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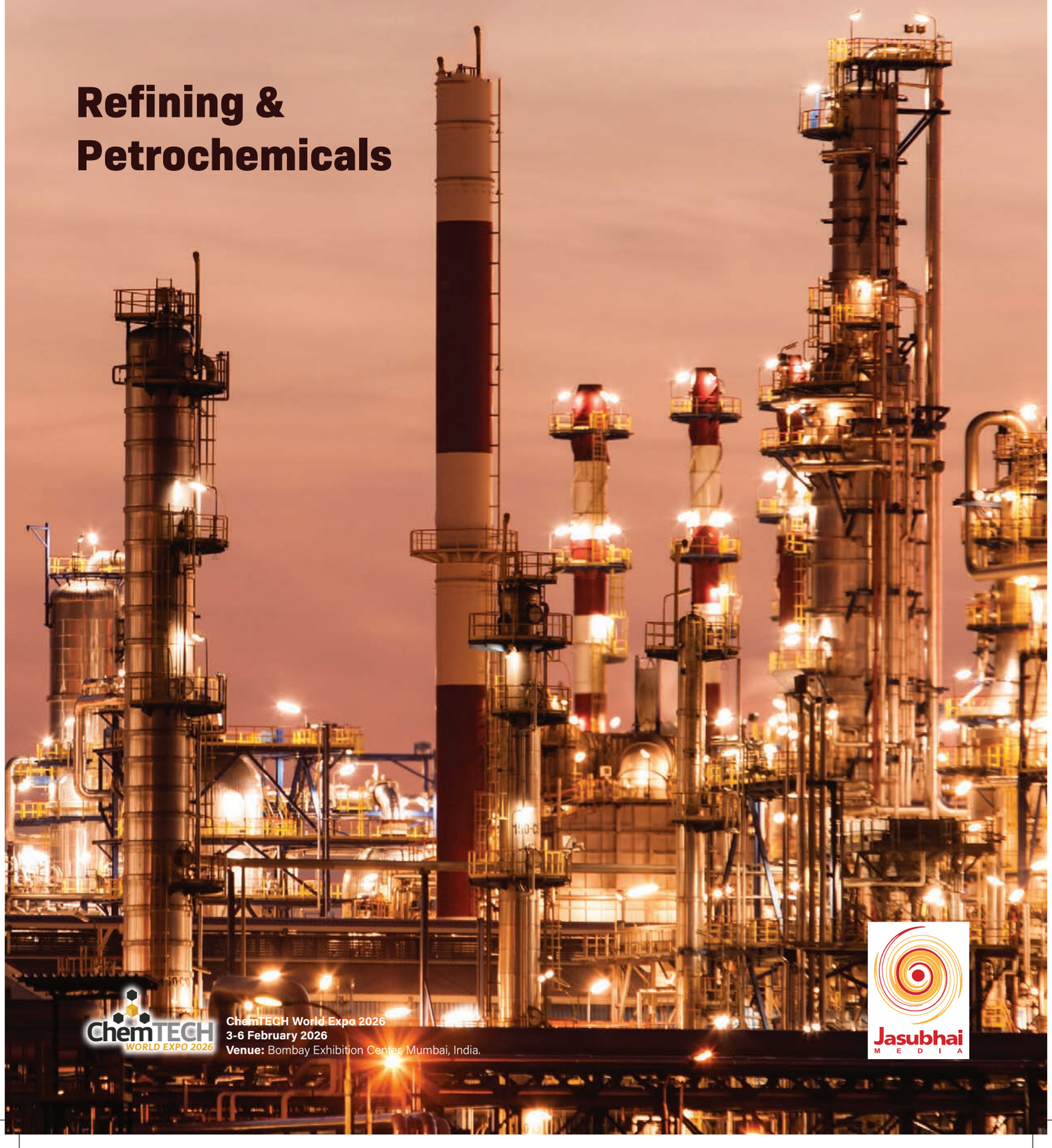

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BASF Catalysts India inaugurates new RD&A lab for automotive emissions control solutions

Chennai, India: BASF Catalysts India Private Limited (BCIL), a subsidiary of BASF Environmental Catalyst and Metal Solutions (ECMS), has inaugurated a new Research, Development, and Application (RD&A) lab at its site in Mahindra World City, Tamil Nadu, Chennai. The strategic investment is focused on the development of emissions control catalysts that are tailored to the unique needs of the Indian automotive market.

Dirk Bremm, President and CEO of ECMS (front right) and Saeed Alerasool, Senior Vice President of RD&A for ECMS (front left) inaugurated the opening of the new RD&A lab in Chennai, India.

"This new RD&A lab will enable the development of market-specific catalyst formulations that meet the unique needs of the Indian market with agility and flexibility," said Saeed Alerasool, Senior Vice President of RD&A for ECMS. "With this investment, ECMS is well positioned to help our customers respond to changes resulting from fuel diversification as well as stricter tailpipe emissions requirements, and ensures our readiness to support future automotive technologies."

The opening of the new lab is a pivotal step aligned with India's evolving automobile industry and the Indian government's focus on diversifying fuel sources, including further adoption of Compressed Natural Gas (CNG) and renewable biofuels and hydrogen. This requires that local Original Equipment Manufacturers launch flex-fuel vehicles capable of running on any biofuel-gasoline mix.

Additionally, the upcoming stricter emissions requirements pose new challenges for automakers in India.

"With this new lab within our Chennai site, BCIL is able to provide end-to-end support to our customers, from initial catalyst development to final product delivery," said Sujan Saha, Business Head India and Head of South East Asia, Mobile Emissions Catalysts. "This also enhances our local ability to cater to the specific needs of Indian customers and address their needs more quickly," he added.

Coromandel International elevates S. Sankarasubramanian as MD & CEO

The Board of Directors of Coromandel International Ltd (CIL) have appointed S. Sankarasubramanian, Executive Director – Nutrient Business, as Managing Director and Chief Executive Officer (CEO) of Coromandel International Limited, with effect from 7 August 2024. Sankarasubramanian brings a wealth of experience and has a proven track record as a Chief Financial Officer and a Business Head. He is a mathematics graduate from University of Madras, and a member of the Institute of Cost and Management Accountants of India, and has completed Advanced Management Program (AMP) at Harvard Business School in 2009. His association with the Murugappa Group goes back to the year 1993. He also serves on the boards of Fertiliser Association of India, Tunisian Indian Fertiliser S.A., Tunisia, and Foskor (Pty) Ltd., South Africa, along with some of the company's subsidiaries.

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Grasim's Chemicals Business achieves revenue of ₹ 2,066 Cr in Q1 FY25

Mumbai, India: Grasim Industries Limited announced its financial results for the quarter ended 30 June 2024. The Chemicals business achieved revenue of ₹2,066 crore, down 4 per cent YoY and 1 per cent QoQ. Speciality Chemicals (epoxy polymers and curing agents) revenue mix improved to 30 per cent for the quarter from 25 per cent in Q1FY24. EBITDA for the Chemicals segment stood at ₹310 crore up by 59 per cent QoQ but declined 13 per cent YoY. Profitability improved sequentially on the back of higher caustic soda realisations and improved margins of chlorine derivatives.

The International Caustic Soda (CFR-SEA) average spot prices stood at USD 469/ton in Q1FY25, improving by 13 per cent and 4 per cent YoY and QoQ, respectively. The continued upward trend in global prices led to a marginal QoQ improvement in domestic caustic soda prices due to overcapacity conditions in the domestic markets. ECU realisations improved by 7 per cent QoQ but declined by 4 per cent YoY.

Shree Pushkar Chemicals and Fertilisers Limited's revenue rises to ₹ 194.2 crore in Q1 FY25

Mumbai, India: Shree Pushkar Chemicals & Fertilisers Limited, a leading manufacturer of Dyes, Dye Intermediates and Fertilisers, announced its financial results for the quarter ended 30 June 2024. Reflecting on the performance in Q1 FY25, Mr. Punit Makharia, Chairman and Managing Director, said, "Our operational performance was solid, with sales volumes showing strong growth across both Chemicals and Fertilisers. Specifically, Chemicals recorded an 40 per cent quarter-on-quarter increase and a 17.8 per cent year-on-year growth, while Fertilisers experienced a 22.1 per cent quarter-on-quarter and a 23.5 per cent year-on-year rise in sales volumes. This led to a significant overall volume growth of 25.1 per cent quarter-on-quarter and 22.4 per cent year-on-year, underscoring our ability to capitalize on market opportunities effectively."

In terms of financial performance, the company's total revenue increased by 1.8 per cent quarter-on-quarter and 10.7 per cet year-on-year to ₹194.2 crores. The Fertilisers segment was a key driver of this growth, with a 21.9 per cent increase in revenue quarter-on-quarter and a 14 per cent rise year-on-year. The Chemicals segment still managed a 6.9 per cent year-on-year growth, demonstrating resilience amidst challenges.

"As we move forward, our focus remains on leveraging our strengths in both Chemicals and Fertilisers, driving operational efficiencies, and sustaining our growth momentum. We remain committed to delivering long-term value to our shareholders through strategic investments and prudent financial management," said Mr. Makharia.

Chemplast Sanmar Limited records 11 per cent margin during Q1 FY25

Chennai, India: Chemplast Sanmar Limited, a speciality chemicals company with a significant presence in the Custom Manufacturing business, the market leader in Speciality Paste PVC in India, and the 2nd largest producer of Suspension PVC in India (through its wholly-owned subsidiary), announced its unaudited Financial Results for the quarter ended 30 June 2024.

DFPCL appoints Prasad Vasant Joglekar as President-Commercial

Deepak Fertilisers and Petrochemicals Corporation Limited (DFPCL) has appointed Prasad Vasant Joglekar as President – Commercial, with effect from 06 August 2024. Joglekar has expertise in strategic sourcing, supply chain management, logistics, procurement of commodity and specialty chemicals, contract manufacturing, and capital equipment purchasing. Prior to joining DFPCL, he was President – Supply Chain at Jubilant Ingrevia Limited. He has also worked previously at Jindal Films Limited, Avantor Performance Materials Inc., E.I. DuPont India Private Limited, Micro Inks Limited, and various business units of Vedanta Resources.

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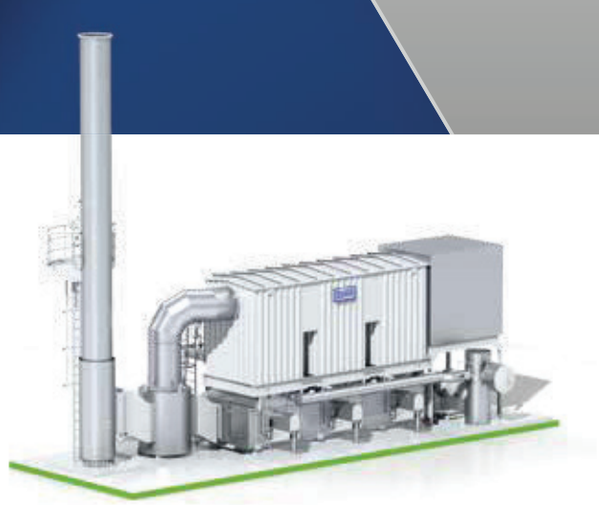

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Commenting on the results, Mr. Ramkumar Shankar, Managing Director, said, "We are pleased to update that the company has reported the total revenues of ₹1,145 crore with an EBITDA of ₹124 crore, an 11 per cent margin during Q1 FY '25. The first quarter of the financial year has started on a positive note registering a noteworthy profitability, showing a sign of improvement both on Y-o-Y and on sequential basis."

The improvement in PVC prices was largely due to a severe container shortage for cargo originating from China – however, these heightened freight rates have started dropping off post the end of the quarter. This, coupled with continued weakness in the Chinese economy and large volumes of low-priced imports coming in from China, has resulted in PVC prices dropping in July. The decision on the anti-dumping petition on Suspension PVC, filed by the domestic industry, is expected only by Q3 of the current financial year, he added.

Meanwhile, on the CMC business, an investment of about ₹160 crores has been approved by the board of directors towards capacity expansion. The company has also recently signed a new Letter of Intent ('LoI') with an agrochemical innovator for an advanced intermediate for a new active ingredient. This LoI is for a period of 5 years.

Chemplast Sanmar Limited is part of the SHL Chemicals Group, which in turn is a constituent of The Sanmar Group, one among the oldest and most prominent corporate groups in South India. It is a major manufacturer of Speciality Chemicals such as Speciality Paste PVC resin and Custom Manufactured chemicals for agro-chemical, pharmaceutical and fine chemicals sector. The company also produces other chemicals such as Caustic Soda, Chloromethane products, Hydrogen Peroxide and Refrigerant gas.

Vipul Organics develops new organic intermediate for manufacturing speciality chemical

Mumbai, India: Vipul Organics Limited (VOL), leading Specialty Chemicals company in the pigments and dyes segment, announced the development of a refined grade of organic intermediate for manufacturing speciality chemical to be finally used for the automobile industry. Used in auto parts such as shock absorbers and bumper extension, this refined developed compound is the result of ceaseless work by Vipul Organics' inhouse R&D team, which worked for over a year to perfect this.

The application of this speciality chemical will lead to better durability and performance of the shock absorbers and bumper extensions by adding on a compound that is resistant to wear and impact. Vipul Organics Limited has been a leader in the dyes and pigments industry for over 50 years.

"Over the last 2 years, we at Vipul Organics have been focusing on moving up the value chain in the pigment and dyes industry by introducing new value-added products. The development of the new organic intermediary by our R&D team opens up a whole new segment for us," says Mr. Vipul Shah, CMD, Vipul Organics Limited.

Safex Chemicals appoints Chandrashekhar Shukla as President of Sales & Marketing

Safex Chemicals, a leading player in the global chemical industry, has announced the appointment of **Chandrashekhar Shukla as the new President of Sales & Marketing.** Shukla brings an extensive 30-year experience in managing profit center operations, international marketing, and sales and portfolio management for prestigious companies such as Bayer, BASF, and DCM Shriram Ltd and Crystal Crop Protection Ltd.

His career is marked by his ability to form and develop high-performing teams, drive business goals, and foster an environment for sustained business growth. His strategic expertise spans managing P&L responsibilities in pesticides, seeds, and farm equipment across India, Thailand, and East Africa. Most recently, he served as the Head of International Business Development at Crystal Crop Protection Limited. His impressive career also includes his role as Vice President of Business Development at Dhanuka Agritech Ltd.

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"The size and scale of the Auto sector is huge and we are excited that our new product when used to formulate the Speciality chemical will significantly add not only to our topline but also our bottom-line in the coming years", he adds.

The product samples of the Speciality Chemical are already with suppliers to the top auto companies across the world and it is undergoing final testing and approval by the auto industry.

Shri Pralhad Joshi chairs agreement signing ceremony for export of green ammonia

New Delhi, India: The Union Minister of New and Renewable Energy, Shri Pralhad Joshi, chaired the signing ceremony of the first-ever agreement for the export of green ammonia from India to Japan. The project offtake agreement, marks a significant step forward in India's journey to becoming a global leader in green hydrogen and ammonia production.

The Heads of Terms (HoT) agreement was signed between Sembcorp Industries, Sojitz Corporation, Kyushu Electric Power Co., and NYK Line, solidifying a cross-border green ammonia supply partnership from India to Japan. This agreement represents the first such collaboration between the two nations, underscoring India's growing prominence in the global green energy landscape.

Singapore-headquartered Sembcorp Industries will lead the production of green ammonia in India, utilizing renewable energy sources. Kyushu Electric Power Co. has committed to integrating this green ammonia into their energy mix, partially replacing coal consumption at their thermal power plants in Japan. Sojitz Corporation will act as the business intermediary, facilitating the connection between the ammonia producer and the offtaker. NYK Line will oversee the maritime transportation of the green ammonia from India to Japan.

Speaking at the event, Shri Pralhad Joshi emphasized the importance of this partnership, stating, "Today is a historic day as we mark the first-ever agreement for the supply of Green Ammonia from India to Japan. This agreement will help establish a robust supply chain from production in India to consumption in Japan, paving the way for future collaborations in the green energy sector."

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Toray Advanced Composites appoints Steve Mead as Global Chief Commercial Officer

Toray Advanced Composites has announced a key leadership expansion with **Steve Mead joining as the new Global Chief Commercial Officer (CCO),** effective August 15. Mead will play a pivotal role in achieving Toray's global commercial strategy and expanding the market penetration of Toray's next-generation composite materials technology. Having held senior management positions at Toray Advanced Composites for over ten years, this appointment follows Mead's recent position as CCO at Re:Build Manufacturing in North America. Mead has a strong reputation for driving growth in the composites industry, spearheading the development of key business growth initiatives for all areas of the value chain from composite material development to industrializing high-rate composite part manufacture across major industry sectors.

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Clariant, OMV aim to reduce carbon footprint of ethylene and ethylene oxide derivatives

Muttenz, Vienna: Clariant, a sustainability focused specialty chemical company, and OMV has announced their intended collaboration for the supply of ethylene with a lower carbon footprint. "We are continuously working on solutions for our customers' journeys towards the use of lower carbon footprint ethoxylates and this cooperation is an important step forward to reach this goal," said Christian Vang, Business President Care Chemicals and Americas, Member of the Executive Steering Committee at Clariant. "Renewable low-carbon footprint ethylene from OMV will enable us to grow our bio-based ethylene oxide derivatives portfolio, as well as strengthen the supply chain with production in Europe, for Europe."

For Clariant this is another step on its journey towards supporting their global customer base with low carbon footprint ethoxylates. Since 2022, Clariant has successfully been serving its customers worldwide with segregated bio-based ethoxylates through Clariant IGL Specialty Chemicals Ltd (CISC).

"There is a broad application base for ethylene oxide and derivatives, and we are dedicated to enabling sustainable transformations for our customers as well as for OMV. By fostering the supply of circular feedstock, we are reinforcing our commitment to a circular economy and sustainability. This agreement is an important contribution to the progress we are making towards our Strategy 2030 ambitions," said Daniela Vlad, Executive Vice President Chemicals and Member of the Executive Board of OMV.

Clariant and OMV plan to explore and develop new strategies to meet sustainability targets in the ethylene supply chain. As part of this cooperation, both companies will share their research findings, adopt a Life Cycle Assessment (LCA) methodology for unified approaches and define detailed CO2 reduction roadmaps. This will include the joint analysis of collaboration potential for the Ethanol-to-Ethylene (E2E) technology.

Barentz acquires Anshul Life Sciences

Hoofddorp, The Netherlands: Barentz International, a leading global specialty ingredients solution provider, announces the acquisition of Anshul Life Sciences Group in India, a high-end life science focused specialty chemicals distributor that caters to regulated Pharmaceuticals, Food & Nutraceuticals and Personal Care markets. With this strategic move Barentz establishes a leading life science distribution platform in India and reinforces its commitment to providing innovative solutions, technical expertise, and an even more innovative range of ingredients to customers and principals pan-India.

Hindusthan Speciality Chemicals appoints Yogesh Tank as CEO

Yogesh Tank has been appointed as **Chief Executive Officer (CEO)** of **Hindusthan Speciality Chemicals Limited (HSCL)**, part of the Hindusthan Group having interests in manufacturing and marketing of epoxy and allied products.

Till recently, he was the Chief Financial Officer (CFO) heading the commercial accounts taxation and finance functions. Prior to this, he has worked with SDI Group of Companies, ATC Tires India Private Ltd., Indsur Global Ltd., Hettich India Pvt. Ltd., and Deloitte.

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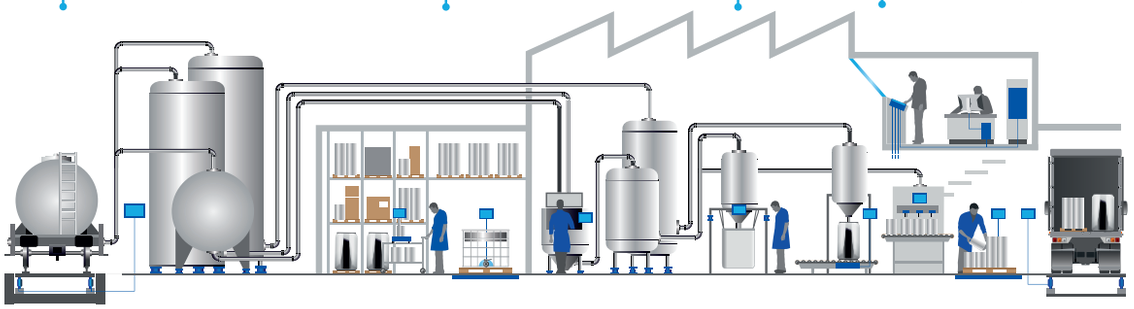

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The acquisition will further strengthen Barentz' position in India creating a leading life science distribution platform. Anshul Life Sciences enforces and complements Barentz India pharmaceuticals ingredients portfolio with high-quality excipient, APIs and intermediates and widens our Personal Care and Nutraceuticals offering. The combination will unlock significant growth potential across Asia Pacific.

Nagarajan Kailasam, CEO and the current team of Anshul Life Sciences will continue to manage the day-to-day business operations.

Marc Duchene, CEO, APAC, said, "We are extremely excited to welcome Anshul Life Sciences to the Barentz Group. The acquisition underpins our ambitions to further grow in India, one of our key strategic markets, and the Asia Pacific region in general. The acquisition benefits our customers and principals by providing access to a broader portfolio of high-quality pharmaceuticals excipients and products and a deeper pool of expertise."

Nagarajan Kailasam, CEO of Anshul Life Sciences, said, "Barentz aligns strongly with the entrepreneurial spirit and ethical standards of Anshul Life Science's founding partners. We are excited to join the Barentz family and start our collaboration to capture the enormous potential of the Indian market by offering even more comprehensive solutions to our customers and principals in the Indian market and beyond."

GHCL announces annual maintenance activities of boiler

Noida, India: GHCL, largest manufacturer of soda ash has announced that the annual maintenance activities of boiler at the company's soda ash plant is scheduled to take place from 16 September 2024 for a period of two weeks. This is expected to result in a total production shortfall of approximately 14,000 tons. The purpose of the activities is to carry out essential maintenance tasks to ensure the efficient and safe operations of its Soda Ash plant.

During this period, the company has assured that there is sufficient reserve stock of Soda Ash to meet its customers' requirements. As a result, there will be no adverse impact on the supply commitments during the aforementioned period.

GHCL manufactures Soda Ash (Anhydrous Sodium Carbonate), a major raw material for detergents, glass and ceramics industries and Sodium Bicarbonate (baking soda). The company has a Soda Ash manufacturing plant at Sutrapada in Gujarat with an installed production capacity of 12 Lakh MTPA and is in the process of expanding it by another 500 Thousand MTPA by end of 2025. GHCL Soda Ash is available in two grades – light and dense grade and is marketed in India under the brand name 'LION.'

Chemical Concepts appoints Andrew Morris as new CEO

Chemical Concepts, a leading supplier of adhesives, specialty chemicals, and related products, has announced the appointment of **Andrew Morris** as the company's new **Chief Executive Officer,** effective 01 August 2024. In his new role, Andrew will guide the company into a new era of national expansion, focusing on innovation, geographic growth, and operational excellence.

Andrew joined Chemical Concepts 13 years ago as a sales representative. He quickly rose to the position of National Sales Manager and then Vice President, developing a deep knowledge of adhesives and assembly solutions and a keen business acumen. Under Andrew's leadership, the Sales and Marketing teams at Chemical Concepts have seen explosive growth over the last four years. Andrew immersed himself in all facets of the business, uniting teams to achieve common goals.

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Saint-Gobain to acquire OVNIVER Group

Courbevoie, France: Saint-Gobain has announced that it has entered into a definitive agreement to acquire OVNIVER Group, for USD 815 million (approximately €740 million) in cash. This move represents another strategic step in establishing Saint-Gobain's worldwide presence in construction chemicals, which will have combined sales of €6.5 billion across 76 countries following the acquisition (pro forma).

OVNIVER Group is a leading construction chemicals player with a strong commercial and industrial footprint in the high-growth Mexican and Central American markets. The company is expected to generate revenues of USD285 million, with a growth rate of around 20 per cent per year on average in the last 5 years, and achieve an EBITDA margin of 21.7 per cent in 2024. With 16 manufacturing plants and around 1,000 employees, OVNIVER Group offers a wide range of innovative solutions for residential and non-residential construction markets, including façade coatings, tile adhesives, waterproofing and surface preparation mortars.

Benoit Bazin, Chairman and Chief Executive Officer of Saint-Gobain, commented: "The acquisition of OVNIVER Group perfectly aligns with our "Grow & Impact" strategic plan. It is an excellent opportunity for Saint-Gobain to further reinforce its presence in construction chemicals and to strengthen its presence in high-growth markets."

Hector Abella, Chief Executive Officer of OVNIVER Group, commented: "Today marks the beginning of an exciting new chapter in OVNIVER Group's history. Joining Saint-Gobain, a worldwide leader in light and sustainable construction with a well-established presence and strategy for Mexico as well as a global player in construction chemicals is the perfect next step for us."

Deepak Nitrite records ₹2,186 crore total income in Q1 FY25

Deepak C. Mehta, Chairman & Managing Director, Deepak Nitrite

Mumbai, India: Deepak Nitrite, a leading chemical intermediates producer with a diversified portfolio that caters to the dyes and pigments, agrochemical, pharmaceutical, plastics, textiles, paper and home and personal care segments and petrol derivates intermediates - phenolics, acetone and IPA in India and overseas has announced its Q1 FY25 results. The total income for Q1 FY 25 stood at ₹2,186 crore.

Revenue growth was driven by a combination of improved product mix, volume growth and proactive steps to target newer territories and newer customers. The Phenolics segment demonstrated strong year-on-year revenue growth, driven by improved realisations. This was fuelled by robust demand and favourable spreads. Softer agrochemical demand was offset by higher contribution from other end-use sectors like dyes, pigments, paper, and homecare; revival in agrochemicals segment is expected in H2 FY25.

Commenting on the performance for Q1 FY25, Deepak C. Mehta, Chairman & Managing Director said, "International developments such as geopolitical disruptions and weakening global consumption will continue to impact the global chemical industry. We are fortunate that our business is highly dependent, to the extent of approximately 80 per cent, on the domestic market which is a bright spot at present. Further, the policy thrust and initiatives by the Central Government including PLI, Infrastructure augmentation, *Aatmanirbharta* to name a few have created a fertile environment for growth of the Chemical Industry and we anticipate double-digit growth for the industry over the next few years."

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CCI approves proposed amalgamation of Mangalore Chemicals & Fertilizers with Paradeep Phosphates Limited

New Delhi, India: The Competition Commission of India (CCI) has approved the proposed amalgamation of Mangalore Chemicals & Fertilizers with Paradeep Phosphates Limited and proposed acquisition of equity shares of Mangalore Chemicals & Fertilizers Limited by Zuari Maroc Phosphates Private Limited. Paradeep Phosphates Limited (PPL) is a company under the Adventz group of companies (Adventz group). The majority shareholding in PPL is held by ZMPPL. ZMPPL is a 50:50 joint venture between Zuari Agro Chemicals Ltd (ZACL), a company belonging to the Adventz group and OCP S.A. (OCP). PPL is primarily engaged in the production and marketing of complex phosphatic fertilizers. Mangalore Chemicals & Fertilizers Limited (MCFL) is a company under the Adventz group. The majority shareholding (i.e. 54.03 per cent) in MCFL is held by ZACL. MCFL is primarily engaged in the production and marketing of complex phosphatic fertilizers. Zuari Maroc Phosphates Private Limited (ZMPPL) is a 50:50 joint venture between ZACL and OCP. ZMPPL currently holds 56.08 per cent equity stake in PPL.

ZMPPL carries out trading of fertilizers. The proposed combination comprises of the proposed amalgamation of MCFL with and into PPL, on a going concern basis (Proposed Merger); and the proposed acquisition of 3,92,06,000 equity shares of MCFL by ZMPPL from ZACL (Proposed Acquisition) (the Proposed Merger and Proposed Acquisition are collectively referred to as the Proposed Combination). Detailed order of the Commission will follow.

AGC develops innovative fluoropolymers manufacturing process

Tokyo, Japan: AGC, a world-leading manufacturer of glass, chemicals, and other high-tech materials, has developed an innovative process to manufacture fluoropolymers without the use of surfactants. Using the technology, AGC aims to achieve a continuous and stable supply of fluoropolymers, which is indispensable for the realization of a carbon-neutral and digital society.

Some fluoropolymers have been conventionally manufactured through a method called emulsion polymerization using fluorinated surfactants as polymerization aids. In the past few years, there has been a growing demand for the development of manufacturing technologies not using fluorinated surfactants. However, some other currently developed technologies using non-fluorinated surfactants have some issues, such as the generation of fluorinated byproducts and inferior performance of products compared to those manufactured through conventional technologies. The technology AGC has developed makes it possible to manufacture fluoropolymers having the same type of high performance properties as those produced by conventional methods with an extremely low generation of fluorinated byproducts, without using any surfactants.

Fluoropolymers are used in multiple applications in various fields, including semiconductors, automobiles, electronics, and energy, and are indispensable materials for the sustainable development of society. Fluoropolymers produced using the technology demonstrate the same kind of excellent properties as those of conventional products, such as heat resistance, cold resistance, chemical resistance, durability, and other properties. The technology is currently in development with the aim of starting industrial scale production by 2030. ■

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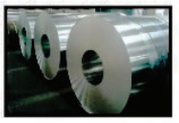

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Igus India inaugurates new manufacturing plant in Bengaluru

Bengaluru, India: In a strategic move to fortify its footprint in the Indian market, Igus, a global leader in motion plastics, has inaugurated a state-of-the-art, 92,000 sq ft manufacturing plant in Mandur near Budigere in Bengaluru. This development marks a significant milestone for Igus India, as it prepares to focus on new divisions dedicated to the semiconductor and renewable energy sectors, areas poised for substantial growth. The expansion is part of Igus's long-term strategy to enhance its operational capabilities and support its extensive customer base in India.

Igus India, a wholly-owned subsidiary of the German-based Igus GmbH, has been a major player in the motion plastics industry since its establishment as a subsidiary in 2000. With over 19,000 customers in India, Igus India has built a robust presence. The company boasts an extensive catalogue of 125,000 parts, which can be used for innumerable customer demand-based assemblies done locally. On an average over 200 new products are introduced annually, underlining its commitment to innovation and customer satisfaction.

The new Bengaluru facility represents a substantial investment of over ₹100 crores (approximately 12 million euros), underscoring igus's commitment to the Indian market. The financial allocation includes ₹20 crores for setting up the factory, ₹40 crores for advanced injection moulding machines, and ₹20 crores for the manufacturing process. The plant is equipped with cutting-edge technology and infrastructure designed to meet the high standards of motion plastics production, ensuring that Igus India continues to deliver world-class products to its customers.

Deepak Paul, Managing Director of Igus India, emphasized the strategic importance of this expansion, stating, "The Indian market presents tremendous potential for Igus, as demonstrated by our continued growth and investment here. This alignment has been a key driver of our significant growth in the country. As we look forward, our plans include expanding beyond Bengaluru, with logistics and assembly centers set to be established in Pune, Gurugram, and Noida."

Igus India is currently the 6th largest subsidiary among Igus's 38 global subsidiaries, a position that reflects its strong performance and growth potential. Over the past two years, Igus India has doubled its market growth, with revenue figures climbing from ₹199 crores to ₹313 crores. The company expects this upward trajectory to continue, projecting a revenue of ₹340 crores for 2024. Additionally, Igus India has invested in a clean room testing facility in Germany and plans to establish a similar setup in India, further enhancing its product development and quality assurance capabilities.

Santhosh Jacob, Country Manager and Director of Igus India, added, "Technology and innovation are at the core of everything we do at Igus. With a catalogue of 125,000 parts and 247 new products introduced this year, we are constantly inspired by our customers' needs to push the boundaries of what is possible. Our ongoing expansion of the motion plastics product world, coupled with the integration of digitalization and AI, is a testament to our long-term corporate strategy. We are making significant progress in embedding digitalization as a key technology at Igus, which will play a crucial role in our future growth and success."

NOCIL announces investment of ₹ 250 crore

Mumbai, India: NOCIL Limited, largest rubber chemical manufacturer in India, has announced its financial results for the quarter ended June 30, 2024. The consolidated revenue from operations stood at ₹372.17 crores as compared to ₹356.50 crores for previous quarter. Consolidated EBITDA for the quarter stood at ₹41.05 crores, down by 8 per cent as compared to previous quarter, mainly on account of Q1FY25 being a seasonal quarter. Operating PBT for Q1FY25 stood at ₹37 crores as compared to ₹38 crores in Q4FY24.

The standalone revenue from operations stood at ₹372.17 crores as compared to ₹356.50 crores for previous quarter. Standalone Profit After Tax from continuing operations was ₹27.23 crores as compared to ₹41.13 crores for previous quarter. Besides, the company also announced an investment of ₹250 crores to strengthen its market presence in the rubber chemical space.

Commenting on the results, Anand VS, Managing Director, NOCIL Limited, said, "Our company continues to demonstrate resilience and adaptability, inspite of macro-environment headwinds we stay on our growth path both in the domestic and international markets. We are also making progress with our ₹250 crores capacity expansion project in Dahej. This expansion is critical to our long-term growth strategy, ensuring that we are well positioned to capitalize on emerging opportunities and cater to the growing demand from our customers. Our focus on innovation, customer-centricity, and sustainability continues to drive our business, enabling us to maintain our leadership position in the rubber chemicals industry."

GNFC announces expansion plans

Pankaj Joshi, IAS, Managing Director, Gujarat Narmada Valley Fertilizers & Chemicals Ltd

Bharuch, Gujarat: Gujarat Narmada Valley Fertilizers & Chemicals Ltd, while announcing its unaudited financial results for Q1 FY2024-25 said production at Dahej complex is expected to start in August 2024, which is expected to further normalise the supply in domestic market. Explaining the results, Pankaj Joshi, IAS, Managing Director, GNFC, said, "During the Q-1 FY 24-25, industrial chemicals witnessed better margins in general which helped improve the EBITDA. While the EBITDA is favourable, on Q-o-Q basis, the annual turn around at Dahej complex has limited the available volume having consequential impact on PBT."

Of late the domestic share of TDI out of the total production has increased making relatively improved realisation as compared to exports, he added. The chemical portfolio in general witnessed improved margin having positive impact on EBITDA. TDI-II Dahej plant went under annual turn around due to which limited volumes were available.

Further the Board in its meeting has cleared investment proposal for establishing 600 MTPD i.e. 2,00,000 MTPA of weak nitric acid. With this investment, GNFC will enhance capacity of weak nitric acid by approximately 57 per cent. Apart from this, decks are cleared for investment in Ammonium Nitrate as downstream. The Board has also approved the appointment of Strategic Management Consultant (SMC) i.e Kearney for setting strategic direction for the company. With the appointment of the SMC, measures for short, medium and long term will be laid out before Board for the future growth of company over next six months.

With annual shutdown getting over at Dahej complex in August 2024 coupled with stable Bharuch operations, the company expects to have better performance in over next few quarters of FY 24-25. GNFC is a joint sector enterprise promoted by the Government of Gujarat and the Gujarat State Fertilizers & Chemicals Ltd (GSFC). It was set up at Bharuch, Gujarat in 1976.

Lubrizol to build company's largest manufacturing facility in India

Mumbai, India: The Lubrizol Corporation, a global leader in specialty chemicals, has signed a Memorandum of Understanding to purchase a 120-acre plot in Aurangabad, India, where it plans to construct a new manufacturing facility to initially support the region's growing transportation and industrial fluid markets. The initial phase of the project represents a projected investment of approximately USD200 million, the company's largest ever in India, and builds on previously committed investment in the region.

The plant will become the company's second-largest manufacturing facility globally and its largest manufacturing facility in India when completed. Construction will progress in phases over the next several years with room for future expansion.

"Lubrizol has made meaningful investments in India for more than five decades," said Flavio Kliger, President of Lubrizol Additives. "This new state-of-the-art manufacturing facility will allow us to enhance our local capacity and capabilities for our Additives business with the potential to support other Lubrizol businesses and regions in the future."

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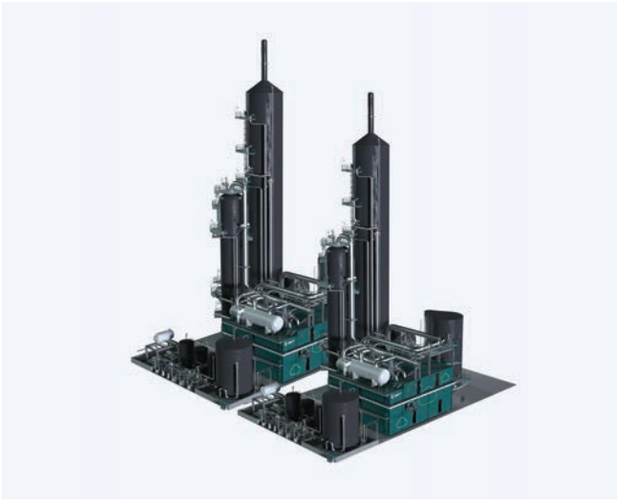
The announcement of the Aurangabad plant signals the company's latest efforts to accelerate growth and enhance its local-for-local capacity in the region. "This announcement underscores our continued commitment to our employees, our partners and our customers in the region," said Nitin Mengi, Vice President Lubrizol Additives IMEA and Chairman & Managing Director, Lubrizol India Private Limited. "The growing transportation and industrial markets in India represent a tremendous opportunity, and Lubrizol is thrilled to be a part of the bright future of these industries."

In addition to supporting demand for India, this site will enable export opportunity to surrounding countries and to other Lubrizol sites. Commencement of manufacturing at the site is expected to coincide with Lubrizol's 100th anniversary in 2028.

SLB, Aker Carbon Capture JV bags FEED contract



Houston, US: The SLB and Aker Carbon Capture joint venture (SLB-ACC JV) has bagged a contract award by its partner CO280 Solutions for Front End Engineering and Design (FEED) of a large-scale carbon capture plant at a pulp and paper mill on the U.S. Gulf Coast. The project, which aims to remove 800,000 tonnes of carbon emissions annually, will also deliver permanent, verifiable and affordable carbon dioxide removals (CDRs).

North America's pulp and paper industry represents a carbon removal opportunity of up to 130 million tonnes per year. By capturing and storing these emissions permanently, the industrial activity achieves negative emissions as more carbon dioxide is removed from the atmosphere than is being emitted from the process.

The concept design for the FEED of the carbon capture plant is based on the SLB-ACC JV's modularized Just Catch™ 400, a standardized and modular technology that enables the pre-fabrication of carbon capture units. The JV is already delivering both Just Catch™ and Big Catch™ solutions to several industrial sites in the bioenergy, cement and waste-to-energy sectors.

"Partnerships are the key to removing megatons of carbon before 2030: We are proud of the partnerships we have established in both the pulp and paper industry and CDR markets and of our collaboration with the SLB-ACC JV as a key technology partner," said Jonathan Rhone, Chief Executive Officer, CO280.

SABIC, Fujian Government to build engineering thermoplastics compounding plant in China

Riyadh, Saudi Arabia: SABIC, a global leader in diversified chemicals, signed a potential investment agreement with the Fujian government on August 1, under the auspices of the Saudi Ministry of Energy, to build an engineering thermoplastics compounding plant in China's Fujian Province. The new investment further underscores SABIC's efforts to meet the unique requirements for differentiated innovative solutions from its local customers in China while strengthening its roots in the Chinese market and its contributions to the high-quality and sustainable development of the chemical industry.

The planned compounding plant will be located in the Gulei Port Economic Development Zone, Zhangzhou, Fujian. It will primarily produce pelletized LEXAN™ Polycarbonate (PC) and CYCOLOY™ PC/ABS blends

for use in advanced materials tailored to the needs of industries including electrical and consumer electronics, automotive, and emerging sectors such as solar energy, electrification, and 5G. The site will include compounding lines, color development capabilities, and advanced equipment that will enable SABIC to work with its customers and partners to create new innovative solutions for engineering plastics.

Abdulrahman Al-Fageeh, SABIC CEO, said, "By creating synergy with upstream and downstream partners, the project aims to strengthen our supply capability in compounding products and serve this important strategic market with innovative and consistently high-quality material solutions. Building on this, we will continue to collaborate with our existing global and local partners and customers to grow together in China."

Henkel further invests in its largest Indian manufacturing facility

Pune, India: Henkel Adhesives Technologies India Private Limited (Henkel India) announced the completion of Phase III of its manufacturing facility in Kurkumbh, near Pune, Maharashtra. The Kurkumbh site, which was launched in 2020, serves the growing demand of Indian industries for high-performance solutions in adhesives, sealants, and surface treatment products. The new Loctite plant, named after Henkel's renowned brand Loctite, was inaugurated by Mark Dorn, Executive Vice President, Henkel Adhesive Technologies, along with other Senior Management members of the company.

The new Loctite plant in the Kurkumbh manufacturing site reflects Henkel's vision to drive growth in the Indian market. The plant will serve Indian businesses, further localize the product portfolio, and thus, reduce dependence on imports. It will also help address the supply-demand gap of high-performance adhesive solutions for the manufacturing, maintenance, repair and overhaul (MRO), and automotive components sectors. Henkel Adhesive Technologies is well-positioned to meet the demand arising in these fast-growing market sectors.

Speaking on the launch, Mark Dorn, Executive Vice President at Henkel Adhesive Technologies, said, "India has emerged as a focus market for Henkel globally. The new Loctite plant highlights our vision to emerge in the country as a self-reliant global market player with a strong local presence. With continued investments, efficient supply chains, and customer-focused solutions, Henkel is committed to driving growth in India and building ecosystems of innovative and sustainable solutions with our partners and customers."

The Kurkumbh site meets the highest standards of sustainability and is LEED Gold certified, a rare feature among chemical plants. In addition, Henkel aims to achieve carbon-neutrality in Kurkumbh for Scope 1 and 2 emissions by 2030. To support this ambition, the site has signed a green electrical energy Power Purchase Agreement and installed on-site solar panels.

S. Sunil Kumar, Country President of Henkel India, commented, "The expansion of our manufacturing footprint reinforces Henkel's sustained commitment to making India a manufacturing hub for advanced and high-performance adhesive, sealant, and functional coating solutions. A key highlight of the new Loctite plant is the Automated Storage and Retrieval System (ASRS), which enables fast execution of material storage and retrieval. The plant will leverage Industry 4.0, optimize production efficiency, and further drive profitable, organic growth for Henkel India, while continuing to contribute to the 'Make in India' initiative of the Indian government."

Borouge signs project collaboration agreement for speciality polyolefins complex in China

Abu Dhabi, UAE: Borouge Plc, a leading petrochemicals company providing innovative and differentiated polyolefins solutions, has announced a strategic consortium, aimed at developing a speciality polyolefins complex in China. The consortium, comprising Borouge, ADNOC and Borealis, has signed a Project Collaboration Agreement (PCA) with China's Wanhua Chemical and Wanrong New Materials (Fujian), a subsidiary controlled by Wanhua Chemical.

The proposed complex in Fuzhou, Fujian Province, is set to produce 1.6 million tonnes per annum (MTPA) of speciality polyolefins leveraging both Borealis' cutting-edge proprietary Borstar® technology and Borouge's extensive sales network. The consortium intends to establish a Sino-foreign joint venture with Wanrong New Materials (Fujian), with a shareholding ratio of 50:50 respectively, subject to customary regulatory approvals.

Hazeem Sultan Al Suwaidi, Chief Executive Officer of Borouge, said, "This strategic growth initiative builds on the robust economic ties between the UAE and China, and offers the potential to create value for Borouge shareholders by accelerating our expansion in China. The proposed complex will leverage the strengths of our partners and majority shareholders, who bring a capacity to deploy significant capital, world-leading technology, innovation and technical expertise, as well as extensive logistics and customer networks."

The final structure of the project and financial commitments will be established following the completion of the feasibility study, which will also explore artificial intelligence (AI) solutions to support automated plant operations.

VTT opens pilot plant utilising captured carbon dioxide in Finland

Espoo, Finland: VTT, LUT University, and companies have opened a pilot plant in Espoo, Finland, to process captured carbon dioxide into compounds that can replace fossil raw materials in plastic products and chemicals. The pilot plant, built in sea containers, started operations in August. The Forest CUMP research project of VTT and LUT University has investigated how bio-based carbon dioxide from, for example, the forest industry and waste incineration can be captured and converted into high-value products such as polypropylene and polyethylene. The promising results will now be put into practice as VTT and its partners open a pilot plant built in sea containers in the Bioruukki pilot centre in Espoo, Finland.

"Finland has huge potential to be one of the leading countries in utilising bio-based carbon dioxide," says Juha Lehtonen, Research Professor at VTT. "Finland produces around 30 million tonnes of bio-based carbon dioxide per year. If captured and converted into products, Finland could become a major producer and exporter of polymers and transport fuels made from carbon dioxide and hydrogen."

Polypropylene and polyethylene are the most common plastic types used in everyday life, which are currently mainly produced from fossil raw materials. Plastics play an important role in sequestering carbon dioxide in long-lasting products. "The technology creates a

significant export opportunity for renewable high-value-added products. Due to its extensive forest industry, Finland has a huge potential to utilise bio-based carbon dioxide. Outside the Nordic countries, large sources of bio-based carbon dioxide are rare," Lehtonen says.

The Forest CUMP project is implemented in close cooperation with business partners as part of Business Finland's Veturi ecosystem, which supports sustainable development. One of the Veturi companies is Borealis. Forest CUMP is part of Borealis' SPIRIT programme, which promotes the green transition of the plastics industry. The research project has studied the entire production chain from carbon capture to ethylene and propylene production. Ethylene and propylene are the raw materials for polyethylene and polypropylene. At this stage, they are produced at VTT Bioruukki from flue gas carbon dioxide. In the future, the technology can be brought into production wherever bio-based carbon dioxide is produced, such as in forest industry or waste incineration plants.

The Forest CUMP project, funded by Business Finland, is part of the Business Finland Veturi ecosystem, which develops various solutions towards sustainable development and national carbon neutrality together with major Finnish companies. The project started in August 2022 and will run until the end of 2024. The project involves the leading companies Borealis, Neste and ABB, as well as Metsä Spring, Kemira, Vantaa Energy, Stora Enso, Kleener Power Solutions, Carbonreuse Finland, Fortum and Essity. In addition to VTT, LUT University is a research partner. ■

Pioneering Sustainable Innovation in the Chemical Sector

Godrej Industries (Chemicals) has set an ambitious goal to double volume, sales and profits by 2028. The company has recently entered into a business transfer agreement for acquisition of the Ethoxylation Unit II at Kheda of Shree Vallabh Chemicals. **Vishal Sharma, Executive Director and Chief Executive Officer, Godrej Industries (Chemicals),** throws more light on the recent acquisition by the chemicals business, as well as the overall development of the business and growth plans, in an interview with **Mittravinda Ranjan.**

VISHAL SHARMA
Executive Director and Chief Executive Officer
Godrej Industries (Chemicals)

How do you think changes in raw material costs, geopolitical tensions, and shifting consumer preferences are affecting the chemical manufacturers?

Raw material costs have dropped significantly compared to 12 to 18 months ago, which has led to improved results for several chemical companies in the last quarter. Some companies have moved to higher profitability, some have shifted from losses to profitability, and others have reduced their losses. Overall, the cost landscape is improving. Although costs in certain categories may have increased due to demand-supply issues, the general trend is a decrease.

Geopolitical tensions have become a significant factor in our lives. For example, the Russia-Ukraine war, which was expected to last six months, has now continued for over two and a half years with no end in sight. Recently, tensions between Israel and Gaza/Hamas have also risen. In the eastern part of the world, China has strained relationships with its neighbours, including Japan, the Philippines, and certain Southeast Asian countries. North Korea tensions add on to all this.

These geopolitical issues led to trade route disruptions which has compelled all countries to look inwards and aim for self-reliance. Geopolitical tensions have also significantly impacted trade routes. The risks associated

with certain routes have led to longer shipping times, clogged ports, and a dramatic increase in freight rates—e.g. from USD 1,200 to USD 7,000 per container. This has caused severe supply chain disruptions, logistics issues, and stockouts. This, in turn, reinforces the push for self-reliance. The trend towards globalization that began in the 1960s and continued until the 2000s is reversing in some way. The COVID-19 pandemic, which caused massive shutdowns in China, highlighted the risks of global supply chains and the breakdown of logistics. As a result, the era of large global plants supplying products worldwide is over. Supply chains are decentralizing, and countries are focusing on becoming more self-reliant. These trends are likely to continue for the next decade or so, with countries becoming more insular and focusing on self-reliance. After this period, we may see a new era of peace and a potential return to globalization.

Regarding evolving consumer preferences in the chemical industry, the consumer preference is increasingly moving towards natural and organic ingredients. There is a strong preference for sustainable products, which includes avoiding plastic bottles and packaging that contributes to landfills. Glass bottles, which are recyclable, are becoming more popular. Consumers are willing to pay a premium for these preferences. In India, the rise of Direct-to-Consumer (D2C) brands reflects this trend, as these brands focus on sustainability and natural products.

For the Indian industry, current logistics and supply disruptions present an opportunity to become more self-reliant, develop import substitutes, and invest in R&D for products made from renewable and sustainable sources. Godrej Industries, which operates in the oleochemicals, surfactants, specialities and biotech space, is well-positioned to benefit from these trends, as its products are made from renewable feedstocks. We view these developments positively and expect them to positively impact our business.

Walk us through the Scope I, II & III emissions mitigation strategy of Godrej Industries.

We are diligently measuring Scope 1 and Scope 2 emissions and taking comprehensive steps to address them from the energy, water, and emissions perspectives. We are on track to meet our 2025 goals and are in the process of setting new targets for 2030, which we will announce in the coming months. When it comes to Scope 3 emissions, the first challenge is measurement. Scope 3 emissions encompass a wide range of activities beyond our immediate control upstream and downstream, including the emissions of our transporters, suppliers, and customers using our products. It involves assessing how these entities manage their operations and emissions. It is important to note that what is scope 3 for us is scope 1 and 2 for our suppliers and partners.

Currently, Scope 3 emissions present a significant challenge not just for our industry, but for every sector globally. No one has yet fully resolved how to measure these emissions accurately because, without a baseline, it is difficult to gauge progress or setbacks. Scope 3 remains a complex and nebulous area for the industry. Companies are taking steps, such as responding to inquiries from customers about emissions and working with vendors to improve their efficiency and reduce their emissions. However, companies are yet to achieve a comprehensive baseline for Scope 3 emissions or a clear roadmap for the next five years. This is a complex issue, and we hope that advancements will be made in the coming years to address it more effectively.

Godrej Industries' Chemicals Business has announced the signing of a Business Transfer Agreement with Shree Vallabh Chemicals Unit II (Kheda) with the intention to acquire Ethoxylation Unit II. How does this technology acquisition help Godrej Industries further enhance the product portfolio and strengthen the market presence?

Our investment plan is substantial. At the Vibrant Gujarat Summit, we announced a Rs 650 crore investment in Gujarat over the next four years, and those investments are already underway. Additionally, we have recently acquired Shree Vallabh Kheda Unit II, a unit that expands our presence into the ethoxylation space, introducing us to a new product and technology area. We are also exploring other inorganic growth opportunities and expect to announce further developments in the coming months.

Can you throw more light on the overview of Chemicals business of Godrej Industries in India and internationally and provide us insights into the product portfolio?

GIL Chemicals is one of the few integrated Oleochemicals players globally, that is into base oleochemicals from vegetable oil feedstock, it also makes surfactants, oleochemical derivatives and has recently also got into biotech again using fully renewable feedstocks. This

puts us into a unique situation to serve our customers and markets with a wide portfolio of products for their needs. We serve customers in well over 70 countries globally with a wide network of distributors and also serve some customers directly, while the majority of our business sits within India where again we serve the market through a distributor network as well as work with several thousand customers directly together with our regional and business teams.

Our Oleochemicals business comprises mostly fatty acids, glycerine and fatty alcohols, and we span across different carbon chain lengths with the attempt to serve customers across their requirements. Our surfactant business comprises largely of primary surfactants like SLS, AOS and SLES, while our future focus will also be on mild surfactants and more speciality surfactants that the market is evolving towards and which are used as secondary surfactants by customers.

Our specialty chemistry business is focused largely on Oleochemical derivatives, and is focused on developing portfolios for the home and personal care, oil and gas, food and beverage, paints and coatings, agrochemicals and a few other market segments. A significant amount of investment is also taking place on the R&D front accordingly.

The Biotech business is currently focused on biosurfactants and probiotics, with our eyes set on several other biological technologies we will get into soon. We have been working on this over the last few years as the development work required is significant and time consuming. We are patient and ready to play the long term game here.

What are the key trends shaping the future of the chemical industry? How is Godrej Industries positioning itself to capitalize on these trends?

There are a few key trends in the chemical industry currently that are driving the direction of development and progress. First is sustainability and green chemistry, where every segment from personal care to the oil industry is trying to get into more natural, green, renewable and eco-friendly products and ingredients. The entire effort is on minimising the carbon footprint during the entire life cycle of the products being used as well as sold. LCA is gradually becoming a requirement for companies to measure. The second trend is cost efficiency, where companies and products that can help customers, whether B2C or B2B, source their requirements more economically. And this is from a total operating cost perspective not just a cost / kg perspective of an ingredient or product. The third trend is lower volume, where everyone is looking for more volumetrically efficient solutions and would like to achieve the same results with a smaller quantity of products. This leads to significantly lower packaging and shipping costs as well as lower carbon emissions. So the industry will need to work in this direction from a development standpoint. There could be more trends taking place, but I see these as the major ones.

Our focus as a company has been on building our product development and marketing capability so that we can take the opportunities presented by the market, as well as capitalise on the trends in the market and industry. It is on these lines that a significant amount of investment is taking place in capacities and technologies, organic as well as inorganic, and we are also hiring a lot of new resources across various functions in the business.

What will be the key drivers for the growth of Godrej Industries in the next 5 to 10 years?

First of all, being based in India is a significant advantage; it's a bright spot in the global market, and we are very positive about our position here. We hold a leading market share in most of the categories in which we operate domestically. However, on a global scale, our market share remains quite modest, likely in the low single digits. This presents us with a substantial opportunity for international growth. We plan to expand our market share, enter more countries, reach more customers, increase product offerings, and drive innovation. Our strategy encompasses all these aspects to foster growth.

We have set an ambitious goal to double our size — in volume, sales and profits — by 2028. This includes expanding our workforce, growing our R&D team, and significantly increasing our production capacities. We also aim to launch more products, particularly in the Specialties and Biotech sectors, where we are making substantial investments. We are actively seeking talent and would like to reach out through the Chemtech forum: if you are a skilled professional in the chemical industry, Godrej is an excellent place to work, and we would love to hear from you. ■

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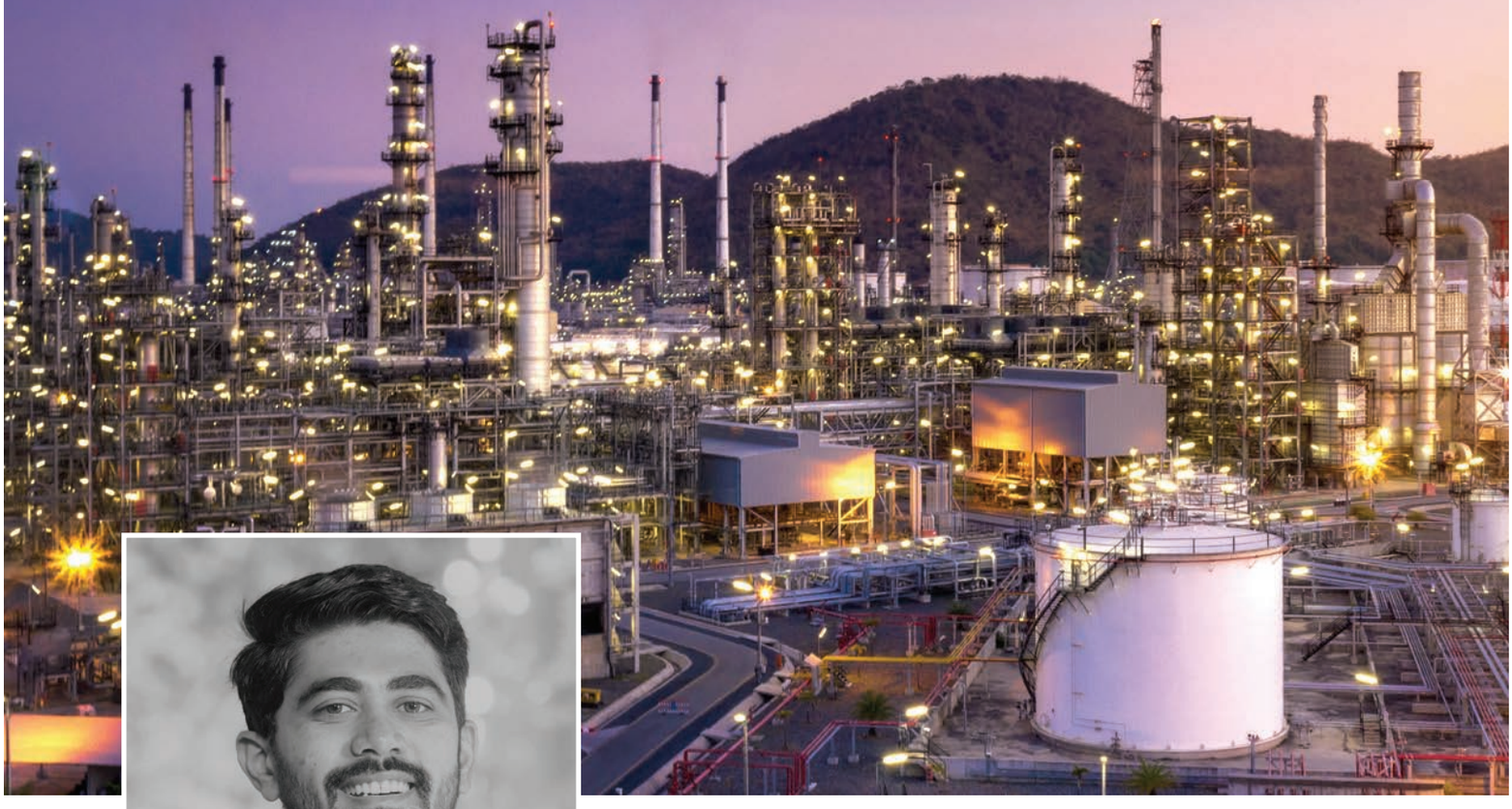
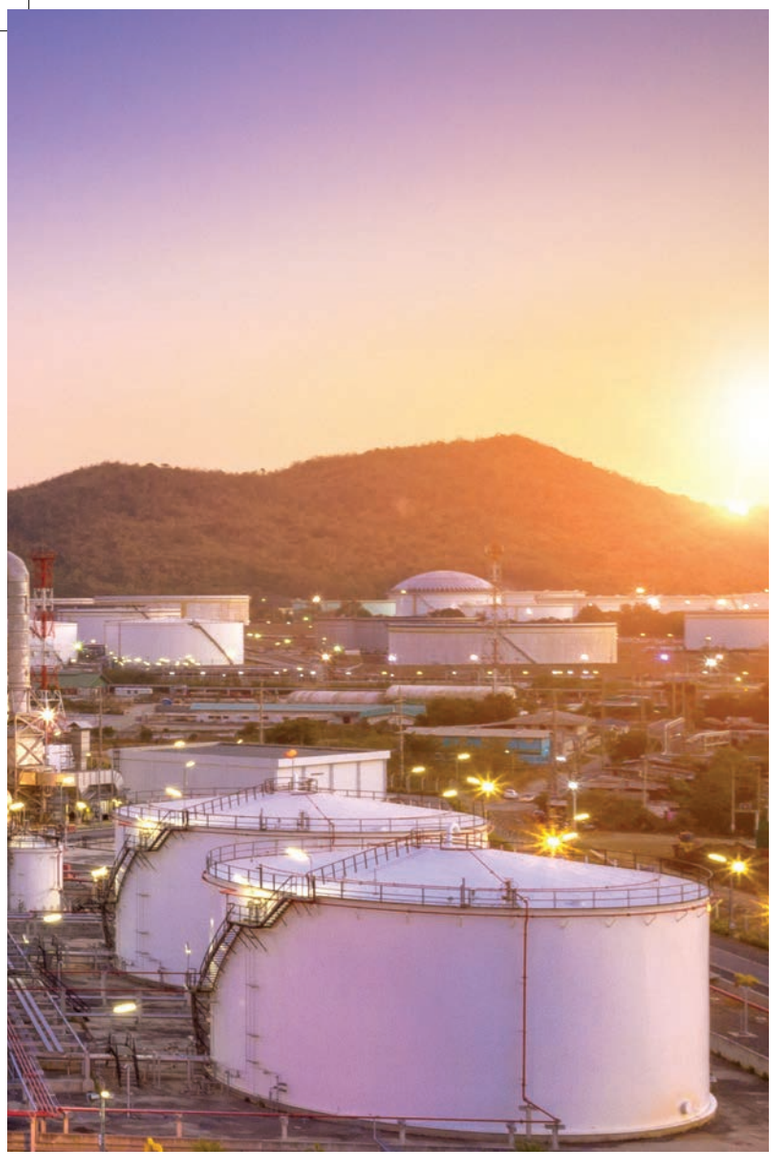
Digital Transformation in India's Chemical Industry: The AI/ML Imperative



Shrey B Patel, MSc CENG MIChemE MIET
Founder-Director
Angiras Rasayan LLP, IN

The chemical industry, a linchpin of modern industrialisation, stands at a crossroads of transformation, driven by the convergence of digital technologies and the potent capabilities of Artificial Intelligence (AI) and Machine Learning (ML). **Shrey B Patel, Founder-Director of Angiras Rasayan LLP**, throws light on the profound impact of digitalization and AI/ML on India's chemical sector, examining its advantages, challenges, and future trajectory.



Digitalization, encompassing technologies like the Internet of Things (IoT), big data analytics, cloud computing, and AI/ML, is reshaping business models and processes across industries. The chemical sector, traditionally characterised by complex processes and hazardous materials, is increasingly recognising the potential of these technologies to enhance efficiency, safety, and sustainability.

India's chemical industry, a significant contributor to the nation's Gross Domestic Product, has embarked on a digital transformation journey. However, the pace of adoption varies across segments, with larger organizations leading the charge. According to Deloitte, digital investments in the global chemical industry decreased by 0.1 per cent in 2023 due to economic conditions, yet 94 per cent of industry leaders believe AI will be critical to future success. In India, the sector is expected to grow at a CAGR of 11-12 per cent by 2027, driven by rising domestic demand and a shift in global supply chain dynamics.

A report by PwC highlights that 60 per cent of chemical companies globally are investing in digital technologies, with the potential to increase productivity by 15-20 per cent and reduce costs by 5-10 per cent. In India, a survey by NASSCOM revealed that AI adoption in the chemical industry has grown by 25 per cent over the past two years.

Digital transformation initiatives in India are particularly focused on the integration of IoT and AI to improve process monitoring and control. For example, the adoption of IoT in the Indian chemical industry has enabled real-time monitoring of production lines, leading to significant reductions in downtime and maintenance costs. Additionally, cloud computing has facilitated the seamless sharing of data across different units within an organisation, enhancing collaborative efforts in R&D and production.

Role of AI and ML

AI and ML, subsets of digitalization, are proving to be game changers for the chemical industry. Their ability to analyse vast datasets, identify patterns, and make predictions offers immense potential for process optimization, quality control, and predictive maintenance.

Predictive Analytics and Process Optimization: AI-powered predictive analytics can forecast equipment failures, optimize production schedules, and reduce energy consumption. According to McKinsey, AI-driven process optimization can lead to a 5-10 per cent increase in overall equipment effectiveness (OEE) in the chemical industry. For instance, predictive maintenance systems use AI algorithms to analyse historical data from machinery sensors, predicting potential failures before they occur and thus preventing costly downtime.

Enhanced Quality Control: AI-powered vision systems and spectroscopic analysis can detect defects with

A report by PwC highlights that 60 per cent of chemical companies globally are investing in digital technologies, with the potential to increase productivity by 15-20 per cent and reduce costs by 5-10 per cent. In India, a survey by NASSCOM revealed that AI adoption in the chemical industry has grown by 25 per cent over the past two years.

greater accuracy and speed than human inspectors, leading to improved product quality and reduced rework costs. Advanced AI algorithms can identify minute variations in product specifications that might be overlooked by human inspectors, ensuring higher consistency and compliance with industry standards.

Supply Chain Optimization: AI/ML algorithms can optimize inventory levels, predict demand, and improve logistics efficiency, resulting in reduced costs and improved customer satisfaction. By analysing data from various points in the supply chain, AI can provide insights into potential bottlenecks and inefficiencies, enabling companies to make data-driven decisions that enhance overall supply chain resilience.

Research and Development Acceleration: AI can accelerate the discovery of new materials and chemicals by simulating complex reactions and analysing vast datasets. For example, machine learning models can predict the properties of new compounds, significantly reducing the time and cost associated with experimental testing. This capability is particularly valuable in the development of sustainable and environmentally friendly materials.

Challenges and Opportunities

Despite the promising potential, the widespread adoption of AI/ML in the Indian chemical industry is hindered by several challenges:

Data Quality and Availability: The lack of high-quality, standardised data is a major hurdle. Many companies in the industry are still reliant on legacy systems that produce fragmented and inconsistent data, making it difficult to harness the full power of AI/ML. To address this issue, companies must invest in modern data infrastructure that ensures the accuracy and consistency of the data being collected.

Artificial Intelligence and Machine Learning, subsets of digitalization, are proving to be game changers for the chemical industry. Their ability to analyse vast datasets, identify patterns, and make predictions offers immense potential for process optimization, quality control, and predictive maintenance.

Cybersecurity Concerns: Protecting sensitive data from cyberattacks is paramount. As chemical companies increasingly rely on digital systems, they become more vulnerable to cyber threats. Implementing robust cybersecurity measures, such as encryption and multi-factor authentication, is essential to safeguard against potential breaches.

Talent Gap: A shortage of skilled professionals in AI/ML is a significant challenge. To bridge this gap, the industry must collaborate with academic institutions to develop specialised training programmes that equip the workforce with the necessary skills. Additionally, offering competitive salaries and career development opportunities can help attract and retain top talent.

Integration Challenges: Integrating AI/ML with existing legacy systems can be complex. Many chemical companies have been operating for decades and have deeply entrenched legacy systems that are not easily compatible with modern AI/ML technologies. Addressing this challenge requires a phased approach, starting with pilot projects that demonstrate the value of AI/ML and gradually scaling up to full-scale implementation.

To overcome these challenges, the industry must invest in data infrastructure, cybersecurity, and talent development. Collaboration between industry, academia, and government is essential to create a conducive ecosystem for AI/ML adoption.

Case Studies: Indian Success Stories

Several Indian chemical companies have successfully implemented AI/ML solutions, demonstrating the technology's potential. For instance, Reliance Industries Limited has deployed AI for predictive maintenance in its refineries, while Tata Chemicals has leveraged AI for process optimization and quality control. These case studies serve as inspiration for other companies in the industry.

Reliance Industries, for example, has utilised AI to monitor the health of critical equipment in real-time, predicting potential failures and scheduling maintenance activities proactively. This has resulted in a significant reduction in unplanned downtime and maintenance costs, enhancing overall operational efficiency. Similarly, Tata Chemicals has employed AI-driven quality control systems that analyse product samples for defects, ensuring higher product consistency and reducing the need for manual inspections.

The Road Ahead: A Vision for the Future

On a global scale, the AI market in the chemical industry is expected to reach USD 3.88 billion by 2027, growing at a CAGR of 23.5 per cent from 2020. This growth is driven by the increasing demand for predictive analytics and process optimization, which are key areas where AI can deliver substantial benefits.

The future of AI/ML in the Indian chemical industry is bright. The integration of AI/ML is predicted to have a profound impact on the chemical industry. By 2025, it is estimated that AI-driven solutions could boost the industry's efficiency by 15-20 per cent and reduce operational costs by up to 10 per cent. As the Indian market continues to mature, companies that leverage AI/ML will likely see increased competitiveness on a global scale.

Moreover, the concept of autonomous chemical process plants, controlled by AI/ML systems, is gaining traction. Digital twins, virtual replicas of physical assets, offer immense potential for process optimization and predictive maintenance. These digital twins enable companies to simulate various operational scenarios, identify potential issues, and optimise processes without disrupting actual production.

To realise the full potential of AI/ML, the industry must focus on building a robust digital infrastructure, investing in talent development, and fostering a culture of innovation. Collaboration between industry, academia, and government is crucial to address challenges and accelerate adoption. The establishment of innovation hubs and research centres dedicated to AI/ML in the chemical industry can facilitate knowledge sharing and the development of cutting-edge solutions.

Conclusion

The integration of AI/ML is transforming the Indian chemical industry, offering unprecedented opportunities for growth and efficiency. By overcoming challenges and embracing collaboration, India can position itself as a global leader in the digital transformation of the chemical sector. The journey towards a sustainable and competitive chemical industry lies in harnessing the power of AI/ML to drive innovation and create a brighter future. ■

Driving Accelerated Benefits via Digitalization for Chemical Producers

In the competitive chemicals market, companies with updated digital infrastructure benefit from higher production margins and better sustainability metrics. In recent years, the market has been marked by significant uncertainty, with shortages and high raw materials price, inflation, lower demand and the environmental challenges of emissions and plastic waste pollution. Upgrading digital infrastructure to help design and operate more efficient processes has been one of the leading pathways chemical producers have relied on to address those challenges, writes **Dr. Anahita Khanlari, Solution Marketing Director - Chemicals, Aspen Technology, Inc.**

Chemical producers benefit from digitalization in short, near, and long-term operations. Immediate benefits of digitalization include reduced operating costs, improved production uptime, reduced variability in product streams and improved on-time delivery metrics. For example, it is possible to achieve up to 15 to 20 per cent incremental energy efficiency benefits, as well as corresponding emissions reductions, through digital engineering and advanced control tools. Similarly, on-time delivery enabled by better planning or scheduling will improve margins and help maintain sales targets. In the near and long-term, as the global markets change, digital tools enable producers to stay agile and flexible to quickly respond to change, increase or decrease production, and swap raw materials while maintaining yield and productivity.

New Digital Tools to face Today's & Tomorrow's Challenges

As the chemical markets and demand patterns have evolved and become more complex, so have digital technologies. In today's everyday life, Artificial Intelligence (AI)-enabled tools help consumers find products that fit their needs faster and more accurately. Voice assistants, like Siri and Alexa, interact naturally with users and generative AI tools can aid users in writing and creating art.

In the industrial world, AI-enabled tools are helping engineers and operators to better understand data patterns and guide them for the best course of action. Importantly, however, industrial AI should be combined with first, principles engineering approaches, to ensure AI generated data and conclusions are sensible and do not lead to catastrophic outcomes.

A number of AspenTech AI-enabled solutions are used in different segments of the chemicals production value chain. Starting with supply chain management, planning tools relying on previous demand patterns, help to minimize inventory and increase production margins. Similarly, AI-enabled asset performance management tools constantly monitor equipment performance and plant data and predict failure months in advance. Engineering hybrid models combine first-principles guardrails with AI-based analytical algorithms to simulate hard-to-model processes that lack adequate data for conventional model building. Our new advanced process control tools guide control engineers and provide answers to their questions to achieve best performance.

Many AspenTech partners have benefited from AI enabled solutions for years. Machine learning (ML) and data analysis as well as natural language processing tools have been woven into the fabric of our engineering and advanced process control tools since the early 2000s. For example, Dow Chemical has solved production challenges in a complex reaction unit using ML hybrid models, increasing yields by 10 per cent with immediate benefits in profitability. In another example, Braskem used our deep learning-based APC to adapt to operating conditions, achieving better control, better on spec performance, and a lower energy use. Using Maestro, BASF has been able to build APC controllers quickly and efficiently, replacing several weeks of complex testing and adjustments that needed many hours of professional expertise.

New digital tools bring the best of both conventional engineering and smart features to chemical producers. These tools utilize production's historical data to predict the future and enable corresponding planning and execution. In this way, margin gaps are closed, materials and energy are saved, and production becomes more sustainable.

Digital Solutions to Enable Decarbonization and Circularity

As the chemical industry marches towards decarbonization, digital solutions are playing a pivotal role. Creating a decarbonized chemical operation requires incorporating renewable feedstocks, increasing fuel efficiency, low carbon or renewable sources of energy, minimum blue water use, and minimal waste generation. The challenge lies in reconciling existing operations which may not have been designed primarily for sustainability with the decarbonization and net zero targets. Digitalization is part of the answer to this question.

Digital tools advance sustainability initiatives on several fronts. Starting with quantifying a company's environmental footprint, digital engineering tools help to correct existing workflows or design new ones. Leveraging digital models, engineers can create comprehensive technical and economic evaluations of all available options, helping them choose the right solution. These models can be created in a relatively short amount of time, are accurate and well represent the future of the operation, including energy demand, emissions and product yields. For new processes, digital probability models de-risk projects by identifying bottlenecks and potential sources of future failure. In this way, they allow for considering alternative designs and mitigating risk. Several green hydrogen and ammonia projects have used Aspen Fidelis™ to de-risk their design and operation.

AspenTech digital solutions evolve with market needs and challenges, and sustainability solutions are no exception. AspenTech has created one of the industry's largest (if not the largest) library of sustainability models. These models cover everything from processing biobased feedstocks to producing fuel or chemicals to battery recycling, CCS, plastics pyrolysis, green hydrogen and more. These models combine our expertise and our latest innovations to provide users with a jump start on their sustainability projects. We are excited to not only be part of the industry's transition but also play a fundamental role in it by unlocking possibilities for our users. ■

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GUEST COLUMN

Carbon Capture, Utilization and Storage Deployment in India

Baroruchi Mishra
Partner and Group CEO
NET Enterprise Pvt. Ltd.

India was ranked as the 5th most vulnerable country to climate change as per the Global Climate Risk Index (GCRI) in 2019. GCRI is a measure of how prone is a country to the impact of global warming in terms of floods, drought, heat wave, debilitating cold weather etc. Our ambition to achieve Net Zero by 2070, although a bit late, could yet be missed, if we do not have meaningful strategies for mass removal of CO_2 from the flue gases of coal fired power plants, cement kilns, blast furnaces of steel mills and from the flue gases emitted by numerous other industries as part of their manufacturing processes. 0.4 giga tonnes per year of CO_2 will need to be stored in geological formations by 2050 for India to meet its Net Zero aspiration. **Baroruchi Mishra, Partner and Group CEO, NET Enterprise Pvt. Ltd,** throws more light on this growing concern in India and how important carbon capture, utilization and storage deployment in India is to meet our net zero ambitions.

The Scope-1 CO_2 emissions in industries like cement or oil and gas production from high CO_2 reservoirs, make them hard to abate by any other means than by deploying Carbon Capture, Utilization and Storage (CCUS) – either for permanent storage in geological formations or by using the CO_2 for enhanced oil recovery. For decarbonization of steel production, until such time that there is enough green hydrogen available to adopt the Direct Reduced Iron (DRI) process, and this could be at least 10-15 years away, CCUS deployment is the only option.

Further, if not for CCUS, the option space for the coal based thermal power plant operations are only two:

- Continue to run them while venting CO_2 at average rate of 1 kg/kwh of electricity produced or
- Shut them down and leave them as stranded assets.

Given that thermal power plants meet 65 per cent of our power demand (with 85 per cent of thermal PPs being coal fired power plants), shutting them down is not an option. This is also due to the very high cost involved in abandoning thermal power plants. Consider the case of Germany, which wants to retire all its coal fired power plants by 2038 – roughly about 40 GW. It has to make a provision for USD 45 billion for impacted stakeholders – coal mine and power plant owners and the auxiliary industries owners that support these units.

All technologies needed for delivering a CCUS project are proven and commercialized i.e. they are at TRL9. Virtue lies in now implementing them through some financing support framework. As of end of 2023, 68 CCUS projects were in operation around the globe, 39 under development, and 533 in various planning phases (source: Mckinsey-Global Energy Perspective, CCUS Outlook).

So what is needed to deploy CCUS at pace in India? It would be meeting the intent of this paper if we examined CCUS separately in some detail and understand how Carbon Capture Utilization and Carbon Capture Storage (CCS) can be deployed at scale. For CCS to be deployed in India, following would be some key considerations:

Political will

Political will (and a sense of urgency) shaped by the fact that staying with the status quo poses an existential threat to large population of the country. Creating infrastructure and an enabling project ecosystem for CCS should now become part of the annual budgetary commitments. Given the Net Present Value (NPV)–ve project economics of CCS projects in the absence of viability gap funding in India, private sector will be slow to act in this space. Hence, the government needs to kick-start the CCS projects.

Carbon Pricing

Following from the above, a regulatory framework for carbon–pricing will need to be established. The intention of this should be to impose a cost on carbon (however small), and a cap on CO_2 emissions, for the industries that emit CO_2 as part of their manufacturing or generation process. It is pertinent to note that some form of Carbon Pricing now covers 25-27 per cent of global CO_2 emissions. India can evaluate the possible implementation of various Carbon Pricing mechanisms noted below:

Emissions Trading System (ETS): Implemented in Europe – Individual entities can either implement CO_2 abatement measures to stay within the regulator-imposed limits on CO_2 emissions or buy emission units in the carbon market depending upon the relative cost of these options to them. Two types of ETS are prevalent – Cap and Trade systems and Baseline and Credit systems.

- **Cap-and-trade systems –** Emission allowances up to a cap (absolute limit on permitted CO_2 emissions) are given to the individual entities by the regulator – mostly freely distributed but also through auctions. Allowance units can be traded under the ETS.
- **Baseline-and-credit systems –** Regulator sets the baseline emission levels for an emitter entity. If these entities reduce their emissions below the baseline, they are given credits. These can be sold to those exceeding their limits.

Carbon tax: A price per tonne of CO_2 is imposed as a tax on carbon content of the fossil fuels. Unlike the ETS, this is fixed or pre-determined.

Result Based Finance Framework (RBCF): If the entities meet their emission reduction goals, they receive credits in the form of funds from the regulator. Independent verification is needed to establish if the pre-determined climate related goals such as emission reductions are met.

Setting the Social Cost of Carbon (SSC): SSC is a dollar value today based on a damage function and optimal discounting of the capex that the government needs to spend in future to deal with climate related consequences of global warming. This cost helps the governments justify mitigation related investments/ policies as economically robust. US uses a SCC of USD50/tonne of CO_2.

Notional Cost of CO_2 for FID decision making: Private firms should also use a notional cost of CO_2 as Opex while calculating the life-cycle NPV of projects. They should also set clear targets for sustainable Scope 1 and Scope 2 emissions. Companies like Shell, Exxon and others use a cost of CO_2 in their project economics while taking final investment decision on any project; this helps them earmark funds for CO_2 abatement. Shell, for example, have made high-cost/ high-technology gas-turbine selection to keep their CO_2 emissions from LNG Canada at 0.16t per tonne of LNG produced.

Use of funds

Use of the funds from the carbon tax to subsidies the CCUS projects. As per the World Bank, revenues from carbon taxes and ETSs was USD 95b in 2022 – growth of 10 per cent over the previous year. Roughly, 40 per cent of the collected revenue was earmarked for Green Financing by the governments; approximately 10 per cent was direct transfer to vulnerable sections of the population and firms impacted by climate change (source: Institute for Climate Economics).

The potential to generate a revenue stream in India needs to be explored urgently. Consider this: India produces approximately 375 mt per annum of cement every year. Cement is a hard-to abate sector so a levy or a cess could be justified. If a carbon cess of Rs 5 per 50kg-cement bag is imposed, it could generate a revenue stream of approximately USD 0.45 billion per annum – enough to set up one CCUS hub in the western part of India. This cess will go almost unnoticed by the consumers as the cost of 50 kg bags range from 350 to 450 rupees per bag; Rs 5 per 50 kg increase is approximately 1 per cent increase in cost, which can be part accommodated in the manufacturers' margins and part passed through to the consumer. Similar carbon-cess could be imposed on steel and thermal power with the ambition of using the revenues to fund research and development in CCUS / provide subsidies for emitters to capture and store CO_2.

Identification of Geological Storage

Setting up a central agency that comprises professionals to monitor and expedite the work related to proving up the pore spaces in depleted oil and gas reservoirs, saline aquifers or in young basalts. A separate section can be set up in the Directorate General of Hydrocarbons (DGH) – if not already, for this purpose.

Structured work that moves prospect ranking from 'Basin' to 'Field' to 'Lead' and then to a licensing application is needed. We still need to create a licensing authority and make the regulations regarding the award of license acreages for storage clear. Allowing private players to prospect for pore spaces through a licensing round with some incentives will help the cause.

The finalization of a geological storage should conform to the 5 key pillars of CCUS (this applies to both depleted oil and gas fields and to saline aquifers):

Location and Stakeholders – Population density, Land ownership, and proximity to potable water aquifers supporting the water needs of a community, of the area in which CCUS storage, is being planned are very important considerations.

Capacity: It should be sufficient to meet contracted volumes and future projected increase in injection.

Geological containment – CO_2 has to be stored for over a thousand years – up until it mineralizes. Interestingly, if the storage is in young Basalts, as in ORCA CCUS Capture and Storage plant run by the partnership of Climeworks and CarbFix in Iceland, the CO_2 gets absorbed in its pore spaces of young Basalts and converts to calcium carbonate (mineralizes) within

a few years. Some key considerations for geological containment are:

- Presence of geological sealing mechanism – structural or stratigraphic sealing which do not allow the escape of CO_2 from the designated reservoir(s).
- Seismic activities in the area which could impact sealing effectiveness.
- Well density (number of producer wells or water injection wells in close proximity) which if very high, could provide an escape path for CO_2.
- History of shallow gas hazards, which may point to deep vertical fissures that may provide a flow path, to the stored CO_2 to come to the surface.
- Depth - Sufficient but always greater than 1,000 meters to keep the CO_2 in the dense phase required for injection.

Transport and Infectivity - Costs go up if the transportation of CO_2 for injection is over very long distances (over 1,000 kms) or in the offshore fields. Repurposing existing natural gas pipelines have a distinct cost and schedule advantage, if the asset integrity of the pipeline, is robust and the residual design life meets the CCUS project design-life requirements.

Measurement, Monitoring and Verification (MMV) - MMV is needed to ensure that communities are not impacted, should anything go wrong while CO_2 injection operations are in currency in any field. As an example, the MMV scope has been classified into the following operational monitoring activities for Quest CCS project in Canada (source: Quest Regulator Filing):

- **Atmosphere Domain:** Monitoring of CO_2 levels in the atmosphere at the injection well sites using the Light Source technology.
- Daily operator rounds at the injection well sites.
- **Hydrosphere Domain:** Monitoring of ground water wells on a continuous basis, discrete sampling at project wells
- **Biosphere Domain:** Soil gas and soil surface CO_2 flux measurements.
- **Geosphere Domain:** Monthly satellite image collection for InSAR. A single frame is centred over the injection well pads for image collection.
- Borehole Vertical Seismic Profiling data are collected and processed for interpretation.
- **Well-based Monitoring:** Continuous data collection via wellhead gauges, downhole gauges, downhole micro seismic geophone array, and DTS lightboxes etc.

Setting up the Regulatory Framework

Setting up the regulatory framework (and not a bureaucratic framework). This has two aspects:

- Firming up the applicable codes and standards to act as guide-rails for engineering and design of CCUS projects. This should not be too onerous as the risks of handling CO_2 is relatively lower than that for oil and gas, which are inflammable and can form explosive mixtures quickly.

- Regulations for award of CO_2 storage licenses, delineation of liabilities, subsidies, tax holidays, contracting for difference etc. IEA lists about 89 regulations that are in force in various countries around the world. Some examples : European Union (CCS Directive), Victoria, Australia (Greenhouse Gas Geological Sequestration Act 2008) , Northern Ireland (The Storage of CO_2 Regulations 2015) US (Subpart RR, Class VI – Wells for Geological Storage, Texas Administrative Code, SB498, SB 2139 etc), Canada (Carbon Sequestration Tenure Regulations) etc.

The key question of unlimited liabilities on the CCUS project developer to perpetuity will need to be addressed. A time cap on liability duration after the injection and storage activities are completed for a given field will be needed to get the private players interested. We have examples from the West on how this can be seamlessly managed.

Creation of a Western CCS Hub and an Eastern CCS Hub

Creation of a western CCS hub and an eastern CCS hub, which provide an option for CO_2 emitters to capture their CO_2 and send them to these hubs for further compression, transportation, and ultimately injection, in the designated wells for injection and storage. The

commercial construct for these hubs can be worked out by government department responsible for CCS with the involvement of key players – the providers of the pore spaces and the emitters. Multiple CCS hubs are in operation globally: Porthos – port of Rotterdam, Alberta Carbon Trunk Line (ACTL), Northern Lights in Norway etc.

CCU – Addressing the Utilization Question

Multiple utilization pathways are in operation for CO_2 but at the global level, they will lead to only 10-15 per cent of CO_2 intensity abate; India is no exception. Captured CO_2 is used as raw material for various products like urea but not necessarily with a decarbonization intent; eventually the CO_2 will get back into the atmosphere. Except for the high cost and the fact that utilization pathways are grossly insufficient for India or the world to achieve their net zero targets, there are no risks involved in utilization. For decarbonization – there are generally two ways in which captured CO_2 can be utilized:

- Conversion of CO_2 to chemicals, which could be used as fuel or as circular products. This is highly energy intensive (CO_2 is a stable molecule and needs additional energy to make it unstable so that it can be reformed into other molecules – methanol, methane, syngas, etc.) These serve as energy carriers or as chemicals products.

- **CO_2-EOR:** The other large-scale use of captured CO_2, which is produced along with the oil and gas from the reservoir (Scope-1 CO_2), is from enhanced oil recovery – reinjecting the CO_2 back into the reservoir to push the oil and gas out as a tertiary recovery mechanism. As of 2019 (EIA 2019), a total of 166 EOR projects were active around the world enhancing oil production of 450,000 bbls. This is approximately 500,000 bbls now. Depending upon the type of reservoir and its depletion history, per barrel of enhanced oil production would need 300 kg to 600 kg of CO_2 injection. Compare this with the fact that approximately 400 kg of CO_2 is emitted when completely combusted and approximately 100 kg is used during the production process itself. In this situation, the oil production is CO_2 positive or at best CO_2 neutral. However, if one can deploy technologies to use higher amounts of CO_2, say 900kg per barrel of oil produced, it would be a 'carbon-negative' enhanced oil production, as one-third to half of the CO_2 injected for EOR would remain in the reservoir. In India, except for a pilot in Assam which was started by Oil India, there is no CO_2-EOR being undertaken anywhere. Discussions to start a pilot in Gandhar Field of ONGC is afoot.

EOR and Urea manufacturing accounts for approximately 90 per cent of the total global demand of CO_2. No carbon credits are generated from urea production unless green ammonia and CO_2 from biogenic sources are being used for manufacturing urea.

Utilization is very important nevertheless – it generates significant amount of employment besides helping the reduction of CO_2 intensity, even if it is to a limited extent.

Some other utilization cases of CO_2 that can support India's decarbonization journey are as follows:

Concrete: Concrete production emits 46-48 per cent CO_2 as Scope 1 and little can be done about it other than Capture and Storage in geological formations. And yet, some amount of CO_2, approximately 7-8kg of CO_2 per tonne of cement produced can be used for curing the cement. Special cements – Calcium Silicate based cements can sequester much higher amounts of CO_2 per tonne of cement produced.

Mineralization of CO_2 - Synthetic Calcium Carbonate by capturing CO_2 with brine is another area of research and needs to fast tracked. The synthetic Calcium Carbonate has a growing demand – approximately 100 million tonnes and price range of 300USD/tonne in the US. Used in the pharmaceutical industry.

CO_2 to Methanol – This is a proven technology at commercial scale. As an example, Renewal Hydrogen, Canada produces over 120,000 tonnes per annum of methanol from grey hydrogen and CO_2, which is captured from fossil fuels use. The challenges in this space are higher input energy requirements, high cost of green hydrogen, efficiency and stability of catalyst. The current cost of green methanol ranges from 1,500

to 2,200USD/t; this has to come down to less than 600USD/tonne to be competitive with fossil fuels. Shell, BASF, ThyssenKrupp, TOPSOE and many others are technology providers in this space.

CO_2 to Methane: In the presence of catalysers and green hydrogen, CO_2 can be reduced to methane. This technology is not commercialized yet. While multiple pilots are in operation globally, some companies like the Carmaker Audi, have taken the bold and costly step to make 1,000 Mtpa methane from green hydrogen in the town of Werite in Germany. Conversion of CO_2 to Methane using sunlight and a polymer catalyst that can use the sunlight to reduce CO_2 to Methane are at TRL 2/3 stages. Scale is always an issue with these new technologies.

CO_2 based Polymers - Last on CO_2 utilization, there is a proven pathway to convert CO_2 to CO_2 based polymers, which in turn can be converted to plastics, is promising. India can make a promising start in this space as its plastic needs are high (approx. 20kg per capita per year). Chinese companies are leading in this space; Novomer, now Saudi Aramco, has CO_2 based polymer plastics in its product slate.

Carbon Capture

Cost and efficiency are the two key areas that need to be worked upon to get emitters interested in capturing the CO_2 that they emit. The technology itself is very mature. As per a CCS Institute Report, there are at least 3 technologies using Liquid Solvents (supplied by Flour, Shell, Dow, Aker Solutions, Kerr-McGee, UOP, Linde, Air Liquide) and one technology using Solid absorbent (Air Product - used in Port Arthur SMR CCS) that are at Technological Readiness Level 9. The current cost of post combustion capture ranges from 60-100USD/tonne of CO_2. R&D efforts in this space to reduce costs can do with a lot of support from the government.

HPCL in India has developed a 'HP-HiGas' technology for carbon capture from their hydrogen manufacturing unit. This technology is based on process intensification of separation processes and utilizes a Rotating Packed Bed (RPB) for improving the mass transfer efficiency, which results in significant size reduction of equipment size. This is now being commercialized through a demo-cum-commercial plant being delivered as an EPC scope by Nauvata Energy Transition Enterprise, at the HPCL's Vizag Refinery in Andhra Pradesh.

In conclusion, it can be said that the days of the Nimby's (not in my back yard) are all but over. India is seeing the acute impacts of global warming with the wet bulb thermometer temperature exceeding 33 deg C in many parts of India; at 35+ deg C, there will be mass deaths as the human body's ability to maintain its temperature breaks down. We need to start CCUS (both CCU and CCS) to save the country from titanic devastations.

Wisdom lies in knowing what to do, skill in knowing how to do it but the real virtue lies in actually doing it! A learner mind-set and disciplined delivery are the two wheels that will get us moving on CCUS! ■

Revolutionizing Green Transportation Technology

Aligning with the National Hydrogen mission to position India as a global hub for Green Hydrogen production and export, Indian Railways is introducing its first hydrogen train. GreenH Electrolysis Pvt. Ltd. has bagged the contract to provide the Engineering, Procurement, and Construction of a Hydrogen production and refuelling station for this important and ground-breaking project. **Anil Srikar Pavuluri, Business Development Head, GreenH Electrolysis,** shares insights about this project.

Using hydrogen as fuel provides significant benefits in the direction of green transportation technology as a clean energy source, to support zero carbon emission goals. Indian Railways will introduce its first hydrogen train aligning with National Hydrogen mission to position India as a global hub for Green Hydrogen production and export. Indian Railways plans to launch about 50 such trains by 2047. The 1st Hydrogen train will operate on the Jind-Sonipat section covering a total of 360 km daily vide 2 round trips. The train will be fuelled by India's largest Hydrogen Refuelling station of 420 kg/day at Jind near to the railway station.

This initiative is part of a broader effort to enhance the sustainability and efficiency of the national transporter. This move is part of Indian Railways' broader strategy to reduce its carbon footprint and integrate clean energy solutions into its operations.

Project Stakeholders

Northern Railways: Owner of the Project.

Medha Servo Drives Pvt. Ltd., Hyderabad: Northern Railways has awarded this pilot project to Medha for the retrofitment of a Hydrogen Fuel cell on an existing

Hydrogen Fuel Cell Locomotive

Diesel Electric Multiple Unit (DEMU) rake along with ground infrastructure, which is planned to be run on the Jind-Sonipat section of the Northern Railway. Medha entrusted GreenH Electrolysis Pvt. Ltd. the contract to provide the Engineering, Procurement, and Construction (EPC) of a Hydrogen production and refuelling station for this important and ground-breaking project.

GreenH Electrolysis Pvt. Ltd., Gurgaon: GreenH Electrolysis is Original Equipment Manufacturer in PEM Electrolyser technology, a Joint Venture company of H2B2 Electrolysis Technologies, Spain. Project scope includes complete Hydrogen Production and Hydrogen Refuelling station EPC, integration, interconnection, construction, commissioning, and testing. Scope also includes 5 year Long Term Service Agreement (LTSA) with production guarantees and plant availability to Indian Railways.

Project Details

Electrolyser

- 1MW PEM Electrolyser producing 430 kg/day Hydrogen at 40 bar and 99.99 per cent purity suitable for use in Fuel Cell Hydrogen train. Containerised solution suitable for ambient -5^{0}C to +55^{0}C.
- Electrolyser manufactured by GreenH Electrolysis Pvt. Ltd. at Jhajjar, Haryana with support from its parent H2B2 Electrolysis Solutions, Spain.
- Produces approximately 430 kg/day hydrogen, enough to fuel the Hydrogen train to run more than 400 km per day.

1MW PEM Electrolyser being assembled at GreenH factory, Jhajjar, Haryana

Compressor

Diaphragm compressor, compressing from 40 bar to 500 bar. Accompanied by buffer vessel to stabilize the flow. Compressor is in a containerised solution with a main block imported from USA and assembly of the compressor carried out in India.

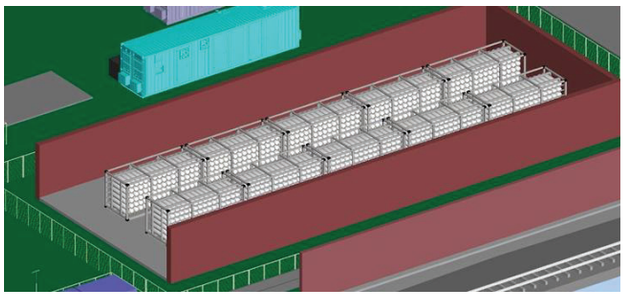
>500bar diaphragm compressor*

Dispenser

- H35 Dispenser with TK16 nozzle and infrared communication. Accompanied by T20 chiller. Dispensing 210 kg/hr with average flow rate of 3.6 kg/min.
- Two nos. dispenser allocated for each Driving Power Car (DPC) and dispensers are located 210 m away.
- Simultaneous filling into train dispensing total 420 kg in 1 hour to 2 nos. of DPC.
- Dispenser is manufactured in India following all Petroleum & Explosive Safety Organisation (PESO) approvals.

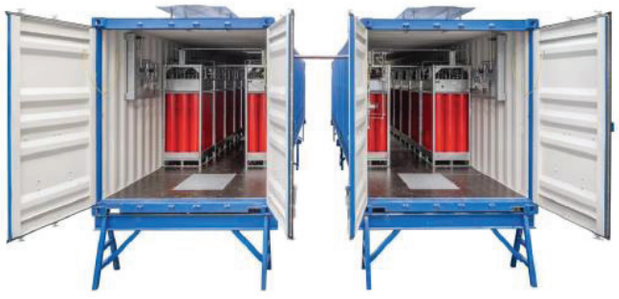
H35 Dispener with T-20 precooler*

Storage



Back-up storage with concrete wall*

- Total 3,000 kg storage is envisaged which is by far the largest on-ground Hydrogen storage in India.
- 3,000 kg is split into Type-I and Type-IV storage.
- Approximately 2,300 kg stored in Type-I steel cylinders at 200 bar, which is utilized as a back-up storage. This storage is protected with a 3 meter high fire protection concrete wall.



Containerised Type-IV cylinders*

- Balance 700 kg is stored in Type-IV composite cylinders at 500 bar used for daily purpose filling. Type-IV cylinders are better suited for high pressure storage and used for continuous refuelling. Being composite cylinders, embrittlement issues are negated. These are again split into two parts catering to each dispenser.

Challenges

- Longest train with two dispensers located 210 metres away.
- Filling both coaches at same time within same time limit.
- 1st time approval of 500 bar Type-IV cylinders.
- Largest on-ground high pressure Hydrogen storage of 3,000 kg.
- Complicated fuelling protocol.

Mitigation Plans

- Comprehensive planning to get the approval of Type-IV 500 bar cylinders by PESO. Lot of documentation, design approvals, drawing reviews, factory visits, final acceptance tests etc. are carried out timely for a smooth execution of the project.
- Developing multiple fuelling simulations, and devising the most complex and accurate fuelling simulation, employing Tk16 nozzle with infrared communication ensuring Hydrogen temperatures inside the train cylinders within prescribed limits.
- Employing trench hydrogen piping and cabling with protective fencing all around the 210 m length prohibiting invasions and for safer plant operation.

The execution of this ground-breaking project is ongoing and in full swing by GreenH Electrolysis Pvt. Ltd. Post-commissioning (in 2024), it will pave the way and set an example for many such Hydrogen projects in India. India's 1st Hydrogen train project is of national importance and heralds a new era for the Indian Railways. This ambitious project signifies India's commitment towards a cleaner and greener future. ■

** representative pictures*

Author

Anil Srikar Pavuluri
Business Development Head
GreenH Electrolysis Pvt Ltd

Green Ammonia: Revolutionizing the Transport of Green Hydrogen

It is well-known that green hydrogen is a game changer in our move towards a sustainable environment, however its transportation poses challenges. Ammonia, with its existing infrastructure, higher energy density, and ease of storage, offers a practical solution for overcoming these challenges. By revolutionizing hydrogen transport, green ammonia helps make the transition to a cleaner energy future more achievable and efficient. **Parag Chepe, Chief Engineering Officer & Executive Director – thyssenkrupp Uhde India Private Limited,** describes how green ammonia presents a promising solution for transporting hydrogen.

Green hydrogen is produced through a process called electrolysis, where water (H_2O) is split into hydrogen (H_2) and oxygen (O_2) using electricity. When this electricity comes from renewable sources like wind, solar, or hydropower, the hydrogen produced is termed 'green hydrogen.' This process emits no greenhouse gas emissions (GHGs), making it a clean energy solution.

The potential of green hydrogen to reduce greenhouse gas emissions across various industries such as refinery, chemicals, fertilizers, steel, energy, etc., has led to significant interest and investment. The National Hydrogen Mission (NHM) Initiative launched by the Government of India, is a significant step towards making India self-reliant in the production and even export of green hydrogen. The budget for the current fiscal year saw a 100 per cent increase in the funds allocated to the NHM, underscoring the importance of this small molecule.

Green hydrogen can be used as a fuel and raw material across various industries. In refineries, it can replace hydrogen derived from natural gas, cutting down CO_2 emissions. It can be used to produce green chemicals, decreasing reliance on fossil fuels. In the fertilizer industry, green hydrogen is essential for producing ammonia and minimizing carbon emissions. In steel production, hydrogen can replace coal, leading to a substantial reduction in CO_2 emissions. Additionally, green hydrogen can be stored and used to generate electricity, offering a reliable and carbon-free energy source. In the mobility sector, hydrogen fuel cells can power vehicles, with the only emission being water vapour. Green hydrogen has diverse applications that significantly reduce CO_2 emissions across various sectors.

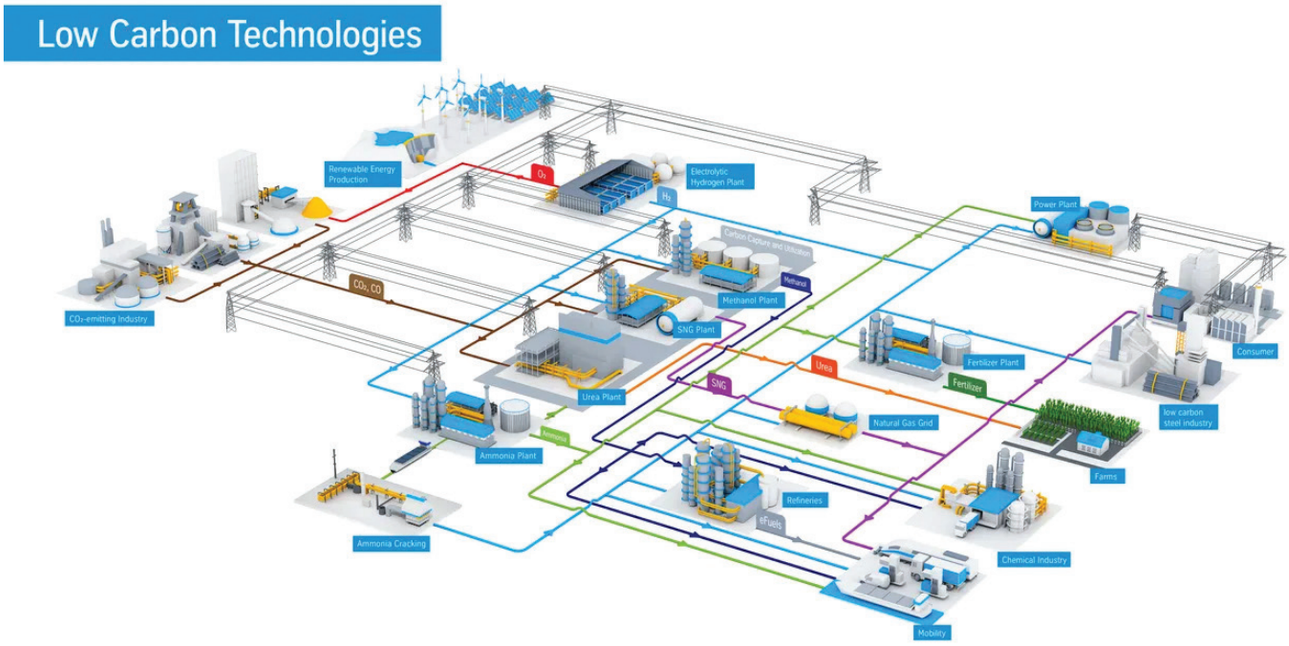
Challenges with Transporting Green Hydrogen

Despite its potential, transporting green hydrogen poses several challenges:

Highly Inflammable: Hydrogen is highly inflammable and requires very low ignition energy to start burning.

Material Penetration: Due to its low molecular weight and small size, hydrogen can easily penetrate the grain structure of materials and potentially destroy them, depending on the temperature and pressure.

Liquefaction Challenges: To increase the density for transport of hydrogen efficiently, it must be compressed to high pressures and/or cooled to very low temperatures, both of which require significant energy. Liquefying hydrogen requires cooling it down to -253°C at atmospheric pressure, consuming around 30-40 per cent of its energy content.



How Green Hydrogen Can Be Transported

Keeping these challenges in mind, several methods can be considered for transporting green hydrogen:

Pipeline Network: Compress and introduce hydrogen into a pipeline network, allowing consumers to receive it over distances. This method is limited by the lack of hydrogen pipeline infrastructure in most countries and requires special material considerations based on hydrogen's pressure and temperature.

Compressed Gas Transport: Compress hydrogen gas and transport it via pressurized gas tankers. This method is limited by the low density of hydrogen, restricting the amount that can be transported in one tanker.

Cryogenic Liquid Transport: Liquefy hydrogen and transport it as a cryogenic liquid. This method allows for larger quantities to be transported across countries or continents using ships. While liquid hydrogen has a higher energy density than compressed gas, it requires significant energy to liquefy.

Liquid Organic Hydrogen Carriers and Metal Hydrides: Use Liquid Organic Hydrogen Carriers (like methyl cyclohexane) or convert hydrogen into metal hydrides for transport.

Ammonia Conversion: Convert hydrogen into green ammonia, which is more easily transportable as a cryogenic liquid at -33°C. This method shows significant promise for hydrogen transport.

Why Green Ammonia?

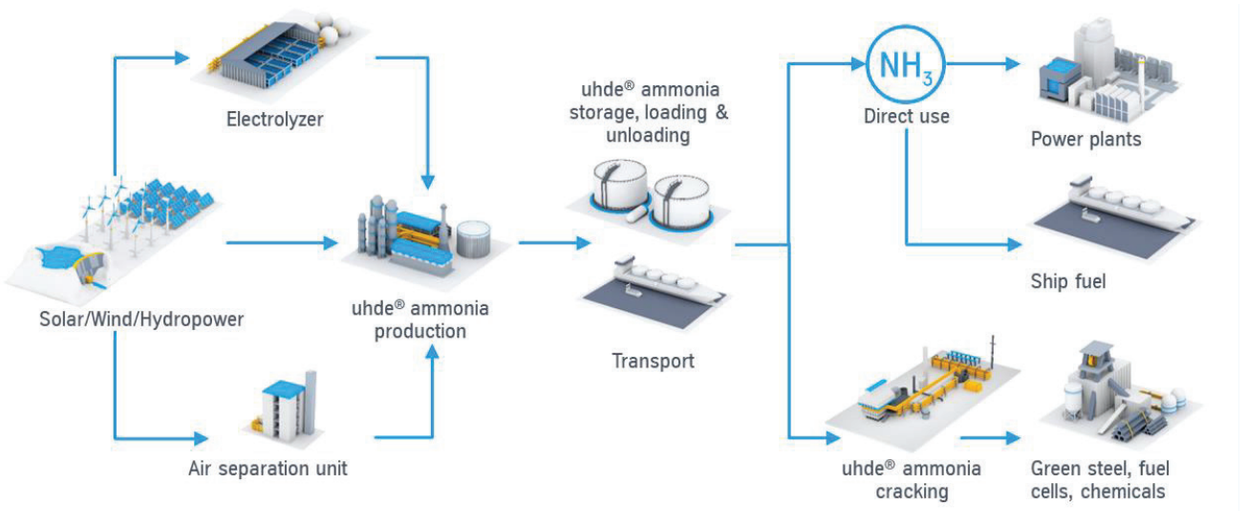
Green ammonia presents a promising solution for transporting hydrogen. Here are some key reasons:

Established Technology: The production of ammonia from hydrogen has been in practice for several years, ensuring that the technology for converting hydrogen to ammonia is well-established and reliable.

Existing Infrastructure: Millions of tons of liquid cryogenic ammonia are already transported globally using ships and pressurized road tankers, supported by a robust infrastructure for ammonia transportation.

Higher Energy Density: Cryogenic liquid ammonia has a higher energy density.

To produce green ammonia, green hydrogen is reacted with nitrogen in a Haber-Bosch Gas Synthesis process. The required nitrogen can be produced using renewable energy through air separation. Green hydrogen/green ammonia production can occur where renewable power is available at a competitive price, while consumption can be far away. For example, green hydrogen and green



ammonia could be produced in India and consumed in Japan. Thus, storing and transporting green hydrogen/ammonia over large distances is necessary, typically done by ships and large vessels. This also necessitates installing cryogenic storage at the ports of dispatch and receipt for green ammonia. However, many ports worldwide are already handling ammonia, so the maturity level of the whole infrastructure – ships, pipelines, storage tanks – has a very high maturity level.

Once received, green ammonia can either be used as is or converted back to green hydrogen by cracking. Cracking ammonia back into hydrogen and nitrogen is crucial for utilizing the hydrogen stored in ammonia. Developing efficient ammonia cracking technologies is vital for the widespread adoption of this transport method.

Government support is essential for the adoption of green ammonia. This includes funding for research and development to improve production and transportation technologies, as well as investment in infrastructure. Clear regulations need to be established, alongside financial incentives like subsidies and tax breaks to lower costs and encourage initial private investment and grow up on the learning curve. Public-private partnerships can help accelerate progress, while education and training programs will build the necessary expertise. Policies promoting green ammonia as a cleaner alternative to fossil fuels, along with market mechanisms to ensure profitability, are also crucial.

Green ammonia represents a significant step forward in the transport of hydrogen. Not only does it promise cleaner production methods, but it also significantly reduces the impact of global warming. Successfully adopting and establishing an ecosystem where green hydrogen is readily available and accessible is a significant task for the industry.

After all, isn't this what the planet needs now? ■

Author

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Chief Engineering Officer & Executive Director
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Optimizing Refinery-Petrochemical Integration for a Sustainable Future

Integrating refinery and petrochemical operations offers a significant opportunity for energy optimization and waste reduction. As the global demand for energy and materials continues to grow, the move towards a more unified and eco-friendly production process becomes increasingly vital for the planet's long-term health, writes **Pramod Shinde, Assistant General Manager - Oil, Gas & Chemicals - Project Management, Burns & McDonnell.**

Refineries traditionally convert crude oil into valuable fuels such as gasoline, diesel, and jet fuels. Petrochemical plants produce chemicals and materials like plastics, fertilizers, and solvents from oil and gas derivatives. These facilities often operate independently despite their interrelated operations, leading to inefficiencies and increased environmental footprints.

The industry can achieve higher efficiency and sustainability by harnessing the potential of coprocessing, where refineries can simultaneously produce fuels and petrochemicals. This approach not only maximizes the value extracted from each barrel of crude oil but also minimizes the environmental impact by reducing the carbon footprint and lowering emissions.

Global Energy Sector

The energy sector is experiencing a significant shift on a global scale. The rise in demand for electric vehicles and efficiency improvements has led to a shift towards renewable energy sources. This has further resulted in reshaping the energy industry and declining demand for oil-based fuels, particularly gasoline. Globally, refineries that can process nearly 100 million barrels of crude oil daily, are facing reduced utilization rates. This trend is expected to lead to a contraction in profit margins and could result in the closure of less efficient plants.

However, the demand for petrochemical feedstocks, such as ethane, LPG, and naphtha, is forecasted to grow with rising global wealth. This presents an opportunity for refineries to adapt by increasing their output of these feedstocks, which are essential for producing polymers for plastics, synthetic fibers, and other petrochemical intermediates.

Globally, more than 30 per cent of refineries are now integrated with commodity petrochemicals, benefiting from diversified product slates and the potential to unlock more excellent value through economies of scale and operational cost synergies. This integration allows for the co-production of on-specification gasoline at a reduced rate while maintaining crude capacity and producing higher-value petrochemicals.

The Indian Context

As India looks to its future in this sector, it can draw lessons from the global movement towards integration, delivering long-term viability and competitiveness in a world that increasingly values sustainability and efficiency.

India's energy sector relies heavily on fossil fuels, with oil and natural gas playing crucial roles. Despite having one of the largest refining capacities globally (5 million barrels/day, which is 4th largest refining capacity globally behind China (18.5 million barrels/day), USA (18.4 million barrels/day) and Russia (6.8 million barrels/day, as of 2023), inefficiencies persist due to the separation of refining and petrochemical operations. The growing demand for petrochemical products and the need to minimize carbon footprints underscores the importance of integrating these sectors.

Benefits of Refinery-Petrochemical Integration

The strategic amalgamation of refinery and petrochemical operations heralds a new era of industrial synergy, offering many advantages beyond resource optimization and feedstock versatility. By channeling by-products such as naphtha into the production of petrochemicals, this integration not only curtails waste but also slashes operational expenditures, thereby amplifying profit margins. Facilities that embrace this integrated model exhibit remarkable adaptability to a diverse array of feedstocks, encompassing both renewable resources and recycled materials, which is pivotal in today's resource-conscious landscape.

Thanks to state-of-the-art energy management systems and sophisticated heat recovery mechanisms, integrated complexes are at the forefront of energy conservation. These innovations are crucial in diminishing energy demands, curtailing greenhouse gas emissions, and fortifying the commitment to environmental stewardship. The shared infrastructure of these complexes paves the way for substantial cost reductions, spanning from minimized transportation needs to the realization of economies of scale. This economic efficiency positions integrated operations at a competitive vantage point globally.

The integration process enhances products' intrinsic value. Steering production towards higher-value commodities opens avenues for market diversification and bolsters profitability. The capacity to fulfill the escalating demand for fuels and petrochemicals is a testament to the operational efficacy of these facilities, which in turn catalyzes economic proliferation and buttresses a multitude of industries.

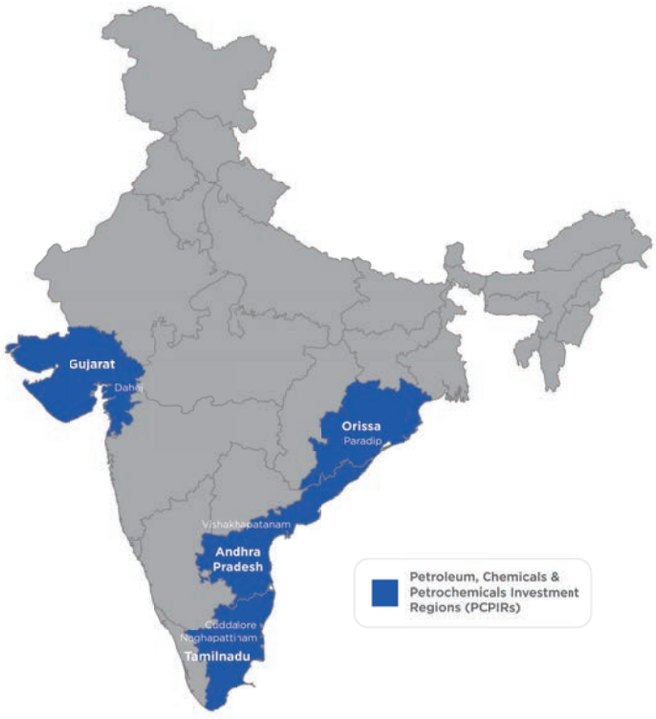
Deploying innovative technologies such as digitalization, Artificial Intelligence (AI), and the Internet of Things (IoT) further refines operational precision and augments safety protocols. The economic resilience afforded by a diversified product portfolio delivers that integrated complexes can more easily weather market volatility.

Beyond the industrial realm, integrated complexes benefit local communities by spurring job creation and fostering the development of specialized skills. This socioeconomic uplift is integral to the broader narrative of progress and prosperity.

In the grand scheme of environmental conservation, the unification of the energy and petrochemical sectors is a significant stride towards reducing the collective carbon footprint. This alignment with global climate goals underscores the imperative for sustainable practices and reinforces the industry's role in shaping a greener future.

Key Strategies for Optimization

Enhancing Operational Excellence through Advanced Process Control (APC): The deployment of APC systems is pivotal in operational performance. These systems deliver conditions that are maintained



Source: IndiaChem-2024-FICCI-Department of Chemical & Petrochemicals, Ministry of Chemicals and Fertilizers, Government of India.
Note - This map is meant to be for illustrative purposes only. It indicates PCPIRs regions in India.

at their optimum levels by perpetually monitoring and fine-tuning process parameters. The result is a dual benefit of heightened efficiency and diminished energy usage, which bolsters industrial processes' stability and dependability.

Embracing Digital Transformation with Industry 4.0: Integrating the Internet of Things (IoT), Artificial Intelligence (AI), and expansive data analytics marks a significant leap toward comprehensive digitalization. These technologies are instrumental in achieving seamless integration, offering instantaneous monitoring, anticipatory maintenance, and strategic decision-making based on robust data analysis. The outcome is a more synchronized and efficacious management of intricate processes.

Carbon Management via Carbon Capture and Utilization (CCU): Incorporating CCU solutions presents a formidable strategy in the quest to curtail carbon emissions. By capturing carbon dioxide and repurposing it as a raw material for chemical and fuel production, these technologies help alleviate environmental impacts and pave way for new economic opportunities through the commodification of captured carbon.

Cultivating Synergy and Fostering Innovation: Building bridges between and among the industrial sector, academic circles, and research entities is essential for technological innovation. Collaborative ventures and shared research endeavors can catalyze significant advancements, enhancing integration technologies' efficiency and ecological footprint.

The Government of India, vide 'Policy Resolution for Promotion of Petroleum, Chemicals and Petrochemical Investment Regions (PCPIRs),' has approved four PCPIRs in Andhra Pradesh (Vishakhapatnam), Gujarat (Dahej), Odisha (Paradeep), and Tamil Nadu (Cuddalore and Naghapattinam) to promote investment and industrial development. These regions are envisioned to reap the benefits of co-siting, networking, and greater efficiencies through shared infrastructure and support services.

Conclusion

Optimizing refinery-petrochemical integration is essential for a sustainable energy sector. It improves resource efficiency, reduces emissions, and enhances economic viability. As the world shifts toward cleaner energy sources, this integration will be crucial in meeting significant global sustainability goals.

Balancing energy demands with environmental sustainability is a significant challenge for India. Refinery-petrochemical integration offers a strategic opportunity to enhance resource efficiency, reduce environmental impact, and strengthen energy security. This approach is a step towards sustainability and a leap towards a resilient and prosperous future.

The future of this integration depends on continued innovation and collaboration. Government, industry leaders, and stakeholders must work together to develop supportive policies and frameworks. The industry can lead the way to a sustainable future by embracing technology and a holistic approach. ■

Author

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Assistant General Manager - Oil, Gas & Chemicals - Project Management
Burns & McDonnell

ReactRaman™ 802L: Bringing Compositional Analysis to Every Laboratory

At Mettler Toledo, we simplify Raman spectroscopy with the ReactRaman™ 802L, bringing compositional analysis to every laboratory. From data collection to analysis, automated parameter selection ensures accurate data and meaningful scientific insights, allowing one to get control results right the first time, every time, in every process stream.

Compact Performance: The compact design of the ReactRaman™ 802L offers class-leading performance with excellent stability and reliability software. It is adaptable for development in both the laboratory and pilot plant, combined with industry-standard software to ensure inherent safety and consistent results.

Information-Rich Experimentation: Data acquisition and analysis are quick and easy with the industry-standard iC software for reaction analysis. This software seamlessly integrates with ongoing operations, providing a comprehensive process understanding and enabling efficient and information-rich experimentation.

Shared Expertise: The global team at Mettler Toledo is committed to ensuring successful process integration, offering expert support through training and application development, available both in-person and virtually whenever needed.

The ReactRaman™ 802L guides users to high-quality reaction information from in-situ and real-time composition analysis. Whether monitoring polymorph transitions during crystallization, studying reaction kinetics, or investigating downstream bioprocess variables, it provides in-depth understanding of key reaction aspects. This allows scientists to make informed decisions quickly. The high-performance spectrometer, coupled with an intuitive, integrated software platform, ensures reliable and high-quality reaction information from every experiment.

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. ■

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A Journey Towards Cleaner Fuel: KHT Project at BPCL Mumbai Refinery

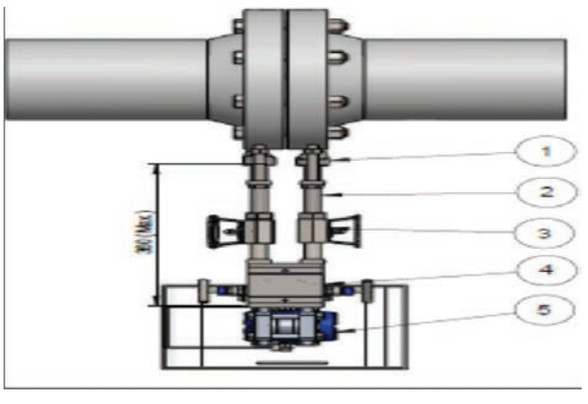
A refining hub and a net exporter of petroleum products, India, has an installed refining capacity of 256.8 MMT as on April 1, 2024, with majority (around 65%) being held by PSU refiners and their subsidiary/joint venture companies. BPCL, one of the leading PSU company of India, has oil refineries, wide marketing network and presence in upstream activities as well. Overall crude refining capacity of BPCL is 35.3 MMTPA out of which Mumbai Refinery (MR) contribution is 12 MMTPA.

BPCL Mumbai Refinery (MR) had commissioned 1.5 MMTPA Capacity Kerosene Hydrotreater Unit (KHT) in Feb'23. The unit was integrated with the existing Diesel Hydrotreater (DHT) unit having capacity of 2.83 MMTPA, to optimize space and inter-unit distances through sharing of heat load, recycle gas, amine & wash water facilities. The unit upgrades high sulfur kerosene to ultra-low sulfur Superior Kerosene Oil, Aviation Turbine Fuel, Mineral Turpentine Oil and High-Speed Diesel making it environment friendly.

The project was executed in collaboration with reputed licensors, experienced project management consultants (PMC), and main contractors. The project involved 95 numbers of equipment, including 48 over-dimensional items. The project was completed and commissioned safely in just 22 months, without any Loss Time Accident, despite the COVID-19 pandemic. This achievement was made possible by the dedicated efforts of the Mumbai Refinery Team, with support from all internal and external stakeholders while maintaining the timeline and cost of the project.

The project team had adopted various execution strategies which facilitated faster execution. Some of the key strategies are mentioned below:

- Site readiness by removal / relocation of existing facilities to match project schedule.
- New initiatives viz. High Integrity pressure protection system (HIPPS), Prefabricated Pipe spools, Prefabricated Instrumentation hook-ups, Dual redundant Variable Frequency Drive (VFD) for Recycle gas compressor (RGC).
- Early commencement & completion of OSBL activities related to associated units during their respective shutdowns facilitated Project commissioning.
- Early formation of Pre-commissioning task force leading to synergy with other stakeholders.
- A new warehouse for storage of project material was constructed to facilitate KHT supplies.
- Continuous interaction with vendors for timely delivery of material.



- Construction of new approach road beside project plot for simultaneous working by multiple contractors.
- Carrying high pressure circuit dry out without commissioning DHT reactor effluent circuit. The KHT feed is preheated with the DHT reactor effluent, which couldn't be commissioned due to incomplete flare systems. To overcome this, a dedicated MP steam line was used to heat circulating N_2 via the KHT feed heat exchanger, saving 11 days in the commissioning process.

New Initiatives at MR for KHT Project

Prefabricated Piping Spools: For the first time in BPCL group refineries, prefabricated spools were used for entire project piping jobs. Use of prefabricated spools helped in reducing total procurement and construction time, enhanced safety, and quality.

Prefab Instrument Hook-up: Prefabricated Instrument Hook-up were installed for measuring process pressure and flow. Prefabricated Instrument Hook-ups are a convenient way of eliminating impulse piping by using sandwich construction valves. Use of such hookups helped in reduced testing requirements at site as it is pretested at factory, reduced number of welding joints at site and faster erection.

High Integrity Pressure Protection System (HIPPS): HIPPS is used in KHT project. The use of HIPPS for hot feed lines minimizes flare load during power failure scenarios. With the help of HIPPS, the adequacy of existing flare in MR was ensured.

Dual Redundant Hot Standby VFD with DOL facility for RGC: Dual Redundant Hot Standby VFD system with DOL facility is provided for KHT RGC HT Motor. It is first of its kind in BPCL facilitating auto changeover from one VFD to another automatically without affecting the process parameters.

Awards: KHT Project has won IndSTT Trenchless Excellence Award 2022 for Best Project Management, Best Project, HSE and 13th CIDC Vishwakarma Award 2022.

Safety: Multi-tier Safety approach Including Dedicated External Safety agency for enhanced safety, helped us in achieving 3 million manhours without lost time accident. Key safety features are as mentioned below:

- State of Art Process Interlocks for automatic safe shutdown.
- High Integrity Pressure protection system (HIPPS) Installed at Feed lines to make Flare KOD adequate (as per OISD 106) for revised liquid flare.

- One emergency depressurization valve (HP Circuit).
- Provision of HC, H_2S and H_2 leak detectors at strategic locations.
- Closed Blow down and Amine Blow Down system.
- Closed loop sampling for H_2, HC and Amine.
- Sour Gas processing in existing ATU facility.
- Sour Water processing in existing SWS- facility.

The successful completion and commissioning of the KHT project at BPCL Mumbai Refinery marks a significant milestone in the journey towards producing cleaner fuels. The integration of innovative technologies and strategies, along with the collaborative efforts of all stakeholders, underscores BPCL's commitment to operational excellence and environmental sustainability. This project not only enhances the refinery's capability to produce ultra-low sulfur fuels but also sets a benchmark for future projects in terms of efficiency, safety, and environmental stewardship. ■

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DOMESTIC

Oil Gas & Power World Expo 2025

Date: 5-7 March 2025

Venue: Hall 4, 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

HTS 2024

Date: 4-6 September 2024

Venue: Bombay Exhibition Centre, Mumbai

Details: International exhibition on heat treatment

Organiser: Tafcon Projects India Pvt. Ltd

Contact: +91-11-49857777

Email: htsexpo@tafcon.in

Website: https://htsindiaexpo.com/

Boiler India 2024

Date: 25-27 September 2024

Venue: CIDCO Exhibition & Convention Centre, Navi Mumbai

Details: Global conclave of boiler and allied industries under one roof

Organiser: Orangebeak Technologies Pvt Ltd

Contact: 84463 02245

Email: anosh@orangebeak.com

Website: https://india.boilerworldexpo.com/

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

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Refining India 2024

Date: 9-10 September 2024

Venue: New Delhi

Details: Refining India 2024 will address a range of crucial topics, from enhancing profitability and optimising FCC unit performance to improving refinery turnarounds and accelerating carbon capture deployment.

Organiser: PTQ magazine

Contact: +44 7841 699 431

Email: sales@petroleumtechnology.com

Website: https://refiningindia.com/

Valve World Expo

Date: 19-20 September 2024

Venue: Hall 3, Bombay Exhibition Centre, Mumbai

Details: A premier exhibition and convention dedicated to industrial valves and valve accessories

Organiser: Messe Düsseldorf India and Global Flow Control

Contact: +91-79820 33911

Email: g.punetha@globalflowcontrol.com

Website: https://valveworldindia.com/

INTERNATIONAL

Middle East Produced Water Oilfield Symposium & Exhibition

Date: 17-18 September 2024

Venue: Marsa Malaz Kempinski, The Pearl – Doha, Qatar

Details: The 2024 Qatar edition will serve as a paramount platform for addressing the latest challenges, exploring opportunities, showcasing innovations, discussing technological advancements, navigating environmental regulations and delving into water treatment and reuse within the realm of produced water management.

Organiser: Energy Technical Exchange

Contact: +971 55 737 4341

Email: info@energy-te.com

Website: www.meproducedwater.com

Smart Process Manufacturing Congress

Smart Process Manufacturing Congress

Date: 24-25 September 2024

Venue: Vogel Convention Center Würzburg

Details: The Smart Process Manufacturing Congress provides a holistic and highly topical overview of the digital transformation in the chemical and process industry.

Organiser: Vogel Communications Group

Contact: +49 931 418-2516

Email: sina.zorn@vogel.de

Website: www.smart-process-manufacturing.de

JEC World 2025

Date: 4-6 March 2025

Venue: Paris-Nord Villepinte

Details: JEC World is the global trade show for composite materials and their applications.

Organiser: JEC

Email: hotline@jeccomposites.com

Website: www.indiachem.ficci.in

Gastech 2024

Date: 17-20 September 2024

Venue: George Brown Convention Centre, Houston, USA

Details: It is the largest global energy conference focusing on Gas, LNG & Hydrogen sectors.

Organiser: dmg events

Contact: +44 (0) 20 4551 1602

Email: sales@gastechevent.com

Website: www.gastechevent.com

KHIMIA 2024

Date: 21-24 October 2024

Venue: Expocentre Fairgrounds, Moscow, Russia

Details: A meeting place for chemical manufacturers, service providers, suppliers of the latest equipment, materials and technologies, and consumers from all over the world.

Organiser: Expocentre

Contact: +7 (499) 795-37-99

Email: centr@expocentr.ru

Website: www.chemistry-expo.ru

Plastex 2026

Date: 11-14 January 2026

Venue: Cairo, Egypt

Details: The largest plastics and rubber exhibition in the Middle East and North Africa

Organiser: dmg events

Email: plastex.sales@plastexegypt.com

Website: www.plastexegypt.com

YSTRAL Coflow: Continuous Powder Wetting & Dispersing Machine

The YSTRAL Coflow is a continuously operating inline powder wetting and dispersing machine for the production of dispersions. With the YSTRAL Coflow, powdered solids are inducted, mixed and dispersed into liquid streams in a controlled way and in proportion to quantity via volumetric or gravimetric solid dosing systems. The powders and liquids are combined in a premixing zone, fine dispersion then occurs via a rotor-stator system, whereby the dispersing tools can be designed with different slot widths depending on the application. The product is subjected to a pressure increase via an inducer installed between the premixing zone and the rotor-stator zone, which causes separation of the air inducted with the powder, thus resulting in a lower residual air content in the product. In the chemical industry, YSTRAL Coflow for example is suitable for the production of adhesives, coatings, polyester resins or silicone sealants. For its market launch, the YSTRAL Coflow is available in Coflow-4 size for production with an overall throughput of 6,000-13,500 kg/h. ■

Diaphragm Control Valve

The Diaphragm Valve from Pneucon Valves Pvt Ltd is a simple pinch clamp, closed by pressing a flexible diaphragm against transverse weir, when fully closed, the diaphragm seats against the weir providing a leak tight closure. The diaphragm valves are recommended for handling sticky and viscous fluids, slurries and highly corrosive and hazardous substances and other hard-to-handle mediums or where tight closure is prime factor. It is the most ideal valve to handle fluids that require high purity and should remain free from contamination. The Diaphragm Valve is a simple pinch type valve and of low pressure type because of large area of diaphragm and is extensively used for both on/off and throttling services and finds its application in waste and water treatment plants, filtration plants, chlorination plants etc. ■

PowderAdd™ 9780 from Lubrizol

Lubrizol announces the launch of PowderAdd™ 9780, a new wax additive that enables formulators to achieve fine texturing effects in powder coatings with a host of additional benefits. PowderAdd 9780 is a PTFE-free wax additive for use in powder coating formulations to provide a range of benefits for industrial OEM applications. Primarily, it delivers fine texturing effects for a unique visual appearance. It also enhances scratch resistance, slip control, and metal marking resistance. And with its inherent matting efficiency, formulators can also reduce complexity by eliminating the need for additional matting agents. ■

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International Integrated **ENERGY** Exhibition & Conferences

Oil Gas & Power

World Expo 2025

5-7 March 2025

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

Oil&GAS World Expo 2025 | POWER + COAL World Expo 2025 | Nuclear ENERGY World Expo 2025 | GREEN ENERGY & HYDROGEN World Expo 2025 | GAS WORLDTECH Expo 2025 | Refining & Petro CHEMICALS 2025 | SMP Shipping, Marine & Ports WORLD EXPO 2025 | Surface Engineering Coating & Corrosion World Expo 2025

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Director (Production)
ONGC Limited & Chairman
Oil & Gas World Expo 2025

Mr. Subramanian Sarma
Wholetime Director & President (Energy)
Larsen & Toubro & Co-Chairman CAB, **Oil & Gas World Expo 2025**

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

Mr Arvind Kumar
Director Refineries, IndianOil
Chairman CAB,
Refining & Petrochemicals World Expo 2025

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

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NTPC Ltd. & Chairman,
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Oil & Gas World Expo 2025

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Former Director Projects, NTPC Ltd. & Patron,
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Former Director Exploration & Addl Charge- CMD, ONGC Ltd & Convener
Oil & Gas World Expo 2025

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Gas World Tech Expo 2025

Concurrent Conferences: Oil & Gas | Natural Gas & LNG | Refining & Petrochemicals | Power & Coal | Nuclear Energy | Green Energy & Hydrogen Shipping, Marine & Ports | Surface Engineering Coating & Corrosion Control | Student Outreach Program

EXHIBITOR GROUPS

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

NATURAL GAS & LNG
- Natural Gas Marketing
- City Gas Distribution
- Transportation & Storage Infrastructure

REFINING
- Oil Refining
- Marketing
- Petrochemicals Manufacturing
- Technology Licensors

POWER
- Power Generation
- Technology Licensors
- Power Transmission & Distribution
- Infrastructure

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

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

SHIPPING MARINE & PORTS
- Shipping Services
- Ports
- Inland water ways
- Transportation Warehousing
- Supply Chain Management
- Material Handling & Supply Chain Management
- Logistics Services

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

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

FACTS AND FIGURES OIL GAS & POWER 2023

3 DAY TRADESHOW

201 EXHIBITORS & PARTNERS

8897 VISITORS FROM 28 COUNTRIES

192 VIP GUESTS

5 CONFERENCES

853 DELEGATES

147 SPEAKERS

670 ENGINEERING UNDERGRADS FROM 23 C OLLEGES ACROSS INDIA

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

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