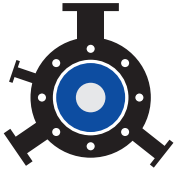


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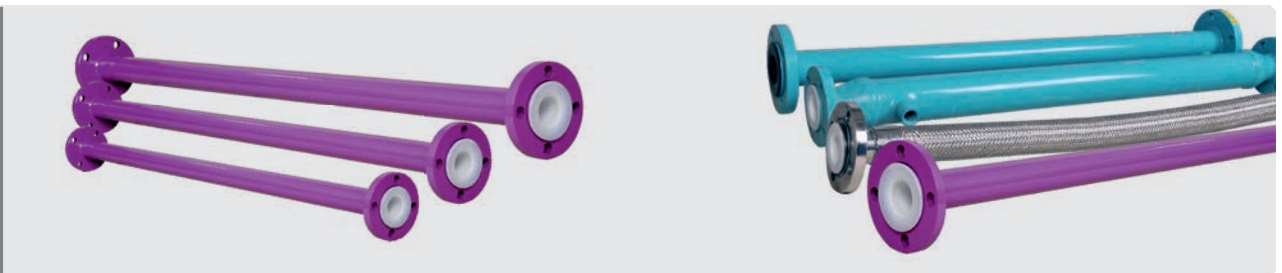
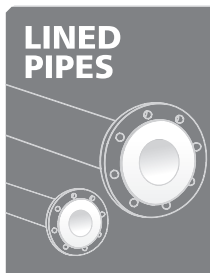
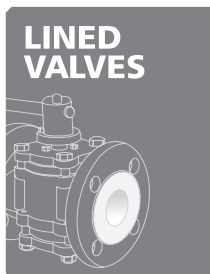
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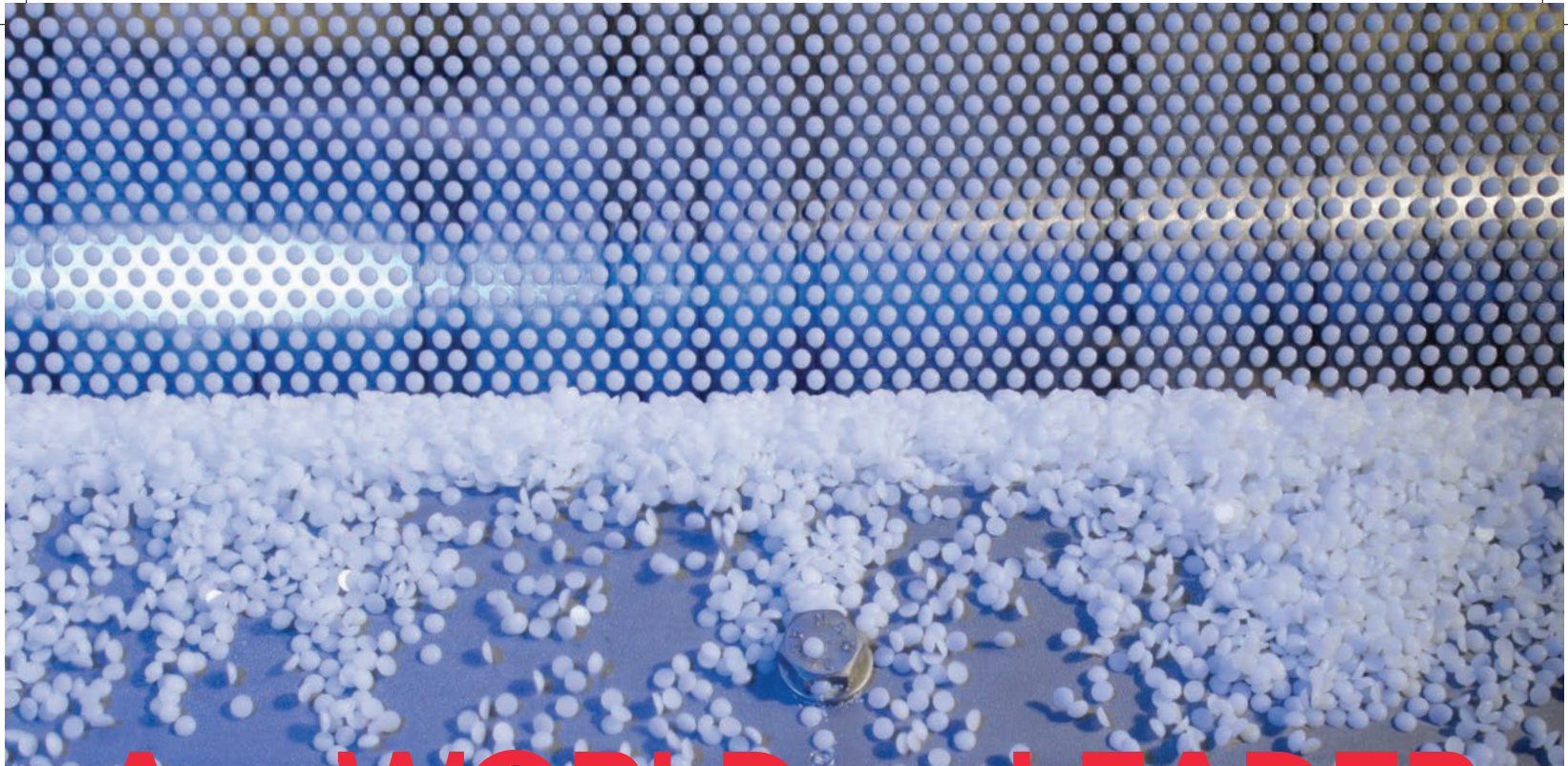
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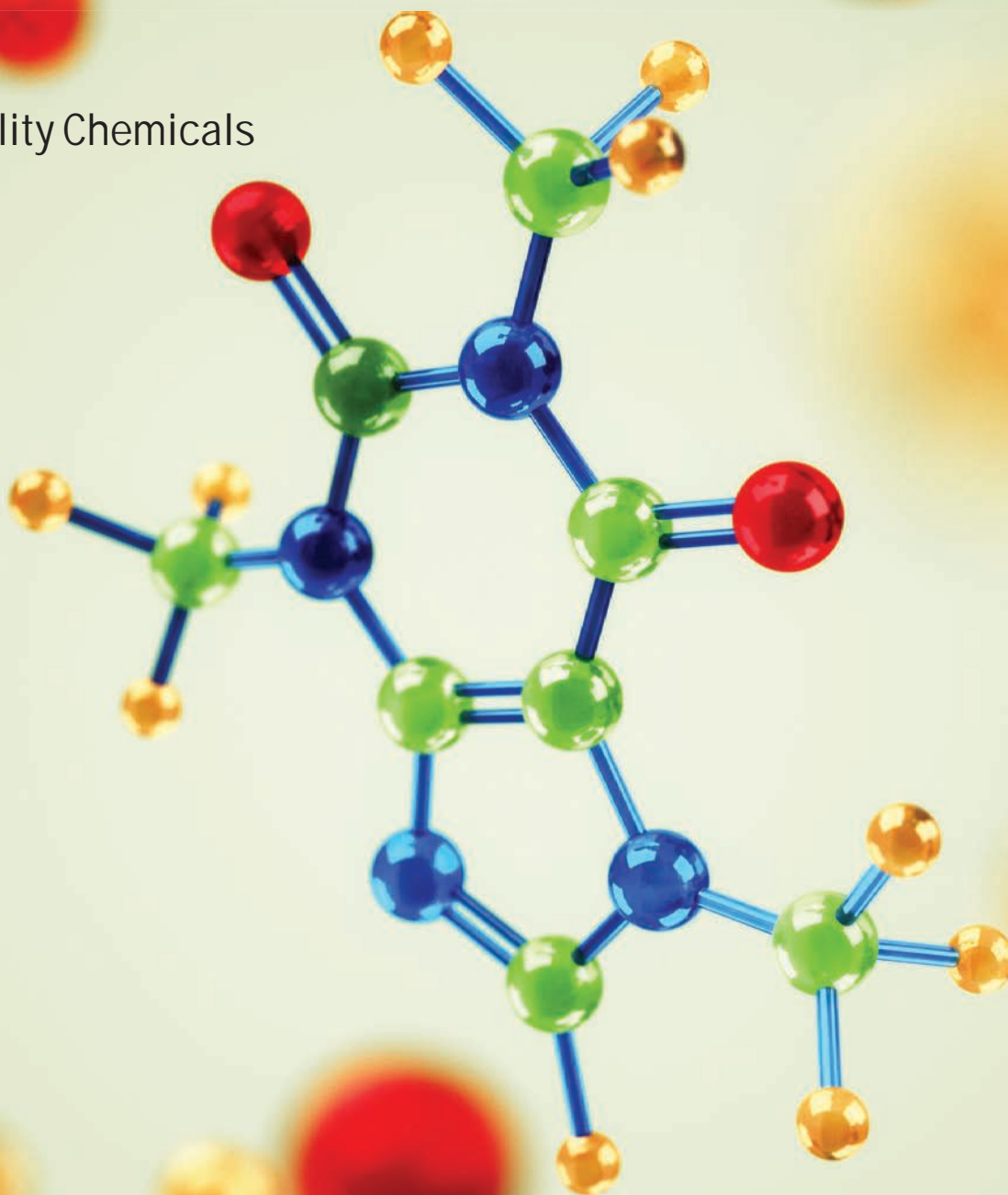
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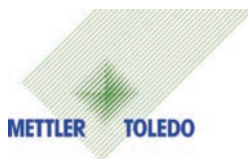
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8 Ways to Ensure Quality and Efficiency

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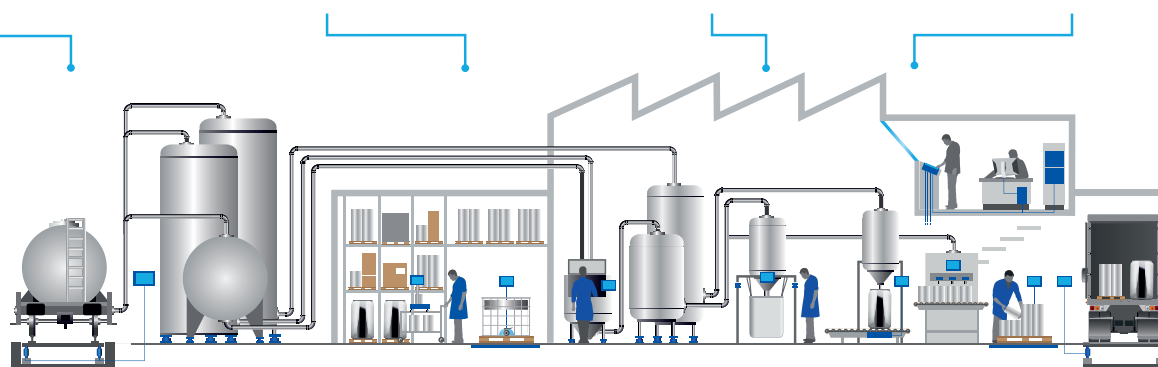
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Boost Throughput

7. Scale Performance Verification

Increase Uptime



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Efficient Material Handling

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Ensure Accuracy

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Launch of Reference Fuels fosters vision of AtmaNirbhar Bharat: Hardeep S Puri



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

New Delhi, India: The Launch of Reference Fuels produced by Indian Oil's Paradip & Panipat Refineries, utilizing the intellectual talent available at Indian Oil's Research & Development Centre, is a dynamic achievement", said Hardeep Singh Puri, Minister of Petroleum & Natural Gas and Housing & Urban Affairs. Pankaj Jain, Secretary, Ministry of Petroleum & Natural Gas and S.M. Vaidya, Chairperson, Indian Oil were also present at the event. Addressing the gathering, Hardeep Singh Puri said, "This step stamps our indigenous technical prowess which gives impetus to the Make in India mission of the Government of India."

The Minister said that this is the first time that India is venturing into the production of Reference Gasoline and Diesel Fuels. He mentioned, the home-grown development of these products in-line with international benchmarks testifies to the brilliance and relentless hard work of Indian Oil. This achievement not only reduces

India's dependence on imports but also catapults India's energy industry to the select global players armed with exclusive competencies.

The Petroleum & Natural Gas Minister spoke about the four-pronged energy security strategy adopted by the Ministry of Petroleum & Natural Gas. He held that the strategy guided by Prime Minister Narendra Modi's vision of transforming India into an 'energy-independent' nation by 2047, includes, Diversification of energy supplies, Increasing India's exploration and Production footprint, Alternate energy sources and meeting energy transition through Gas based economy and Green Hydrogen and EVs.

Government will ensure India is competitive in the Green Hydrogen export market: R. K. Singh



R. K. Singh, Union Minister of Power and NRE

New Delhi, India: Union Minister of Power and New and Renewable Energy R. K. Singh held a meeting with concerned Ministries, Green Hydrogen Developers and Industry Associations in New Delhi to understand the issues faced by the developers and how the Government could help overcome these issues.

Speaking on occasion, Singh said that the Ministry of Power and Ministry NRE will work with concerned ministries to ensure Ease of Doing Business for Hydrogen Developers.

Anuj Jain appointed as Director (Finance) of Indian Oil



Anuj Jain has taken over as the **Director (Finance) on the Board of Indian Oil Corporation.** Prior to this appointment, he was serving as the Chief General Manager (Finance) at the Company's Refineries Headquarters. A Chartered Accountant, Jain brings with him a rich experience of over 27 years with the energy major, at its refinery & marketing locations and Corporate Office. His expertise spans functions like corporate finance, treasury & fund management, supply chain optimisation, pricing, shipping, and taxation, among others.

Jain has also helmed the finance function in Lanka IOC PLC., a subsidiary of IndianOil, and served as a Board Member and a member of the Audit Committee for Ceylon

Petroleum Storage Terminals Limited (CPSTL), a key petroleum entity in Sri Lanka. Jain has been at the forefront of formulating pivotal business strategies, ensuring smooth transition in the evolving energy landscape.

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The industry representatives were requested to share the locations of their upcoming green Hydrogen/Ammonia plants and the corresponding withdrawal capacity required, so that the required transmission infrastructure can be planned accordingly. Thereafter, the industry stakeholders raised various issues, such as SEZ policies, regulatory provisions for enabling dual connectivity, certain contractual conditions, demand charges being levied by States and other issues related to cost reduction of Green Hydrogen production in India.

R. K. Singh assured the Industry that all their concerns would be acknowledged and the Government would take all possible steps for the resolution of their outstanding issues at the earliest. The Minister also said that India is committed to being a competitive player in the Green Hydrogen and its derivatives export field. He also announced that no compromise would be made with regard to Grid Security while ensuring that production of green hydrogen stayed competitive.

Coal Ministry plans 1,404 million tonnes production by 2027

New Delhi, India: Coal Ministry stated that it has plans to produce 1404 million tonne (MT) of coal by year 2027 and 1577 MT by year 2030, at current level production of about one billion tonne per annum. The coal to be supplied to domestic coal-based power plant is around 821 MT for the current year.

The Ministry of Coal has taken note of the additional coal requirement for supplying to additional 80 GW thermal capacity to be added in the country by 2030. The coal requirement for additional thermal capacity would be around 400 MT at 85% PLF, and the actual requirement may be lower depending on the generation requirements in the coming times due to contributions from renewable sources. Ministry of Coal has plans to produce additional quantity of coal in its production enhancement plan and will ensure adequate availability of domestic coal to thermal power plants.

ONGC commences oil production off Andhra coast

Andhra, India: ONGC, India's state-owned Oil and Gas Company, will start oil production from its USD 5 billion project off the Andhra coast within the next few weeks. This production will originate from the KG-DWN 98/2 block, marking the second deep-sea project in the east coast following RIL-BP's KG-D6 acreage. The venture is expected to play a significant role in bolstering domestic oil production.

The endeavor will initially produce associated gas at a rate of 2 million cubic meters per day, while actual gas production is slated to commence in May 2024, with an anticipated output of 7 to 8 million standard cubic meters per day. Peak oil production of 45,000 barrels per day is projected to be achieved sometime in 2024-25. Additionally, the USD 1.6 billion infrastructure being constructed for the block represents the largest subsea development project in the country.

Sandeep Kumar Gupta appointed as Chairman - Mahanagar Gas Limited



Sandeep Kumar Gupta has been appointed as **Director on the Board** and elected as **Chairman of Mahanagar Gas Limited** effective from 31st October 2023. Sandeep Kumar Gupta is Chairman & Managing Director of GAIL (India) Limited, India's leading natural gas company with diversified interests across the natural gas value chain of trading, transmission, LPG production & transmission, LNG re-gasification, petrochemicals, city gas, E&P, etc. Gupta is the Chairman of GAIL Gas Limited, Brahmaputra Cracker and Polymer Limited and Director of Petronet LNG Limited. He is also Chairman of Standing Conference of Public Enterprises (SCOPE), an apex professional organization representing the Central Government Public Enterprises. Before joining GAIL in October 2022, Mr. Gupta held the position of Director (Finance) of Indian Oil Corporation Limited.

Gupta is a Fellow member of the Institute of Chartered Accountants of India and has received prestigious recognition such as "CA CFO - Large Corporate - Manufacturing and Infrastructure Category" in January 2021 by ICAI, adjudged among Top 30 CFOs in India by StartupLanes.com in May 2022 and Best CEO - Oil & Gas Sector 2022-23 by India Today. He has wide experience of over 35 years in the Oil & Gas Industry.



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L&T bags off shore project in Middle East



S N Subrahmanyam,
CMD, L&T

New Delhi, India: Larsen & Toubro (L&T)'s hydrocarbon business announced that it has bagged an offshore project for a gas compression plant worth over ₹ 15,000 crore in the Middle East. It has secured a Letter of Intent for yet another Ultra-Mega Onshore project from a prestigious client in the Middle East for a Gas Compression plant stated the organization.

The scope of work includes procurement and construction for a gas processing plant, consisting of inlet separation facilities and booster compression system, among others, in new onshore facilities and its integration with existing gas processing plants. We are proud of our LTEH team," said L&T Chairman & Managing Director S N Subrahmanyam.

"In the ever-evolving landscape of the oil and gas sector, twin wins for LTEH demonstrates our execution and delivering capabilities of ultra-mega projects," said Subramanian Sarma, Whole-Time Director and Senior Executive Vice President. (Energy).

RIL Q2 revenue up by 18.8%



Mukesh D. Ambani,
CMD, Reliance Industries
Limited

Mumbai, India: Reliance Industries Ltd. posted results for the second quarter ended September 30, 2023. The company's Gross Revenue stood at ₹ 255,996 crore (₹ 30.8 billion), up 1.2% Y-o-Y, supported by continuing growth momentum in consumer businesses, while EBITDA increased by 30.2% Y-o-Y to ₹ 44,867 crore (USD 5.4 billion).

The company's Global oil demand in 2Q FY24 rose 2.5 mb/d Y-o-Y to 102.7 mb/d, with strong demand mainly from China and India. Jet/Kero and gasoline posted robust demand growth Y-o-Y at ~1 mb/d and ~0.7 mb/d respectively, while diesel demand saw relatively lower growth of ~0.2 mb/d. Crude oil benchmarks declined Y-o-Y due to macro-economic headwinds on high interest rates, lower industrial activities, and sentiments shifting from risk premium to fundamentals.

Commenting on the results, Mukesh D. Ambani, Chairman and Managing Director, Reliance Industries Limited said: "Strong operational and financial contribution from all business segments has helped Reliance deliver another quarter of robust growth. I am happy that Jio remains committed to the vision of a digital India through the launch of two innovative and transformative offerings, JioAirFiber and JioBharat phone. Based on our state-of-the art standalone 5G network, JioAirFiber significantly expands the reach and benefit of high-speed connectivity to millions of households across India. Resilient performance of the O2C segment despite volatility in energy markets was led by strong growth in fuel demand in a supply-constrained market. Weak global demand and supply-overhang continued to impact downstream margins".

Chemplast Sanmar's CMC division signs Lol with an agrochemical firm

Chennai, India: The Custom Manufactured Chemicals Division of Chemplast Sanmar Limited has signed a Letter of Intent (LOI) with a global agrochemical innovator to manufacture a new pipeline Active Ingredient (AI). The LOI covers a period of 5 years. Commercial supplies are expected to start from CY 2025. This new product will be manufactured in the recently commissioned production block.

Commenting on this, Dr. Krishna Kumar Rangachari, Deputy Managing Director, Chemplast Sanmar Limited, stated that "Last quarter, we announced that we had been selected to manufacture an AI. This is an important milestone for the Company since this is the first time, we will be involved in the development of an AI. This is the third LOI we have signed over the past 12 months. This expansion reiterates our customers' confidence in our ability to integrate a world-class research and development capability with a broad range of chemical technologies at production scale."

The Custom Manufactured Chemicals Division manufactures advanced intermediates for agrochemical, pharmaceutical, and fine chemical innovators. Led by a qualified team of chemists and engineers, the division has invested in state-of-the-art production blocks, Pilot and R&D facilities to handle a wide range of chemistries and processes.



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NTPC achieves significant growth in Coal production and dispatch

New Delhi, India: NTPC Ltd., India's leading integrated power producer, has reported a substantial growth of 99% in coal production from its captive mines during the first quarter of the fiscal year 2024, as compared to the corresponding period in the previous year. The company achieved an impressive coal production of 8.48 million metric tons (MMT) during Q1 FY24, as compared to 4.27 MMT in Q1 FY23.

In addition, NTPC has also achieved a coal dispatch of 8.82 MMT in Q1 FY24, marking a significant 112% increase over the previous year for the same period. This outstanding performance reflects NTPC's relentless commitment to enhancing coal production from its captive mines and ensuring efficient supply to meet the nation's energy needs.

To achieve sustained growth in coal production, NTPC has implemented a range of strategies and technologies. These include the adoption of rigorous safety measures, improved mine planning, equipment automation, workforce training, and the implementation of continuous monitoring and analysis systems. These initiatives have played a vital role in optimizing operations, enhancing productivity, and ensuring the safety of the workforce.

NTPC remains committed to delivering reliable and sustainable power to the nation. This remarkable growth in coal production and dispatch is a testament to NTPC's dedication to operational excellence and its contribution to meeting India's energy demands. The company will continue to explore innovative technologies and sustainable practices to further enhance its performance and support the nation's energy goals.

Malaysia's Gentari and Singapore's GIC tie up with Greenko

Kuala Lumpur, Malaysia: Gentari, the clean energy division of Malaysia's Petronas and AM Green, set up by the founders of Greenko, announced the signing of definitive agreements together with an affiliate of GIC to produce 5 million tons per annum (MTPA) of green ammonia by 2030 – equivalent to about 1 MTPA of green hydrogen.

The partnership will focus on the production of green

ammonia across multiple locations in India, which is expected to accelerate efforts to achieve net zero targets in India as well as in OECD markets. Exports of green ammonia to key OECD markets, such as Germany, Japan, South Korea, as well as Singapore from this platform is expected to begin in late 2025.

The green ammonia will be produced by a unit of AM Green, known as AM Green Ammonia Holdings. Post-investment from Gentari, GIC and AM Green, the unit will be a fully funded platform that will invest, in the Indian regions of Andhra Pradesh, Tamil Nadu, Gujarat, Karnataka, and Himachal Pradesh.

The 5 MTPA of green ammonia will be equivalent to about 1 MTPA of green hydrogen, representing a fifth of India's target for green hydrogen production under the country's National Green Hydrogen Mission and 10 per cent of Europe's target for green hydrogen imports by 2030. Achieving this scale of production will place the new venture among the world's pioneers in large-scale and cost-competitive green ammonia production.

GAIL Q2 revenue stood at ₹ 31,823 crore



Sandeep Kumar Gupta,
CMD, GAIL

New Delhi, India: GAIL (India) Limited reported Revenue from Operations of ₹ 31,823 crores in Q2 FY24 as compared to ₹ 32,227 crores in Q1 FY24. PBT registered a jump of 66% to ₹ 3,130 crores in Q2 FY24 as against ₹ 1,889 crores in previous quarter and PAT followed the way with an increase of 70% to ₹ 2,405 crore

in Q2 FY2, as against ₹ 1,412 crore in previous quarter. During the quarter, Natural gas transmission volume stood at 120.31 MMSCMD in Q2 FY24 as against 116.33 MMSCMD in Q1 FY24. Gas marketing volume stood at 96.96 MMSCMD as against 98.84 MMSCMD in previous quarter. LHC sales stood at 242 TMT as against 247 TMT and Polymer sales stood at 168 TMT as against 162 TMT in comparison to previous quarter.

Sandeep Kumar Gupta, Chairman & Managing Director, GAIL said that during the quarter the company has performed well specially on the strength in Gas Transmission segment which will continue to perform better. He said performance during the quarter was constrained due to lower realisation in Polymers and LPG which are expected to be better going forward.



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HPCL H1 consolidated net Profit stood at ₹ 12,592 Crore

Mumbai, India: Hindustan Petroleum Corporation Limited (HPCL) has posted consolidated profit after tax (PAT) of ₹ 12,592 crore for the first half of 2023, a remarkable reversal from the consolidated net loss of ₹ 11,033 crore incurred in the same period last year. The company's strong performance was primarily driven by improved gross refining margins (GRMs), which averaged USRs 10.49 per barrel during the half-year, compared to USRs 12.62 per barrel in the corresponding period last year.

HPCL's standalone PAT for the half-year also reached a record high of ₹ 11,322 crore, compared to a standalone net loss of ₹ 12,369 crore in the same period last year. The company's standalone PAT for the quarter ending September 2023 stood at ₹ 5,118 crore, a substantial improvement from the net loss of ₹ 2,172 crore incurred in the corresponding quarter last year.

HPCL's improved financial performance is a testament to its effective strategies to navigate the volatile oil market and its commitment to delivering value to its stakeholders.

Deepak Fertilisers and Petrochemicals Q2 net profit stood at ₹ 63 crore

Pune, India: Deepak Fertilisers And Petrochemicals Corporation Limited, one of India's leading producers of industrial chemicals and fertilizer's, announces its results for the quarter ended September 30, 2023. The company posted net profit at ₹ 63 crore for the second quarter, while operating revenue stood at ₹ 2424 crore.

Commenting on the performance, Sailesh C. Mehta, Chairman & Managing Director, Deepak Fertilisers And Petrochemicals Corporation said, "While the last year comparative base was unusually on higher side, DFPC performance in Q2FY24 underscores our resilience and adaptability under varied market volatilities and geopolitical challenges. Our Mining Chemicals segment demonstrated remarkable growth, achieving record sales volumes despite seasonal slowdowns and pricing pressures from dumping of cheap Russian products as they faced global embargo. The Ammonia plant began commercial production in Q2 and the production has now stabilized. With this facility, we have significantly reduced our dependency on imported ammonia, which will enhance our operational efficiencies and eliminate global price volatility impacts"

Tata Chemicals Q2 consolidated income from operations stood at ₹ 3998 crore

Mumbai, India: Tata Chemicals Limited reported consolidated income from operations of ₹3,998 crore, compared to ₹ 4,239 crore in the corresponding quarter of the previous year after the half year end. Consolidated EBITDA stood at ₹ 819 crore for the quarter, compared to ₹ 920 crore in Q2FY23. Amalgamated PAT stood at ₹ 495 crore for the quarter, compared to ₹ 685 crore in Q2FY23. PAT includes an exceptional item of ₹ 102 crore.

On a standalone basis, income stood at ₹ 1,066 crore for the quarter, compared to ₹ 1,185 crore in Q2FY23. PAT on a standalone basis stood at ₹ 236 crore, compared to ₹ 243 crore for the corresponding quarter of the previous year. The consolidated gross debt dropped to ₹ 6,048 crore, as compared to ₹ 6,296 Cr as of March 31, 2023. Also, the cash and cash equivalents stood at ₹. 1,701 crore, compared to ₹ 2,398 crore as of March, 2023.

The company expects the medium-term demand-supply situation to remain balanced driven by sustainability trends especially for applications like solar glass and lithium.

14th AOSDAC reflects industry's growing focus on sustainable practices

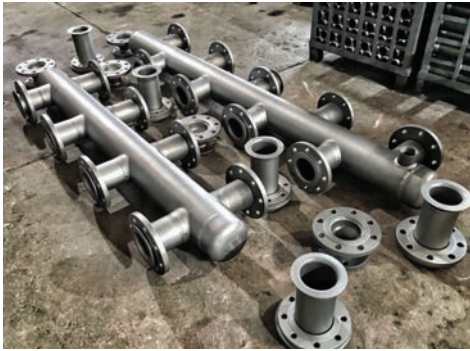


Mumbai, India: The Indian Home and Personal Care Industry Association (IHPCIA) recently hosted the 14th Asia Oceania Soap & Detergent Associations Conference (14th AOSDAC) in October 2023 at Mumbai. The conference brought together industry leaders, experts, and policymakers from across Asia and Oceania to discuss the future of the home care industry and its commitment to sustainability.

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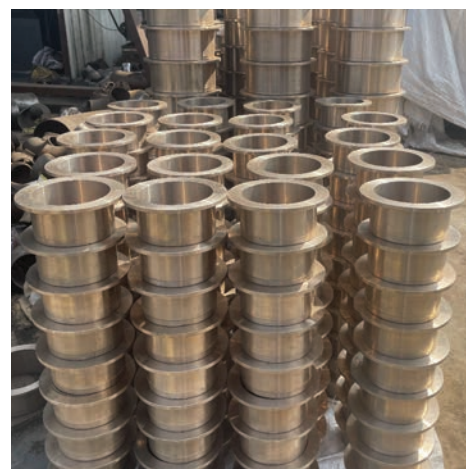
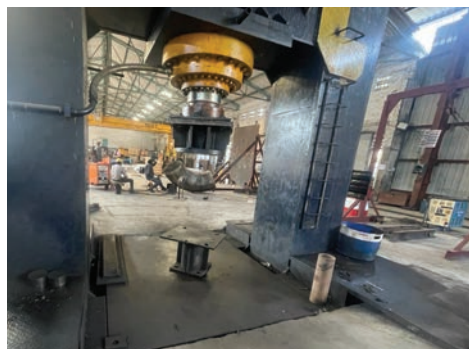
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The main theme of the conference was “Future of Green,” reflecting the industry’s growing focus on sustainable practices and environmental responsibility. The conference explored a range of topics related to sustainability, including Sustainable sourcing and manufacturing, Eco-friendly product formulations, Reducing waste and promoting circularity and Educating consumers about feasible practices.

The conference also featured presentations from international associations and industry leaders on market dynamics, opportunities, and challenges. The event provided an opportunity for interaction and networking with National and International industry players.

“A 100% bio-based surfactant is composed of both a bio-sourced head and a bio-sourced tail. Today, it represents 5% of the total surfactant market globally. It is the most dynamic segment, growing by more than 20% per year. A green surfactant is not only limited to bio-based raw material sourcing; it is also about the manufacturing process”, said Sanjay Trivedi Director, IHPCIA. He further acknowledged that the 14th AOSDAC was a crucial platform for the home care industry to come together and discuss how we can collectively build a more viable future. “We are committed to working with our partners to reduce our environmental impact and promote sustainable practices throughout the supply chain,” he remarked.

The conference attracted over 500 delegates from across Asia and Oceania, along with great industry performers like Dr. Sandeep D Gharat, Godrej Industries Ltd (Chemicals), Prof Rakesh K Trivedi, Harcourt Butler Technical University (HBTU) Kanpur, RAJIVE SHAH Managing Director, Sauradip Chemical Industries Pvt. Ltd. Indorama Ventures, and ECOF industries Pvt. Ltd.

Tuticorin Alkali Chemicals & Fertilizers Ltd Pioneers Green Soda Ash Production

Singapore/Chennai, India: Tuticorin Alkali Chemicals & Fertilizers Limited (TFL), part of the green energy solutions business of AM International, Singapore achieved a global milestone in sustainable manufacturing with the start of commercial production of green soda ash, an ingredient used to make products of everyday use. The company achieved this breakthrough by leveraging cutting-edge carbon-capture technology to establish carbon-neutrality in the manufacture of soda ash.



Ashwin Muthiah, Founder Chairman AM International, Singapore

Ashwin Muthiah, Founder Chairman AM International, Singapore ceremonially launched the inaugural production batch of green soda ash at its plant in Thoothukudi, Tamil Nadu. It is the first company in the world to manufacture carbon-neutral soda ash.

To produce green soda ash, TFL set up a CO₂ Recovery Plant to capture carbon from coal used as fuel in its boiler for steam production. The carbon is converted into biomass fuel to eliminate fossil-fuel usage, thus achieving carbon-neutrality in the manufacturing process. Further, TFL uses green ammonium, imported from Egypt, to produce its near-zero soda ash.

Congratulating the TFL team, Ashwin Muthiah, Founder-Chairman, AMIH, Singapore, said, “It is a matter of great pride to achieve this carbon-neutral milestone. It aligns with our ESG vision of producing greener product solutions for our customers with the larger goal of contributing to a cleaner environment. The R&D efforts have borne fruit, whereby TFL is able to capture CO₂ from flue gases of bio-mass boiler and reuse it to deliver a near-zero carbon effect, a move towards a circular economy.”

It has also been relentlessly pursuing its ESG goals and prides itself on using green technology. The company’s ground-breaking project to make near-zero soda ash is an endeavor to move away from the use of fossil fuels and reduce greenhouse gas (GHG) emissions.

TFL has tied up with one of the world’s largest MNCs for the supply of green soda ash in the manufacture of detergents, and is optimistic about forging further partnerships. With its latest accomplishment, TFL has taken a step towards the AM International’s commitment to the circular economy, and a cleaner, more sustainable future. ■

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PROJECT UPDATES

GAIL signs agreement with BPCL for supply of Propane for GAIL's Petrochemical Plant at Usar



From left to right: Shri Sanjay Kumar, Director (Marketing), GAIL, Shri Kamlesh Sharma, Executive Director (Marketing Retail), GAIL, D. V. Mamadapur, Executive Director (LPG), BPCL and Shri Sukhmal Jain, Director (Marketing), BPCL.

New Delhi, India: In a significant move to secure availability of feedstock for its petrochemicals production, GAIL (India) Limited signed an agreement with Bharat Petroleum Corporation Limited for 15-year supply of Propane for its upcoming petrochemical plant in Usar, Maharashtra.

The agreement was signed here in the presence of Sukhmal Jain, Director (Marketing), BPCL and Sanjay Kumar, Director (Marketing), GAIL by Kamlesh Sharma, Executive Director (Marketing Retail), GAIL and D. V. Mamadapur, Executive Director (LPG), BPCL.

The 15-year supply contract, estimated at a value of over ₹. 63,000 crore, will see GAIL procuring 600 KTPA of Propane from BPCL's LPG import facility at Uran, which is presently capable of handling 1 MMTPA of LPG imports and is undergoing expansion to accommodate 3 MMTPA of propane and butane imports. The strategically positioned GAIL's PDH-PP project in Usar, Maharashtra, will be India's first propane dehydrogenation (PDH) plant, which is likely to commence operations in 2025. The PDH unit will boast a nameplate capacity of 500 KTPA, with propylene production seamlessly integrated into a polypropylene (PP) plant of equal capacity. This pioneering venture aligns perfectly with the surging demand for polypropylene, which is projected to reach 6.3 million tons by 2025, up from 4.9 million tons in 2020.

Tata Steel Commences construction of ₹ 2,600 Crore Green Steel Plant in Ludhiana

Mumbai, India: Tata Steel, a prominent player in the steel industry, marked a significant milestone by

holding the groundbreaking ceremony for its state-of-the-art 7.50 lakh tonne per annum scrap-based electric arc furnace (EAF) plant in Ludhiana. This pioneering venture, set to revolutionize the steel manufacturing landscape, will receive an initial investment of ₹2,600 crore and is slated for commissioning by March 2025.

Representing Tata Steel's foray into low-carbon green steel production in India, this groundbreaking project aligns with the global commitment to reducing carbon emissions. The Ludhiana plant will incorporate cutting-edge technology, including electric arc furnaces, renowned for their energy efficiency and substantial reduction in carbon emissions compared to traditional steelmaking methods.

Ludhiana was strategically chosen as the site for this groundbreaking endeavor due to its proximity to the Hi-Tech Valley Industrial Park and a bustling auto hub. This proximity ensures a seamless supply of steel scrap, which will be transformed into long steel products under the flagship Tata Tiscon brand.

Tata Steel's Managing Director, TV Narendran, expressed his enthusiasm for this forward-looking initiative, emphasizing that the Ludhiana facility marks a pivotal step in the company's pledge to sustainable manufacturing and the ambitious goal of achieving Net Zero emissions by 2045.

Cabinet approves Green Energy Corridor (GEC) Phase-II - project in Ladakh

New Delhi, India: The Cabinet Committee on Economic Affairs, chaired by the Prime Minister, Narendra Modi, approved the project on Green Energy Corridor (GEC) Phase-II - Inter-State Transmission System (ISTS) for 13 GW Renewable Energy Project in Ladakh. The project is targeted to be set up by FY 2029-30 with total estimated cost of ₹ 20,773.70 crore and Central Financial Assistance (CFA) @ 40 percent of the project cost i.e. ₹ 8,309.48 crore.

The project will contribute to achieving the target of 500 GW of installed electricity capacity from non-fossil fuels by year 2030. The project will also help in developing long term energy security of the country and promote ecologically sustainable growth by reducing carbon footprint. It will generate large direct & indirect employment opportunities for both skilled and unskilled personnel in power and other related sectors, especially in Ladakh region. This project is in addition to Intra-State Transmission System Green Energy Corridor Phase-II (In STS GEC-II), which is already under implementation

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in the States of Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu and Uttar Pradesh for grid integration and power evacuation.

NLCIL's lignite-to-methanol project likely to be completed by March 2027

New Delhi, India: The lignite-to-methanol project of NLC India Ltd, estimated at ₹ 4,394 crore, at Neyveli, in Tamil Nadu is likely to be completed by March, 2027, the company said in a regulatory filing.

"The total period of the project is 42 months from the date of Letter of Award (LOA)," it added.

In October last year, NLC had floated a global tender for awarding the project through project management consultancy Engineers India Limited (EIL) for the gasification block (LEPC-1) of its Lignite-to-Methanol project at Neyveli, in Tamil Nadu.

Odisha government signs three MoUs for semiconductor manufacturing

Odisha, India: The Odisha government signed an memoranda of understanding (MoUs) with three organizations to foster the growth of a semiconductor manufacturing ecosystem. These entities include the India Electronic and Semiconductor Association (IESA), Synopsys, and the Electronics and Computer Software Export Promotion Council (ESC). IESA will collaborate with the state government to develop capacity-building programs, promote the semiconductor ecosystem through events, and create educational materials.

Synopsys will partner with Odisha in areas such as the O-Chip program, talent transformation, workforce development, assessing the state's readiness for semiconductors and very large-scale integration (VLSI) domains, and providing internship and placement assistance to students from the state's engineering institutions. ESC will focus on promoting electronics and IT/ITeS exports from India.

Lubrizol and Grasim break ground on world's largest CPVC Resin plant



Gujarat, India: Lubrizol, a global leader in specialty chemicals, and Grasim Industries Limited, a flagship company of the Aditya Birla Group, broke ground on the first phase of a 100,000 metric-ton CPVC resin plant in Vilayat, Gujarat, India. The facility located at the Grasim Industries' site will be the largest single-site capacity for CPVC resin production globally, designed to meet rising CPVC demand for piping applications in India, as well as neighboring countries like Nepal, Bangladesh and Indonesia. This resin plant will utilize Lubrizol's most advanced CPVC resin manufacturing technology. This technology, coupled with Grasim's expertise in reliable manufacturing, will enable access to high-quality, locally manufactured CPVC material.

In addition to the resin site, Lubrizol is doubling its existing CPVC compound manufacturing capacity at its Dahej, Gujarat, India site from 70,000MT to 140,000MT. When coupled, these projects advance Lubrizol's stands

to be the largest producer and the only company with end-to-end CPVC capability, allowing for Lubrizol's partners to meet the projected 10-12% annual increase in

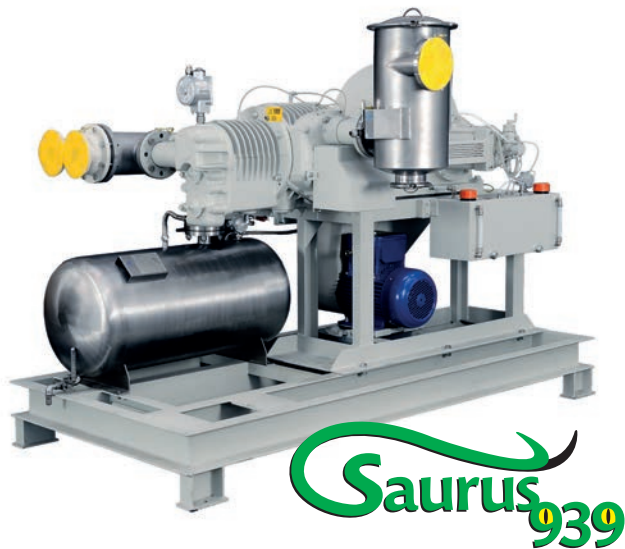
CPVC demand within the India market.

Phase one of the resin site in Vilayat, as well as the additional line in Dahej, are expected to be operational by early 2025. With the upcoming project in Vilayat and expansion of the Dahej plant, Lubrizol expects to add 150 to 200 new employees in the next year at this location, with an intention to add more jobs over the next several year.

Commenting on the occasion, Scott Mold, General Manager, Lubrizol revealed, "Investing in India will ensure our ability to service and support the growing demand in India and the country's increasing quality expectations when it comes to improving access to clean, safe drinking water for millions globally. India is a key market for building and expanding our global CPVC leadership position." ■

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The Big 9 drivers: Accelerating Growth through a Carbon Intelligent & Resilient capacity

While global overcapacities and leverage in the steel industry have adversely affected profitability and sustainability, opportunities in India remain strong.

The baseline

The global steel industry: The steel industry has been struggling with pricing stress amid shifts in demand and consumption patterns and changing environmental norms.

"Five megatrends" have made the environment especially challenging:

Global steelmaking capacity is showing an upward trend over the past decade (see figure 2). This has created challenges in supply demand scenarios and price-based competition in commodity markets. With renewed focus on "Net Zero" it is increasingly important for steel players operating with variable process route to be competitive focusing on sustained growth outcomes.

The absence of China from the world export market and higher import of steel from China are significant factors

that could ensure steel prices remain strong. In contrast, domestic players' demand-supply instability in the global market presents an export opportunity.

India's steel industry

An up-cycle in steel prices is expected to continue in FY 22, with stimulus packages unveiled by various countries keeping demand for steel high.

India has raw materials cost advantage with iron ore and domestic coal reserves. The cost curve will decrease with raw materials, logistics, productivity, and energy improvements. The steel industry will grow in close correlation with overall economic growth.

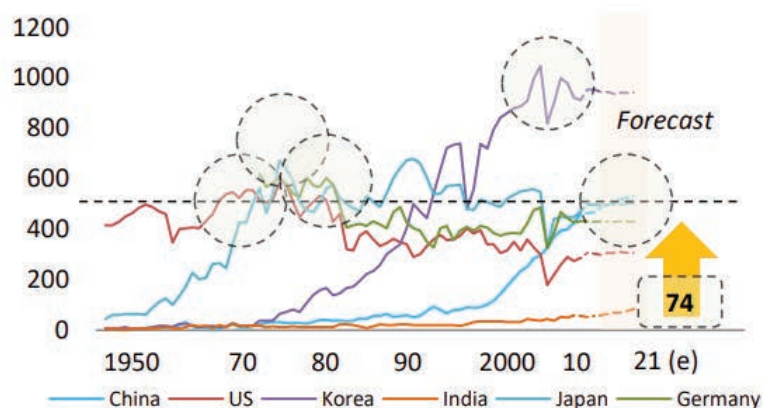
As we progress and given that the steel industry is on the cusp of rapid transformation, Frost & Sullivan has identified nine enablers for India to create a globally competitive steel industry.

Ensuring domestic demand through "Make in India" and the rise in steel prices enabled the Indian steel sector to remain an attractive destination for global investments with low-cost resources to increase capacity utilization and effectively meet the rising demand.

Fig 1: Global steel consumption (kg/ capita)

Crude steel consumption

Kg per capita



1. India's per capita steel consumption is 1/3rd of world average and manufacturing oriented policies to accelerate steel consumption
2. Opportune time for investments in productivity and sustainability while planning for future investments in capacity

Source: Frost & Sullivan, Macquarie

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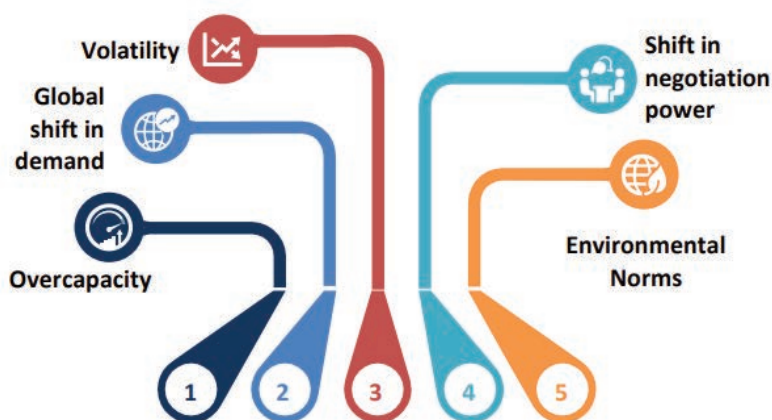
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Global & Indian Steel Scenario: Correlation between GDP growth and steel use

We expect an upward trend in the capital expenditure for plants incorporating private-public steelmakers in India. Alternative financing methods and hedging costs reduction may help make the financing options more competitive for future expansions, ensuring cost leadership.

The earnings for steelmakers took a hit because of supply-demand instability and liquidity issues.

An analysis of India's large integrated steelmakers with the small-medium-size players represent that the small-medium-size steelmakers are more prone to volatility in input costs since raw material cost covers 55% of their revenue as opposed to 40% for integrated steelmakers.

Comparing Indian steel producers with global best-in-class peers highlights a 70 percent lag in R&D spending as a percent of revenue, a 38 percent lag in CO₂ emissions per ton of crude steel, and a 5 percent lag in process yield.

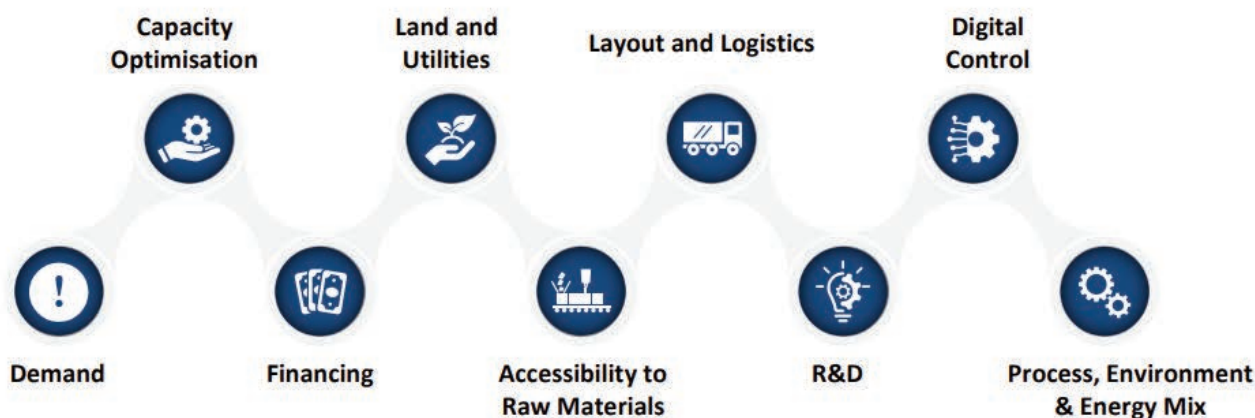
EAF based steel plants can explore several vital opportunities to further improve the cost, quality, and flexibility of operations based on price dynamics and product goals with a charged mix like pig iron, HBI, DRI, and scrap recycling to promote the concept of circular economy.

Our analysis indicates that in 2022, more focus will be on green hydrogen-based steel production. Scrap recycling utilizing a mini-mill will play a critical role in reducing the total emission footprint.

Accelerating India's growth trajectory in 2022 and beyond

India has the opportunity to lead in 2022 by focusing on the following key imperatives:

- India's growing economic development necessitates a top-tier steel industry to reinforce our development to 8-9 percent, with steel capacity reaching about 124 MT in FY 22. This is considering the Union Budget for 2021-22 with a sharp 35% y-o-y increase in allocation of CAPEX at ₹5.6 lakh crore. Lately, production cuts and lowering demands from China is reducing overcapacities.
- As the industry grows, the steelmakers are looking at realigning their focus from capacity to engineer intelligent, resilient, and environmentally friendly capabilities for the future with the flexibility to combine direct reduction, Blast furnace, arc furnace, and BOF technologies. This will increase the ability to add incremental capacities at lower lifecycle



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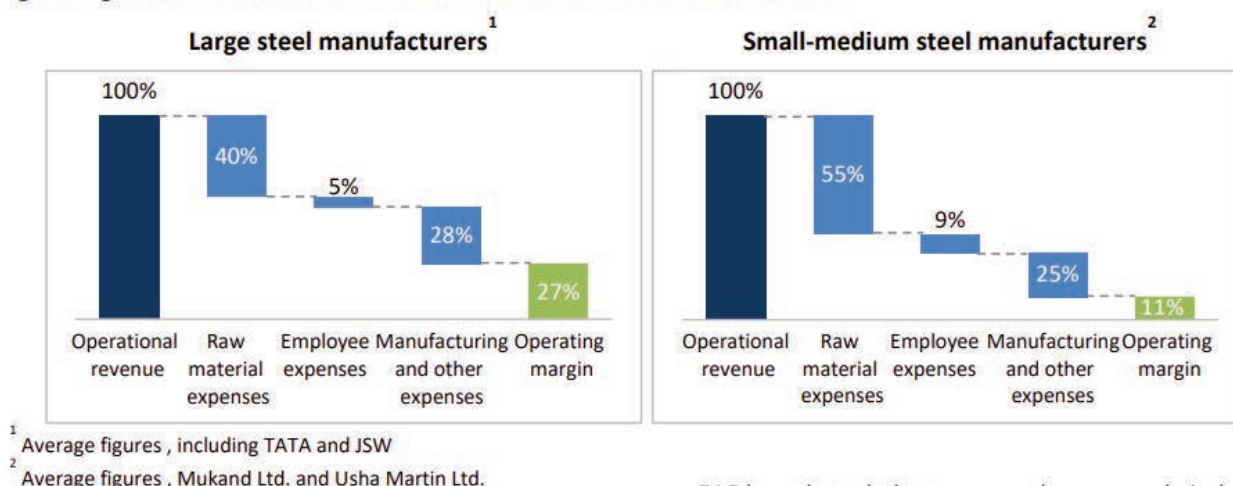
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Fig 5: Large steel manufacturers & Small and medium steel manufacturers



costs. Additionally, the flexibility to complement clean coal energy sources like coal gasification can make steel at a lower carbon footprint and sustained profitability, minimizing risk.

- Availability and volatility of raw material prices will continue to destabilize margins. While India has an advantage in iron-ore & coal – the proper sourcing, raw material blending, M&As combined with flexible capacity can push up the EBITDA/ ton. Flexibility in raw material inputs, process innovation, and sourcing strategy will continue to play a critical role in 2022.
- India has particular challenges concerning the productivity of the plants. A significant part of our blast furnaces run around 2 t/m³/day productivity compared to over 2.8 t/m³/day in the benchmarked operations. We emit around 1.8-2.0 t of Co₂/ton of steel. It is expected to focus more on operations, energy, and carbon efficiency to gain a competitive advantage.
- Rail and road logistics is the primary mode of transportation In India. Logistics cost for bulk movement in India is 2.5X times more than other developed nations. Continued investments in rail, slurry pipelines, and coastal infrastructure to reduce logistics costs by about \$30-\$40/ton.
- As the industry grows in 2022, our assessments show that flexible plant configuration, multi-modular logistics, efficient utilization of natural resources, efficiency, and digital control can further increase the steel industry's EBITDA/ton by more than \$50-\$60.
- We have the chance to lead by harnessing the power of flexibility, technology, growth, and innovation. The overall industry looks uneven due to its cyclical nature. However, steelmakers have tremendous opportunities with a sustained focus on growth imperatives. The shift from commodity steel to value-added and carbon-efficient products integrates the technical, economic, logistical, and digital dimensions of steel making model to ensure the healthy levers of profitability realizing the steel mission of 2030-31. ■

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India's Specialty Chemicals Revolution: Navigating Global Transformations

RAJENDRA GOGRI

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The specialty chemicals sector in India is currently on a remarkable growth trajectory, driven by a noteworthy global shift away from China and a decline in chemical production within the European Union (EU). The EU has been grappling with consistent reduction in specialty chemical production due to stringent environmental regulations, high energy costs and weakening demand. **Rajendra Gogri, Chairman & Managing Director, Aarti Industries Ltd.** talks about the revolution, India's Specialty Chemicals is undergoing. He also spoke about the challenges and opportunities for the Indian specialty chemical manufacturers.



GUEST COLUMN

staggering USD 1,000 billion by then. Moreover, India is expected to account for over 20% of the incremental global consumption in this sector over the next two decades, solidifying its position on the world stage. The Indian chemical companies have injected USD 91 billion into new projects during the fiscal year 2023. Over the past six fiscal years, from FY17 to FY23, the gross block has expanded by 2.7 times, revenue has surged by 2.8 times, and EBITDA has grown by threefold. With demand on the upswing, the sector is anticipated to maintain its revenue growth in the foreseeable future.

India's chemical exports have surged, reaching a record of USD 29 billion in FY22, a significant leap from USD 14 billion in FY14. This remarkable growth, exceeding 100% in less than a decade, hints at even more potential for expansion. Specialty chemicals are pivotal in this growth, constituting over 50% of chemical exports, primarily in agrochemicals, dyes, pigments, and related sectors. These export achievements underscore the Indian chemical industry's enhanced competitiveness and robust global presence, driven by cost-effective manufacturing, a skilled workforce, a reputation for intellectual property protection, and strong process optimization capabilities.

Meanwhile, China has faced production disruptions due to government policies aimed at curbing energy consumption and pollution emissions. These challenges have prompted international buyers to diversify their sourcing, leading to a surge in demand for Indian specialty chemical manufacturers.

However, despite its promising growth prospects, the industry remains vulnerable to short- to medium-term macroeconomic challenges that impact the sector. Ongoing geopolitical conflicts, such as the Ukraine-Russia war and the Israeli-Palestinian Conflict, have added complexity. The current economic climate, characterised by rising interest costs and elevated inventory levels, has created a chain reaction of effects. China's economic deceleration and global margin compression further compound the situation, presenting challenges for both demand and pricing. Nonetheless, experts anticipate the market to regain its footing in the next two quarters and sustain this positive trajectory for an extended period.

Fueling India's Chemical Renaissance

The industry is undergoing a transformation that promises to make it a global powerhouse by 2040. Forecasts suggest that the Indian chemical market will reach a

Collaboration with global companies is a crucial strategic avenue that holds promise for sustainable industry development. Partnerships combining the manufacturing proficiency of Indian companies with the market reach of global companies can be a win-win combination. This synergy not only empowers Indian firms to tap into a broader customer base but also allows global players to leverage India's cost-effective production capabilities and skilled workforce, creating a mutually beneficial ecosystem for innovation and growth in the chemical industry.

India's Thrust Towards Sustainable Growth and Global Evolution

Additionally, one of the primary drivers of this impressive growth is the increasing global demand for environmentally friendly and bio-friendly products. India stands out as a leading producer of chemicals crucial for creating sustainable, eco-conscious goods. This strategic advantage places India at the forefront of the global shift toward green solutions, making it a significant player in this emerging market.

At present, the entire pharmaceutical ecosystem is witnessing consistent developments. Reports of drug shortages in the United States have been surfacing,

and the reason could relate to active pharmaceutical ingredients (APIs). China is responsible for manufacturing 80% of the world's APIs, possibly scaling back its production for various structural and geopolitical reasons. This presents a significant opportunity for India, contributing only around 10% of the global API supply. Indian API manufacturers have a substantial chance to increase production, especially for the specialised chemicals that support the API ecosystem.

The "China plus one" strategy extends beyond the chemical and pharmaceutical sector and includes producing electronic items and consumer durables for domestic and export markets. China has traditionally dominated this field, but India has a good chance of exploiting the opportunities. For instance, southern India is now emerging as a substantial outsourced electronic manufacturing services industry, which also presents demands for electronic chemicals. Fresh opportunities are opening up in the sunrise sectors, such as battery chemicals, climate change initiatives, etc., which will also feed the requirement for chemicals in future.

While the domestic industry thrives in Agrochemicals, APIs, Dyes and pigments, it must explore new avenues for sustainable growth in the specialty chemicals sector. This entails chemical investments for higher value-added opportunities and next-generation businesses, such as Electronics, IT, Telecommunication (5G), Electric Vehicles, Smart Mobility, and more. These industries rely on various advanced specialty chemicals not currently manufactured in India. Thus, it is crucial to identify the key end markets and emerging trends where technical expertise and market knowledge can blend seamlessly with economies of scale, achieving higher profit margins.

Bridging the Gap: India's Journey to Chemical Industry Excellence

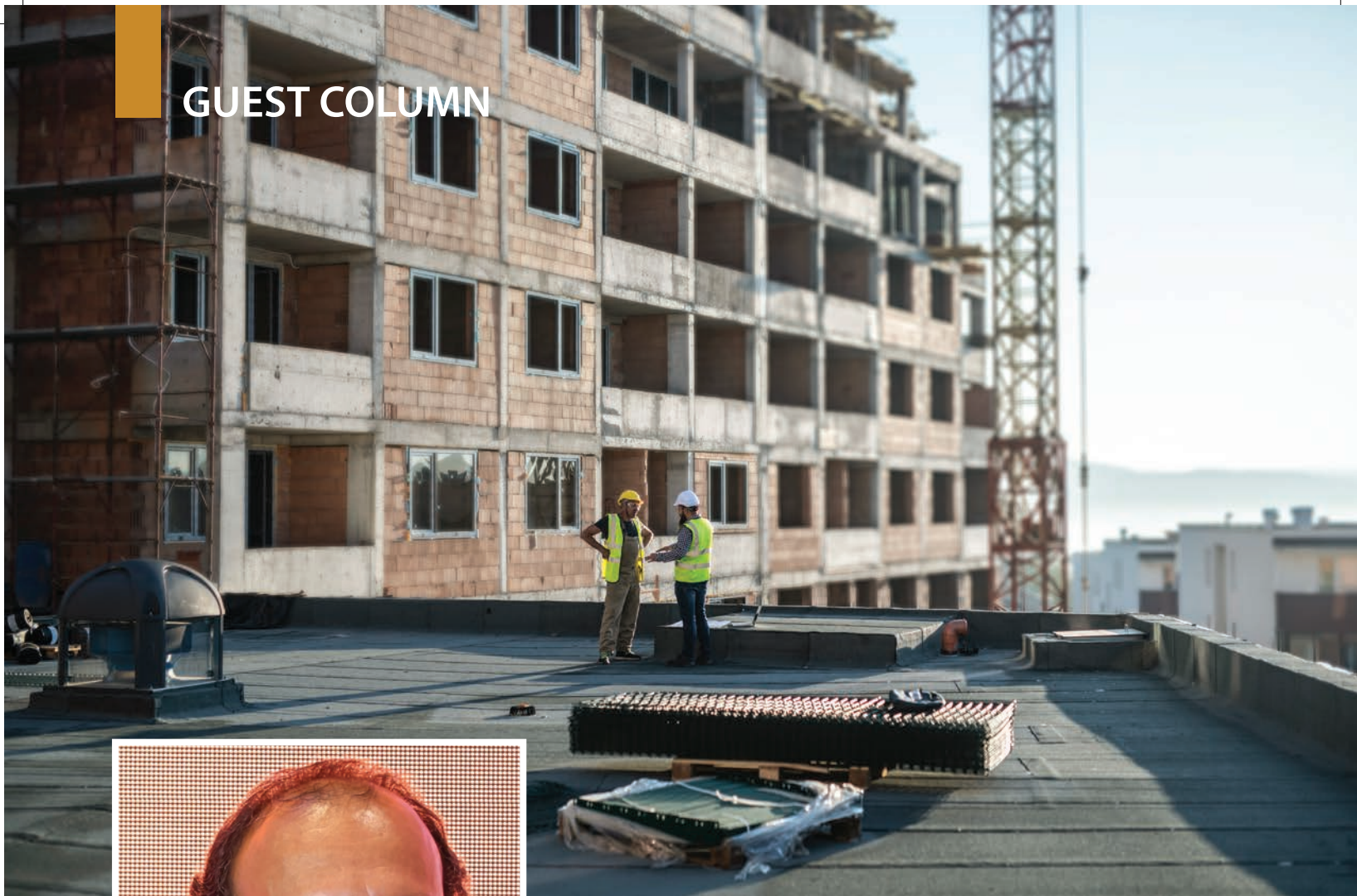
Amidst the surging demand for chemical manufacturing in India, it's imperative to acknowledge the existing infrastructure constraints and factor cost disparities compared to China, which remain critical challenges for the sector. Domestic companies have committed substantial capital investments to address these hurdles, primarily focusing on advancing complex chemistry and streamlining feedstock integration. However, a noteworthy portion of these resources is redirected towards developing essential utilities and supporting infrastructure. This shift is primarily due to the absence of plug-and-play facilities, which are prevalent in more developed manufacturing hubs. Consequently, these

challenges restrict the allocation of resources to crucial areas such as research and technology, hindering the sector's full potential.

Given the pivotal role of research and technology in the chemical industry's success, government support is paramount. Initiatives like the Production-Linked Incentive (PLI) scheme and R&D incentives are essential to foster innovation and competitiveness. Southeast Asian countries are also vying for opportunities from the China+1 and Europe+1 trends. This competition underscores the urgency of further improving the ease of doing business in India.

Additionally, comprehensive trade policies featuring ladder-up duty structures, enhancements in duty remission schemes, streamlined statutory approval processes, and an unrelenting focus on R&D and technological advancements are vital components of the industry's future success. Simultaneously, strategic investments in infrastructure, including feedstock availability, storage, pipeline networks, and port facilities, are indispensable to bolster the sector's competitiveness and ensure its long-term sustainability. These multifaceted efforts are poised to transform the Indian chemical industry into a global powerhouse, playing a pivotal role in shaping the future of this critical sector.

India's specialty chemicals industry is at the cusp of a transformative journey, propelled by a global shift in sourcing and a surge in demand. As it strides forward, the sector faces exciting opportunities and critical challenges. The nation's chemical companies are making significant strides towards becoming a global powerhouse by 2040, and the forecasted growth is undeniably promising. However, to harness the full potential of this burgeoning industry, it's imperative to address infrastructure constraints, promote innovation through government support, and foster collaboration with global partners. These multifaceted efforts will shape the future of India's chemical sector and establish it as a driving force in the global arena. ■



Emerging Demand & Opportunities in the domain of Construction Chemicals

NILOTPOL KAR
Managing Director
Sika India

Nilotpol Kar, Managing Director, Sika India, underscores the vast opportunities in the construction chemicals sector. He highlights the construction sector's significant contribution to India's GDP and its role as a leading employment generator.

Our country is witnessing a golden phase with a strong growth outlook across sectors and infrastructure is going to act as the backbone of the economy as we develop, connect more cities to towns and further, build more ports, and public utilities, and generate housing for all being the world's most populous country and with a young population. Urbanisation is an ever-growing trend which in turn requires a ramp up of the infra and housing sectors to accommodate the shift.

The trend is reiterated in this year's union budget that we saw where the capital investment outlay for infrastructure is increased by 33% making it 3.3% of GDP. The rising FDI in the sector is another healthy indication of the scope we have in the sector to grow. Even the defense infrastructure is undergoing a major uplift with substantial investment in lines with public infrastructure.

Another development in India which is now being seen as a major game-changer is the country's role as a manufacturing hub for the world. Roll-out of 5G network, increasing internet penetration and continued growth in digitization are expected to further boost the Data Center segment in the years to come which is also a positive indicator for the construction industry suppliers especially due to the specialized flooring requirements of a data center.

The construction chemicals sector owing to these trends is going to play a pivotal role by being a strategic partner to the construction industry by bringing in the latest technologies in concrete and construction solutions to build, protect, and finish new construction projects within the timelines and by making them more durable and sustainable as well as repair the existing ones to improve the structures longevity.

We at Sika, believe in anticipating and meeting future challenges by providing reliable, innovative, sustainable, and long-lasting solutions in the construction, building, and manufacturing industries. In everything we do, we provide a seal of quality that our employees, customers, and all stakeholders can rely on – building trust every day.

In the new construction side of business, one of our core target markets is concrete where we have a range of admixture systems that have become an integral part in the making of everyday concrete. Given that concrete is used twice as much in construction over all other building materials, emphasis on quality, performance, and sustainability is essential for the industry to grow and thrive. Our range of concrete admixtures ensures this aspect when added during concrete mixing to enhance specific properties of the fresh or hardened concrete such as workability, durability, and early and final strength.

Moreover, we are collaborating with the industry to introduce some innovative methods in concrete technologies like the use of tailor-made admixtures for the making of UHPFRC (Ultra High-Performance Fibre Reinforced Concrete). Recently in collaboration with a client, 150 Mpa compressive strength concrete was made possible. This resulted in thinner, smarter girder sections with great finish and produced to deliver high performance as well as durability.

Another innovative concept that we introduced more than a decade back- Smart Dynamic Concrete makes vibration-free concrete and comes with a 3E benefit (Economy, Ecology, and Ergonomy). SDC which entered its 14th year in India increases the speed of construction, and owing to its self-consolidating properties, eliminates the need for the vibration of concrete. So, concrete placement times are reduced substantially and, on the other hand, improves productivity with less labour requirement at the site. SDC is dense and free-flowing - so reduces energy consumption and thus cost. And it also enables early de-shuttering thereby improving formwork reusability. Overall, be it mass housing, or a high-rise project, SDC not only saves time but also considerable cost.

We have also worked on areas within the concrete target market from the ESG point of view wherein we have worked with clients for utilization of bottom ash in concrete as a replacement of sand that is becoming scarce and powered to deliver normal performance with our admixtures. This novel concept of execution has been made possible in road concrete. This is a big step towards decarbonisation and sustainability. The use of supplementary cementitious materials would

be important in lowering energy demands and carbon emissions with India being the world's second largest consumer of cement.

When the concrete structure is ready, it also calls for protecting it from extreme environmental conditions as a crucial step. For this step, we are partnering with the industry to provide solutions that protect concrete and give it a longer lifespan. Our range of protective coatings gives anti-carbonation, waterproof, UV, and chemical resistant properties. Our waterproofing product range offers customers increased longevity of their building structures by reducing water ingress and leakages and is the choice of many architectural masterpieces in India. We supply innovative, fast-curing hand and spray-applied waterproofing technologies, whose versatility addresses the refurbishment and protection of a variety of structures. Pre-formed HDPE membrane has become a preferred solution for basement waterproofing in a short period and superstructure waterproofing has started finding rapid growth in the usage of two-component PU/PUA technologies.

Often it is at the joints where a building is weakest to leakage. We offer high-quality joint sealants to cater to this market which manages to keep your building or structure sustainably tight during its entire life. And of course, our bonding range ensures a stiff bond of a combination of several elements, be it precast concrete parts, a connection of different construction materials, or structural additions like rails.

We also have forayed into a growing requirement of passive fire protection systems that are an essential asset for occupants and building owners as they limit the spread of fire and slow the spread of toxic gas and black smoke. Thereby protecting built assets in case of exigencies when a fire breaks out.

With a slow but steady move towards increasing regulations in the building segment several of these technologies will play an important role in abiding by the same and safeguarding the interests of all the stakeholders.

With several new manufacturing setups coming up and many manufacturers opting to expand their existing production lines, we are also witnessing high traction in our flooring target segment. Our flooring solutions meet

the highest requirements for industrial floor systems (typically applied in the manufacturing industry, life science industry, warehouses, and parking garages) as well as decorative floor systems (typically applied in commercial, institutional, and residential buildings).

Our advanced polyurethane flooring solutions for harsh environments demonstrate extraordinarily high resistance to mechanical, chemical, and thermal stress, retaining its integrity at temperatures of up to 130°C. I am proud to say that our flooring systems have proven for more than 50 years to meet the most stringent hygiene and cleanliness requirements. Many 20–30 years old floors in aggressive environments are still in service.

For a floor that involves tiles, we give the building fraternity the right tile installation system including the right tile adhesive and tile grout for each of the different areas of the project. From decorative tiled surfaces to highly functional tiled wall and floor finishes, Sika has a complete portfolio of tile fixing solutions. ■



Soap and Detergents: Balancing Performance and Sustainability in the Speciality Chemical Industry

SANJAY TRIVEDI

Founder, Director

Indian Home and Personal Care Industry Association (IHPCIA)

The Indian Home and Personal Care (HPC) industry is poised for double-digit annual growth, driven by favorable demographics, rising aspirations among a younger generation, and increasing demand from rural India. **Sanjay Trivedi, Founder, Director, Indian Home and Personal Care Industry Association (IHPCIA)** gives a brief insight on the Future of Green stating how its invasion in specialty chemicals will enhance the growth ,fueled by the ease and convenience of digital transactions.

The Indian Home and Personal Care (HPC) industry is on the cusp of an exciting decade of growth. Driven by favorable demographics, rising aspirations among a younger generation, and increasing demand from rural India and massive consumers, the industry is poised for double-digit annual growth. This growth will be further fueled by the ease and convenience of digital transactions, which have expanded market reach and consumer choice.

Urban consumers are also evolving in their preferences, seeking products that are cost-effective, sustainable, and aligned with climate change goals. This shift in consumer behavior presents a unique opportunity for specialty chemical manufacturers who supply active ingredients to the HPC industry. These manufacturers can play a pivotal role in developing innovative solutions that meet the demands of both consumers and the environment.

The post-World War II era witnessed a surge in the use of fossil-based raw materials, leading to a decline in renewable-based products. For instance, detergents gradually replaced soaps for fabric cleaning. While this transition brought about cost savings and convenience, it also came at the expense of environmental sustainability.

India's entrepreneurs have demonstrated their ability to innovate and develop cost-effective solutions. The creation of detergent powders by homegrown entrepreneurs decades ago is a prime example of this ingenuity. However, continuing on this path is neither sustainable nor environmentally friendly. A paradigm shift is required, and specialty chemical manufacturers have a crucial role to play in leading this transformation.

The future of the HPC industry lies in continuous processes and increased adoption of bio-processes utilizing enzymes and microbes. India's rich biodiversity offers a plethora of non-edible oils that can serve as the foundation for developing products with a reduced carbon footprint. Additionally, byproducts from palm olein production, such as palm stearin and free fatty acids, and glycerin from fatty acid manufacturing, can provide sustainable inputs for the future. The use of sugars and glycerol to produce esters is another promising avenue.

India possesses the necessary expertise to drive these innovations. Central research laboratories like the National Chemical Laboratories in Pune and academic institutions like the Institute of Chemical Technology, Laxminarayan Institute of Technology, Harcourt Butler Technology University, and the Indian Institutes of Technology are well-equipped to provide solutions.

Indian consumers are astute and value-conscious. They will gravitate towards innovations that offer both cost savings and sustainable solutions. For example, concentrated detergent cleaners without fillers and inert can reduce costs, energy consumption, water usage, and polymer use, thereby lowering the carbon footprint. The government can play a catalytic role in incentivizing such innovations by reducing taxes and promoting industry growth. These are just a few examples of the many product innovations in the HPC sector that have the potential to improve the lives of users. The Indian Home and Personal Care Industry Association is actively collaborating with its members, academia, and government agencies to achieve this goal.

Specialty chemical manufacturers have a bright future if they expand their focus to value-added products derived from renewable sources, which represent a larger market compared to performance chemicals for selective use. Climate change poses a real threat, and all stakeholders must act collectively and expeditiously to protect the future of generations to come. India possesses the skills and capabilities, leveraging AI and digital technologies, to manufacture products for the global market. The Atmanirbhar Bharat initiative must be pursued with renewed zeal and enthusiasm, embracing the future with knowledge, innovation, and capabilities, complemented by India's rich heritage, traditions, and values. ■



From Laboratories to Gigafactories: India's Impact on the Battery Chemicals Landscape

KUNAL DAGA

Founder, MolSynth and Director - Business Development
Daga Global

Dr. Arumugam Manthiram and Dr. Akshaya Padhi's unwavering belief in their LFP invention, despite initial skepticism, led to a ground breaking discovery that revolutionized battery technology. Their triumph underscores India's engineering prowess and instils pride in the talent nurtured within our institutions. **Kunal Daga, Founder, MolSynth and Director - Business Development, Daga Global** highlights the key achievements and impact on the Indian diaspora with the transforming battery chemical landscape.

In Charles J. Murray's ground breaking work, "Long Hard Road: The Lithium-Ion Battery (LiB) and the Electric Car," we unveil an awe-inspiring narrative that shatters the myth of India's missed opportunities in the world of battery development. This captivating story introduces us to the dynamic duo of Dr Arumugam Manthiram and Dr Akshaya Padhi, Indian scientists who, in partnership with Dr John Goodenough at the University of Texas, pioneered the use of polyanion oxides, leading to the revolutionary discovery of Lithium Iron Phosphate (LFP). Even in the face of doubts about its conductivity, their work captured the attention of Dr Michel Armand, who transformed their invention with carbon coating, resulting in the LFP Lithium-Ion Batteries (LiBs) we use today. This narrative not only underscores Indian engineering and research excellence but also instils a profound sense of pride in the talent cultivated by our institutions.

In an era defined by environmental awareness and energy efficiency, batteries have assumed a pivotal role. The exponential growth of electric vehicles (EVs), renewable energy sources, and portable electronics has ignited an unprecedented demand for batteries. At the epicentre of this transformation lies the realm of Battery Chemicals, a sector that is moulding our present and future. In this article, we will explore the surging demand and promising opportunities in the domain of Battery Chemicals, fortified by verified industry data and compelling statistics. We will delve into key sides, including the core elements of battery materials, the global panorama, India's remarkable journey, and the potential that extends beyond the confines of lithium.

Basics of Battery Materials: The Bedrock of Power

Behind every battery's extraordinary prowess resides a complex symphony of materials. The essential components - anode, cathode, and electrolyte - delineate a battery's performance. Lithium-ion batteries, renowned for their remarkable energy density and longevity, dominate the landscape, constituting a staggering 89% of the global rechargeable battery capacity in 2022.

Global Perspective: Shaping the Future

▪ The Rise of Nationalism in the Battery Supply Chain

Nations across the globe are fervently pursuing self-reliance in battery production, propelling a wave of policies aimed at securing access to critical minerals and robust supply chains. More than thirty countries have

enacted policies to fortify domestic production of vital materials such as lithium, cobalt, and nickel. Moreover, North America and Europe are meticulously crafting strategies towards reshaping supply chains in a profound manner. The most striking example is the USA's Inflation Reduction Act (IRA), which has effectively redirected a sizeable portion of global investment in the battery and materials sector to the USA, even drawing resources away from Europe. While China remains indispensable for global supply chains in this space too, world is looking at diversification of supply chains. From minerals to chemicals, from cells to battery packs, localization and nationalism are orchestrating a transformation of existing supply chains, ushering in new dynamics across the globe.

▪ China's Dominance and Challenges

China, as the global battery production powerhouse, wields an imposing influence, particularly in rare earth elements (REEs). In 2022, China single-handedly produced a staggering 80% of the world's rare earth elements, cementing its pivotal role in the battery supply chain. This dominance extends to exports, with China accounting for over 40% of global lithium-ion battery exports in 2022. However, despite its supremacy, China faces challenges, with EV sales slowing down while capacities continue to expand, leading to a sharp decline in new energy commodity prices. Nevertheless, China is still poised to lead the world in EV exports, presenting a formidable challenge to EU and North American automakers on their home turf.

India's Transformation: Powering Progress

India is amid a remarkable transformation in the realm of battery technology. Driven by government incentives and burgeoning environmental consciousness, EV sales in India surged by a remarkable 131% in 2022, reaching a total of 1.3 million vehicles. India is at the forefront in the 2-wheeler and 3-wheeler segments, with promising prospects for short-distance light 4-wheeler vehicles. Furthermore, the adoption of Energy Storage Systems (ESS) is gaining momentum in India, exemplified by NTPC's recent mega contract.

India's Gigafactories: A Paradigm Shift

The Production-linked Incentive (PLI) scheme has injected dynamism into battery manufacturing in India, resulting in ground breaking announcements of battery and cell capacities in the country. The Indian

government's push for 80% localization in lithium-ion batteries by 2030 has elicited substantial investments and capacity declarations from industry titans such as Tata, Epsilon, and Reliance.

Notably, Ola, Rajesh, and Reliance have secured the Production-Linked Incentive (PLI) for an impressive total of around 30 GWh. Lead-acid battery industry giants - Amara Raja and Exide, are boldly venturing into LiB production with a combined target of 30 GWh with a significant advantage of existing automobile industry operations and relationships. Additionally, prominent automobile manufacturers like Tata, Maruti, Mahindra, and TVS have unveiled ambitious plans to establish Gigafactories, collectively targeting approximately 40 GWh in production capacity. Remarkably, L&T is poised to construct a Gigafactory for power tools.

These initiatives collectively signify a substantial commitment by Indian companies, with announcements indicating a remarkable capacity build-up of over 135 GWh by the year 2030. Few other reports like that of CEEW talks about 300 GWh+. Such audacious endeavours underscore India's resolve to assume a prominent role in the global battery industry, aligning seamlessly with the broader global shift towards electric mobility and sustainable energy solutions.

The action in the battery materials space

In the rapidly evolving Indian battery materials sector, a dozen noteworthy developments are taking place. Epsilon and Himadri are expanding their presence in anodes. Epsilon, a Mumbai based advanced chemical company has spearheaded its Lithium Iron Phosphate (LFP) Cathode Active Materials (CAM) plan by acquiring Johnson Matthey's LFP research centre in Germany. Tirupati Graphite is investing significantly in research and production of natural and synthetic graphite. Companies like Himadri, GFCLEV, and Neogen are entering the LFP CAM manufacturing space. Tata has created Agartas while Reliance has created Reliance New Energy for their Gigafactories, and both firms have separately announced LFP as their primary technologies.

Moreover, various firms like GFCLEV, Neogen, Anupam Rasayan, Tatva Chintan, and Aether are planning to set up manufacturing plants for electrolytes and battery additives. SRF and GFCLEV are setting up capacities for PVDF binders, while companies like Balaji Amins and Alkyl Amines are gearing up for NMP Solvent production. Birla Carbon is entering the production of carbon

nanotubes for battery applications. Hindalco is investing in copper film production and recycling, and Rubamin is pioneering the extraction of cathode and anode materials from black mass waste from the end-of-life LiBs. These developments highlight India's growing importance in the global battery industry, aligning with the worldwide shift toward electric mobility and sustainable energy solutions.

Sun shines for India from the Land of the Rising sun

Japanese firms have consistently been at the forefront of collaborations with Indian entities. Notable partnerships include Neogen's alliance with MUIS on electrolytes and Epsilon's memorandum of understanding with KRI on battery and material testing. Asahi Kasei is also exploring the possibility of expanding its presence in India. Distinctively, Japanese Sogo Shosha firms like CBC and Nagase are proactively investing and driving business initiatives in this domain. Companies with specialized expertise, such as Tex Technologies, further reinforce the strength of these collaborations. In contrast, Chinese companies remain distant, largely due to political strains. Meanwhile, European and American enterprises are currently focused on selling their products and services to India rather than forging partnerships due to their perceived policy uncertainty here.

Pioneering Innovations and Future Frontiers

In the realm of Battery Chemicals, unceasing innovation is the guiding star. Research and development endeavours are laser-focused on enhancing electrolytes, carbons, binders, and solvents to augment both performance and safety. In addition to these, in the vast expanse of opportunities that beckon, India also needs to urgently capture below:

▪ Black Gold: Carbons – Synthetic and Natural Graphite

India has an extensive reservoir of pet-coke, a critical raw material for graphite production. With China's recent embargo on graphite exports, India is poised to capture an estimated 5% share of the global market by the decade's end, as predicted by Benchmark Minerals.

▪ Ferrous Phosphates

India stands as one of the world's largest consumers of phosphate-based fertilizers and boasts some of the world's largest steel plants. This guarantees a stable supply of raw materials and the ability to produce

competitive Iron Phosphates on a global scale. LFP is not only indigenously producible, but also the most economically produced cathode active material since it is free of Nickel and Cobalt. This makes it an ideal choice for the most price sensitive market in the world.

• REEs and J&K Lithium Deposits

India's recently unveiled critical minerals policy marks a significant stride in the right direction. Vigorous efforts should be directed toward regularizing mining activities and streamlining commodities markets to harness these invaluable resources. Notably, Jammu and Kashmir's lithium deposits, estimated at a staggering 5.6 million metric tons, present an opportunity of immense significance. While it will take several years to extract lithium from these Lepidolites in Bauxites, they are a resource coveted by the world throughout this century. India must begin investments in local and international refining assets to harness this resource. Last month, the Ministry of Mines held a private meeting with industry stakeholders to encourage efforts in acquiring assets and undertaking exploration activities, both domestically and internationally. In the near future, the ministry plans to auction several mines rich in rare earth elements (REEs) and critical minerals to accelerate private investment in the mining sector.

• Recycling Black Mass

Recycling will be the cornerstone of India's mineral security. While firms like Batx, Attero and several others have made intensive efforts towards collecting end of life batteries and converted them to Blackmass, efforts should be made by Government to set up India as the hub for recycling in South Asia, Southeast Asia, Africa, and the Middle East. Substantial investments are needed to support the metallurgical Research & Development at institutes like CSIR-IMMT in creating indigenous technologies to extract metals out of this Blackmass. Rubamin's is perhaps the single biggest private investment in this direction.

Leveraging India's Chemical Industry and Talent Pool

India's vibrant chemical industry and its reservoir of talented scientists and engineers can play a pivotal role in advancing the battery materials industry. Collaborative endeavours between battery manufacturers, research institutions, and the chemical industry can catalyse the development of innovative materials that enhance battery

performance, safety, and sustainability. This constructive collaboration has the potential to not only meet domestic demands but also position India as a key player in the global supply chain for advanced battery materials. Such examples have been seen in how India became the Pharmacy of the World, purely through the industry-academia collaborations at CSIR-NCL, Pune.

Conclusion

In conclusion, the landscape of Battery Chemicals is a dynamic arena shaped by localization, geopolitics, innovation, and global competitiveness. We find ourselves at the vanguard of an industry poised to fuel a sustainable future. From India's meteoric rise in EV sales to Australia's rare earth element mines, from innovative research laboratories to recycling facilities, Battery Chemicals truly epitomize the essence of a cleaner, greener tomorrow. The possibilities are limitless, and the world charges ahead toward a brighter future empowered by Battery Chemicals, with India's chemical industry poised to be an indispensable protagonist in this transformative odyssey. ■



Safety in Chemical Logistics

V RAJU

Head of Supply Chain Chemicals Business
All Cargo Logistics

The successful operation of the chemical industry is dependent on the safe and secure transportation of chemicals, which is a vital sector of the world economy. **V Raju**, offers his opinions on how to ensure the utmost safety and security for chemical shipments. His competence and proficiency in handling and moving hazardous items, together with his ongoing innovations in new equipment, guarantee the highest standards of security and safety. He shares his expertise on the significance of safety in the chemical logistics sector as well as some of All Cargo Logistics' best practices.

Safety is not only about being socially responsible, but it also makes good business sense. The safer the employees work, the more productive they are benefiting the overall financial health of the firm. Saying so, it is no different for the warehousing industry as well as for transportation operations. As the best practices necessitate safety equipment should be installed at all warehouses. Similarly, for the lifting of heavy items, it needs to be ensured that forklifts and hydraulic dollies are in proper functional condition and safe to use. Fire extinguishers, sprinklers and fire exits should never be blocked. Warehousing players will need to establish clear guidelines to govern the safe storage of hazardous material (hazmat). The implementation of Globally Harmonized System (GHS) in warehouses will ensure suitable labelling and packaging of goods. Specific areas should be designated and segregated for the unloading of combustible and chemical materials following their transportation to warehouses.

Flammable and combustible material should be stored in well-ventilated storage areas where the risk of ignition is minimized. Safety audits and risk reviews of warehousing operations should be undertaken at periodic intervals to identify critical risk areas and initiate the necessary safety control measures. Warehousing players should assiduously implement a digital safety checklist for the assessment of safety protocols in warehouses.

Wearing Personal Protective Equipment (PPE) like face shields, gloves and head covers should be made mandatory for personnel within the warehousing premises. They should also be made aware of the best safety practices and security standards in warehouses. Each of our warehouses are manned by professional trained in safe handling of the most hazardous chemicals and lubricants, continuous training by safety experts ensure that safety practices always are accorded topmost priority in all our warehouses. Knowledge and training to handle spillage, leakages, emissions, fumes etc. are constantly provided by our on-site safety and emergency handling teams, there are extremely strict measures on the Dos and DONTs during working and handling of cargo within our warehouses. Mock drills, fire drills, and other safety exercises are carried out regularly, in addition to handling safety drills in these warehouses. Last but not the least, safety audits by our internal auditors, customer auditors, global audit teams etc. ensures a safe working environment of the highest global standard for chemical cargo storage.

Similarly, while in transit, the packing, loading and unloading of such chemical cargo is done under detailed supervision of experts at the warehouses and as per SOP mutually agreed with customer operations and safety teams. Drivers of such vehicles are trained in safe carriage of chemicals and safe driving. They are provided with safety equipment in the vehicles and TREM cards that have detailed contact numbers of important offices and personnel should any untoward incident like spillages, leakages, emissions, accidents etc. occurring in transit. Control tower in respective regions are always in contact with such vehicle drivers and the GPS is closely monitored to ensure a safe transit for the vehicle.

Safe Logistics Key to Success

Chemical manufacturers and the third-party logistics partners that serve them, tackle enormous challenges to keep the industry moving. The chemical supply chain comprises these and myriad other products, many of which require special care in handling, transporting, and storing to prevent safety hazards such as combustion, contamination, fire, explosions and spoilage.

The manufacturers, carriers, and third-party logistics providers who store and transport these products need to adhere to a complex web of ever-changing government regulations aimed at minimising the hazards for workers and the general public who might be affected if an accident occurs. Being a high-risk business, chemical logistics requires flexibility and adaptability. The chemical supply chain is long, volatile, and highly complex and thus there are numerous inputs, and many touches to the end consumer. While chemical companies are adept at designing their products and manufacturing safely, the logistics companies offer the expertise required to safely navigate transport and store these potentially dangerous products safely adhering to the norms and safety regulations, at all times.

The dominance of big multinational companies has enforced lot more stricter and tougher regulatory norms for countries like India. In such a scenario, domestic players have no option but start investing in better safety norms, better infrastructure and advanced technology, all of which can reduce the costs for the manufacturer. These transformations are also enabling new business models that can bring chemical manufacturers closer to their suppliers, their direct customers, and even to their end customers.

Importance of the EHS policy

Our Quality Health Safety and Security Environment (QHSSE) procedures set the benchmark for policies in these areas, with processes tailored exclusively to the needs of different customers and industries.

Product storage plays a critical role, as product characteristics may have health, safety and environmental hazards. Hazardous chemicals improperly stored and improperly handled in the warehouse, can cause fire or explosion resulting in injury of personnel at the site, as well as the neighbouring areas and loss of property in and around the warehouse area. An understanding of hazards and associated risks will help in selecting better control measures. The potential safety, health and environmental impacts can be prevented by implementing control measures in the early design stage. The Globally harmonized system (GHS) hazard class guides hazardous product storage. GHS also guides labelling and hazard communication which helps in identifying hazards and also helps in handling measures. At the same time, storage of food chemicals require different type of storage and so is it with storage of food items that require extremely severe safety and security standards while they remain in hygienic storage facilities.

The industry needs to start using integrated planning systems to improve logistics asset productivity and network reliability. Efficient, competitive and sustainable logistics are therefore of great importance for its future development. For example, it is common for explosive, toxic, and dangerous materials to be transported through the supply chain. Great care must be taken to ensure safety and security of materials, during transportation.

Points to consider before storage and handling of chemicals in warehouses

- Is the MSDS and product literature available and have we gone through the same to prevent unsafe practices?
- Is the warehouse safety located to store hazardous chemicals? Away from human settlements and schools and hospitals and water bodies?
- Are all personnel using the PPEs necessary for handling chemicals?
- Are warehouses having sprinklers, smoke detectors, alarms, face and eye washers, contamination water pits, fire hydrants, fire extinguishers etc. available in the warehouse?
- Are compatibility charts adhered to while storing the chemicals?
- Are the warehouses having sufficient emergency doors, spacious, well ventilated and high roof to have good number of air exchanges etc.?

Chemical storage and transportation must be carefully planned and controlled at every stage, from the production facility to the end user. Companies need to consider the type of containers used for transporting the chemicals and ensure the right modal mix - whether it should be transported by truck, train, or sea; the organizations that will have access to the materials during shipment; and how they can get real-time information about the location and status of the materials, in order to minimize risk. Logistics management for chemicals industry demands continuous improvement in operational safety and security. Supply chain security and risk management will be the key differentiator.

Chemical warehouses also need to be specially designed for safety. If you have flammable chemicals, you need to have a designated room that contains a sprinkler system and wide aisles. Chemical warehouses also need to be designed to ensure waste streams are contained in case of an accident. Compliance involves not only complying with governmental rules, but also following voluntary "good practice" guidelines like 'Responsible Care'. To achieve certification, companies need to have a detailed and documented process for responsibly managing the logistics associated with chemicals.

The following is a non-exhaustive list of examples of inadequate storage systems and practices commonly found in warehouses and drum stores:

- Chemicals stored on passageways including forklift truck routes, other vehicle routes such as truck access routes to loading bays, pedestrian walkways etc.
- Absence of a suitable vehicle and pedestrian traffic management plan including defined forklift truck routes with appropriate speed limits, etc.
- Emergency exits obstructed by chemical containers.
- Chemicals stored on damaged, or inadequately secured racking or on damaged pallets.
- Warehouse racking not suitably designed or constructed to withstand the anticipated loading of chemical containers placed on it. Absence of secondary containment and spill kits.
- Inadequate/no training provided for forklift truck drivers.
- Where applicable, the absence of a suitable area for the transfers of chemicals from a large to smaller

packaging, e.g. for production or laboratory use, batch kitting, etc.

- Cylinders not properly secured against falls.
- Inadequate / no emergency response plan for dealing with chemical incidents such as liquid spills, toxic gas releases or fires.
- Chemicals stored by poorly chosen categories, such as all acids (inorganic and organic, strong oxidizers) together; all organics stored together

When putting in place the cargo segregation scheme it is important to identify all the hazard properties of a chemical. Many chemicals have multiple hazards and a decision must be made as to which storage location within the warehouse or drum store is the most appropriate for each individual chemical. Normally the storage area will be determined by the more hazardous property of the chemical and having assessed the consequences in the event of an accident in the storage area. There will always be some chemicals that will not fit neatly in one category or another, but with a proper identification of the chemical hazards and assessment of consequences of an accident release using the information available in the MSDS, most chemicals should be assigned to appropriate storage areas. In addition to the Material Safety Data Sheet (MSDS) there are many industry documents and guidance available on chemical hazard classes, reaction hazards and segregation policies, please see list of references.

The encouraging growth of chemical industry in India has naturally brought the issues concerning hazardous chemical storage and distribution into sharp focus. The bottlenecks pertaining to infrastructure, suitable storage facility, equipment and technology is posing serious challenges for the growth of the sector. There is a lack of continuous engagement at the strategic and tactical level between the chemical industry and logistics service providers. However, with the government providing a few sops in the areas of storage facility, equipment, etc., the logistics sector seems to be moving on the right track. Hazardous materials storage and distribution risk management involves establishing, organising, planning, executing and monitoring a set of operations that aims to decrease the probability of accidents and reduce the relevant potential consequences. This risk management process pertains to preventive and repressive safety measures. Status of storage & distribution of hazardous chemicals in India – way forward Preventive and repressive safety measures. ■

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M E D I A

"Port Of Antwerp-Bruges to Receive the First Green Hydrogen Molecules on its Platform by 2028."

Port of Antwerp-Bruges is committed to becoming a genuinely sustainable port by 2025. In an exclusive interview **Luc Arnouts, Vice President Port of Antwerp – Bruges**, shares the port's strategic plans to focus on economic growth, climate neutrality, sustainability, and social responsibility. He further divulges an insight on investing in infrastructure, technology, and partnerships to achieve the planned objectives. Key initiatives embraced by him include, a container roadmap, investments in hydrogen or methanol-powered tugs, factories that captures and reuses CO₂, and an open network of hydrogen pipelines.



LUC ARNOUITS

Vice President,
Port of Antwerp – Bruges

Driven by energy transition what is your observation on emerging trends in the ports sector?

Our ambition is clear - to become the world's first port that reconciles economy, people, and climate.

Port of Antwerp-Bruges has an extensive ecosystem of industrial and logistics companies and the right know-how about chemical processes, logistics, operations, and infrastructure. It is the ideal hub for alternative energy flows. By fully investing in efficiency and circularity and by switching to renewable sources and raw materials, we are taking the step towards a climate neutral economy.

Our ultimate goal is to become the green energy gateway of Europe. We are working on pioneering lighthouse projects in the three core areas of Energy, Industry and Shipping around carbon capture and storage, circular economy, waste heat, alternative marine fuels and green hydrogen.

- **Hydrogen Solutions:** To meet Belgium's 80% CO₂ reduction target by 2050, we're exploring hydrogen and related molecules (ammonia and methanol) as energy carriers, leveraging our strategic position as a hub.
- **Carbon Reduction Initiatives:** Antwerp@C

is dedicated to reducing CO₂ emissions by capturing and reusing CO₂, contributing to a carbon-neutral port by 2030.

- **Power to Methanol:** Our 'Power to Methanol' project creates sustainable methanol from captured CO₂ and renewable hydrogen, saving 8,000 tonnes of CO₂ annually.
- **Shore Power for Vessels:** We're enabling shore power for vessels, enhancing local air quality by allowing ships to switch off engines while berthed. Large container ships will have access by 2028.
- **Hydrogen-Powered Tugboat:** We lead innovation by introducing the world's first hydrogen-powered tugboat, the Hydrotug, in collaboration with Compagnie Maritime Belge (CMB).
- **Innovation for a Sustainable Future:** Together with our port community, customers, and partners, we actively seek innovative solutions to fulfil our environmental and societal responsibilities.

Can you tell us about port's overall strategy and role in facilitating distribution in Europe? How did the current geopolitical & geo economic shifts impact the port operations & profitability?

After the first nine months of 2023, the total throughput of Port of Antwerp-Bruges was 204.4 million tonnes, a drop of 6% compared to the same period last year. The still unstable geopolitical and economic conditions are negatively impacting demand for container traffic around the world, while the picture is still mixed for other cargo flows. The Eurozone economy is under pressure from interest rates, which have risen sharply. Despite the drop in energy prices, the global economic situation also remains volatile and future indicators



point to a continued economic downturn. As a result of this uncertain economic climate, containerised trade flows (biggest segment in our port) are falling around the world. For Port of Antwerp-Bruges, this is reflected in a 6.5% drop in container throughput in terms of tonnage, and 6.8% in TEUs, compared to the same period in 2022. Despite the decline in container throughput, Port of Antwerp-Bruges' market share in the Hamburg - Le Havre range nevertheless grew by 1% point, to 30.6% in the first half of this year.

What technologies and systems does Port of Antwerp utilise to ensure smooth cargo flow, transparency in cargo tracking & documentation and minimizing delays in supply chain with improved efficiency and accuracy?

All the players in the logistics chain have information that they exchange with each other. NxtPort, a subsidiary of Port of Antwerp-Bruges, makes sharing data easier and more transparent. That way, all the players in the logistics chain get the right information at the right time. The Bulkchain application ensures that the administrative processes in the breakbulk sector run faster and more smoothly, while the container pick-up platform (CPu) uses digital innovation to optimize and streamline the container pick-up process, providing the supply chain with a digital, secure and optimized cargo release and pick-up process in the Port of Antwerp-Bruges.

As a critical hub for global supply chains, what are some unique challenges and opportunities you've encountered? Tell us about the risk mitigation strategies taken by the Port to avoid supply chain disruptions & safeguard assets?

The last couple of years we have been encountered with various challenges. The COVID-19 period led to global containerised liner shipping being highly disrupted, causing irregular calls from ocean-going vessels and ports to be missed out in the rotation. This represented a major challenge for the entire logistics chain in and around the port. In addition, the shortage of port labour, and federal measures to combat the virus, also played a role. Thanks to the strong container throughput rates, the port was able to limit the overall decline in output in these years.



2022 was another year of challenges for Port of Antwerp-Bruges. Geopolitical tensions, the energy crisis and ongoing disruptions in supply chains made their presence felt and, in addition to shifts within the various commodity flows, put sustained pressure on the container segment. This affected throughput slightly, which was down 0.7% compared to 2021.

However, 2021 and 2022 were also the years of the merger of the ports of Antwerp and Zeebrugge, which is a great opportunity for us. Port of Antwerp-Bruges will combine the best of both worlds and will focus on the strengths of each site. The ports of Antwerp and Zeebrugge are largely complementary – for example, Antwerp has strengths in the handling and storage of containers, breakbulk and chemical products, while Zeebrugge is a major port for RoRo traffic, container handling and the transshipment of liquid natural gas. In addition, the combination of Antwerp's position as the second largest petrochemical cluster in the world and the coastal position of Zeebrugge provides a unique opportunity to take a leading role in the roll-out of the green hydrogen economy. By 2028, Port of Antwerp-Bruges plans to have the capacity to receive the first green hydrogen molecules on its platform. To this end, it is working to expand terminal capacity for existing and new hydrogen carriers at both port sites. A hydrogen pipeline between the two sites and towards the European hinterland will ensure that the port area as a whole and, by extension, Belgium and a large part of Europe, can make use of this important carrier for renewable energy.

What steps has your port taken to enhance sustainability and reduce the environmental impact of logistics and supply chain activities? How is Port of Antwerp preparing to handle new product

cargoes like Green Hydrogen, Green Ammonia etc. that are likely to hit the markets in the near foreseeable future?

Climate change is a global problem, hence to tackle it locally alone is not wise. As a world port, we want to contribute to a climate-neutral European economy by committing to the hydrogen economy. In a hydrogen economy, hydrogen gas is used as an energy carrier or as a raw material during a production process. We do so with producing our own green hydrogen, as well as by importing hydrogen. In Northwest Europe, it is impossible to generate all the required energy locally from renewable sources. As such, highly concrete plans are on the table to import hydrogen, produced with green energy from countries where there is abundant sun. The hydrogen modules are transported via pipelines or by ship to Port of Antwerp-Bruges. However, they do need to be bonded with a hydrogen carrier such as ammonia or methanol first. At the port, this is reconverted back to pure hydrogen, which can be used as a raw material or fuel. The imported hydrogen carriers, such as ammonia and methanol, can serve as green fuel for ships and aeroplane, for generating heat or as a raw material for chemistry. There is still a long way to go here, but it is the route we are continuing to work on. DEME, Engie, Exmar, Fluxys, Port of Antwerp-Bruges and WaterstofNet, as industrial players and public stakeholders, are bringing their expertise together in the hydrogen coalition. Together, we are throwing our weight behind practical projects for shaping the production, transport and storage of hydrogen.

Tell us about Green targets and what are you doing specifically in this regard?

Taking up the European Green Deal, Port of Antwerp-Bruges wants to become a climate-neutral port by 2050. It is working on several pioneering projects related to the circular economy, alternative marine fuels, green of our fleet, shore power, CO₂ capture and storage (CCS) and hydrogen, all contributing to making the port Europe's green energy hub.

What is your observation on port / maritime logistics in India vis-à-vis other ports across the world? As India aspires to become a global supplier, what are the gaps that need to be addressed?

The cornerstone of the economic welfare of any country is the presence of a performing infrastructure. Seaports are a critical part of this infrastructure and essential to boost and support the economic development. As Port of Antwerp-Bruges, we can only share our own best practices and experience. Our observation is that the Government of India has already commenced its journey of building a modern port infrastructure system in the nation by launching several initiatives. The country has been investing significantly in the modernization of its ports to improve their efficiency and capacity. Sagarmala projects includes projects from various categories such as modernisation of existing ports and terminals, new ports, terminals, RoRo & tourism jetties, enhancement of port connectivity, inland waterways, lighthouse tourism, industrialization around port, skill development, technology centres, etc.

Recently, Jawaharlal Nehru Port became the first significant port in the nation to operate all of its berths on a PPP model, making it a 100% Landlord port of India. We believe that above initiatives are very crucial and will lead to expedited growth in the maritime sector in India.

To ensure sustainable growth and to secure Port of Antwerp-Bruges' position as a hub in the global market, we have been continuously upgrading our infrastructure and adopting new technologies to prepare our port for the future and make it more efficient, safer and smarter.

Tell us about future plans & investments of Port of Antwerp Burges

With our strategic plan 2022-2025, we are making our mission to be a genuinely sustainable port a reality. Our main activity remains the operation of the port. It is only when everything is running smoothly that there is room to look to the future. We do this by means of a strategic plan with a focus on our economy, our climate, on people and on the environment. In addition, we remain committed to major infrastructure projects, such as additional container capacity and a new sea lock.

- **Economy:** By means of a commercial strategy and a clearly elaborated pricing policy for our

merged port, we are making the benefits clear to our customers. By implementing container roadmap, we intend to make maximum use of the existing space and optimise our operations, while waiting for a new dock. Operating from two locations calls for a smooth interconnection, both in terms of transport and also on a digital level.

- **People and environment:** We have an essential social role: we are a port of people and for people and are aware of the impact of our activities on the environment and local residents. That is why in the coming years, we will especially be investing in projects around water quality and nature. Safety, mobility and quality of our environment are already high on the agenda anyway.
- **Climate:** It's not just about economics. In line with the European Green Deal, Port of Antwerp-Bruges is aiming to be a climate-neutral port by 2050. We are reducing the CO₂ emissions of our own fleet by investing in hydrogen or methanol-powered tugs and taking a closer look at the energy efficiency of our buildings and operations. We are working together with the port community and partners to make the port more climate-friendly by focusing on shore power and alternative fuels, building a factory that captures and reuses CO₂, further focusing on the circular economy with projects such as NextGen and finally by taking on a pioneering role in the hydrogen economy with initiatives such as an open network of hydrogen pipelines. ■

Life Cycle Analysis of Assets in Chemical Industry

While developing any new chemical process unit, the unit is designed always with an intent that assets will serve and deliver performance with efficiency till the process unit is retired. The end of life of a process unit is usually linked to economics of operation when running the unit becomes unviable. Obsolescence and environmental reasons also do force some process units to permanently shut down.

It has always been an intent and practice to specify a design life for different categories of assets. For e.g a pressure vessel is designed for 30 years and in plant pipelines are designed for about 15 years. It has been observed that in real life, the experience is different. Generally speaking about 80% of the assets, provides a life more than anticipated with minimum or NIL maintenance. The remaining about 20% of assets demand significant maintenance attention or replacement decisions to sustain the process unit operations during its life cycle.

This concept of life cycle analysis (LCA) is also sometime referred to as "Cradle to Grave". The various stages of assets in a typical chemical plant could be specified as follows.

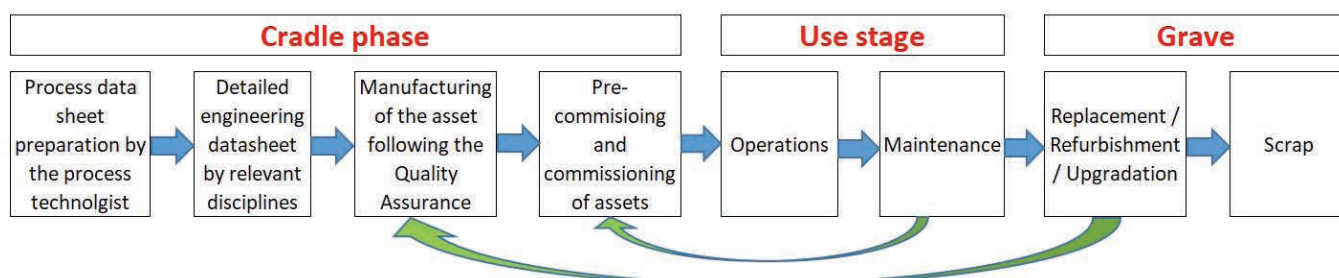
Actions mentioned as below, when followed, can lead to more number of assets live upto full useful life of process unit.

In a typical chemical plant, the cradle stage for assets starts when the process datasheet for the assets are conceived on a piece of paper. This stage can be even referred to as the pre-cradle stage. The process technologist involved in the design of the process unit

has the primary responsibility of designing assets that are "Inherently safe". Critical assets shall be designed considering all the various operating conditions that can possibly happen during life cycle of the equipment. All the critical recommendations of the "Process hazard Analysis" shall be incorporated as a part of the design. The design shall eliminate catastrophic incidents. The process technologist shall specify the following as accurately as possible so that the assets are designed and manufactured to endure the life of the process unit itself.

- Chemistry of the operating fluids. The chemical constituents that are present in "Parts per million" level shall also be indicated.
- Fluid phases
- Various operating conditions (pressure, temperature and flow) during various stages of operations that includes steady state, turn down operations, startups, planned shutdowns, emergency shutdowns, process trips of critical equipment, power outage, cooling water outage, prolonged shutdown (mothballing) etc.
- A well-established chemical / metal interaction matrix.

Corrosion is one of the damages that is given significant importance while designing of process units. The material selection of critical assets shall be based on proven experience. The recent practice has been to complete the base line RBI (Risk Based Inspection) study during the cradle phase of the process unit. Even if RBI software is not available, the process plant can be analyzed for



the concepts of RBI as per API 580/581. Carrying out RBI helps in identifying the damage mechanisms that is applicable to assets or set of assets for all the specified operating conditions. RBI study also involves the presence of material expert who could provide valuable inputs during material selection for various assets. This will also identify weak link in the plants that would require attention by maintenance and reliability teams after commissioning.

All assets shall be designed, manufactured, constructed and tested in accordance with well-known, latest national and international codes and standards. Local statutory regulations, if any, needs to be adhered to. Adherence to codes and standards primarily insures safety of operations in the long run. It also assures delivery of efficient performance by the assets throughout the life cycle.

Assets shall be manufactured and procured from good reputed vendors and suppliers. Inspection during manufacturing of assets shall be done using a well-established "Quality Assurance Plan". Involvement of third party Inspection agencies as a part of manufacturing cycle of assets will further enhance quality of fabrication and remove surprises.

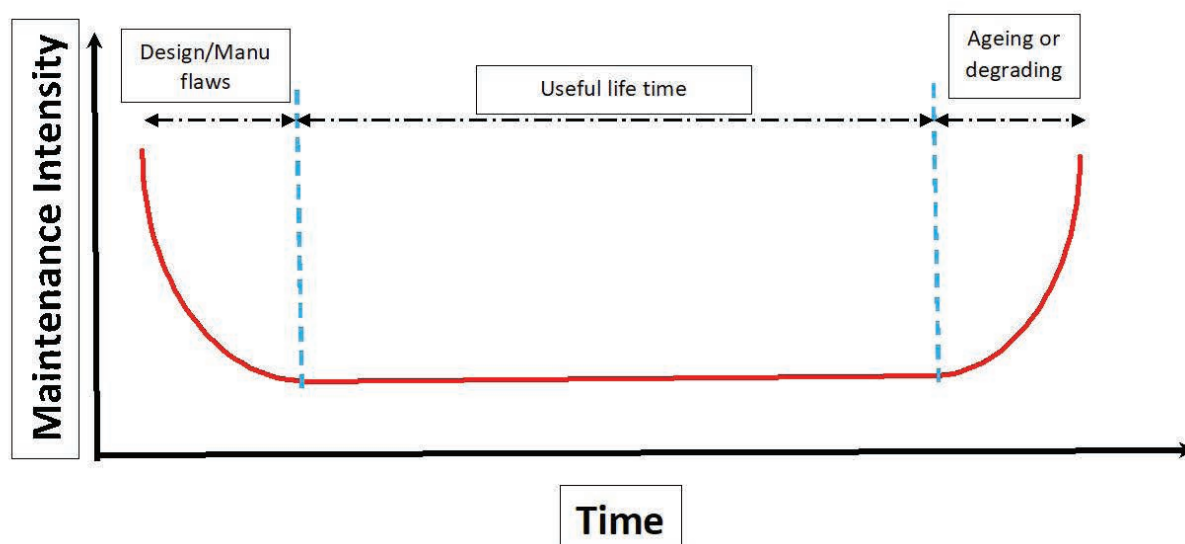
Assets shall be preserved adequately till they are commissioned. The operating crew shall prepare a testing plan for assets and implement the same as a part of pre-commissioning phase. The assets that need to be tested will include critical items like safety valves, isolation valves, NRV's etc. The testing shall ensure reliable operations on commissioning of the plant.

All the manufacturing records, O & M manuals shall be preserved safely so that they are available for reference when problems are encountered during normal operations of the plant. The above essential steps when adhered to shall ensure safe, efficient, reliable and predictable operations of the process units soon after commissioning. This is very essential to realize the business objectives of building the process unit.

Once the process units are commissioned, it is essential to sustain the safety and reliability of the process units. There has always been a question on how much maintenance is considered as optimum maintenance because maintenance costs money. Most of the assets do follow the bath tub curve as shown below. There is phase of high intensity maintenance after initial commissioning that addresses the design and construction flaws. Thereafter there will be a long period of low intensity maintenance where the wear and tear is very slow, steady and predictable. Towards the end of the life cycle there will be an increase in the intensity of maintenance once again.

Operating and business managers always demand least outage of assets and least expense for asset maintenance. The learning that has happened over a period of time has been as follows. Planned, timely and condition based maintenance has always resulted in reduction in maintenance costs. Delayed maintenance, reduces reliability and increases maintenance costs over a period of time.

Different categories of assets require different type of monitoring and maintenance. The assets in a process



FEATURES

units shall be analyzed and categorized as Vital / Essential / Desirable. The categorization shall be based on safety and production losses. Alternately some of the process unit follow the practice of identifying safety and production critical equipment. The intent of this categorization is to carry out adequate maintenance on each of the asset so that overall availability of process unit for production is high. The maintenance and reliability team shall have a written maintenance strategy document for various category of assets.

The assets shall have one or more of the following asset strategies.

Whereas maintenance strategies do get formulated based on experience, it is imperative to incorporate all the OEM recommendations as per the O & M manuals.

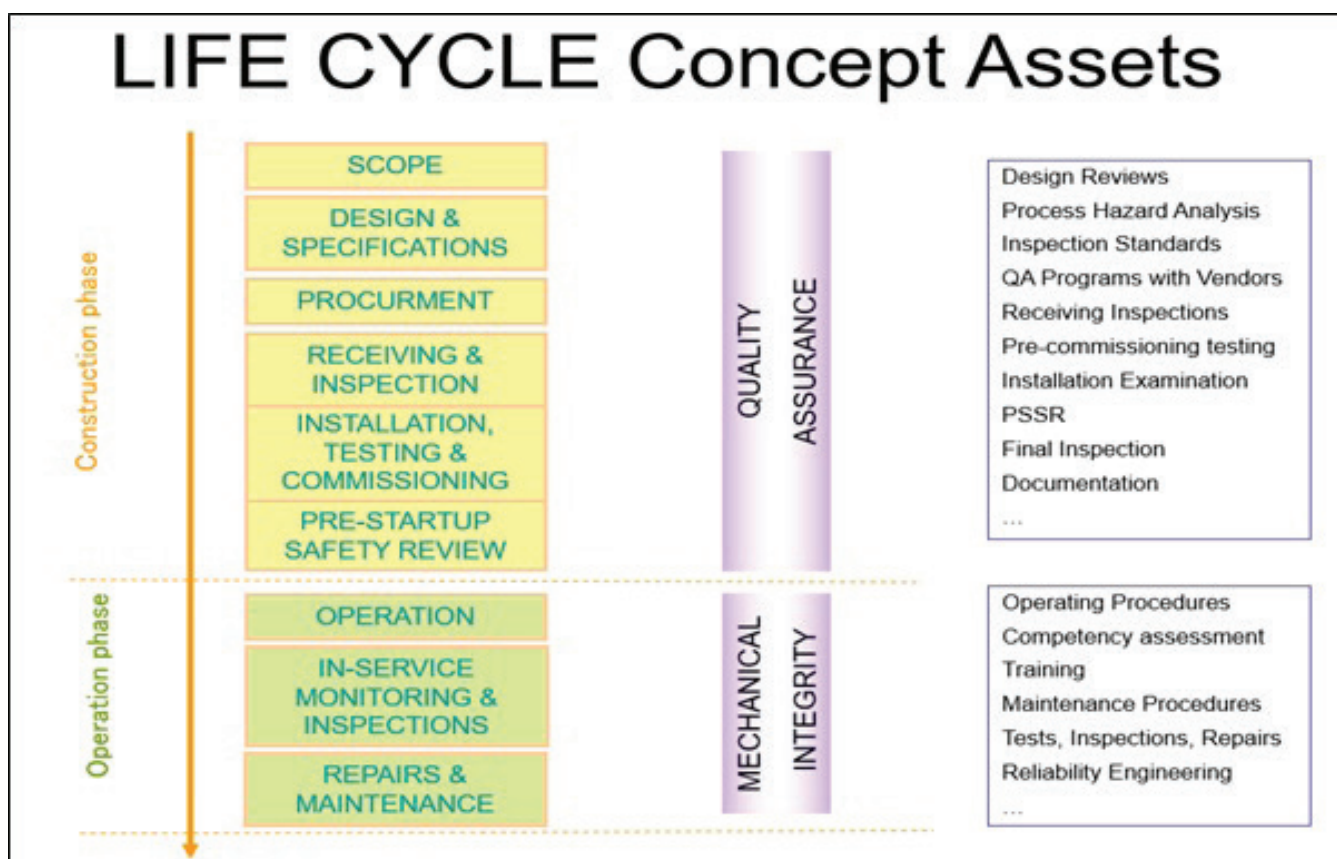
Predictive maintenance - These are activities that are carried out on the assets when the asset is in operations. Vibration monitoring of rotary equipment, Thermography of critical assets, pipeline thickness checks, operating parameters monitoring, Look/Listen/Feel (LLF) inspection, operator rounds etc are typical examples of predictive maintenance activities. With the advancement of IT tools, many of these inspections can be automated

and made on line and further analytics can be added. The concept of "EED - Early Event Detection" is fast catching up in chemical plants to have a pre-warning of the failure rather than detection after the failure.

Preventive Maintenance - These are minimal maintenance activities that are carried out on the assets when they are not in operation. Preventive maintenance does not require assets to be dismantled or opened for inspection.

Overhauling maintenance - These are maintenance activities that are carried out on critical assets by dismantling, inspecting, cleaning and overhauling them. Maintenance of static equipment during a major shutdown, maintenance of rotary equipment like turbines and compressors, maintenance of transformers etc., will come under the category of overhauling maintenance.

All maintenance and testing shall be carried out based on a written down document and records shall be maintained for future reference. All repairs / refurbishments shall be based on written down procedures and will be in line with the codes, standards and proven good engineering practices.



Failures shall be analyzed to understand the root cause and corrective actions shall be implemented to avoid repetitive maintenance.

Monitoring the assets for process side corrosion is a very critical activity to increase the life of assets. Process plants shall be operated within a specific window referred to as "IOW - Integrity Operating windows". API 584 provides guidance and methodology on developing IOW for chemical process unit. Operating the unit within defined IOW's shall eliminate catastrophic and surprise failures.

Some of the following categories of assets and the damage mechanisms, if not taken care can lead to an increase in maintenance intensity. These are also sometimes referred to as "pin prick failures". Sometimes failures under this category of assets and damage mechanisms can also lead to significant incidents resulting in safety and production loss incidents. The maintenance and reliability team shall develop a long term strategy for these type of degradation mechanisms and provide adequate care to assets.

- Atmospheric (External) corrosion
- Corrosion under Insulation
- Corrosion under fireproofing
- Corrosion under pipe supports
- Buried assets
- Critical process to utility interfaces and Non-return valves
- Critical Isolation valves
- Small-bore connection subjected to vibrations
- Dead legs (no flow piping and connections)
- Long term metallurgical degradations like fatigue and creep

Preservation of assets that are taken out of service for more than few months has to be done adequately. There has to be a marked-up document readily available with the operating crew indicating the assets that have been mothballed. There has to be a written down procedure and a testing protocol for re-commissioning of mothballed assets.

All changes to the plant shall be done based on a written down document. This is typically referred to as "MOC - Management of Change". The changes shall be engineered wherever required. Experienced personnel in

the respective disciplines shall be provided an opportunity to review the changes proposed. OEM support can be considered if changes are considered critical. All changes to Trips and alarms limit or disabling the function of safety-critical assets shall follow the MOC process.

All the above interventions are summarized in the following pictorial.

Conclusion

Assets in a chemical plant can be built to endure the full life cycle of the process unit. At each stage different strategies have to be applied for exploiting the highest efficiency from the asset throughout its life cycle and also ensuring safe operations.

A high level of senior-level management commitment is essential to achieve the objective of assets available for operations till the process units are retired. ■

Author



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Increasing Safety and Sustainability for a better tomorrow

A staggering number of people work in dangerous and unsafe conditions every day, and they depend on their safety gear to get them home each night. India's safety and security sector has been expanding steadily, with some categories expected to rise between 10 and 15 percent annually. Expectations for stronger safety and security measures are being driven by population growth, urbanisation, industrialisation, and the expansion of infrastructure and mass transit networks, particularly in connection with important national infrastructure projects.

Safety in a processing facility is an important factor not just for employees' right to work in a safe workplace, but also for controlling public exposure to danger. Process operations always involve some level of risk, and when that risk manifests itself in an accident, it has the potential to seriously disrupt corporate operations. Protecting workers with comprehensive safety services built on knowledge of the sector and unwavering commitment to innovation is a top priority. Innovative solutions for safety such as first aid supplies, electrical safety, fall protection, gas and flame detection, hand protection, head/eye/face protection, hearing protection, protective footwear, and respiratory protection among other things, is what the workers need to adapt to the changing conditions.

Automated Mobile Robots Enabling Higher Safety and Productivity

A wise course of action is to make adequate investments in safety procedures to prevent future accident costs. The process industry's present approach to these investments is essentially determined by basic risk-based heuristics, insurance market prices, corporate culture, and management discretion. However, a comprehensive approach to support such an effort is needed. In order to enable systematic and optimal allocation of financial resources across all key risk aspects within a process plant, a strong decision-making framework must be developed.

For Instance: Autonomous mobile robots (AMR) have been developed to boost productivity, eliminate accidents, and enhance security. By automating the movement of carts used to deliver selected orders or

returns, these AMRs significantly increase productivity. They can move across any floor surface that is smooth enough to support a conventional cart pulled by a person. These AMRs also provide a versatile and effective means of moving pallets, which is normally done primarily with forklifts and conveyor systems. Workers may just park carts in predetermined pickup areas around the complex and summon robots to collect them, preventing them from having to travel for more than half the day.

These AMRs may do repetitive and often lengthy activities, enabling labour resources for higher-value jobs that are in higher demand. This alone has numerous advantages, such as increasing worker satisfaction and minimising accidents and turnover rates. Companies are rethinking how they conduct business as a result of the pandemic and its long-term implications on workforce shortages. According to a survey, more than half of the businesses are now more eager to spend money on automation as a result of the pandemic and its long-lasting impacts. According to the same report, businesses view automation's top three benefits as increased speed, personnel utilisation, and productivity.

Safety Through Sustainability

In addition to this, companies all across the world are working to optimise energy use and lower or eliminate their greenhouse gas emissions in today's climate-conscious environment. The necessity to maximise the use of energy, gas, oil, and water to meet emissions reduction targets drives investments aimed at emission monitoring and reduction. Through preventive maintenance, tracking and lowering emissions can increase process uptime and lower product losses throughout the process.

Government regulations, investors interested in environmental, social, and governance issues, as well as expert company objectives, are just a few of the factors driving emissions reductions. Additionally, emission leakage may result in a loss of income or, more crucially, safety concerns.

The market is split when it comes to moving forward. On the one side, you have businesses that require assistance in beginning their sustainability journeys, and on the other, you have those that have depended on process modifications and now want in-depth knowledge of how to approach more challenging issues. The real potential is in moving ahead with a technology-driven strategy for sustainability, regardless of how established a company is. To enable businesses to embrace practises that offer sustainable production, we have shifted our focus toward the creation of technologies that will shape the future of sustainability.

Oil and gas corporations claim they are getting ready to increase expenditures in new technologies and sustainable energy this year after reporting record earnings in 2022. The energy sector is also looking for methods to reduce the number of greenhouse gases, most notably methane, emitted by its historic natural gas production. To reach net zero emissions, the transportation sector has long sought a carbon-free alternative. Over the years, the sector has seen the introduction of numerous new fuel options. The automotive industry has focused on BEVs (battery electric vehicles), hydrogen fuel cells, compressed natural gas (CNG), liquefied natural gas (LNG), and ethanol, among other alternatives. Alternative fuel sources for aviation, however, have not yet been fully uncovered. The issues in the aviation sector are much more complicated than those in the automobile industry, despite the introduction of a number of solutions, including electric power. SAF (sustainable aviation fuel) is used by the industry as a stoppage to cut emissions until a real carbon-neutral fuel source is found.

India's newest and fastest-growing vertical is the production of ethanol. The country is investing extensively in ethanol because it believes that it is a more feasible solution for a developing nation like India. By 2025, the Ethanol Blended Petrol (EBP) Programme is expected to blend 20% ethanol, according to the National Policy of India on Biofuels 2018. Being a part of this government initiative underlines a company's commitment to sustainability. Making the switch to renewable energy sources like ethanol and biofuels will contribute to the creation of a greener planet. For instance, process technologies enable firms to use energy more effectively,

increase environmental compliance, reduce emissions, and improve overall business performance with automation solutions. Process technologies are built to optimise operations, and improve efficiency, and safety.

A Global Priority

Reducing the global carbon footprint by concentrating only on the mode of transportation is not going to be as effective. It's important to look past this moving equipment. Air quality is a crucial global safety concern because of the significant pollution and emissions that factories, plants, and warehouses produce. The improvement of industrial operations, energy efficiency, the management of the burning of agricultural waste, and fuel conversion are crucial elements in lowering emissions of pollutants. Burner Management Systems (BMS), Emissions Management Solutions, Gas Cloud Imaging, and Gas sensors that are intended for use in environmental applications that can detect a range of gases- Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Carbon monoxide (CO), and Ozone are all urgently needed.

To address the demand for long-term energy storage in this regard, Flow Batteries may be the future. These batteries function with renewable energy sources like solar and wind. Depending on the amount of energy needed and the required discharge rate, the battery's two electrolyte tanks circulate at various rates. When wind and solar electricity aren't available, there are power outages, or the power networks are overburdened, it stores energy that can be used in those situations. It outperforms lithium-ion batteries and can store and discharge electricity for up to 12 hours.

We anticipate that over the next decade, sustainability will continue to be given top priority through both policy and increased investment by the world's most successful businesses to highlight the value of sustainable practises and turn them into a global standard for customers, investors, and company boards. ■

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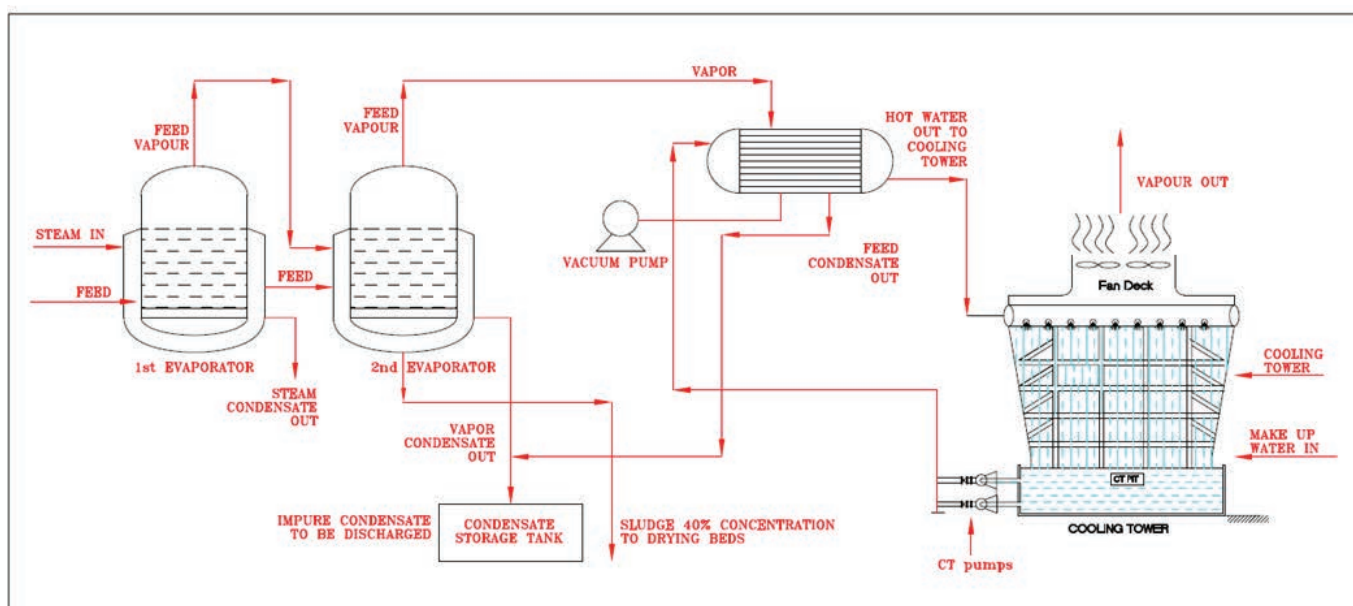
Mist Evaporation System For Zero Liquid Discharge: An Environment Friendly Solution For Liquid Waste Disposal



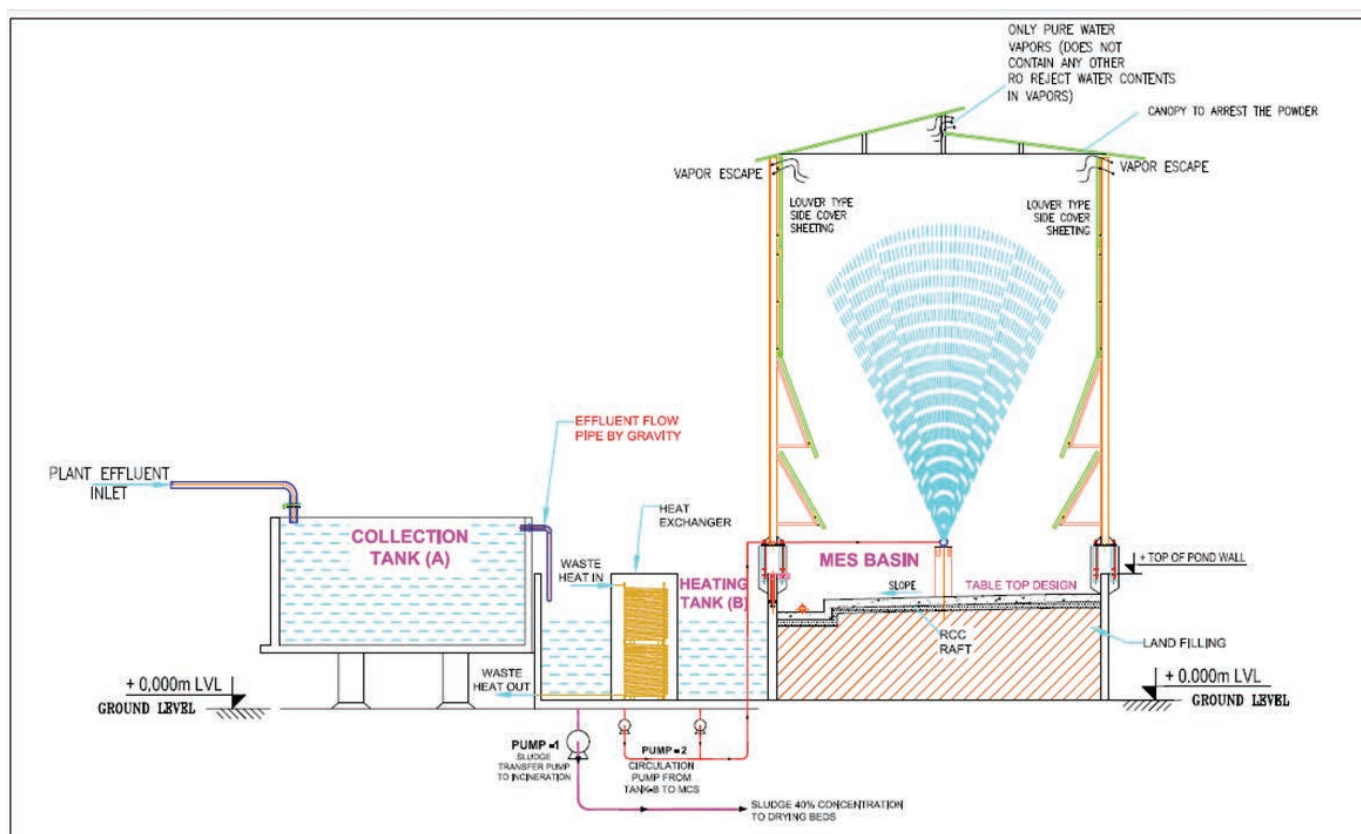
Makarand A. Chitale, the Director (Technical) of **Mist Resonance Engineering**, explains the essence of Mist Evaporation System technology, and how MREPL has executed a system to adopt Zero Liquid Discharge Policy to safeguard nature.

We all know that Industrialization is very much essential for our economy and growth of the society. However, it is also necessary to keep balance of nature & maintain a pollution-free environment. Hence, A few years ago, Government of India declared Zero Liquid Discharge Policy for process industries. This means that any process industry, which is using water as its auxiliary must consume or reuse the water in its process. Any form of liquid which can pollute our rivers/water source should not be discharged outside the premises.

This mandate forced the process industries to use the conventionally known Zero Liquid Discharge Technologies, which use large Multiple Effect Evaporators that consume high amount of steam/ coal. Their capital expenditure is also very high & at the same time their OPEX is also enormously high. So it was not possible for the small/ medium sized industries to adopt this technology. Many industries still throw the dirty effluent water/ RO reject to open water sources/rivers thus polluting precious water or harm aqueous life.



Schematic Drawing For Conventional Multiple Effect Evaporator (Mee) System



Schematic Drawing For Mist Evaporation System For ZLD

Hence it was necessary to find a technology which will be affordable to all size of industries and environment friendly.

MREPL is glad to announce that they have developed Mist Evaporation System (Natural evaporator) for Zero Liquid Discharge of RO Reject / Effluent, which use minimum utilities like steam/coal/electricity. Effluent/RO reject is naturally evaporated by their unique patented technology of Mist creation with or without help of waste heat available in the plant. This helps the industry to adopt this system at minimal OPEX compared to conventional system & even its first investment is about 50% or less in comparison to MEE.

In the year 2016, MREPL received the prestigious “G. S. PARKHE INDUSTRIAL MERIT AWARD” given by MCCIA for Innovation in Entrepreneurship. The Award was received for our Technology of Mist Creation & its application in Zero Liquid Discharge of RO Reject / Effluent.

Since then the system has been successfully implemented at many process industries.

Technology of Mist Evaporation System

Mist Evaporation System is a high efficiency system, which works on our Mist Cooling Technology which induces water to intensive atomization i.e. water particles are subdivided to around 5 microns. The atomized particles shoot out of MIST-CREATOR NOZZLES at immense speed and rise to a height of 6 meters above the nozzles.

This ensures extensively large surface area for a longer interval and at high velocity providing a mist formation. Surface evaporation is very fast, faster than the time needed to reach equilibrium. This ensures faster evaporation of water and the effluent water starts concentrating.

It is very important to note here that, this evaporation is carried out inside a closed chamber in most cases & hence pure water vapor goes away from top through Mist Eliminators thus achieving Zero Liquid Discharge.

Mist creator nozzles operate with a choke-less design as mist formation is achieved when water comes out in whirling motion through its bore of size more than 16 mm in diameter. Hence, MES can easily handle RO/

FEATURES

Sr. No.	Description	Conventional MEE System	MES with natural evaporation – without using any heat source	MES with waste heat source viz. Hot air, hot water, flash steam, flue gas etc.	Mist Evaporation System with live steam as heat source throughout the year
1	Capacity (KLPD)	10	10	10	10
2	Salient features a) Water Consumption b) Waste Water Generation c) Civil Work d) Maintenance	a) Make up required for CT b) Impure 50°C condensate generated is to be disposed. c) Heavy due to static and dynamic load d) Very high	a) No Make up required b) No excess /impure condensate generated. c) Simple due to table top construction with static load. d) Negligible	a) No Make up required b) No excess /impure condensate generated. c) Simple due to table top construction with static load. d) Less	a) No Make up required b) No excess /impure condensate generated. c) Simple due to table top construction with static load. d) Less
3	Operational Cost/KLPD	Rs. 1000/KLPD	Rs. 100/KLPD	Rs. 80/KLPD	Rs. 500/KLPD
4	Saving on OPEX	Nil	Rs. 900/KLPD	Rs. 920/KLPD	Rs. 500/KLPD
5	Initial Cost	High	Low	Low	Low
6	Plot size	3 m ² /KLPD	10 m ² /KLPD	6 m ² /KLPD	6 m ² /KLPD

Effluent water of TDS up to 40% concentration without any choking.

Mist Evaporation Effect

As effluent water passes through Mist Evaporation System at very high velocity due to our patented nozzle design, it atomizes the water particles to fine mist to the size of 5 micron. As these fine mist particle come in contact of large air surface area, they tend to absorb heat available in ambient air and hence evaporate instantaneously to a large extent. We have observed this natural evaporation is appx. 18% in a day (Annual Average). This is additional evaporation due to natural mist evaporation effect combined with solar evaporation. This natural evaporation reduces actual heat required in heating tank.

Mist Evaporation System For Zero Liquid Discharge

Mist Evaporation System combines our unique Mist Cooling Technology with ambient Heat/ Solar plate effect to achieve Zero Discharge of Effluent / RO Reject. This

unique system also can use waste heat available at the plant to heat the effluent on one side & evaporation is achieved through Mist Evaporation Tower on second side to achieve Zero Liquid Discharge with minimum use of energy.

Salient Features Of MES Over Conventional Systems (MEE/MVCM)

- Minimal OPEX due to Natural Evaporation.



- Lower CAPEX.
- Entire operation happens inside a closed chamber only allowing pure water vapour to escape thus acting as a Natural evaporator.
- Negligible maintenance due to choke less design of nozzles.
- Vacuum and cooling system is not required.
- No make-up water required.
- MES achieves complete zero liquid discharge as the process does not produce impure condensate which is generated by conventional MEE which is to be disposed.
- Easy to operate.

Comparative Diagram Of Conventional Mee System & Mist Evaporation System For Zero Liquid Discharge

Types Of Mist Evaporation System (Mes)



Open Type MES

Where area is available, MREPL can guarantee complete Natural evaporation of effluent/RO reject by our high efficiency Mist Creation System installed in Open basin.

Totally Enclosed MES For Salt Concentration/ Zero Liquid Discharge



MES is closed from all sides up to 7 meter height by louvers and by canopy/mist eliminators at the top. Entire operation happens inside a closed chamber with top covered with Canopy/ Mist Evaporators. This allows only pure water vapour to escape from top & avoid carryover of any mist particle or impurities and also arrest entry of rain water.

This Technology Will Now Help Any Size Of Industry To Adopt Zero Liquid Discharge Policy Easily And Preserve Nature.■

Author



Makarand A. Chitale
Director
Mist Resonance Engg Pvt Ltd

Make the Right Maintenance Decisions With Intelligent Sensors



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

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

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

And despite all this maintenance, half of industrial accidents are maintenance related. Further, 20 % are due to human error. Hence, an increasing percentage of chemical plant expenditure is devoted to safety aspects. Until recently, deciding if and when to perform

sensor maintenance or replacement has been based on a combination of past experience and guesswork. Now, a modern technology removes all measurement system uncertainty and allows sensor maintenance to be conducted in a safe environment. This technology not only increases process reliability and plant safety, it also significantly reduces the costs of operating a measurement system over its lifetime.

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

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

Predictive diagnostics for efficient maintenance

In chemical plants, maintenance is often conducted on a scheduled basis, and an analytical sensor might be calibrated even though it may not actually be needed.

In other situations, plant engineers may wait until they think there is an issue with a measurement point. By which time, the concerned process or plant equipment may be detrimentally affected. ISM's diagnostics tools have solved these issues.

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

ISM diagnostics allow a measurement point to be optimized on an ongoing basis and for all critical situations to be predicted, so that maintenance staff can respond before production is affected. And because measurement point maintenance only happens when it is required, operators can be certain that resources



are not being wasted. With ISM, measurement point maintenance is converted from being a passive, costly, and unpredictable workflow, to a fully safe and controlled procedure. The key diagnostics tool in ISM is the Dynamic Lifetime Indicator (DLI).

Sensors That Learn

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

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

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

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

iSense – a digital sensor expert

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

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

Plug and Measure – fast and simple start up

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

Significant cost savings can be achieved

Calibration away from the process and Plug and Measure result in much lower sensor maintenance expenditure. Time spent on maintenance can be reduced by as much as 80 % by adopting ISM systems.

However, reduced maintenance is not the only avenue to cost savings. A standard pH sensor that requires calibration combined with an interference-prone analog signal can mean that a transmitted pH measurement may be off by 1 pH unit or more. If a process involves the feeding of reagents to raise pH, a reading that is 1 pH unit lower than the true value means ten times more reagent is being used than is required.

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

ISM solutions across your processes

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

Seamless integration of diagnostics data

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

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

Conclusion

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

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

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

About METTLER TOLEDO

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

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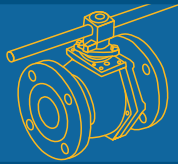
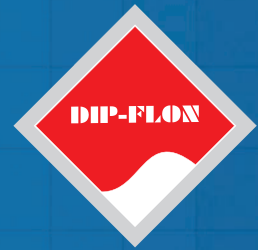
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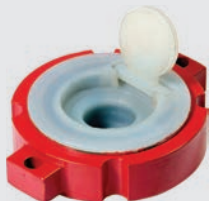
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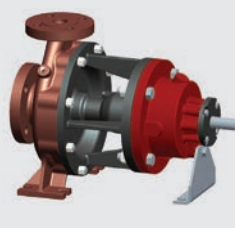
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