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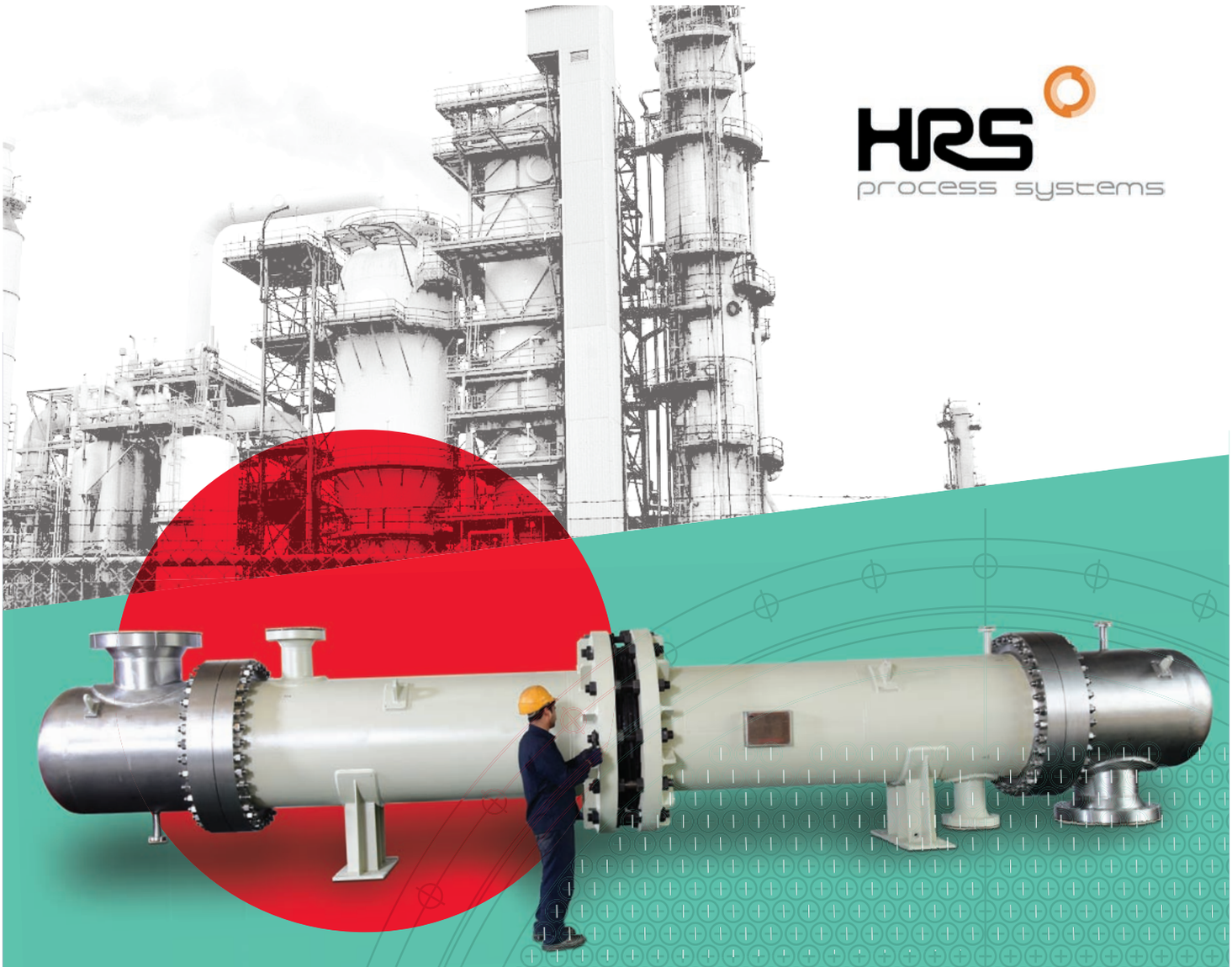

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Chemicals & Petrochemicals demand in India expected to nearly triple and reach USD 1 trillion by 2040

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

New Delhi, India: "25% of the global energy demand growth in the next two decades is going to emanate out of India", said the Union Minister of Petroleum & Natural Gas and Housing & Urban Affairs Hardeep Singh Puri.

Talking on energy availability, affordability and security for all, the Petroleum Minister said, "The market size of the Indian Chemicals and Petrochemicals sector is currently USD 190 Billion. This sector supports the Hon'ble Prime Minister's initiative of Make in India and Make for the World, as it can transform India into a global manufacturing hub". "India is not only the sixth largest chemicals producer in the World and the fourth in Asia but also exports Chemicals to more than 175 countries. It accounts for 13% of India's total exports", added Puri.

Talking about the growth of Petrochemical Sector in India, the Petroleum Minister said that it is governed by several factors, the most important of these is the increasing demand for petrochemical products from a growing population and a rapidly expanding economy. "The India petrochemical industry has come a long way from inception in the 1970s and is poised for transformational growth. It is expected to contribute almost 10% to the incremental growth in the global petrochemical demand in the coming years", added Hardeep Singh Puri.

Coal Ministry Invites Proposals for Research & Development in Coal Sector

New Delhi, India: The Ministry of Coal invites research proposals from Academic Institutions and Research Organizations. Thrust Areas for Research & Development in coal sector includes the following: Advanced technology/methodology for improvement of production & productivity from underground mining and open cast Mining; Improvement of safety, health and environment; Waste to wealth; Alternative use of coal and clean coal technologies; Coal beneficiation and utilization; Exploration and Innovation and indigenization (Under Make-in-India concept).

The guidelines, format and online submission facility available at the website: https://scienceandtech.cmpdi.co.in and the last date of submission of proposal is 15th July 2023.

"India is a world leader in energy transition, we will adhere to our pledge of making 50% of energy from non-fossil fuels by 2030"

R K Singh, Union Minister for Power and New & Renewable Energy

New Delhi, India: The Union Minister for Power and New and Renewable Energy R. K. Singh has reiterated the need for India to keep adding energy capacity so that the nation can keep growing in the times to come. "What we need to be concerned about is the requirement of energy for our growth. There can be no compromise on this. Our electricity demand is growing rapidly. By 2030, energy consumption is expected to double. We will need to add capacity so that our country can grow.

Net Zero is important, but what is more important is that we ensure enough electricity for our growth. The living standards of our people will need to improve - and that will require higher per capita consumption of

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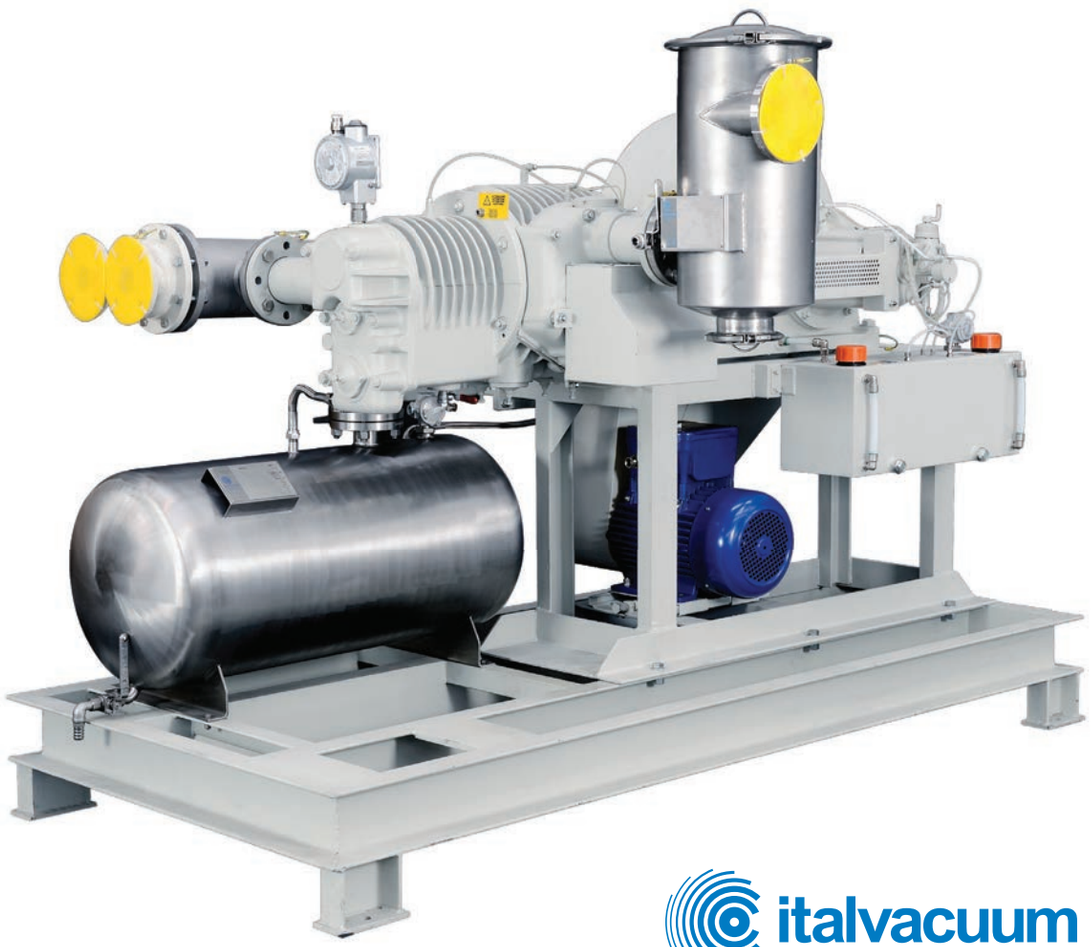

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electricity". The Power Minister recalled that the country has added 1.84 lakh MW of power from 2014 till now, but that this is not sufficient. Our per capita carbon emissions are one third of global average, and there is going to be no compromise in ensuring 24/7 electricity, said the Minister.

Biofuels has a huge role to play in the Energy Quadrilemma

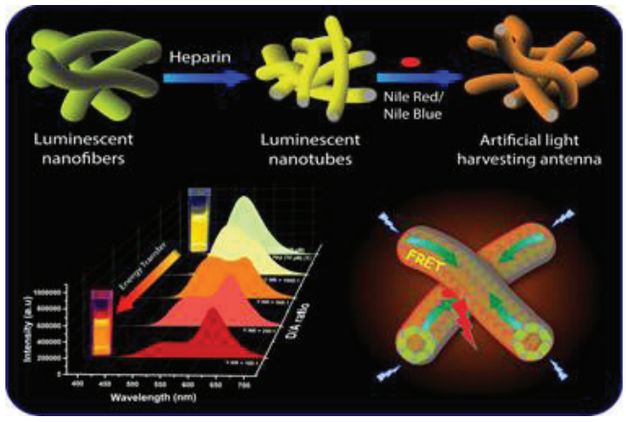
Pankaj Jain, Secretary, Ministry of Petroleum & Natural Gas (MoP&NG)

Mumbai, India: Secretary, Ministry of Petroleum and Natural Gas, Pankaj Jain highlighted the role of Biofuels and the importance of G20 countries collaboration in achieving the full potential of biofuels, for a cleaner and greener tomorrow. He was addressing the Global Biofuel Alliance Seminar, organised by MoP&NG on the side lines of the 3rd Energy Transition Working Group Meeting in Mumbai on 15th May 2023.

Pankaj Jain, Secretary, MoPNG, in his keynote address, focused on the untapped potential in biofuels and its increasing appeal from clean energy transition, wide-ranging application, techno-commercial viability, and financing standpoints.

New artificial light-harvesting system using organic nanotubes useful for solar cells, photocatalysis, optical sensors & tuneable multi-colour light emitting materials

Kolkata, India: Inspired by natural photosynthetic systems, researchers have developed a new method of harvesting artificial light using organic nanotubes, which can be utilized in solar cells, photocatalysis, optical sensors, and tuneable multi-colour light-emitting materials.



Dr. Supratim Banerjee from the Indian Institute of Science Education and Research (IISER) and Dr. Suman Chakrabarty from the S. N. Bose National Centre for Basic Sciences (SNBNCBS) carried out experimental and computational investigations on artificial light-harvesting in organic nanotubes derived from the union of an organic fluorescent molecule and a therapeutically important biopolymer. The former is an amphiphilic cationic molecule called cyano stilbenes (an organic molecule with fluorescent properties that are known to exhibit enhanced emission in their aggregated state), and the latter is an anionic therapeutically important biopolymer called heparin (used as an anti-coagulant-during-surgery-and-in-post-operative-treatments) in aqueous media.

In the presence of heparin, the cationic cyano stilbenes employed in this study formed nanotubes with bright greenish-yellow emission through an electrostatically driven co-assembly process. Just like the antenna chromophores or pigmented (coloured) membrane-associated vesicles used to perform photosynthesis in bacteria, the nanotubes acted as highly efficient energy donors (antennae) in a system that mimicked the natural photosynthetic process.

They donated energy to acceptor dyes such as Nile Red and Nile Blue, resulting in emission colour tuning from initial greenish yellow to orange red, including white light. The energy transfer phenomenon demonstrated in this study is known as FRET (Förster resonance energy transfer), which has significant importance in different applications such as the determination of DNA/RNA structures, mapping biological membranes, real-time PCR tests, and so on.

The future is moving towards the conversion of solar energy for storage as chemical or electrical energy, and the process of energy transfer is a key factor for such applications.

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International Cooperation will play a key role in achieving India's Net Zero emissions target by 2070

Dr Jitendra Singh, Union Minister of State (IC), Ministry of Science & Technology at CEM-14/MI-8

New Delhi, India: Union Minister of State (Independent Charge) Ministry of Science and Technology, and Minister of State (MoS) PMO, MoS, Ministry of Personnel and Public Grievances, Dr. Jitendra Singh has said International Cooperation will play a key role in achieving India's Net Zero emissions target by 2070 as laid out by Prime Minister Narendra Modi.

"We all have collective responsibility to work together for a more secure and sustainable future. The ever-growing challenges of climate change are beyond the control of one country, organization, company, or any individual effort," said Dr Jitendra Singh, during the Website and Logo launch event of the Joint 8th Mission Innovation Ministerial (MI-8) and 14th Clean Energy Ministerial (CEM-14).

Dow and New Energy Blue collaborate to develop renewable plastic materials from corn residue

Michigan, United States: Dow and New Energy Blue announced a long-term supply agreement in North America in which New Energy Blue will create bio-based ethylene from renewable agricultural residues. Dow expects to purchase this bio-based ethylene, reducing carbon emissions from plastic production, and using it in recyclable applications across transportation, footwear, and packaging. Dow's agreement with New Energy Blue, staffed by experts with deep experience in bio-conversion ventures, is the first agreement in North America to generate plastic source materials from corn stover (stalks and leaves). This is also Dow's first agreement in North America to utilize agriculture residues for plastic production.

"We are unlocking the value of agriculture residues in this new partnership with New Energy Blue," said Karen S. Carter, Dow President of Packaging & Specialty Products. "By committing to purchase their bio-based ethylene, we are helping to enable innovations in waste recycling, meeting demands for bio-based plastics from customers, and strengthening an ecosystem for diverse and renewable solutions.

BASF strengthens R&D with more powerful supercomputer

Dr Melanie Mass-Brunner, Chief Technology Officer (CTO), BASF

Ludwigshafen, Germany: BASF has started up a new supercomputer at its Ludwigshafen site to replace the existing one. With 3 petaflops of computing power, the new supercomputer is considerably more powerful than its 1.75 petaflop predecessor. "Digital technologies are among the most important instruments to further expand our research and development capabilities," said Dr. Melanie Maas-Brunner, member of the Board of Executive Directors and Chief Technology Officer of BASF.

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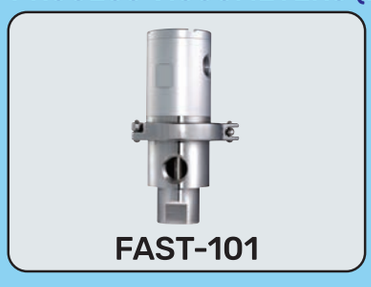
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As one example, she noted that above-average computing power is required these days to work out the most promising polymer structures from thousands of possibilities. "Over the past five years, we have worked very successfully worldwide with our supercomputer Quriosity. It enabled us to considerably shorten the development time for innovative molecules and chemical compounds and thus accelerate the market launch of new products," Maas-Brunner said. "But the computing capacity was no longer sufficient. Moreover, the complexity of our research projects and thus the demands on the supercomputer have increased. We therefore decided to invest in a new high-performance computer."

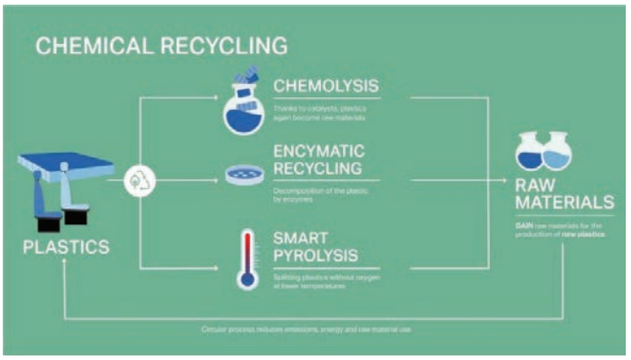
Huber group inaugurates state-of-the-art chemical plant for UV oligomers

Suresh Kalra, Managing Director (India) & President- Asia at Huber Group

Vapi, India: Huber group has inaugurated a state-of-the-art chemical plant for UV oligomers at their site in Vapi. The new UV oligomer facility is equipped with leading technology and will play a key role in expanding Huber's production capabilities by 800 MT per year. The Vapi plant will serve as a hub for driving technological advancements and increasing collaboration with industry partners and research institutions.

Suresh Kalra, Managing Director India & President Asia at Huber group, stated, "This investment reaffirms our commitment to delivering innovative solutions to our customers. The plant will enable us to meet the growing market demands and strengthen our position as a leading provider of high-quality UV oligomers." Taner Bicer, President of the Chemicals Division, added, "We firmly believe that sustainable development is the key to long-term success. Through our new chemical plant, we aim to lead the way in developing and delivering solutions that meet the evolving needs of our customers."

Innovative recycling technologies by Covestro to combat plastic waste



Leverkusen, Germany: Covestro has achieved a technological breakthrough for the chemical recycling of soft foam for mattresses. So far, around 40 million of these end up in waste incineration plants or landfills each year in the European Union alone. With the new "Evocycle CQ-Mattress" process, the two central foam components can now be recycled. At the company's Leverkusen site in Germany, this process is being further developed in a pilot plant with the prospect of industrial use.

The chemical recycling of rigid foam for insulating buildings and refrigeration appliances is the focus of a Europe-wide research project CIRCULAR FOAM initiated in 2021 and coordinated by Covestro. Here, 22 partners from nine countries are working together. If the material cycle can be closed, around one million metric tons of waste and three million metric tons of CO2 emissions per year could be saved in the European Union from 2040.

In order to also improve the recycling of food packaging made of paper and cardboard, Covestro has been offering a new development on the market since May 2023. For this purpose, the company has developed a special coating material that, unlike conventional coatings, can be recycled together with the packaging. It is also produced itself in the spirit of circularity - with raw materials that are partly based on plants.

Grasim Industries FY23 consolidated revenue crosses ₹ 1 lakh crore

Mumbai, India: Grasim Industries Limited announced its Financial Results for the quarter and year ended 31st March 2023. Consolidated revenue for FY23 crossed a historic milestone of ₹1 Lakh crore reaching ₹1,17,627 crore. Revenue is up by 23% YoY driven by the strong underlying performance of standalone businesses coupled with the robust performance of its key

subsidiaries: UltraTech Cement, Aditya Birla Capital and Aditya Birla Renewables.

For Q4 FY23, the Company's consolidated revenue stood at its highest levels of ₹ 33,462 crore, reflecting a growth of 16% YoY mainly contributed by the strong performance of key subsidiaries. Consolidated EBITDA for the quarter grew by 5% YoY to ₹ 4,873 crore. Consolidated comparable PAT from continuing operations during the quarter stood at ₹ 1,369 crore compared to ₹ 1,419 crore in Q4 last year (adjusted for tax write-backs & other one-off items). Standalone PAT for the quarter was impacted by the softening of realisations in the Chemicals business compared to the elevated levels of Q4 last year and continued global weakness in the VSF business.

Grasim has embarked on a transformational growth phase by incubating new, high-growth businesses.

GSFC Q4 FY23 consolidated PAT drops to ₹ 224.91 crore

Vadodara, India: Gujarat State Fertilizers & Chemicals Limited (GSFC) has posted net profit of ₹ 224.91 crores for the period ended March 31st, 2023, as against net profit of ₹ Rs. 409.93 crores for the period ended December 31, 2022. The company posted net profit of ₹ 285.65 crores for the period ended March 31, 2022. GSFC has reported total income of ₹ 2411.56 crores during the period ended March 31, 2023, as compared to ₹ 3497.15 crores during the period ended December 31, 2022. The company reported total income of ₹ 2099.40 crores during the period ended March 31, 2022.

For the Financial Year ended March 31, 2023, GSFC has reported total income of ₹ 11517.54 crores as compared to ₹ 9265.90 crores during the Financial Year ended March 31, 2022. The company has posted net profit of ₹ 1265.92 crores for the Financial Year ended March 31, 2023, as against net profit of Rs.898.58 crores for the Financial Year ended March 31, 2022.

Manali Petrochemicals posts revenue of ₹ 334 crore in Q4 FY 23 & ₹ 1181 crore for FY22-23

Chennai, India: Manali Petrochemicals Limited (MPL), a part of AM International, Singapore as announced its Quarterly and Annual Audited financial results for the Q4 & YE FY23. During the quarter ended 31st March 2023, revenue on standalone basis was ₹ 266 crore and Net Profits were ₹ 1.33 crore. For the year ended 31st March 2023, revenue and profits were ₹ 1033 crore & ₹ 51 crore, respectively. During the quarter ended 31st March 2023, revenue on consolidated basis was ₹ 334 crore and Net Loss of ₹ 0.45 crore. For the year ended 31st March 2023, revenue and profits were ₹ 1181 crore & ₹ 50.67 crore, respectively.

With the continuing downtrends on global cues, sales and profitability continued to be under pressure during the above period. The Board of MPL has recommended a dividend of ₹ 0.75 per share (15%) for FY22-23, subject to approval of the Members.

Ashwin Muthiah, Chairman, MPL and Founder Chairman, AM International, Singapore said: "The company's performance has got affected by the global macroeconomic situation as higher raw material costs and the inability to pass on the increase to the customers has impacted the bottom-line. However, we are looking at improving our operational efficiencies and focusing on margin improvements." ■

Indian Oil awards PMC contract to McDermott for maleic anhydride project

Panipat Refinary, IndianOil Corp Ltd, Haryana

New Delhi, India: McDermott has been awarded a Project Management Consultancy (PMC) contract from IndianOil Corporation Limited (IOCL) for the Maleic Anhydride (MAH) unit at the Panipat Refinery and Petrochemical Complex, located approx. 100 kilometres from New Delhi, India.

McDermott's scope includes project management and consultancy services for the unit, including front-end engineering design (FEED), review of engineering activities, construction supervision services, assistance in start-up, pre-commissioning, commissioning, performance guarantee test run and project closure.

"McDermott has a long-standing relationship with IOCL and is currently executing three large-scale projects at their Barauni and Haldia refineries," said Vaseem Khan, McDermott's Senior Vice President, Onshore. "Our unrivalled project management and execution capabilities, combined with our decades of experience in India, uniquely position us to successfully execute this project."

This will be India's first mega-scale MAH plant to manufacture chemical products like polyester resins, surface coating plasticizers, agrochemicals and lubricant additives. Other chemicals that will be produced from the plant include Tetra Hydro Furan (THF), which is widely used in adhesives and vinyl film, and Butanediol (BDO), which is used in engineering-grade plastic and biodegradable fibres.

Shiva Engineering bags EPCm contract for a greenfield specialty chemical facility

Vadodara, Gujarat: Shiva Engineering Services (SES) bags EPCm contracts for specialty chemical facility (multi- purpose plant) greenfield project. As part of this investment, SES is also developing hydrogenation facility, chlorination & nitration operations and so on. Total planned investment will be around ₹ 145 crores.

SES' project scope of work consists of Site Master-Planning, Basic and Detail Engineering Services, Procurement & Sourcing Support, Construction & Safety Management, Inspection & expediting, Site Supervision, Commissioning & Start-up Support, and so on.

"SES is working with leading global companies in basic engineering, detailed engineering, procurement, and construction. The major pain point for leading companies is vetting of various technology packages and adhering to local country specific standards. SES has helped many such customers in past 13 years successfully." said, Business Unit Head at SES.

The company will produce Polypropylene (250,000 t/y); Low-density polyethylene (80,000 t/g); Ethylene vinyl acetate (100,000 t/y); Polyethylene terephthalate (300,000 t/g); High density polyethylene (280,000 t/g).

Government Invests ₹6,850 crore in Mega Integrated Textile Region & Apparel (MITRA) Park in Madhya Pradesh

Dhar, Madhya Pradesh: The Mega Integrated Textile Region and Apparel (MITRA) Park in Madhya Pradesh is likely to see an investment of about ₹ 6,850 crore. This was announced by the Minister of Textiles, Piyush Goyal on the sidelines of the MITRA park launch.

The Minister has also mentioned that other parts of Madhya Pradesh may receive investment of up to ₹ 8,675 crore. The 1,563 acres MITRA Park is a major step forward in positioning India as a global hub for textile manufacturing and exports and the park is being set up in Bhensola village in Dhar district, and the land parcel is under the possession of Madhya Pradesh Industrial Development Corporation (MPIDC). It is located at a distance of 110 km from Indore and 85 km from Pithampur Industrial cluster.

The Central government is also planning to launch seven of such similar parks and has received 13 proposals to bolster the 'farm to fibre to factory to fashion to foreign' concept. These will be spread over 1,000 acres and involves an outlay of ₹ 4,445 crore in five years.

INOX Air lays out a ₹3,000 crore investment plan by 2025

Mumbai, India: INOX Air Products, plans to invest ₹ 3,000 crore spread across ten sites across the country by 2025. Of this, the company will allocate ₹ 1,300 crore towards setting up two air separation units (ASUs) at Tata Steel's Meramandali plant in Odisha, which will have a daily production capacity of 1,800 tonne of oxygen, nitrogen and argon.

As the company's largest greenfield project at a single site till date, for which INOX Air Products has secured a contract for 20 years with supply and offtake guarantees. It will also utilise the same facility to produce liquid gases, catering to a range of smaller consumers in the state, and the eastern region. The funding will be managed through a mix of internal accruals and debt.

Avantium awarded € 1.5 million grant for CO2-to-polyester process

Amsterdam, Netherlands: Avantium N.V announced that it has been awarded a €1.5 million grant by the EU Horizon Europe programme for its participation in the research and development programme HICCUPS1. This programme aims to demonstrate the utilisation of CO2 as a feedstock for the production of polyesters. The €1.5 million grant will be paid out in tranches to Avantium over a period of four years, starting in September 2023.

Avantium is a frontrunner in developing and commercialising innovative technologies for the production of materials based on sustainable carbon feedstocks, i.e., carbon from biomass or carbon from the air (CO2). One of Avantium's innovative technology platforms, called Volta Technology, uses electrochemistry to convert CO2 into high-value chemical building blocks and polyesters. Under the HICCUPS programme, Avantium will convert CO2 from biogas produced at wastewater treatment plants into the sustainable plastic material PLGA (polylactic-co-glycolic acid).

PLGA with 80% glycolic acid or more has an excellent barrier against oxygen and moisture and good mechanical properties. It is furthermore recyclable and both home compostable and marine degradable. PLGA can be used, for example, as coating material and in moulded plastic materials. This makes PLGA an excellent alternative for fossil-based polyethylene.

Sandhya Organic Chemical to set up its new unit in Valsad, Gujarat

Valsad, India: Sandhya Organic Chemical is planning to set up a pesticide intermediate, pesticide technical and a speciality chemicals manufacturing unit at Vapi in GIDC with a capacity of 21,574 TPM. The proposed unit will spread over 4.77 acres of land.

Currently, Sandhya Organic Chemical is awaiting terms of reference (ToR) for the project. The company will appoint contractors and machinery suppliers as it receives approval. The company expects to begin the work on the project by November 2023 and complete it by mid-2024. ■

Embracing Sustainability in Chemicals with Data-led Digital Transformations

Data-led technologies are driving efficiency, supporting greener approaches, and advancing the circular economy in the chemicals industry. Digital transformation is fueling the chemicals industry's evolution. The latest digital tools are already enabling companies in the energy, chemicals, and power industries to proactively address the bigger picture by minimizing their carbon footprints, promoting recyclable raw materials and products, and electrifying and automating operational processes.

Sustainability in business is now non-negotiable – particularly for the chemicals industry. The sector has already been identified as the largest industrial energy consumer and the third largest industry subsector in terms of direct CO_2 emissions, according to data from the International Energy Agency. While mitigating these outcomes through ESG targets remains important, the sector's primary focus lies in building sustainable and building greener models to enhance efficiency and growth.

By harnessing technologies such as big data, artificial intelligence (AI), simulation, automation, cloud, and the industrial internet of things (IIoT), chemicals companies are realizing both sustainability and value gains.

Three-step digital framework boosts sustainability

Across brownfield plants and greenfield developments, these goals can be achieved with the help of a model-driven framework built around data-led technologies such as cloud-based data management platforms or digital twins. Technologies such as big data, artificial intelligence (AI), simulation, automation, cloud, and the industrial internet of things (IIoT) can support chemicals companies in realizing both sustainability and value gains.

Three pillars essential to unlocking sustainability goals

- **Improving efficiency to create agility**

Reliable and efficient plants can produce products more quickly with fewer resources at a lower cost. The operational gains in terms of flexibility and can better adapt to dynamic market conditions. For example, production can be quickly adjusted in response to demand shifts or to harmonize with changes in feedstock availability.

Digital tools can be harnessed to improve efficiency on a number of fronts. By using a digital twin to determine the ideal state, process modelling and simulation

Key technologies for unlocking Sustainability in Chemical Industry

- **Artificial Intelligence (AI)**
- **Automation**
- **Big Data**
- **Cloud Infrastructure**
- **Digital Twins**
- **Industrial Internet of Things (IIoT)**
- **Simulation**

Harnessing Digital Tools
Digital Twin: Determine Ideal process state
Process Modelling: Determine key areas of Improvement
AI powered asset optimization: Equipment operates at peak efficiency
Experimental Training Programs: Increase human efficiency & competency

can identify areas for improvement and determine the most efficient ways to reduce waste and increase throughput. Further, with AI-powered simulations, asset optimization helps ensure that equipment operates at peak efficiency and reliability. In addition, human efficiency can also be improved, such as by enhancing workforce competency through experiential training programs to develop employee skills and enhance health and safety.

▪ Adopting greener approaches for production

Embedding clean-tech elements across the value chain supports greener outcomes for chemical operations. Such measures include tweaking existing processes and developing innovative production methods. Incorporating feedstocks that have a lower footprint, such as bio-based materials, can dramatically reduce emissions. With the help of a process digital twin, companies can evaluate the impact of feedstocks changes, and ascertain when to shift to cleaner materials, such as those sourced from recovery chains.

Similarly, digital technologies can help engineers to identify and design novel and sustainable processes. The use of AI simulation, predictive analytics, supply chain and information management solutions enable fast and low-risk engineering cycles, optimizing every phase of capital projects, and giving companies control over their value chains.

▪ Shifting gears to advance the circular economy

In a rapidly changing business landscape, embracing the circular economy is a game-changer for the chemicals industry. Digital technologies light the way to the sustainable and regenerative approaches that are essential to circularity, showing how resources can be used more efficiently, waste minimized, and materials are recycled and repurposed.

Process simulation supports the switch to circularity by helping operators understand how different energy sources can impact their operations. For example, replacing gas-powered steam generators with electrical boilers slashes energy consumption. Similarly, with the help of solar panels, wind turbines and a repository of real-time weather data, companies can create 360-degree simulations of green hydrogen production, modelling electrical fluctuation and predicting hydrogen output. True circularity requires the use of recycled feedstocks. Here, a process digital twin serves as a valuable tool to monitor, optimize, and visualize operations in real-time for the efficient uptake of recycled materials.

Another application is real-time Key Performance Indicator (KPI) monitoring and reporting. Digital twins provide a holistic view of operational data, enabling companies to quantify and optimize critical metrics. With programs such as AVEVA Process Simulation, organizations can track environmental KPIs in real time and make realistic visualizations for sustainable operational excellence.

Real-world chemical industry successes unlock data dividends

Industrial enterprises are increasingly deploying data-led technologies – including the digital twin – for their numerous benefits. Across the industrial sector, early investors are already reaping the benefits of this new technology.

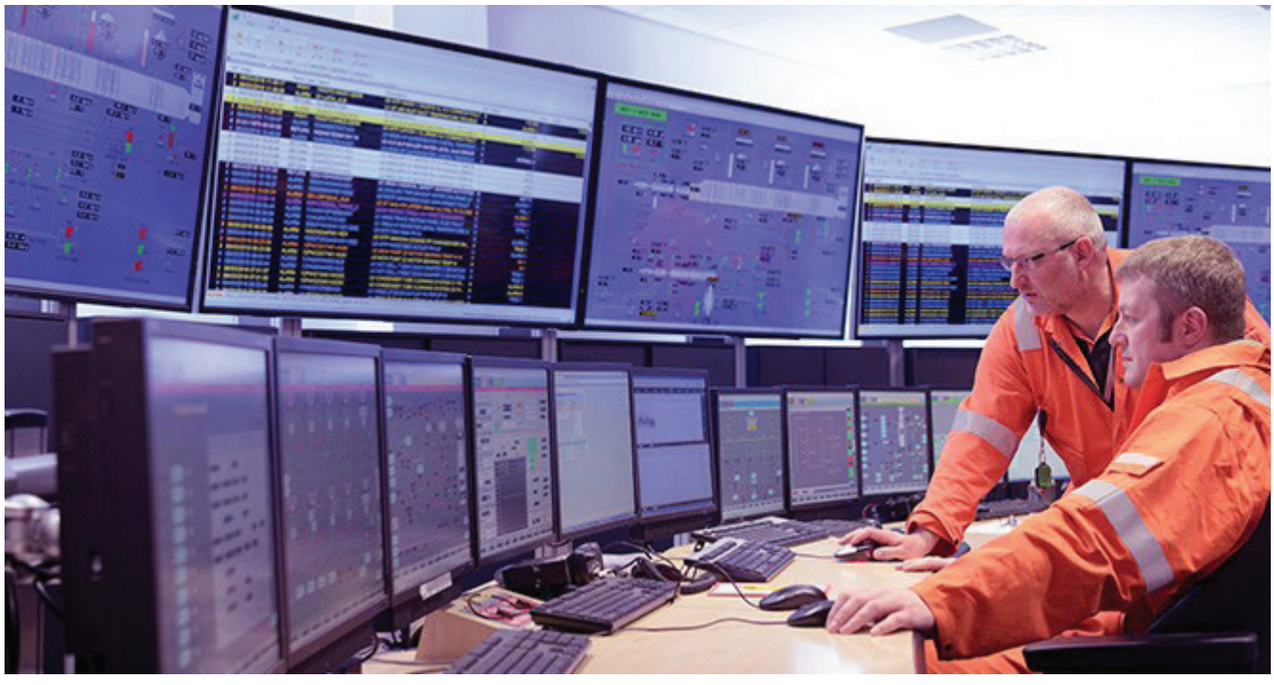
Here in Asia, SCG Chemicals, for example, achieved a transformative impact with the adoption of a unified digital reliability platform. Teams at the petrochemical leader benefitted from integrated, real-time visibility into various facets of operations, leading to improved operational efficiency and reduced unplanned downtime across the value chain. Thanks to these enhanced visibility and analytics models, SCG Chemicals was able to demonstrate exceptional results, including 100% plant reliability and an impressive nine-times return on investment (ROI) within just six months.

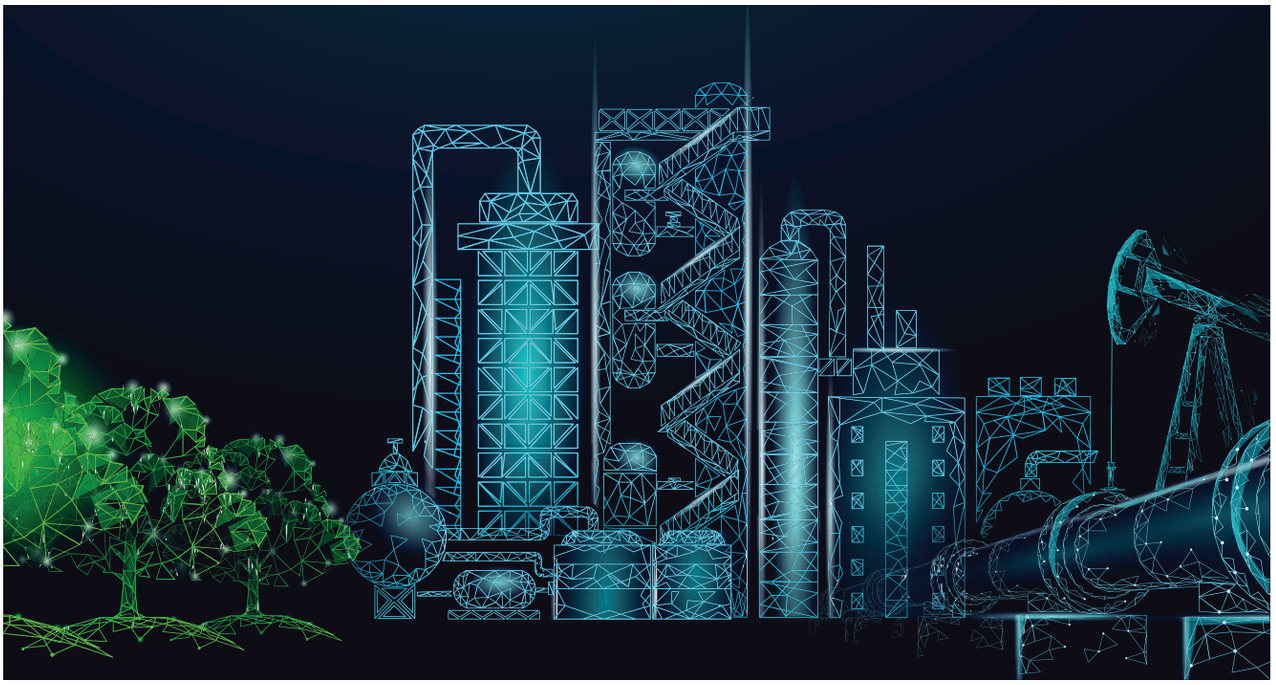
Elsewhere, Eastman Chemical, a producer of

Real-world Chemical Industry Successes via Digital Transformation		
SCG Chemicals	**Unified Digital Reliability Platform**	▪ Improved Operational Efficiency ▪ 100% Plant Reliability ▪ Nine-times Return on Investment (ROI)
Eastman Chemical	**Digital Transformation Platform- SEIGA** (Seamless EPCom Integrated Global Access)	▪ Seamless Data sharing ▪ Improved collaboration in Operations ▪ Improvement in Project efficiency
Covestro	**Cloud based Data Management System**	▪ Improvement in Vertical Integration ▪ Standardize energy & production data ▪ 30% reduction in Energy consumption ▪ 39% reduction in CO_2 emission per ton of product

advanced materials, chemicals, and fibers, was able to drive circularity and improve the sustainability of its operations with a digital transformation platform - Seamless EPCom Integrated Global Access (SEIGA). With engineering documents replaced by a data-centric system, teams benefit from seamless data-sharing and improved collaboration among engineering, construction, operations, and maintenance functions. Engineering errors and rework have been reduced, and project efficiency has improved. The company can now undertake new capital projects more sustainably.

Meanwhile, Covestro, a leading manufacturer of high-quality polymer materials and their components, used a cloud-based data management system to improve vertical integration within the organization and facilitate horizontal, or B2B, integration with authorized industry partners. Internal stakeholders benefited from one version of the truth and a shared understanding of how to address problems, while shared data supported innovation and service improvements for external suppliers. The system enables teams to standardize energy and production data and identify resource savings opportunities. As a result, Covestro was able to reduce energy consumption by 30% and cut CO_2 emissions by 39% per ton of product. It is now on track for a 50% reduction in consumptions and emissions by 2030.





Industries invest in digital solutions to combat disruption

With disruption increasingly being seen as the new normal, industrial leaders are looking to ramp up investments in industrial digital solutions.

Some 87% of executives polled in a recent survey by Wakefield Research and AVEVA said they plan to increase spending on more industrial digital solutions in the coming year. They will do so in order to tackle combined business challenges, including economic uncertainty, unstable geopolitical environments, labor shortages, and disrupted supply chains. The October 2022 survey polled 650 executives at global companies with a minimum annual revenue of USD 50 million in the chemicals, manufacturing, and power industries around the world.

In the chemicals industry, 62% of business leaders have increased or accelerated their investment in industrial digital solutions, surpassing other industries. The investment reflects the sector's response to environmental regulations and sustainability pressures, with 33% identifying them as the most significant challenge in the next 12 months (compared to 23% across all sectors).

As McKinsey points out, end-to-end digitization can positively impact the chemicals value chain, nearly doubling the average EBITDA earnings from 8.5% to 16%.

With data-led technologies, chemicals companies can drive sustainability and deliver significant value gains. By leveraging real-time insights, advanced analytics, and process optimization, companies can minimize waste, increase efficiency, and drive innovation at every level. ■

Author

Stephen Reynolds
Industry Principal- Chemicals
AVEVA

INTERVIEW

Journey towards Achieving Net-Zero Targets in the Indian Chemical Industry

BIMAL GOCULDAS
MD & CEO
DMCC Specialty Chemicals

*In this exclusive interview, we have the privilege of speaking with **Bimal Goculdas, MD & CEO, DMCC Specialty Chemicals** about the Indian chemical sector's journey toward achieving net-zero targets. He sheds light on the necessary measures and investments required to reduce Scope I and II emissions, as well as the company's role in the global markets following their sustainability initiatives. He also addresses the recent drop in revenues and provides insights into current investments and future plans.*

What is your observation for the Indian chemical Industry to achieve net zero targets?

India's commitment to achieving net zero by 2070 provides a considerable timeline, but it will require strong political will to drive the necessary changes within the chemical industry. Mere goodwill won't be enough to accomplish this goal. Therefore, it becomes imperative to introduce monetary incentives, necessitating robust political determination to implement policies similar to the Carbon Tax imposed by the European Union. A viable approach would involve offering premium prices for low-carbon products, thereby making customers bear the cost while benefiting from lower taxes or facing penalties for purchasing high-carbon supplies. By penalizing companies with high carbon footprints and incentivizing those employing cleaner processes throughout the value chain, manufacturers will be encouraged to invest in sustainable practices.

Dahej facility of DMCC under construction

There are several steps the industry can take internally, starting with transitioning to renewable energy sources like solar and wind power. In addition to procuring clean energy, manufacturers can adopt technical measures to enhance energy efficiency. For instance, converting batch processes to continuous operations would lead to significant improvements in power consumption and substantial reductions in carbon emissions.

The transportation system for chemical goods in India is currently highly inefficient, with trucks spending significant time on the roads to transport raw materials and finished products. The government is actively promoting the use of efficient trucks, and infrastructure development efforts led by Mr. Gadkari are unprecedented. Leveraging the country's extensive railway network can play a crucial role in improving transportation efficiency. By reducing reliance on trucks and shifting to railway transport, not only can efficiency be enhanced, but it also proves to be a more cost-effective option. Currently, the facility for loading trucks onto trains and offloading them at the destination is only available for routes between Kolar and Mangalore or Cochin. Despite having a 4000-kilometer coastline, India lacks efficient coastal transportation for chemicals or a comprehensive roll-on-roll-off system for railway wagons. Enhancing multimodal connectivity through road, rail, and waterways can serve as a game changer in improving overall efficiency and sustainability within the chemical industry.

Tell us about the measures taken by DMCC Specialty Chemicals towards achieving carbon neutrality & investments so far to reduce Scope I & II emissions?

At DMCC Specialty Chemicals, our journey towards carbon neutrality has been a gradual process, undertaken over a period of time. Our goal is to achieve carbon neutrality by the end of this year. Rather than relying on a single big project, we have implemented a combination of small and large initiatives to improve our process and energy efficiencies. While it is challenging to provide an exact figure for the investments made, we have consistently invested in projects to drive sustainability.

One of the key steps we have taken is transitioning most of our processes to continuous operations. This shift has not only improved our energy efficiency but has also allowed us to produce even smaller volume products more efficiently. Additionally, we have made significant use of solar & wind energy as a major part of our energy input. Furthermore, we are currently focused on enhancing our power generation from waste heat. This initiative aims to reduce our reliance

on the grid by 90%, leading to a significant reduction in our carbon energy footprint and operational costs. The high costs associated with electricity in the industrial sector make this investment particularly valuable. By investing in steam pipelines at both our manufacturing units in Dahej and Roha, we have substantially improved steam utilization efficiency, which has not only benefited us but also neighboring units by reducing fuel consumption. Through these measures and investments, we are committed to achieving carbon neutrality and contributing to a more sustainable future.

How do you see the position of DMCC in the global markets after having taken all these initiatives?

Following the implementation of these initiatives, DMCC should be regarded as a prominent player in the global markets, particularly as a premium supplier of carbon-neutral or low-carbon goods compared to our competitors. Although we may not currently enjoy a competitive advantage due to the absence of enforceable laws, it is crucial to note that such regulations will inevitably come into effect.

As governments and international bodies increasingly prioritize sustainability and carbon neutrality, DMCC's proactive approach places us in a favorable position to meet future requirements and market demands. By aligning our operations with environmentally conscious practices and offering carbon-neutral or low-carbon products, we anticipate gaining a competitive edge as regulatory frameworks become more stringent. Our commitment to sustainability and the investments made towards achieving carbon neutrality not only demonstrate our dedication to environmental responsibility but also position DMCC as a trusted partner for customers seeking sustainable solutions. As global markets shift towards a greener and more conscious economy, we are poised to capitalize on the growing demand for environmentally friendly products and services. While the current market advantage may be limited, we firmly believe that DMCC's proactive initiatives position us favorably for future developments in global markets. By being a supplier of carbon-neutral and low-carbon goods, we are well-prepared to meet upcoming regulatory requirements and cater to the increasing demand for sustainable products.

"Our commitment to sustainability and the investments made towards achieving carbon neutrality not only demonstrate our dedication to environmental responsibility but also position DMCC as a trusted partner for customers seeking sustainable solutions."

May we have your comments on the drop in revenues this year after a strong growth in FY 2022?

After experiencing strong revenue growth in FY 2022, the group faced a decline in revenues in the subsequent year. This drop can be attributed to various factors. Firstly, in July-August 2022, there was a significant decrease in commodity prices, leading to a sharp decline of approximately 65% in terms of previous values. This resulted in a drop in revenue during the July-September quarter.

On the market front, the group witnessed a reasonably good first quarter. However, during the second quarter, there was a noticeable deferral of shipments, primarily driven by the prevailing uncertainty in Europe. The high energy prices in Europe and a general reduction in stock by businesses caused disruptions throughout the supply chain. Consequently, the demand for products decreased, creating panic among producers, which further led to price reductions.

The group's bulk chemicals business, which deals with commodities such as dyes and intermediates for textiles, particularly struggled, impacting the overall

offtake. Moreover, in October, a planned maintenance shutdown of a plant took place, which occurs every one and a half years. This not only increased maintenance costs but also had an adverse effect on revenues.

During the October-December quarter, the market conditions remained weak. Customers across various sectors lacked product visibility and therefore refrained from placing orders for raw materials, resulting in reduced volumes for the group.

These factors collectively contributed to the decline in revenues after a period of strong growth in FY 2022. The group faced challenges arising from fluctuations in commodity prices, uncertainty in the European market, disruptions in the supply chain, and a decrease in customer demand.

Tell us about current investments & future plans.

Regarding our projects and internal operations, we are pleased to announce the successful completion of all our planned capital expenditures (Capex). Our brownfield Sulphuric acid plant in Dahej is now operational, and in the latter part of the quarter, we also completed the construction of our specialty chemical plant in Dahej. We are excited to begin the process of ramping up production at this plant over the coming quarters. While there may initially be a higher focus on commodities, we anticipate that over time, the product mix will balance out, with approximately one-third being commodities and two-thirds being specialties.

We have made significant value additions to our sulfone products, which are performing reasonably well and have been launched in the market. However, due to the global slowdown, we have yet to witness the full impact of these additions. Currently, we are producing smaller volumes of three products from our multipurpose plant, but we expect them to contribute positively to our bottom line. Although we are unable to disclose specific product names, we continue to produce sulfonation and chloro-sulfonation based products in our multipurpose plants and are now expanding production at the Dahej facility.

In the Indian market, the annual demand for Boron spans various industries, including glass, ceramics, pharmaceuticals, fertilizers, steel, brass, precious metals, and refining. Unfortunately, India does not have Boron mineral reserves, necessitating imports of boric acid from the US, Turkey, or South America for the production of Boron specialties. Recently, there have been restrictions imposed on boric acid imports, posing challenges for our operations. As the availability of the main raw material is limited, we are considering expanding our boric acid production. However, we acknowledge that this expansion may not be globally competitive. This aspect of our business is currently under review, and a decision is yet to be made. Overall, our projects have progressed well, and we have achieved important milestones in expanding our production capabilities. We are optimistic about the potential of our specialty chemical plant, and while challenges exist in certain areas, we continue to explore strategies to overcome them and drive growth in our business. ■

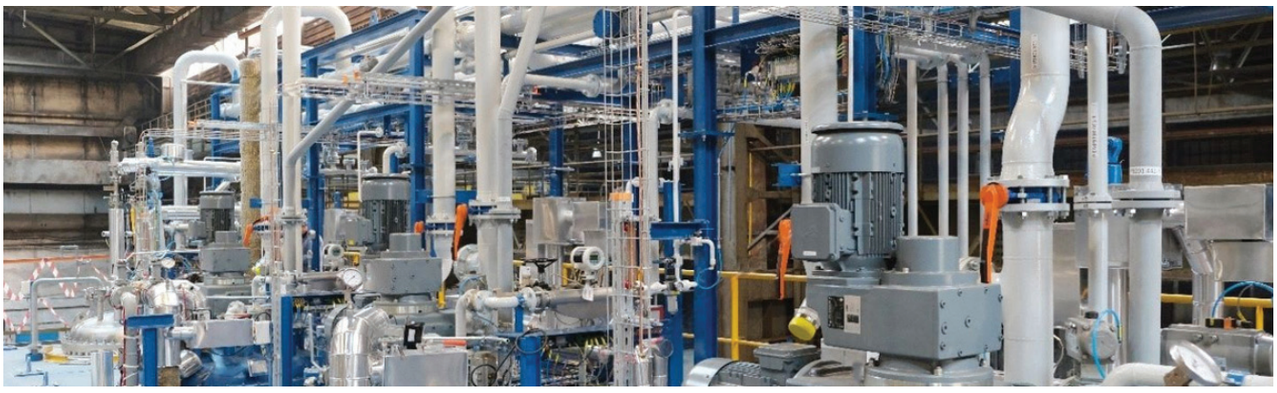
GUEST COLUMN

Harnessing the Power of AI for Predictive Maintenance

G BALAJI
SVP, Head of Energy Industries
ABB India

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

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



AI can address issues before they impact productivity

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

Condition monitoring is a critical aspect of asset management and maintenance. It enables the detection and diagnosis of abnormal activities or faults in equipment and processes to optimize maintenance and performance. However, traditional condition monitoring relies on the assumption that equipment failure is random and unpredictable and that the best way to prevent it is to perform regular inspections and repairs. It focuses on scheduled maintenance activities, such as lubrication, cleaning, calibration, and replacement of parts, regardless of the actual condition of the equipment.

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

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

For instance, if a plant operator wants to make sure their equipment is working well and avoid any breakdowns or accidents. What's the best way to monitor the condition of the assets? The operator could use the traditional method of performing planned maintenance activities. But there are higher possibilities of missing some early signs of trouble or it could alert the operator too late. This method also ignores the bigger picture of how the overall assets are performing. Or the operator could use the smarter method of using AI. Through this, they can detect problems earlier and more accurately by looking at multiple sensors' signals together. AI can also tell what to do to fix the problem and how long the asset will last. This way, the operator can save money and time by performing maintenance only when needed and not too often or too late. AI can help improve the plant's overall reliability and safety by offering expert advice and predictions based on data.

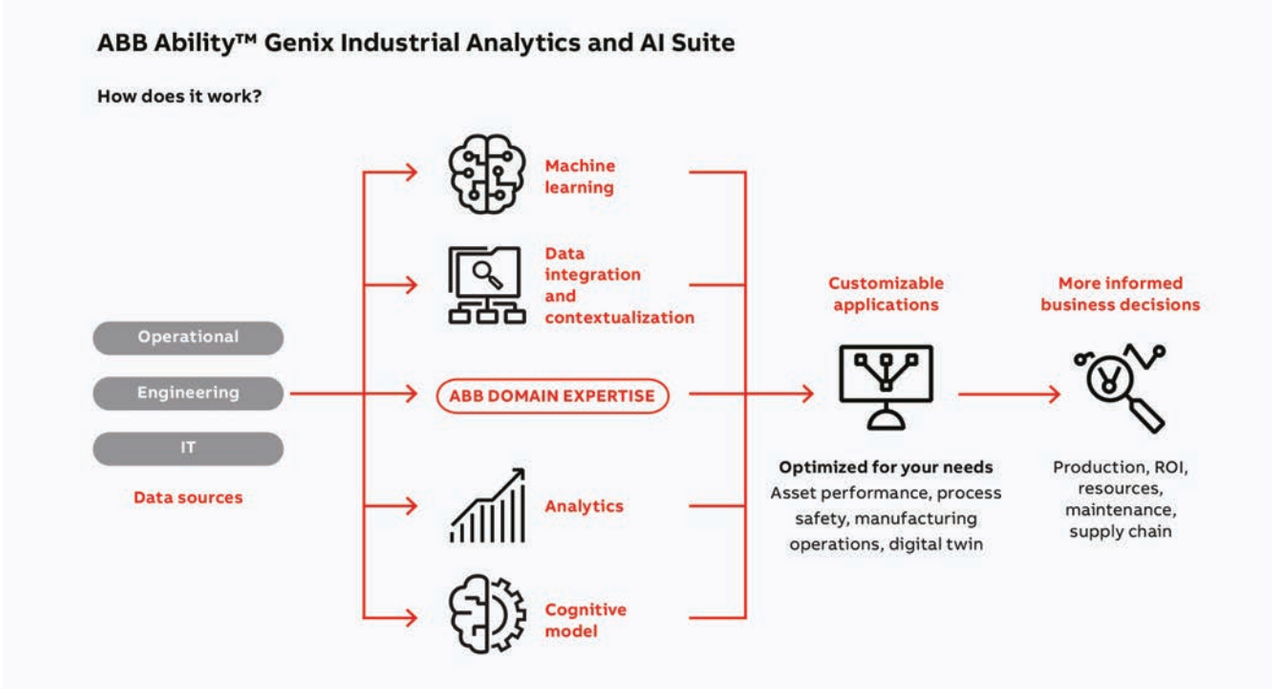
Taking a transformative step in operations

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

By using advanced technology like the ABB Ability™ Genix APM, plant operators can bring together condition information from disparate systems into one dashboard view, accessible via a web browser. It gives users who are both inside and outside the organization instant and secure access to the equipment data they need, so they can make decisions faster and prioritize actions that help optimize operations and reduce maintenance and operating costs. The suite also includes tools for analyzing historical data, which can be used to identify trends and optimize equipment performance over time. Some of its key benefits include aggregated equipment health overview, highlighting assets with the degraded condition, a 14-day failure prediction AI algorithm, a report generator, and a dashboard for raw data diagnostics.

System Anomaly detection using AI

Avoiding a trip in the plant is one of the major objectives of operations and maintenance teams. Any process upset or plant trips imply inherent hazards along with loss of production. Most often, operations and



maintenance teams, as part of root cause analysis post-plant trip, notice changes in critical parameter patterns that caused the trip. Often, these go unnoticed due to limited resources and the massive amounts of data involved. The System Anomaly Detection App, which is part of the ABB Ability™ Genix Industrial Analytics and AI Suite, is designed to detect unusual, anomalous behaviour from process streaming time series data. It then uses Artificial Intelligence / Machine Learning (AI/ML) methods to support dynamic decision-making in all types of process-driven industries (including oil & gas, refinery, petrochemicals, metals, cement, and the like). Typical predictive maintenance solutions focus on asset health checks. The app, however, focuses on integrated assets (or systems) based on the function it performs. Potential system anomalies are highlighted using AI/ML for plant operator review, enhancing response time for process upsets. In essence, functionalities in the app are focused on reducing unscheduled trips, increasing plant availability, avoiding process upset conditions, and increasing operator responsibility. It also has the capability to identify factors that are responsible for the anomalous state of the system, allowing for immediate action and problem resolution before it affects the business process. The system anomaly detection solution can reduce unscheduled trips by up to 50%.

Conclusion

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

Minimizing Life cycle Costs of Rotary Equipment

Chemicals Industry has traditionally been characterized by high R&D costs, complex processes, use of hazardous reagents, purification issues, large volumes of waste and pollution. Manufacturers are seeking to improve and manage these challenges better through use of digital and sustainable technology and strategic approaches such as condition monitoring, predictive maintenance, and reliability-centered maintenance (RCM). By implementing these services, organizations can significantly minimize downtime, extend equipment lifespan, enhance safety, and ultimately reduce overall lifecycle costs.

Rotary equipment, such as pumps, compressors, turbines, and motors, plays a vital role in various industries, including oil and gas, power generation, manufacturing, and many others. However, the continuous operation of these machines under demanding conditions inevitably leads to wear and tear, which can result in unexpected breakdowns, reduced performance, and increased maintenance expenses.

To counter these challenges, maintenance inspection engineering services have emerged as a strategic approach to identify, monitor, and address potential issues before they escalate. These services encompass a range of techniques, including condition monitoring, predictive maintenance, and reliability-centered maintenance (RCM), among others. By implementing these services, organizations can significantly minimize downtime, extend equipment lifespan, enhance safety, and ultimately reduce overall lifecycle costs.

Condition Monitoring Techniques

Techniques such as vibration analysis, thermography, and oil analysis provide valuable insights into the health of rotary equipment. Regularly scheduled inspections using these methods allow maintenance teams to detect early signs of equipment degradation, such as abnormal vibrations, high temperatures, or contamination in lubricating oils. By proactively addressing these issues, maintenance engineers can perform corrective actions before they develop into costly failures.

Predictive maintenance

It leverages advanced data analytics and machine learning algorithms to predict when equipment failures are likely to occur. By continuously monitoring and analyzing real-time data from rotary equipment, patterns and anomalies can be identified, enabling maintenance teams to plan maintenance activities at the most opportune times. This approach minimizes the need for unnecessary preventive maintenance and maximizes equipment availability, resulting in substantial cost savings.

Reliability-centered maintenance (RCM)

It is another valuable methodology that focuses on optimizing maintenance strategies based on equipment criticality and failure consequences. By identifying the failure modes that would have the most significant impact on the operation, safety, and productivity of rotary equipment, maintenance engineers can develop tailored maintenance plans. This approach ensures that resources are allocated efficiently, reducing costs associated with unnecessary maintenance while prioritizing high-risk assets.

In addition to these techniques, maintenance inspection engineering services often involve establishing comprehensive maintenance programs, utilizing technology-driven tools, and fostering a culture of proactive maintenance within organizations. It is essential to invest in skilled and knowledgeable maintenance professionals who can operate and interpret the data provided by various inspection and monitoring techniques effectively.

By implementing maintenance inspection engineering services to minimize lifecycle costs of rotary equipment, organizations can achieve a range of benefits. These include increased equipment reliability, reduced breakdowns and associated downtime, optimized maintenance schedules, improved safety, enhanced productivity, and ultimately, significant cost savings.

Conclusion

The importance of maintenance inspection engineering services cannot be overstated when it comes to minimizing lifecycle costs of rotary equipment. By leveraging advanced techniques, such as condition monitoring, predictive maintenance, and reliability-centered maintenance, organizations can proactively address potential issues, optimize maintenance activities, and extend the lifespan of their equipment. As industries become increasingly competitive, these services are a vital component of any organization's strategy to enhance operational efficiency and reduce costs. ■

Author

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INTERVIEW

"The rapid growth of India's Specialty Chemicals Industry presents significant opportunities for CRAMS and CDMOs"

ANURAG ROY
CEO
Astec LifeSciences Limited

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

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

The Indian Specialty chemicals sector is at a very bright spot. Comprising nearly 50% of India's chemical sector exports and representing 22% of India's overall chemicals and petrochemicals market, it is poised to be a net exporter by 2040. While the strong local and international demand has led to companies expanding their capacities to cater the demand, the clampdown on industries in China has catapulted the potential of India to become a global hub as innovators explore the China+1 strategy. With the government's efforts to establish advanced chemicals parks and promote innovation within the industry, there is a renewed focus of Indian manufacturers to invest in capacity expansion. Such collaborated efforts will aid create a favourable eco-system thereby poising the Indian specialty chemicals market for substantial growth.

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

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

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

Which products are driving value generation at Astec LifeSciences?

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

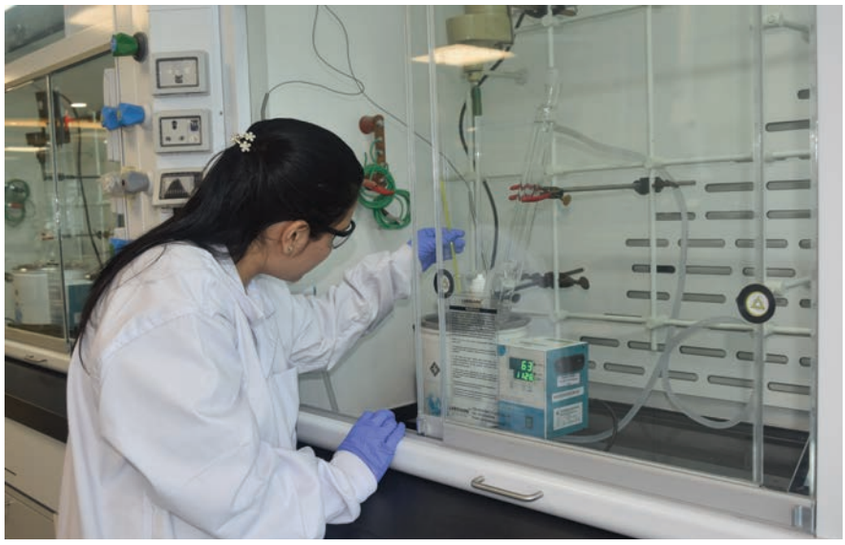
What kind of opportunities will be unlocked Indian CRAMS & CDMOs due to rapid growth Specialty Chemicals industry?

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

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

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

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



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

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

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

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

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

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

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

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

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

Resistotech Industries Pvt Ltd acquires SGL Carbon India Pvt Ltd

Prashant Patil, Managing Director, Resistotech Industries

It gives us immense pleasure to announce that Resistotech Industries Private Limited, India has completed acquisition of SGL Carbon India Pvt Ltd, Pune (earlier 100 % subsidiary of SGL Carbon, Germany) with effective date 28th April 2023 and the new entity is a part of Resistotech group.

SGL Carbon India manufactures solutions for Graphite equipment and PTFE components and earlier was part of the process technology business unit under direct control and SOPs from SGL Germany. It has a world class manufacturing facility located at Ranjangaon, Pune, India which also includes installations as well as repair service.

As a part of this acquisition, Resistotech shall get access to world class German technology in Graphite based products, equipment, machineries, manpower & skilled workforce. Mr Prashant Patil, Managing Director, Resistotech group has committed that the same legacy will be carried forward for quality of products offered and performance with fast delivery & competitive prices henceforth.

Resistotech is one of the fastest growing companies in India & is already serving the chemical process Industry in India and global market by unique solution offerings based on PTFE lined pipes and equipment for critical corrosion protection applications. With this acquisition, Resistotech group has added one more feather to the crown by entering into Graphite technology involving world class Graphite based products for wider industry applications such as graphite equipment and systems.

With solution offerings based on the dual technology in Fluoropolymers lining as well as Graphite equipment, Resistotech shall solve most critical challenges associated with corrosion management in the chemical process industry along with faster service and optimum value proposition to esteemed clients, channel partners and business associates in Indian and global markets.

"Along with Fluoropolymers lining for Pipes & equipment, the move of adding Graphite technology under one umbrella makes Resistotech Group as the only player in India with multiple technical solution offerings for the benefit of the industry" says Narendra Thakkar, Director- Marketing.

Technological advancement in Graphite Technology

Going forward, the Resistotech team shall invest in newly developed value-added products based on innovative technologies to upgrade the performance of Graphite based systems for improved satisfaction of our esteemed clients. Incorporation of latest technologies like Vibration molded graphite blocks and Isostatic molded graphite parts shall offer high density, Homogeneous and improved performance over traditionally extruded Graphite rods. ■

CONTACT:

Email: sales@anticorrosion.in

Innovative Alloy Solutions for Highly Corrosive Environments

The chemical industry encompasses a diverse range of sectors that produce various products including plastics, organic acids, fertilizers, drugs, and pesticides. In India, the chemical industry is poised for significant growth, with projections indicating an 11 to 12 percent expansion from 2021 to 2027, followed by a growth rate of 7 to 10 percent from 2027 to 2040. These developments are expected to triple India's global market share by 2040, primarily driven by rising domestic consumption. Over the next two decades, India is anticipated to account for more than 20 percent of the global consumption of chemicals. This surge in demand is predicted to elevate domestic requirements of around USD 180 billion in 2021 to about USD 1,000 billion by 2040.

The selection of material for any application must consider various factors including mechanical properties, application temperature, corrosivity of process media and weldability. In the chemical industry, the primary criteria for material selection revolves mainly around the corrosivity of process media and application temperature. According to a study on "An analysis of the updated cost of corrosion in India" (2014), the direct cost of corrosion in India amounts to USD 26.1 billion (2.4% of the nation's gross domestic product (GDP)), with an estimated USD 9.3 billion being unavoidable. Furthermore, the indirect cost of corrosion is estimated at USD 39.8 billion. Corrosion in the chemical industry primarily occurs due to the liquids and gases utilized in chemical processes, which erodes the inner metallic surfaces of processing apparatus and storage containers.

Material Selection for the Chemical Industry Processes

Wet corrosion comes in many forms, including general, pitting, crevice, erosion, galvanic, intergranular corrosion (IGC), and stress corrosion cracking (SCC), and the chosen alloy must resist all the prevailing corrosion mechanisms in the given service. Alleima, a leading manufacturer in high value-added products, has consistently been at the forefront of advancing industries through innovative material solutions. Our expertise in understanding customers' current problems, coupled with extensive knowledge of alloys and corrosion, is crucial in developing solutions to address the industry's needs. Over the past decades, Alleima has developed a number of alloys specifically designed for the chemical industry.

This article provides an overview of the advancements in material technology that have successfully addressed challenges within the chemical industry.

Material Advancements for the Chemical Industry

Some of the most corrosion-resistant alloys currently available include advanced super austenitic stainless steels, super duplex or hyper duplex stainless steels, and nickel alloys. Corrosion-resistant steels typically feature high concentrations of Nickel (Ni) and Molybdenum (Mo), which contribute to a lower corrosion rate. Additionally, they contain significant amounts of Chromium (Cr), Mo, and Nitrogen (N) to facilitate the formation of a passive film. The addition of nitrogen elevates the pitting corrosion potential, promoting re-passivation and effectively inhibiting the onset of pitting corrosion.

Prominent challenges within the chemical industry & corresponding innovative alloy solutions

Organic acids, such as acetic acid, formic acid, propionic acid, oxalic acid, and butyric acid, are generally weaker than common inorganic acids like hydrochloric acid and sulfuric acid. Most of these organic acids are reducing acids. The 300-series austenitic alloys can successfully handle many organic acids at lower temperatures. The duplex alloy Alleima® 3RE60 played a crucial role in the successful commercial operation of equipment used to produce Methanol via the Lurgi process.

However, the passivity of 300-grade of stainless steels is heavily reliant on oxidizing conditions, especially at high temperatures, and reducing agents like chlorides can adversely affect their corrosion resistance. SCC can occur in these steels at temperatures above 100°C, even with low chloride contents as low as a few parts per million. Consequently, more severe conditions involving high concentrations of formic acid, high temperatures, or high chlorides contents necessitated the development of duplex stainless steels like SAF™ 2205 and super duplex steels like SAF™ 2507, or higher alloyed austenitic steels like Alleima® 2RK65 (904L) or Sanicro® 28. In the 1990s, SAF™ 2507 was specified by Lurgi for seawater coolers in numerous methanol plants situated along coastal regions worldwide. Another example involves the production of pure terephthalic acid (PTA) through xylene oxidation, where SAF™ 2205 and SAF™ 2507 were incorporated into the process technology patent by Imperial Chemical Industries (ICI).

Phosphoric Acid Applications

Traditional graphite heat exchangers often encounter issues such as tube breakage and production loss. This is due to phosphoric acid produced through the "wet" method, which contains varying concentrations of impurities derived from the raw material, phosphate rock. The corrosiveness of the process solution primarily depends on the impurities present. Among these impurities, free chlorides and fluorides pose the greatest risks. As such, Alleima developed Sanicro® 28, a specially optimized composition that outperforms even the higher alloyed materials to address these challenges in phosphoric acid applications. Laboratory tests conducted at 200°C in contaminated 95% super phosphoric acid showed that Sanicro® 28 exhibited super resistance to other high alloy materials (as shown in Table 1). Sanicro® 28 has emerged as the most widely used metallic material for evaporator tubes. Several units incorporating Sanicro® 28 have been in service for over 10-15 years, demonstrating its exceptional performance and durability.

Sulfuric Acid Applications

The choice of construction material in sulfuric acid applications greatly depends on the acid concentration and temperature. Alleima has developed a high silicon-containing austenitic stainless-steel grade called Alleima® SX, specifically designed for use in concentrated sulfuric acid environments. This material proves particularly suitable for acid coolers, acid piping systems, acid distributors, acid towers and tanks, pumps, nozzles, internals, strainers, mesh pads, and other related components. Additionally, Sanicro® 28 has established itself as a reliable material for heat exchanger tubes and piping used in sulfuric acid production.

Material	Chemical	Composition	Nominal, %					
	C	Cr	Ni	Mo	Cu	W	Co	Others
	max							
Sanicro® 28	0.02	27	31	3.5	1.0	-	-	-
Alloy 904L	0.02	20	25	4.5	1.5	-	-	-
UNS N08020	0.07	20	34	2.5	3.3	-	-	Nb
Alloy 825	0.05	21.5	42	3	2.3	-	-	Ti
Alloy G	0.03	22	45	6.5	2	1.0	2.5	Nb
Alloy C	0.08	15.5	54	16	-	4	2.5	-

Table 1 Chemical compositions of materials tested

Nitric Acid Applications

Nitric acid is another prevalent acid used in the fertilizer industry. Close productivity monitoring is essential to minimize downtime to ensure profitability in today's competitive nitric acid market. The selection of appropriate materials can help prevent unplanned shutdowns caused by plugging or even the need for complete replacement of heat exchanger units. Nitric acid is highly oxidizing, thus necessitating stainless steels with high chromium content but low molybdenum content. To address corrosion challenges in nitric acid service, Alleima developed Alleima® 2RE10. With its 24.5% chromium, 20% nickel, and low impurity content, it exhibits significantly better nitric acid resistance than ASTM 304L type steels. This material is highly suitable for heat exchanger tubes and pipes in various processes involving nitric acids, such as manufacturing nitric acid, acrylic fibres, ammonium nitrate, and nuclear reactor fuel reprocessing. Corrosion is typically encountered at the inlet end of cooler/condensers, where the first condensate forms (See Figure A). If reboiling of the first condensate occurs, the corrosive conditions become even more severe. Extensive practical experience in such applications has consistently confirmed the superior performance of Alleima® 2RE10 over standard steels. A significant portion of the produced nitric acid is used in fertilizer manufacturing, with concentrations typically ranging between 60% and 65%. In addition, the duplex grade SAF 2906 specifically addressed the issues of 316/316L-type alloys' failure due to SCC caused by trace amounts of chlorides in the urea production process.

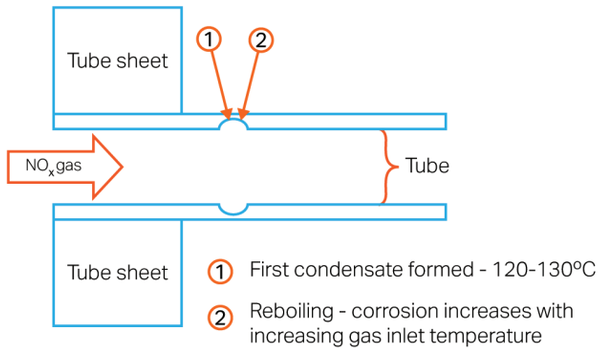


Figure A

Hydrochloric Acid Applications

The chemical industry presents numerous challenging applications including handling hydrochloric acid at higher temperatures. When the duplex family or advanced austenitic steels cannot meet the rigorous demands, the next alternative is often the utilization of costly nickel alloys. However, Alleima recently introduced a groundbreaking solution, Sanicro® 35, an alloy that combines the finest qualities of super austenitic stainless steels and nickel alloys. This grade showcases exceptional corrosion resistance, particularly in highly corrosive environments encompassing acids and acidic substances. Due to the combination of high contents of nickel, chromium and molybdenum, Sanicro® 35 has good resistance to many commonly found acids, such as sulfuric acid, nitric acid, phosphoric acid and organic acids. Sanicro® 35 exhibits remarkable resistance to pitting and crevice corrosion and SCC. The impressive corrosion resistance of Sanicro® 35 in hydrochloric acid is vividly depicted in Figure B.

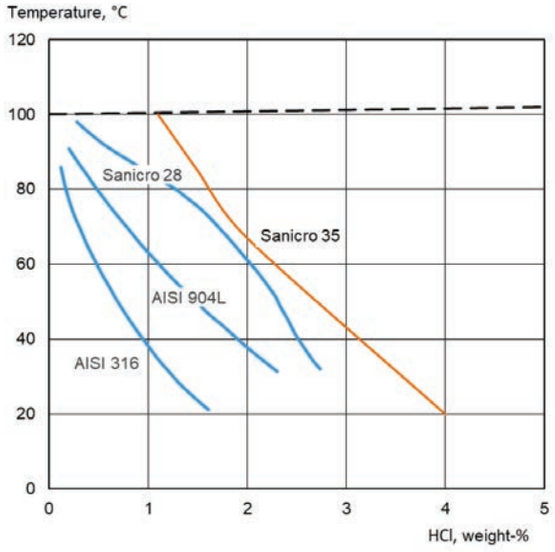


Figure B. Isocorrosion in hydrochloric acid. The curves represent a corrosion rate of 0.1mm/year.

Challenges and Advances in Corrosion Testing

Developing corrosion resistant alloys tailored to specific conditions requires accurate corrosion test data. It is important to acknowledge that laboratory-scale corrosion testing faces several challenges, some of which are outlined below:

- Laboratory testing is typically conducted using pure chemicals and water solutions nearly

saturated with air. The corrosion rate can differ significantly if the solution is devoid of oxygen.

- Corrosion testing in laboratories can be misleading if unintentional impurities strongly influence the corrosion rate.
- High concentrations of organic acids and non-aqueous solvent solutions, such as benzene, exhibit very low electrical conductivity, posing difficulties in corrosion testing.
- Short-term tests on metals can be misleading, as the metal may remain passive during the initial exposure but corrode rapidly in an active state after prolonged exposure.

Conclusion

This comprehensive overview of different alloys suitable for the chemical industry was put together based on a wealth of experience gained from application in various industrial-scale operations. Alleima maintains an extensive databank of laboratory tests and reference lists, showcasing the exceptional performance of these alloys in diverse commercial settings within the chemical industry. Additionally, Alleima provides test coupons, enabling customers to evaluate the performance of alloys under precise application conditions within their process equipment. Developing ground-breaking alloys is at the heart of Alleima, supported by a fully integrated value chain that encompasses R&D, rigorous testing, state-of-the-art melting rolling processes, and timely delivery. This approach is aimed at effectively addressing customer challenges and driving technological advancements within the industry. ■

Author

Rohit Ojha
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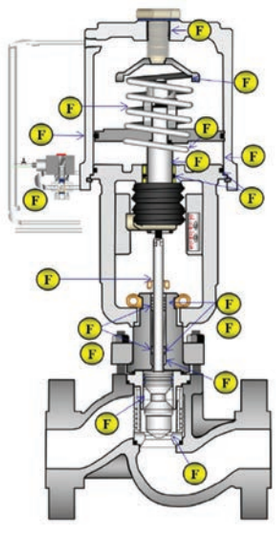
Alleima

IIoT Technology Enhancing Valves Operational Reliability

Valves play a crucial role in maintaining the stability, efficiency, and capacity of a process. Several factors including degradation, malfunction, or failure can cause valve performance to deviate from normal operation. This can result in process instability with cascading effects on operational objectives. Mechanical breakdown and failure of valve components due to fatigue and poor reliability can lead to safety hazards, high maintenance costs, and unplanned downtime of the unit. Industrial Internet of Things technologies when deployed automatically capture process data provide insights into performance and pro-actively send alerts thus increasing operational reliability.

The digital valve positioners and electric actuators have multiple sensors that monitor the valve. The data captured is securely transmitted to an IoT platform which provides insights into performance over time while sending emails and alerts so immediate action can be taken as abnormal conditions develop. This revolutionary approach to monitoring enables plant reliability engineers, operators, and maintenance personnel to predict valve health and proactively prevent unplanned downtime.

Common valve failures affecting operations



Valve failure points

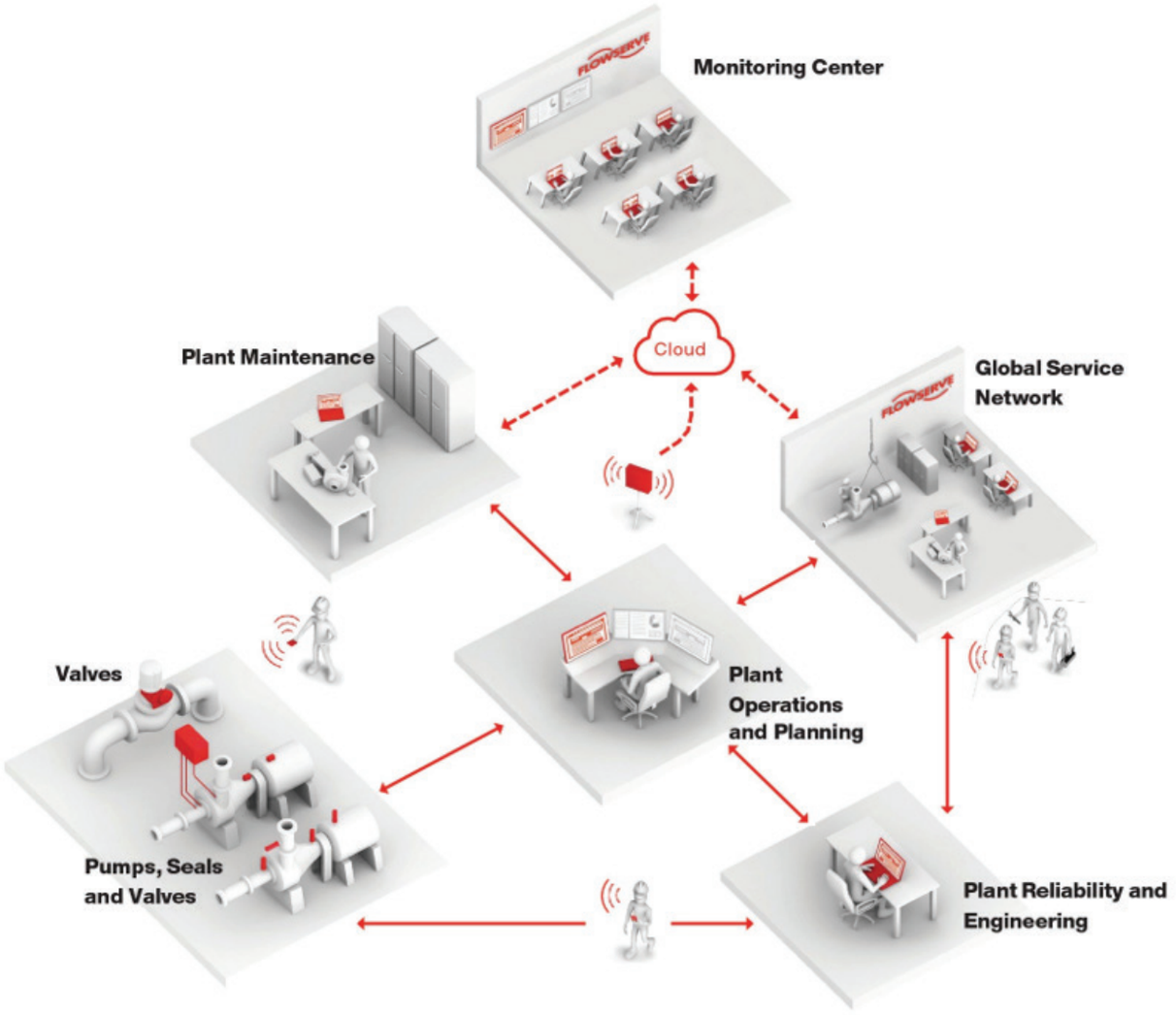
- Mechanical damage due to fatigue like Spring,
- High / Low friction, causing deviations in stroking speed.
- Bearing wear in rotary valves
- Packing leaks
- Seat wear, leading to increased leakage
- Loosening of parts due to vibration and cycling
- Actuator leak
- Damaged tubing Lines
- Clogged Filter Regulator

Industrial IoT Architecture

This is reference network architecture framework from ISA, IEC and NAMUR showing how to approach and implement Industrial IoT.

The IoT ecosystem is composed of the following layers

- **Devices:** Positioners, Electric Actuators and Transmitters that collect data for analysis
- **Data:** The data that's collected, processed, sent, stored, analyzed, and presented for insights
- **Connectivity:** A communications infrastructure that transmits data from devices via a secure network, and encrypted protocols
- **Application:** A set of integrated services with specific analysis technology designed to gain useful insights into equipment performance over time, while sending emails and alerts so immediate action can be taken when an asset experiences a problem and to generate reports from the data gathered
- **Technology Users:** A reporting center staffed with experienced professionals and subject matter experts watching over insights to provide help.



Benefits of deploying Industrial IoT in Valves

Advances in asset health management, driven by data analysis breakthroughs using IoT technology, deliver significant benefits such as

- **Minimize:** repair cost, disruptions, and downtime
- **Refocus:** Focus on assets that require attention, spare parts & inventory planning
- **Enhance:** Enhance equipment efficiency by knowing performance against a most efficient point
- **Reduce:** Reduce total cost of ownership (TCO) by easily recognizing when to schedule equipment maintenance and lowering spare part inventories
- **Improve:** Improve reliability and availability by detecting and addressing unacceptable operating conditions before they evolve into significant issues. Also, increased safety by limiting the personnel time spend in hazardous environments.

IIoT Enabled Connected Ecosystem - Monitoring and Service

Recent advances in instrumentation and monitoring enable plant operators, reliability managers, and maintenance teams to maximize their time by focusing on critical assets that need the most attention.

Process Upset: From Reactive to Predictive Maintenance

REACTIVE	PREDICTIVE
1. Detect Issue	**1. Detect Issue**
Events ▪ DCS Process Operator notices upset condition ▪ Calls I & E to look at the valve & rushes to the Asset Management Console to Check Alarm **Risk** ▪ Typically occurs at night i.e., minimal staff personnel on field ▪ Time: <10 mins to hours	**Events** ▪ Notifications from IoT Application specific analysis ▪ Monitoring Centre and Technology users notices abnormality in the valve before Process upset occurs **Reward** ▪ Get notified before process upset occurs
2. Identify Root Cause (Internally)	**2. Identify Root Cause**
Events ▪ I&E opens manufacturer software, IOM, multiple loops to figure out **Risk** ▪ Limited memory in Positioner, Electric Actuator - Alarms overwritten ▪ Time Lost: <30 min to 1 day	**Events** ▪ Actionable Insights from IoT Application specific analysis ▪ SME review by vendor, Monitoring Centre communicates root cause to plant I&E team ▪ Notification to QRC for Spares as needed **Reward** ▪ Expertise on demand ▪ Planned intervention
3. Resolve the Issue	**3. Resolve the Issue**
Events ▪ Contact Valve vendor, multiple phone calls, emails, texts to try to find resolution ▪ Schedule service visit, fix the valve **Risk** ▪ Lead time, availability ▪ Time Lost: Multiple Days	**Events** ▪ Collaboration and action plan by Service specialists to mitigate ▪ Schedule service visit, fix the valve **Reward** ▪ Avoid suboptimal production or unplanned shutdown and expensive emergency repairs

Conclusion

Aging valves, complex datasets, and limited availability of maintenance personnel challenge today's plant operators. They can cause failures, unplanned shutdowns, emergency repairs and lost revenue. Reliable insights begin with the right technology. IoT enabled connected ecosystem with the right remote monitoring application, provides the real-time analytics and data-driven insights across multiple locations, and the support of monitoring and services from manufacture's expert personnel around the globe, helps to make significant improvements in valves operational reliability. ■

Author

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Weighing automation solutions to boost productivity

SANJEEV KUMAR KAPOOR
Head of Industrial and Product Inspection Business
Mettler-Toledo India

Sanjeev Kumar Kapoor, Head of Industrial and Product Inspection Business, Mettler-Toledo India *articulates the commitment of Mettler-Toledo towards providing weighing automation solutions enabled with digital technologies which yield high performance and fulfil most global regulations for safety, quality, hygiene, traceability, and hazardous-area use.*

How is Mettler-Toledo poised in Indian & International precision measuring tools market?

METTLER TOLEDO is a leading global manufacturer of precision instruments. The Company is the world's largest manufacturer and marketer of weighing instruments for use in laboratory, industrial and food retailing applications. The Company also holds top-three market positions for several related analytical instruments and is a leading provider of automated chemistry systems used in drug and chemical compound discovery and development. In addition, the Company is the world's largest manufacturer and marketer of metal detection systems used in production and packaging.

What are the major challenges of the changing and evolving field of precision instruments and how have you addressed them?

Designing & utilizing customized automation solutions requires a significant investment of time & money in engineering, integration, and operator training. METTLER TOLEDO offers a smart solution for various steps throughout the industrial production process that enable end-to-end connectivity. Whether you are helping your customer to develop semi or fully automated processes or just hoping to strengthen their continuous improvement initiatives with better process visibility, choosing the right devices is the first step towards achieving agility & profitable growth.

What are some of Mettler-Toledo's latest technological breakthroughs in precision measuring tools?

The IND360 family offers three modules based on the same core technology with global approvals to minimize complexity for machine builders, integrators & end-users when designing customized solutions. The indicator family allows you to reuse existing PLC software for different needs with the optimal housing & interface technology for each project. IND360 base automation terminals deliver precision measurement and status information to your control system. This gives you the ability to manage your weighing applications easily & efficiently, boost throughput & save time and materials.

IND360 includes the following key features

▪ Boost Machine Performance

With ultra-fast processing connected to the world's most widely used PLCs/DCS, the IND360 terminal boosts productivity and increases operational uptime. Condition monitoring and Smart5™ alarming ensure your system is performing as expected and lets you react quickly when issues arise.

▪ Simplify Integration

IND360 is the smartest way to integrate weighing. For ease of use, terminals use certified automation interfaces and include sample programming code. Detailed documentation and automation drivers include Rockwell EDS, AOPs & Siemens function blocks save you time & money on implementation and maintenance.

▪ Eliminate Programming Time

Programmed applications for semi or fully automated weighing processes including tank/vessel weighing, filling/dosing, rate control and dynamic weighing allow you to benefit from METTLER TOLEDO's weighing expertise. You improve process throughput without spending time on custom programming.

How have you been leveraging Automation to stay competitive in the business?

In the complex and quickly changing world of automation and IIoT, operations are left trying to adapt quickly to changing demands from customers and corporate strategy. Implementing connected weighing devices provides benefits throughout your production line including cost reduction, productivity increase and yield maximization. For these reasons, choosing devices that can evolve with future needs ensures agility and profitable growth.

METTLER TOLEDO offers smart solutions throughout industrial production process steps that ensure end-to-end connectivity in weighing, including solutions to:

- Improve weighing processes: achieve full automated control
- Collect weighing data: gain transparency into production processes
- Analyze data: identify areas for improvement
- Make improvements: integrate identified changes to achieve future growth

Connected weighing of smart devices allows you to improve transparency, analyze meaningful and implement actions that save money, improve

productivity, and prepare for the future, With the increasing demand for digitalization, METTLER TOLEDO has been investing significantly in Industry 4.0. Most of our equipment is Industry 4.0-ready and can be integrated with any MES systems.

Mettler-Toledo deals with many industries sectors from chemical, pharma to engineering, how have you adapted to the changes and transformations in these sectors?

METTLER TOLEDO has been present in India for more than 25 years and has developed capabilities in pre-sales consulting, engineering, and post-sales support. We are sensitive to the need for prompt customer support. For example, we are closely monitoring and foresee Ethernet APL for weight data in hazardous areas. We have also introduced a revolutionary calibration method that dramatically reduces calibration time and efforts typical to the calibration of large tanks. Also, on the operational front, we are adapting our sales processes to the latest market trends. We are providing a comprehensive set of technical information including CAD data, sample codes, and virtual demos to integrate our products more efficiently into our customers' processes or plants. We have also introduced our Customer Portal, which is one combined platform for fast online purchasing, easy collaboration, and transparent after-sales services including an asset overview. We also invest a significant effort and time in training our customers so that they can deploy our equipment optimally.

About Sanjeev Kumar Kapoor

Mr. Sanjeev Kumar Kapoor is Head of Industrial and Product Inspection Business, Mettler-Toledo India. He has a background in Electronics and Telecommunications engineering, augmented with marketing qualification, and is associated with Mettler-Toledo for 24 years, previously managing Service, Marketing, and Supply Chain Operations for the company.

Additional information about METTLER TOLEDO can be found at "www.mt.com." ■

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

PHARMA & BIOPHARMA

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

CLEAN ENERGY

- Hydrogen
- Biofuels
- Methanol
- Carbon Capture Utilization & Storage
- Renewables – Solar Wind & Hydro

LOGISTICS

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

CORROSION CONTROL

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

Concurrent Events

EPC 2024 · SPECIALTY ChemICAL World Expo 2024 · Chlor-Alkali World Expo & Conference 2024 · Bio Pharma World Expo 2024 · LAB ANALYTIX World Expo · Refining & Petro CHEMICALS 2024 · WaterEX WORLD EXPO 2024

Industry AUTOMATION & Control 2024 · PVE Pumps, Valves & Energy WORLD EXPO 2024 · BOILER World Expo 2024 · Surface Engineering Coating & Corrosion World Expo 2024 · Student Outreach Program 2024 Develop Future Leaders

ChemTECH World Expo 2022

300+	19350	6	150	650+	200	27
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