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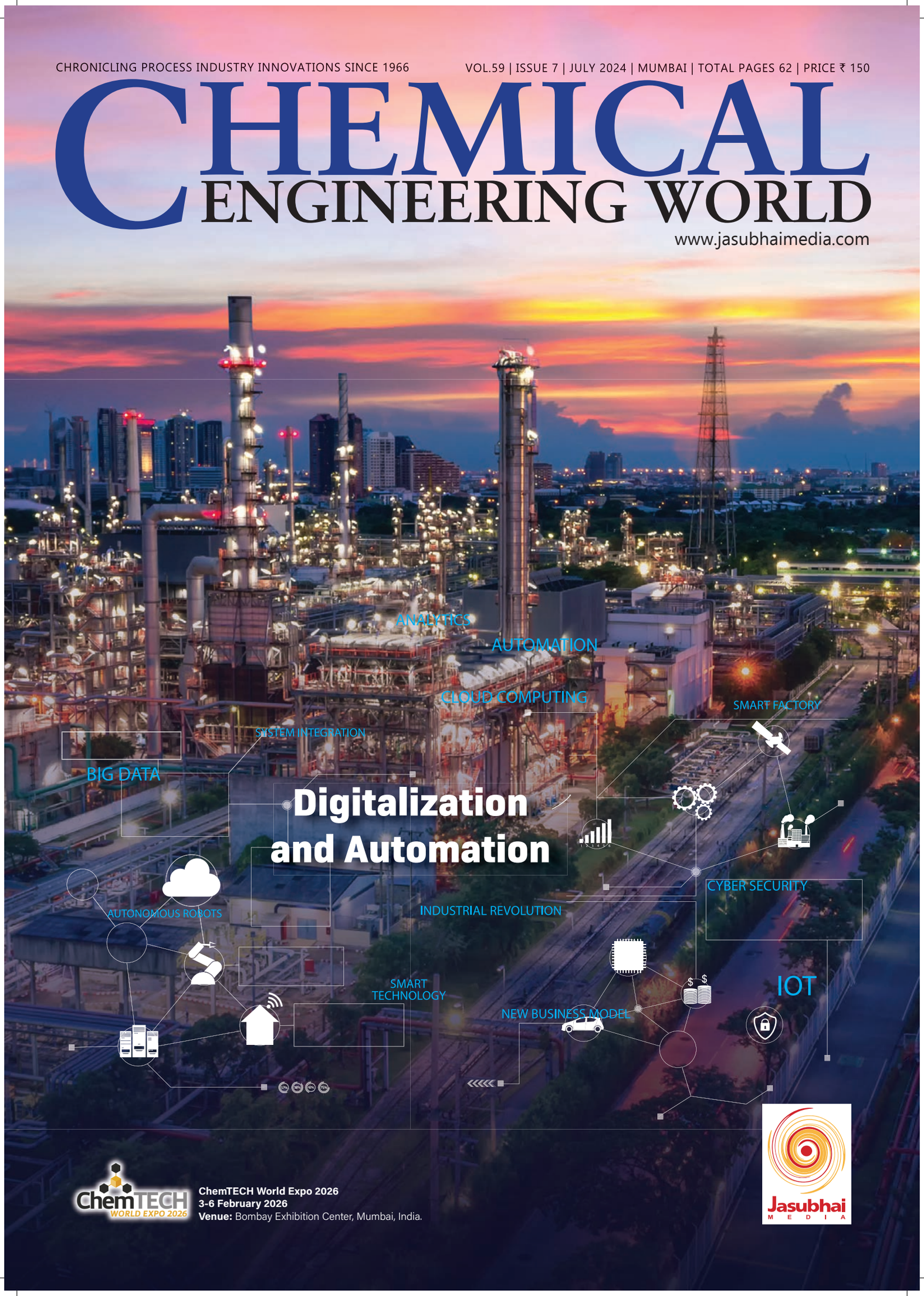

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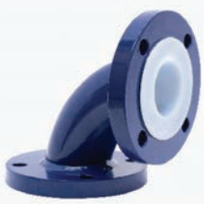

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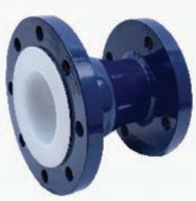

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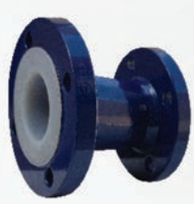

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Aramco to acquire 50% stake in Blue Hydrogen Industrial Gases Company

At the signing ceremony are APQ CEO Ebubekir Koyuncu (sitting left), and Aramco Acting Senior Vice President of New Business Development Mohanad M. Alamdar (sitting right). (Standing from left) Aramco Executive Vice President of Strategy & Corporate Development Ashraf Al Ghazzawi; APQ Chairman Dr. Samir Serhan; Air Products Chairman, President & CEO Seifi Ghasemi; Aramco President & CEO Amin H. Nasser; APQ Vice Chairman Mohammed Abunayyan, and Aramco Downstream President Mohammed Y. Al Qahtani.

Dhahran, Saudi Arabia: Aramco, one of the world's leading integrated energy and chemicals companies, has signed definitive agreements to acquire an equity interest in the Jubail-based Blue Hydrogen Industrial Gases Company (BHIG), a wholly-owned subsidiary of Air Products Qudra (APQ). The transaction, which is subject to standard closing conditions, will also include options for Aramco to offtake hydrogen and nitrogen.

Building on its efforts to develop a lower-carbon hydrogen business and expand its portfolio of alternative energy solutions, Aramco expects its investment in BHIG will contribute to the development of a lower-carbon hydrogen network in the Kingdom of Saudi Arabia's Eastern Province, serving both domestic and regional customers. Upon completion of the transaction, Aramco and APQ, a joint venture between Air Products and Qudra Energy, are expected to each own a 50 per cent stake in BHIG.

Mr. Ashraf Al Ghazzawi, Aramco Executive Vice President of Strategy & Corporate Development, said, "This investment highlights Aramco's ambition to expand its new energies portfolio and grow its lower-carbon hydrogen business. We are delighted to partner with APQ on this journey and believe there are promising commercial opportunities for hydrogen with lower emissions. We intend to leverage our growing capabilities in carbon capture and storage (CCS), as well as our technical expertise in hydrogen, with the ambition to support the establishment of a vibrant marketplace for lower-carbon hydrogen — helping lay the foundations of a future energy system."

Dr. Samir J. Serhan, Air Products Qudra Chairman, said, "It is an honor to further extend Air Products Qudra's strong partnership with Aramco, working to accelerate the hydrogen economy and driving the creation of the largest hydrogen network in the Middle East, which is expected to serve the refining, chemical, and petrochemical industries. We look forward to providing our expertise in hydrogen and pipeline operations and supporting Aramco's need for a reliable supply of lower-carbon hydrogen for domestic and regional requirements."

Ashtech appoints Ajay Pathik as CEO - Microfine Products Division

Ashtech (India), India's largest processor, distributor, exporter, and transporter of fly ash and other building materials has announced the appointment of **Ajay Pathik as the CEO of Ashtech (India) Pvt. Ltd.**, Microfine Products Division. In his new role, Pathik will be responsible for driving initiatives, managing operations, and fostering innovation in building materials. With over 30 years of experience in the building materials and construction sector, Pathik's career is marked by his vision and operational expertise in leadership roles both domestically and internationally. His previous positions include CEO and COO roles at companies specializing in specialty products as well as significant tenures at Ambuja Cement and Lafarge Holcim Singapore. Most recently, he held the position of CEO at Ultrafine Mineral & Admixtures in Mumbai. Pathik holds a Bachelor's degree in Civil Engineering from Government Engineering College, Ujjain MP, and PGEMP from SP Jain Institute of Management & Research, Mumbai.

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GCF approves USD215.6 million for SIDBI's Projects in Indian MSMEs

Green Climate Fund (GCF) has approved USD215.6 million in its 39th Board meeting held in Songdo, South Korea on July 17, 2024 for implementing Financing Mitigation and Adaptation Projects (FMAP) in Indian Micro, Small and Medium Enterprises (MSMEs)

New Delhi, India: Green Climate Fund (GCF) has approved USD215.6 million in its 39th Board meeting held in Songdo, South Korea on July 17, 2024 for implementing Financing Mitigation and Adaptation Projects (FMAP) in Indian Micro, Small and Medium Enterprises (MSMEs). The programme aims to support the MSMEs in India to adopt low emission and climate resilient technologies, thereby contributing to the Net Zero targets of the country. The programme will also target scaling up Climate Finance for MSMEs by leveraging private sector investments from the Participating Financial Institutions (PFIs) including Non-Banking Financial Companies (NBFCs), Small Finance Banks (SFBs) and Micro Finance Institutions (MFIs) which will then be utilized to provide concessional loans to MSMEs to adopt various mitigation and adaptation technologies.

The FMAP facility carries a two-fold target: firstly, USD15.6 million grant support from GCF will be utilized to build the capacity of various stakeholders including MSMEs and PFIs to understand the various low emission and climate resilient technologies in the market and the importance of adopting the same and secondly, USD 200 million will be utilized to provide the much-needed support of concessional finance to enable scaling up the targeted intervention. The FMAP programme is expected to result in GHG emission reductions to the tune of 35.3 million tons and the adaptation activities would not only lead to substantial water savings but also build resilience of vulnerable communities benefitting more than 10.8 million beneficiaries. FMAP programme encourages higher level of participation of women in all the activities envisaged.

Dr. Dirk Backhaus joins Sajjan India Limited as Independent Director

Sajjan India Limited, a leading contract development and manufacturing company (CDMO) of specialty chemicals and active ingredients for agrochemicals, pharmaceuticals and other industries, announces the appointment of **Dr. Dirk Backhaus** as its Independent Director. Dr. Backhaus is an esteemed industry leader with nearly three decades of experience in the crop science and agrochemical sectors. He previously served as Member of the executive leadership team and Head of Product Supply for Bayer's Crop Science Division, overseeing planning, sourcing, development, manufacturing, and delivery of crop protection and seed products globally. He also held board positions at Cefic, CropLife International Operations committee, and the VCI (association of chemical industries) North Rhine-Westphalia. Throughout his career, Dr. Dirk has focused on sustainability commitments, talent development and DE&I initiatives.

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India launches scheme to strengthen green hydrogen testing infrastructure

New Delhi, India: The Government of India has issued guidelines for funding of testing facilities, infrastructure, and institutional support under the National Green Hydrogen Mission. The scheme, announced by the Ministry of New & Renewable Energy (MNRE), will support the identification of gaps in existing testing facilities for components, technologies, and processes in the green hydrogen value chain. It will also fund the creation of new testing facilities and the upgradation of existing ones to ensure safe and secure operations. The scheme will be implemented with a total budgetary outlay of ₹200 crores (USD24 million) until the financial year 2025-26. The National Institute of Solar Energy (NISE) will be the implementing agency.

This initiative is part of the broader National Green Hydrogen Mission, launched in January 2023 with an outlay of ₹19,744 crores ($2.4 billion) until 2029-30. The mission aims to make India a global hub for the production, usage, and export of green hydrogen and its derivatives, contributing to the country's goal of energy self-reliance and the global clean energy transition. The robust quality and testing ecosystem envisioned under the mission guidelines will ensure the safety, sustainability, and performance of green hydrogen technologies, paving the way for India's leadership in this critical clean energy sector.

India to boost plastic recycling rate to 67%

Dignitaries at the recent Global Conclave on Plastic Recycling and Sustainability (GCPRS) in New Delhi

New Delhi, India: The Government of India is taking concerted steps to curb plastic pollution and promote a circular economy for plastics, as highlighted at the recent Global Conclave on Plastic Recycling and Sustainability (GCPRS) in New Delhi. Inaugurating the four-day conference, Nivedita Shukla Verma, Secretary of the Union Ministry of Chemicals and Fertilizers, emphasized the need for a collaborative effort across various sectors to address the challenge.

She noted that currently, only 10 per cent of the total plastic waste generated globally is recycled, and stressed the importance of the plastic industry in providing employment and contributing to the economy. Verma outlined the government's initiatives, including the Plastic Waste Management Rules introduced in 2016, which mandated extended producer responsibility and banned specific single-use plastics. She also highlighted the critical role of institutions like CIPET and DCPC in implementing these regulations.

Mundkur S Kamath takes additional charge as Director (Finance) of MRPL

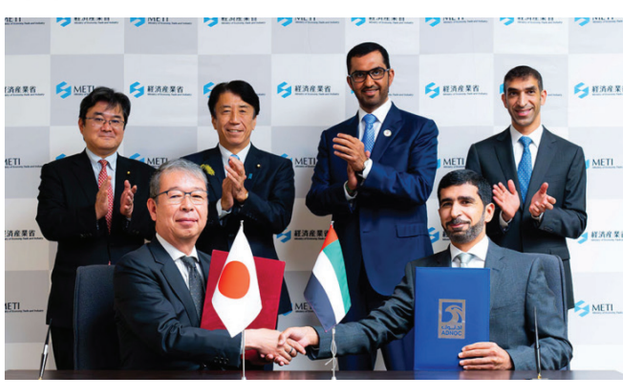
Mundkur S Kamath, who is now the **Managing Director (MD) of Mangalore Refinery & Petrochemicals Limited (MRPL),** has been given the additional responsibility of Director (Finance). He has been assigned the extra duty of the post for three months beginning July 2, 2024 or until the appointment of a regular incumbent to the post or until further directives, whichever comes first. Kamath has been the MD of MRPL from February 28. Kamath is a graduate of Manipal Institute of Technology (MIT) and TA Pai Management Institute (TAPMI), Manipal.

He joined MRPL in July 1992 and has held different positions there, including a deputation at ONGC Mangalore Petrochemicals Ltd (OMPL). Prior to his appointment as MRPL's Executive Director (Refinery) on June 1, 2022, he was the Group General Manager (Technical Services).

Mercy Epao, Joint Secretary of the Union Ministry of Micro, Small and Medium Enterprises, expressed the ministry's support for the cause and announced plans to set up a state-of-the-art export center in Hyderabad to boost the industry. Industry leaders at the event noted that India's plastic recycling industry is rapidly growing and is expected to reach USD6.9 billion by 2033, driven by government initiatives and a robust existing recycling rate of around 60 per cent. The conclave aimed to address critical issues in plastic waste management and explore solutions to achieve sustainability in the sector.

ADNOC and JBIC sign USD 3 billion green financing agreement

Dignitaries from Abu Dhabi National Oil Company and Japan Bank for International Cooperation during the signing of the green financing agreement



Abu Dhabi, UAE: Abu Dhabi National Oil Company (ADNOC) has signed a USD3 billion (AED11 billion) green financing agreement with the Japan Bank for International Cooperation (JBIC) to support its ongoing decarbonization and energy transition initiatives. The credit facility is part of JBIC's Global action for Reconciling Economic growth and Environmental preservation (GREEN) lending program and is partially supported by Japanese commercial banks.

Khaled Al Zaabi, ADNOC Group Chief Financial Officer, stated, "We are very pleased to once again partner with JBIC on ADNOC's first green funding to accelerate our decarbonization and energy transition initiatives. Proceeds of this credit facility will enable ADNOC's strategy to support a just, orderly and equitable global energy transition."

ADNOC, one of the least carbon-intensive oil and gas producers, aims to reduce its carbon intensity by 25 per cent by 2030 while investing USD 23 billion (AED84.4 billion) to decarbonize its operations and accelerate the growth of future energies, including hydrogen, geothermal, renewables and carbon capture technologies. The company also plans to achieve net zero by 2045 and zero methane emissions by 2030. This agreement marks a significant milestone in the long-standing strategic energy relationship between the UAE and Japan, and ADNOC looks forward to further collaboration with JBIC as it delivers against its ambitious growth strategy.

Dr Ajay Kumar takes charge as Director of Board at Sify Technologies

IAS officer Dr Ajay Kumar has been named the new Director on the board of **Sify Technologies Limited.** Kumar, an Indian Administrative Service officer from the 1985 batch, most recently held the position of Defence Secretary for the Indian government. He holds vast expertise in the areas of technology and policy.

He has previously led multiple government organizations and orchestrated significant achievements in the military industry ecosystem, such as the defense startup ecosystem via iDEX between 2017 and 2022 and the Digital India programs. In addition to supporting startups in the drone and space industries between 2020 and 2021, Kumar has played a significant role in improving the performance of Defence PSUs from 2018 to 2022. He graduated from the University of Minnesota with a B.Tech in electrical engineering, a Master's in applied economics, and a PhD in business administration from the Carlson School of Management. Following his superannuation, Kumar joined the Indian Institute of Technology, Kanpur's Department of Management Sciences and Department of Economic Sciences as a Distinguished Visiting Professor.

European chemical industry sees glimmer of recovery

Brussels, Belgium: The European Chemical Industry Council (Cefic) is cautiously projecting a possible 1.0 per cent growth in EU27 chemical output for 2024, after a challenging period marked by a 7.6 per cent decline in production in 2023 and a 6.3 per cent decrease in 2022.The decline in European chemical production over the past years can be attributed to the surge in energy prices, a significant decrease in demand for goods in the aftermath of the COVID-19 pandemic, inflation, decreasing purchasing power, and a complex regulatory agenda in Europe.

Besides the automotive sector, other domestic customer industries also experienced a slowdown in 2023.Commenting on the outlook, Cefic Director General Marco Mensink said that while there are signs of recovery, the high energy and feedstock costs remain the 'Achilles' heel' of the European chemical industry, causing it to lose its competitive edge in global markets. He noted that while companies in other regions, such as the USA and the Gulf, are looking to invest again, investments in Europe are under 'huge stress' due to the impacts of the US Inflation Reduction Act.

Looking ahead to 2024, Cefic expects a gradual normalization of demand structures, with a shift from an over-proportional focus on services in private consumption to a higher emphasis on goods. However, growth expectations remain limited, as elevated interest rates continue to dampen demand in the construction sector, and the automotive industry is not expected to accelerate beyond the production levels achieved in 2023. Therefore, the overall economic outlook for the EU chemical industry remains uncertain.

Brenntag acquires assets of Industrial Chemicals Corporation in Denver

Brenntag has acquired assets of Industrial Chemicals Corporation (ICC) in Denver, Colorado to expand its geographical footprint and strengthen its regional presence in North America

Denver, Colorado: Brenntag, the global market leader in chemicals and ingredients distribution, has announced the acquisition of the assets of Industrial Chemicals Corporation (ICC) in Denver, Colorado. This strategic move will expand Brenntag's geographical footprint and strengthen its regional presence in North America.

ICC, a leading regional industrial commodity chemical distributor, has built a significant, centrally located chemicals distribution facility and transportation hub over the past 60 years. The facility in Denver is directly linked to an inland rail terminal and has large storage capacities, making it a highly compatible fit with Brenntag's strategy.

Godrej & Boyce appoints Vijay Balakrishnan as Chief Digital and Information Officer

Godrej & Boyce has named **Vijay Balakrishnan** as its Chief Digital and Information Officer. Vijay has over 20 years of expertise in Digital Transformation in the Manufacturing sector.

In his new post, Vijay will manage Godrej & Boyce's digital transformation, focusing on improving customer experience, linking goods, introducing smart manufacturing, and digitizing the supply chain. His efforts will also focus on operational efficiencies in various corporate functions, including commercial, research and development, procurement, and human resources. Vijay intends to use behavioral modeling and implement reactive controls, command center monitoring, and corrective actions to ensure the integrity and efficiency of digital operations.

Before joining Godrej & Boyce, Vijay oversaw Digital Transformation programs at GE, Michelin, and UPL Ltd. He is also a well-known speaker at technology conferences and has worked on cost-effective innovation projects in emerging technologies.

Scott Leibowitz, President of Brenntag Essentials North America, stated, "The location in Denver, Colorado is a highly compatible fit to our strategy, adding strong local last mile service operations with a state-of-the-art site to strengthen our regional footprint in North America. With this acquisition, we will increase service levels and cost efficiency for Brenntag customers while providing Brenntag supply partners with greater access to the local market."

Jamie Biesemeier-Wilkins, CEO of ICC, commented, "For nearly 70 years, ICC has been striving to support our customers in the best way possible. Brenntag recognized what we have built here, and we're excited to be joining forces with them. It's a great way to expand our reach and better serve our local and regional customers." The acquisition, with ICC reporting an annual revenue of $40 million in 2023, will strengthen Brenntag's last-mile operations and distribution network in the North American market.

Arkema achieves mass balance ISCC+ certification for powder coating resins facility

Sant Celoni, Spain: Arkema, a leader in specialty materials, has announced that its powder coating resins facility located in Sant Celoni, Spain has obtained ISCC+ certification. This is part of Arkema's larger initiative to decarbonize the global coating value chain.

The certification allows Arkema to expand its leading range of mass balance solutions, offering up to 40 per cent bio-attributed powder polyester resins and achieving a related reduction of up to 25 per cent in product carbon footprint. The Sant Celoni facility houses a polyester resin production line and a state-of-the-art R&D laboratory dedicated to improving the sustainability and performance of powder coating materials.

Neil Tariq, Global Business Director Coating Resins, Arkema

With this certification, Arkema can now offer a complete portfolio of bio-Mass-Balance coating solutions, including waterborne, UV/EB, advanced liquid resins and powder resins for use across many different industries, such as new mobility, decarbonized industrial environments, green buildings, and more sustainable homes including furniture and appliances.

Neil Tariq, Global Business Director Coating Resins at Arkema, stated, "The global powder coatings market continues to show strong growth driven by megatrends across end user markets and the inherent sustainability of the technology. Arkema is committed to supporting our customers worldwide with the materials they need to further decarbonize their offers and ensure they can meet their sustainability goals."

Bionema appoints Andrew Turnbull as Biological Technical Specialist

Bionema Group Limited has announced the appointment of **Andrew Turnbull** as Biological Technical Specialist. Andrew joins the team with an impressive 25 years of experience as a turf professional, bringing a wealth of knowledge and expertise to the company. Before joining, Andrew was at Biotechnica as a Business Development Manager. Andrew's appointment starts in his role on July 8, 2024. Andrew's academic background includes a BSc (Hons.) and a Master of Research in plant sciences. His career has been distinguished by his pioneering work in using plant and soil biostimulants, particularly in the UK and European turfgrass markets. Andrew has demonstrated exceptional abilities in identifying challenges that growers, farmers, and turfgrass managers face, sourcing potential solutions, and implementing innovative treatments for optimal plant growth and health. Andrew will work closely with existing and new markets in his new role, leveraging his extensive experience to enhance plant health through optimised rhizosphere interactions, plant nutrition, and natural responses to pest and disease attacks.

Epsilon Carbon bags 'Best CSR Project of the Year 2024' for Women Empowerment Initiative

Epsilon Carbon won the 'Best CSR Project of the Year 2024' for the project 'Sustainable Livelihood Interventions for Women of Sripura Village, Jharsuguda District.'

Jharsuguda, India: Epsilon Carbon Private Limited, a leading global manufacturer in the carbon industry, has been awarded the 'Best CSR Project of the Year 2024' for its Women Empowerment Project at the Indian Corporate Social Responsibility Awards, organized by The Marketing and Brand Honchos. The project, 'Sustainable Livelihood Interventions for Women of Sripura Village, Jharsuguda District,' involved 5 Self-Help Groups (SHGs) and 80 women with the objective of empowering them through sustainable economic business activities. These initiatives motivated the women to work in groups, thereby enhancing productivity, enabling community building, grassroots empowerment, and fostering self-reliance.

Mr. Pratish Koparkar, Chief Human Resource Officer, Epsilon Group, said, "We are proud to win the 'Best CSR Project of the Year' for our Women Empowerment Project. As leaders in the chemical industry, we recognize the importance of integrating ESG and sustainability practices. We believe in the power of women to transform communities, and this recognition showcases our commitment to the welfare of people at the grassroot level, even in Tier 3 and Tier 4 cities."

The project also helped enhance market linkages and enabled the socio-economic development of its members, impacting the lives of over 200 women in Sripura village, Jharsuguda district.

Dow launches bio-based NORDEL™ REN EPDM

Wiesbaden, Germany: Dow has announced the launch of NORDEL™ REN Ethylene Propylene Diene Terpolymers (EPDM), a bio-based version of its EPDM rubber material, at the German Rubber Conference (DKT) 2024. This latest addition to Dow's growing portfolio of sustainable materials aims to help the automotive, infrastructure, and consumer industries lower their Scope 3 emissions.

NORDEL™ REN EPDM is a key component of automotive weather seals and hoses, and it also goes

ONGC appoints Vivek Tongaonkar as Director (Finance)

ONGC has announced the appointment of **Vivek Chandrakant Tongaonkar** as the new Director (Finance). Shri Tongaonkar is an industry veteran with over 37 years of professional experience in diverse activities across the energy value-chain. He brings a wealth of experience and a proven track record in financial and managerial leadership, making him a valuable addition to India's Energy Maharatna.

In his previous role, he served as Director (Finance) & CFO at Mangalore Refinery & Petrochemicals Limited (MRPL) from May 2023 till June 2024. He is also serving as the Chairman of the Board for the Mangalore Special Economic Zone Limited, a key entity within the ONGC group of companies.

into building profiles, roofing membranes, wire, and cable applications. By using bio-residues from other industries as raw material, NORDEL™ REN EPDM can further support Dow's customers in the rubber industry to offer their own customers a lower-carbon product.

Zshelyz Lee, Global Automotive Plastics Circularity Team Leader at Dow, stated, "At Dow, we recognize the necessity to support our customers in their decarbonization journeys, as we drive towards our own carbon neutrality. With our commitment to deliver 3 million metric tons per year of circular and renewable solutions by 2030, we are proud to bring NORDEL™ REN EPDM as the newest offering to help our customers achieve their ambitious sustainability goals and create a better tomorrow."

The plant-based EPDM will be made through an ISCC PLUS certified mass balance system, which traces the flow of bio-based raw material through the value chain and attributes it through verifiable bookkeeping. Crucially, the resulting product offers identical performance to virgin material, helping customers accelerate their transition to more sustainable options without the need for additional time or carbon emissions from the construction and maintenance of a new parallel production stream.

CEID to build 5,000 cu mt CBG plant at Nalanda University

Bihar, India: CEID Consultants and Engineering, a leading EPC company for Compressed Biogas (CBG) manufacturing plants, has announced the establishment of a 5,000 m^3 CBG plant at the new campus of Nalanda University. The plant aims to generate 200 kW of electricity per hour, supporting campus sustainability and potentially reducing the carbon footprint.

The university, which was recently inaugurated by Prime Minister Narendra Modi, aims to achieve self-sustainability and become a net-zero campus. With this sustainable ambition, the university plans to establish a CBG plant that will convert the daily food waste of the campus into electricity.

CEID Consultants and Engineering are responsible for designing, supplying, installing, testing, and commissioning the biogas co-generation and bio-methanation plant at Nalanda University. The plant will generate electricity using regular food waste from the university campus, where the university hostel accommodates around 550 students, with a total university capacity of 7,500 teachers and students. The plant will utilize daily food waste from these facilities and other feedstocks such as municipal solid waste (MSW) and cow dung to generate electricity.

Mr. Abhinav Govil, DGM - Marketing of CEID Consultants and Engineering, stated, "I am thrilled to announce our collaboration with Nalanda University in establishing a 5,000 m^3 CBG plant on their new campus in Rajgir, Bihar. By generating this 200 kW of electricity per hour from Nalanda's food waste, our commitment to sustainability is set to mark a step towards a green future. This initiative supports the Indian government's vision to transform waste into wealth."

The plant is expected to be completed by the end of December 2024, with the civil design nearing its final stages and mechanical work currently in progress.

Chandra Shekhar Verma joins Shyam Metalics as independent director

Shyam Metalics and **Energy Limited** has announced the appointment of former SAIL Chairman and Managing Director (CMD) Chandra Shekhar Verma as its Independent Director. Verma will join the strategic advisory board and participate in all key decision-making processes related to the company's growth and development. "I am eager to contribute to the critical decision-making processes that drive the company's business development," Verma said. Prior to joining Shyam Metalics, Verma served as CMD of Steel Authority of India Ltd (SAIL) from June 2010 to June 2015. He also held additional charges such as CMD of NMDC and International Coal Ventures Ltd (ICVL).

ICT Mumbai collaborates with University of Leeds to promote excellence in chemical technology

Dignitaries during the signing of Memorandum of Understanding (MoU) Institute of Chemical Technology (ICT), Mumbai, has signed a Memorandum of Understanding (MoU) with the University of Leeds, UK to enhance international collaboration in chemical technology and engineering.

Mumbai, India: The Institute of Chemical Technology (ICT), Mumbai, has signed a Memorandum of Understanding (MoU) with the University of Leeds, UK. This partnership aims to enhance international collaboration in chemical technology and engineering. Combining the strengths of both institutions, the collaboration will promote innovative solutions to global challenges, improve educational quality, and provide students with a global perspective. The MoU outlines the development of collaborative research projects, joint academic activities such as workshops, conferences, and seminars, and the exchange of research and teaching personnel, student placements, and publications. Both institutes will also pursue joint funding applications to support and enhance their research and educational initiatives.

Professor Ross from the University of Leeds stated, "We are delighted to formalize our partnership with the Institute of Chemical Technology, Mumbai. This collaboration will enhance our research capabilities and provide our students and faculty with unique opportunities for international engagement and learning."

Professor AB Pandit, Vice Chancellor of ICT Mumbai, added, "This MoU will strengthen ties between the UK and India, contributing to global academic efforts to address issues such as sustainability, clean energy, waste management, health, and technological advancements. This partnership sets a benchmark for international cooperation in higher education and inspires other universities to pursue similar collaborations."

KBR's Green Ammonia Technology Selected by Ocior Energy for Odisha Plant

Odisha, India: American technology firm KBR has announced that its green ammonia technology, K-GreeN®, has been selected by Ocior Energy for its plant located in Odisha's Gopalpur region. This will be the 10th KBR-licensed green ammonia plant globally and the first to be located in India.

As per the terms of the contract, KBR will provide a technology license, proprietary engineering design, equipment, and catalyst solutions to Ocior for a green ammonia plant with a capacity of 600 metric tons per day. Additionally, KBR will help Ocior's plant achieve the optimal levelized cost of ammonia production. Jay Ibrahim, President of KBR Sustainable Technology Solutions, stated, "We look forward to supporting OCIOR Energy on this landmark project, which will help the region in meeting its decarbonization goals by utilizing our zero-carbon K-GreeN solution."

Ocior Energy, incorporated in Abu Dhabi, develops, builds, owns and operates green hydrogen and green

ammonia facilities, including the renewable energy needed to generate these green fuels. Mr. Ranjit Gupta, CEO of Ocior Energy, said, "Ocior's green ammonia project aims to set a benchmark for reliable green fuels production. We are confident that KBR's proven expertise and commitment will ensure the success of this project." Ocior's strategy focuses on developing well-engineered green ammonia projects in renewable resource-rich regions to fulfill increasing demand from global off-takers.

India Glycol to supply sustainable feedstock for polyester production in Japan

Noida, India: India Glycol, a green chemicals supplier based in Noida, has joined a multinational consortium of seven companies across five countries to establish a supply chain that replaces fossil materials with renewable, bio, and captured carbon feedstock in polyester fibre production. The consortium includes Finland-based Neste, South Korea's SK Geo Centric, Thailand's Indorama Ventures, Japan's Mitsubishi Corporation, Chiyoda Corporation, and Goldwin. Goldwin, the manufacturer of 'The North Face' outdoor clothing in Japan, plans to use the sustainable fiber in some of its products, including sports uniforms. The brand will consider using the fiber in other Goldwin products and brands after the first trial.

The first supplier in the chain is Neste, which will supply its renewable naphtha from bio-based waste and residue oils and fats. To produce renewable 'Neste RE', Neste uses its proprietary NEXBTL (Next generation biomass to liquid) technology, which turns bio-based oils and fats into pure hydrocarbons—fuels or feedstock for polymer production.

SK Geo Centric will use 'Neste RE' to produce renewable para-xylene, an intermediate feedstock for polyester production. Chiyoda and Mitsubishi will supply para-xylene produced from captured carbon dioxide, as part of a pilot project with the University of Toyama, HighChem, and Nippon Steel. The para-xylene will then be used by Indorama Ventures to manufacture terephthalic acid (TPA) from carbon captured feedstock. India Glycols will use sugarcane and other feedstocks to produce bio ethylene glycol, which Japan's Toyobo will finally use to produce PET originating from renewable, bio, and carbon captured feedstocks. The seven companies apply a mass balancing approach to ensure traceability of material streams throughout the supply chain.

Navin Molecular to construct new plant in Dewas

Madhya Pradesh, India: Navin Molecular, the pharma-focused contract development and manufacturing organization (CDMO) division of Navin Fluorine, has announced a ₹288-crore investment to construct a 9,000-square-metre GMP manufacturing plant in Dewas, Madhya Pradesh. The new facility will nearly double the overall capacity at the site to 420 cubic meters and will support existing commercial-scale projects as well as meet future demands.

Designed to be multi-purpose, the facility will add 200 cubic meters of manufacturing capacity, using different vessel types including stainless steel, glass-lined, Hastelloy, and Inconel. It will be capable of undertaking a range of chemistries, including hazardous processes such as direct fluorination, cyanation, azide chemistry, cryogenic reactions, and high-pressure hydrogenation. The plant will feature a high level of automated control, including a distributed control system (DCS), maximizing efficiency while reducing risks to employees and the environment.

The expansion will also enhance the size and capacity of the site's existing 21 CFR-compliant quality control laboratory to carry out in-process testing and final product release. A new process safety laboratory will be constructed, along with a dedicated zero liquid discharge (ZLD) effluent treatment plant. The construction will comply with India's optimum green building concepts, utilizing modern technologies in materials, equipment, and design, including renewable energy generation and solvent containment. A ground-breaking ceremony took place at the site in April this year, and the project is scheduled to be completed by the end of 2025.

CSIR-CSMCRI transfer technology to enable re-use of discarded RO membranes

Dignitaries of CSIR and CSMCRI during the technology transfer deal for a novel membrane rejuvenation technology

Bhavnagar, India: The CSIR-Central Salt & Marine Chemicals Research Institute (CSMCRI) in Bhavnagar has announced a technology transfer deal for a novel membrane rejuvenation technology. The institute, known for its work on water desalination through indigenously developed advanced membrane systems, has transferred the process know-how for end-of-life reverse osmosis (RO) membrane rejuvenation to Delhi-based Membrane Engineering Pvt. Ltd. (MEPL). With growing demand for RO membranes, there is an equivalent increase in end-of-life discarded RO membrane elements, which is a potentially hazardous polymeric waste. CSIR-CSMCRI's technology enables reuse of these membrane elements. According to the institute's officials, disposing of a membrane module is associated with significant greenhouse gas emissions. Recycling and reusing membrane elements for alternate applications can create value from waste while helping the environment.

CSIR-CSMCRI has set up a pilot plant facility at an experimental salt farm where it has successfully rejuvenated membrane elements from different industries. The institute has also filed an Indian patent for this membrane transformation facility. Dr. Hiren Raval, the principal investigator of the technology, mentioned that the process could transform discarded end-of-life RO elements into membranes for different applications, including partial substitution for new membranes in the same application, brackish water RO, wastewater reuse, and zero liquid discharge applications. CSIR-CSMCRI is a pioneer in synthetic membrane design, manufacturing, and membrane-based technologies. The institute has been doing pioneering work towards developing cost-effective technologies in the area of salt, marine chemicals, and seaweed processing.

ONGC and IOCL partner to establish LNG plant near Hatta Gas Field

Dignitaries from ONGC and IOCL during the signing of the Memorandum of Understanding to establish a Liquefied Natural Gas plant in Vindhyan Basin.

Madhya Pradesh, India: ONGC and IndianOil Corporation Limited (IOCL) have recently signed a memorandum of understanding (MoU) to establish a small-scale Liquefied Natural Gas (LNG) plant near the Hatta Gas Field in the Vindhyan Basin. The establishment of the Hatta LNG plant will significantly enhance the Vindhyan Basin's status, upgrading it from a Category II to a Category I Basin. The MoU signing ceremony was attended by IOCL Director (Planning & Business Development) Sujoy Chaudhary and ONGC Director (Exploration) Sushma Rawat. The plant will utilize cutting-edge technology to produce LNG, a cleaner alternative to traditional fossil fuels, significantly reducing carbon emissions and aligning with India's climate change mitigation goals.

The discovery at Hatta represents the culmination of five decades of sustained exploration efforts. ONGC has already submitted its Field Development Plan (FDP) to the Directorate General of Hydrocarbons (DGH) to monetize its assets in the Hatta area.

Gujarat's chemical industry shows signs of recovery

Ahmedabad, India: Gujarat's chemical industry, which produces 75 per cent of India's chemicals, is showing signs of recovery after a difficult year. Although chemical exports fell by 14% percent in FY 2024, recent data shows a 2.8 per cent increase in exports for April and May 2024 compared to the same period last year.

There is a prediction of 7-9 per cent growth for FY 2025, driven by a resurgence in both domestic and international demand.

The specialty chemicals sector, accounting for 21 per cent of the domestic industry, is expected to see margins recover. The agrochemicals segment is experiencing increased demand both domestically and globally, partly due to supply chain disruptions that have led to more orders for Indian manufacturers.

Gulshan Polyols awarded contract to supply 2,713 kiloliters of ethanol to OMCs

New Delhi, India: Gulshan Polyols Limited has been awarded a contract by Oil Marketing Companies (OMCs) Bharat Petroleum Corporation Limited (BPCL), Indian Oil Corporation Limited (IOCL) and Hindustan Petroleum Corporation Limited (HPCL) to supply 2,713 kiloliters of ethanol worth an estimated ₹18.85 crore. The tender was floated under the Ethanol Blending Petrol Programme (EBPP) for the Ethanol Supply Year (ESY) 2023-24 until October 2024. Gulshan Polyols will supply the ethanol from its 60 KLPD ethanol plant located at Boregaon.

This contract is part of the government's efforts to promote the use of ethanol-blended petrol in the country. The OMCs have been actively participating in the EBPP to increase the ethanol content in petrol, which helps in reducing India's dependence on crude oil imports and also contributes to environmental sustainability by reducing greenhouse gas emissions. Gulshan Polyols, a leading manufacturer of ethanol, has been playing a significant role in supporting the government's ethanol blending program. The company's state-of-the-art ethanol plant at Boregaon is equipped with advanced technology to ensure consistent supply of high-quality ethanol to the OMCs.

Evonik opens R&D facility for Life Sciences

Massachusetts, USA: Evonik's strategic innovation unit and business incubator, Creavis, has opened an Innovation Satellite with labs and offices in Cambridge, Massachusetts, in the Greater Boston metropolitan area. This new facility will focus on healthcare innovations, particularly nucleic acid-based medicines, enhancing Evonik's presence in North America's life sciences cluster.

"With our new Innovation Satellite in Cambridge, we are extending an invitation for collaboration to the brilliant minds across this dynamic region," said Anil Saxena, who also leads Evonik's RD&I in North America. "We look forward to weaving our capabilities into the local life sciences ecosystem and advancing the industry's growth," added Christian Kessler, Evonik, Head of Incubation Cluster Life Sciences, Creavis.

From left to right: Christian Kessler, Evonik, Head of Incubation Cluster Life Sciences, Creavis; Kevin Kuros, Massachusetts Office of Business Development, Central Massachusetts Regional Director; Guido Skudlarek, Evonik, President North America; Robert Langer, MIT, David H. Koch Institute Professor; Ralph Marquardt, Evonik, Chief Innovation Officer; Anne White, MIT, Associate Vice President for Research Administration and School of Engineering Distinguished Professor of Engineering; Anil Saxena, Evonik, Head of Research, Development & Innovation (RD&I) North America.

"Addressing the global challenges of our time requires worldwide collaboration of competent partners, and we are looking forward to jointly developing innovative solutions. We are strengthening regional R&D in North America and Asia to benefit from innovative ideas outside of Europe and be closer to our customers in those regions," stated Ralph Marquardt, Evonik, Chief Innovation Officer.

Coromandel unveils magnesium-enriched 'Paramfos Plus' to boost crop yield

Bengaluru, India: Coromandel International Limited, India's leading agri solutions provider, has launched a new magnesium-fortified complex grade fertiliser called 'Paramfos Plus' in Bengaluru. The product was unveiled by Sankarasubramanian S, Executive Director of the Nutrient Business at Coromandel International, in the presence of the company's senior leadership team and key channel partners from Karnataka and Tamil Nadu. 'Paramfos Plus' contains 16 per cent Nitrogen, 20 per cent Phosphorus, and 13 per cent Sulphur, along with an additional 0.6 per cent Magnesium. The added Magnesium boosts photosynthesis, chlorophyll production, and promotes the vegetative growth of plants, leading to improvements in both quality and yield. It is versatile and can be applied as a basal and top dressing for a wide variety of crops, including paddy,

cotton, maize, sugarcane, pulses, ragi, groundnut, oilseeds, and vegetables.

Paramfos Plus granules are free-flowing and suitable for both seed drill application and broadcasting. Sankarasubramanian S stated, "Paramfos Plus, an enhanced version of Paramfos, is fortified with 'Magnesium' that improves the vegetative growth of crops and provides early greening leading to increased yield and superior quality. Coromandel's innovation in fertilisers is a testament to our commitment and dedication to boosting nutrient efficiency, reducing environmental impact, and improving the economic viability of farming in India. This innovation also aligns with the Government's initiatives to promote the use of fortified fertilisers in India."

GAIL accelerates net zero goal for greenhouse gas emissions

New Delhi, India: In a significant move towards sustainability, GAIL (India) Limited, the state-owned gas company, has announced that it will achieve net zero carbon emissions for its Scope-I and Scope-2 greenhouse gas (GHG) emissions by 2035, five years earlier than its previous target of 2040.

The decision to advance the net zero target was made after an extensive study conducted by GAIL to enhance its sustainability goals and align with India's broader commitment to reach net zero emissions by 2070.

Mr. Sandeep Kumar Gupta, Chairman and Managing Director of GAIL, stated, "GAIL, as a company that markets and transmits natural gas, a cleaner fuel, is already contributing to reducing emissions for various industries and end-consumers. Now, by advancing our emission reduction targets to 2035, we are reaffirming our role as a trailblazer in India's energy landscape, driving sustainable development and contributing significantly to the country's net zero emission goals."

GAIL plans to achieve this ambitious target through a strategic approach involving the electrification of natural gas-based equipment, the integration of renewable energy, the deployment of battery energy storage systems (BESS), the utilization of compressed biogas (CBG) and green hydrogen, as well as CO_2 valorization initiatives and afforestation efforts.

PI Industries to acquire UK's plant health care for around ₹400 crore

Udaipur, India: PI Industries Ltd, an Udaipur-based agrochemicals company, has announced that its board of directors has authorized the acquisition of Plant Health Care Plc (PHC) for approximately 32.8 million pounds (around ₹400 crore). The acquisition is proposed to be done through a wholly-owned international subsidiary of PI Industries and will be paid in cash, funded from the earlier Qualified Institutional Placement (QIP) proceeds.

PHC is an AIM UK-listed company with subsidiaries in the United States, Brazil, Mexico, and several other countries. The company is well-known for its products, intellectual property, and experience with protein/peptide technology in the agricultural biological arena. PHC's technology has gained traction in recent years, particularly through the registration and commercialization of its patented 'PREtec' peptide products. PI Industries stated that the acquisition aligns with its long-term strategic objective to build a differentiated portfolio of integrated solutions for sustainable agriculture. With PHC, PI will gain access to cutting-edge biological/peptide technology platforms in the 'Plant Immunity Inducers' space. PI Industries already has a portfolio of 8 products in biologicals and more in the development and registration pipeline. Revenue from biological products increased by over 29 per cent in FY24. By combining these with other complimentary technologies and a pipeline of chemical products, PI will have a 'double engine' to generate a portfolio of products that will feed into well-oiled sales engines in India and important overseas markets.

Jay Chemical inaugurates specialty chemicals plant in Gujarat

Gujarat, India: Jay Chemical Industries Private Limited has inaugurated a cutting-edge specialty chemicals facility in Saykha, near Dahej, Gujarat. The new plant will focus on producing derivatives and formulated products based on ethylene oxide and propylene oxide. These products will primarily serve as raw materials in the textile auxiliaries sector. The facility aims to enhance the stability of various chemicals by reducing surface and interfacial tension, thereby improving product performance across multiple industries.

Plasma Water Solutions expands business to Tamil Nadu and Uttar Pradesh

Tamil Nadu, India: Plasma Water Solutions, known for its patented plasma-activated water technology, has commenced commercial services at two farmer producer organizations (FPOs) in Rae Bareilly, Uttar Pradesh, and Chennai, Tamil Nadu. Mr. Pragya Kalia, Managing Director of Plasma Water Solutions (I) Pvt Ltd, India, stated, "We are expanding our services to several other regions in India, including Rajasthan, Gujarat, and Telangana."

Plasma Water, a wholly-owned subsidiary of Plasma Water Solutions Inc. based in Miami, USA, produces plasma-activated water, which contains specific oxygen radicals beneficial for plant growth. "Plasma water is essentially like lightning, containing reactive oxygen and nitrogen species," explained Kalia.

Using its patented machine, Plasma Water replicates the effects of lightning to create plasmized water. Seeds treated with this water demonstrate increased disease resistance, faster and more robust germination, and improved stress tolerance. Plasmized water can be utilized as a foliar spray, replacing pesticides and insecticides to manage various infestations. Kalia informed that Plasma Water India, launched in August 2022, installs its patented machine, which converts regular water into plasmized water, at the premises of farmer producer companies.

Farmers bring their seeds to these locations for treatment and pay for the service. The scientific collaborations include the Indian Council of Agricultural Research (ICAR) in New Delhi and ICRISAT in Hyderabad.

Eurosyn announces strategic partnership with hubergroup Chemicals

Milan, Italy: Eurosyn, a leading distributor of specialty chemicals for the Italian market, has announced a strategic partnership with hubergroup Chemicals, a division of the international chemical and ink specialist hubergroup. hubergroup Chemicals specializes in the production of raw materials for industrial coatings, printing inks, and adhesives for flexible food packaging. The company also develops, scales, and manufactures customized solutions for the chemical industry. The strategic collaboration brings together Eurosyn's distribution skills with hubergroup's expertise in printing ink and coatings raw materials, offering Italian customers access to high-quality raw materials and innovative solutions.

hubergroup's chemicals division operates two production plants in India, specializing in the manufacture of UV-curable oligomers, polyurethane resins, modified rosin resins, and more. "We are happy to partner with hubergroup Chemicals," said Mr. Enrico Campana, CEO at Eurosyn. Campana added, "This partnership strengthens our ability to provide customers with a comprehensive range of high-quality raw materials for printing inks and coatings."

Exide Energy Solutions nears completion of new project in Bengaluru

Bengaluru, India: Exide Industries, a leading storage battery manufacturer, anticipates completing the first phase of its 12 GWh lithium-ion cell manufacturing facility in Bengaluru by the end of the current financial year. The project, undertaken by Exide's subsidiary Exide Energy Solutions, is progressing on schedule.

Exide Energy Solutions is in the final stages of setting up the lithium-ion cell manufacturing project, which is crucial to India's burgeoning electric vehicle market. In line with this, Exide Energy Solutions Limited (EESL) has signed a non-binding memorandum of understanding (MoU) with Hyundai Motor and Kia Corporation to explore strategic cooperation in the sector.

With the rising demand for lithium-ion batteries and storage solutions, Exide Energy's operations will include producing, assembling, and commercializing battery modules and packs for mobility and grid-based applications. The plant, initiated in 2022, is designed to reach a total capacity of 12 GWh, split into two phases of 6 GWh each.

In 2023, Exide partnered with SVOLT Energy Technology, a known global lithium-ion cell and battery manufacturer, for technical expertise and to execute the project on a turnkey basis. SVOLT is assisting Exide Energy Solutions in setting up an end-to-end production process, including the upstream supply chain, manufacturing plant and equipment, and quality processes. The Bengaluru facility, spread across 325,000 square meters, will have a Phase 1 capacity of 6 GWh, including 3 GWh of NCM (Nickel Cobalt Manganese) cells and 3 GWh of LFP (Lithium Iron Phosphate) cells. Phase 2 will add another 6 GWh capacity to the plant.

IISc researchers develop new biocatalyst

Mumbai, India: Researchers at the Department of Inorganic and Physical Chemistry (IPC) at the Indian Institute of Science (IISc) have developed an enzymatic platform capable of transforming abundant and inexpensive fatty acids into valuable hydrocarbons known as 1-alkenes, which are promising biofuels.

In prior research, the IISc team isolated and characterized an enzyme named UndB, found in the membranes of certain bacterial cells, which converts fatty acids to 1-alkenes at an unprecedented rate.

However, the enzyme's efficiency was hindered as it became inactive after only a few cycles, primarily due to the inhibitory effect of H_2O_2, a byproduct of the reaction.

In their recent study published in Science Advances, the team addressed this issue by incorporating another enzyme, catalase, into the reaction mix. Catalase breaks down H_2O_2, thereby enhancing UndB's activity 19-fold, increasing its turnover from 14 to 265 cycles.

Technip Energies acquires technology to accelerate bio-polyester production

Nanterre, France: Technip Energies and Shell Catalysts & Technologies have signed a technology transfer agreement, which accelerates the commercialization of Technip Energies' Bio-2-Glycols™ technology for bio-based Mono Ethylene Glycol (MEG) production from glucose.

MEG is traditionally produced using fossil-based feedstock to make various types of polyesters for packaging materials, such as plastic bottles, and in clothing apparel. With this acquisition, Technip Energies intends to offer a bio-based polyester solution by replacing fossil-based feedstock. By using a bio-sourced monomer, the Bio-2-Glycols™ technology allows for polyesters to be produced with lower carbon footprints and less environmental impact.

The technology transfer agreement allows to combine Shell's research and development results with Technip Energies' bio-MEG technology, to offer a more efficient, bio-based MEG technology to the market. The new combined technology will be commercialized under the Bio-2-Glycols™ trademark.

Wei Cai, Chief Technology Officer, Technip Energies commented, "We are pleased to have completed this agreement which allows us to propose an optimized, combined solution to make bio-MEG, a common feedstock for various everyday life applications. We are confident about rapidly commercializing our Bio-2-Glycols™ technology. Our objective is to offer this technology in 2025 which will contribute significantly to the net zero challenge".

Adani Wilmar acquires 67% stake in Omkar Chemicals

Ahmedabad, Gujarat: Adani Wilmar Limited (AWL), one of the largest food FMCG players in India and a leading player in Oleochemicals in the country, having largest oleo-chemical plant of the country in Mundra, has signed the share subscription and share purchase agreement to take a majority stake of 67 per cent in Omkar Chemicals Industries Private Limited, a specialty chemicals company.

Omkar Chemicals operates a manufacturing plant in Panoli, Gujarat with an annual capacity of around 20,000 MT of surfactants and is further adding capacity for other products as well. The entrepreneurs promoting Omkar Chemicals bring over 15 years of experience in the specialty chemicals manufacturing industry. The specialty chemicals market presents a significant opportunity across diverse sectors such as home and personal care products, food additives, plastics and polymers, agrochemicals, and lubricants and petrochemicals.

AWL currently operates in this sector through third-party manufacturing and by importing from Wilmar's plants. Mr. Saumin Sheth, Chief Operating Officer, Adani Wilmar said, "We are pleased to add these specialty chemicals, which represent further downstream derivatization of our product portfolio. Through this acquisition, AWL will immediately establish a production footprint and capabilities that will allow us to better meet customer requirements. Downstream derivatization of our basic oleochemicals in select areas is a strategic focus for us, in line with the focus of our co-promoter Wilmar International which is the world's largest Oleo-chemical manufacturer. We aim to bring the diversified product portfolio of Wilmar and its associates to India to better serve our customers." ■

Aramco's gas expansion progresses with USD 25bn contract awards

Aramco signing ceremony for Master Gas System III contracts in Dhahran, Saudi Arabia

Dhahran, Saudi Arabia: Aramco, one of the world's leading integrated energy and chemicals companies, has awarded contracts worth more than USD 25 billion to progress its strategic gas expansion, which targets sales gas production growth of more than 60 per cent by 2030, compared to 2021 levels. The contracts relate to phase two development of the vast Jafurah unconventional gas field, phase three expansion of Aramco's Master Gas System, new gas rigs and ongoing capacity maintenance. Amin H. Nasser, Aramco President & CEO, said, "These contract awards demonstrate our firm belief in the future of gas as an important energy source, as well as a vital feedstock for downstream industries. The scale of our ongoing investment at Jafurah and the expansion of our Master Gas System underscores our intention to further integrate and grow our gas business to meet anticipated rising demand."

Aramco has awarded 16 contracts, worth a combined total of around USD 12.4 billion, for phase two development at Jafurah. The work will involve construction of gas compression facilities and associated pipelines, expansion of the Jafurah Gas Plant including construction of gas processing trains, and utilities, sulfur and export facilities. It will also involve construction of the Aramco's new Riyas Natural Gas Liquids (NGL) fractionation facilities in Jubail — including NGL fractionation trains, and utilities, storage and export facilities — to process NGL received from Jafurah.

Another 15 lump sum turnkey contracts, worth a combined total of around USD 8.8 billion, have been awarded to commence the phase three expansion of the Master Gas System, which delivers natural gas to customers across the Kingdom of Saudi Arabia. The expansion, being conducted in collaboration with the Ministry of Energy, will increase the size of the network and raise its total capacity by an additional 3.15 billion standard cubic feet per day (bscfd) by 2028, through the installation of around 4,000km of pipelines and 17 new gas compression trains. An additional 23 gas rig contracts worth USD 2.4 billion have also been awarded, along with two directional drilling contracts worth USD 612 million. Meanwhile, 13 well tie-in contracts at Jafurah, worth a total of USD 1.63 billion, have been awarded between December 2022 and May 2024.

Privi Speciality Chemicals receives ultra mega project status for expansion

Mumbai, India: With the approval of its proposed expansion project and the incentives provided by the Maharashtra government's Package Scheme of Incentive Policy, Privi Speciality Chemicals has accomplished a noteworthy milestone. With its facility situated in the Maharashtra Industrial Development Corporation (MIDC) area in Mahad, Raigad, Privi's expansion initiative to manufacture synthetic aroma chemicals has been given the status of 'Ultra Mega Project' by the Industries, Energy, Labour and Mining Department of Maharashtra.

The recognition of Privi Speciality Chemicals' expansion project under the Package Scheme of Incentive Policy, 2013 (PSI 2013) offers multiple advantages. As to the PSI Letter that was obtained from the Maharashtra government, the project is eligible for the subsequent incentives, provided that it complies with the guidelines mentioned in PSI 2013 and any other relevant laws. Privi Speciality Chemicals' expansion project is expected to increase the company's ability to produce synthetic aroma chemicals, which are essential parts of the flavour and fragrance industries. Through the utilisation of the advantages offered by the PSI 2013 policy, Privi hopes to fortify its position in the market and stimulate innovation in its range of products.

The expansion project of Privi Speciality Chemicals is expected to have a major impact on the trajectory of growth of the company. The PSI 2013 policy's strategic incentives will assist the business in cutting expenses, making investments in cutting-edge technology, and strengthening its position as a market leader internationally.

Voltalia and Taqa Arabia to develop renewable hydrogen hub in Egypt

Egypt, Cairo: French renewable energy firm Voltalia and its partner TAQA Arabia recently signed a framework agreement during the Egypt-EU Investment Conference 2024. The Egypt-EU Investment Conference was held under the auspices of Ursula von der Leyen, President of the European Commission, and Abdel Fattah El-Sisi, President of the Arab Republic of Egypt. With its partner TAQA Arabia, Voltalia is continuing to develop a cluster combining renewable energy and green hydrogen production. The framework agreement is a continuation of a Memorandum of Understanding (MoU) signed in December 2022 to develop a cluster combining green hydrogen production with renewable power generation. The project will be implemented in two identical phases, each comprising a 500-megawatt electrolyzer powered by more than 1.3 gigawatt of solar and wind energy. The facility will have an annual production capacity exceeding 130,000 tons of hydrogen for each phase. It will be located at a greenfield site near Ain Sokhna port in the Suez Canal Economic Zone. Sebastien Clerc, CEO of Voltalia, said, "Egypt has promising opportunities to enhance its regional leadership in green hydrogen production and export within the country's plans for green transformation. Voltalia is working hard to support these plans by signing a framework agreement in partnership with TAQA Arabia, which has great experience in the energy sector. This landmark project will contribute significantly to Egypt's transition to a green sustainable economy."

SABIC Agri-Nutrients to set up blue ammonia project in Saudi

Jubail, Saudi Arabia: SABIC Agri-Nutrients Company has announced that the company has received approval from the Ministry of Energy for allocating the required quantities of feedstock to build SABIC Agri-Nutrients plant the (6th) in Jubail Industrial City, Saudi Arabia to produce 1.2 MMTA of Blue (low carbon) Ammonia and to produce 1.1 MMTA of urea and specialized agri-nutrients.

The company will do the engineering studies to evaluate the leading technologies and will select the most efficient in energy and feedstock utilization.

BASF achieves ISCC+ certification

Ludwigshafen, Germany: BASF achieves ISCC+ certification across all its global major production sites for Acrylics, Alcohols, Glycol Ethers and Acetates, taking an important step to support customers fulfilling their targets and ambitions. With this step, BASF is now able to produce more than 60 products related to this portfolio with one or more sustainability attributes.

In addition to the already known high-quality and reliable 'Classic' products, the majority of the portfolio can also be offered with one or more of the following sustainability attributes: 'Low-PCF' and 'Zero-PCF' lead the way in reducing the product carbon footprint, aiding customers' greenhouse gas reduction targets. 'Bio-based' products are partially made of biomass, traceable via the 14C method. Ccycled® products are made using chemically recycled raw materials from plastic waste or end-of-life tires which is instrumental in fostering a circular economy and products 'Made using Green Power' underline BASF's commitment to renewable energy, further mitigating the environmental impact of the production process.

Martin Liedemit, Senior Vice President Global Strategic Business Development Petrochemicals at BASF, said, "Based on BASF's strong global and versatile asset footprint, we are capable to offer products with different sustainability attributes. Over the past years, we implemented measures that enable us to provide solutions, which support our customers worldwide to reach their sustainability targets and ambitions." ■

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A significant stride towards sustainability

Aether Industries, a leading player in India's specialty and fine chemical manufacturing sector, has commissioned a groundbreaking 5 MW solar power plant at its facilities. This milestone achievement marks a transformative chapter in the company's unwavering commitment to renewable energy and its ambitious efforts to meet its operational energy needs through eco-friendly means.

"This is a proud moment for us at Aether Industries," beams Faiz Nagariya, Chief Financial Officer (CFO). "Our newly commissioned solar plant is not just a testament to our environmental stewardship, but also a testament to our relentless pursuit of innovation and our determination to pave the way for a greener future," he added.

Solar plant

The 5 MW solar plant, featuring state-of-the-art Auto-Tracker Modules, is part of a larger 15 MW project undertaken by Aether Industries' wholly-owned subsidiary, KPIG Energia Private Limited, in partnership with KPI Green Energy Limited. This ambitious endeavor is designed to power the company's manufacturing facilities, delivering substantial cost savings and bolstering its bottom line.

"The current 5 MW capacity can fulfill over 15 per cent of our total electricity needs," Faiz explains, "which translates to approximately ₹6 crores in annual savings on our electricity expenses. This is a significant boost to our profitability and a clear demonstration of the financial benefits of embracing renewable energy." The remaining 10 MW of the solar capacity is slated for commissioning in the coming months, and once the entire 15 MW project is online, Aether Industries anticipates total savings of at least ₹18 crores per annum. This substantial cost reduction will have a significant impact on the company's financials and contribute to notable reductions in emissions, further enhancing its sustainability efforts.

Faiz Nagariya
Chief Financial Officer, Aether Industries

Auto-tracker modules

Discussing further about technologies Faiz highlighted about the Auto-Tracker Modules, as a cutting-edge technology, that provides a distinct advantage over traditional fixed solar panels. By dynamically adjusting to the sun's direction throughout the day, these modules ensure that the panels are always optimally positioned to capture the maximum amount of direct sunlight, leading to a remarkable increase in energy generation. "Unlike fixed tilt panels, which experience varying sunlight angles and consequently lower energy capture, our Auto-Trackers maintain an optimal angle to the sun, maximizing efficiency and improving the return on investment for our solar energy projects," Faiz proudly states.

Stable Energy Supply

To address the cyclical nature of solar power, which may not always meet the energy demands of Aether Industries' process equipment, the

company has secured a generation guarantee from its service provider. This guarantee ensures a predictable output based on seasonal variations, providing a stable and reliable energy supply. "While solar generation may be lower during monsoon and cold winters, it is balanced by optimal and sometimes excess generation during the summer and other parts of the year," Faiz clarifies. "This affirmation gives us the confidence to fully embrace solar power as a primary energy source."

Hybrid Power Solutions

Looking ahead, Aether Industries is exploring innovative hybrid power solutions that integrate wind and solar technologies. By combining wind and solar, a more consistent and reliable power supply can be ensured, as the variability of one source can be offset by the other. This diversified renewable energy mix will help achieve more optimal energy generation and greater savings, ultimately strengthening the energy strategy and supporting sustainability goals.

Sustainable Journey

As Aether Industries continues to lead by example in the chemical manufacturing sector, its commitment to renewable energy and its steadfast pursuit of innovative solutions have positioned the company as a trailblazer in the industry's sustainability journey. With the successful commissioning of the 5 MW solar plant and the promise of future expansions, Aether Industries is poised to shine even brighter, illuminating the path towards a greener and more sustainable future. ■

(By Minaz Khan)

UNION BUDGET 2024

Industry leaders share their opinion on Budget 2024, announced on 23rd July 2024 by Finance Minister, Smt. Nirmala Sitharaman

S. Sunil Kumar
Country President of
Henkel India

"Outlines pathways to position India as a global economic powerhouse"

"The Union Budget offers a strategic roadmap to consolidate India's economic gains and propel it towards new heights. It has identified several key growth catalysts such as Manufacturing & Services, Employment & Skilling, Infrastructure Development, Innovation, and Research. Collectively, these will advance the nation towards a 'Vikshit Bharat', reflecting a commitment to sustainable and inclusive growth through targeted investments and strategic development.

With a significant allocation of Rs.11.11 lakh crore towards capital expenditure for FY 2024-25, the government is paving the way for robust infrastructure development and sustainable economic growth in India. Over the next five years, the focus on large-scale projects has the potential to transform the economic landscape, reduce logistical costs, and improve the efficiency of transportation networks. It is also promising to see the government taking measures to boost job creation in the manufacturing sector, a key contributor to the country's GDP.

The government has earmarked over Rs.3 lakh crore for schemes benefiting women and girls and boosting their participation in the workforce. It is a welcome development that will unlock productivity, promote social equity, and enhance India Inc's journey towards a more diverse and inclusive workplace. By leveraging the full potential of all talent, including women, industries can build a more robust and capable workforce.

Overall, the Union Budget 2024 outlines pathways to enhance India's long-term economic resilience and competitiveness, and to position it as a global economic powerhouse."

Pankaj Poddar
Group CEO, Cosmo First

"We welcome the focus in the budget on creating job opportunities in the manufacturing sector"

"India's packaging industry is growing at a healthy pace and is contributing significantly through the export route to the exchequer. There is a need to enhance skills for youth, innovation, and R&D support for the sector. We welcome the focus in the budget on creating job opportunities in the manufacturing sector and this coupled with support to the employers will propel the industry to new heights. Further, the introduction of credit guarantee scheme for MSMEs and facilitating term loans to MSMEs for purchase of equipment without collateral or guarantee will go a long way to enhance access to capital in the sector."

UNION BUDGET 2024

Dr. Kapil Garg
Chairman & Managing Director,
Oilmax Energy Pvt. Ltd

"An encouraging Budget"

"We commend the Government and the Hon'ble Finance Minister for presenting an encouraging Budget. Reducing the fiscal deficit to 4.9 per cent is an extremely encouraging step for India Inc.

We appreciate the Budget's efforts to enhance ease of doing business through favourable policies. The substantial investment of ₹26,000 crores in the development of Eastern India will attract more industries to the region. With a capital expenditure of ₹11.11 lakh crores and the crucial development of the industrial node at Gaya on the Amritsar-Kolkata industrial corridor, the manufacturing sector will receive a significant boost, ensuring seamless end-to-end production.

The CREDIT GUARANTEE Scheme for MSMEs in the manufacturing sector, offering coverage of up to ₹100 crores, will further support the sector. We also welcome the exemption of customs duty on 25 critical minerals to benefit strategic sectors.

Additionally, ongoing efforts to create jobs in manufacturing and the incentives for first-time employees under the EPFO Scheme will increase the workforce, positively impacting the demand-supply ratio.

Overall, with favourable and inclusive employment policies and a focus on robust infrastructure development, we believe this Budget will pave the way for the country's ambition of becoming 'Viksit Bharat' by 2047."

Ms. Kavita Shirvaikar
Acting Managing Director
Patel Engineering Limited

"A pivotal step"

"The Union Budget's emphasis on promoting pumped storage projects is a pivotal step towards a sustainable and resilient energy future. The introduction of a new policy to support electricity storage will significantly enhance the integration of renewable energy sources, ensuring a stable and reliable power supply. This forward-thinking approach not only addresses the challenges of renewable energy intermittency but also positions India as a leader in innovative energy solutions. By fostering investment in pumped storage and other renewable energy technologies, the government is paving the way for a greener and more sustainable future. We are confident that these initiatives will accelerate the transition to clean energy, reduce our carbon footprint, and create substantial opportunities for growth and employment in the energy sector.

The finance minister emphasized that the government is laying the groundwork for sustained economic growth with an impressive allocation of Rs.11.11 lakh crore. This substantial investment demonstrates the government's strategic foresight for India's long-term growth trajectory, ensuring economic transformation and the creation of numerous job opportunities."

Streamlining Compliance Operations: How Digital Solutions and Workflows Optimize Organizational Efficiency

RISHI AGRAWAL
CEO and Co-Founder, Teamlease Regtech

The sheer number of compliances increases the risk of lapses and high penalties, causing bottlenecks in the chemical industry. **Rishi Agrawal, CEO and Co-Founder, Teamlease Regtech,** discusses how workflows can help chemical companies streamline their compliance operations and navigate the complex regulatory landscape in India. By leveraging technology, chemical enterprises can centralize data management, automate workflows, improve collaboration, and gain real-time visibility into their compliance status.

The USD 200 billion Indian chemical industry, a vast and diverse sector, encompasses over 80,000 products and contributes to approximately 11 per cent of total exports. However, the complex and demanding regulatory framework hones the industry's growth. For instance, a single-entity chemical manufacturing business operating in a single state is burdened with over 60 one-time registrations and approvals. An average small chemical manufacturing company with one manufacturing unit in Maharashtra needs to deal with 635 unique obligations. For a company to establish a new chemical compound manufacturing facility, it must secure nearly 72 licenses and permissions under at least 52 Acts from Central and State authorities at various stages. However, an enterprise needs to obtain numerous certificates/ approvals before starting construction. These include building layout and drainage plan approval, NOCs for storm water drainage, tree felling and sewage water discharge, plinth and building completion certificates and others. They also need an approved factory layout plan under the Factories Act, 1948. The employer may also need approval for non-agriculture land use if the land is not zoned for industrial use.

Businesses must also keep track of directions, notifications, circulars, notices, etc., issued by regulatory bodies and ensure adherence. Enterprises are required to comply with regulations such as the Chemical Weapons Convention Act, 2000 & Chemical Weapons Convention Rules, 2016; Essential Commodities Act, 1955; and the Insecticides Act, 1968 & Insecticides Rules, 1971. The multiplicity of compliances increases the risk of lapses and high penalties, causing chemical industry bottlenecks. Furthermore, after accounting for 53 monthly, 93 quarterly, 48 half-yearly, and 61 annual compliances, compliance obligations rise to 1,545 for a chemical company. Labour compliances (334) are the biggest unique regulatory obligations for chemical companies, followed by Commercial (136) and EHS (98). This further increases the complexities of compliance.

Chemical enterprises also need to deal with several other challenges related to compliance. These include:

- There is a lack of an accurate list of applicable compliances. Depending on the size and the chemical manufactured, chemical companies must follow hundreds of laws and thousands of rules. Corporations also need to comply with the Ministry of Environment, Forest, and Climate Change (MoEF&CC) Chemical Committee and Basic Chemicals, Cosmetics, and Dyes Export Promotion Council export regulations. Compliance is also dependent on the location of manufacturing units (industrial areas, export-oriented units, gram panchayats, special economic zones, etc.), quantity and severity of chemicals manufactured, and use of specific equipment. Notifying the relevant authority to change threshold quantities is also difficult. Most Indian chemical companies struggle to track compliance with so many regulations.

- Dealing with a fluid regulatory environment. There is an absence of a central repository of regulatory updates that provides national, real-time, comprehensive, and personalised information on all compliance changes. Over 8,000 regulatory updates were published on 2,233 union, state, and local government websites in FY24.

- Chemical enterprises are subject to strict liability due to the nature of their operations. Any unfortunate incident that can put the public

Chemical companies struggle to track compliance obligations, which can be event-based or ongoing in nature. The large number of requirements makes it challenging for compliance teams to maintain oversight, as they must stay vigilant to identify and apply changes triggered by specific business or regulatory events.

at risk and cause significant damage. As such, companies must ensure that they abide by safety requirements to prevent any accidents. The lack of a comprehensive checklist puts employers at a disadvantage.

- We have already established that even a small chemical enterprise must deal with tens of licenses, registrations, and various other approvals. These licenses, registrations, permissions, consent orders and NOCs need to be tracked meticulously to ensure that they are in good order, failing which, there are serious business consequences. However, enterprises struggle with renewals and license requirements due to poor understanding and management of license applicability.

- Businesses suffer from poor tracking of compliances. Compliances can be divided into event-based or ongoing in nature. Event-based compliances are triggered by changes brought by specific business or regulatory events. As such, employers need to be on their toes to identify and assess the requirements of such compliances that can become applicable. Similarly, the sheer number of compliance obligations can lead to the compliance teams losing track of their compliance status.

- Several organisations still use ad hoc, paper-based, and people-dependent processes for compliance workflows. Compliance officers manually track status with spreadsheets. Consequently, there may be accidental misses, delays, lapses, defaults, expired licenses, and missed legal updates. They often firefight and are stressed during regulatory audits. This complex and extensive process underscores the need for digital solutions to streamline and manage these compliance requirements.

Digital Public Infrastructure (DPI) has already demonstrated the potential and impact of creating a technological backbone. The digitisation of transactions, e-commerce activities, and communication channels has already reshaped the business landscape. Integrating that also take advantage of the three layers (Unique identity, Centralised document repository, and straight through filings) will significantly boost the ease of compliance in the economy. It will be a crucial step towards eliminating the lingering regulatory cholesterol.

It is not just beneficial but crucial for chemical companies to embrace digital compliance solutions. These technology-based tools can help businesses navigate the intricate regulatory landscape, significantly improving efficiency and reducing the risk of non-compliance. By adopting these solutions, entrepreneurs can more effectively manage their operations, monitor their financial health, and stay on top of their regulatory requirements. Utilising RegTech is not just a trend but a necessity for enterprises to stay on top of their compliance requirements and avoid lapses, delays, and defaults. It gives employers better visibility and control over compliance functions. Compliance technology has replaced traditional manual compliance processes with unique features, including customised checklists, real-time regulatory updates, automated alerts and reminders, and periodic analytics.

Digital compliance solutions aid employers in transforming their compliance management through their various offerings and capabilities. These include:

Digital compliance solutions offer real-time monitoring and reporting capabilities, allowing organizations to track compliance activities, identify potential issues, and generate comprehensive reports. This visibility helps organizations stay on top of their compliance obligations and quickly address any concerns.

- Conducting applicability assessments of their business. In a fluid regulatory environment, the applicability of compliances changes with the use of specific equipment, input raw materials and end products, among others. As such, a compliance management system vendor can aid the enterprise in creating a list of compliance obligations by analysing business operations and the extant regulatory framework. This checklist can then serve as a baseline for the organisation and be periodically reviewed and refreshed based on regulatory changes.

- Digital solutions give employers access to national, real-time, personalised and comprehensive regulatory updates. These updates are curated in a single place within 24 hours of them being released by government bodies across 2,000+ government websites. Compliance teams can then sort through these updates using search and filter capabilities to find information.

- Compliance management revolves around paperwork and documentation. Digital solutions allow for the creation of a central repository of digital compliance documents. These are verified, version-managed and tamper-proof copies that allow businesses to go paperless.

- Digital compliance solutions come equipped with smart dashboards, integrated compliance databases, analytics and reporting capabilities, and integrated document management systems. These are SaaS-based solutions that are also available through native mobile apps, and offer configurable workflows that can adapt to business processes.

- These solutions further enable organisations to create a culture of compliance. This creates a sense of shared responsibility among employees for compliance. It also pushes for the senior management to set the tone from the top to push compliance to the forefront of business processes.

Digital compliance solutions enable employers to shift away from ad-hoc, manual, paper-based, and people-dependent compliance to more efficient, paperless, presence-less, and cashless compliance processes. The resultant reduction in the cost of compliance and the instances of poor compliance significantly reduces their exposure to fines and penalties, making it a win-win situation for the industry and the regulatory bodies. Adopting and adapting these solutions can help companies improve compliance visibility and control. The digital transformation of the chemical industry will be critical in boosting ease of compliance and ease of doing business in the country, allowing more investments and employment opportunities to come up. ■

GUEST COLUMN

Industrial Robotics: Applications and advantages in Indian market scenario

SUNIL RAIBAGI
Managing Director Asia & Vice President Strategy & Business Development, Zimmer Group

Capacity enhancement is happening in Indian industry and many new modern plants with smart and robotic automation are getting ready. **Mr. Sunil Raibagi, Managing Director Asia & Vice President Strategy & Business Development, Zimmer Group,** shares his views on major growth drivers for the India industrial robotics market.

The Indian economy is expected to grow by approximately 8 per cent in the next 5-6 years, endorsed by increasing public investment in infrastructure and a pickup in private sector investment. Investors, motivated by the results of their investments in the past fiscal year, are prepared to devote a significant gear percentage of their savings to capital instruments in the forthcoming years. They are also motivated to invest in the growing industries in India. Due to this, capacity enhancement is happening in Indian industry and many new modern plants with smart and robotic automation are getting ready.

Major growth drivers for the India industrial robotics market include the rising advancements in technology, increasing automation needs, and efforts to enhance manufacturing capabilities in the country. Due to digitisation; increased throughput requirements, many modern manufacturing scenarios are getting immerged and smart manufacturing robots are getting more popular in every industry sector. An increasing e-commerce and logistics and growing adoption of industry 4.0/5.0 are projected to propel the expansion of the India industrial robotics market during the next five years.

Initiatives like 'Make in India' are structured to incentivize robotics adoption, thus magnifying manufacturing capabilities. Marina Bill, President of the International Federation of Robotics, notes that India has witnessed a remarkable expansion in the operational stock of industrial robots, marking an impressive 16 per cent annual growth rate since 2016. With India ranking as the fifth largest global economy in terms of manufacturing output, the automotive industry leads the way, accounting for 31 per cent of robotics consumption in 2021.

India industrial robotics market size was estimated approximately 5 billion USD in 2022. In next 5 years, the size of India industrial robotics market is projected to grow at a CAGR of 12.50 per cent reaching a value of USD11 to 12 billion by 2029.

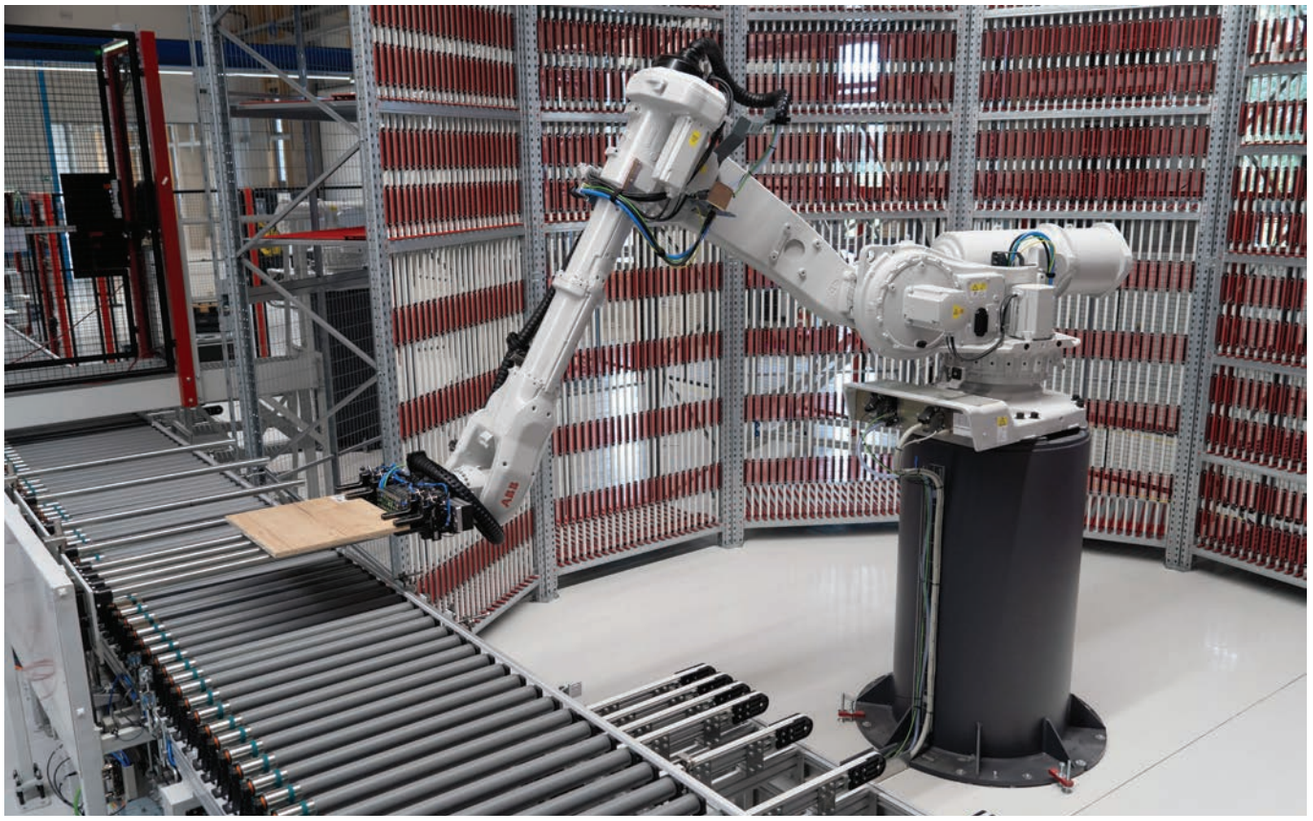
At the moment, industrial robot's population is more in the industrial sectors such as automotive and electronics. In these sectors, these industrial robots were primary adapted for impeccable quality, and continuous production. Safety, ergonomics, and innovation collectively enhance the adoption of industrial robotics.

These multifaceted dynamics culminate in collaborative robots (cobots) augmenting operational flexibility, the power of Industry 4.0 fuelling intelligent and interconnected factories, and an unwavering commitment to environmental consciousness promoting sustainable practices. This holistic ecosystem propels India's industrial robotics domain into a future defined by innovation, precision, and sustainable growth, signifying a promising evolution on the horizon.

India industrial robotics market refers to the landscape encompassing the manufacturing, distribution, and utilization of robotic technologies within various industries and sectors across India. This market involves the integration of advanced robotic systems and automation solutions to enhance productivity, efficiency, and precision in manufacturing processes. It encompasses a wide range of robotic applications, including assembly, welding, material handling, painting, and more, aimed at improving operational capabilities and addressing the evolving needs of Indian industries. The India industrial robotics market reflects the adoption of cutting-edge technologies to optimize manufacturing workflows, bridge skill gaps, meet demand surges, and contribute to the country's economic growth and industrial competitiveness.

By type or construction, the India industrial robotics market is divided into Articulated, Cartesian, SCARA, and AMRS. The articulated segment held the highest share in the India industrial robotics market by type due

Initiatives like 'Make in India' are structured to incentivize robotics adoption, thus magnifying manufacturing capabilities. Marina Bill, President of the International Federation of Robotics, notes that India has witnessed a remarkable expansion in the operational stock of industrial robots, marking an impressive 16 per cent annual growth rate since 2016



to its versatility and adaptability to various industrial applications. AMR is also catching up. Articulated robots feature multiple interconnected joints, offering a wide range of motion like a human arm. This flexibility allows them to navigate complex tasks, reach difficult-to-access areas, and perform precise movements. In manufacturing environments, such as automotive assembly lines, electronics production, and packaging, where intricate and diverse operations are required, articulated robots excel. Their ability to handle tasks with precision and efficiency, combined with advancements in control systems and sensors, has made them a preferred choice for industries seeking enhanced productivity and operational excellence. This aligns with the growing adoption of Industry 4.0 principles, where automation plays a pivotal role in optimizing manufacturing processes.

Based on application, the India industrial robotics market is divided into Handling, Assembling and Disassembling, Welding and Soldering, Cleanroom, Dispensing, and Processing segments. The handling segment holds the highest share in the India industrial robotics market by application due to its fundamental role in enhancing operational efficiency and reducing human intervention across various industries. Handling robots are designed to manipulate and transport materials, components, and products within production lines, warehouses, and distribution centres. Their precise and repetitive movements streamline tasks such as picking, packing, palletizing, and sorting, which are essential in industries like e-commerce, logistics, and manufacturing. The rapid growth of e-commerce and the need for faster order fulfilment have driven the demand for handling robots. Moreover, in industries like automotive and electronics, where precision is crucial, handling robots ensure consistent quality and reduce the risk of errors. As companies strive to optimize their supply chain and improve productivity, the versatility and reliability of handling robots make them a cornerstone of automation strategies, thus contributing to their prominent market share.

Based on end user, the India industrial robotics market is divided into Automotive, Electrical/Electronics, Metal/Heavy Machinery, Chemical, Rubber, & Plastics, and Food segments. The food segment occupies the highest share in the India industrial robots market by end user due to its role in addressing key challenges faced by the food processing and packaging industry. Industrial robots have gained significant traction in this sector due to their ability to enhance hygiene, efficiency, and product quality. In the food industry, stringent hygiene and safety standards are

paramount, and robots offer a solution by reducing human contact in food handling processes, minimizing the risk of contamination. Additionally, industrial robots can handle delicate tasks such as sorting, packaging, and labelling with precision, reducing waste and ensuring consistent product presentation. The demand for processed and packaged food products, driven by changing consumer lifestyles, has further propelled the adoption of robots in this sector. As companies seek to optimize production, ensure compliance with regulations, and meet consumer demands, industrial robots have emerged as a valuable tool, making the food segment a prominent contributor to their widespread usage in the Indian market.

Growth Drivers

Increase in E-commerce and Logistics Business: The surge in e-commerce and logistics is significantly impacting India's rapidly growing industrial economy. Industrial robots fleet for palletizing; Innovative end effectors to handle batch or Mix, Logistic software's for MES; SCADA and ERP; AMRs to handle movement in factory without human driver - An autonomous mobile robot (AMR) - is a type of robot that can understand and move through its environment without being overseen directly by an operator or limited to a fixed, predetermined path and Intelligent Automated Storage and Retrieval System (ASRS) are driving the modern plan automation. Operational Technology (OT) and Information Technology (IT) works here hand in hand. There is a big transformation and new modern robot driven wear-houses.

Growing adoption of Automation in industry: The automotive sector claims the largest share of robot installations in India at 44 per cent, while the general industry, including rubber, plastics, metal, and electrical/ electronics, is rapidly catching up, illustrating the expanding influence of Industry 4.0's transformative potential. Over the past five years, the count of industrial robots in India has doubled, the International Robotic Federation (IRF) reveals India's climb to the top 10 countries for annual robot installations. The report states that in 2019, India welcomed over 4,300 new industrial robots, leading to a total of more than 26,000 units — a doubling in just five years. This growth resonates with the principles of Industry 4.0, where technological integration is paramount.

Constraints

High Initial Investments: India industrial robots market faces a significant hurdle due to the requirement for substantial initial investment. Procuring and installing industrial robots encompasses considerable upfront costs, including robot purchase, integration, training, and infrastructure adjustments. As technology advances, costs may gradually decrease, enhancing accessibility and adoption across industries.

Required eco-system to maintain and run: Slowly our eco-system is getting ready but still not apt to serve all the segments with total solutions related to planning and simulation, infrastructure required for IT and OT, maintenance and upgrades. This is done by big companies but also can be done by service companies, which will emerge now.

Education and Training: Though government has initiated robotic skill building activities in education sector, we really need institutes who will give required training. Here is need that many professional institutes should plan for this.

Major Players

Major robot OEMs players operating in the India industrial robotics market include ABB Ltd, Yaskawa Electric Corporation, Mitsubishi Electric Corporation, Nachi-Fujikoshi Corp., Comau Spa, KUKA AG, Gude AG, Fanuc Corporation, Denso Corporation, Kawasaki Heavy Industries, Ltd. and Delta Electronics. There are many big integrators like Adverb, Wipro PARI, Comau, Wooshin and several are entering in different industry fields. ■

Key AI trends in India: Determining future standing in global rankings

The demand for Artificial Intelligence-based tools and systems is increasing across India as a result of rapid digitization in all major sectors of our economy. 2024 will be a watershed moment for the future of Artificial Intelligence, as academics and businesses work to determine how this evolutionary leap in technology may be most practically integrated into our daily lives.

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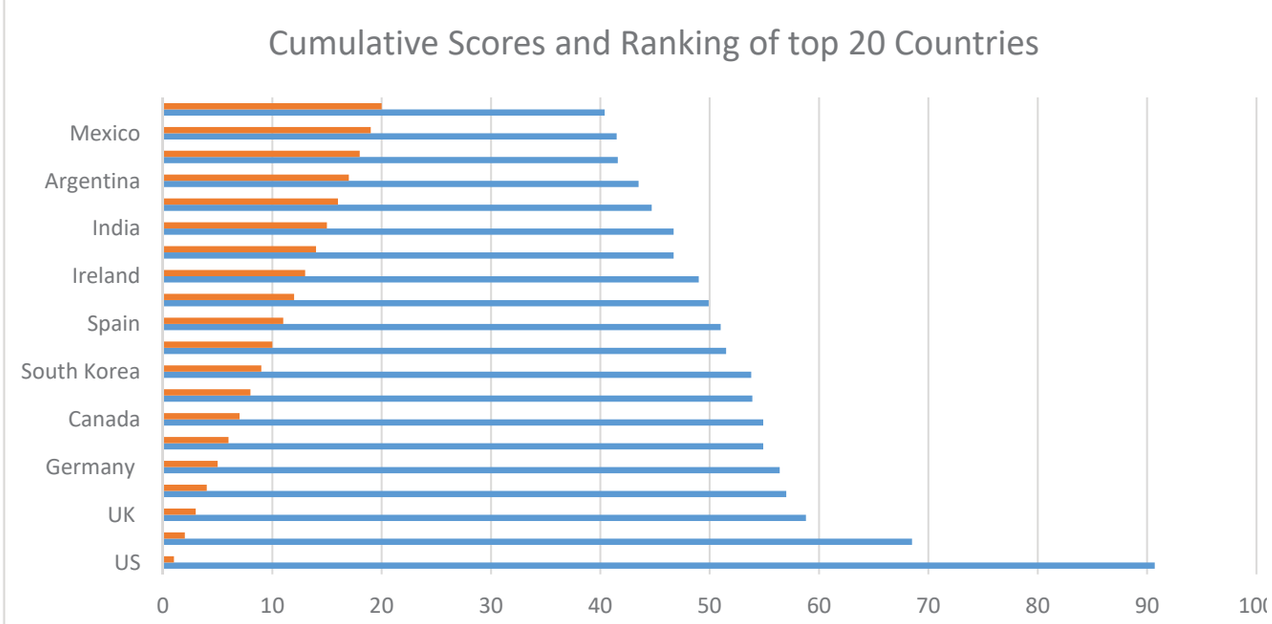
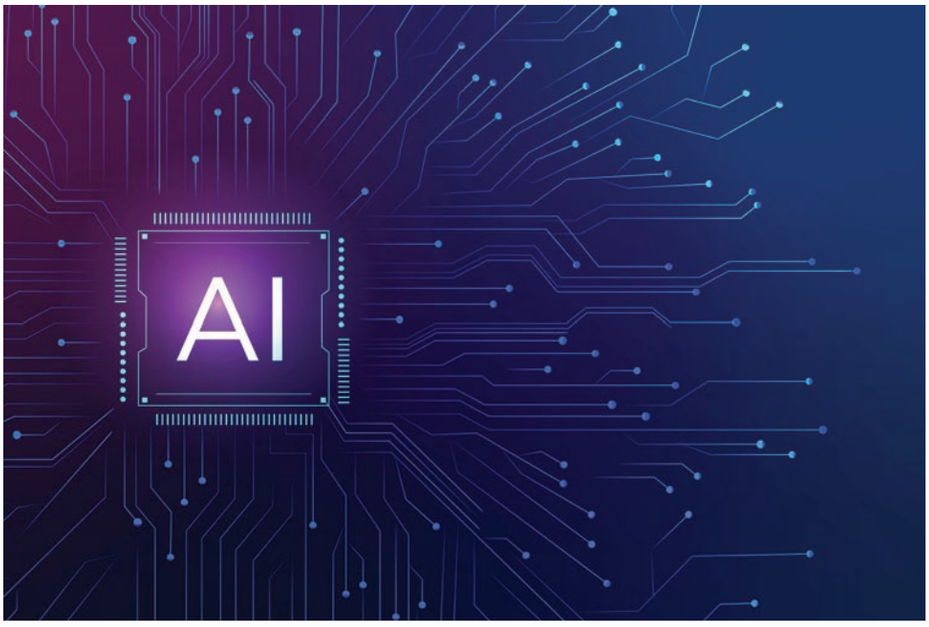
Generative artificial intelligence (AI) first gained public attention in 2022, and it began to take root in the commercial world in 2023. According to research conducted by Tufts University's business school, the Fletcher School, India ranks 15th among the top 25 countries in AI, but it has 'the most upward potential.'



	US	China	UK	Japan	Germany	France	Canada	Australia	South Korea	Sweden	Spain	Switzerland	Ireland	Belgium	India	Brazil	Argentina	Malaysia	Mexico	Turkey
Rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Score	90.7	68.5	58.8	57	56.4	54.9	54.9	53.9	53.8	51.5	51	49.9	49	46.7	46.7	44.7	43.5	41.6	41.5	40.4

Top Ranked AI Nations (TRAIN) Scorecard to evaluate where 25 leading AI creator countries stand in the race for global leadership
Source : The Fletcher School at Tufts University



The United States leads the way, followed by China in the race for global AI leadership, and then the United Kingdom, Japan, and Germany. India ranks 15th, ahead of Brazil, Argentina, Indonesia, Mexico, Turkey, Indonesia, and Thailand.

AI Growth in India

The demand for AI-based tools and systems is increasing across India as a result of rapid digitization in all major sectors of our economy, including banking and financial services, healthcare, automobiles, and telecommunications because AI simply aids in automation, error minimization, and the management of repetitive tasks. Let us have a look at some of the key estimates that depict India as the future leader in artificial intelligence.

- The AI market in India reached $680 million in 2022 and is predicted to expand to $3,900 million by 2028, representing a 33 per cent compound annual growth rate (CAGR) between 2023 and 2028.
- AI expenditure in India increased by 109 per cent, or $665 million, in 2018, and is expected to rise at a 39 per cent CAGR to $11,800 million by 2025.
- AI has the potential to boost the country's GDP by about $500 billion by 2025.

Transition into Industrial Segments

AI is transforming industries worldwide, and India is no exception. It has generated a significant shift in the country's industrial sector, from its inception to its current applications and future possibilities. AI in India's industrial sector is fast altering traditional processes, opening the way for a more efficient and inventive future.

India began investigating AI research, especially through academic organisations such as the Indian Institutes of Technology (IITs) and the Indian Institute of Science. Early research concentrated on theoretical elements of AI, with few practical applications due to technological and infrastructure constraints.

AI can potentially add significant value to several industries and become a crucial source of competitive advantage for businesses worldwide.

- **Healthcare:** AI can reduce barriers to accessing healthcare facilities, especially in rural locations with limited connectivity and professionals. Implementing use cases like AI-driven diagnostics, personalized treatment, early pandemic detection, and imaging diagnostics can help reach this goal.

- **Agriculture:** AI has the potential to revolutionize agriculture and fulfil rising food demand. By 2050, the world will need to produce 50 per cent more food to feed an additional 2 billion people. It can address difficulties such as poor demand forecasting, insufficient irrigation, and excessive use of pesticides and fertilizers. Real-time advice can boost crop production, monitor pest infestations, and estimate crop prices for better planting techniques.

- **Smart Mobility, encompassing Transports and Logistics:** This has potential use cases like autonomous fleets for ride-sharing, semi-autonomous features like driver assist, and predictive engine maintenance. AI can enhance autonomous trucking, delivery, and traffic management.

- **Retail:** The retail sector has been an early adopter of AI technologies, enhancing customer experience through personalized suggestions, preference-based

browsing, and image-based product search. Other use cases include anticipating client demand, improving inventory management, and managing deliveries efficiently.

▪ **Manufacturing:** The manufacturing industry will benefit greatly from AI-based solutions, enabling a 'Factory of the Future' with flexible and adaptable technical systems that automate processes and machinery to respond to unexpected situations and make smarter decisions. AI has a wide range of applications in engineering, supply chain management, production, maintenance, quality assurance, and in-plant logistics and warehousing.

▪ **Energy:** Energy system modelling and forecasting can improve predictability and efficiency in power balancing and utilization. AI can enhance renewable energy storage through smart grids and improve solar energy reliability and price. AI can be used to predict grid infrastructure upkeep, similar to its use in manufacturing.

Transforming Indian Industrial Operations

▪ **AI-driven automation:** AI-powered robotics are becoming a vital part of modern manufacturing operations in India. Automotive and electronics industries are using AI-powered robots for jobs ranging from assembly to packing, considerably improving precision and efficiency. The use of AI in automation has resulted in increased operational efficiency, lower human error, and higher production.

▪ **Predictive Maintenance:** AI is extensively used for predictive maintenance in Indian industries. Machine learning algorithms analyze sensor data to predict equipment failures before they occur, allowing for timely maintenance and reducing unplanned downtime. Predictive maintenance systems help extend the lifespan of equipment, minimizing maintenance costs, and enhancing overall operational efficiency.

▪ **Quality Control & Inspection:** AI-powered computer vision systems are transforming quality control and inspection procedures. These systems are used to detect faults in products in real time, maintaining high-quality standards in industries such as textiles, pharmaceuticals, and automotive. The use of AI in quality control has considerably improved the accuracy and consistency of inspection operations, lowering the number of faults and reworks.

▪ **Supply Chain Optimization:** AI is helping to optimize supply chain operations in India. Artificial intelligence aids with demand forecasting, inventory management, and logistics optimization by evaluating big datasets. The use of artificial intelligence in supply chain management results in significant cost savings, increased efficiency, and higher customer satisfaction through timely and accurate product delivery.

▪ **Improving Workplace Safety:** AI when integrated with the Internet of Things (IoT), improves workplace safety by monitoring ambient conditions and worker behaviour in real-time. This integration contributes to accident prevention and compliance with safety laws. AI-powered real-time data analytics gives timely alerts and insights for increasing workplace safety and lowering accident risk.

Emerging Trends and Innovations

▪ **Smart factories :** Industry 4.0 envisions the merging of AI, IoT, and sophisticated robots to produce highly efficient, self-optimizing manufacturing settings. Smart factories use real-time data to drive continuous improvement.

▪ **Autonomous Industrial Operations:** Future AI systems will have self-learning capabilities, allowing them to adapt and optimize processes autonomously, reducing the need for human intervention. This will significantly enhance operational efficiency.

▪ **Sustainable Manufacturing:** AI will be critical in encouraging sustainable industrial processes by improving resource utilization and reducing waste. Artificial intelligence will assist industries in reducing their environmental impact.

▪ **Human-AI Collaboration:** The future industrial workforce will work closely with AI systems, with humans focused on strategic, creative, and supervisory positions and AI handling everyday chores. This collaboration will boost overall productivity and innovation.

▪ **Advanced Predictive Analysis:** Combining AI and quantum computing will revolutionize predictive analytics, allowing for unparalleled precision in solving difficult optimization problems and making real-time decisions. This will create new opportunities for industry innovation and growth.

▪ **Autonomous Farm Machinery:** As India continues to embrace technological advancements in agriculture, autonomous machinery is emerging as a game-changer for the industry. With a growing population, labour shortages, and the need for increased productivity, autonomous machinery offers a solution that can revolutionize farm labour and operations.

Future

Government policies and initiatives have an important role in advancing AI adoption in the industrial sector by fostering innovation, increasing competitiveness, and addressing societal concerns. Governments provide an enabling environment for industries to effectively exploit AI technologies by creating strategic frameworks, funding programs, infrastructure development, regulatory standards, and skill-building efforts. The future looks promising for sustained collaboration, innovation, and growth in AI-powered industrial applications, putting countries at the forefront of the global AI scene.

As discussed during the 6th Global AI Leadership Meet 2024, significant developments in AI are set to elevate the broader AI ecosystem, catalyzing a transformational impact on the planet. It is critical that we, around the world, anticipate this transformation and equip ourselves with the necessary abilities to efficiently traverse this cutting-edge technology by:

- Sustaining AI talent investments
- Promoting a dynamic innovation ecosystem
- Investing in AI research - Incorporating development and infrastructure considerations into future planning
- Recognizing the importance of business AI in driving ROI for organizations. ■

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Secret of long lifespan, efficiency and reliability of Graphite Equipment

Graphite is basically manufactured by finely grinding PET Coke residues available from petroleum refineries mixed with the Coal Tar binder pitch with preliminary heat treatment for proper binding as well as venting unwanted volatiles from base PET Coke. **Mr. Yogesh Khairnar, Director, Anticorrosion India Pvt. Ltd,** throws more light on the efficiency and reliability of graphite equipment.

Impregnated Graphite is being used for the manufacture of pressure vessels to handle highly aggressive media viz. acids and alkalis. It provides an opportunity to have unique raw material considerations for design, fabrication and testing. Metallic vessels are made from materials having well established allowable stresses based on measured values of tensile and ductility properties. It has numerous advantages as material of construction over other materials as below:

- Excellent corrosion resistance
- High thermal conductivity
- Easily machined with standard machine tools
- Simple joining technique by cementing
- Favorable price-performance ratio

On the other hand, the parts made from impregnated Graphite are brittle and the properties of the parts are dependent upon the fabrication process.

Powered by the broad base of competencies, products and services, good graphite equipment manufacturer always try to offer best solution to customers and are characterized by:

- **Reliability:** Chemicals manufacturing businesses strongly depend on reliability of graphite products which deliver dependable results with long lasting life and large periods between consecutive service Intervals. Excellent corrosion resistance by use of first class synthetic resins / Fluoropolymers in combination with proven full material impregnation ensures highest corrosion resistance and plant availability.
- **Efficiency:** Integrated approach on Chemistry, materials, technology and design ensure outstanding efficiency, higher yields, lower operating costs, lower service and maintenance costs, longer service intervals, less downtime, extendable product lifetime thus proving total significant lower cost of ownership and higher return on investment. High heat conductivity ensures efficient and economic process equipment with less footprint.
- **Sustainability:** In all the industries, resource & energy is consumed in large volumes and is of crucial importance and should have optimized utility consumption and reduced Greenhouse gas emissions.

There exist specifications for Graphite and Impregnating agents but there are no published specifications / standard for the impregnated Graphite. These are made from different combinations of graphite grades and impregnating agents. Impregnated Graphite manufacturing process is specified by the manufacturer and is proprietary. The "specified processes" include Grade of Graphite, Type of resin, Combinations of Pressure, Vacuum and Temperatures for different holding periods during impregnation cycles and any other steps to produce the desired grade of impregnated Graphite.

Graphite is basically manufactured by finely grinding PET Coke residues available from petroleum refineries

mixed with the Coal Tar binder pitch with preliminary heat treatment for proper binding as well as venting unwanted volatiles from base PET Coke. The density of binder pitch is higher than the PET Coke and thus implies that the resultant properties of Graphite depend upon the combination of PET Coke and binder pitch. More the binder pitch, more is the resultant density and vice versa. Intermediate Graphite is then taken to pressing by way of Extrusion OR Vibro molding OR Isostatic compression followed by carbonization. This is one critical step in manufacture of Graphite and any deviation in the process will lead to production of inferior quality graphite.

Following steps are involved in manufacture of Graphite suitable for process equipment:

- **Mixing:** The low iron petroleum coke are pulverized in Crushers and Ball mills and screened according to required particle size distribution. Resultant powder is mixed with coal tar pitch binder or petroleum pitch binder in calculated ratio at moderate temperature to form a homogeneous compound.
- **Forming by extrusion:** It is a continuous process / forming into solid materials or tubes.
- **Forming by Vibration Molding:** it is a Non-continuous process. Graphite properties non-directional.
- **Baking:** The formed parts are baked into baking furnace in absence of Air. This process converts the binder pitch to coke, removes most of the volatiles above 1200ºC, binds powder particles to form a solid non-deformable body of amorphous carbon. This process is also termed as Carbonization. This process results in formation of pores and its total relative volume i.e. porosity, is determined by the binder pitch quality.
- **Pitch Impregnation:** Baking is followed by impregnation with binder pitch again.
- **Re-baking:** The pitch impregnated Carbon body is re-baked to improve the density and other physical properties of the Carbon body.
- **Graphitization:** The Re-baked carbon body is heated in electric furnace in absence of Oxygen for a calculated period to achieve a body temperature of 3000 0C. It converts amorphous Carbon into Hexagonal Carbon Crystalline Structure - Graphite. During this process, graphite is also purified as most of the impurities like binder residues, gases, oxides, Sulphur etc. vaporize.
- **Resin Impregnation:** The Graphitized carbon body is then impregnated with synthetic resin with application of vacuum-pressure-temperature-time combination to fill the pores within the Graphitized body and make it impermeable to liquids / gases. There are various fluoropolymers available for impregnation such as Phenolic, PTFE, PFA etc. to cover the pores. Different manufacturers have their specific recipes for impregnation process and achieve their desired results.

Fluoropolymer resins are bad conductors of heat & electricity. Use of these fluoropolymers is governed by the porosity available in Graphitized carbon body. Lower the porosity in graphite, lower is the requirement of synthetic resin to make it impermeable and suitable for construction of pressure vessels / equipment. However, Fluoropolymer resins have a significant impact on the properties of the Graphite. The impregnation Cycle and resin type vary from manufacturer to manufacturer and may also vary the grades of Graphite manufactured. Hence it calls for very tight control on impregnation process to ensure the material achieves specific minimum values of specified following properties:

Grain size distribution:

- Pore distribution, pore volume and pore size are governed mainly by the grain size distribution. They are so selected that the optimum base graphite strength is achieved with poorest ceramic properties.
- Synthetic resin impregnation increases the strength of Graphite by a factor of about 2 to 3.
- Compressive strength of Graphite is about 3 to 5 times its tensile strength and this is why it is used as material of construction in many chemical process equipment.
- Mechanical strength calculations in Graphite equipment construction are based on specifications AD-2000-Merkblatt-N2.

Corrosion Resistance: Pure carbon and un-impregnated Graphite show excellent corrosion resistance. Carbon is strongly attacked by electronegative elements such as Oxygen at 500ºC,

As per ASME Table UIG-6-1 for Impervious Graphite heat exchangers, the properties of certified material required are as follows:

Property Description	UOM	Tube *1	Block *1
Minimum Tensile Strength at room temperature	Psi	3800	2000
	MPa	26.2	13.8
Minimum Tensile Strength at max design temperature	Psi	3000	1600
	MPa	20.7	11.0
Minimum Flexural Strength	Psi	5700	NA
	MPa	39.3	NA
Minimum Compressive Strength	Psi	10000	6500
	MPa	69	45
Maximum Co-efficient of Permeability	In2/s	$4.5x10^{-5}$	$4.5x10^{-5}$
	Mm2/s	$2.9x10^{-3}$	$2.9x10^{-3}$

Note: *1: Resin Impregnated Graphite Material

elemental halogens and powerful oxidizing acids such as Nitric Acid and Chromic Acid. The corrosion resistance of impregnated graphite used for chemical process equipment is mainly governed by corrosion and thermal shrinkage behavior of synthetic resin and pore structure of the graphite at different temperatures. Every good manufacturer provides corrosion resistance chart wrt difference chemicals.

Thermal stability: Non-impregnated graphite can sustain a temperature of 3000ºC in inert atmosphere while that of 500ºC in an Oxidizing environment. German technical supervisory board experts have recommended the resin impregnated graphite can be used for temperatures between 180 to 240ºC.

Thermal conductivity: The thermal conductivity of impregnated Graphite at 20ºC for tubes is 60~80 W/mK and 100~160 W/mK for blocks which is far better than many common metals used in equipment manufacturing in industry such as Glass, Stainless Steel, Carbon Steel, Tantalum, Silicon Carbide while is slightly lower than Aluminium.

Mechanical strength: The inherent strength of impregnated Graphite is governed by Pore size, pore distribution, forming operation, baking and Graphitization process used in manufacturing. Iso Graphite has improved pore distribution and hence better strength than Vibro molded and Vibro molded has better strength than extruded graphite. Optimized grain size distribution ensures a balance between brittleness and ductility and better resistance against mechanical overstress.

Thermal expansion: The co-efficient of thermal expansion is governed by production process for controlling porosity and properties of impregnating resin.

Permeability: Optimum complete cycle synthetic resin impregnation in combination with base Graphite material will have low impermeability.

The blocks produced while taking care of all the above processes and achieving the best possible physical properties are used in manufacture of Graphite equipment such as Heat Exchangers, Columns, Chemical Process Equipment etc. which serve a long life, have less maintenance or downtime i.e. high uptime, good efficiency and thus is the secret of these equipment. ■

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Smart Biomanufacturing: Integrating manufacturing with digitalization and automation

The biomanufacturing industry is rapidly advancing with the integration of Industry 4.0 technologies and preparing for Industry 5.0. This combines digitalization, automation, and data-driven processes to enhance efficiency, quality, and scalability. Looking forward to Industry 5.0, human-machine collaboration and the convergence of physical and digital worlds will create opportunities for customized production and sustainable practices. This evolution not only accelerates innovation in biomanufacturing but also supports sustainable production practices.

Tools like IoT devices, AI-driven analytics, and robotics have streamlined workflows from strain development to packaging, optimizing processes, reducing costs, ensuring safety and sustainability. Real-time data analysis helps us predict maintenance needs and fine-tune processes, ensuring that every product meets stringent quality standards. Looking forward to Industry 5.0, human-machine collaboration and the convergence of physical and digital worlds will create opportunities for customized production and sustainable practices. This evolution not only accelerates innovation in biomanufacturing but also supports sustainable production practices.

The digitalization strategies can be applied in various biomanufacturing steps, as follows:

Strain selection and engineering

The biological systems can be engineered with high precision, desired functions and greater efficiency by the knowledge of systems biology; thus, opening new opportunities for bioprocess intensification by increasing the productivity. Biofoundry is a state-of the art infrastructure that facilitates iterative end-to-end cycles of Design, Build, Test, and Learn (DBTL) for accelerated prototyping of novel biological systems through leveraging technologies such as:

- Microbial colony-picking and cell sorting by robots and flow cytometry respectively.
- Identification and design of desired genes and pathways by software (CELLO), databases (KEGG, BRENDA) and tools (OptKnock, RetroPath), etc.
- Assembly of DNA constructs through automated DNA synthesis and fragment analysers, next generation sequencing (NGS) machines.
- Robust management of NGS data through cloud computing.
- High-throughput screening using multiple modular bioreactors and robotic arms.

Seed train development

Maintaining the quality is important criteria in seed train and includes biomass assessment by microscopy (cell size, shape and motility) and quantification by optical density (OD). Traditionally, biomass assessment and quantification are limited to off-line analysis. However, digitalization can be done through oCelloScope (Biosense technologies) system which allows for live cell imaging and facilitates automatic image acquisition and analysis. Similarly, dencytee arc sensors (Hamilton) enable real time monitoring of cell density.

Process development

Traditionally, shake-flasks and bench-top bioreactors are used for process development which are labor intensive and prone to human errors. These can be reduced by high-throughput process development and optimization by employing quality by design, process analytical technology and continuous process verification. Mathematical modelling and Computational Fluid Dynamics based modelling

techniques aid in developing predictive models. Technologies such as artificial intelligence (AI), machine learning (ML), and digital twins further support predictive modeling and process optimization to improve the critical process parameters, enabling the shift from a black box model to a more knowledge-driven digitalized approach.

Production

Strategies to automate and control the bioprocesses in their optimal state are crucial to reduce the production costs and increase the volumetric productivity while maintaining the product quality. Automated process control can be either open-loop or closed-loop control. In an open-loop system, a predetermined input process parameter can be maintained, however, unexpected disturbances in the system are not considered which can affect productivity. This is avoided by employing closed-loop control where real-time sensing of key parameters such as temperature, pH, biomass and substrate concentrations and integrating a feed-back control to maintain these parameters. Temperature sensors coupled with PID controllers adjust heated or chilled water supply to maintain temperature. pH sensors coupled with pH controller maintain pH by automated addition of acid or base. Real-time measurement of dissolved oxygen (DO) using IoT sensors can be used to control the flow rate of the input gases such as air/oxygen and agitation to maintain desired DO. The broth level in the fermenter can be monitored using level sensor which coupled with automated input or output valve control can ensure desired levels are maintained. Pressure sensors coupled with automated pressure relief valves and exhaust gas flow valves can confirm the system is maintained at optimum pressure levels. This guarantees optimal process control and safe operations.

Integration of IoT sensor data with AI-driven analytics can be employed to predict parameters to maximize unit operation efficiency while minimizing damage. Robots can also be integrated into the workflow of these unit operations to handle repetitive tasks such as loading and unloading samples or adjusting equipment settings under human supervision. This helps in improved process control, minimize human error, and enhanced safety.

Cell growth and the respiratory coefficient can be determined by the OD sensor and online exhaust gas analyzer, respectively. In-line metabolite concentrations can be determined using spectroscopy-based sensors like BioPAT® Spectro (near IR spectroscopy), Tensor 27 (FTIR spectroscopy), iPAS 801 R4 (spectrofluorometer), etc. Multivariate data analysis based on principal component analysis, regression based quantitative models or neural networks are used to interpret the spectral data and obtain the metabolite concentrations. Based on the biomass and metabolite concentrations the substrate inlet flow can be controlled and flow sensors can be employed to monitor the set flow rate. Fermentation broth can also be analysed using integrated automated sampler systems such as Merck's MAST. These systems aseptically collect samples, process and transfer them to connected analytical instruments which ensures broth quality check in terms of cell viability, morphology, product concentration, contamination, etc.

Integration of real time data analytics with AI/ML platforms provides valuable insights into process trends, supporting predictive maintenance and optimization strategies, thereby improving process performance and reduced variability.

Downstream processing

It is vital to development an efficient downstream process to improve product quality and reduce production cost. Depending on the type of product and process these unit operation can include cell separation such as centrifugation, filtration, etc. and drying techniques like spray drying, freeze drying, etc. For cell separation, the critical parameters include pH, temperature, viscosity, density, inlet and outlet flow rates. Similarly, key factors in the drying process include feed solution viscosity, density, and feed composition, inlet/outlet temperature, feed rate, gas flow rate/steam pressure. Real-time data from dedicated IoT sensors integrated with automated actuators for each of these parameters ensure maintenance of operational

Robotic arms can be used for automated filling and packaging of products into suitable packages (pouches, vials or syringes) and automated labelling. Automation of repeated procedure ensure increased throughput, precise dosing, and minimized human error. Big data coupled with AI and deep learning (DL) models can be used to create automated defect detection systems in packaging and labelling.

conditions required for optimal cell separation and drying.

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Packaging and Labelling

Packaging and labelling followed by quality check ensure that products meet strict regulatory standards and maintain high levels of safety and efficacy. IoT sensors throughout the packaging and labelling lines monitor critical parameters such as temperature, humidity, pressure, and the speed, accuracy and consistency of the packaging and labelling process. Real-time monitoring coupled with data analysis ensures environmental conditions are optimal for product stability and integrity.

Robotic arms can be used for automated filling and packaging of products into suitable packages (pouches, vials or syringes) and automated labelling. Automation of repeated procedure ensure increased throughput, precise dosing, and minimized human error. Big data coupled with AI and deep learning (DL) models can be used to create automated defect detection systems in packaging and labelling. This can be used to recognize surface defects, deformations or mislabelling which reduces product recalls and improves compliance.

Conclusion

While the integration of Industry 4.0 and 5.0 technologies in biomanufacturing offers significant opportunities it also presents several challenges. Use of IoT, automation, and AI results in reduced downtime, better resource utilization leading to improved process efficiency. Advanced monitoring and analytics allow real-time quality control which reduces variability and yields consistent product quality. Generating a digital twin for the end-to-end system will allow virtual simulation and optimization of system performance under varying operational conditions.

Engineers can simulate various operational scenarios at the level of individual processes without interrupting actual production. This can help in identifying bottlenecks and inefficiencies, allowing for process improvements and increased throughput. Cloud computing and IoT also enables collection, storage, and processing of data from different sites. This helps in data traceability, data management, maintenance of quality across different locations, and regulatory compliance. Several platforms which enable data collection from IoT sensors, data analytics, automation include Watson IoT Platform, Insight Hub – Industrial OperationsX, Rockwell automation, Predix platform, BioContinuum™ Platform, etc. Use of collaborative robots increase productivity and safety by working alongside humans. Furthermore, AR/VR technologies, such as Microsoft HoloLens2, can be employed to provide immersive training on complex equipment setup and maintenance procedures resulting in reduced training time, improved operational efficiency, and enhanced safety.

However, the adoption of these technologies also poses significant challenges. High implementation costs can put a strain on financial resources. Increased connectivity and data sharing raise concerns about cybersecurity and data privacy, with risks of data and intellectual property theft. Integrating new technologies with legacy systems can be complex and costly. The skill gap and workforce resistance to change require extensive training programs may delay technology adoption. Interoperability issues between different systems and devices add complexity to system

integration and may reduce efficiency. Additionally, ethical and social considerations, such as the potential for job displacement due to AI and automation.

Despite these challenges, the benefits of integrating Industry 4.0 and 5.0 technologies in biomanufacturing are immense. With careful planning, investment in workforce training, and robust cybersecurity measures, companies can navigate these hurdles and fully realize the advantages of these technological advancements. ■

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Future of Desalination: Single Walled Carbon Nanotube Membranes in Action

The advanced membrane technology developed by NoPo Nanotechnologies is a pioneering solution for water purification. These versatile membranes, make use of a single architecture for drinking water, seawater, and grey water, and surpass the performance of commercially available alternatives due to their innovative chemistry and the integration of HiPCO® Single-Walled Carbon Nanotubes (SWCNTs).

Water is the most essential ingredient for life. Despite most of earth being covered in water; only a small part of it is potable. The burgeoning population, rapid industrialisation, and scanty rainfall due to climate change has forced us to identify ways to provide clean water.

Nature has developed techniques to absorb clean water using a biological structure called Aquaporin . Every cell wall has these proteins to allow for efficient water transport. A few companies have commercialised membranes using Aquaporins in their membrane surface. It is cumbersome to extract Aquaporins from biological material and assemble them into a membrane. Such membranes give good performance but are expensive to produce. There is a need for high performance membranes that are affordable.

The advanced membrane technology developed by NoPo Nanotechnologies is a pioneering solution for water purification. These versatile membranes, make use of a single architecture for drinking water, seawater, and grey water, and surpass the performance of commercially available alternatives due to their innovative chemistry and the integration of HiPCO® Single-Walled Carbon Nanotubes (SWCNTs). SWCNT's with a 0.8nm diameter are a synthetic analogue for Aquaporins. They are produced using the HiPCO Process and further processed into Membranes on a conventional membrane assembly line.

Key Achievements and Innovations

- **Enhanced Performance of membranes with SWCNTs:** The use of SWCNTs has resulted in exceptional purification results and also significantly extending the life of our membranes.
- **Unique Disc Tube Module:** Our engineering team has developed the ANUDA disc tube module for both high and low-pressure systems. This module is efficient and a unique offering in the Indian market.

IDEX and NITI Aayog Grants:

- Under the IDEX grant, we are focusing on developing SWCNT-based membranes, membrane modules, and portable desalination systems.
- The NITI Aayog grant supports our efforts in creating SWCNT-based membranes and modules, a portable grey water system with 1,000 Litres per day capacity of drinkable water, and a membrane fabrication system with a capacity of 50 m^2 per day.

Our extensive research and development have enabled us to achieve significant breakthroughs in membrane technology, positioning India as a potential leader in the development of nanotube membranes. These advancements promise to revolutionize water

Scientists Eldho Kurian (left) and Cerin Johar fabricating the Carbon Nanotube PA membranes at NoPo.

purification, ensuring sustainable and efficient solutions for various water sources.

Membrane performance data

The membrane performance is evaluated using feedwater with different PPM and the membranes are tested using a cross-flow filtration system using different pressures based on the requirement.

The main parameters compared are LMH and rejection. LMH is the amount of water in Litre passing through 1 m^2 area of membrane per hour. And rejection is the total percentage of salt rejected by the membranes.

Water Quality testing

Water quality testing based on drinking water standards IS10500 is also carried out on the purified sea water and grey water.

Value Proposition

SWCNT membranes provide unmatched efficiency in removing salts from water. They are sturdy, lowering replacement costs. Their thermal and chemical stability ensures consistent performance. With a larger flux, these membranes enhance recovery rates, making desalination faster and more economical. Real-world applications demonstrate their effectiveness, supporting sustainable water resource management.

In Drinking water systems, the higher flux helps reduce the cost of RO membranes substantially. A smaller area is needed to obtain the same performance.

SWCNT membranes excel in filtering out salts from water efficiently. They offer high selectivity and permeability, allowing rapid desalination processes. Their nanoscale structure provides a controlled area for filtration compared to traditional membranes. This increased efficiency reduces energy consumption and operational costs, making the desalination process more economical and sustainable.

Target Customers

The versatile membranes made using HiPCO® offer unparalleled performance in Desalination, Grey Water and Drinking water applications. The membranes are revolutionary in multiple areas.

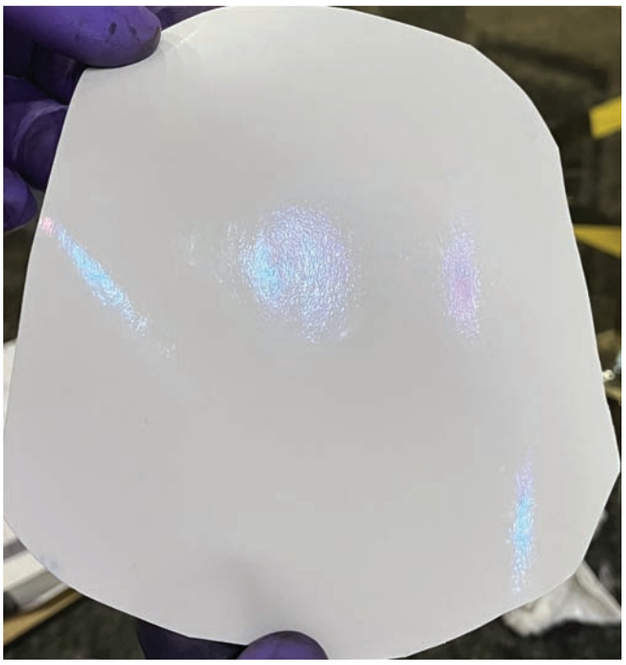
Performance data for membranes Control vs Carbon Nanotube.

Type of water	Dissolved salt	PPM	Pressure (Bar)	Flux (LMH)	Flux (SWCNT) (LMH)	Rejection %	Rejection (SWCNT) %
High PPM (Desalination)	NaCl	32000	60	55	75	98.5	98.5
Low PPM (Drinking water)	NaCl	2000	6	18	23	97.5	98
Grey water	Synthetic grey water prepared accordingly	1200	6	16	23	98	99.3

Industrial Water Treatment: Industrial effluents have a complex composition that varies between samples. The HiPCO® SWCNT membranes focus on extraction of water through their unique structure. Thus giving them the ability to extract clean water despite a variable composition of inlet water. This is an area for immediate usage where the Nanotubes can make a big difference.

Desalination: Ocean salt content is dependent on several factors and changes continuously based on seasons, latitude and presence of Water bodies. Salt content can be extremely low in cold regions and significantly higher in Bays. A membrane tuned for a single concentration cannot function in all regions. The Middle East faces the problem of extracting clean water from a significantly salty ocean. The problem is exacerbated by RO reject water being dumped back in the ocean. SWCNT membranes using transport properties offers a superior solution as the technology is selectively allowing water molecules to flow through. The flux can be improved to more than 5-10 times of the current commercial membranes .

Drinking Water: Domestic Drinking water membranes require frequent changes in their RO Membranes. This is the most expensive components of the filter. A higher flux membrane reduces the surface area and hence cost of replacement of membranes. The current state of art Nanotube membranes reduces Membrane requirement by 50 per cent.



Clear Rainbow patterns visible on the SWCNT PA Membranes.

Grey Water and Apartment Water Treatment: Current grey water solutions are often too expensive for mid-level households. We are changing that with a portable system that offers high flux and superior filtration using our low-pressure ANUDA disc module and advanced nanotube membranes.

Imagine a compact, efficient grey water treatment system that fits right into your home. It's cost-effective, easy to install, and uses cutting-edge technology to purify water better than traditional methods.

Rare earth metal extraction: Some of the high-value metals that are frequently present as cationic species in seawater and brine include copper, nickel, cobalt, and lithium. In contrast, uranium, platinum, molybdenum, and vanadium are present in brine as anionic species[3]. These rare earth metals can be extracted using functionlaized SWCNTS and also with CNTs of specific diameters[4].

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Business Model and Revenue Strategy

SWCNT membrane technology can reduce operational costs in desalination plants. Licensing the technology to water treatment facilities ensures steady revenue. Manufacturers can offer maintenance and support services, creating an additional income stream. Governments and organizations may provide subsidies for adopting sustainable technologies, further boosting revenues for companies using SWCNT membranes.

SWCNT membranes enhance desalination efficiency, leading to lower energy consumption. Reduced maintenance costs arise from the durability and fouling resistance of these membranes. Overall operational expenses decline as SWCNT technology requires fewer chemicals for cleaning. These factors cumulatively offer substantial savings for water

treatment facilities, boosting economic feasibility and promoting wider adoption.

NoPo would provide membranes and is keen to work with partners.

Conclusion

The benefits of SWCNT membranes in desalination are clear. They offer significant advantages in efficiency and cost-effectiveness. These membranes can transform the future of water purification. Researchers should continue exploring enhancements and applications. The promise of SWCNT technology underscores a sustainable future for global water resources.

SWCNT membranes enhance desalination efficiency by filtering saltwater more effectively. They require less energy, reducing operational costs. The membranes are durable, extending their lifespan and lowering maintenance expenses. Additionally, they offer higher water flux rates, which improves overall productivity. These benefits make SWCNT technology a promising solution for sustainable water purification.

Single-walled carbon nanotube (SWCNT) membranes present a groundbreaking opportunity for sustainable water purification. Their efficiency can reduce energy consumption significantly. As a result, operational costs will decrease, making desalination more accessible. Additionally, SWCNT membranes' durability ensures long-term reliability. This technology heralds a new era in environmental and economic sustainability for water resources. ■

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Setting a new standard: DSC 5+

Differential scanning calorimetry (DSC) measures enthalpy changes in a material due to changes in physical and chemical properties as a function of temperature or time. The DSC 5+ sets the new standard, delivering a superior performing and more productive DSC.

Features and benefits of the DSC 5+ are as follows:

- FlexMode™, choose power compensation or heat flux mode – for optimal DSC performance.
- Power compensation – provides outstanding resolution for separating close-lying effects.
- MultiSTAR™ sensor with 136 thermocouples – exceptional sensitivity for the measurement of weak effects.
- Patented electrical heat flow adjustment – saves time and ensures excellent measurement accuracy.
- Unrivalled modular concept – tailor-made solutions for current and future needs.

- Time-saving FlexCal™ adjustment – guarantees accurate results under all measurement conditions.
- Innovative robot with gas-purged crucible chamber – protects samples from the environment and operates reliably around the clock.

Differential scanning calorimetry measures the enthalpies associated with transitions and reactions and the temperatures at which these processes occur. The method is used for the identification and characterization of materials.

DSC is fast and very sensitive. Sample preparation is easy and requires only small amounts of material. The technique is ideal for quality control, material development and material research.

The revolutionary DSC sensor, with 136 thermocouples and 2 integrated heaters for power compensation mode, provides superior performance.

DSC Sensor, Power Compensation and Heat Flux

The DSC 5+ sensor with the FlexMode™ functionality can easily be switched between two different measurement modes. The robust and chemically resistant MMS 1 ceramic sensor provides a power compensation mode for excellent resolution and a heat flux mode for measurements that require high levels of sensitivity. This advanced sensor provides superior performance and allows the user to switch between modes to best suit the needs of the sample under investigation.

Advanced Automation

Automation is more than just a sample robot. The DSC 5+ brings a combination of advanced hardware and software solutions resulting in a more productive DSC. The 3-axis sample robot, powerful STAR software, and the superior performance provided by the MMS 1 sensor allows one to perform more experiments, in a shorter time, with less resources.

Temperature Options, Optimal Configuration

The DSC 5+ has an unrivalled modular concept. You can select the operating temperature to perfectly fulfill measurement needs. This makes it an ideal choice for all laboratories, from industrial development and academic research to production and quality assurance.

The innovative design of the sensor includes integrated heaters. This enables the sensor to accurately self-adjust for heat flow, resulting in a DSC that is always correctly adjusted over the entire temperature range. This advanced feature allows users to save valuable time and increase productivity with the automatic instrument adjustment. ■

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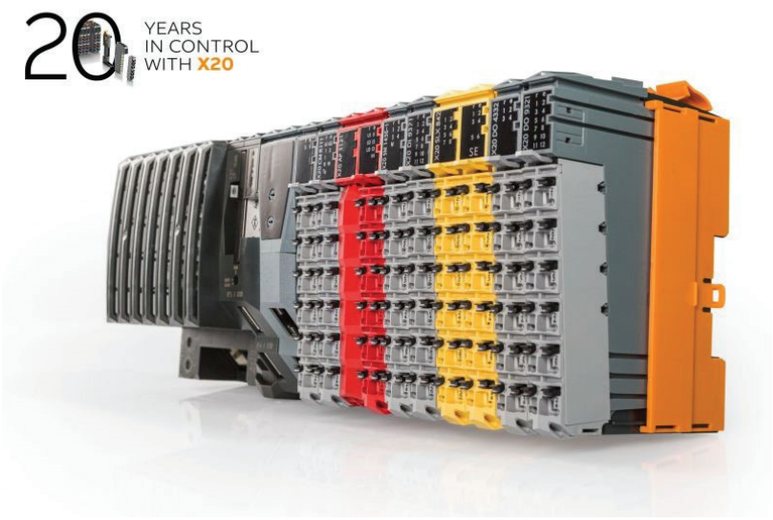
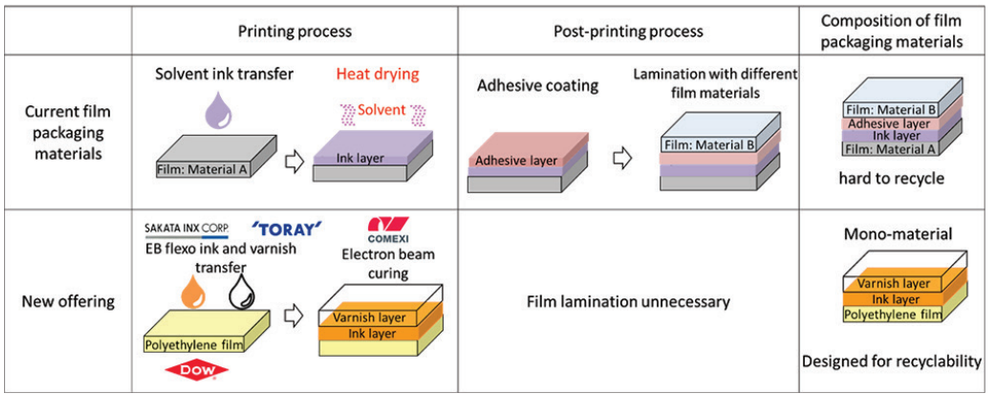
X20 system from B&R Industrial Automation



The X20 system has been an essential component of countless industrial applications for the last 20 years. The X20 has transformed industrial automation with its small size and potent features, enabling machines all around the world to function accurately and effectively. Its innovative technology and sturdy design has made it the preferred option for machine manufacturers in a variety of sectors. It acts as a complete control solution. Depending on the user's demands and individual application requirements, the X20 System family makes it possible to combine the exact components necessary. It is extremely compact, has a large selection of modules, and its 3-slice design makes it easy to wire and maintain. ■

Toray jointly develops film packaging material and technology



Toray Industries, Inc., Dow Inc, Comexi Group Industries, S.A.U., Sakata Inx Corporation and SGK Japan have jointly developed a surface printing mono-material film packaging material technology.

The material will serve in wide-ranging food and daily necessities applications. Flexible film substrates are used in a myriad of different applications including food packaging and detergent refill pouches because they are light, transparent, and easy to process. The issue with many existing film packaging materials is that they are hard to recycle as they are made by laminating films made from different materials to achieve the functional and shape requirements of the application.

In view of this shortcoming, the European Union is mandating that all packaging materials are designed for recyclability by 2030.

The surface-printed mono-material film packaging material technology can reduce plastic consumption and significantly lower CO_2 emissions from printing processes. This technology should also help cut costs and shorten delivery times owing to abbreviated manufacturing processes. ■

Battery Powered Wireless Gas Detector from Ambetronics

The Wireless Gas Detector (WGD) 100-FLP is a battery-powered WGD designed for hazardous locations such as refineries, petrochemical plants, automotive industrial areas, and more. It features a standalone system with integrated rechargeble lithium-ion battery offering approximately 6+ months of life (1 transmission/day). It boasts 4G GSM connectivity with dual SIM card slots for automatic switching and data logging upto 15,000 log records in case of network failure. The device transmits encrypted data to the wireless control unit (WCU) and comprehensive information such as sensor status, gas leak details, battery percentage, date and time, UID number, location, and RSSI to the users. The device highlights includes dual settable alarms, SMS daily and alert notifications to the 5 users and 2 Wireless Control Units (WCU) at a time, MQTT cloud connectivity, Low battery saving mode features, Timezone selection, SMS compatibility in different countries, operating on Electrochemical or NDIR technology, the detector ensures a fast and reliable response, continuously monitoring gas leakage and flameproof housing with IP66 & IP68 enclosures for Gas Group IIC, PESO approved. User-friendly features include a magnetic wand, button keys and LCD display, for man-machine interface and calibration, various LED indications for visual device status and buzzer. ■

Carbon Fiber Profile Cable Core Rod and Pole

Aeron Composites' fiberglass poles are able to withstand high temperature and extreme weather conditions. They are highly durable and economical too. Besides decorative fiberglass poles, the company also manufactures cable core rod and fiberglass pole.

The cable core rod and carbon fiber profile offer predominant product characteristics that are vital in requesting applications:

- Excellent solidness to weight proportion
- Excellent quality
- Low thermal co-efficiency
- Excellent exhaustion quality
- Smooth surface
- Weightless and dormancy
- Tolerance proficiency and more. ■

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