 crore in corresponding previous year. Pigments reported net revenue and EBITDA of ₹138.5 crore and ₹9.4 crore respectively as compared to ₹121.4 crore and ₹8.4 crore in corresponding previous year.

Sudarshan Chemical enters into definitive agreement to acquire Heubach Group

Mumbai, India: Sudarshan Chemical Industries Limited (SCIL) has entered into a definitive agreement with Germany-based Heubach Group, on its acquisition in a combination of an asset and share deal. This strategic acquisition will create a global pigment company, combining SCIL's operations and expertise with Heubach's technological capabilities.

Post-acquisition, the combined company will have a broad pigment portfolio of high-quality products and a strong presence in major markets including Europe and the Americas. It will enhance SCIL's product portfolio, giving it access to customers and a diversified asset footprint across 19 sites globally. The combined company will be led by Mr. Rajesh Rathi and a high performing management team with quality execution skills and technical competency.

The Heubach Group has a 200-year history and became the second largest pigment player in the world after its integration with Clariant in 2022. Heubach had over a billion euros in revenue in FY21 and FY22, with a global footprint especially in Europe, Americas, and the APAC region. The Group faced financial challenges over the past two years due to rising costs, inventory issues, and high interest rates. SCIL's acquisition of Heubach will address these challenges with a clear turnaround plan.

Coromandel International increases shareholding in Senegal-based BMCC

Chennai, India: Coromandel International Limited, India's leading agri solutions company, has announced acquisition of additional equity stake in Baobab Mining and Chemicals Corporation (BMCC), Senegal, through its wholly owned subsidiary Coromandel Chemicals Limited. Coromandel will acquire an additional 8.82 per cent equity stake in BMCC, taking its overall shareholding to 53.8 per cent. Coromandel will invest USD3.84 million (₹32 cores) in BMCC, besides loan infusion of USD 6.5 million (₹54 crores) to fund expansion projects and meet working capital requirements.

Rock phosphate is a critical raw material for manufacturing phosphoric acid, an intermediate used for phosphatic fertiliser production. BMCC,

Safex Chemicals appoints Praveen Dubey as Sr VP - Strategic Alliances & Commercial

Safex Chemicals Group has announced the appointment of Praveen Dubey as Senior Vice President - Strategic Alliances & Commercial. With an extensive career in institutional business and strategic sourcing, Praveen brings a wealth of industry experience that aligns with Safex mission to strengthen its global presence. Dubey has joined Safex Chemicals Group following his most recent position as Sr. GM & Head of Institutional Business & Strategic Sourcing at NACL Industries Limited. His career spans over two decades with significant roles at ADAMA Ltd., Coromandel International Limited, where he developed an in-depth understanding of the agrochemical and chemical industries.

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incorporated in 2011, has renewable exploitation permit for processing phosphate ore and Coromandel acquired 45 per cent stake in September 2022. The company has since stabilised mining operations and is currently commissioning fixed processing plant to optimise the rock production.

Schwing Stetter India opens all-women service centre for construction equipment

Chennai, India: Schwing Stetter India, a leading manufacturer of construction and concreting equipment, has announced the launch of an all-women service centre in Chennai. The centre was officially launched by Ms. Michaela Küchler, Consul General of the Federal Republic of Germany to India.

Located in Poonamallee, Chennai, Tamil Nadu, the service centre will be staffed by a team of 17 skilled women technicians, all aged between 20 and 25. Their expertise spans servicing and overhauling a diverse range of concrete pumps and mixers, encompassing everything from troubleshooting component malfunctions and carrying out preventive maintenance to providing comprehensive machine servicing.

The all-women service centre promotes safe work practices and is equipped with appropriate safety gear and tools within a secure premise. Additionally, it provides transportation and other support services, including on-site medical assistance. Schwing Stetter India aims to open similar facilities across India.

Seeq and AVEVA partner to provide best-in-class Enterprise Data Management Services

Paris, Tokyo: Seeq, a global leader in industrial analytics, AI, and enterprise monitoring, has announced a strategic partnership with AVEVA, a global leader in industrial software. Core to the partnership is the native integration between the two companies' platforms that will simplify access to operational data in context, enabling chemical, energy, metals, mining, and utility organizations to improve their operations and production outcomes.

With the CONNECT industrial intelligence platform as the central integration hub of a connected data ecosystem, this partnership enables Seeq users to rapidly access operational data in CONNECT, accelerating time to insights and business value. AVEVA customers can take advantage of the Seeq Industrial Analytics and AI Suite to power and scale a wide range of analytical and monitoring use cases across the enterprise as needs evolve. This combination of best-in-class data management services, industrial analytics, AI and enterprise monitoring delivers new opportunities for data-driven innovations, including monitoring across plants, energy data exchange along the value chain, streamlined R&D collaboration, emissions data transparency and more.

Tata Chemicals appoints Subodh Srivastav as Chief Marketing Officer

Tata Chemicals has announced the appointment of Subodh Srivastav as Chief Marketing Officer (Senior Management Personnel) of the company. The appointment is with effect from 21 October 2024. Subodh Srivastav is an engineer from IIT BHU with business management qualification from FMS Delhi. He has over 29 years of experience in sales, marketing and general management. Subodh is currently the Managing Director and CEO of Tata Chemicals Magadi Limited, a subsidiary of the company. Prior to joining the company, he has worked with organisations such as ICI, DuPont, Pepsi and Idea Cellular Limited.

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Safic-Alcan and Carbon Waters partner to enhance anticorrosion paint formulations

La Défense, France: Safic-Alcan, a global leader in the distribution of specialty chemicals, has announced a new distribution partnership with Carbon Waters, an innovative French start-up specializing in advanced sustainable additives. This strategic alliance will provide high-performance graphene dispersions, Graph'Up Oxi, to customers in Italy, Spain, the United Kingdom, and Ireland.

These ground-breaking graphene-based dispersions have been meticulously developed for both solvent and water-based anticorrosion paint formulations. The products also offer robust mechanical strength, high electrical conductivity, and excellent barrier properties, making them ideal for a range of industrial applications where top-tier anticorrosion performance is required.

Mitsubishi Chemical Group launches higher biomass content grades of Benebiol

Chiyoda-ku, Tokyo: Mitsubishi Chemical Group has launched grades of Benebiol™, a biomass-based polycarbonatediol, with higher biomass content. Benebiol™ is the world's first biomass-based polycarbonatediol of its kind, and is mainly used as a primary raw material for polyurethane resins. Compared to conventional petroleum-derived products, the use of biomass components allows manufacturers to impart polyurethane resins with superior functions, including flexibility without sacrificing chemical resistance, stain resistance, and a distinctive tactile feel. These resins are used in paints and coatings for automotives, furniture, and outdoor products, as well as in synthetic and artificial leather.

The biobased content of existing grades of BENEBiOL™ was mainly 20-50 per cent, but the new HSS and NLDS grades have achieved a bio-based content of over 80 per cent.

Jubilant Ingrevia to join WEF's Global Lighthouse Network

Noida, Uttar Pradesh: Jubilant Ingrevia Limited, a global integrated life science products and innovative solutions provider serving diverse industries and sectors has announced its inclusion as a member of the elite Global Lighthouse Network (GLN) of the World Economic Forum (WEF). WEF has recognised Jubilant Ingrevia Limited's Bharuch manufacturing facility as a Global Manufacturing Lighthouse, the only Indian company to achieve the same in this cohort. Jubilant Ingrevia Limited's Bharuch site manages complex chemical manufacturing processes at scale. It hosts Asia's largest Acetic Anhydride production facility with the world's largest merchant capacity, fully managed and operated by less than 40 people. ■

Robert Stivale appointed as VP – IPCO India & Southeast Asia

Robert Stivale has been appointed as Vice President, IPCO - India and Southeast Asia. He has taken over from Kumaraswamy Kowta, Managing Director-IPCO India. Stivale is with The Industrial Processing Company (IPCO) since 30+ years and has served various roles in Sales, Aftermarket, CFO and VP-Region Americas Market as recent portfolio. He will continue to serve India and South-East Asia market and will be based out of Pune office.

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Praj unveils demonstration facility for biopolymers in Pune

Pune, India: India's first-of-its-kind 'Demonstration Facility for Biopolymers', at Jejuri near Pune, showcasing Praj's indigenously developed integrated Polylactic Acid (PLA) technology, was inaugurated at the hands of Dr. Jitendra Singh, Hon' Union Minister (GoI), Minister of State (IC), Ministry of Science & Technology, in the presence of Dr. Rajesh Gokhale, Secretary, Dept. of Biotechnology (DBT) and Dr. Ashish Lele, Director, National Chemical Laboratory.

At Praj's recently constructed state-of-the-art demonstration facility, PLA is the first biopolymer in the series to be scaled up. This facility houses fermentation, chemical synthesis, separation and purification sections along with other supporting sections, spread over 3 acres. The facility showcases production capacities of 100 tons per annum (TPA) for Lactic Acid, 60 TPA for Lactide, equivalent to 55 TPA for PLA.

Bio-based plastics, which are made up of natural monomers and contain safer additives, are biodegradable and provide an effective solution to mitigate the hazards of plastics. Functionality and processability of PLA has been established for flexible and rigid products that are used in sectors like food, personal care, agriculture, pharma, etc.

Prigiv commences operations at new Mahad facility

Mumbai, India: Prigiv Specialties Private Limited (Prigiv) has announced that it has commenced operations at its greenfield facitity in Mahad in Maharashtra. Prigiv is a joint venture company of PriviSpeciatity Chemicals Limited (Privi), a leading aroma chemicals manufacturer from India and Givaudan SA, a world leading multinational company in the fragrance, beauty, taste and wellbeing industry.

The greenfield facitity at Mahad is a state-of-the-art manufacturing unit, custom-built to produce small volume fragrance ingredients of medium to high complexity exclusively for Givaudan. The total capital expenditure incurred for this project is approximately ₹178 crore, funded through equity contributions from both partners and loan financing from Givaudan. Privi holds a 51 per cent equity stake in the joint venture with Givaudan holding the remaining 49 per cent.

BHP, Carbon Clean, and JSW Steel to explore Carbon Clean's CycloneCC technology

Mumbai, India: JSW Steel, carbon capture solutions provider Carbon Clean, and BHP, are collaborating to accelerate deployment of carbon capture technology for steelmaking decarbonisation, following the signing of a joint study agreement between the parties.

Under this agreement, the parties will commence joint studies to explore the feasibility of Carbon Clean's CycloneCC modular technology to capture up to 100,000 tonnes per year of CO_2 emissions – the largest scale CycloneCC deployment to date in steelmaking.

There are several challenges with the adoption of carbon capture technology in the steel industry, including capital expenditure and ongoing operating costs, as well as the integration of new equipment into an existing operations site with space limitations. The CycloneCC rotating packed bed (RPB) technology in combination with Carbon Clean's proprietary APBS-CDRMax solvent aims to address these challenges through reducing total installed cost and the unit footprint by up to 50 per cent, and equipment that is ten times smaller in size than conventional carbon capture technologies.

DCW Ltd unveils major expansion of CPVC production capacity

Mumbai, India: DCW Limited, a leading specialty chemical company in India, has announced a significant investment to expand its Chlorinated Polyvinyl Chloride (CPVC) production capacity from 20,000 metric tonnes (MT) to 50,000 MT. This expansion involves increasing capacity by 30,000 MT through a combination of new installations, de-bottlenecking existing facilities, and process optimization. The capacity increase will be rolled out in phases, with 20,000 MT expected to be operational in the second half of Q2 FY26 and an additional 10,000 MT by the end of FY26.

The total investment of ₹140 crore aligns with the rising demand for CPVC across various sectors. To maintain financial prudence, DCW Limited plans to fund approximately 30 per cent of the project through internal accruals and balance through debt, but maintaining its position for a reduction in overall debt in the coming years. ■

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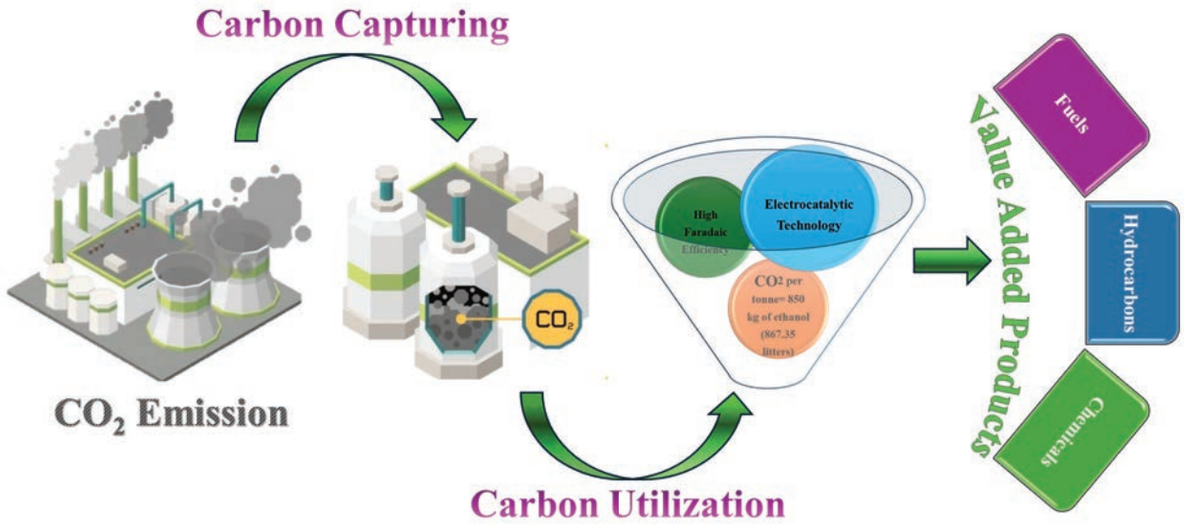
From Carbon Emissions to High-Value Products

Electrocatalytic Technology - Direct conversion of carbon emissions to chemicals by transforming greenhouse gases to valuable and marketable products with better efficiency, which reduces emission and provides sustainable resolution with substantial environmental and economic benefits. ***Kaushik Palicha, Founder & Inventor Technology, Entity 1 Value Emission Pvt Ltd,*** throws more light on the significance and the benefits of this technology.



Global warming has been a major concern, which poses a serious threat to life on the earth in the forms of widespread flooding and extreme weather conditions. While scientists continue to study global warming and its impact on the earth,several strategies are being attempted to reduce carbon dioxide (CO_2) emission. The electrochemical reactions of CO_2 are of specific interest for the synthesis of chemicals and for approaches to decrease global warming. Work has been done looking at synthesizing specialty chemicals such as formate and urea from carbon dioxide.

However, a far greater impact on decreasing atmospheric CO_2 levels might be obtained by converting CO_2 into fuels, or in other words synthesising fuels from CO_2. In such carbon-based energy cycles, energy from renewable power would be used to synthesize fuels from captured CO_2, which, when used, would not release additional CO_2 to the atmosphere (i.e., 'CO_2 neutral fuels'). As such, these processes represent the storage of these energy sources as chemical energy, which allows them to be more widely used, particularly for transportation applications. The present disclosure provides a method of electrochemical conversion of CO_2 into value-added products such as ethanol and so on.

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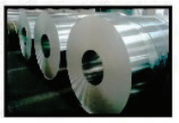

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Innovation

The main advantages of such carbon-based fuels, vs. storing electricity in batteries or as hydrogen, are the ease of use within existing infrastructures and the higher energy density. Because this involves converting electrical energy to chemical energy, here electrochemistry is an important enabling technology. In one carbon-based energy cycle concept, electrolytic hydrogen would be reacted within the system (Reactor) to form methanol and water, which, following distillation, yields liquid. Another concept would react electrolytic hydrogen and CO_2 to form methane (with condensation of water to shift the equilibrium and achieve good yields). Although different organic molecules may be obtained from electrochemical CO_2 reduction such as formic acid, hydrocarbons (methane, ethane), alcohols (methanol, ethanol, propanol), production of ethanol specifically becomes an important and inevitable process due to the utility of ethanol as alternate fuel to fossil fuel and as an important organic commodity chemical. Ethanol possesses high energy density and compatibility with present day IC engines and thus can be blended with fossil fuel and used as fuel for automobiles. Ethanol is also a key precursor in the synthesis of various chemical compounds that cater to the medical and food industries. The extensively followed procedure for production of ethanol world-wide is via fermentation of starch rich biomass such as sugarcane, corn, paddy etc. Recently, electrochemical reduction of CO_2 to ethanol had become a potentially more effective and sustainable alternative.

Solution

In present disclosure, the electrochemical process for conversion of CO_2 to ethanol involves utilization of Cu and Cu-alloy electrodes due to their high hydrogen overvoltage and negligible CO adsorption, and due to the nature of Cu in an electrode for CO_2 reduction in producing hydrocarbons and alcohols at significant current densities. The flow type reactors with gas diffusion electrodes such as porous carbon is efficient in achieving the specificity and selectivity of the reaction. In the flow type reactor configuration, KOH can be used as the electrolyte and CO_2 is made to flow from one side of the electrode through the Gas Diffusion Layer (GDL) to react at the electrocatalyst/solution interface at the other side of the electrode. Cu is the foremost metal capable of C–C coupling reactions, and hence conversion of CO_2 to products with two or more carbon atoms (C^{2+}) becomes facile on Cu or Cu-alloy surfaces.

In addition to the above discussed factors that influence the reaction rate and its selectivity, performance and yield with selectivity and specificity of ethanol production from CO_2 further increases by optimizing the following parameters: current density, applied potential, and faradaic efficiency (FE).

Technology

The direct conversion of CO_2 to ethanol with faradic efficiency of 85 per cent, is performed with a current density (5–10 mAcm-2) and current efficiency (up to 69 per cent at 00C) at a copper foil electrode or copper alloy electrodes in aqueous electrolytes.

Focus area

Carbon capture technologies: The technology captures and utilises CO_2 emission by converting it into high-value products. This innovation utilizes CO_2 emission sustainably, transforming emissions into valuable chemicals and contributing to significant reductions in greenhouse gases.

Reuse and recycling of carbon: Transforms captured CO_2 into valuable products, fostering the reuse and recycling of carbon. This approach minimizes waste, reduces emissions, and supports a sustainable circular economy by turning carbon into useful fuels and hydrocarbons.

Measurable effects

The electrochemical conversion of carbon dioxide into ethanol of the present disclosure has the following advantages. The source of carbon (CO_2) is free of cost or negligible cost. Electrode or electrocatalyst employed is an earth abundant material and hence highly cost effective. Recycling of the electrode and electrocatalyst is highly feasible and facile making the process highly closed loop. Flow type electrochemical reactor design leads to high selectivity and yield of ethanol production, The Faraday efficiency of the process is greater than 85 per cent. Cost of ethanol produced is approximately USD1.21 per litre, with 85 per cent efficiency, per tonne of CO_2, 850 kg (867.35 litters) of ethanol is expected. Thus, the break-even of the investment is faster, Ethanol produced is a vital fuel to automobile industries, essential precursor to medicinal and food industry, as the demand is high. Carbon credits due to CO_2 reduction, Process can be fine-tuned to any other value-added products (VAPs) such as acetaldehyde,

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10 KL Twin Shaft Dispersor

25 KL SS 904L Reactor

62 KL Limpeted Storage Tank

methane, formic acid etc as per the need of the end-user. To process tonnes of CO_2 per day, continuous flow electrochemical reactor can be designed with ease and hence scaling up and mass production is highly feasible, less chemical intensive process, easy design and operation completely renewables driven. Zero waste concept with 5R compliance mitigation of CO_2 content in the atmosphere at lower cost and involving production of useful fuels.

Impact of Technology

Producing high-value chemicals from CO_2 emissions, advancing environmental goals, aiding industries to handle emissions and meet sustainable goals, generating renewable energy fuels, improving air quality, benefitting public health and environment.

Goal 3 (Good Health and Well-being): Enhance health and well-being by capturing CO_2 and converting into fuels and hydrocarbons. This sustainable approach reduces air pollution, mitigates climate change, and fosters cleaner, healthier environments for communities.

Goal 07 (Affordable and Clean Energy): Promote affordable, clean energy by capturing CO_2 and converting it into value-added products like fuels/ hydrocarbons. This approach supports sustainability, reduces emissions, and drives innovation in circular economies.

Goal 09 (Industry, Innovation & Infrastructure): This approach enhances industrial sustainability, drives technological advancement, and reduces carbon footprints.

Goal 11 (Sustainable Cities and Communities): This strategy supports greener urban development, reduces emissions, and creates cleaner, more resilient communities.

Goal 12 (Responsible Consumption and Production): This strategy reduces waste, lowers emissions, and supports a circular economy for sustainable resource management.

Goal 13 (Climate Action): Boost climate action by capturing CO_2 and converting it into valuable fuels and hydrocarbons. This strategy cuts greenhouse gas emissions, combats climate change, and drives a sustainable, low-carbon future. ■

Author

Kaushik Palicha
Founder & Inventor Technology
Entity 1 Value Emission Pvt Ltd

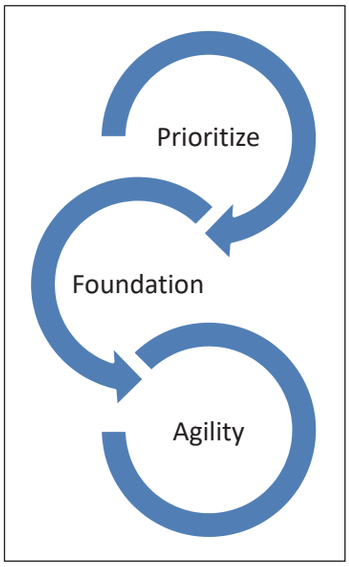
Digitization in Oil, Gas and Power Sector

Rashid Hussain
Executive Director
3C Corporate Consulting Contracting

Digitization refers to integrating digital technologies into various processes, systems, and operations within a company. This means using digital tools and techniques to improve efficiency, safety, and sustainability in the oil, gas, and power sectors. **Rashid Hussain, Executive Director, 3C Corporate Consulting Contracting,** explains in detail the various facets of digitization in oil, gas and power sector.

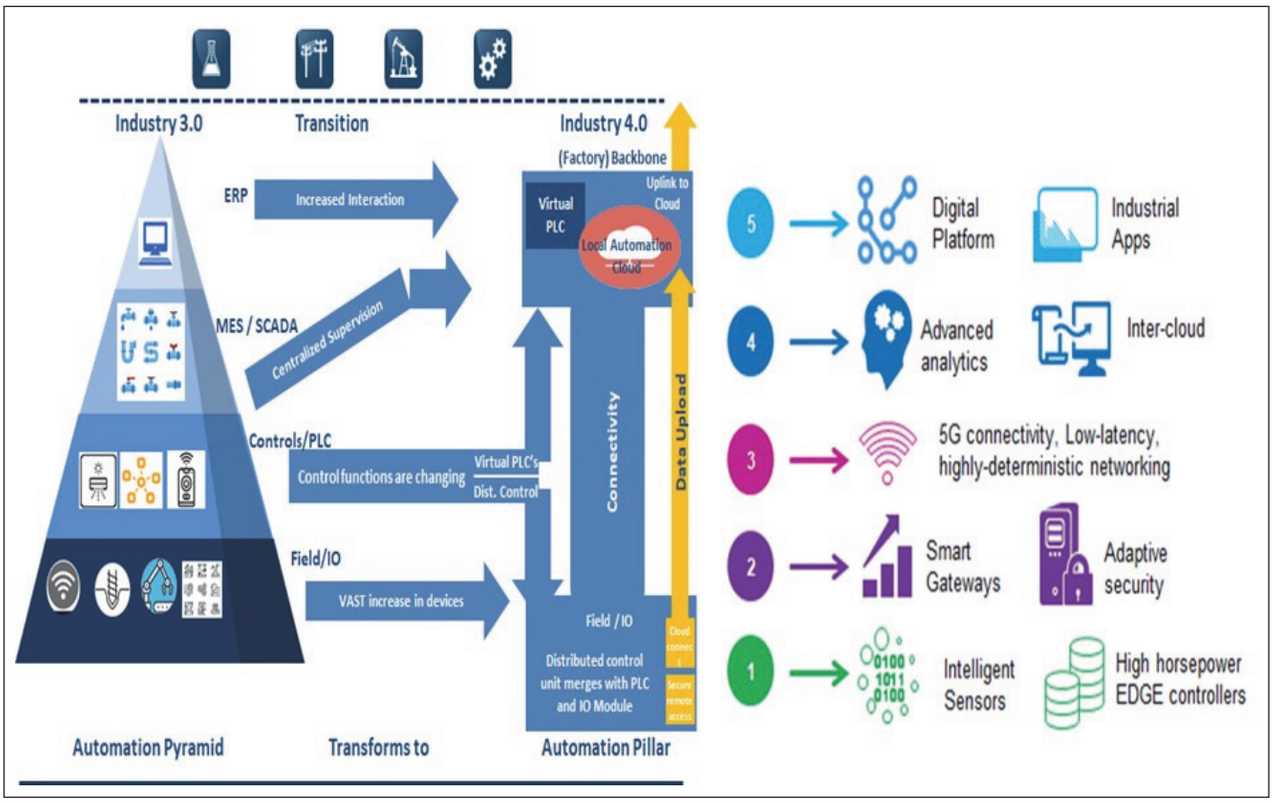
Organizations worldwide understand the potential of digitization for their operations and face challenges in launching and executing digitization projects in their core businesses that would lead to a measurable return on investment. The structured and systematic approach toward digitization consists of three specific areas:

- First organizations need to prioritize their digitization efforts by linking them to the functions with the maximum value.
- Second, an organization needs to build foundation capabilities in data and analytics, technological architecture, talent, and culture, and cybersecurity for ongoing digital transformation, regardless of changes to the underlying technology.
- Thirdly, organization needs to apply more agile approach by piloting few new technologies linked to business priorities and scale up the initiatives that have proven their applicability and delivered associated benefits.



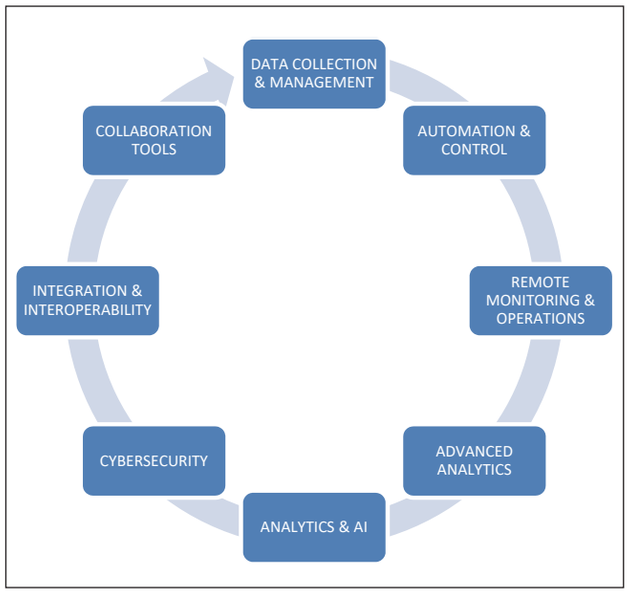
structured approach

The complete digitization process requirements of an organization are as follows:



Digitization in a nutshell

- **Data Collection and Management:**
  - Implement sensors and IoT devices to collect real-time data from equipment, pipelines, and facilities.
  - Use data management platforms to store, process, and analyze collected data.
- **Automation and Control:**
  - Automate control systems for drilling, extraction, production, and distribution using advanced software and robotics.
  - Employ machine learning and AI for predictive maintenance and decision-making.
- **Remote Monitoring and Operations:**
  - Utilize remote monitoring systems to oversee operations from central control rooms.
  - Enable remote operations to manage assets and respond to issues without physical presence.
- **Advanced Analytics:**
  - Apply advanced analytics and big data to optimize production, reduce downtime, and forecast demand.
  - Use digital twins to simulate and optimize processes and equipment performance.
- **Analytics and AI:**
  - Applying machine learning algorithms to analyse data and predict trends.
  - Using AI for predictive maintenance, anomaly detection, and optimization of operations.



Digitization process

Digitization - Advantages	
Advantages	**Solution**
Increased Productivity	Enhanced operational efficiency leads to higher productivity
Cost Savings	Reduction in downtime and maintenance costs
Improved Safety	Fewer accidents and hazardous incidents
Sustainability	Reduced environmental impact through better resource management.
Enhanced Decision-Making	Data-driven insights enable better strategic decisions

Challenges and Solutions	
Challenge	**Solution**
High Initial Costs	Long-term ROI through operational efficiency
Cybersecurity Threats	Robust cybersecurity frameworks and regular audits
Workforce Adaptation	Training and development programs for employees
Data Integration	Use of standardized platforms and interoperable systems
Resistance to Change	Change management strategies and stakeholder engagement

Region-wise comparative requirements on digitization

Region	Oil Sector Status	Gas Sector Status	Power Sector Status
North America	Advanced digitization with extensive use of IoT and AI for exploration and production.	High level of automation in gas distribution and monitoring systems.	Significant use of smart grids and renewable energy integration.
Europe	Mature digitization with focus on sustainability and emission reductions.	Advanced use of digital tools for pipeline monitoring and safety.	Leading in smart grid technology and renewable energy management
Middle East	Growing adoption with investments in AI and robotics for enhanced production.	Increasing use of digital solutions for efficient gas extraction.	Gradual adoption of digital tools for power management and efficiency.
India	Emerging digitization with a focus on improving exploration and refining processes	Early stages of adopting digital monitoring and control systems.	Developing smart grid infrastructure and renewable energy integration.

Region-wise comparative pertinent usages - Digitization in Oil, Gas & Power Sectors

Region	Data Collection & Management	Automation & Control	Remote Monitoring & Operations	Advanced Analytics	Cybersecurity
North America	Extensive use of IoT, cloud storage	AI and robotic automation	Centralized control rooms	Big data, digital twins	Robust measures with IBM
Europe	IoT and data platforms	Robotic process automation	Remote operation centres	Predictive analytics	Advanced cybersecurity
Middle East	Sensors and IoT	Advanced automation	Remote monitoring systems	Big data and analytics	Comprehensive strategies
India	IoT and real-time monitoring	AI-enhanced automation	Remote technologies	Advanced analytics	Advanced cybersecurity

Region-wise comparative percentages and remaining work for key digitization processes are highlighted below:

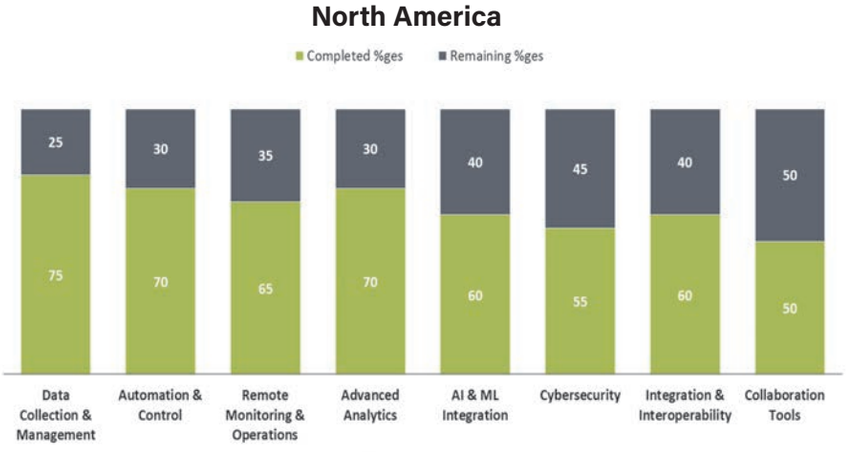
Region	Data Collect & Management	Automation & Control	Remote Monitoring & Operations	Advanced Analytics	AI & ML Integration	Cyber-security	Integration & Inter-operability	Collaboration Tools
North America	75% C	70% C	65% C	70%C	60% C	55% C	60% C	50 C
	25% R	30% C	35% R	30%R	40% R	45% R	40% R	50 R
Europe	80% C	75% C	70% C	75%C	65% C	60% C	65% C	45 C
	20% R	25% R	30% R	25%R	35% R	40% R	35% R	55 R
Middle East	25% C	70% C	65% C	70% C	60% C	45% C	40% C	50 C
	75% R	30% R	35% R	30% R	40% R	55% R	60% R	50 R
India	50% C	45% C	40% C	45%C	40% C	35% C	40% C	30 C
	50% R	55% R	60% R	55%R	60% R	65% R	60% R	70 R

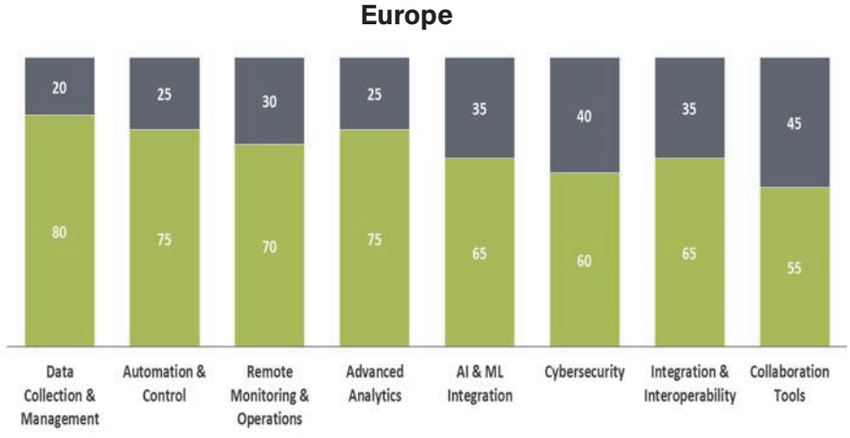
C = Completed / R = Remaining

Source:

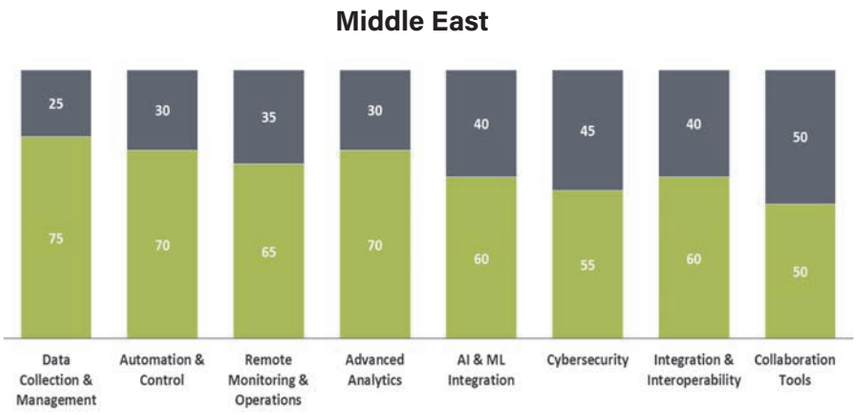
- McKinsey's insights on automation in oil and gas production (McKinsey & Company).
- Saudi Aramco's digital transformation strategies and their impact (Oil and Gas Middle East).
- Energy transition trends and investment data from Oxford Energy and Energy Monitor (Oxford Energy) (Energy Monitor).

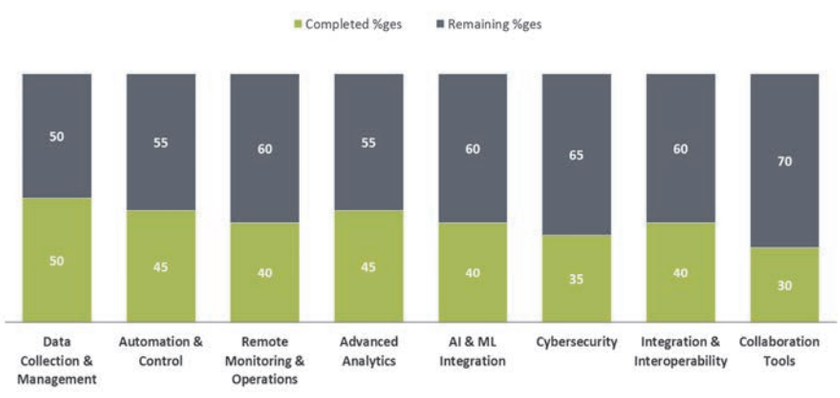
Region-Wise Digitization percentages-wise status in Oil, Gas, and Power Sectors





- **Cybersecurity:**
  - Ensuring robust cybersecurity measures to protect critical infrastructure from cyber threats.
  - Implement robust cybersecurity measures to protect digital infrastructure from threats and ensure data integrity.
- **Integration and Interoperability:**
  - Ensure seamless integration of various digital tools and systems.
  - Use interoperability standards to facilitate communication between different technologies and platforms.
- **Collaboration Tools:**
  - Using digital platforms to enhance collaboration among teams and stakeholders.





- o Leveraging virtual and augmented reality for remote assistance and training.

Digitization process

Highlights of Digitization

- **Real-Time Data Access:** Instant access to operational data for better decision-making.
- **Enhanced Efficiency:** Streamlined processes and reduced operational costs.
- **Predictive Maintenance:** Early detection of potential issues to prevent equipment failure.
- **Safety Improvements:** Reduced risk of accidents through automated monitoring and control.
- **Environmental Benefits:** Lower emissions and better resource management through optimized operations.

Recommendations and Usefulness to Mankind and Future Generations

- **Sustainable Development:** Digitization can lead to more sustainable energy production methods, reducing environmental impact and conserving resources for future generations.
- **Innovation:** Continuous digital innovation can drive new energy solutions, ensuring reliable and clean energy supply.
- **Economic Growth**: Efficient and optimized operations contribute to economic growth by reducing costs and increasing productivity.
- **Quality of Life:** Enhanced safety, reduced environmental impact, and efficient energy production improve the quality of life for communities globally.

These recommendations highlight the potential of digitization to transform the oil, gas, and power sectors, providing significant benefits to humanity and paving the way for a sustainable future.

Conclusion

The latest advances in digitization provide a significant opportunity to change the management and operations of an organization in fundamental and operational ways. However, many management teams are overwhelmed by the sheer range of new technologies, the pace at which they progress, and the complexity of applying those technologies across massive enterprises.

To make sense of the options, organizations need to take a business-first approach to technology, rather than a technology-first approach. By applying the approved framework for digitization as directed by the Executive Management, the organizations can be rewired for better performance today, and position themselves to capitalize on the new technologies that will emerge tomorrow. ■

EPC for Mid-size Projects

Suneet Prakash
Advisor and Ex-Corporate Head – Projects
Aditya Birla Group

The Engineering Procurement and Construction (EPC) model of project execution for mid-size companies comes with its own challenges. ***Suneet Prakash, Advisor and Ex-Corporate Head – Projects, Aditya Birla Group,*** throws more light on the key issues in execution of mid-size EPC projects.

To say that this is the golden era for capex in India may sound a bit cliched, but the fact is that the India growth story continues unabated. India has announced its intent in becoming a developed nation in the foreseeable future. *Amrit Kaal* is being ushered in. As a first step towards this, the newly elected government has announced infra projects worth ₹3 lakh crores in its first 100 days in office. Such a massive spending will certainly cascade down to all sectors necessitating fresh capex investment from both private as well as state-owned companies.

India is standing at the cusp of an exponential growth thereby providing a golden opportunity to the Engineering Procurement and Construction (EPC) companies. The large projects, usually have global bidding and get executed by engineering and construction behemoths from around the world. It is the mid-size projects which sometimes fall in the 'no-man's land' since they are often too 'small' for large construction companies.

In chemical sector alone India's share in global chemical production is a meagre 3 per cent. With

several countries tightening imports, especially those from China, the Indian companies can rush in to fill the gap thus created. The key to success in such projects will be professional execution. Let's examine some of the key issues in execution of mid-size EPC Projects. An understanding of these issues by EPC companies and their redressal will help them in winning EPC contracts in the domain of mid-size projects.

Perceived gaps in execution of mid-size projects

- Skill-set
- Safety
- Benchmarking with global companies
- Plant operability
- Cost and time overrun
- Risk management
- Statutory approvals

Whereas all these factors apply to large projects as well, in mid-size projects they become more acute since such projects are often not done on EPC basis. By carefully positioning themselves to address each of these areas EPC companies can reap in India's growth story by successfully participating in EPC of mid-size projects. Let us examine each of these areas more carefully to see what changes can be brought about in approach execution strategy.

Gaps in Skill-set: Mid-size projects are often manned by internal resources drawn from different functions. This typically happens in companies which do not have a steady pipeline of projects. In such companies, it is a common practice to transfer engineers from production, maintenance and other departments to projects for the duration of projects. In several cases such resources continue their 'main' role in addition to projects. Given this half-hearted approach, it is not difficult to imagine the outcome of such projects.

The EPC companies can depute their functional experts as 'owners engineers' to the projects. These engineers act as an extension of owners' team and are Subject Matter Experts (SMEs) in their functions. This obviates the need for owners to maintain a large team of discipline experts on their rolls and the project gets executed with a small team.

Safety: The safety performance of projects in our country is far below that in other countries. One of the key reasons is lack of training and failure to implement set processes. The whole process of multiple sub-contracting of construction work dilutes the application of safety standards. EPC companies can demonstrate their own safety track record and tools to ensure a safe approach to construction. By infusing modern construction techniques and artificial intelligence in plant construction and design, EPC companies can develop competitiveness and align closely with projects goals. As more global players enter the Indian EPC market, it will be imperative for Indian EPC companies to enhance their efficiency and safety standards.

The use of digital tools including drones can be a game changer in this regard. Drones can be used to monitor and alert safety lapses and prevent accidents. Virtual reality can be employed for safety training. There are several more tools like smart Personal Protective Equipment (PPE) etc and companies who have adopted them are already reaping in the benefits. With tightening labour laws, EPC companies that have a poor safety record will continue to be penalized and sidelined in major contracts.

Global benchmarking: How do projects in India fare on key metrics? It is a fact that schedule overruns happen almost everywhere – but their scales vary. Almost 80 per cent projects in mid-size segment suffered from cost and schedule overrun in India. Global benchmarking will gain more importance since India is selling its products and services globally. Similarly, we can see higher cost but more efficient foreign resources being deployed for projects in India. Such a scenario will impel 'Survival of the fittest' amongst EPC companies. One way to overcome this is by having a Plan-Monitor-Control (PMC) for the mid-size projects. Whereas the concept of a Project Management Office (PMO) and/or PMC is common in large projects, it is still somewhat uncommon in mid-size projects. An empowered PMC that lays down project governance tools, monitors the projects and guides the team to take necessary corrective action in a timely manner, helps in recruitment and training amongst others, can add tremendous value in any project. For better efficacy, such PMCs should be

In most cases cost and time overrun are two primary reasons for project under performance. It is also important to communicate to the owners of a likely slippage in schedule and cost well ahead of time so that necessary corrective action can be taken.

manned by Small and Midsize Enterprises (SMEs) who have extensive experience in execution of projects and working with global teams.

Plant operability: This refers to the metrics which formed the baseline of project feasibility – for example cost, time, throughput, efficiency, consumption of raw material, utilities, etc. Any change in these parameters from the planned values can impact the Internal Rate of Return (IRR) or the profitability of the project. The impact of the individual factors can be studied through a sensitivity analysis and factors that impact the project the most should be paid special attention. Normally this is done by owners, but in EPC contracts several of these factors are controlled by contractors. A project can be deemed successful only if it meets all criteria for which it was set-up or which were considered as a basis for project evaluation and approval.

Cost and time overrun: In most cases these are two primary reasons for project underperformance. These two factors can shave off the plant IRR substantially (to be evaluated by sensitivity analysis) and it is imperative to measure them periodically and necessary corrective action to keep the project aligned with baseline. Here it is also important to communicate to the owners of a likely slippage in schedule and cost well ahead of time so that necessary corrective action can be taken. Various digital tools are available for project planning and cost control and must be used.

Risk management: As a project moves from conceptualization to commissioning phase, it faces different risks along its lifecycle. The importance of proper risk management can never be overstated. In EPC contracts the risks are shared with contractors, hence it is imperative for EPC companies to have a robust risk management system to avoid depletion in margins. Having a risk manager helps greatly in monitoring and mitigating risks.

Statutory approvals: This is mostly carried out by owner team, but the EPC companies can assist with timely submission of necessary technical documentation. In EPC model, the contractors also have to obtain several approvals related to construction. The lead time for such approvals must be considered while doing project planning.

The EPC companies will do well to demonstrate the value addition they bring to a project at an extra cost. Their cost competitiveness will be spurred by adoption of modern techniques in design and construction – something that often eludes owner companies. To further increase transparency and boost owners' confidence, alternate contracting strategies like cost plus basis can be explored. This is common in West.

The gaps in EPC execution, if addressed by contractors, will go a long way in building trust with the owners. ■

INTERVIEW

"Energy transition is opening up new avenues for consumers"

AMAR KUMAR
Head of Refinery
Nayara Energy

The petrochemical and refining industries are at the forefront of driving India's economic growth and energy security. With India's refining capacity projected to reach 400 million tonnes per annum by 2025 and substantial investments being made in petrochemical complexes, the sector is poised for significant transformation. In an exclusive interview with ***Mittravinda Ranjan***, ***Amar Kumar, Head of Refinery, Nayara Energy,*** speaks about the emerging trends in the industry and shares company growth plans.

Given the evolving global energy landscape and India's growing energy demands, what is your refinery's capacity expansion strategy for the next 5 years? How do you envision balancing traditional fuel production with the growing demand for low-carbon products?

India as a nation is on a growth trajectory and upholds immense potential for growth. Energy players are playing a crucial role in an endeavor to meet the growing energy demand of a nation whose aspirations are soaring by the day. Nayara Energy is currently contributing to around 8 per cent of India's refining capacity and operating around 6,500+ retail outlets to ensure supply of quality fuels to consumers. We are committed to meeting India's growing conventional fuel and petrochemical demand thereby contributing to nation building. As a refinery we continue to focus on improving our operational efficiency and lowering our energy intensity to reduce carbon emissions. Also, we are gearing up to meeting 20 per cent Ethanol blending requirements in MS by 2025 and we already have the

infrastructure in place for Bio diesel blending into High Speed Diesel (HSD).

The refining industry is undergoing a significant transformation. How do you see the emerging market scenario impacting your refinery's operations and product mix in the next 5 years?

We do not anticipate major impact on our refinery operations or significant changes in the product mix over the next five years, as we are still in the early stages of the energy transition. Our refinery in Vadinar has a high NCI of 11.8 which enables us to process a wide range of crude basket with varying °API, providing flexibility in crude selection and optimizing our feedstock. We are focusing on our strengths to maintain and operate our assets with higher capacity utilization, ensuring high reliability while minimizing our energy intensity to maximize refining margins.

Environmental Social and Governance (ESG) and sustainability have become paramount for businesses. What are your refinery's specific ESG goals and net zero targets? How do you plan to integrate these objectives into your operations while ensuring financial viability?

As an organization, we have a well-defined sustainability agenda and our ESG goals, with a clear implementation road map. These goals are aligned with our operational needs and our efficiency improvement programs meeting the twin objective of efficiency gains with carbon footprint reduction.

The energy transition is opening up new opportunities. How is your refinery positioning itself to capitalize on emerging areas like green hydrogen and green ammonia? What are the key challenges and opportunities you foresee in this space?

The energy transition is opening up new avenues for consumers, and as an industry, we must align with this transition to meet customer needs. We are aligning ourselves with market developments and working towards a pilot-scale green hydrogen production unit, which can be scaled up as we gain clarity on the critical aspects associated with the generation and utilization of green hydrogen.

Given the increasing regulatory pressures and consumer expectations, how is your refinery adapting its operations and product portfolio to meet the evolving environmental standards? What technological advancements are you exploring to enhance energy efficiency and reduce emissions?

We have been successful in reducing our Energy Intensity Index substantially and look forward to further optimize on our internal fuel requirements. We have identified many energy conservation projects which are at various stages of implementation such as preheat improvement in our main crude unit, flare gas recovery system, heat integration of hydrogen unit and Captive Power Plant (CPP), revamp of boilers to improve energy efficiency, increased operational efficiency, reliability and optimum turnaround cycle helps in reducing emissions.

Talent acquisition and development are crucial for the industry's future. What steps is your refinery taking to build a skilled workforce capable of navigating the complexities of the energy transition? How are you fostering innovation and collaboration within your organization?

Human capital has always been our greatest strength. We continuously enhance the knowledge of our people through sustained Learning & Development (L&D) initiatives be it trainings and providing exposure to emerging technologies through seminars, conferences and other knowledge sharing platforms. We have a well-established system of training and inducting new talent into our system, so that they are well equipped to take independent charge of their assigned roles. Our people are well trained with adequate skills to handle any future challenges and navigate the organization through it.

Can you share insights into the ongoing and upcoming projects and investments?

Our refinery is constantly upgrading its technology and existing assets. We are investing in upgradation of the refinery by implementing revamps of our existing Vacuum Gas Oil Mild Hydro Cracking (VGOMHC) unit and replacement of coke drums along with many energy conservation projects which are planned to be executed during the next refinery turnaround planned in early 2026. Diversification into petrochemicals with multi feed steam cracker remains our major focus area. We are also actively working towards green hydrogen and renewable energy projects for meeting the sustainability goals. ■

Corrosion Mitigation: How FRP Products are Revolutionizing Industrial Applications

Gautam Watve
Managing Director
Suyash Composite Industries Pvt Ltd

Corrosion is a significant problem in industries worldwide, leading to significant expenses in repair, maintenance, and replacements annually. The impact of corrosion is rarely measured but it affects nearly every industry, from chemical processing to power generation, wastewater treatment, and transportation. Metals used in environments exposed to chemicals, corrosive gases, moisture, or salt, are especially prone to corrosion. While traditional materials like steel and concrete require continuous upkeep to protect against corrosion, Fiber Reinforced Polymer (FRP) has emerged as a powerful solution to combat this issue. ***Gautam Watve, Managing Director, Suyash Composite Industries Pvt Ltd,*** explains in detail about FRP products and how it is revolutionizing industrial applications.

Corrosion is the gradual degradation of materials, usually metals, through chemical or electrochemical reactions within their environment. For instance, steel exposed to oxygen and water forms rust, weakening structural structures. Corrosion takes many forms and impacts various materials, but the results are the same — structural damage, operational inefficiencies, safety risks and high maintenance costs. To mitigate corrosion, industries are turning to FRP products such as tanks, pipes, scrubbers, and structural components, which provide excellent resistance to corrosive environments.

Types of Corrosion and FRP as a Mitigation Solution

FRP products are now widely used in industries where metal components would quickly degrade due to corrosion. Here's a breakdown of how FRP products are being used to mitigate the different types of corrosion.

Acid Storage Tank

▪ **Uniform Corrosion:** Uniform corrosion is the even degradation of a metal's surface due to chemical or moisture exposure. Over time, the entire material becomes thinner and weaker. This is particularly problematic in environments with acidic chemicals, such as chemical processing plants or even normal acid or water storage tanks.

Example: Chemical storage tanks in acid plants. In facilities that handle corrosive chemicals, such as sulfuric acid or hydrochloric acid, metal tanks are highly susceptible to uniform corrosion. Acid can eat away at the metal, requiring frequent maintenance or replacement.

Mitigation Using FRP Products

FRP Tanks: FRP tanks are used in chemical plants to store aggressive chemicals like acids and alkalis. These tanks are chemically resistant and do not suffer from uniform corrosion like steel. For example, many sulfuric acid plants now use FRP storage tanks instead of metal tanks to store concentrated acid, dramatically reducing maintenance costs and increasing tank longevity.

FRP Pipes: In chemical transport systems, FRP pipes are replacing traditional steel pipes, providing better protection against uniform corrosion caused by chemicals. The FRP pipes used in chemical plants are resistant to a wide range of aggressive substances, extending the life of the system.

▪ **Pitting Corrosion:** Pitting corrosion is a localized form of corrosion that creates small, deep holes or pits on the surface of metal. This type of corrosion is particularly dangerous because it can be hard to detect and lead to catastrophic failure if not addressed.

Example: Stainless Steel Equipment in Water Treatment Plants

In water treatment facilities, equipment like stainless steel tanks and pipes exposed to chloride ions (from salt or brine) are vulnerable to pitting corrosion. Over time, these small pits can penetrate the metal, causing leaks or structural failure.

Mitigation Using FRP Products

FRP Scrubbers: FRP scrubbers, used to control and remove pollutants from exhaust gases in wastewater treatment plants, are highly resistant to pitting corrosion. Since scrubbers come into contact with moisture and aggressive chemicals, FRP is ideal due to its durability and resistance to chloride attack. In many water treatment plants, FRP scrubbers have replaced metal scrubbers, providing a longer-lasting solution.

FRP Water Storage Tanks: Water treatment plants are increasingly using FRP tanks to store saline or brine solutions because FRP is resistant to chloride-induced pitting. The tanks can be custom-designed for different applications and offer a maintenance-free solution.

▪ **Crevice Corrosion:** Crevice corrosion occurs in narrow, confined spaces like the joints between two materials or under gaskets and seals. In these areas,

Acid Storage Tank

FRV Composite Scrubber

the local environment becomes more aggressive, leading to localized attacks and damage.

Example: Bolted Joints in Flue Gas Systems.

In flue gas desulfurization (FGD) systems, which remove sulfur dioxide from industrial emissions, metal components such as bolts and flanges are exposed to moisture and acidic gases, making them prone to crevice corrosion.

Mitigation Using FRP Products

FRP Ductwork and Scrubbers: FGD systems in power plants and industrial settings are using FRP ductwork and scrubbers to replace metal components. These FRP products are resistant to both acidic gases and the crevice corrosion that occurs in joints. For example, many coal-fired power plants have installed FRP scrubbers for their FGD units, significantly reducing the risk of crevice corrosion in high-moisture and acidic environments.

FRP Flanges and Fittings: In corrosive environments, using FRP flanges and fittings ensures that crevice corrosion is eliminated. FRP's non-metallic nature prevents moisture from accumulating in small crevices, offering a more durable solution than traditional metal parts.

- **Galvanic Corrosion:** Galvanic corrosion occurs when two dissimilar metals are in electrical contact in a conductive environment, such as saltwater. The more reactive metal corrodes, often at a faster rate, while the less reactive metal is protected.

Example: Offshore Oil Rigs.

Offshore oil rigs, constructed with various types of metal, are particularly susceptible to galvanic corrosion. Saltwater acts as a conductive medium, accelerating the corrosion process where different metals meet.

Mitigation Using FRP Products

FRP Piping Systems: Offshore platforms are replacing metal piping systems with FRP pipes. FRP is a non-conductive material, eliminating the possibility of galvanic corrosion between dissimilar metals. For instance, FRP seawater intake pipes on offshore rigs are now standard, offering superior resistance to the aggressive marine environment.

FRP Grating and Structural Components: Platforms also use FRP grating and structural components to avoid galvanic corrosion. Unlike metallic grating, FRP does not contribute to corrosion when in contact with other metals, making it ideal for environments with mixed metal use.

- **Erosion Corrosion:** Erosion corrosion happens when the metal surface is simultaneously exposed to corrosive elements and mechanical wear from fast-flowing liquids or gases, leading to rapid material loss.

Example: Cooling towers in power plants.

Cooling towers in power plants pump large volumes of water at high speed, causing erosion-corrosion in

metal pipes and tanks, especially if the water contains abrasive particles or chemicals.

Mitigation Using FRP Products

FRP Cooling Tower Components: Power plants now install FRP cooling tower components, including fans, decking, and water distribution systems. These components are not only corrosion-resistant but also highly durable in fast-flowing water systems. For example, in nuclear power plants, FRP cooling towers are used to handle the high demands of cooling without suffering from erosion-corrosion.

FRP Pipes in Desalination Plants: In desalination plants, where seawater is processed, FRP pipes are used for high-velocity water transport. The non-abrasive and non-corrosive nature of FRP ensures that the pipes last longer, even in the presence of saltwater and high-speed flow.

- **Stress Corrosion Cracking (SCC):** SCC is caused by the simultaneous action of tensile stress and a corrosive environment, leading to cracking and potential failure of metal components.

Example: High-Pressure Chemical Pipelines.

Pipelines carrying hazardous chemicals at high pressure can experience SCC, especially in welded sections. Over time, these cracks can spread, leading to leaks or failure of the equipment.

Mitigation Using FRP Products

FRP Pressure Vessels: In chemical processing plants, FRP pressure vessels are being used to replace metal ones, offering protection against SCC. FRP does not suffer from SCC because it is a non-metallic material, even when under high pressure. For example, in industries dealing with caustic substances, FRP pressure vessels are used to avoid the risk of cracking and failure.

FRP Reinforced Pipelines: Chemical pipelines are also being wrapped in FRP composite materials to protect them from SCC. The FRP reinforcement acts as a protective layer while armouring the pipes. This not only reduces tensile stress but also prevents the corrosive elements from penetrating the metal beneath.

Pipes and Fittings

Conclusion

Fiber Reinforced Polymer (FRP) products like tanks, scrubbers, pipes, and structural components are transforming the way industries manage corrosion. With their superior resistance to aggressive chemicals, moisture, and mechanical wear, FRP products are replacing traditional materials in critical applications across a wide range of sectors, including chemical processing, wastewater treatment, marine environments, and power generation.

Real-world examples from chemical plants, desalination facilities, and offshore platforms show that FRP offers long-term durability, lower maintenance costs, and improved safety by mitigating the various forms of corrosion. As industries continue to seek more efficient and cost-effective solutions, FRP's role in corrosion mitigation will only continue to grow, cementing its place as a key material in modern infrastructure and industrial processes. ■

Evolution of Safety and Operational Excellence in India's Chemical Process Industries

Shrey B Patel
Founder-Director
Angiras Rasayan LLP

Advances in artificial intelligence (AI) and machine learning (ML) are paving the way for industries to enhance both safety and efficiency. Globally, AI/ML-driven safety frameworks are being integrated to better detect hazards, predict failures, and optimize chemical processes. For India, adopting these technologies represents an opportunity to scale up safety measures, aligning with global best practices while meeting local regulatory requirements. ***Shrey B Patel, Founder-Director, Angiras Rasayan LLP,*** throws light on the evolution of safety and operational excellence in India's chemical process industries with AI/ML integration.

India's chemical process industry is one of the fastest-growing sectors, with the market size estimated to reach USD304 billion by 2025. The sector contributes 7 per cent to India's GDP and accounts for 17.6 per cent of the country's total exports. As the sixth-largest producer of chemicals globally and the third-largest in Asia, India's chemical sector plays a vital role in its industrial landscape, employing over 2 million people directly. The global competitiveness of Indian chemical companies is set to rise further as the industry undergoes technological transformations aimed at optimizing production while maintaining strict safety protocols. Ensuring operational safety in this high-stakes industry is paramount. Given the complex chemical reactions and hazardous materials involved, safety breaches can lead to severe consequences.

Critical Safety Challenges in India's Chemical Process Industries

The Indian chemical sector comprises 45 per cent of production involving hazardous chemicals, making safety protocols essential. India records approximately 25 major chemical accidents per year, with over 2,000

incidents related to chemical hazards reported between 2014 and 2018, according to the Ministry of Labour and Employment. This highlights the need for real-time safety solutions that can anticipate and mitigate risks.

Traditional safety techniques like Hazard and Operability Studies (HAZOP) and Failure Modes and Effects Analysis (FMEA) have served as the foundation for identifying potential hazards. However, as Indian chemical companies scale operations to meet increasing demand (which is growing at a 9.3 per cent CAGR), these traditional methods are proving insufficient to manage the complexities of modern-day production facilities. The use of AI and ML, which can provide predictive and preventive safety management, is quickly becoming a necessity for Indian plants to maintain operational safety and efficiency.

Integrating AI/ML for Functional Safety

Global developments in AI/ML technologies offer transformative potential for functional safety across industries, including chemical processing. AI-driven predictive maintenance, hazard detection, and real-time process monitoring enable better safety management by detecting anomalies before they evolve into full-scale operational risks.

In India, where many chemical plants still rely on manual safety checks and legacy systems, integrating AI and ML could lead to significant improvements. A report by McKinsey states that companies incorporating AI-powered predictive maintenance can reduce unscheduled downtime by 30-50 per cent, while improving machine life by 20-40 per cent. For India's chemical industry, this could translate into substantial cost savings and enhanced safety. Moreover, AI systems can process data from sensors and control systems, continuously monitoring equipment, detecting deviations from standard operating procedures, and sending early warnings to operators. By reducing human intervention and error, AI helps mitigate the risk of accidents, improving safety outcomes across the board.

Optimizing Chemical Processes through AI/ML

Process optimization is a key focus for chemical industries looking to improve production efficiency while reducing waste and energy consumption. India's chemical industry is projected to grow at a 12-14 per cent CAGR over the next few years, with strong demand across sectors such as petrochemicals, fertilizers, and specialty chemicals. With growing pressure to meet this demand sustainably, AI/ML-based process optimization tools are essential.

A study by the Confederation of Indian Industry (CII) estimates that process optimization through AI can lead to a 5-10 per cent increase in yield and a 5-8 per cent reduction in energy consumption. AI-based models, fed with historical and real-time data, can predict optimal conditions for chemical reactions, leading to reduced energy costs, improved process efficiency, and better resource utilization. This is especially relevant for India's energy-intensive chemical industry, which accounts for 15 per cent of the country's energy consumption.

By using AI to optimize chemical processes, Indian plants can also minimize environmental impact. The Central Pollution Control Board (CPCB) estimates that India's chemical industry contributes to over 20 per cent of the country's hazardous waste. AI-powered monitoring systems can track emissions and waste levels in real time, ensuring that plants operate within regulatory limits while reducing their environmental footprint.

Adapting Global Safety Standards to India's Chemical Sector

India's regulatory framework for chemical safety, governed by laws such as the Factories Act and the Environment Protection Act, is comprehensive. However, there is a growing need for Indian industries to align more closely with global safety standards like IEC 61508 and ISO 45001. As India's chemical industry becomes more integrated into global supply chains, meeting international safety standards becomes not only a matter of compliance but also a competitive advantage.

AI/ML technologies can help ensure compliance with both Indian and international safety regulations. Real-time data analytics can offer better transparency into operations, enabling companies to stay compliant with evolving regulations. Additionally, AI-based safety systems can track regulatory adherence in real-time, reducing the risk of human error in manual reporting systems.

The Indian government, through its National Action Plan for Chemical Safety, aims to establish India as a global leader in chemical safety, with AI/ML technologies being an integral part of this vision. By adopting AI-driven safety protocols and incorporating latest knowledge from cross-functional guidebooks like The Application of AI/ML in Functional Safety, published by IET, UK amongst many other literature published by various organisations across the world, Indian chemical plants can ensure that they not only meet local regulatory requirements but also set a benchmark for safety standards globally.

Indian Chemical Industry: A Context for AI/ML Integration

India's chemical industry is diverse, encompassing over 70,000 products across different sectors, including pharmaceuticals, petrochemicals, agrochemicals, and specialty chemicals. The sector is export-oriented, contributing to nearly 20 per cent of the country's total exports, with major markets in North America, Europe, and Asia-Pacific.

However, the sector faces several challenges, including fluctuating raw material prices, increasing energy costs, and pressure to meet stringent safety and environmental standards. AI/ML integration offers a path to address these challenges. Predictive analytics can optimize resource use, reducing operational costs and mitigating the impact of raw material price volatility. AI-powered monitoring systems can also track environmental emissions, helping companies ensure compliance with both local and international environmental regulations.

The Indian government's Production Linked Incentive (PLI) scheme, which aims to boost domestic manufacturing, includes provisions for the chemical industry. By incorporating AI/ML technologies, Indian companies can further improve their global competitiveness while ensuring they meet the safety and operational standards required to participate in international markets.

Case Studies

Several Indian companies have already started implementing AI/ML to enhance safety and operational efficiency. A petrochemical plant in Gujarat successfully adopted AI-powered predictive maintenance, reducing equipment downtime by 20 per cent and increasing overall safety standards. Meanwhile, a specialty chemical manufacturer in Maharashtra implemented real-time AI-based emission monitoring systems, resulting in a 15 per cent reduction in emissions and enhanced regulatory compliance.

These examples underscore how AI/ML integration is not just a futuristic concept but a present reality for India's chemical industry. As more companies follow suit, the industry stands to benefit from safer operations, improved efficiency, and a stronger global presence.

Future Prospects: Shaping Global Safety Standards from India

India's chemical process industry is at a pivotal moment. The adoption of AI/ML in functional safety and process optimization can propel India into a leadership role on the global stage. According to the Federation of Indian Chambers of Commerce and Industry (FICCI), AI-driven technologies in the chemical sector could contribute an additional USD20 billion to India's GDP by 2030.

To realize this potential, greater collaboration between the government, industry leaders, and regulatory bodies will be necessary. Investments in AI infrastructure, R&D, and skill development are crucial for ensuring that India's chemical industry remains at the forefront of global safety and operational excellence.

All-in-all

India's chemical process industry is on the brink of a technological transformation. With the integration of AI/ML technologies into functional safety systems, the industry can enhance operational efficiency, reduce risks, and meet stringent safety standards. As India positions itself as a global leader in the chemical sector, AI-driven safety and operational protocols will be key to its sustained success.

The future of India's chemical industry is one where cutting-edge technology works hand-in-hand with traditional safety protocols, creating a safer, more efficient, and globally competitive industry. ■

Tapping the Potential of Engineering Industry

Varsha Vasant Mestry
Managing Director
Suvidya Institute of Technology Pvt. Ltd.

The engineering industry is essential for constructing vital infrastructure like power plants, oil refineries, highways, and bridges. These projects are complex and demand meticulous planning, advanced technology, and a highly skilled workforce. Over the years, the industry has undergone significant changes driven by new technologies, evolving regulations, and a growing focus on sustainable development. ***Varsha Vasant Mestry, Managing Director, Suvidya Institute of Technology Pvt. Ltd.,*** throws more light on the challenges and the growth opportunities of the engineering industry.

Renewable energy is a hot topic in engineering these days. Engineers are focusing on creating energy from natural resources that won't run out, like the sun, wind, and water. Solar power is a big deal in renewable energy. Engineers design solar panels that capture sunlight and turn it into electricity. This clean energy source is used to power homes, businesses, and even whole communities.

Wind energy is also gaining popularity. Engineers build wind turbines that use the wind's force to generate electricity. These turbines can be found on land and offshore, harnessing the power of the wind to produce clean energy. Hydroelectric power is another form of renewable energy. Engineers create dams and reservoirs to capture the energy of flowing water. This energy is then converted into electricity, providing a reliable and sustainable power source.

The engineering challenge lies in designing efficient systems that can harness renewable energy effectively. This includes developing advanced technologies, optimizing energy storage solutions, and integrating renewable sources into existing power grids.

Renewable energy engineering is not only about creating sustainable power but also about reducing carbon emissions and combating climate change. It is an exciting field with a focus on innovation and environmental stewardship.

GUEST COLUMN

Embracing Sustainability

Sustainability has become a central focus in the engineering industry. There is a growing emphasis on adopting eco-friendly practices, developing renewable energy projects, and reducing carbon footprints. Companies are increasingly using sustainable materials and energy-efficient designs to comply with regulations and meet customer demand.

Green building practices involve using environmentally friendly materials and construction methods that minimize environmental impact. This includes using recycled materials, reducing water consumption, and optimizing energy efficiency. Green buildings not only benefit the environment but also provide healthier living and working spaces.

Renewable energy projects are becoming more prevalent as the world shifts towards sustainable energy sources. Solar farms and wind energy installations are being developed to reduce reliance on fossil fuels and decrease greenhouse gas emissions. These projects contribute to a cleaner and more sustainable energy future.

The engineering industry is also focusing on reducing carbon footprints in construction processes. This involves implementing energy-efficient technologies, optimizing transportation logistics, and using low-carbon materials. By adopting these practices, companies can significantly reduce their environmental impact and contribute to global efforts to combat climate change.

Global Market Trends

The global engineering market is experiencing robust growth, particularly in emerging economies that are heavily investing in infrastructure development. In countries like China and India, there is a surge in construction activity due to rapid urbanization and industrialization. These nations are building new cities, expanding transportation networks, and developing industrial hubs to support their growing economies.

In North America and Europe, the focus is on upgrading existing infrastructure and developing smart cities. Aging infrastructure in these regions requires significant investment in maintenance and modernization. Additionally, the development of smart cities aims to integrate advanced technologies into urban planning, enhancing the quality of life for residents through improved transportation, energy management, and public services.

The Middle East continues to invest heavily in oil and gas projects while also exploring renewable energy options. Countries in this region are diversifying their energy portfolios to reduce dependence on fossil fuels and embrace sustainable energy sources. This shift is driving the development of large-scale renewable energy projects and the adoption of green technologies.

Challenges and Opportunities

The engineering industry faces several challenges, including a shortage of skilled labour and project delays. The demand for trained professionals is high, but there is a significant skills gap that needs to be addressed.

Effective project management is crucial to avoid delays and cost overruns, ensuring that projects are completed on time and within budget.

The shortage of skilled labour is a pressing issue that affects the entire industry. There is a need for more engineers, technicians, and project managers who possess the necessary skills and expertise to handle complex projects. Addressing this skills gap requires investment in education and training programs that prepare individuals for careers in the engineering industry.

Project delays are another common challenge in the engineering industry. Delays can occur due to various factors, including unforeseen site conditions, regulatory hurdles, and supply chain disruptions. Effective project management involves identifying potential risks, developing contingency plans, and maintaining clear communication among all stakeholders.

Despite these challenges, there are numerous opportunities for growth and innovation in the engineering industry. Companies that invest in technology, adopt sustainable practices, and focus on workforce development are well-positioned to succeed. The integration of modular construction methods is one such opportunity. Modular construction involves creating building components off-site and assembling them on-site, reducing construction time and improving efficiency. This approach is gaining popularity for its ability to streamline the construction process and reduce costs.

Conclusion

The engineering industry is evolving rapidly with the advent of new technologies and a growing focus on sustainability. Despite challenges such as skilled labour shortages and project delays, there are significant opportunities for growth and innovation. Companies that embrace technological advancements, sustainable practices, and workforce development are well-positioned for success. ■

Make the Right Maintenance Decisions with Intelligent Sensors

Plant safety and process reliability often rely on analytical instruments operating correctly, which means sensors must be kept in good condition. This requires regular maintenance and servicing. But knowing exactly when to maintain, service or replace a probe has been very imprecise. Cutting-edge measurement systems that utilize intelligent sensors that learn from your processes, take all guesswork out of maintenance decisions. This technology also reduces the possibilities of human error and lowers instrument lifecycle as well as production costs.

Failure of analytical sensors in a process can lead to poor product quality, over-or underuse of reagents, or production downtime. And if a sensor is required for safety purposes, its failure can have devastating consequences. Therefore, instrumentation engineers spend a great deal of time ensuring measurement points are operating reliably.

However, it has been estimated that as much as 60 per cent of sensor maintenance is conducted needlessly.

And despite all this maintenance, half of industrial accidents are maintenance related. Further, 20 per cent are due to human error. Hence, an increasing percentage of chemical plant expenditure is devoted to safety aspects. Until recently, deciding if and when to perform sensor maintenance or replacement has been based on a combination of past experience and guesswork. Now, a modern technology removes all measurement system uncertainty and allows sensor maintenance to be conducted in a safe environment. This technology not only increases process reliability and plant safety, it also significantly reduces the costs of operating a measurement system over its lifetime.

Intelligent Sensor Management (ISM®) is an innovative digital technology for analytical process parameters that combines many features into a unique solution.

The foundation of the technology is built from a microprocessor embedded in all ISM sensors. This allows a wealth of valuable features that analog sensors cannot compete with, including: a robust digital signal; fast, error-free measurement point start up; and advanced diagnostics that clearly inform operators when calibration, maintenance or replacement will be required.

Predictive Diagnostics for Efficient Maintenance

In chemical plants, maintenance is often conducted on a scheduled basis, and an analytical sensor might be calibrated even though it may not actually be needed. In other situations, plant engineers may wait until they think there is an issue with a measurement point. By which time, the concerned process or plant equipment may be detrimentally affected. ISM's diagnostics tools have solved these issues.

When an ISM pH sensor is installed in a process, it does not just measure pH with great accuracy. It very quickly learns how conditions in the process will affect its ability to measure reliably over time, and therefore, when it will need to be calibrated, serviced and replaced. This data, displayed as easy-to-read tools, means that maintenance can be scheduled based on actual requirements.

ISM diagnostics allow a measurement point to be optimized on an ongoing basis and for all critical situations to be predicted, so that maintenance staff can respond before production is affected. And because measurement point maintenance only happens when it is required, operators can be certain that resources are not being wasted. With ISM, measurement point maintenance is converted from being a passive, costly, and unpredictable workflow, to a fully safe and controlled procedure. The key diagnostics tool in ISM is the Dynamic Lifetime Indicator (DLI).

Sensors that Learn

The DLI provides technicians with a clear indication of how much the exposure to a process has altered a sensor's condition.

In the case of pH sensors, by continuously analyzing the process conditions and other factors, the DLI constantly calculates the remaining reliable lifetime of the sensor. If process conditions become more or less harsh, the DLI rapidly responds appropriately. In addition, the DLI actually adapts to process conditions to ensure diagnostics data is always reliable.

Through observing the DLI (or via transmitter alarms), pH sensors with a short remaining lifetime can be replaced preemptively before they fail during operation, resulting in improved safety, higher process integrity and fewer product quality fluctuations.

The DLI, and all other ISM diagnostic tools, are viewable on ISM transmitters and iSense software. They can also be integrated into asset management systems for remote monitoring.

iSense – Digital Sensor Expert

iSense is Windows-based software for ISM sensors that runs on PCs, laptops and mobile devices. It is the hub for all ISM sensor activities, including calibration and maintenance, and provides a fully controllable method of managing sensors and maximizing their use.

All calibration and maintenance routines on iSense are accompanied by easy-to-follow animations. These reduce the requirement for training and ensure that every procedure is performed without mistakes or missed steps.

Plug and Measure: Fast and Simple Start-up

Once an ISM sensor has been calibrated, it can be stored until required. Further, when connected to an ISM transmitter, the pre-calibrated sensor is instantly recognized and the transmitter configures itself appropriately without any operator intervention. Now when an exchange of sensor is needed, this plug and measure functionality means a pre-calibrated sensor can be installed and be ready to measure in under a minute. This substantially reduces the time maintenance staff need to spend at measurement points.

Significant Cost Savings

Calibration away from the process and plug and measure results in much lower sensor maintenance expenditures. Time spent on maintenance can be reduced by as much as 80 per cent by adopting ISM systems.

However, reduced maintenance is not the only avenue to cost savings. A standard pH sensor that requires calibration combined with an interference-

prone analog signal can mean that a transmitted pH measurement may be off by 1 pH unit or more. If a process involves the feeding of reagents to raise pH, a reading that is 1 pH unit lower than the true value means ten times more reagent is being used than is required.

ISM's digital signal and diagnostics data allows operators to prevent such overuse from occurring.

ISM Solutions across your Processes

ISM is not only for pH measurement. Solutions for dissolved and gas oxygen as well as conductivity are also available. For safety critical processes, a range of in situ tunable diode laser gas analyzers combine exceptional ease of installation and use, with high accuracy and reliability.

Seamless Integration of Diagnostics Data

The invaluable sensor diagnostics data that ISM provides does not stop at the transmitter. Integration through HART®, PROFIBUS® or FOUNDATION fieldbus™ into control systems and asset management software allows real-time monitoring of sensor performance from the convenience of a maintenance room. This means that if production staff are away from the process and a measurement point needs attention, it will be noticed instantly.

A range of advanced multi-parameter, dual / multi-channel, and mixed-mode (accepts ISM and conventional analog sensors) transmitters further ensure the adaptability of ISM solutions to your needs.

Conclusion

Chemical plants have two main areas of concern: production efficiency and quality; and plant, staff and environmental safety. In-line process analytics often has a significant role to play in both respects.

Achieving the best performance from in-line sensors demands that they be kept in good operating condition. However, sensor maintenance is often conducted to a fixed schedule, meaning that a probe might be cleaned, calibrated or even replaced when it is not necessary. This costly use of resources is due to lack of information as to what tasks actually need to be performed and when.

With its highly informative diagnostics that adapt rapidly to process conditions and its robust digital signal, ISM offers efficiencies in maintenance planning, plant safety and productivity while also reducing production costs.

About Mettler Toledo

Mettler Toledo is a leading global manufacturer of precision instruments. The company is the world's largest manufacturer and marketer of weighing instruments for use in laboratory, industrial and food retailing applications. The company also holds top-three market positions for 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 systems used in production and packaging. Additional information about Mettler Toledo is available at www.mt.com. ■

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Selection Citeria for Glass-lined Equipment and Challenges

Glass-lined equipment is a century-old technology that has significantly improved through the decades. Today, it is used widely in all kinds of process industries where equipment is exposed to aggressive corrosion. ***Kausik Mukhopadhyay, Discipline Lead-Mechanical, Design India, Mott MacDonald,*** provides an overview of how glass-lined equipment can be used and guidance about the selection criteria for different processes.

Glass-lined steel equipment has some unique features which make it critical for all kinds of industries where the process conditions are difficult. When the process exceeds the resistance limitations for corrosion, abrasion or mechanical and thermal shocks, it becomes mandatory to use glass-lined equipment.

Glass-lining process

Glass-lining is achieved by spraying a mixture of enamel powder and emulsifying agents onto the surface to be glass lined. After drying this surface, the equipment is placed in a furnace at a controlled temperature to ensure the proper fusion between glass particles. It is then cooled in a controlled manner. This process is repeated until the appropriate thickness is achieved before it passes through a quality test until the desired quality is achieved.

Enamel powder is prepared from raw materials, mainly silica, soda ash or limestone, which are selected in a controlled manner and melted in a furnace at around 1300°C to 1400°C. The melted glass is then poured into water and sudden tempering breaks the enamel into small grains. These grains are then ground down to form an enamel powder.

Benefits of glass-lined equipment

Before selecting glass-lined equipment, it is important to understand the benefits it can provide, for example:

- Chemical resistance to acidic and alkaline mediums
- Mechanical resistance to shocks and abrasion
- Thermal allowance for varied temperatures
- Anti-stick properties
- Flexibility to handle a wide range of chemical conditions
- Ease of cleaning
- Absence of catalytic effect
- Economical – glass-lined steel equipment is the most cost-effective, corrosion-resistant material compared to the cost of exotic materials or polymer lining

Selection of glass-lined equipment

Based on process parameters:

- Characteristics of process fluid
- Capacity (operating volume)
- Operating and design temperature
- Operating and design pressure

Based on type of equipment:

- Reactor
- Pressure vessel
- Storage tanks
- Column

Based on equipment orientation and support:

- Vertical skirt / lug / leg mounted
- Horizontal saddle mounted

A major criterion for selection is the process parameter

as glass-lined equipment is suitable for all kinds of alkali and acidic solutions.

Corrosion resistance on acids and alkalis

Acids

Glass lining has the benefit of creating corrosion resistance to almost all hydras inorganic acids commonly used in industries, such as sulphuric acid, nitric acid and hydrochloric acid. It is essential to select glass-lined equipment for a particular process based on the iso-corrosion curve, a diagram showing high corrosion conditions.

All manufacturers have the iso-corrosion curve of

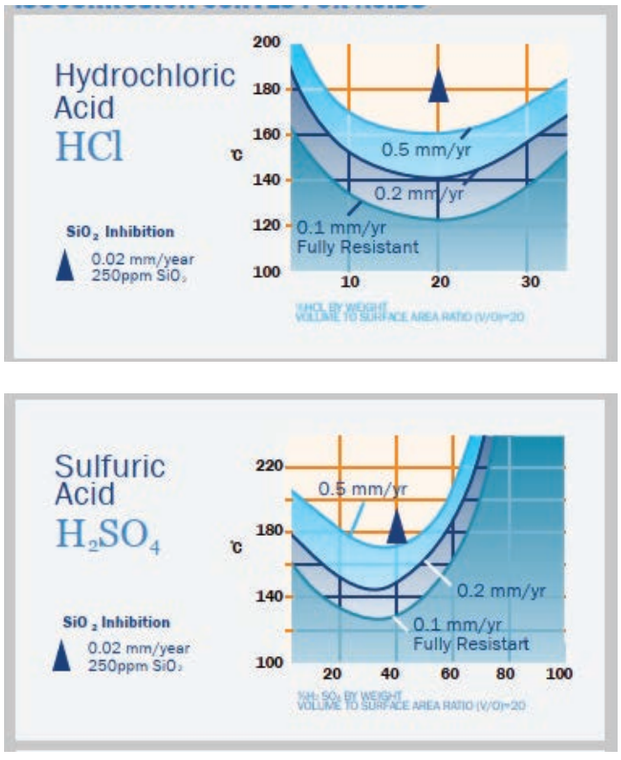

Figure 1: Examples of acid iso-corrosion curves (courtesy: M/s GMM Pfaudler).

their product based on acid used and laboratory test results with a corrosion rate of 0.1 to 0.2 mm/year. The corrosion rate of an acid is dependent on its concentration and the temperature and can be shown on an iso-corrosion curve. Some examples of acid iso-corrosion curves are given in figure 1.

Alkalis

Glass-lined equipment also has outstanding corrosion resistance in relation to all alkalis. The permissible

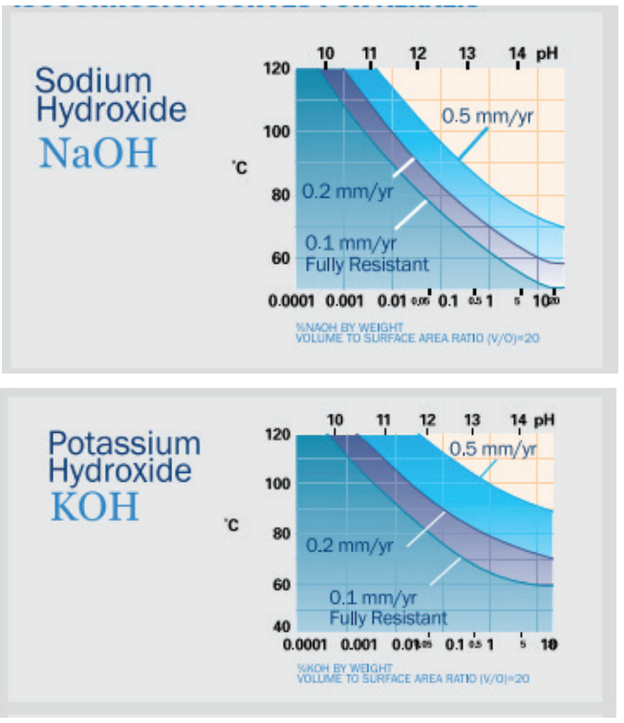

Figure 2: Iso-corrosion curves for some alkalis (courtesy: M/s GMM Pfaudler).

temperature limit for glass-lined equipment is lower than in the case of acids. Care must therefore be taken in the selection of glass-lined equipment based on the iso-corrosion curves for hot alkalis. Dip pipes are inserted into the vessel to avoid alkalis splashing or seeping through the hot vessel walls. Iso-corrosion curves for some alkalis are given in figure 2.

Inhibitor

In glass-lined reactors, reactions can be so severe that the glass-lined surface causes rapid corrosion. Use of additives to the reacting agent can inhibit the corrosion to within the permissible limit. For example, when acid is used, the addition of silica will save the glass-lined surface and reduce the corrosion rate within the permissible limit during the liquid phase.

Challenges of glass-lined equipment

- **Challenges in design and selection**

Limitation of pressure and temperature conditions: Glass-lined equipment may not be suitable for high pressure and high temperature services. For high pressure and temperature conditions, the selection of glass-lined equipment should be done with prior consultation with the manufacturer. Different manufacturers have different pressure and temperature conditions based on their proprietary technology.

Proprietary design: A major challenge in the selection of glass-lined equipment is the proprietary design as there is limited flexibility to make alterations. The capacity and dimensions of the glass-lined equipment are standardised by each manufacturer. The designer must select the capacity based on the available model and there is limited scope for any adjustments based on the process requirement and/or layout fitment etc.

Limitations of nozzles: Another major challenge is that the size and quantity of nozzles is pre-defined. To accommodate the number of nozzles needed in glass-lined equipment as per the process requirement can be nearly impossible if the process and utility connections are more than the predefined quantity. However, there are other options for accommodating multiple small nozzles in one big nozzle or using the manifolds (tee, cross, header) in a single nozzle to accommodate multiple nozzles. Also, small size nozzles (25NB, 40NB) are not possible due to limitations in the glass-lining process. It is critical to finalise the capacity, dimension and nozzles at the early stage of engineering based on the manufacturer's data to avoid any confusion or difficulties at a later stage of engineering.

Fragility: Glass lining is more susceptible to damage from mechanical impacts and thermal stress. This may lead to potential cracks and chips so process reactions play a major role in determining the selection of glass-lined equipment.

- **Challenges in erection and commissioning**

Receipt at site in good condition: Don't assume that equipment arrives at site in perfect condition. Upon arrival, a full inspection of the interior and exterior of the equipment should be performed to confirm its condition as per the Original Equipment Manufacturer (OEM) recommendation. Any rectification required should be done by the OEM or trained person under supervision of the OEM.

Handling of the equipment at site: The most important point is to prevent the damage of equipment during handling. Lifting should be done with two cranes and each crane needs to be capable of lifting complete equipment. Chains are acceptable for straight lifting but must never be allowed to contact steel surfaces, which are glass-lined on the opposite side. The uneven pressure of the links can cause localised stress leading to glass fracturing on the inside of the vessel. Handling of the equipment is to be done based on the recommendation of the OEM.

Preventing mechanical damage: During operation or maintenance of the vessel, don't use any glass or metallic instruments. This may cause damage to the glass-lined surface. Always use plastic or polytetrafluoroethylene-lined tools to ensure the safety of the glass lining. Also always wear clean, rubber-soled shoes when entering a vessel.

- **Challenges in operation**

Design limitations: Equipment shall be operated within the design condition recommended by the OEM. The operator must be aware of the design limitations of the equipment. Thermal shock to the glass lining can occur when the recommended safe temperature differential is exceeded. This can cause an immediate loss of the integrity of the internal glass lining. The OEM recommendation should be followed to avoid this.

Charging of materials: Don't charge material through nozzles without filtering the content. Filtering is extremely important to make sure that there are no foreign materials or large particles present that could cause damage to the glass. It is essential to monitor and approve all products prior to adding them into the vessel.

Agitator: Before starting the agitator, ensure that the right volume of product is inside the vessel. This will prevent the premature seal failure and even glass damage on the agitator itself.

External loads on nozzles: Ensure required flexibility is provided (Hose/Bellow) at the nozzle of the glass-lined equipment while providing piping connection to prevent the equipment from suffering from piping network shock and stress load.

Ingress of foreign material during storage and transportation: Lastly, all openings need to be properly closed and tightened before the vessel is operational. Don't allow spilled chemicals to remain on the vessel exterior. Immediately flush and neutralise spills. ■

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In Pursuit of a Data-driven Energy Transition

Digital technologies will undoubtedly become indispensable building blocks in the global energy transition, paving the way for advances in automation and efficiency. The time is now for a data-driven energy transition, opines **Lars Buus, Country Director, India, Bangladesh and Sri-Lanka, Energy Systems at DNV.**

By the time we reach mid-century, Artificial Intelligence (AI) will support a global USD 1.3 trillion decrease in clean energy costs through enhanced demand management[1]. It will also help reduce grid management costs by USD188 billion and reduce overall power system costs by between 6-13 per cent through intelligent flexibility in the management of devices and grids. AI will achieve this by harnessing the power of rapid and ongoing developments in digitalization, a powerful collaboration which will support the transformation of the energy industry towards a greener future. The benefits of this diarchy of superpowers are already being embraced by forward looking organizations across the industry, with digital technologies not only optimizing energy generation, but transmission, distribution and consumption.

Digitalization

This is not a scenario of the future, but a factor of the present and it would seem clear that adopting these technologies and building them into day-to-day operations should be a no contest, win-win situation. But there is more to the successful implementation of digitalization than simply having it available at our fingertips; features such as a culture of innovation, strategic vision and strong, supportive leadership within an organization all have a crucial role to play. In an energy sector wrestling with the issues of decarbonizing to meet strict government targets, there is wide understanding that a timely and effective energy transition will be impossible without automation, data-driven decision making and digital innovations.

DNV recently conducted a survey of almost 1,300 senior energy industry professionals for its 'Leading a data-driven transition' Energy Industry Insights report, which concluded that just over a quarter (28 per cent) saw their organization as a leader in digitalization and data-driven strategies.

Interestingly, this forward-thinking approach is not just limited to digitalization. The surveyed professionals who viewed their organization as progressive in this area also had the most optimistic outlooks on achieving net zero targets, in addition to profit and revenue goals, compared to their peers who felt that their organization was lagging in the move to digitized operations.

Challenges

However, there are concerns that stand in the way of a greater embracement of digitalization. While the value of applying data-driven technologies might be accepted, and forward-thinking organizations are keen to capitalize on the potential, they are often hampered by the problems relating to the integration of systems and databases. Many companies typically have legacy systems still in place, where data is locked within applications, and considerable resources are now required to identify ways to smoothly transfer information.

The true potential of accelerating a digital approach can also come up against the barrier of digital overload, where data is disorganized and sometimes untapped because organizations are unaware of all the data they have at hand and the potential it offers. Reaping the benefits of digitalization, supported by AI, is about much more than the availability and accessibly of these technologies. One of the biggest stumbling blocks, and therefore greatest challenge, regarding organizations across the energy industry moving towards digitization hinges, to a huge extent, on the human factor and the willingness to accept and run with change.

Many energy companies control potentially hazardous systems and substances, meaning they have a responsibility for safeguarding critical products and services, which could create an environment where they feel unable, or unwilling, to take what they see as a risk in scenarios where failure is unthinkable. Following on from resistance to change, cybersecurity risks, data quality and management, cost, lack of digital skills within an organization, lack of investment, lack of data sharing within the energy industry, a lack of industry standards and compatibility issues with partners and customers are all highlighted as potential roadblocks.

Against all these qualms about the adoption of digitalization and AI is the harsh reality that a timely and effective energy transition will not be possible without them. Against that backdrop, prioritizing digitalization is on par with advancing decarbonization itself. The world is reworking its energy story and around the globe there is a scaling of low-carbon energy systems taking place. It is a movement that is not, and will not, stand still. Digitization is increasingly not just a key enabler, but a prerequisite to ensure swift and effective progress. Without digitization, it would be next to impossible to monitor and manage the exponential growth in systems and equipment required to fuel our energy future.

Oil & Gas Sector

In the oil and gas sector, digitalization can improve efficiency and help companies reduce their carbon footprint and lower environmental risks. It also has a crucial role to play in the adoption and integration of new fuels and gases. Hydrogen, a much-lauded fuel of the future, has its downsides, posing greater risks than natural gas – it is more flammable, harder to contain and can damage or weaken metals in pipes, valves and other equipment, all of which require the enhanced monitoring and analytics delivered by digitalization. Organizations which are adopting digital technologies and data are already well ahead in their commitment to the energy transition and the decarbonization of their respective sectors. It means, of course, those lagging behind in embracing this way of the future are finding that the quality data available to them to decarbonize their operations is woefully inadequate.

In reporting where they are getting the most impact and deriving maximum benefit from digitalization, leaders in the field have identified their top three areas – optimizing processes, integrating systems and databases, and automating operations. A large percentage of organizations also see major benefit from other digital innovations ranging from predictive maintenance to supply chain management.

Artificial Intelligence

But digital transformation is not progressing in isolation. Increasingly, the advent of Artificial Intelligence (AI) and AI-driven applications will be an integral part of future progress for forward thinking organizations. Sometimes seen as the new kid on the block, AI isn't in fact new – but it has a vast wealth of potential which remains untapped. Inevitably, unresolved questions remain about the safe and responsible use of AI, and how it will interact with and impact other parts of the system, with performance, property – and, of course, people, is still yet to be fully revealed.

As a reassurance to the doubters, while digital technologies and AI will become essential support tools which drive the energy transition, it will be some time before they are used to automate decision-making for critical energy infrastructure. However, transformation of any kind demands that organizations think and act differently, and change is inevitable if we are to reach net zero through a successful energy transition, meaning that an unwillingness to adopt digital transformation is now no longer an option. ■

[1]*https://www.dnv.com/power-renewables/energy-industry-insights/leading-a-data-driven-transition/.*

Author

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Designing a Pump in Multiple Liquid Service

Pumps are a vital part of process operations in the Chemical Process Industry, since without pumps no transfer of liquid could be possible. Thus, pumps are often called 'Heart of the Chemical Process Industry'. Hence, it is obvious that sizing and selection of the pump is to be done in an optimized way. **Nikhil Kadam, Deputy General Manager, Essar Energy Transition (EET) Fuels,** throws more light on the various parameters for pump selection.

Different cases need to be considered for pump designing such as start-up operation, winter and summer operation, regeneration or any miscellaneous operating condition. This ensures that the pump is designed appropriately, and it can operate effectively at any operating condition mentioned above. Apparently, appropriate sizing of the pump would always give returns in energy and cost saving.

In most of the cases, pump operates only to a dedicated service. However, there may be some cases where the pump would have to handle multiple liquids considering different operating scenarios. Designing a pump which operates to a dedicated liquid is comparatively simple task. As we all know, the differential head and hydraulic power of the pump are function of the density of the liquid, whereas Net Positive Suction Head Available (NPSHA) is function of vapor pressure of the liquid at operating temperature. Thus, hydraulic calculation for the pumps in single liquid service becomes very easy as these variables remain unchanged. For such pumps, mentioning differential head, Hydraulic power and NPSHA value in datasheet is not a challenge. Apparently, vendors would select the pump model based on these specifications.

As said earlier, there may be different operating scenarios where pump would have to operate for different liquid services on need basis. In such cases, sizing a pump sometimes is tricky and designers need to be very careful in understanding different scenarios. In such instance, hydraulic calculation is carried out for all operating scenarios and the values to be mentioned in datasheet such as differential head, hydraulic power and NPSHA are selected in a way pump can operate in every possible operating scenario.

For better understanding, the example illustrated below would elaborate the procedure to design a pump when it operates with multiple services.

Example: As shown in Figure 1, drain drum D-430 is provided to collect drain from different tankages. There are Benzene, Methanol, MEG, P-xylene, O-xylene, DEG and Gas Condensate tanks. Drain from these tanks is routed to a Drain drum which is provided with a submerged drain pump P-430A/B to transfer liquid

Liquid	Density	Viscosity	Vapor Pressure
	Kg/m³	cP	bar(a)
Benzene	848.1	0.45	0.328
Methanol	718	0.4	0.44
MEG	1094	7.72	0.001
P-Xylene	838.9	0.47	0.037
O-Xylene	858.3	0.58	0.032
DEG	1098	13.09	0.000
Gas Condensate	696.4	0.48	0.899

Table 1: Physical properties of liquids.

D-430	
Operating temperature	47°C
Operating pressure	Atmospheric
Low level	200 mm

Table 2: Operating conditions of drain drum D-430.

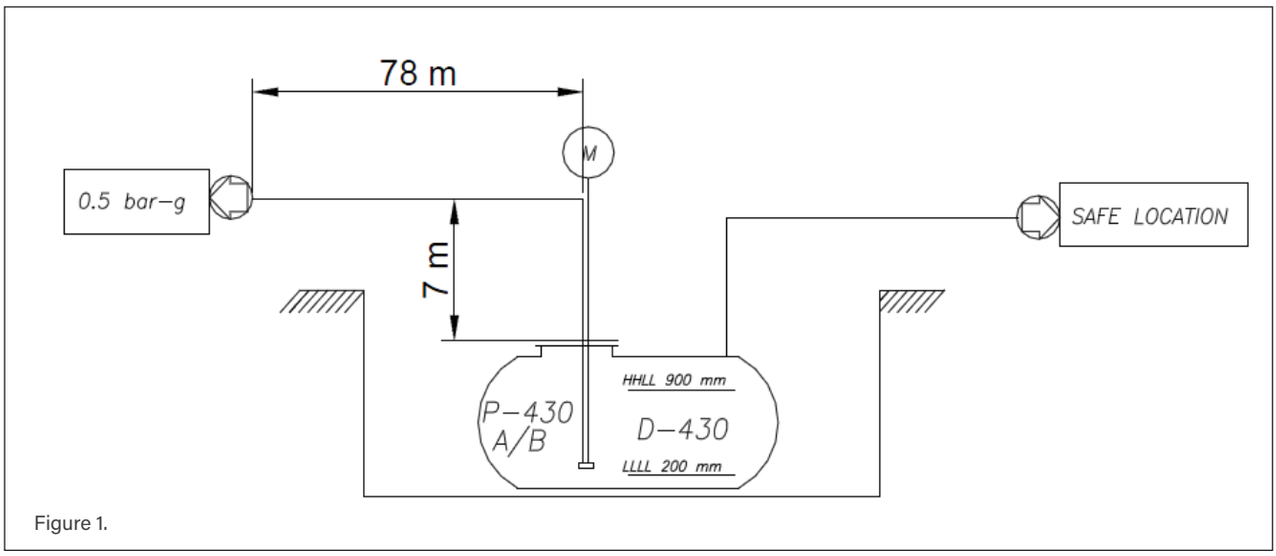

Figure 1.

from D-430. Draining from these tanks is not done simultaneously, thus there is only one tank draining at a time. Table 1 shows the physical properties for these liquids.

Now, for P-430A/B design, hydraulic calculations for every liquid mentioned above are done. As an example, hydraulic calculations for methanol are shown in Table 3.

We all know that pumps work on the principle of differential head (m). Hence, specifying differential head in pump datasheet is crucial when pump handles multiple services.

Suction		
Pump capacity		10 m³/hr
Operating pressure, D-430		1.013 bar(a)
Static head, D-430	200 mm	0.014 bar(a)
Line loss		0 bar(a)
Pump suction pressure		1.027 bar(a)
Net Positive Suction Head		8.34 m
Discharge		
Delivery pressure, B.L		1.5 bar(a)
Static head	7 m	0.492 bar
Line loss		0.511 bar
Other losses		1.5 bar
Discharge pressure		4.003 bar(a)
Total differential pressure		2.976 bar
Differential head		41.45 m
Power		
Hydraulic Power		0.81 KW
BHP	75% efficiency	1.08 KW

Table 3: Hydraulic calculations for methanol.

From Table 4, we could see that differential head in case of gas condensate service is 41.97 m which is highest compared to other liquid services. However, to specify differential head as 41.97 m in pump datasheet, the actual pressure calculated at the pump discharge for other services need be calculated. In no case the calculated discharge pressure should be lower than discharge pressure mentioned in Table 4. An example for one of the services (Benzene) is given below:

Suction pressure in Benzene service = 1.030 bar (a) ... From Table 4

Differential head of the pump = 41.97 m

Density of the Benzene = 848.1 kg/m³ ... From Table 1

Specific gravity of Benzene = 0.8481

Differential pressure = 41.97 * 0.8481 / 10 = 3.48 bar

Discharge pressure of the pump = 1.030 + 3.48 = 4.51 bar (a)

As we can see from Table 5, discharge pressure calculated in Methanol case is lower than required discharge pressure. Hence, differential pressure of 41.97 m cannot be specified for the pump.

To ensure calculated discharge, pressure in all services is above required discharge pressure, it is recommended to specify differential head with highest differential pressure converted to differential head in meter of liquid using lowest density of the liquid.

Referring to Table 4, differential pressure in DEG service is highest compared to other liquids. As specified above, to convert this differential pressure into a meter of liquid, lowest density is to be used

Service	Suction pressure	NPSHA	Discharge Pressure	Differential Pressure	Differential Head	Hydraulic Power
	bar(a)	m	bar(a)	bar	m	KW
Benzene	1.030	8.446	4.277	3.247	38.29	0.88
Methanol	1.027	8.34	4.003	2.976	41.45	0.81
MEG	1.034	9.465	4.881	3.847	35.16	1.05
P-Xylene	1.029	12.079	4.257	3.228	38.48	0.88
O-Xylene	1.030	11.87	4.3	3.27	38.10	0.89
DEG	1.035	9.616	4.89	3.855	35.11	1.05
Gas Condensate	1.027	1.87	3.95	2.923	41.97	0.8

Table 4: Summary of results of hydraulic calculation for other liquids.

which gives the highest differential head in meter of liquid. Differential head in this case is calculated as 55.35 m, illustrated as below:

Service	Discharge Pressure as per Table.4 (A)	Discharge Pressure calculated (B)	Is (B) > (A)
	bar(a)	bar(a)	
Benzene	4.277	4.51	Yes
Methanol	4.003	3.97	No
MEG	4.881	5.52	Yes
P-Xylene	4.257	4.47	Yes
O-Xylene	4.3	4.55	Yes
DEG	4.89	5.54	Yes
Gas Condensate	3.95	3.95	Yes

Table 5: Calculated discharge pressure for other services including Benzene.

Service	Discharge Pressure as per Table 4 (A)	Discharge Pressure calculated (B)	Is (B) > (A)
	bar(a)	bar(a)	
Benzene	4.277	5.72	Yes
Methanol	4.003	5.00	Yes
MEG	4.881	7.08	Yes
P-Xylene	4.257	5.67	Yes
O-Xylene	4.3	5.78	Yes
DEG	4.89	7.11	Yes
Gas Condensate	3.95	4.88	Yes

Table 6: Calculated discharge pressure for other services including DEG

Highest differential pressure =3.855 bar -------- From Table 4

Lowest density = 696.4 kg/m³ ---------- From Table 1

Specific gravity = 0.6964

Differential head = 3.855 * 10 / 0.6964 = 55.35 m

Based on the above, differential head in pump datasheet to be specified as 55.35 m. This ensures that the pump will deliver efficiently in all services mentioned above. With this, when pump is operated in DEG service, pressure at the pump discharge will be calculated as follow:

Suction pressure in DEG service = 1.035 bar (a) ---------- From Table 4

Differential head of the pump = 55.35 m

Density of the DEG = 1098 kg/m³ ------- From Table 1

Specific gravity of DEG = 1.098

Differential pressure = 55.35 * 1.098 / 10 = 6.07 bar

Discharge pressure of the pump = 1.035 + 6.07 = 7.11 bar (a)

Also, the pump is operating in gas condensate service, Net Positive Suction Head available (NPSHA) is 1.87 m which is lowest compared to NPSHA for other liquids. Thus, it is the designer's duty to give specifications in a datasheet which would cover pump operation for every liquid mentioned above.

Pump Specification

Giving specifications for the pumps operating with multiple liquids is not conventional. Users need to be very careful while reporting parameters in the datasheet since based on these specifications vendor would select the pump model. For the above example,

Parameter	Value	Remark
Suction pressure	1.035 bar (a)	Since differential pressure is highest in DEG service
Discharge pressure	4.89 bar (a)	Since differential pressure is highest in DEG service
Differential pressure	3.855 bar	
Differential head	55.35 m	Differential head calculated using lowest density
NPSHA	1.87 m	Lowest NPSHA (for Gas Condensate Service)
Density	Min - 696.4 kg/m³ and Max – 1098 kg/m3	Range of the densities to be specified
Hydraulic power	1.66 KW	Power calculated for highest density

Table 7: Parameters to be reported in datasheet.

Parameter	Guideline
Suction Pressure	Suction pressure to be specified which gives maximum differential pressure
Discharge Pressure	Discharge pressure to be specified which gives maximum differential pressure
Differential head	Differential pressure converted to Head with minimum density
NPSHA	Lowest value
Hydraulic power	Value calculated corresponds to differential head with maximum density
Density	Range of the densities (minimum and maximum) to be specified

Table 8: Guidelines to report pump specification in datasheet.

the parameters to be reported in the datasheet are as follow:

Explanation: Table 8 shows a few guidelines to report pump specification in the datasheet if pump is handling multiple liquids. Also, user can take some margins on these values to be on conservative side.

Conclusion

If we follow these minimum guidelines while reporting pump specification, it facilitates the vendor to select appropriate pump model. Also, it assures that the pump would be able to operate efficiently in every possible liquid service for which it is intended to. ■

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EPC: Challenges Faced by the Industry

Engineering, Procurement and Construction (EPC) companies are basic infrastructure companies providing industrial growth, increasing consumption pattern, exports and overall economic development. EPC industry needs skilled workforce, engineers, commercial and legal experts. Required international engineering practices and standards must be followed at every stage to create an output which is globally accepted. This article helps in evaluating the challenges faced by the EPC companies during the global shift. In addition to these, it also describes the current scenario of transformation of EPC sector for accepting sustainability and technical advancement.

For sustainable infrastructure development, any country needs Engineering, Procurement and Construction (EPC) sector of its own; especially for energy, petrochemical, chemical, civil infrastructure, agriculture, telecom, railway and defence etc. sector developments. EPC sector needs Government support in terms of funding, soft loans and timely subsidies to sustain irregular cash flow cycles as biggest consumer of EPC output is either State or Central Government. For developing countries like India, it is highly essential to have required inputs globally available to reduce our dependence.

During last 10-15 years, EPC sector is providing required push to India's growth towards world's third largest economy. EPC industry is helping countries' Micro, Small & Medium Enterprises (MSME) sector to a great extent in providing opportunities to existing and new entrepreneurs by shaping their future. Simulation software and use of AI are also helping EPC sector in getting required results with lesser input cost involvement.

About EPC industry

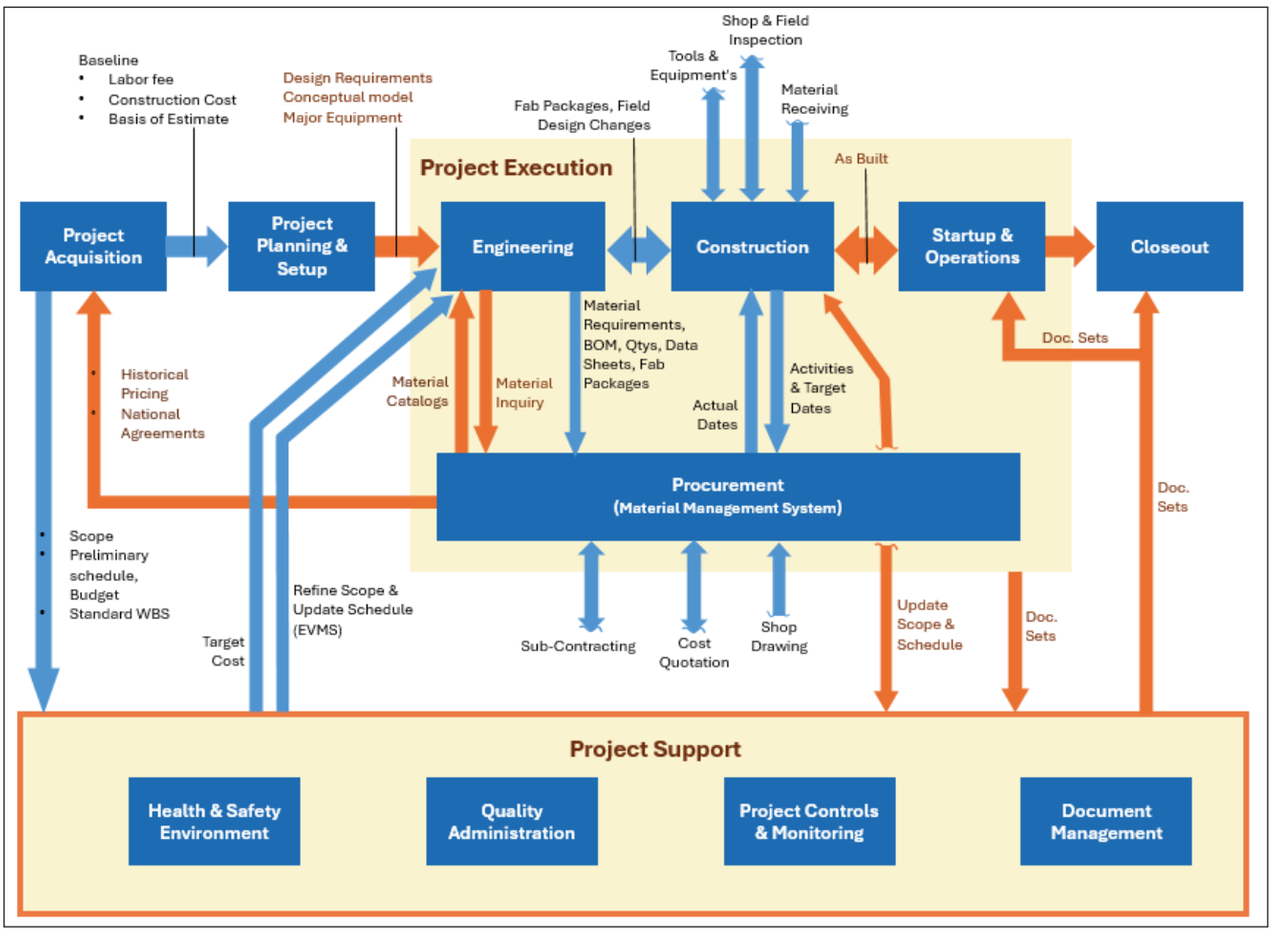
There are three core pillars of the overall EPC model such as Engineering, Procurement, and Construction. This means that in a single package the EPC model helps the companies execute projects from conceptualization to outcome. A project is operated by a main contractor who is responsible for the entire life cycle of the project. The approach of the EPC industry is used in different large-scale infrastructure projects.

Challenges faced by industry

Despite different opportunities due to dynamic global priorities, currently EPC industry is facing challenges due to technological disruption, regulatory pressure, economic fluctuation, global political scenario, skilled manpower, labour law reform and environmental clearance across the globe.

Cost overruns: The cost management and the delay in the project delivery is one of the serious issues that EPC projects are currently facing. In the case of large-scale and multi-disciplinary projects, the fluctuation of the raw material price, shortage in labour, political interference, and statutory approvals are the major reasons for cost overrun. However, the complexity present in the project, and supply chain disruption are increasing the delivery time.

Environmental compliance and regulatory pressure: Maintenance of environment regulation especially for carbon emission waste management and energy efficiency is one of the major criteria for EPC companies.



The other number of regulatory comprehensives is adding complexity and increasing the cost of the overall project. Due to this reason, the EPC companies should invest in modern technologies and materials that fulfil the sustainability target of the government. Overall, this regulatory and environmental comprehensive of the government is increasing the capital expenditure.

Skill gap: It is identified that there is a shortage of skilled engineers, project managers and even labourers who have their expertise for large-scale complicated projects. This talent shortage and the skill gap are directly impacting the EPC industry. Due to the rapid development of digital tools, EPC professionals are facing challenges in handling advanced technology during project completion.

Global Scenario: Covid, Ukraine-Russia War and recent Israel-Iran conflict are few examples of highly volatile scenario which is directly affecting logistics, input costs as the demand supply gap is increasing temporarily time to time. This is one of the reasons that predicting cost overrun for long delivery projects are a herculean task.

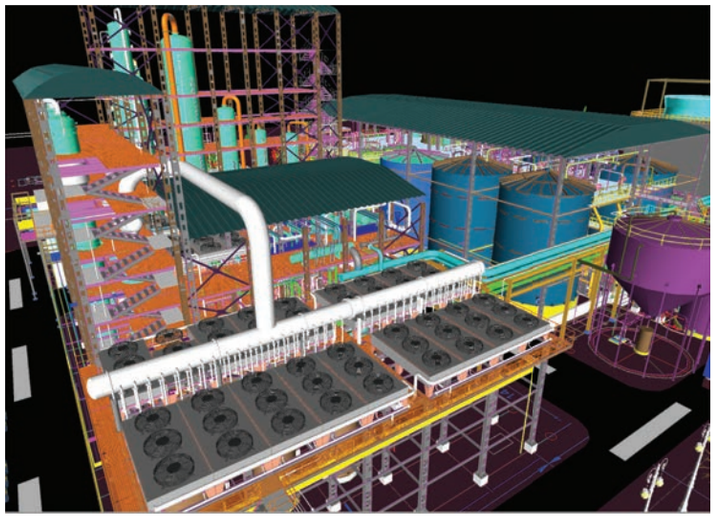
As far as India is concerned, we need labour law reform immediately to rationalise manpower cost vis-à-vis output. In addition to that, absence of indigenous internationally acclaimed rating/approval agencies for inspection and manufacturing standard is also a problem for getting best fit solution for Indian EPC sector.

Last but not the least, unsolicited interference from non-government entities by using legal procedures after award of project to delay the progress of project results in undesirable cost overrun.

Current situation of transformation of EPC industry

The evolving demands for infra development are the main reason for the incorporation of technical advancement and sustainable resources in the EPC industry.

The EPC companies can save time, minimize the overall budget, and improve the quality of the project by pre-fabricating the modules off-site. This is an extremely beneficial method for large-scale industrial



projects. Especially for the chemical/petrochemical project, consistent replicable units are required to maintain the quality. This process of pre-fabricating modules off-site benefits the project by maintaining the consistency of the quality.

Along with these, the current EPC industry is transforming itself from importer to self-reliant of Make in India initiative. 3D modelling is a revolution for the EPC project which helps in better visualization and collaboration by minimizing the errors and rework.

In addition to that artificial intelligence is used for predictive maintenance and automation and robotics are important for improving precision and reducing human error. The Internet of Things devices are important for using for monitoring equipment performance and tracking resources and materials as well. Along with the digital transformation, there is a global push for sustainability which helps in adopting green technology and eco-friendly materials for the EPC sectors. Companies use low emission construction machines and the sustainable building materials, and it is reducing the environmental footprint. The carbon capture and storage system, the energy-efficient design and the waste recycling method are transforming the overall landscape of the EPC project in an environmentally friendly way and improving circular economy.

Growth and potential of the Indian EPC market

The EPC market of India is currently witnessing huge growth potential, thanks to the large-scale infrastructure and energy projects. The increasing demand for energy, in all over the country and the supportive initiatives of the government are facilitating factors for the expansion of the Indian power EPC market in the forecast period between 2023 and 2029. The EPC market size of India was USD13.8 billion in 2022. During the forecast, from 2023 to 2029 the size of the Indian EPC market is projected to grow approximately 21 per cent which is reaching a value of 42 to 46 billion by 2029.

However, the major factors that are driving the growth of the Indian EPC market are the growing industrial operation and the government initiatives. On the other hand, government policies like Make in India, Biofuel policy, Production-Linked Incentive (PLI) Scheme for active pharmaceutical ingredients and key Starting materials, minerals mining and investment in clean energy are also opening new avenues for EPC companies. The increase in the demand for large-scale EPC services, the modernized facilities production capacity and adaptation of sustainable practices are facilitating the growth of the EPC industry.

Conclusion

Overall, it can be concluded that the EPC industry is a crucial part of the Indian economy. Despite facing challenges like regulatory comprehensive cost management and rapid transformation digital advancement and modular construction and green technology are increasing the opportunity for facilitating the growth of the EPC market in India. Particularly the focus of the government on renewable energy and interest structure are the major driving force of the Indian EPC market in the current situation. Recently built Chenab Railway bridge, Underwater Metro in Kolkata, Atal Setu in Mumbai and Atal Tunnel in HP are few examples, which are self-explanatory regarding EPC sector capabilities and reliance on Indian EPC companies. ■

Author

Himanshu Gupta
Senior General Manager in an EPC Company based in Pune

Chemtech World Expo 2026

Date: 3-6 February 2026
Venue: Bombay Exhibition Centre, Goregaon (E), Mumbai

Details: World meet of the chemicals, petrochemicals, biopharma and process industry in India

Organiser: Jasubhai Media Pvt Ltd
Contact: 022-4037 3636
Email: sales@jasubhai.com
Website: www.chemtech-online.com

Oil Gas & Power World Expo 2025

Date: 5-7 March 2025
Venue: Bombay Exhibition Centre, Goregaon (E), Mumbai

Details: The 13th edition of 'International Integrated Energy Show' will bring together the stakeholders of energy ecosystem from the up-mid and downstream of hydrocarbon industry, alternate and new energies, power generation, transmission and distribution and allied sectors.

Organiser: Jasubhai Media Pvt Ltd
Contact: 022-4037 3636
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Website: www.chemtech-online.com

27th Energy Technology Meet

Date: 12-14 November 2024
Venue: The Leela Bhartiya City, Bengaluru

Details: Industry meet for the refining industry.

Organiser: Centre for High Technology
Contact: 9892067088
Email: kulkarni@cht.gov.in
Website: https://www.cht.gov.in

4th Dahej Industrial Expo

Date: 20-22 November 2024
Venue: Dahej GIDC Gujarat

Details: An exhibition showcasing the latest industry trends and technology, newest and most innovative products and services.

Organiser: Ads Pages Pvt Ltd
Contact: 9825042135, 9313516025
Email: info@industrialexpo.co.in;
Website: www.industrialexpo.info

ICC Sustainability Conclave 2024

Date: 5-6 December 2024
Venue: The Lalit Hotel, New Delhi

Details: The two-day event will host senior representatives from Indian and Global companies.

Organiser: Indian Chemical Council
Contact: +91-22-61144000
Email: pallavithakur@iccmail.in
Website: https://iccsustainabilityconclave.org/

Water & Waste Expo 2025

Date: 20-22 February 2025
Venue: Pragati Maidan, New Delhi

Details: Leading fair for water, sewage, waste and recycling

Organiser: CII
Contact: 011-45771000
Email: info@cii.in
Website: www.cii.in

Automation Expo South

Date: 20-22 March 2025
Venue: Chennai Trade Centre, Hall 2 & 3

Details: 2nd Edition of South Asia's Automation Expo

Organiser: IED Communications Ltd
Contact: 022 - 2207 9567
Email: sales@industrialautomationindia.in
Website: www.industrialautomationindia.in

TURKCHEM EURASIA 2024

Date: 27-29 November 2024
Venue: Istanbul Expo Center

Details: 10th International Fine, Specialty Chemicals, Commodity Chemicals, Petrochemicals, Laboratory, Test-Measurement Equipment, Process and Automation Industry, Packaging, Recycling and Environmental Technologies Exhibition.

Organiser: Artkim Fuarcılık Tic. A.Ş.
Email: sales@artkim.com.tr
Website: www.turkchem.com.tr/2024/

Strainers

Meson Valves India Limited brings in Strainers – Y-Type, Basket, Simplex and Duplex. The features include NAB, Gunmetal, AISI 316 equivalent body strainer with AISI 316 basket, raise face flanged. It is suitable for filtering of water, oil, process liquids in general. It is available in different material, mesh sizes and end connections. ■

FIG

Bonnie Tech Model FIG Rotary Gear Pump is fuel injection internal gear pump, self priming and has capacity to create vacuum pump up to 600/650mm hg. The Model FIG comes with optimum quality CI castings following EN 19 standards. Also, it consists of needle bearing and self lubricating bushes and is available in ¾', 3/4' size and 1 BSP. It is useful for Boiler, Oil burner, Hydraulic drives, Maximum Temperature at 200°C, Pressure and transfer pump, Minimum viscosity at 2.5 CST and Maximum viscosity at 450 CST. The salient features include continuous duty pump, zero leakage mechanical seal, flange and foot mounting option, higher suction lift with built relief valve and external by-pass arrangement. ■

Piston Valve

The Type 6440 from Bürkert is a servo-assisted 2/2-way piston valve. The stopper and the core guide tube are welded together to increase pressure resistance and leak-tightness. The coils are moulded with highly chemically resistant epoxy. Sliding rings increase the service life for dry gases. Cartridge and flange connections, and solenoids with automotive plugs (IP6K9K), are available for optimised use in fuel cells. The features comprise safety shut-off valve in fuel cell systems and other hydrogen applications, available for up to orifice 12 mm and pressure range 40 bar, available as flange or cartridge variant for quick system integration and degree of protection IP65 or IP6K9K with automotive plug. ■

FRP Storage Tanks

Fibre-reinforced plastic (FRP) storage tank is specially designed to store wide range of chemical and liquids in industrial applications. BS Projects brings in FRP Storage tanks for chemical storage, oil storage, water storage, liquid storage and many other applications. The company manufactures horizontal and vertical FRP tank as per customer requirements. FRP tanks are mostly used in various industries because of their durability, corrosion resistance and versatility. The storage capacity is upto 250 KL (in – house), 250 – 500 KL (at site). ■

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ChemTECH WORLD EXPO 2026

SPECIALTY ChemiCAL WORLD EXPO 2026

Bio Pharma World Expo 2026

32nd International Exhibition and Conferences

3-6 February 2026

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

Concurrent Events

EPC 2026 | Specialty ChemiCAL | Refining & Petro Chemicals 2026 | Bio Pharma | Industry Automation & Control 2026 | PVF | WaterEX WORLD EXPO 2026 | Surface Engineering Coating & Corrosion WORLD EXPO 2026 | Chlor-Alkali World Expo & Conferences 2026

Scope for ChemTECH World Expo 2026

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

Scope for Specialty Chemicals World Expo 2026

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

Scope for Biopharma World Expo 2026

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

FACT & FIGURES 2024

- **750** EXHIBITORS FROM 15+ COUNTRIES
- **25871** VISITORS FROM 53 COUNTRIES
- **8** TECHNICAL CONFERENCES
- **250+** GLOBAL SPEAKERS
- **1500+** BUSINESS DELEGATES
- **2500+** ENGINEERING PHARMA & SCIENCE STUDENTS AT STUDENT OUTREACH PROGRAM FROM 28 STATES & UNION TERRITORIES
- SCALE@CHEMTECH World Expo 2024: 60+ GLOBAL CLIMATE TECH STARTUPS FROM 20 COUNTRIES; 40 TECHNICAL PRESENTATIONS
- BRICS WORKING GROUP BRAIN STORMING SESSION

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