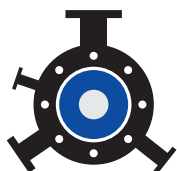


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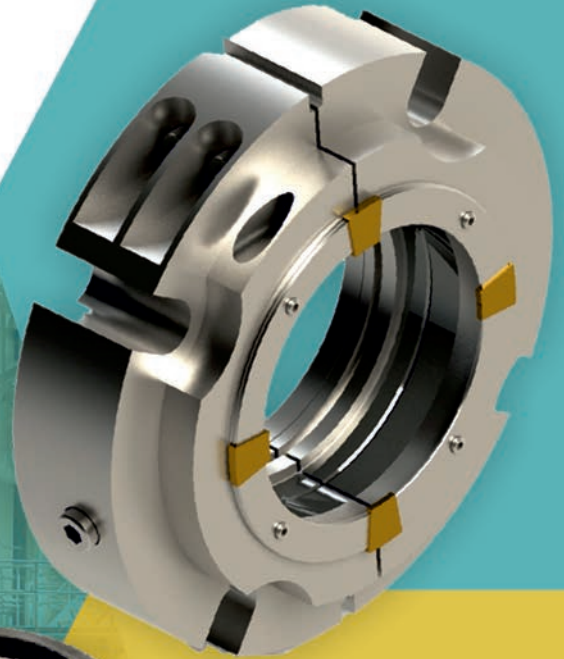


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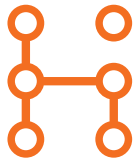
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Email: [vp@horizonpolymers.com](mailto:vp@horizonpolymers.com)



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Maulik Jasubhai Shah

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Mittravinda Ranjan

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Yash Ved

**CREATIVES**

Arun Parab

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Prashant Koshti

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CMO  
Biznustek Systems Pvt. Ltd.

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## PM witnesses Core Loading at India's First Fast Breeder Reactor



PM Narendra Modi inaugurating Fast Breeder Reactor

**Tamil Nadu, India:** In a significant milestone for India's nuclear program, Prime Minister Narendra Modi witnessed the commencement of "Core Loading" at India's first indigenous Fast Breeder Reactor (500 MWe) in Kalpakkam, Tamil Nadu. This marks entry into the crucial second stage of India's three-stage nuclear program. The Prime Minister toured the Reactor Vault and Control Room, being briefed on its salient features. The reactor, developed by Bhartiya Nabhiykiya Vidyut Nigam Ltd (BHAVINI), is a testament to Aatmanirbhar Bharat, constructed indigenously with contributions from over 200 Indian industries including MSMEs. Upon completion of core loading, the reactor will approach criticality, leading to power generation. The Fast Breeder Reactor (FBR) utilizes Uranium-Plutonium Mixed Oxide (MOX) fuel initially and holds promise for utilizing Thorium-232 in later stages, contributing to sustainable energy goals.

Safety features of the PFBR ensure prompt shutdown in emergencies and reduce nuclear waste. Despite advanced technology, its capital and operational costs are competitive.

India's nuclear power program aligns with goals of energy security and sustainable development, showcasing commitment to expanding peaceful nuclear technology applications while ensuring safety and security.

## India and Bhutan Sign MoU on Energy Efficiency

**New Delhi, India:** The Union Cabinet, under the leadership of Prime Minister Shri Narendra Modi, has approved the signing of a MoU between India and Bhutan on cooperation in the field of Energy Efficiency and Energy Conservation Measures. This MoU, to be signed between the Bureau of Energy Efficiency, Ministry of Power, Government of India, and the Department of Energy, Ministry of Energy and Natural Resources, Royal Government of Bhutan, aims to bolster energy efficiency initiatives in Bhutan. India intends to assist Bhutan in enhancing energy efficiency in households by promoting the star labeling program developed by the Bureau of Energy Efficiency. Additionally, the formulation of building codes suitable for Bhutan's climate conditions will be facilitated based on India's experience. The MoU also envisions the creation of a pool of energy professionals in Bhutan through institutionalized training of energy auditors. Furthermore, the MoU will facilitate the exchange of information, data, and technical expertise related to energy efficiency and conservation between the two

## B. Sairam assumed charge as the new Chairman and Managing Director of NCL



**B Sairam** has taken charge as the new **Chairman and Managing Director of Northern Coalfields Limited (NCL)**, a subsidiary of Coal India Limited, located in Singrauli. With 33 years of experience in the coal sector, Sairam holds a degree in mining engineering from NIT Raipur. His expertise spans mine operations, planning, logistics, and regulatory affairs. He completed a PGDM in Energy Management from NTPC School of Business Delhi, including a 15-day program at Nanyang Business School, Singapore. Sairam's commitment to sustainable energy practices is evident through his involvement in studying Just Energy Transition efforts in Germany and Poland.

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countries. It will also support Bhutan in developing and implementing standards and labeling schemes for energy-efficient products, ultimately contributing to energy optimization and sustainability.

## PM Modi Inaugurates Petrochemicals Complex

**Gujrat, India:** Prime Minister Narendra Modi marked a significant day in Gujarat as he laid the foundation stone for the petrochemicals complex of Petronet LNG at Dahej and dedicated 50 Pradhan Mantri Bhartiya Janaushadhi Kendras to the nation from Ahmedabad.

In his address, PM Modi emphasized the widespread impact of development projects, acknowledging participants from over 200 locations. The petrochemicals complex, with an investment exceeding ₹.20,000 crores, aims to boost hydrogen production and polypropylene demand in India.

## Coal Gasification: A Key Initiative for Clean Energy

**New Delhi, India:** The Ministry of Coal, Government of India, is spearheading efforts to promote clean coal technology, particularly coal gasification, as part of its commitment to environmental sustainability. With coal accounting for nearly 70% of India's electric generation, initiatives like the Coal Gasification Mission aim to gasify 100 million tonnes of coal by 2030, fostering a transition towards cleaner energy alternatives. Strategic bilateral agreements, including collaborations between Coal India Limited (CIL), BHEL, IOCL, and GAIL, have been established to drive the implementation of Surface Coal Gasification (SCG) projects. A proposed financial

assistance scheme of ₹.8500 crores incentivizes coal gasification projects, demonstrating their financial and technical viability. Joint venture agreements between CIL and BHEL aim to revolutionize indigenous technology, with plans to establish an ammonium nitrate plant through coal gasification in Odisha. These initiatives not only reduce import dependency but also align with India's vision of self-reliance and job creation. Furthermore, the Ministry is actively exploring other clean coal initiatives such as Coal Bed Methane extraction, Coal to Hydrogen conversion, and Carbon Capture and Storage to enhance environmental sustainability. Through research and development investments, the Ministry aims to ensure the long-term competitiveness and sustainability of coal utilization.

## Researchers Illuminate Structural Transitions in Hybrid Perovskites



Professor C N R Rao

**Bengaluru, India:** In a groundbreaking study led by Bharat Ratna Professor C N R Rao and his team, significant insights into the structural transitions of lead iodide perovskites have been unveiled, crucial for advancing renewable energy generation. Despite their remarkable optoelectrical properties,

## Ravindra Kumar assumes charge as Director (Operations) of NTPC



**Ravindra Kumar** has assumed the role of **Director (Operations) at NTPC Limited**, transitioning from his prior position as Officer on Special Duty (OSD) to the Director (Operations) at the same company. His appointment was approved by the Appointments Committee of the Cabinet (ACC) in February, slated to serve until his superannuation on October 31, 2027, or until further directives. With a B.Sc. in Mechanical Engineering from BIT Sindri, Kumar brings over 34 years of diverse experience in areas such as Commissioning, O&M, Engineering, and Project Management within NTPC, including notable contributions to projects like the Maitree supercritical power project in Bangladesh



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these materials, renowned for their potential in solar cell applications, face stability challenges.

Published in the Journal of Materials Chemistry A, the study conducted by Professor Pratap Vishnoi and Professor C. N. R. Rao from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in Bengaluru, reviewed over a hundred publications to discern the phase transitions and crystal structures of lead iodide perovskites.

Supported by a Ramanujan Fellowship from the Science & Engineering Research Board (SERB), the research elucidated the effects of temperature and pressure on the stability and performance of these materials.

Insights gleaned from this study could catalyze advancements in renewable energy generation and propel innovations in solar cell technology. By comprehending structural transitions in hybrid perovskites, the research aims to unlock the full potential of these materials in facilitating the transition towards cleaner energy solutions.

## India's First Green Hydrogen Plant Inaugurated by Union Minister of Steel

**Haryana, India:** Union Minister of Steel and Civil Aviation, Jyotiraditya M. Scindia, virtually inaugurated India's first Green Hydrogen Plant in the Stainless Steel Sector this month, at Jindal Stainless Limited, Hisar. The event witnessed the presence of other dignitaries, including Secretary of the Ministry of Steel, Nagendra Nath Sinha, and Managing Director of Jindal Stainless Limited, Abhyuday Jindal. The plant marks a significant milestone as the world's first off-grid Green Hydrogen



Union Minister of Steel and Civil Aviation, Jyotiraditya M. Scindia

facility for the stainless steel industry, incorporating rooftop and floating solar technologies. It represents India's commitment to sustainable growth, aiming to drive the nation towards achieving net-zero carbon emissions by 2070. Highlighting India's green leadership, Minister Scindia emphasized the importance of responsible economic progress post-COVID, aligning with global environmental goals. The National Green Hydrogen Mission (NGHM) is transforming the steel industry, supported by initiatives like Pancharmit and Mission LiFE. The Minister urged industry stakeholders to embrace clean technologies, fostering a greener economy. With robust national green policies and task forces in place, India aims to build a globally competitive and sustainable steel industry, spearheading the next era of growth.

## GAIL, ONGC, and Shell Energy India Collaborate on Ethane Import Ventures

**New Delhi, India:** In a strategic move, GAIL (India) Limited, Oil and Natural Gas Corporation (ONGC), and Shell Energy India (SEI) Private Limited have formalized a tripartite MoU to explore opportunities in ethane and

## Mundkur S Kamath assumes charge as MD of MRPL



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

Kamath is an alumnus of Manipal Institute of Technology (MIT) and TA Pai Management Institute (TAPMI), Manipal. After joining MRPL in July 1992, he has held various positions in the organisation apart from his stint on deputation at ONGC Mangalore Petrochemicals Ltd (OMPL). Prior to his appointment as Executive Director (Refinery) of MRPL in June, 2022, he was serving as Group General Manager (Technical Services) at MRPL.



other hydrocarbon imports, alongside the development of evacuation infrastructure at the Shell Energy Terminal in Hazira. This alliance builds upon GAIL's prior bilateral MoU with SEI, which delved into various energy cooperation avenues, including a feasibility study on ethane import infrastructure. With ONGC also having an existing bilateral MoU with GAIL, the three entities have united to address India's increasing demand for ethane and propel ethane infrastructure growth. Rajeev Kumar Singhal, GAIL's Director of Business Development, emphasized ethane's rising significance in the Indian petrochemical sector, outlining plans for importing ethane to fulfill domestic plant requirements. Ashok Kumar, Group General Manager & Head of Petrochemicals at ONGC, stressed ethane's pivotal role as a future fuel for the Indian petrochemical industry, underscoring the necessity for accessible and economically viable ethane supplies. The MoU underscores cooperation in evaluating existing Shell Hazira Terminal facilities and leveraging pipeline routes, aiming to expedite ethane import facility development. This collaboration aims to capitalize on the collective expertise of all three entities to drive efficiency and prompt progress in ethane import ventures.

## CIL and BHEL Forge Joint Venture for Ammonium Nitrate Plant

**New Delhi, India:** Coal India Limited and Bharat Heavy Electricals Limited have officially sealed a joint venture agreement in Delhi, aiming to establish an ammonium nitrate plant utilizing surface coal gasification technology. Situated in the Lakhanpur area of Mahanadi Coalfields Limited, Odisha, the plant is set to initially produce 2000 tons of ammonium nitrate per



Debasish Nanda of CIL and Jai Prakash Srivastava of BHEL

day, with an annual target of 6.60 lakh tons, requiring 1.3 million tonnes (mts) of coal supplied by CIL. BHEL will contribute its indigenously developed pressurized fluidized bed gasification (PFBG) technology. This collaboration marks a significant stride towards the National Coal Gasification Mission, leveraging coal's chemical properties. Ammonium nitrate serves as a crucial component in bulk explosives manufacturing, vital for CIL's open-cast mining operations, thus reducing import dependency and fostering self-reliance as part of the Atmanirbhar Bharat Abhiyaan. With government backing, including financial support for viable gap funding, the project is poised to become a beacon of success. Debasish Nanda of CIL and Jai Prakash Srivastava of BHEL signed the JVA, with plans for future coal utilization in environmentally friendly ventures post-power sector obligations. The SCG technology promises versatile applications, from synthetic natural gas production to downstream chemicals and power generation, aligning with India's energy goals. Projects and Development India Limited has been tasked with preparing the feasibility report, with land acquisition scheduled for completion by

## Rashmi Govil takes over as Director- HR of Indian Oil



**Rashmi Govil** has assumed the position of **Director-HR at Indian Oil Corporation Limited**, announced in an official statement. Previously, she held the role of Executive Director (HRD & Employee Relations) at the company's corporate headquarters. With close to thirty years of service at Indian Oil, Govil boasts extensive experience across various HR functions. She holds an MBA specializing in HR and a Postgraduate Diploma in Finance. Noteworthy for her strategic acumen, Govil has spearheaded initiatives such as the innovation cell 'Srijan' and the implementation of enterprise-wide SAP solutions in HR. Recognized for her collaborative and inclusive leadership style, Govil's elevation underscores her significant contributions to Indian Oil and her forward-looking vision for the role of HR in the energy sector.

September 2024, paving the way for construction commencement. The signing ceremony witnessed the presence of senior officials from both ministries and the participating companies, signaling strong government and corporate commitment to the project's success.

## TDB Supports Alchem Synthon for Advanced Chemical Facility



**New Delhi, India:** In a boost to indigenous manufacturing and pharmaceutical innovation, the Technology Development Board (TDB) has inked a deal with M/s Alchem Synthon Pvt. Ltd., Mumbai, offering ₹.8.6 crores loan assistance for their "Development and Commercialization of Advanced Pharmaceutical Intermediates, Fine & Specialty Chemicals" project. With a total project cost of ₹.19.01 crores, this initiative aligns with the Make in India campaign, positioning India as a global manufacturing hub.

The project targets the establishment of a cutting-edge manufacturing facility for Key Starting Materials (KSMs) and Advanced Intermediates, crucial for Active Pharmaceutical Ingredients (APIs), ensuring compliance with stringent quality standards. Additionally, the facility

will produce Specialty and Fine Chemicals for diverse applications, including polymer and water treatment industries.

By increasing production capacity to 12,000 Kg per month and prioritizing the synthesis of new intermediates, Alchem Synthon aims to reduce reliance on imports for critical chemicals, aligning with the Atmanirbhar Bharat initiative. This endeavor not only promotes self-reliance but also fosters growth in niche markets, reducing industry dependence on imported materials. Shri Rajesh Kumar Pathak, Secretary, TDB, emphasized the significance of the project in driving technological innovation and reducing industry reliance on imports for essential chemicals.

## SRF Establishes wholly owned Subsidiary in Dubai

**Gurgaon, India:** SRF has officially formed a wholly owned subsidiary, SRF Middle East, in Dubai, with an authorized capital of AED 365,000. The subsidiary aims to engage in trading refrigerant gases, with SRF retaining full ownership. Approval for trading in industrial gases has been obtained from the Dubai Supreme Council of Energy, and a commercial license was issued by the Department of Economy and Tourism in March this year. This developments mark significant strides for SRF in expanding its presence and operations in the Middle East, underscoring commitment to growth and excellence

## Bhavana Bindra Appointed Managing Director of Lubrizol for IMEA Region



The Lubrizol Corporation has named **Bhavana Bindra** as the **Managing Director for India, Middle East & Africa (IMEA)**, a move aimed at accelerating Lubrizol's growth commitments in the region.

With over twenty years of experience in the manufacturing industry, including roles at REHAU and Cummins India, Bindra brings a wealth of leadership and industry expertise to her new position. Her mandate involves driving Lubrizol's growth in the IMEA region, emphasizing a local-for-local approach to meet regional market demands.

As the Managing Director, Bindra will lead Lubrizol's IMEA team in delivering regional growth strategies and strengthening relationships with customers, suppliers, and stakeholders. She will also oversee the establishment of a new Global Capability Center in Pune, India, aimed at enhancing Lubrizol's capabilities for regional growth.

## Breakthrough Catalyst Revolutionizes Hydrogen Production

**Bengaluru, India:** Scientists have unveiled a pioneering catalyst that promises to transform the landscape of hydrogen production. Developed by a team at the Centre for Nano and Soft Matter Sciences (CeNS) in Bengaluru, the catalyst efficiently oxidizes urea, significantly reducing the energy requirements for hydrogen generation through urea-assisted water splitting. This breakthrough, published in *ACS Catalysis*, addresses a critical challenge in clean energy technology. By replacing the energy-intensive oxygen evolution reaction with urea electro-oxidation, researchers have achieved a 30% reduction in energy demand for hydrogen production. Led by Nikhil N. Rao, Dr. Alex Chandraraj, and Dr. Neena S. John, the team's work is supported by the Science and Engineering Research Board (SERB), now ANRF. Through advanced spectroscopic techniques, they confirmed the catalyst's direct mechanism of action, enhancing stability and efficiency. Moreover, neodymium nickelate, the catalyst used, exhibits exceptional tolerance to CO<sub>x</sub> poisons, ensuring prolonged durability during electrolysis. Collaborative computational studies further validate these findings, highlighting the catalyst's potential for sustainable and efficient hydrogen production. This groundbreaking research marks a significant step towards achieving clean energy goals and fostering a sustainable future.

## EIB Allocates Loan to Evonik for R&D

**Germany, Europe:** The European Investment Bank (EIB) has approved a €500 million loan for Evonik, Germany's second-largest chemical company, to bolster its research and development (R&D) efforts. This substantial financial backing underscores the EIB's commitment to fostering innovation and technological advancement within the European chemical industry. Evonik, renowned for its expertise in specialty chemicals and materials, will utilize the loan to further enhance its R&D capabilities, focusing on developing cutting-edge solutions and sustainable technologies. The investment aligns with Evonik's strategic vision of driving innovation to address global challenges and meet evolving market demands. This partnership between the EIB and Evonik reflects a shared commitment to promoting research excellence and fostering economic growth. The infusion of funds will enable Evonik to accelerate its innovation

pipeline, supporting its position as a leading player in the global chemical sector. With this significant loan, Evonik is poised to strengthen its position as an industry innovator, driving forward advancements in chemistry and contributing to the development of sustainable solutions for a better future.

## DIC Subsidiary Expands Coating Resins Operations, Launches Application Lab



Application Lab inside view

**Maharashtra, India:** DIC Corporation's subsidiary, Ideal Chemi Plast Pvt Ltd., has initiated operations at a new coating resins facility located in Maharashtra's Supa Japanese Industrial Zone. This facility marks a significant expansion, tripling Ideal Chemi Plast's production capacity for coating resins, aimed at bolstering its presence in India, South Asia, and the Middle East. The move aligns with DIC Group's strategy to strengthen its position in the global industrial polymers market, targeting India's growing coating resins sector, which sees annual growth of approximately 9%.

The new facility prioritizes environmental sustainability with the installation of a Zero Liquid Discharge (ZLD) system for wastewater treatment and the adoption of natural gas and energy-efficient equipment. It will produce acrylic, polyester, and alkyd resins vital for automotive refinish coatings and coil coatings. Furthermore, DIC Corporation, along with DIC South Asia Pvt. Ltd., has established the DIC South Asia Pvt. Ltd. Application Lab. This dedicated laboratory will evaluate coating resins for automotive and infrastructure applications, enabling swift response to local customer needs and offering comprehensive solutions, including compounding formulations and processed samples. The lab, managed jointly by DIC South Asia and Ideal Chemi Plast, aims to enhance product development and customer support in the region.

## Rittal Inaugurates New Integration Centre for Cooling Solutions in Bangalore



**Bangalore India:** Rittal Private Limited, a renowned manufacturer of enclosures and climate control systems, inaugurated a new Integration Centre for Cooling Units and Liquid Cooling Package (LCP) solutions at its Bangalore manufacturing facility. This expansion aims to bolster production capacity and cater to the rising demand for Industrial Cooling Solutions. Equipped with cutting-edge technology, the Integration Centre will manufacture Cooling Units for industrial applications and LCP solutions for IT infrastructure. Lars Platzhoff, Executive Vice President of Business Unit Cooling Solutions, Rittal GmbH & Co. KG, Germany, highlighted the facility's significance, noting it as the third facility globally producing Industrial Cooling Units. Mathew Jacob, Vice President of Sales and Marketing at Rittal Private Limited, reaffirmed the company's commitment to India and neighbouring markets. He emphasized the focus on developing intelligent Industrial Cooling Solutions to enhance energy efficiency and combat climate change.

Rittal Cooling Units are celebrated for their quality and productivity, making them a preferred choice for various applications. The expansion aligns with market trends towards safety, energy efficiency, and sustainability, driving the growth of Industrial Cooling Solutions.

## Deepak Fertilisers Secures 15-Year LNG Contract with Equinor

**Mumbai, India:** Deepak Fertilisers, a prominent player in the chemical and fertilizer industry, has finalized a significant agreement with Norwegian energy giant Equinor. The 15-year contract solidifies a strategic partnership aimed at bolstering India's energy security and supporting the nation's agricultural sector. Under



Helge Haugane, Equinor's Senior Vice President for Gas & Power

the terms of the agreement, Equinor will supply liquefied natural gas (LNG) to Deepak Fertilisers, ensuring a reliable and consistent source of energy for its operations. This long-term commitment underscores Deepak Fertilisers' dedication to sustainable growth and operational efficiency. The partnership with Equinor aligns with Deepak Fertilisers' broader vision of leveraging clean energy solutions to drive innovation and enhance productivity. By opting for LNG, Deepak Fertilisers aims to reduce carbon emissions and mitigate environmental impact while meeting its energy requirements.

Equinor, renowned for its expertise in the global energy market, brings a wealth of experience and resources to the collaboration. The partnership not only strengthens Deepak Fertilisers' supply chain but also opens avenues for mutual growth and development in the Indian chemical industry.

With the LNG contract in place, Deepak Fertilisers reinforces its position as a key player in India's energy landscape, paving the way for sustainable and efficient operations in the years to come.

## Kodiak Strengthens Market Presence through Acquisition of Aztech Lubricants

**Cincinnati, USA:** In a strategic move to bolster its market presence, Kodiak has announced the acquisition of Aztech Lubricants, marking a significant development in the chemical industry. The acquisition solidifies Kodiak's position in the lubricants market, expanding its portfolio and enhancing its competitive edge. Under the agreement, Kodiak will integrate Aztech Lubricants into its operations, leveraging its expertise and resources to further enhance product offerings and customer service. This acquisition reflects Kodiak's

commitment to growth and innovation in the chemical sector. Aztech Lubricants, known for its high-quality lubrication solutions, brings a wealth of experience and a strong customer base to Kodiak. By combining forces, the two companies aim to capitalize on synergies and drive mutual success in the dynamic market landscape.

Commenting on the acquisition, Kodiak's spokesperson expressed enthusiasm about the prospects of the collaboration, emphasizing the shared vision of delivering excellence and value to customers. With this strategic move, Kodiak is poised to strengthen its foothold in the industry and continue its trajectory of growth and expansion. The acquisition of Aztech Lubricants underscores Kodiak's commitment to delivering top-notch products and services, further cementing its reputation as a leading player in the chemical sector.

## Indian Oil Launches ETHANOL 100 Fuel, Pioneering Sustainable Mobility

**New Delhi, India:** Indian Oil, in collaboration with Union Minister for Petroleum & Natural Gas, Hardeep Singh Puri, unveiled 'ETHANOL 100,' a groundbreaking automotive fuel aimed at revolutionizing the transportation sector. Introduced at select 183 retail outlets across Maharashtra, Karnataka, Uttar Pradesh, New Delhi, and Tamil Nadu, ETHANOL 100 emerges as a cleaner, greener alternative to traditional gasoline, boasting lower emissions of greenhouse gases and pollutants. With its high-octane rating ranging 100-105, this fuel is tailored for high-performance engines, promising enhanced efficiency and power output while significantly reducing environmental impact.

The launch of ETHANOL 100 reflects the government's strategic vision to reduce import dependency, conserve foreign exchange, and stimulate the agriculture sector. Since the announcement of E20 in 2023, the availability of ethanol blended fuel has witnessed a substantial increase, with the introduction of ETHANOL 100 accelerating progress towards achieving the target of 20% ethanol blending by 2025-26. This initiative underscores Indian Oil's commitment to sustainability and clean mobility, marking a significant milestone in India's journey towards a greener energy landscape.

Furthermore, the initiative highlights a paradigm shift towards embracing sustainable technologies and reaffirms the commitment to decarbonization in the automotive sector. Indian Oil's dedication to pioneering

innovative solutions for sustainable mobility sets a benchmark for the industry, inspiring confidence in manufacturers to invest in ethanol-based vehicles and driving the transition towards alternative fuels. The launch of ETHANOL 100 signifies a monumental step towards achieving a more sustainable and environmentally conscious future in the automotive industry.

## MRPL Approves Increased Stake in Mangalore SEZ

**Mangalore, India:** Mangalore Refinery and Petrochemicals Limited (MRPL) has greenlit the acquisition of 1,34,80,000 equity shares of Mangalore SEZ Ltd (MSEZ) from IL&FS, paving the way for MRPL's equity stake in MSEZ to surge from 0.96% to 27.92%. MSEZ, established as a special purpose vehicle in 2006, operates as a Joint Venture among ONGC (26%), IL&FS (50%), Karnataka Industrial Area Development Board (KIADB) (23%), MRPL (0.96%), and Kanara Chamber of Commerce & Industry (KCCI) (0.04%). With a sprawling area of 1,607 acres and operational since 2014, MSEZ boasts a vibrant ecosystem with approximately 85% of its area leased out. The Zone hosts 10 operational units including MRPL (Aromatic Complex), Syngene, ISPR, Catsynth speciality chemicals, and food processing units, solidifying its position as one of India's premier multi-product SEZs. Having attracted investments exceeding USD 2 billion and facilitated exports surpassing USD 3.2 billion, MSEZ stands as a testament to India's successful SEZ landscape. Primarily focused on land leasing and providing essential utility services, MSEZ plays a pivotal role in fostering industrial growth and economic development in the region.

## Aramco Reports Strong 2023 Financial Results

**Saudi Arabia:** Saudi Arabian Oil Company (Aramco) has unveiled its full-year 2023 financial outcomes, revealing a net income of USD121.3 billion, marking the second-highest in its history. Despite facing economic headwinds, Aramco demonstrated resilience and agility, resulting in robust cash flows and profitability. The company's total dividends for the year surged by 30% to USD97.8 billion, showcasing its commitment to rewarding shareholders. Key operational highlights include a 28% increase in capital investments to USD49.7 billion, primarily directed towards enhancing operational flexibility and capturing additional value

from operations. Aramco's average hydrocarbon production stood at 12.8 million barrels of oil equivalent per day, maintaining a 99.8% reliability rate in supply.

Additionally, Aramco raised its gas production growth target to more than 60% by 2030 compared to 2021 levels, aiming to capitalize on rising global demand. The company's strategic expansions include its first international investment in LNG and advancements in downstream projects, further bolstering its position in key global markets. Furthermore, Aramco's commitment to renewable energy was underscored by its participation in developing solar projects in Saudi Arabia, with a combined capacity of 2.66 GW. These initiatives reflect Aramco's forward-looking approach to diversifying its portfolio and advancing sustainability efforts amidst evolving energy landscapes.

With a robust financial performance and strategic investments, Aramco remains poised for continued growth and value creation in the global energy sector.

## Hyderabad, India: ICIQ Acquires Majority Stake in Vasant Chemicals

**Hyderabad, India:** Germany's International Chemical Investors Group (ICIQ) has completed the acquisition of a controlling interest in Vasant Chemicals, a Hyderabad-based company. ICIQ, a privately-owned industrial conglomerate with sales exceeding Euro 4.6 billion, operates in various chemical sectors under its five main platforms, including fine chemicals, care chemicals, chlorovinyls, compounds, and hydrocarbons & solvents.

Vasant Chemicals will be integrated into WeylChem, ICIQ's fine chemicals platform, as part of a strategic move to bolster its presence in the global specialty chemicals market. With over 40 years of experience, Vasant Chemicals specializes in producing specialty chemicals and pharmaceutical intermediates from its facilities in Hyderabad and Visakhapatnam.

Dr. Andreas Maier, CEO of WeylChem, emphasized the strategic alignment of the acquisition with their long-term value creation goals, facilitating direct access to the rapidly growing Indian market and establishing a manufacturing and distribution foothold in Asia. The transaction, which sees ICIQ assuming majority ownership while the former majority owner retains a minority stake, is expected to leverage synergies between the two organizations, driving operational efficiencies and unlocking new growth prospects.

## Vipul Organics Secures Order from TNPL worth ₹.7.15 Crore

**Mumbai, India:** Vipul Organics Limited, a leading player in the specialty chemicals industry, has clinched a substantial contract from TamilNadu Newsprint and Paper Limited (TNPL). The deal entails the supply of Blue and Violet Pigment Dyes valued at ₹.7.15 Crore, marking a significant milestone for Vipul Organics in the paper dyes segment.

Venturing into paper dyes just two years ago, Vipul Organics has rapidly gained traction with its innovative products like SunPulp Dispersions, SunDirect Dyes, and the Sunlonic range of modified Basic Dyes. The company's dedication to product innovation and quality has garnered praise from industry stakeholders. Mihir V Shah, Executive Director of Vipul Organics Limited, expressed enthusiasm over becoming the preferred colorant supplier to the paper industry within a short span. He highlighted the company's commitment to meeting industry demands and achieving a target revenue of ₹.50 crores from the paper sector over the next three years. The Indian dyes and pigments segment is poised for robust growth, especially in the paper sector, driven by the expansion of packaging and printing industries. Vipul Organics Limited, with its state-of-the-art manufacturing facilities and global presence, is well-positioned to capitalize on this growth trajectory. Vipul Organics Limited, listed on the BSE (VIPULORG / 530627), reported revenues of ₹.134 Crore for the financial year 2022-23. With this latest contract win, the company further solidifies its position as a key player in the pigments and dyes segment.

## Balrampur Chini Mills Ventures into Poly Lactic Acid Manufacturing

**Kolkata, India:** Balrampur Chini Mills Limited, a prominent sugar mill complex in India, announces its entry into poly lactic acid (PLA) manufacturing, aligning with sustainability goals to combat climate change. With an estimated investment of ₹. 2,000 crores over 2.5 years, the project aims to propel India towards achieving net zero emissions by 2070. The PLA factory, boasting a global-scale capacity of 75,000 t/a, will be established within 30 months on a greenfield site adjacent to existing sugar plants, leveraging existing infrastructure. This venture signifies a significant shift towards circular and regenerative manufacturing principles, utilizing sugar as a raw material to produce

bioplastics, replacing single-use plastics. Stefan Barot, appointed as President (Chemicals), brings over 35 years of experience, including 13 years in the bioplastic industry, to lead the new business. Balrampur Chini's minority stake acquisition in Konkan Speciality Polyproducts Private Limited (Konspec) further facilitates the venture. Vivek Saraogi, CMD of Balrampur Chini, emphasizes PLA's dual benefits as a bio-based and compostable material, reflecting the company's commitment to sustainability. Avantika Saraogi, Executive Director, expresses enthusiasm for the venture's contribution to responsible manufacturing and India's sustainable economic landscape. Vinod Bondal, Managing Director of Konspec, applauds the collaboration's role in fostering a greener environment and assisting industries in meeting extended producer responsibility commitments.

## Hovione Partners with Dragonfly Technologies to advance micellar chemistry technology



**Mumbai, India:** Hovione, a leading Portugal-based Contract Development and Manufacturing Organization (CDMO), has entered into an agreement with Dragonfly Technologies to access its innovative micellar technology for chemistry-in-water processes. Developed by Prof. Bruce Lipshutz of the University of California, Santa Barbara (UCSB), this technology will be further developed by Hovione to enhance its API manufacturing capabilities.

Micellar chemistry facilitates various chemical transformations within nanomicelles dispersed in water, mirroring natural processes. This approach allows reactions to occur at lower temperatures, reducing reliance on rare and expensive metal catalysts. Additionally, it minimizes the use of organic solvents, thereby lowering the carbon footprint associated with chemical reactions.

Dr. Jean-Luc Herbeaux, CEO of Hovione, highlighted the significance of this partnership in advancing sustainable manufacturing options in the pharmaceutical industry. The integration of Dragonfly's micellar technology will enable Hovione to operate under less energy-intensive conditions and reduce reliance on precious metal-containing catalysts and organic solvents.

## Himadri Acquires Stake in Invati: Advancing Clean Energy Innovation

**Kolkata, India:** Himadri Speciality Chemical Limited (Himadri), a prominent global specialty chemical conglomerate, has revealed its acquisition of a 40% stake in Invati Creations Private Limited (Invati) for an estimated value of ₹.45.16 crores. This strategic move involves Himadri infusing ₹.19.99 crores in cash into Invati for growth capital, with the remaining ₹.25.17 crores discharged through a share swap, resulting in the issuance of 7,96,446 equity shares to Invati's promoters. With this acquisition, Himadri secures two nominee directors on Invati's Board, signaling significant influence and fostering close collaboration between the two entities. The decision to invest in Invati aligns with Himadri's vision of excelling in high-quality Lithium-ion (Li-ion) battery materials and exploring innovative battery technology. Invati, founded by alumni from prestigious institutions like IIM Kolkata and IIT Kharagpur, specializes in engineering Li-ion electrode materials for enhanced energy storage and employs cutting-edge nanotechnology biosciences for real-world solutions. The company's portfolio extends to various industries, including agrochemicals, animal health, and energy storage, boasting patented technologies and groundbreaking advancements, such as the development of a broad-spectrum antiviral drug molecule. Anurag Choudhary, CMD & CEO of Himadri Speciality Chemical Ltd, expressed enthusiasm about the collaboration, foreseeing improvements in battery performance, safety, and recyclability. Mukeshh Agarwal, Director of Invati, highlighted their focus on enhancing Lithium-iron-phosphate (LFP) batteries and experimenting with new cathode materials for faster charging, emphasizing the significance of Himadri's R&D expertise and manufacturing experience in advancing their joint objectives. Both companies are committed to driving innovation in clean energy technologies, leveraging their combined strengths to make substantial contributions to the global energy storage landscape.

## Balaji Speciality Chemicals Plans ₹.750 Crore Expansion

**Maharashtra, India:** Balaji Speciality Chemicals Limited, a subsidiary of Balaji Amines Limited, has secured Mega Project Status from the Government of Maharashtra for a proposed investment of ₹.750 crores in various products. The expansion will be executed in phases pending environmental clearances. The project encompasses the production of Hydrogen Cyanide (HCN), Sodium Cyanide (NaCN), Ethylene Diamine Tetra Acetic Acid (EDTA), Benzyl Cyanide (BnCN), Phenylacetic Acid (PAA), and TriEthyl OrthoFormate (TEOF). Additionally, Balaji Amines Limited has approved the enhancement of its existing DMC plant for electronic grade DMC used in electric vehicle battery chemicals, alongside the establishment of a 20 MW solar power plant in Solapur, Maharashtra. The company is also progressing with rooftop solar power plants with a capacity of 3.15 MW, expected to be operational by March 2024. Furthermore, new projects include N-Methyl Morpholine (NMM) and N-(n-butyl) Thiophosphoric triamide (NBPT), slated for commissioning by the end of FY 2024-25. These expansions underscore Balaji Speciality Chemicals' commitment to growth and innovation in the chemical industry.

## BASF Commences Construction of Methyl Glycols Plant in Zhanjiang, China

**Zhanjiang, China:** BASF has initiated the construction of a methyl glycols (MG) plant at its Verbund site in Zhanjiang, China, marking a significant step towards meeting the escalating demand for brake fluids in the region. With an annual capacity of 46,000 metric tons, the facility is slated to begin operations by the end of 2025, becoming the first fully backward integrated MG plant in China. Bir Darbar Mehta, Senior Vice President of Petrochemicals Asia Pacific at BASF, emphasized the plant's integration with a steam cracker, ensuring reliable and high-quality product delivery. Matthias Lang, Vice President of Business Management Fuel & Lubricant Solutions Asia Pacific and Performance Chemicals Greater China, underscored BASF's commitment to the automotive fluids industry and the burgeoning Chinese market. The plant will produce methyl diglycol (MDG), methyl triglycol (MTG), and methyl tetraglycol (MTEG) using methanol and purified ethylene oxide (PEO), with MTG serving as the key ingredient for modern brake fluid in automotive applications.

## W. R. Grace & Co. Expands Fine Chemicals Facility in Michigan, USA



Inauguration of the Fine Chemical Facility in South Haven by CEO of W. R. Grace & Co., Ed Sparks & President of Material Technologies Ms Brenda Kelly

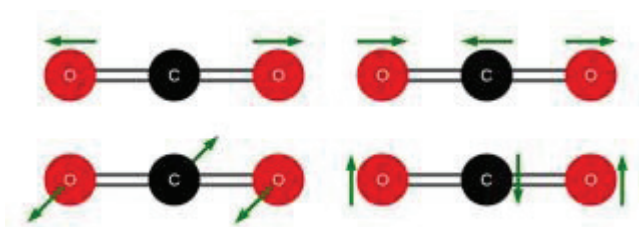
**Michigan, US:** US-based specialty chemicals company, W. R. Grace & Co., has inaugurated its expanded fine chemical contract development and manufacturing (CDM) facility in South Haven, Michigan. With a 25% increase in capacity, the expansion includes the installation of a new 4,000-gallon 'Hastelloy' centrifuge and three 4,000-gallon multi-use chemical reactors, enhancing Grace's capability to meet the rising demand for Active Pharmaceutical Ingredients (APIs).

CEO of Grace, Mr. Ed Sparks, emphasized the company's dedication to supporting customers in delivering life-saving and life-changing drug therapies globally. President of Materials Technologies, Ms. Brenda Kelly, highlighted the significance of the expanded facility in accommodating current and future customer needs throughout the fine chemical manufacturing process.

The South Haven facility, serving the pharmaceutical market for over four decades, manufactures APIs, regulatory starting materials (RSMs), and drug intermediates in quantities ranging from kilos to tons, adhering to FDA's current Good Manufacturing Practice (cGMP) regulations. The integration with Grace's Tyrone facility in Pennsylvania offers customers flexibility in meeting pharmaceutical and nutraceutical production requirements with a US-based supply chain.



## Dow to Establish Leading Carbonate Solvents Facility in US, Supported by DOE



90% of CO<sub>2</sub> emissions capture from ethylene oxide

**Midland, Michigan:** Dow has announced plans to invest in a state-of-the-art carbonate solvents facility on the US Gulf Coast, focusing on ethylene derivatives capacity to meet the rising demand for lithium-ion battery components. This investment aligns with Dow's commitment to supporting the growth of domestic electric vehicle (EV) and energy storage markets, complementing its ongoing expansion projects such as global alkoxylation capacity increases. In collaboration with the US Department of Energy (DOE) Office of Clean Energy Demonstrations, Dow has been selected for award negotiations to establish this world-scale production facility, backed by agreements with key EV original equipment manufacturers and electrolyte manufacturers. The facility will prioritize sustainability by capturing over 90% of carbon dioxide emissions from ethylene oxide manufacturing to produce carbonate solvents crucial for vehicle electrification and grid energy storage. This initiative is part of Dow's Decarbonize & Grow strategy and supports the US government's objectives to reduce greenhouse gas emissions in the transportation sector while enhancing supply chain resilience for battery and EV manufacturing. Brendy Lange, Dow's Vice President of Industrial Solutions Business, expressed enthusiasm for this significant step towards a sustainable future for the automotive industry, emphasizing the DOE's pivotal role in enabling low-carbon product localization. Carbonate solvents are integral to lithium-ion battery electrolytes, facilitating improved battery performance and durability, thus advancing electric vehicle technology adoption.

## INEOS Inovyn Introduces Ultra Low Carbon Chlor-Alkali Range

**Tavaux, France:** INEOS Inovyn has unveiled its latest innovation, the Ultra Low Carbon (ULC) range of Chlor-Alkali products, promising a remarkable reduction in carbon footprint by up to 70% compared

to industry norms. This breakthrough range utilizes renewable energy sources to power manufacturing sites, with initial production sites located in Rafnes, Norway, powered by local hydroelectricity, and Antwerp, Belgium, supplied by North Sea wind turbines. The ULC Chlor-Alkali range, certified under the ISCC PLUS scheme, enables customers to significantly diminish their scope 3 emissions and develop sustainable downstream products tailored to market needs. INEOS Inovyn, already recognized as Europe's largest Chlor-Alkali producer, offers standard products with the lowest carbon footprint in Europe, as validated by Environmental Product Declarations (EPD). Arnaud Valenduc, Business Director at INEOS Inovyn, underscores the company's commitment to sustainable leadership and accelerating the transition to a Net Zero economy through innovative solutions. With the ULC range, INEOS Inovyn aims to provide customers with even greater opportunities to meet ambitious greenhouse gas reduction targets, solidifying its position as an industry leader in environmental stewardship. ■

### PM Modi lays foundation stone of three semiconductor projects worth ₹1.25 trln

Prime Minister Narendra Modi virtually inaugurated three semiconductor projects valued at approximately ₹1.25 trillion this March. These projects, incentivized under the India Semiconductor Mission, comprise a semiconductor fabrication facility at the Dholera Special Investment Region (DSIR) in Gujarat, an Outsourced Semiconductor Assembly and Test (OSAT) facility in Morigaon, Assam, and another OSAT facility in Sanand, Gujarat.

PM Modi emphasized that these initiatives are pivotal for India's aspiration to emerge as a global semiconductor hub, fostering innovation and propelling the nation towards Industry 4.0 milestones. Union Minister Ashwini Vaishnaw revealed that production at the Dholera plant is slated to commence by the end of 2026, with Tata Electronics partnering with Taiwan's Powerchip Semiconductor Manufacturing Corporation (PSMC) to establish India's inaugural semiconductor fabrication facility at an estimated cost of ₹91,000 crore.

Additionally, the OSAT facility in Morigaon, Assam, spearheaded by Tata Electronics, will serve various sectors including electric vehicles, automotive, mobile phones, and power devices. Meanwhile, the ₹7,500-crore OSAT facility in Sanand will be developed by CG Power and Industrial Solutions under the Modified Scheme for Semiconductor Assembly, Testing, Marking, and Packaging (ATMP). A dedicated water supply sourced from the Narmada river canal will support operations in the region.

### bp's GTA LNG Project Reaches Key Milestone as FLNG Vessel Arrives

In a significant milestone for bp's Gas to Power and LNG Terminal (GTA) project, the arrival of the Floating Liquefied Natural Gas (FLNG) vessel marks a major step forward. The project, located in India, is poised to revolutionize the country's energy landscape.

GTA Phase 1, part of bp's broader commitment to sustainable energy solutions, is set to produce liquefied natural gas (LNG) through an innovative offshore facility. With the arrival of the FLNG vessel, the project moves closer to operational readiness, positioning India as a key player in the global LNG market.

The FLNG vessel's arrival signifies bp's dedication to leveraging cutting-edge technology for clean and efficient energy production. By harnessing natural gas



resources and converting them into LNG, bp aims to meet growing energy demands while minimizing environmental impact.

As India seeks to diversify its energy sources and reduce dependence on traditional fuels, the GTA LNG project emerges as a crucial enabler of this transition. Through strategic investments and partnerships, bp reaffirms its commitment to driving sustainable energy solutions and fostering economic growth in India and beyond.

The arrival of the FLNG vessel heralds a new era of energy production for India, underscoring bp's role as a leader in the global LNG industry.

### SJVN arm gets letter of intent for 500 MW solar project in Gujarat

SJVN Green Energy has received a letter of intent from Gujarat Urja Vikas Nigam Ltd for a 500 MW solar project entailing an investment of ₹2,700 crore.

The project is to be developed at Gujarat Industries Power Company Ltd (GIPCL) solar park at Khavda. SJVN Green Energy is a subsidiary of state-owned SJVN Ltd.

The power purchase agreement shall be executed with GUVNL after adoption of tariff (₹2.54 /unit) by Gujarat Electricity Regulatory Commission (GERC), a statement by SJVN said.

The project shall be commissioned in 18 months from the date of signing of the PPA i.e. by November 2025.

The project is expected to generate 1,271.07 million units in the first year after commissioning and the cumulative energy generation over a period of 25 years would be about 29,245.40 million units.

Commissioning of this project is expected to reduce 14,33,025 tonnes of carbon emission.

## JSW Energy arm secures 700 MW project from SECI

JSW Neo Energy has secured a 700 MW inter-state transmission system solar project from Solar Energy Corporation of India (SECI). The wholly-owned subsidiary of JSW Energy received a letter of award (LoA) for the same.

With this awarded capacity of 700 MW, the company's total locked-in generation capacity increased to 11.7 GW, of which 2.1 GW will be solar.

The current installed generation capacity is 7.2 GW, and aims to have 9.8 GW of installed capacity by 2024-end. In addition, the company has 3.4 GW of locked-in energy storage capacity by means of battery energy storage system (BESS) and hydro pumped storage project.

## Tata Power Solar Completes Solar PV and BESS Projects in Chhattisgarh

Tata Power Solar Systems (TPSSL), a subsidiary of Tata Power Renewable Energy (TPREL), has successfully finalized and commissioned a comprehensive solar photovoltaic (PV) and battery energy storage systems (BESS) project in Rajnandgaon, Chhattisgarh. This pioneering project encompasses a 100 MW solar PV facility and a 120 MWh utility-scale BESS.

Securing the contract from the Solar Energy Corporation of India (SECI) in December 2021 for ₹.945 crore, TPSSL managed the project on an engineering, procurement, and construction (EPC) basis. The project involved the deployment of cutting-edge bifacial mono-crystalline technology across 239,685 modules.

This commissioning marks a significant stride towards achieving uninterrupted green energy supply, fostering the transition towards renewable energy sources. With an estimated annual energy generation of 243.53 million units, the project is anticipated to curtail carbon emissions by 4.87 million tonnes over 25 years, aligning with India's vision for energy transition.

TPSSL's commendable delivery of the project on schedule underscores its expertise and commitment to sustainable energy solutions. With a robust solar EPC portfolio exceeding 12.8 GWp for ground-mount utility-scale projects and over two GW for rooftop and distributed ground-mounted systems, TPSSL continues to be at the forefront of India's renewable energy sector.

## L&T Secures Massive Gas Pipeline Project worth ₹5,000-10,000 Crore in the Middle East

**Mumbai, India:** Larsen and Toubro (L&T) has clinched a significant gas pipeline project in the Middle East, valued between ₹.5,000-10,000 crore. The project, awarded to L&T Energy Hydrocarbon (LTEH), involves the Engineering, Procurement, and Construction (EPC) of two new pipelines alongside the existing corridor. This major onshore gas pipeline endeavor marks a significant milestone for L&T, being the largest cross-country pipeline project secured by the company to date.

Subramanian Sarma, Whole-time Director & Senior Executive Vice President (Energy) at L&T, expressed enthusiasm about undertaking this strategic project, highlighting the company's expertise in handling such endeavors. While financial specifics of the project were not disclosed, it falls under the category of major orders valued between ₹.5,000-10,000 crore for L&T. As a leading Indian multinational with a robust portfolio spanning EPC projects, hi-tech manufacturing, and services, L&T continues to strengthen its presence in the global infrastructure landscape through landmark projects like this gas pipeline venture in the Middle East. ■



# HIGHLIGHTS OF CHEMTECH WORLD EXPO 2024

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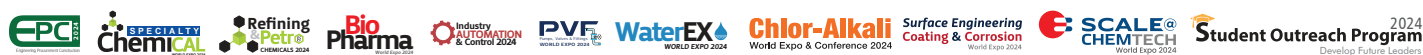


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Inauguration of ChemTECH World Expo 2024

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# HIGHLIGHTS OF CHEMTECH WORLD EXPO 2024



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# GLIMPSES OF CHEMTECH WORLD EXPO 2024



CHEMTECH LEADERSHIP & EXCELLENCE AWARDS 2024

## Student Outreach Program <sup>2024</sup> Develop Future Leaders



Dr Anil Kakodar



Some of the Stalwarts who addressed Student Outreach Program 2024



Dr R A Mashelkar



From (L to R) Dr Rajesh Gokhale & Dr Krishna Ella



STUDENT OUTREACH PROGRAM - BIOPHARMA 2024

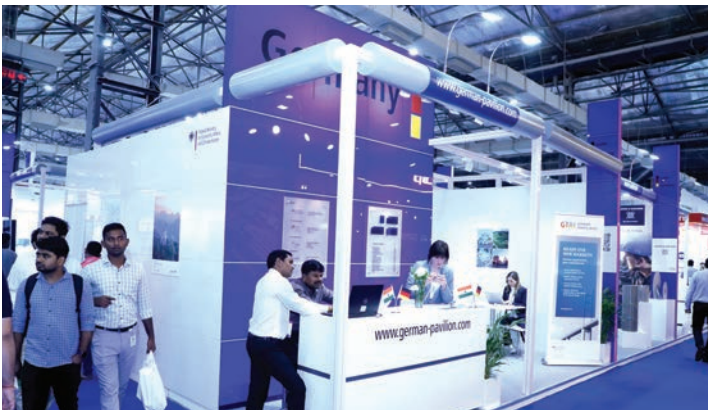
# GLIMPSES OF CHEMTECH WORLD EXPO 2024



SCALE : 60+ Global Start-ups showcased innovations to tackle Climate Crisis



SCALE Pavilion



German Pavilion



International Pavilion



Russian Pavilion

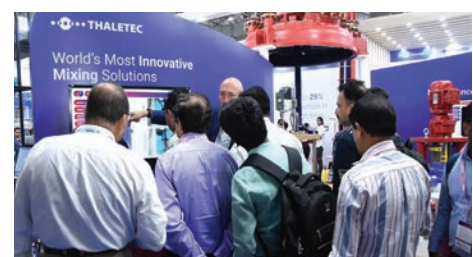


Iran Pavilion

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## Sustainable Energy – Reducing CO<sub>2</sub> Emissions in LNG Plants

Liquefied Natural Gas (LNG) offers a transitional solution to cleaner energy amidst the shift towards net zero carbon emissions. While LNG is cleaner than coal or oil, CO<sub>2</sub> emissions from its production must be mitigated. **Prakash Ray, Engineering Group Supervisor – Process and Aruna Vaidya, Deputy Project Manager, Bechtel**, present a promising avenue for reducing carbon capture from gas turbine exhaust, essential for achieving net zero targets by 2050.

### Liquefied Natural Gas (LNG) and its Importance to Net Zero

Natural gas is a 'traditional' source of energy that is already used for a range of functions, from heating our homes and businesses to cooking and transport. But the fact that it's a fossil fuel means there's a limit to how long we can continue to rely on it. As the world moves towards net zero carbon emissions and renewable energy sources, LNG may be the 'clean' fossil fuel that's best-placed to help transition to a carbon-free future. LNG is created by transforming natural gas into a liquid state, by cooling it to -161°C (-259 °F). The process reduces it to 1/600th of its original un-liquified volume and to half the weight of water. LNG produces 40% less carbon dioxide (CO<sub>2</sub>) than coal and 30% less than oil, which makes it the cleanest of the fossil fuel. It does not emit soot, dust or particulates and produces insignificant amounts of Sulphur dioxide, mercury and other compounds considered harmful to the earth's atmosphere. Clear, odorless, and colorless, LNG is typically 85 to 95% methane, which contains less carbon than other forms of fossil fuels. It also contains tiny amounts of ethane, propane, butane and nitrogen; the exact composition varying depending on its source and processing.

#### Source of CO<sub>2</sub> Emission in LNG Plant:

A series of LNG plants were built around the world in the 1960s and 1970s. Many of these plants, especially

larger ones (1 MTPA and above), use gas turbines for the refrigeration compressors in the liquefaction process. While LNG is a cleaner energy alternative, LNG production process can still create emissions from fuel gas combustion, flaring and venting, fugitive emissions and plant upsets. This creates multiple sources of greenhouse gas emissions in the LNG production chain. CO<sub>2</sub> emissions at an LNG liquefaction facility can be categorized into two primary sources:

- CO<sub>2</sub> vented during upstream pretreatment to remove acid gases
- CO<sub>2</sub> released in the gas turbines exhaust used to drive the liquefaction process

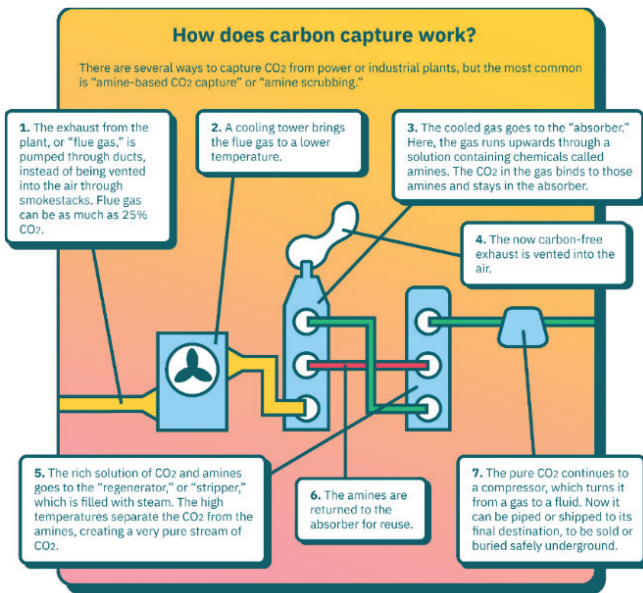
Capturing and sequestering the CO<sub>2</sub> in the feed is already possible with well-proven technologies. A typical acid gas removal unit Acid Gas Removal Unit (AGRU) for LNG already separates CO<sub>2</sub> from the natural gas feed using an amine-based absorption process. The CO<sub>2</sub> stream from AGRU can be compressed for sequestration to reduce CO<sub>2</sub> emission from LNG plant.

The other prime candidate for reducing carbon emission from LNG plants is the Gas Turbine Exhaust.

#### Methods of CO<sub>2</sub> Reduction

Among the two prime locations of CO<sub>2</sub> emission from LNG plant discussed in the above section-B,





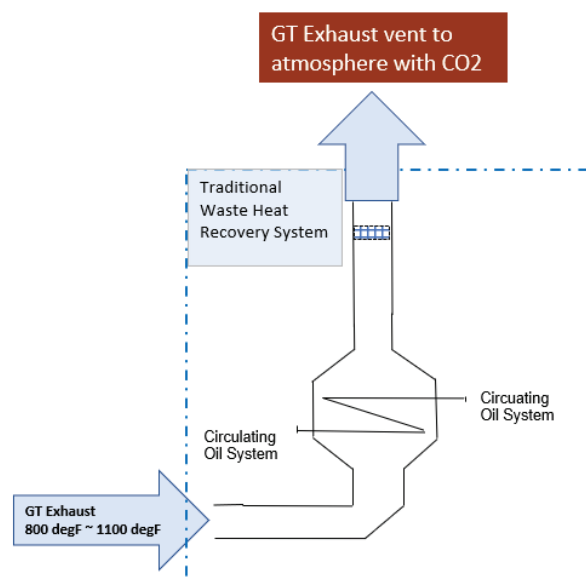
this section described CO<sub>2</sub> capture from Gas Turbine exhaust. Methods of CO<sub>2</sub> reduction from Gas Turbine exhaust can be classified as pre-combustion and post combustion. Pre-combustion CO<sub>2</sub> capture employs de-carbonization of fuel before it is combusted. Post-combustion CO<sub>2</sub> capture involves CO<sub>2</sub> capture from flue gas.

The main focus for LNG plant is post-combustion CO<sub>2</sub> capture from Gas Turbine Exhaust.

The CO<sub>2</sub> reduction process from Gas Turbines exhaust involved three major steps.

### Gas Turbine Exhaust Cooling

The turbine exhaust temperature is generally in the range of 800o F to 1100° F. Traditionally, the heat from



Gas Turbine (GT) Exhaust gas is recovered through Waste Heat Recovery system to cater the heat duty requirement of the LNG process consumers. In this process, Exhaust gas is cooled up to approximately 700-800° F.

As, the Carbon Capture Process needs GT Exhaust to be at ambient temperature (Approximately 100o F), a large cooling duty of GT Exhaust gas from nearly 700-800o F to 100o F is required prior to the Carbon Capture process.

It is possible to utilize multiple options (e.g., cooling water, circulating heat transfer fluid, direct contact cooling, indirect cooling etc.) for cooling the turbine exhaust. The recovered heat can be used in other areas of the plant for process heating and power generation. The GT Exhaust cooling can be performed in two stages.

**First Stage Cooling:** In the first stage cooling high temperature Gas Turbine Exhaust can be cooled to nearly 200°F to 300°F to produce Power. A steam cycle or Organic Rankine Cycle (ORC) can be used to produce power from the high temperature gas.

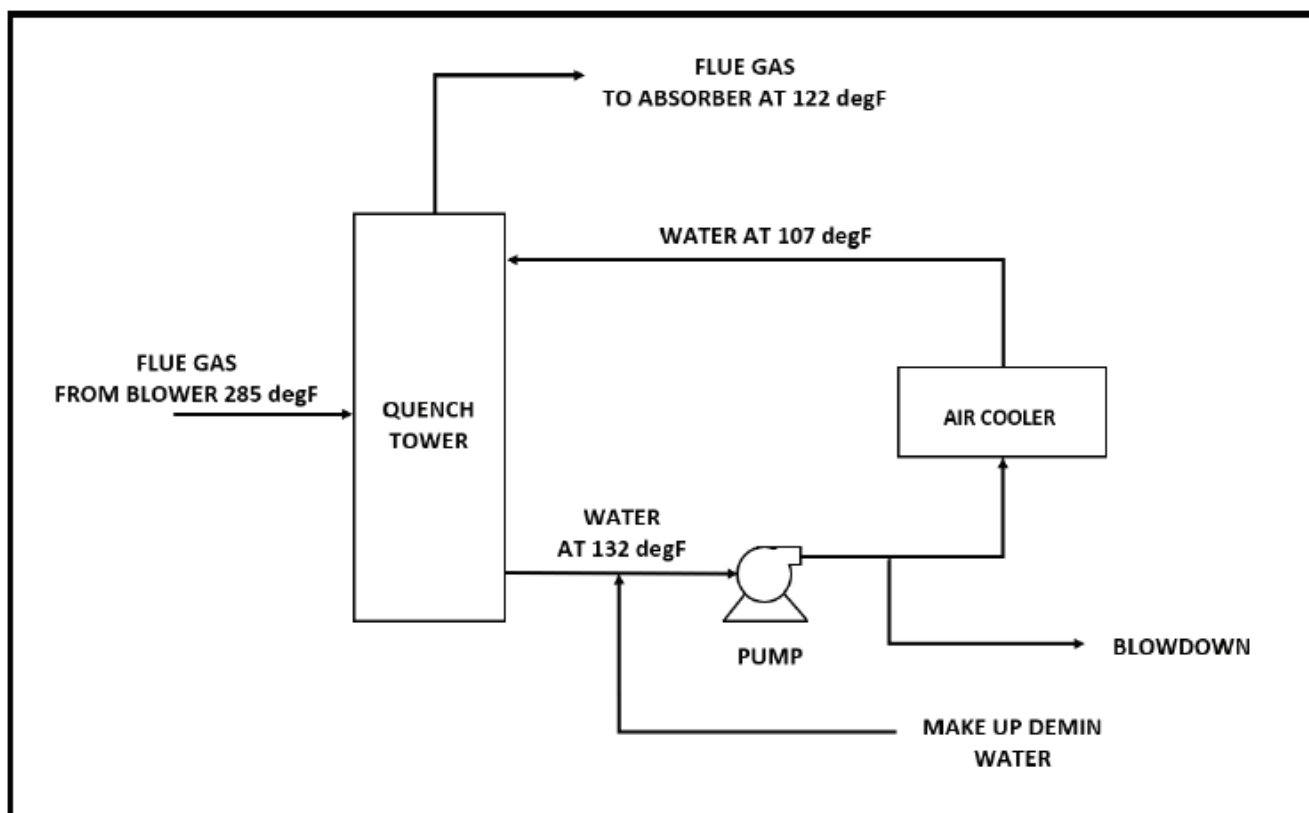
Power generation through steam and ORC has its advantage and disadvantages. Selection between a steam cycle and ORC cycle need to be studied depending on the multiple factors of the plant as listed below.

- Steam can be used for the heating requirement of the carbon capture process which will provide advantage of a steam cycle compared to ORC.
- The ORC loop will require a circulating heat transfer oil to transfer heat from the Gas Turbine Exhaust to the ORC fluid.
- Steam system will require multiple auxiliary equipment to manage condensate, water requirement, dosing etc. An ORC loop can work like a package within its boundary.
- Steam system may produce higher power generation than an ORC loop.

Selection for flue gas cooling between a steam system and Organic Rankine Cycle (ORC) can be decided depending on the above factors.

**Second Stage Cooling:** Flue gas from the 1st Stage Cooling will be further cooled in the 2nd stage cooling to meet the required temperature of the Carbon

## FEATURES



Capture process. A quench column with direct contact circulating water can be applied for the (GT) Exhaust gas second stage cooling.

A schematic drawing of a quench column process is shown below with a representative temperature of the different streams.

### Carbon Capture Process

There are multiple technology and open-art process for carbon capture from Gas Turbine Exhaust. Most of technologies work with circulating solvent with Absorber column, Regenerator column with solvent heating and cooling. Some of the leading processes are listed below.

KM-CDR Process by MHI: "KM CDR Process™" is a CO<sub>2</sub> capture technology that can handle a variety of exhaust sources and a wide range of volumes, from small to large plants. This technology recovers more than 90% of the CO<sub>2</sub> contained in the target gas (with a purity of more than 99.9% by volume). The technology and the solvent used in this process is proprietary of MHI.

OASE Blue by BASF: BASF has developed the OASE<sup>®</sup>blue Technology for capturing CO<sub>2</sub> from flue

gas streams originating from coal, and gas fired power plants, fired heaters and other process streams. The OASE<sup>®</sup>blue solvent is a proprietary amine solution. The technology and the solvent used in this process is proprietary of BASF.

BASF Gas Treating Excellence provides CO<sub>2</sub> capture solutions that support applications ranging from enhanced oil recovery (EOR), urea production and food grade CO<sub>2</sub> production facilities. The OASE<sup>®</sup> technology portfolio has a wide range of solutions that can be tailored to the meet customer-specific needs to provide a high purity CO<sub>2</sub> product available for commercial utilization.

Open-Art MEA: Recent research on CO<sub>2</sub> capture is focusing on the optimization of CO<sub>2</sub> absorption using amines (mainly Monoethanolamine—MEA). CO<sub>2</sub> capture from flue gases using MEA has been widely demonstrated, and the basic feasibility of the process and general trends for capture performance, energy consumption and so on are not in doubt. The Open-Art MEA Plant consists of a number of unit operations, which have been designed individually based on open art principles and then combined into a generic amine scheme.

## CO<sub>2</sub> Compression and Dehydration

CO<sub>2</sub> capture from the carbon capture process is generally at gas stage, low operating pressure (10 to 50 psig), saturated with water and at ambient temperature.

The CO<sub>2</sub> stream will be transported and injected as a liquid or a dense-phase supercritical fluid. Independent of the method used to capture the CO<sub>2</sub>, it remains central to compress carbon dioxide. For CO<sub>2</sub> transportation and storage, CO<sub>2</sub> must be compressed to minimize the volume the CO<sub>2</sub> occupies so that its flow rate through the pipeline can be maximized and to pressurize it enough that it can overcome the pressure of the reservoir into which it is being injected.

One of the most remarkable characteristics of CO<sub>2</sub> is its low critical temperature of 31.1°C (88 °F), which causes CO<sub>2</sub> compression systems work partly below and partly above the critical pressure of 73.8 bara (1070.4 psia). CO<sub>2</sub> in its supercritical state is neither liquid nor gas but instead exhibits properties of both.

The CO<sub>2</sub> stream from carbon capture process are captured at low pressure and water saturated at the regeneration pressure and temperature. As the fluid is compressed up to the necessary injection or disposal pressure (or potentially for EOR usage or other receipt point), some water will begin to condense. However, depending on the composition, operating conditions, and specifications, this fluid may require supplemental dehydration. CO<sub>2</sub> gas, when combined with water, will produce hydrates (at elevated pressures), as well as produce an acidic aqueous phase contributing to corrosion concerns. While corrosion concerns can usually be countered with proper materials selection and corrosion monitoring programs, this is often costly and impractical depending on the process scheme, injection receipt points, and design considerations.

To remove the water from the CO<sub>2</sub> stream a supplementary dehydration unit is generally integrated with the compression process.

A Triethylene glycol (TEG) dehydration process is common for CO<sub>2</sub> Dehydration process. There are other technologies to remove water e.g. DexPro™ process, Molecular Sieve process. Irrespective of the Dehydration technologies, the CO<sub>2</sub> dehydration process is generally located in-between the two Compressor stages where water saturation with CO<sub>2</sub> is minimum.

## Conclusion

Natural gas in the form of LNG will play an important role in the energy transition, but its contribution to global greenhouse and climate change, gas emissions must be reduced to an absolute minimum. To limit global warming, it is critical to lower greenhouse gas emissions like CO<sub>2</sub> from industrial facilities around the world by deploying carbon capture and storage (CCS) at these facilities.

Upcoming LNG Plants have already started working on the Carbon Capture from Gas Turbine Exhaust. These investments in upcoming carbon capture projects in LNG plants will have to be stepped up substantially to help achieve the ambition of net zero anthropogenic greenhouse gas emissions by 2050. ■

## Authors



**Prakash Ray**  
Engineering Group Supervisor  
Process Bechtel India



**Aruna Vaidya**  
Deputy Project Manager  
Bechtel India

## Driving India towards Net Zero: Exploring Decarbonization Technologies including CCUS

Decarbonization is a critical global goal, and many countries across the world have set their emission reduction targets towards a more sustainable, pollution-free environment. India is one of the major nations to set ambitious objectives and is taking big strides towards meeting them.

In the broader effort towards net-zero, there are various decarbonization tools available on the market. This article will draw on **Aker Solutions'** extensive CCUS experience highlighted by **Vishal Pawar, Head of Department - Process & SAE** and **Vinay Parab, Senior Manager - Process Subject Matter Expert - Carbon Capture** to explore a selection of technologies and assess their adoption, as well as commercial availability, enquiry flux, prospects and role in ongoing projects.

### Decarbonization Toolbox

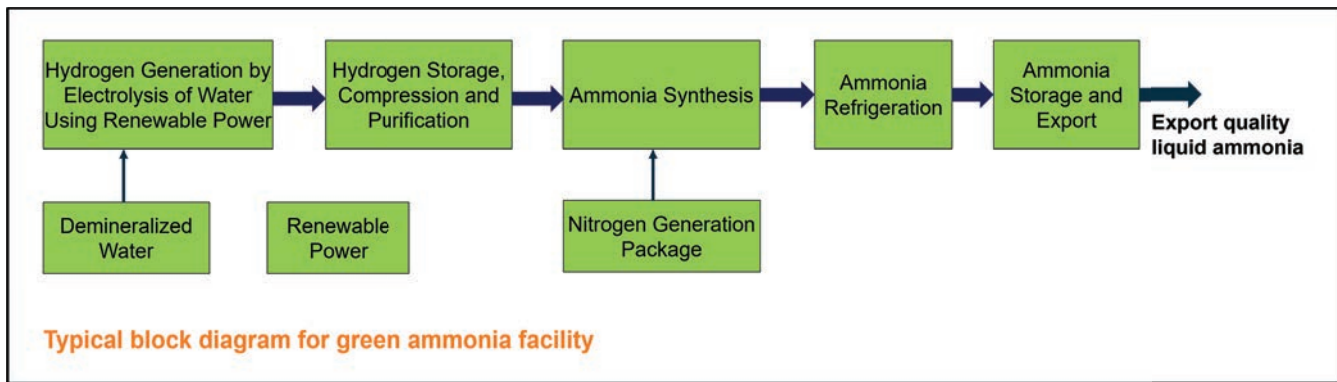
There is no single approach that can be adapted to reach net-zero. Emitting industries should select the appropriate option from the decarbonization toolbox by reviewing feasibility and commercial availability.

In India, renewable energy, electrification, power storage in batteries, green hydrogen, green ammonia, and blending hydrogen in natural gas are expected to be key to reduce emissions from the power sector. With innovations in the production of green hydrogen and

its wide range of applications in refinery fired heaters, and the steel and transport industries, hydrogen is considered as a 'green energy carrier' and a critical decarbonization tool. Similarly, ammonia produced from green hydrogen has the potential to reduce emissions from the fertilizer industry.

Hard-to-abate industries contribute to one-third of total carbon emissions. CCUS can play a vital role in cutting these emissions, based on the approach and learnings from countries that are further along in their net-zero journey.

Decarbonization to achieve Net-zero	Decarbonization technology toolbox	<b>Reduce emission</b> <ul style="list-style-type: none"> <li>Implementing carbon neutral technologies in industries to reduce emissions</li> <li>Energy efficiency improvements</li> </ul>	<b>Alternate fuel</b> <ul style="list-style-type: none"> <li>Renewable energy – solar and wind</li> <li>Green Hydrogen</li> <li>Green Ammonia</li> <li>Bio-mass</li> </ul>	<b>Electrification</b> <ul style="list-style-type: none"> <li>Power storage in batteries</li> </ul>	<b>Carbon Capture Utilization and Storage</b> <ul style="list-style-type: none"> <li>Can be used without any modification to existing method of manufacturing</li> </ul>
	Government support	<ul style="list-style-type: none"> <li><b>Government support for global collaboration and technologies development</b></li> <li><b>Funding demonstration projects</b></li> <li><b>Supportive policy framework</b></li> <li><b>Incentivization</b></li> </ul>			



### Green Hydrogen

Green hydrogen refers to the production of hydrogen by water electrolysis using renewable power. It is emerging as a feasible option due to technological innovations in electrolyzers, electricity generation from renewables, and a variety of hydrogen applications. The Government of India is taking various measures to facilitate the transition from fossil fuel to green hydrogen / green ammonia.

Water electrolysis is a process used to split water into hydrogen and oxygen using electricity. There are three main types of electrolyzers, alkaline electrolyzers, polymer electrolyte membrane (PEM) electrolyzers and solid oxide electrolyzers.

Among these, alkaline electrolyzers have the most developed technology. Potassium hydroxide solution, which operates at a temperature range of 80-90°C and 1-30 barg pressure, is primarily used as electrolyte for these.

Hydrogen production facilities using alkaline electrolyser technology typically consist of an alkaline electrolyser, hydrogen gas separator, gas cooler and electrolyte circulation system. Alkaline electrolyzers have a longer operating life than PEM electrolyzers.

In PEM electrolyzers, a solid sulfonated polystyrene membrane is used as an electrolyte. It operates at a temperature range of 50-80°C and requires a higher quality of demineralized water than alkaline electrolyzers.

Solid oxide electrolyzers operate at a high temperature range of 700-850°C and use water in the form of steam. They operate with high efficiency, but the technology is less mature than the other two options.

### Green Ammonia

The traditional steam methane reforming process for manufacturing ammonia causes carbon dioxide emissions. In the green ammonia process, hydrogen is produced by water electrolysis, with the power requirement for electrolysis and plant operation being produced from renewables and eliminating carbon dioxide emissions.

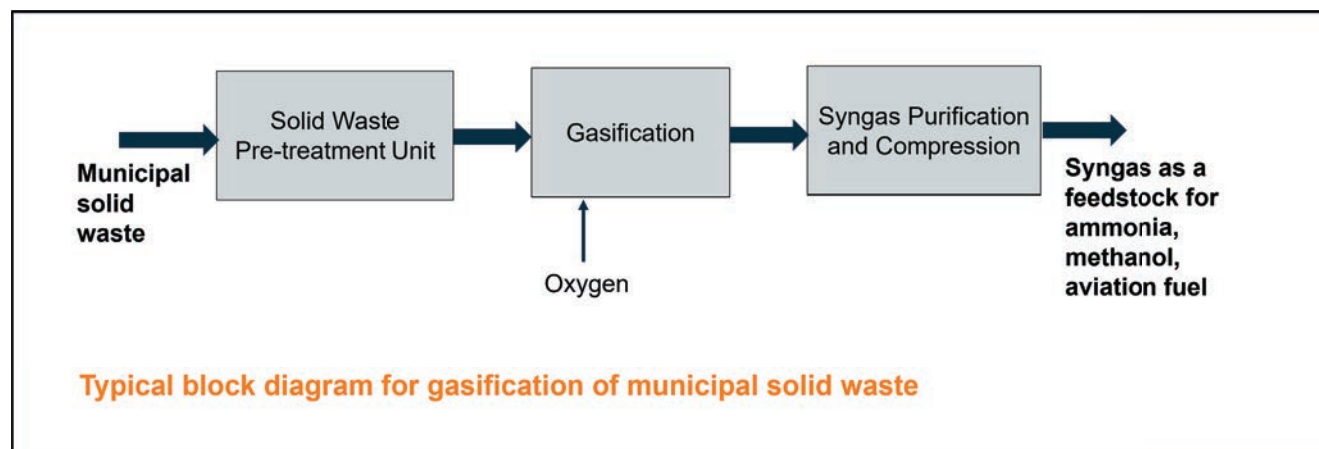
The hydrogen generated from electrolysis reacts with nitrogen from an air separation unit in the ammonia synthesis package to produce ammonia. Hydrogen produced from electrolyzers needs to be purified to remove oxygen and meet the ammonia synthesis loop quality requirement.

It is possible that the renewable power being used may not be available continuously throughout the day and year. In such a scenario, there are various engineering solutions to ensure uninterrupted production of green ammonia. Taking this into consideration, the hydrogen storage facility should be sufficiently sized to provide the required quantity of hydrogen continuously for ammonia synthesis. Also, provision for energy storage using batteries or 'pump hydropower' should be made for continuous supply of renewable power.

### Gasification of Municipal Solid Waste

Municipal solid waste poses an environmental and health hazard if not treated properly. The usual method in India and many other countries is landfilling, dumping grounds or incineration. However, these contribute to carbon emissions in the form of methane and carbon dioxide. The operational model for capturing the emitted carbon dioxide is in an early stage of development.

## FEATURES



Globally, steps are being taken to develop technologies for converting solid wastes into sustainable products through green routes. One of the processes is gasification of waste in a controlled oxygen process to produce syngas, which can form a significant building block for producing chemicals like methanol, ammonia and aviation fuel through various proven technologies.

To initiate, incubate and implement gasification and downstream processes requires continuous research, development of prototypes and scale-up of models to build commercial level plants. This can surely be a sustainable tool for decarbonization at source.

### Carbon Capture, Utilization and Storage (CCUS)

CCUS is an important and well-known tool available for carbon dioxide emitting industries that have exhausted their options to meet emission reduction targets. It can be used without making any modifications to the existing production technology and method.

Considering India's rapidly growing energy needs, dependence on fossil fuels is likely to continue for the generation of affordable and reliable baseload power.

Carbon intensive industries such as steel, cement, oil and gas, refineries, petrochemicals, chemicals and fertilizers are critical to the continued growth of the Indian economy. CCUS has an integral role to play in the decarbonization of these industries.

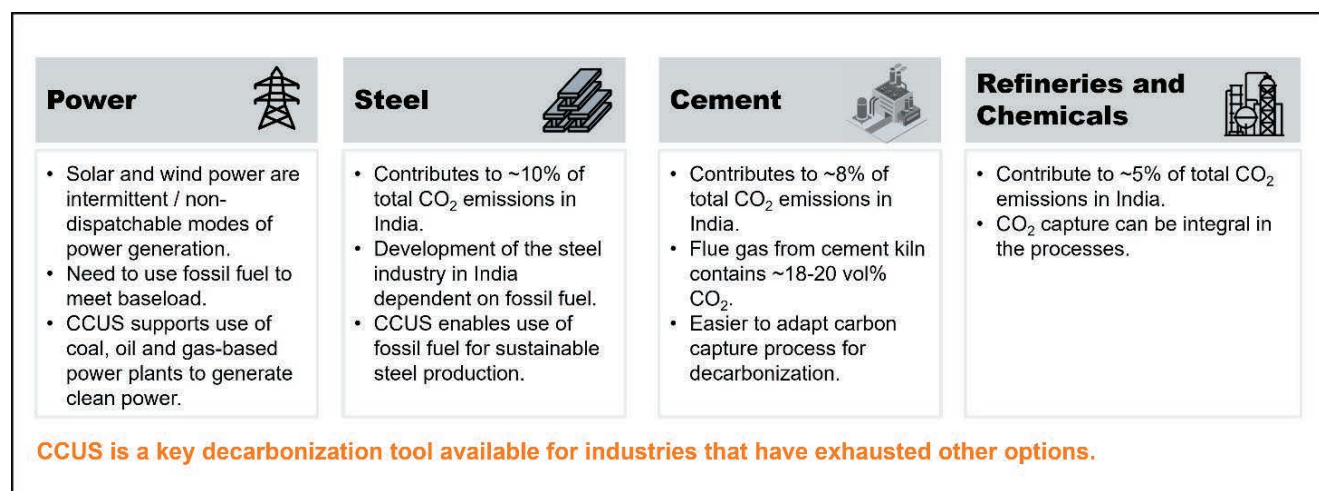
CCUS will also support the transition from blue hydrogen to green hydrogen by accelerating the demand and creating technologies and infrastructure for production, storage and transportation of hydrogen.

### Chemical solvent-based post combustion carbon capture process:

There are different types of commercial-scale carbon capture technologies available, depending upon carbon dioxide concentration and pressure of the gas stream. Among these, chemical solvent-based technologies are widely developed and commercially available.

### Process description

In chemical solvent-based post-combustion capture processes, the flue gas is first cooled and pre-treated



in the quencher to remove acid gases from the flue gas stream. The pre-treated flue gas enters the absorber, where the solvent absorbs carbon dioxide from the flue gas by a chemical bond. The cleaned flue gas is vented to the atmosphere.

The solvent containing the captured carbon dioxide is removed from the absorber bottom and sent to a stripper. The stripper is heated with steam to release the carbon dioxide from the solvent before it is returned to the absorber. The released carbon dioxide is compressed, dried and / or liquefied, depending on the end use.

Impurities from the flue gas will accumulate in the solvent over time. A small slipstream of the solvent is routed to a reclaimer to purify the solvent and reduce solvent loss.

**Solvent selection:** The amine-based gas sweetening process is popular in oil and gas, and refining facilities to remove impurities like hydrogen sulphide and carbon dioxide from the product gas stream. However, these amines have limitations in the post-combustion flue gas carbon dioxide capture process. The effect of post-combustion components from flue gas on the solvent performance should be taken into consideration while selecting the absorption solvent.

The carbon capture process should be energy efficient, economical, and most importantly HSE friendly to make it acceptable to the industry and society. The key element to make the capture plant economically sustainable is the choice of the most robust solvent to absorb the carbon dioxide from flue gas. Robust solvents ensure low solvent degradation, which has benefits like low solvent makeup, low emissions and

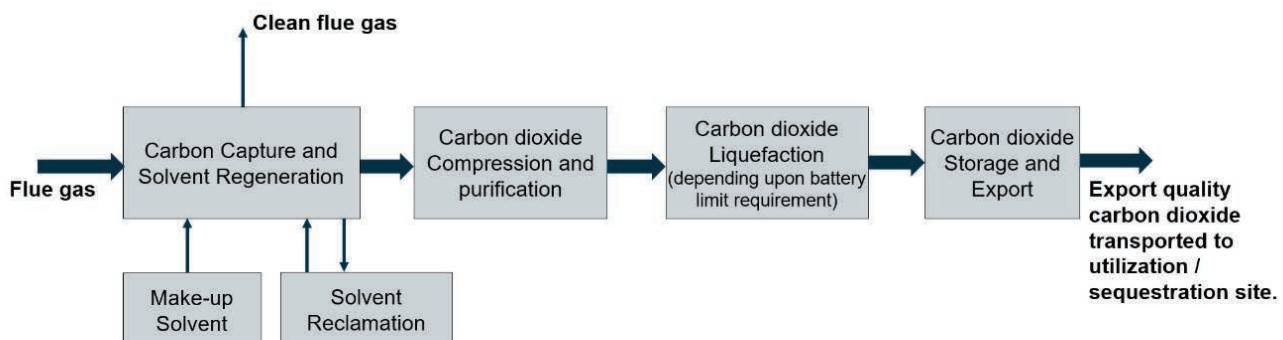
low demand of reclamation, hence saving significant operational costs.

**Design innovation - heat integration:** The process of carbon capture, compression, conditioning, liquefaction, and transport is energy intensive, and every effort should be made to reduce energy requirements. Heat integration within the process and with the balance of the facility wherein the capture plant will be installed can be a challenge to engineering companies and is key for acceptable design.

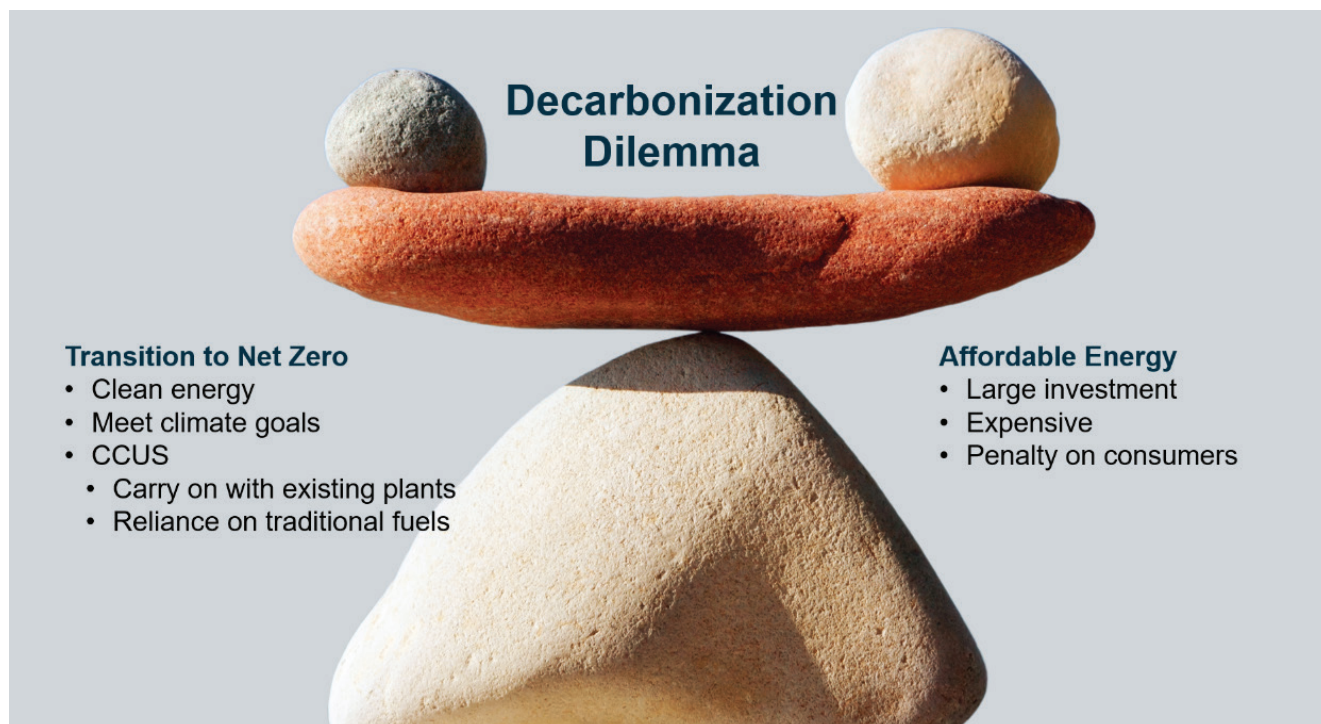
**Sequestration of captured carbon dioxide:** Carbon dioxide utilization technologies can provide a wide variety of opportunities to convert the captured carbon dioxide to value-added products which have a ready market in India. However, it has a limited capacity to contribute to meeting net-zero. For India to realize the net-zero mission, it requires mainly permanent sequestration of captured carbon dioxide supported by value-based utilization.

If geological sequestration is to be realized at a commercial scale, the facilities need to be able to handle several million tons of carbon dioxide. It is vital to develop a hub and cluster concept to make this feasible. Multiple industrial emitters of carbon dioxide can then share common infrastructure for collection of captured carbon dioxide from the emitting industry's battery limit, transportation and gathering facilities and the setup for further sequestration. It supports reduction of unit cost for carbon capture and storage (CCS) due to economies of scale.

Globally, a number of hub and cluster projects are being studied and developed. Aker Solutions has worked on various facilities which are part of such



Typical block diagram for carbon capture facility



a concept, including Norway's pioneering Longship project and Net Zero Teesside in the UK.

We believe that similar concepts should be initiated in India to enhance application of CCS as a decarbonization tool. Government support is required for source-sink mapping, identification of fields for carbon dioxide injection and developing the necessary network.

### Conclusion

Decarbonization in India needs a stepwise approach to reach net zero emissions by 2070. Renewable energy, electrification, green hydrogen, green ammonia and CCUS will play a vital role. The immediate focus should be on the transfer of proven technologies and adapting them at commercial scale. CCS has a critical role to play, and hub and cluster development is vital to make its use feasible. Government support is required for developing carbon dioxide storage infrastructure in India.

The decarbonization dilemma for developing economics like India is to maintain a balance between transition to net-zero and generating affordable energy for the country's development.

A methodology involving adoption of various decarbonization technologies, global collaboration to implement them and government initiatives such

as incentivization, funding demonstration projects and supportive policy framework is the key to India achieving its decarbonization goals. ■

### Authors



**Vishal Pawar**  
Head of Department - Process & SAE  
Aker Solutions



**Vinay Parab**  
Senior Manager - Process Subject Matter  
Expert - Carbon Capture  
Aker Solutions



## Navigating the Nexus: Addressing Antimicrobial Resistance in Water Sources

As advancements in water purity continue, the looming threat of antimicrobial resistance (AMR) becomes increasingly urgent. The unveiling of the Antimicrobials Filter Cartridge marks a significant breakthrough in water purification technology, specifically aimed at tackling AMR compounds. **Pavithra Ravindran, CMO, Biznustek Systems Pvt. Ltd.**, underscores this innovation as vital for safeguarding public health, combating superbugs, and confronting the escalating issue of water contamination.

**T**he Water Purification Technology market has been making significant strides over the last few decades. However, amidst this pursuit of water purity, a silent threat looms large: antimicrobial resistance (AMR) and the proliferation of superbugs. This global challenge has sparked an urgent need for innovative solutions that not only purify water but also address the complex issue of AMR.

In response to the urgent need for effective solutions to combat antimicrobial contamination in water sources, Antimicrobials Filter Cartridge has been introduced by (BSPL). This revolutionary filtration device represents a significant leap forward in water purification technology, specifically engineered to address the complex challenge of antimicrobial resistance (AMR). Unlike traditional filters that primarily target physical impurities, the cartridge utilizes advanced filtration technology to selectively remove a wide range of antimicrobial contaminants, including antibiotics and antimicrobials, from water.

### The Growing Threat of Antimicrobial Resistance

Antimicrobial resistance is a phenomenon characterized by the ability of microorganisms—such as bacteria, viruses, parasites, and fungi—to withstand the effects of antimicrobial drugs, including antibiotics. This resistance arises from various factors, including the overuse and misuse of antibiotics in healthcare, agriculture, and the environment. As a result, once-treatable infections are becoming increasingly difficult—and sometimes impossible—to cure, leading to prolonged illness, higher healthcare costs, and elevated mortality rates.

### Superbugs: A Looming Public Health Crisis

Compounding this issue is the emergence of superbugs—resilient pathogens that have evolved to resist multiple antibiotics. These superbugs pose a formidable challenge to public health, undermining the efficacy of conventional treatment methods and exacerbating the global burden of infectious diseases.

The threat of a superbug pandemic looms large, fueled by interconnected factors such as global travel, antimicrobial misuse, and inadequate infection control measures. As superbugs continue to proliferate and evolve, the urgency of developing effective strategies to combat AMR becomes increasingly apparent. In this context, the role of water contamination in the dissemination of superbugs cannot be overlooked. Water sources contaminated with antimicrobial residues provide a conducive environment for the transmission and proliferation of resistant pathogens, contributing to the amplification of AMR on a global scale.

### The Role of Water Contamination in AMR

Water contamination plays a significant role in the proliferation of antimicrobial resistance. Antibiotics and other antimicrobial compounds can enter water sources through various pathways, including agricultural runoff, pharmaceutical manufacturing, and improper disposal of medications. Once in the environment, these antimicrobial agents can exert selective pressure on microbial populations, driving the emergence and spread of resistant strains. Additionally, wastewater treatment plants may not adequately remove antimicrobial residues, allowing them to persist in the environment and contribute to the development of AMR.

# FEATURES

## Antimicrobials Filter Cartridge

In response to the urgent need for effective water filtration solutions, Biznustek Systems Pvt. Ltd. (BSPL) has developed the Antimicrobial Filter Cartridge—a revolutionary technology designed to combat antimicrobial contamination in water sources. Unlike traditional filters that primarily target physical impurities, such as sediment and debris, the Antimicrobial Filter Cartridge employs advanced filtration technology to selectively remove antimicrobial compounds, including antibiotics and antimicrobials, from water.

At the heart of the Antimicrobial Filter Cartridge lies its sophisticated filtration matrix, which utilizes a combination of physical, chemical, and biological processes to neutralize antimicrobial contaminants. This multifaceted approach ensures that water passing through the cartridge is thoroughly purified, with antimicrobial residues effectively removed to levels below detectable limits.

### Characterised by:

- **Advanced Filtration Technology:** The Antimicrobial Filter Cartridge utilizes state-of-the-art filtration mechanisms to selectively target and eliminate antimicrobial contaminants, ensuring unparalleled water purity and safety.
- **Sustainability and Eco-Friendliness:** The technology is committed to environmental stewardship, prioritizing the use of eco-friendly materials and manufacturing processes in the production of the Antimicrobial Filter Cartridge. This pledge not only minimizes the ecological footprint of the cartridge but also contributes to a healthier planet for future generations.
- **Public Health Impact:** By removing antibiotics and antimicrobials from water sources, the Antimicrobial Filter Cartridge plays a crucial role in safeguarding public health and combating AMR. By mitigating the spread of resistant pathogens, the cartridge helps protect vulnerable populations from the devastating consequences of antimicrobial-resistant infections.
- **Cost-Effective Performance:** Engineered for durability and efficiency, the Antimicrobial Filter Cartridge offers long-term cost savings by reducing maintenance requirements and operational costs. Its robust construction ensures reliable performance over extended periods,

providing consumers with peace of mind regarding the quality and safety of their drinking water.

## Applications and Market Potential

The Antimicrobial Filter Cartridge has a wide range of applications across various sectors, including residential, commercial, and industrial settings. From household water purification systems to municipal water treatment plants, the cartridge can be seamlessly integrated into existing infrastructure to enhance water quality and safety. Additionally, its compatibility with a diverse range of filtration systems makes it a versatile solution for addressing antimicrobial contamination in diverse water sources.

In terms of market potential, the demand for antimicrobial filtration technologies is expected to surge in the coming years, driven by increasing awareness of waterborne health risks and growing concerns about antimicrobial resistance. As consumers and policymakers alike prioritize water quality and safety, the Antimicrobial Filter Cartridge is poised to emerge as a leading solution for addressing these critical needs.

## Conclusion

Daunting challenges posed by antimicrobial resistance and water contamination, the Antimicrobial Filter Cartridge represents a beacon of hope—a testament to human ingenuity and innovation. By harnessing advanced filtration technology, BSPL is paving the way for a future where clean and safe drinking water is accessible to all. As the global community continues to grapple with the complex interplay of environmental, societal, and public health factors, the Antimicrobial Filter Cartridge stands as a symbol of collective efforts to resolve and build a healthier, more sustainable world for generations to come. ■

## Author



**Pavithra Ravindran**  
CMO  
Biznustek Systems Pvt. Ltd.

## Driving the Future: Transformative Trends in India's EPC Industry

Over the past three fiscal years, government spending as a percentage of GDP has risen with nearly a threefold increase in capex budget in setting up energy & infrastructure projects. This anticipated growth presents significant opportunities for the EPC industry to thrive and expand its operations. **Jimmy Spencer, Managing Director, Chemtex Global Engineers Pvt. Ltd.** delves into transformation of India's EPC sector. He shares how this fraternity is prioritizing sustainability and energy efficiency in their projects and expresses that evolving regulatory landscape in India necessitates alignment with global standards and practices to attract overseas EPC contractors and bilateral investments.



### **JIMMY SPENCER**

Managing Director  
Chemtex Global Engineers Pvt. Ltd.

#### **In your experience, what are the biggest drivers transforming the EPC industry in India?**

In my experience, the primary drivers transforming the EPC (Engineering, Procurement, and Construction) industry in India include a significant increase in government spending on core infrastructure projects spanning various sectors such as refining, oil and gas, petrochemicals, and power, including renewable and solar energy initiatives. There is also a notable surge in investments in infrastructure development, encompassing roads, railways, bridges, ports, airports, and other essential facilities. Over the past three fiscal years, government spending as a percentage of GDP has risen, with nearly a threefold increase in capex

budget allocations. This increased expenditure has coincided with an overall improvement in the health of the economy, particularly in the banking sector's ability to finance large-scale infrastructure projects, facilitated by better project evaluation tools. These developments have resulted in improved economies of scale and greater efficiency in government spending reallocation efforts. Consequently, such initiatives are expected to provide a substantial impetus to the economy's aspirations of achieving a USD 5 trillion GDP target in the near future. This anticipated growth presents significant opportunities for the EPC industry to thrive and expand its operations.

### **How are EPC service providers adapting to the increasing focus on sustainability and energy efficiency in projects? How are you driving these themes across Chemtex?**

EPC service providers are increasingly prioritizing sustainability and energy efficiency in their projects. It has transitioned from being an option to a necessity, given the ongoing dynamic changes worldwide. Sustainability has gained significant momentum, prompting a conscious effort to utilize environmentally friendly materials and energy-efficient solutions. There's a heightened focus on mitigating climate damage and protecting the environment. In any EPC project, construction constitutes a substantial portion of the contract, necessitating attention to process-related emissions, climate change mitigation, water resource management, and waste management.

Energy efficiency and the adoption of clean energy solutions are paramount. At Chemtex, we recognize the imperative of adapting to these evolving trends. We are committed to incorporating sustainability and energy efficiency principles into our projects to ensure not only compliance but also contribute positively to environmental protection and resource conservation.

### **What role do you see digitalization and technological advancements playing in the future of EPC projects in India, how is Chemtex leveraging these technologies?**

Digitization and technological advancements are poised to revolutionize the future of EPC projects in India, enhancing operational efficiencies and optimizing core processes. At Chemtex, we recognize the transformative potential of digitization in various aspects of project execution.

Digitization offers improvements across the entire project lifecycle, from engineering and design to project and construction management, commissioning, and project collaboration. By leveraging digital tools, we can expedite the Front-End Engineering Design (FEED) process, enhance engineering quality, and facilitate seamless sharing of information between project disciplines.

Additionally, digital solutions such as Enterprise Resource Planning (ERP) systems streamline procurement, timeline management, and document system management.

Embracing digitization not only enhances operational efficiency but also enables cost optimization in the competitive EPC landscape. Moreover, digital technologies empower EPC companies like Chemtex to deliver value-added services to clients by offering innovative solutions and enhanced project performance. In summary, we believe that embracing digitization and leveraging technological advancements are imperative for the future success of EPC projects in India, and at Chemtex, we are committed to harnessing these technologies to deliver superior outcomes for our clients.

### **Considering the skilled labor shortage, how can EPC companies address the need for a more efficient and upskilled workforce?**

The shortage of skilled labor is a persistent challenge for EPC projects. Construction sites often face a scarcity of skilled workers, including welders, pipe fitters, machine operators, and electricians. To meet project deadlines and avoid cost overruns, EPC companies sometimes compromise on labor quality, risking safety and project quality. Similarly, in design engineering, a lack of skilled and technically proficient engineers leads to lower productivity and increased rework, resulting in project delays and inefficiencies. Additionally, there is a trend of individuals preferring IT careers over engineering due to perceived better opportunities and financial rewards.

To address this issue, EPC companies must offer diverse project opportunities, competitive pay scales, career advancement prospects, and opportunities for multi-skilling. Providing in-house training programs and implementing better hiring practices can help attract and retain top talent. It is crucial to create a work environment that promotes work-life balance and fosters interest in engineering careers. Overall, EPC companies need to take proactive measures to make engineering careers more attractive to students and professionals, thereby mitigating the skilled labor shortage and ensuring the success of their projects.

### **What are your thoughts on the evolving regulatory landscape in India and how do you see it impacting the EPC industry?**

The evolving regulatory landscape in India necessitates alignment with global standards and practices to attract overseas EPC contractors and bilateral investments. This influx of global contractors

enhances competition, improves quality, and drives technological advancements in EPC projects.

Improvements in the approval process, particularly regarding land acquisition and environmental clearances, are crucial. Additionally, access to affordable, long-term financing at competitive rates is essential for capital-intensive industries. Taxation policies require greater certainty and stability to reduce litigation and ensure faster turnaround times.

Positive governmental initiatives, such as encouraging technology adoption, investing in renewable energy and smart cities, and promoting digital transformation, are commendable. However, there is a need for better quality control and skill development to level the playing field in the EPC sector and mitigate project delays resulting from underbidding.

Encouraging public-private partnerships can help overcome funding challenges, while insurance products covering project delays, cost overruns, regulatory uncertainties, and geopolitical shocks on commodity pricing can mitigate risks for EPC contractors. Overall, these measures are vital for fostering a conducive regulatory environment and driving growth in the EPC industry in India.

#### **Walk us through the future plans of Chemtex.**

Chemtex is currently expanding its business horizons in the Gulf countries while maintaining a strong focus on refining and petrochemical projects in India. This strategic decision aligns with the ambitious investment plans announced by IOCL and ONGC in these fields. We are optimistic about the opportunities ahead and look forward to capitalizing on them for mutual success. ■

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Email: sales@jasubhai.com  
Website: www.jasubhaimedia.com



# Traversing Future Trends in the Specialty Chemicals Industry

**Vinod Paremal, Regional President and Managing Director, Evonik India Subcontinent,** discusses key trends and strategies in the specialty chemicals industry. Emphasizing innovation and sustainability, Evonik is poised to capitalize on market growth while addressing challenges like regulatory changes and embracing emerging technologies to drive future success.



### VINOD PAREMAL

Regional President and Managing Director,  
Evonik Indian Subcontinent.

#### **What are the top three trends shaping the specialty chemicals industry, and how are you preparing to capitalize on them?**

Last year, we saw some important trends – high inflation, a slowdown in Europe and China, and strong demand in India. The global and Indian chemical industry experienced various challenges, especially for businesses that rely on exports.

The Indian government is actively boosting local manufacturing initiatives with incentives for key sectors like solar and semiconductors. This move strengthens manufacturing and creates new value chains.

Because of recent events like the pandemic, supply chains faced disruptions. The industry is now shifting

from relying on precise timing to being more prepared for unexpected events. This might lead to more partnerships with global firms.

Evonik in India has two manufacturing facilities, one in Dombivli and one in Jhagadia. With our global presence and supply chain connections, we can meet the needs of the Indian market.

Sustainability is gaining importance in the Indian industry. From Evonik's perspective, our advanced solutions for fuel efficiency, reducing carbon emissions, and making things lighter are becoming popular in the Indian automotive industry. The increasing investments in renewable energy, especially wind and solar power, are also positive for Evonik.

**Can you discuss the latest specialty chemical innovation, its benefits, and new opportunities for customers?**

At Evonik, we're focusing on six key areas of innovation, and we refer to them as our strategic development sectors. These areas are in markets that are growing faster than usual, and they are sustainable nutrition, healthcare solutions, cosmetics solutions, health-enhancing substances and nutritional supplements, gas separation membranes and products for additive manufacturing.

We are working on "Next-Generation Solutions," which are not only environment friendly but also innovative products. For example, we are developing technologies for controlled drug delivery, membranes for biogas and hydrogen, and natural-based ingredients for cosmetics.

We are investing in various projects, like setting up a research center for lithium-ion batteries in China, expanding production capacity in Japan for the battery market, building a plant for biodegradable surfactants in Slovakia, and constructing a facility in the USA for pharmaceutical lipids used in mRNA-based medicines.

These investments show our commitment to making a positive impact through our innovative products.

**How is Evonik integrating sustainability into R&D and product development, and can you provide a few patterns?**

Our Research Centre in India is a crucial hub for developing new products and technologies. This center, known as RCI, caters to the needs of the Indian market, creating products tailored to our Indian customers' specific requirements. RCI is also a global support center for formulation development in pharmaceuticals, nutraceuticals, and the food industry.

In alignment with RCI, we have the Evonik Catalyst R&D facility in Dombivli, serving customers globally in various industries like pharmaceuticals, agro, fine chemicals, food, and edible oil. This site focuses on Life Sciences and Performance Catalysts, which comprises oil and fat hydrogenation catalysts, precious metal catalysts, and activated metal catalysts.

Sustainability is a key focus for Evonik, and we see it as essential for long-term business success. Our

customers increasingly demand products that balance economic, ecological, and social factors. Sustainability has become a growth driver for Evonik, integrated into our key strategic levers - Next Generation Portfolio, Next Generation Innovation, and Next Generation Culture.

Our NextGen Evonik portfolio centers on fighting climate change, safeguarding ecosystems, driving circularity, and ensuring health and well-being. As part of India's sustainability goals, we support initiatives like the Sustainable Alternative towards Affordable Transportation. For instance, our products like Sepuran® Green membranes for Bio-CNG, CBG applications, CAPLUS® for CO<sub>2</sub> removal, and Vestamin® IPD for wind turbine applications contribute to sustainability targets.

Evonik is contributing towards India's sustainable journey by offering NextGen solutions to the industry. Currently, more than a third of our sales come from NextGen Solutions, and our aim is to increase this to over 50% by 2030. This commitment involves investing over €3 billion by 2030 in NextGen Solutions, accounting for around 80% of our annual growth investments.

**How are emerging technologies like AI, big data, and automation impacting the industry and Evonik's operations?**

Artificial Intelligence, or AI, serves as the versatile assistant in the digital era. At Evonik, we see it as a powerful tool, especially for Cognitive Solutions.

We have adopted an AI framework called Cognitive Solutions Agenda, to maximise its potential. To achieve this, we've created a four-step training program for our employees. It covers basic awareness to advanced data analytics and science including determining structures and material compositions in labs, classifying knowledge such as patents, managing information for high-performance polymers, and developing the virtual assistant COATINO for the paint and coatings industry. We also use AI to predict the purchase prices of raw materials.

In the field of industrial AI applications, we are directing our attention on materials discovery. We are partnering with the MIT-IBM Watson AI Lab to create a technique for representing chemical compounds in a machine-intelligible format that can be used by

## INTERVIEW

machine learning algorithms can understand for property prediction. This is especially important for polymers.

**What are the growth expectations and key challenges/opportunities in the specialty chemicals sector over the next 3-5 years?**

The Indian specialty chemicals market is set for strong growth, expected to be around 8-10% in the coming years. This growth is fueled by increased demand in various industries due to rapid urbanization and industrialization. Key factors like a large consumer base with diverse demographics, and rising disposable income will be the driving forces for the industry's growth in the medium to long term.

The demand for specialty chemicals is high, creating a solid foundation for growth in India for both local and global specialty chemicals companies. The Indian specialty chemical sector has great potential for growth in both domestic and export markets, thanks to competitive manufacturing costs. With a renewed focus on stable supply chains, there's an opportunity for India to meet global market demands.

However, to fully unlock the potential of the Indian Specialty Chemicals industry, addressing challenges like changing regulatory norms, such as the Carbon Border Adjustment Mechanism (CBAM), is crucial. The industry also needs to concentrate on innovation, reducing carbon emissions, embracing digitalization and automation, and investing in workforce skills to enhance competitiveness globally. ■

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Website: www.jasubhaimedia.com





## Harnessing the Power of AI for Predictive Maintenance



**G BALAJI**

SVP, Head of Energy Industries  
ABB India

In today's industrial landscape, the scale and momentum of digitalization is compelling companies to reinvent themselves and strive for continuous improvement in their operations. Industry 4.0 is revolutionizing production and distribution processes by integrating smart technologies such as the Internet of Things (IoT), cloud computing and analytics, AI, and machine learning for better business outcomes. Data is the new gold for decision-makers, enabling them to optimize and accelerate their operations with confidence and reliability.

**W**hile the industry is certainly embracing digitalization – particularly in terms of an enhanced ability to collect data – knowing how best to utilize it is key. Analyst studies suggest that industrial companies typically are able to use only 20% of the data generated which limits their ability to apply data analytics meaningfully. The application of artificial intelligence on data produces meaningful insights for prediction and optimization that improve business performance. AI is proving to be very effective for implementing predictive maintenance for companies and saving expenses. According to McKinsey & Company, AI-based predictive maintenance can boost availability by up to 20% while reducing annual maintenance costs by up to 10%.

### **AI can address issues before they impact productivity**

When it comes to maintaining process equipment, there is no one-size-fits-all solution. Different strategies – from proactive, predictive maintenance to reactive maintenance – have their own benefits and drawbacks in terms of costs and time-savings. The key is to choose the right strategy for the right situation. This is especially important for rotating equipment (compressors, pumps, turbines, and others) that are essential in most industrial plants. However, getting a 360-degree view of the condition of rotating equipment can be challenging and time-consuming. Without it, industrial operators may miss the chance to optimize their maintenance plans and increase their operational efficiencies.

Condition monitoring is a critical aspect of asset management and maintenance. It enables the detection and diagnosis of abnormal activities or faults in equipment and processes to optimize maintenance and



performance. However, traditional condition monitoring relies on the assumption that equipment failure is random and unpredictable and that the best way to prevent it is to perform regular inspections and repairs. It focuses on scheduled maintenance activities, such as lubrication, cleaning, calibration, and replacement of parts, regardless of the actual condition of the equipment.

A more advanced approach to condition monitoring is to leverage data analytics, AI, and ML. Enterprises can use data to understand how an asset performs and when it will degrade. This can improve maintenance and prevent failures. To achieve this level of predictive maintenance, the enterprise needs to incorporate more data sources. For example, sensors can capture data points from key components. Other valuable data sources include ERP and procurement data, historical maintenance and repair data, production data, and field reports from employees. AI can augment and enhance traditional condition monitoring by creating an expert system that delivers timely and actionable insights for asset management. It can analyze multiple sensor signals in combination and provide holistic and accurate assessments of equipment health. AI can also generate prescriptive recommendations and predictive estimates of future health and the remaining life of assets. This will allow operators to adopt reliability-focused maintenance strategies that reduce costs and improve uptime by minimizing unnecessary or late interventions.

For instance, if a plant operator wants to make sure their equipment is working well and avoid any breakdowns or accidents. What's the best way to monitor the condition of the assets? The operator could use the traditional method of performing planned maintenance activities. But there are higher possibilities of missing some early signs of trouble or it could alert the operator too late. This method also ignores the bigger picture of how the

overall assets are performing. Or the operator could use the smarter method of using AI. Through this, they can detect problems earlier and more accurately by looking at multiple sensors' signals together. AI can also tell what to do to fix the problem and how long the asset will last. This way, the operator can save money and time by performing maintenance only when needed and not too often or too late. AI can help improve the plant's overall reliability and safety by offering expert advice and predictions based on data.

### **Taking a transformative step in operations**

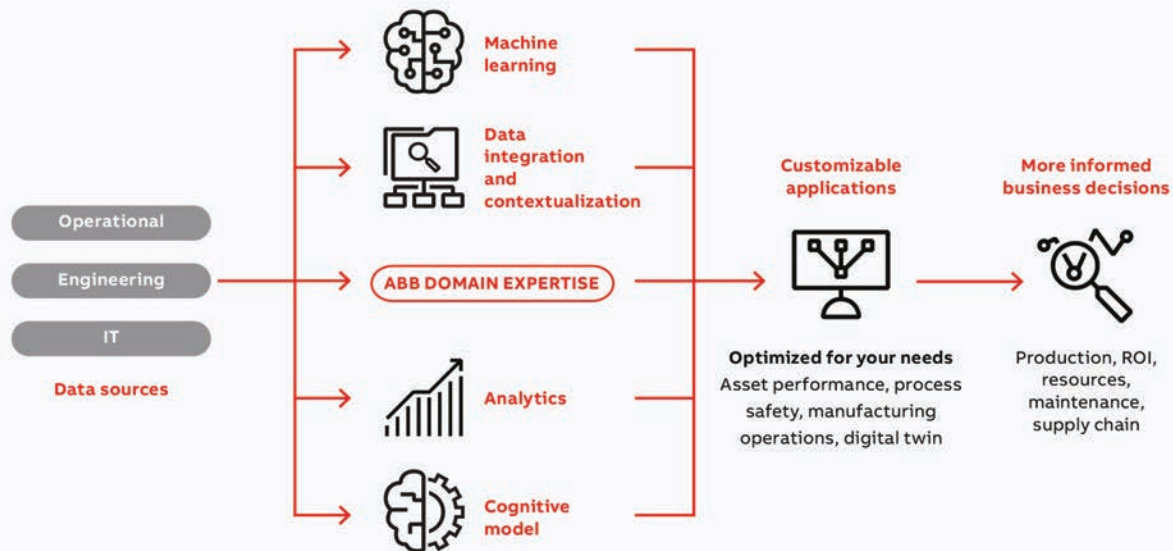
The cost of unplanned interruptions, the impact of unforeseen failures, and the effect of unexpected breakdowns can result in significant business losses. Early detection of anomalies can provide critical information which can help prevent potential system failures and reduce downtime.

By using advanced technology like the ABB Ability™ Genix APM, plant operators can bring together condition information from disparate systems into one dashboard view, accessible via a web browser. It gives users who are both inside and outside the organization instant

**“When it comes to maintaining process equipment, there is no one-size-fits-all solution. Different strategies — from proactive, predictive maintenance to reactive maintenance — have their own benefits and drawbacks in terms of costs and time-savings. The key is to choose the right strategy for the right situation”**

## ABB Ability™ Genix Industrial Analytics and AI Suite

How does it work?



and secure access to the equipment data they need, so they can make decisions faster and prioritize actions that help optimize operations and reduce maintenance and operating costs. The suite also includes tools for analyzing historical data, which can be used to identify trends and optimize equipment performance over time. Some of its key benefits include aggregated equipment health overview, highlighting assets with the degraded condition, a 14-day failure prediction AI algorithm, a report generator, and a dashboard for raw data diagnostics.

### System Anomaly detection using AI

Avoiding a trip in the plant is one of the major objectives of operations and maintenance teams. Any process upset or plant trips imply inherent hazards along with loss of production. Most often, operations and maintenance teams, as part of root cause analysis post-plant trip, notice changes in critical parameter patterns that caused the trip. Often, these go unnoticed due to limited resources and the massive amounts of data involved. The System Anomaly Detection App, which is part of the ABB Ability™ Genix Industrial Analytics and AI Suite, is designed to detect unusual, anomalous behaviour from process streaming time series data. It then uses Artificial Intelligence / Machine Learning (AI/ML) methods to support dynamic decision-making in all types of process-driven industries (including oil & gas, refinery, petrochemicals, metals, cement, and the like). Typical predictive maintenance solutions focus on asset

health checks. The app, however, focuses on integrated assets (or systems) based on the function it performs. Potential system anomalies are highlighted using AI/ML for plant operator review, enhancing response time for process upsets. In essence, functionalities in the app are focused on reducing unscheduled trips, increasing plant availability, avoiding process upset conditions, and increasing operator responsibility. It also has the capability to identify factors that are responsible for the anomalous state of the system, allowing for immediate action and problem resolution before it affects the business process. The system anomaly detection solution can reduce unscheduled trips by up to 50%.

### Conclusion

Unlocking the potential of AI and analytics in maintenance and reliability is not easy, but leading players in different industries have enjoyed significant rewards for their efforts. With product maturity and technology architecture in place, now is the optimal time to invest in technologies such as AI-based predictive maintenance, machine monitoring, and asset management. These systems can help industrial operators reduce cost and risk, improve reliability and efficiency, and become more sustainable and competitive. ■

# “The rapid growth of India’s Specialty Chemicals Industry presents significant opportunities for CRAMS and CDMOs”



**ANURAG ROY**

CEO

Astec LifeSciences Limited

*Amidst geopolitical turbulence, economies are trying to reduce their dependence on China, which has put Indian industry in a sweet spot. With multiple initiatives like increase in R&D investments and PLI schemes, Indian specialty chemicals & poised to be net exporter by 2040. **Anurag Roy, CEO, Astec LifeSciences Ltd** shares insights into how the organization intends to leverage the emerging opportunities & future plans.*

### **Give us brief snapshot of current scenario of Indian Specialty chemicals sector**

The Indian Specialty chemicals sector is at a very bright spot. Comprising nearly 50% of India’s chemical sector exports and representing 22% of India’s overall chemicals and petrochemicals market, it is poised to be a net exporter by 2040. While the strong local and international demand has led to companies expanding their capacities to cater the demand, the clampdown on industries in China has catapulted the potential of

India to become a global hub as innovators explore the China+1 strategy. With the government’s efforts to establish advanced chemicals parks and promote innovation within the industry, there is a renewed focus of Indian manufacturers to invest in capacity expansion. Such collaborated efforts will aid create a favourable eco-system thereby poising the Indian specialty chemicals market for substantial growth.

**What are the key growth drivers that Indian specialty Chemicals Industry needs to capitalize upon for India to become a global processing hub?**

Today, we are witnessing reduction in time for innovators to reap the benefits of their innovations. Hence with companies spending mere 3% of their revenue towards research and development (R&D), the key for India becoming a global process hub is increasing investment in R&D. Our new R&D Centre – Adi Godrej Centre of Chemical Research & Development, a testament to our commitment of offering advanced solutions in addition to fast-tracking go-to-market for the innovators – is a small step in the same direction.

Another critical element is to address import dependence and focus on sustainability. And it is in this regard that the government decision around petroleum, chemicals, and petrochemicals investment region (PCPIR) policy and production-linked incentive (PLI) schemes along with reduced custom duties would aid in promoting Make in India thereby making industry self-reliant. However, as the industry strive to put India on the global specialty chemicals market map, we need to relook our climate goals and consider sustainability as a long-term value creation rather than a compliance.

**Which products are driving value generation at Astec LifeSciences?**

Over the years, our concentrated focus on agrochemical actives has aided us earn a strong reputation for manufacturing quality crop protection products. With our clients spread across 25 countries, we are the largest manufacturer of Triazole fungicides. Further, our entry into herbicides and leveraging our new R&D centre to develop a newer range of sustainable products would enable us tap fast-growing specialty chemicals segment and be a partner of choice for customers around the world. With our intent to specialise in the development and manufacturing of customised, highly complex molecules for crop sciences, life sciences and consumer products, we are confident of introducing specialty molecules and other advanced chemical solutions that cater to the evolving needs of various industries thereby generating value for all our stakeholders in the coming years.

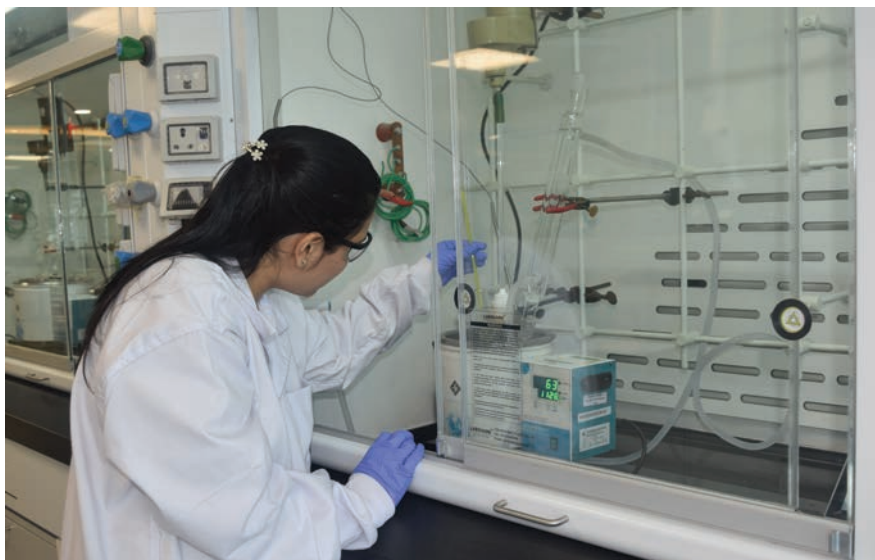
**What kind of opportunities will be unlocked Indian CRAMS & CDMOs due to rapid growth Specialty Chemicals industry?**

The rapid growth of India's Specialty Chemicals Industry presents significant opportunities for Contract Research and Manufacturing Services (CRAMS) and Contract Development and Manufacturing Organizations (CDMOs). Firstly, the increasing demand for specialty chemicals is fuelling the development of various market segments. This surge in demand allows CRAMS and CDMOs to leverage their expertise in research, development, and manufacturing to cater to the specific needs of customers,

Secondly, Indian specialty chemicals companies are expanding their production capacities to meet the rising demand, both domestically and internationally. With global companies seeking to diversify their supply chains away from China, now Europe there is a substantial growth opportunity for CRAMS and CDMOs to collaborate and support the manufacturing of specialty chemicals. By partnering with these companies, CRAMS and CDMOs can contribute to the overall supply chain requirements of the industry.

Lastly, the robust performance of the specialty chemicals sector in India has attracted significant investments and spending. This influx of capital provides an ideal environment for CRAMS and CDMOs to forge partnerships with investors and industry players.

**“Robust performance of the specialty chemicals sector in India has attracted significant investments and spending. This influx of capital provides an ideal environment for CRAMS and CDMOs to forge partnerships with investors and industry players. Leveraging their capabilities, these organizations can deliver specialized services, facilitate research and development, and drive the growth of the specialty chemicals sector.”**



Leveraging their capabilities, these organizations can deliver specialized services, facilitate research and development, and drive the growth of the specialty chemicals sector.

Therefore, the rapid growth of this Industry unlocks valuable opportunities for CRAMS and CDMOs. These opportunities include meeting the growing demand for specialty chemicals, collaborating with global companies to diversify their supply chains, and partnering with investors to drive innovation and development. By seizing these opportunities, CRAMS and CDMOs can contribute to the success and expansion of the industry while delivering specialized solutions to meet customer requirements.

### **What are the business plans of Astec LifeSciences to capitalize on these opportunities?**

At Astec, we are service providers for the innovators, proudly manufacturing in India for the world. Considering tremendous opportunity in the Specialty Chemicals Industry, our objective is to enhance our capabilities by providing end-to-end solutions, from R&D to product commercialization. Our ultra-modern facilities like the kilo lab, flow chemistry lab and process safety lab will aid us in creating sustainable and green chemistry solutions. By building strong relationships and leveraging research capabilities, we aim to become a trusted and go-to-partner for innovators. And it is herein that operational excellence and cost leadership would act as a key driver for growth and value creation. Evaluating partnerships and collaborations to drive transformative innovation, we are hopeful that our

customer-centric approach, agility, and focus on meeting evolving demands would help us to tap into market opportunities, meet customer expectations, and remain at the forefront of the Specialty Chemicals Industry.

### **Which are the key differentiators of Astec's CRAMS division as compared to the competition?**

Our vision to develop cutting edge infrastructure and investment in the state-of-the-art R&D centre is a steppingstone for building a structured ecosystem in the chemical industry. Being part of group with strong legacy and having our own expertise & identity, we are in a sweet spot to offer the best of innovative solutions to our clients enabling them reduce time to market. We are confident that our ongoing investments will help us provide a more personalized solution thereby putting us at the right place in the sector at the right time.

### **Future plans of Astec LifeSciences in investments, product segment expansion & new facilities?**

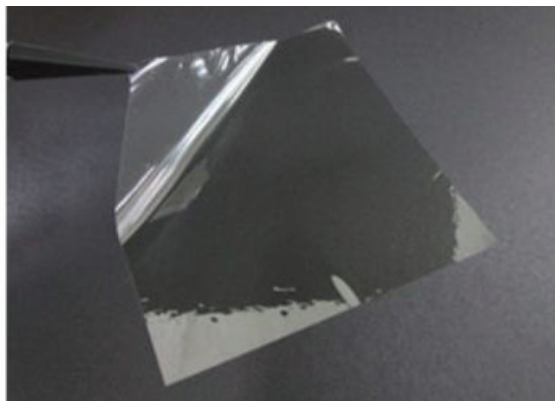
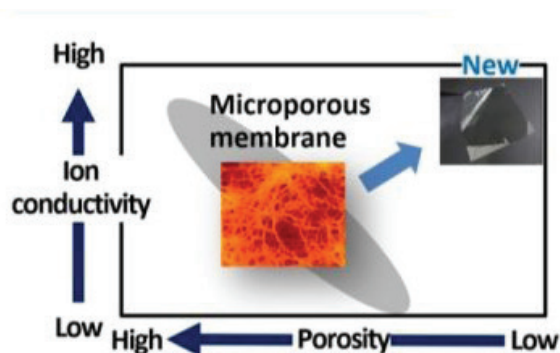
With a strong focus on innovation, growth, and adaptability, we are committed to meeting the evolving demands and requirements of the specialty chemicals industry. Hence our investments will focus on strengthening research and development capabilities, scaling up manufacturing capacities, and adopting advanced technologies. These, coupled with our customer-first approach will enable us to offer a wider product portfolio beyond agrochemicals, including a broader range of specialized chemicals and sustainable solutions that cater to the diverse needs of our customers.

That said, recognizing the value of diversification, we continue to explore new market segments and aim to be an application agnostic player. Providing superior products and services to our clients while maintaining our market leadership by constantly innovating and extending our capabilities will continue to be our endeavor. ■

## Toray Introduces Revolutionary Ion-Conductive Polymer Membrane for Batteries

Toyota's Ammonia Engine: A Game-Changer in Sustainable Transportation

Toyota's collaboration with the GAC Group has yielded a groundbreaking innovation in sustainable



### Revolutionary Ion-Conductive Polymer Membrane for Batteries

In a significant leap forward for battery technology, Toray, a prominent chemical manufacturer, has unveiled an innovative ion-conductive polymer membrane. This breakthrough promises to redefine the performance and efficiency of batteries, marking a pivotal moment in energy storage.

The newly developed polymer film boasts exceptional ion conductivity, enabling accelerated charging and discharging rates within batteries. Through extensive testing, Toray has validated the membrane's remarkable performance and durability across various operating conditions.

This advancement holds immense potential for enhancing lithium-ion batteries, which find widespread applications in electric vehicles, consumer electronics, and renewable energy systems. By facilitating improved ion transport, Toray's membrane stands to significantly enhance battery efficiency and overall performance.

Toray's commitment to innovation in the battery sector is underscored by this breakthrough. As global demand for high-performance batteries continues to surge, Toray's technology is poised to make a profound impact across industries, including automotive, electronics, and renewable energy.

With a history of delivering cutting-edge materials and technologies, Toray remains a leader in the chemical industry. Its latest achievement in developing an ion-conductive polymer membrane signifies a pivotal step towards advancing battery technology and unlocking new frontiers in energy storage.

transportation: the ammonia engine. This revolutionary technology offers a promising alternative to traditional internal combustion engines (ICEs) by primarily utilizing ammonia as fuel. Unlike conventional engines, ammonia engines do not emit carbon dioxide during combustion, marking a significant stride in the fight against climate change.

The prototype developed by Toyota and GAC, boasting a 2-liter, 4-cylinder configuration, generates 161 horsepower while purportedly reducing carbon emissions by up to 90 percent. This remarkable feat not only showcases the viability of ammonia engines but also underscores their potential to revolutionize the automotive industry.

Despite its promising prospects, challenges persist in the widespread adoption of ammonia engines. Managing combustion pressure to address nitrogen emissions remains a key obstacle. However, with continued research and development, these hurdles can be overcome, paving the way for commercially available vehicles powered by this innovative technology.

Toyota's commitment to sustainability extends beyond the ammonia engine, encompassing a diverse range of eco-friendly solutions including battery electric vehicles and hydrogen cars. Nevertheless, the high energy density and readily available nature of ammonia fuel position it as a compelling option, particularly in sectors prioritizing energy efficiency and transportation.

In conclusion, Toyota's foray into ammonia engine technology marks a significant milestone in the quest for greener transportation. With its potential

to decarbonize the transport sector and its versatility across various applications, the ammonia engine could indeed reshape the future of mobility.

### Introducing Verdium: BASF's Carbon-Verified Recycled Metal Solution

BASF Environmental Catalyst and Metal Solutions (ECMS) has introduced Verdium™, a pioneering approach to recycled metal based on mass balance, setting a new standard in the platinum group metal (PGM) industry. Verdium offers customers the ability to verify carbon reduction for their recycled PGM purchases, with each kilogram saving over thirty metric tons of carbon compared to mined materials. This innovation enables customers to track progress towards sustainability goals and reduce Scope 3 emissions significantly.

Verdium's credibility is bolstered by independent validation from UL Solutions, ensuring adherence to mass balance chain of custody standards. This validation process includes annual audits and site visits, providing customers with transparency and confidence in their carbon reduction efforts.

Starting January 2024, Verdium will be available to PGM customers in Europe and the U.S., offering the same quality recycled metal with the added assurance of carbon reduction verification. Through documented verification, customers can trace the recycled metals applied to select end products, contributing to tangible sustainability progress.

Dirk Bremm, President and CEO of ECMS, emphasized their commitment to advancing circularity and sustainability, highlighting Verdium as a traceable and audited solution designed in consultation with customers.

Josh Warren, Vice President and General Manager of UL Solutions, commended ECMS for their carbon reduction efforts, expressing hope that the UL certification of Verdium will facilitate progress towards environmental goals and a more sustainable future.

Verdium represents a significant leap forward in the PGM industry, empowering customers to make measurable strides towards sustainability while contributing to a greener, more environmentally conscious future.

### Shin-Etsu Chemical Innovates Water-Based Silicone Resin

Shin-Etsu Chemical Co. has introduced a groundbreaking innovation with the unveiling of the "KRW-6000 Series," the industry's inaugural water-based silicone resin devoid of emulsifiers. Traditional waterborne silicone resins often relied on emulsifiers, resulting in subpar film properties and extended curing times. In contrast, the KRW-6000 Series boasts exceptional film properties and rapid curing capabilities, thanks to its emulsifier-free formulation.

This silicone resin series offers a host of advantages, including superior water resistance and long-term durability due to the formation of an inorganic silicone-only film post-curing. Moreover, its organic solvent-free composition leads to VOC-free products, aligning with environmental sustainability goals. The resin's fast-curing attributes at low temperatures further contribute to reducing greenhouse gas emissions, as curing can occur at room temperature or with brief heating to 80-150°C.

With the ability to produce high-hardness films and flexible coatings, the KRW-6000 Series presents versatile solutions for various applications, particularly in weather-resistant paints and additives. ■





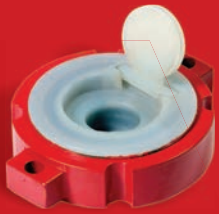
SINCE 1987

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SWING CHECK VALVE



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BALL VALVE

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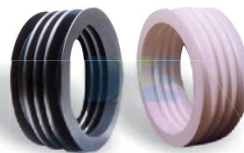
DIP - PIPE



SPOOL PIPE



EXPANSION BELLOW



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## DIP-FLON ENGINEERING & CO.



B-413, B. G. Tower, Outside Delhi Gate, Shahibaug Road, Ahmedabad - 380004. Gujarat, INDIA.  
Phone: +91-79-25624003, 25624169, Mobile: +91 - 9898794440 | Fax: +91-79-25625665  
Email: [info@dipflon.com](mailto:info@dipflon.com) / [sales@dipflon.com](mailto:sales@dipflon.com) | Website : [www.dipflon.com](http://www.dipflon.com)

# ANNOUNCING - 2026

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



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

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

#### Concurrent Events



#### Scope for ChemTECH World Expo 2026

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

#### Scope for Specialty Chemicals World Expo 2026

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

#### Scope for Biopharma World Expo 2026

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

#### FACT & FIGURES 2024



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

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

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