CHRONICLING PROCESS INDUSTRY INNOVATIONS SINCE 1966 VOL.58 | ISSUE 6 | JUNE 2023 | MUMBAI | TOTAL PAGES 50 | PRICE ₹ 150

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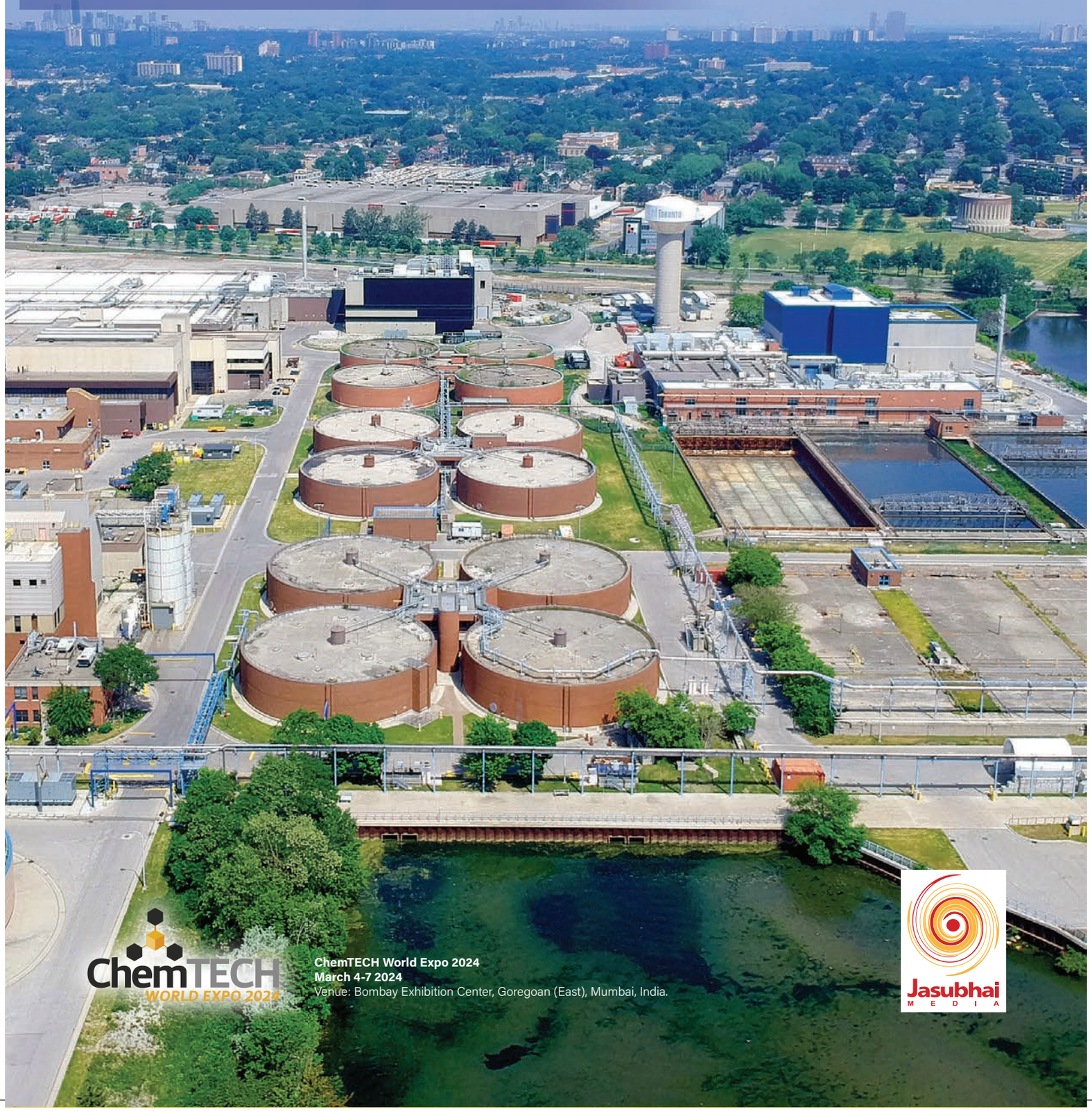

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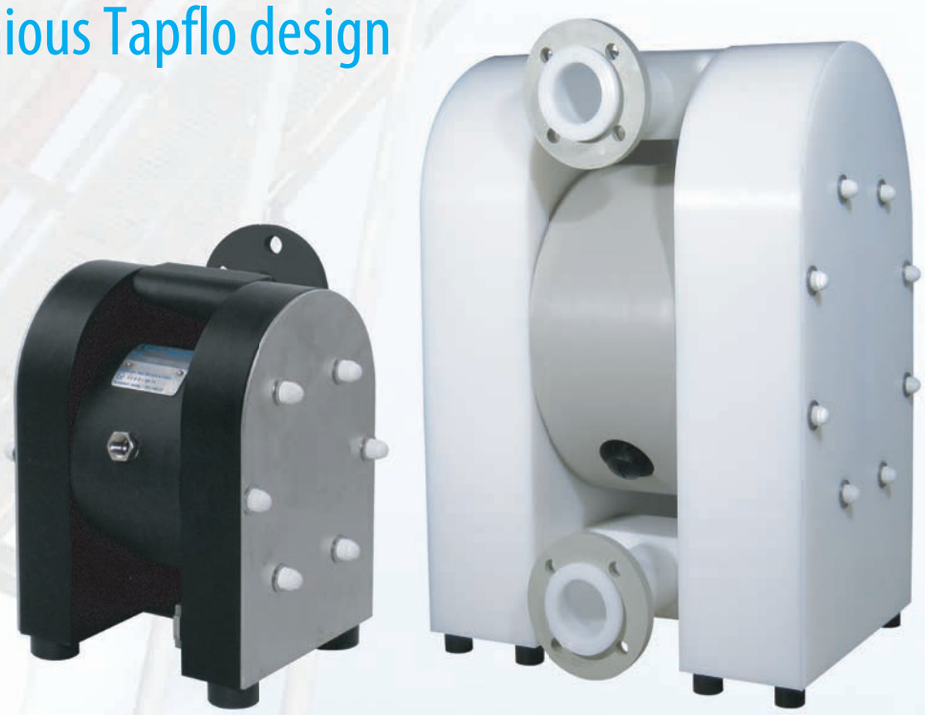

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IOCL and ONGC sign MoU to explore opportunities in petrochemicals

New Delhi, India: Indian Oil Corporation Limited (IOCL) and Oil and Natural Gas Corporation (ONGC) signed a memorandum of understanding (MoU) to explore downstream opportunities in petrochemicals, through greenfield projects and acquisitions. The MoU and NDA (Non-disclosure agreement) was signed by Executive Director, Petrochemicals, (ED-PC), IOCL, Arvindar Singh Sahney, and Executive Director of Joint Venture and Business Development, ONGC (ED-JV&BD), Debdulal Adhikari.

The agreement aims to explore prospects in utilizing downstream business in ONGC and IOCL (including their subsidiaries) and setting up assets, if feasible. Both the Maharatnas aim to scour and harness possibilities for using feedstock from both the companies and their subsidiaries to manufacture petrochemical products. The companies seek to jointly discover and search for global opportunities to enhance value creation from exports of refining and petrochemical yields as well as explore opportunities for collaboration in oil to chemicals and/or niche products.

L&T to build energy infrastructure for world's largest green hydrogen plant

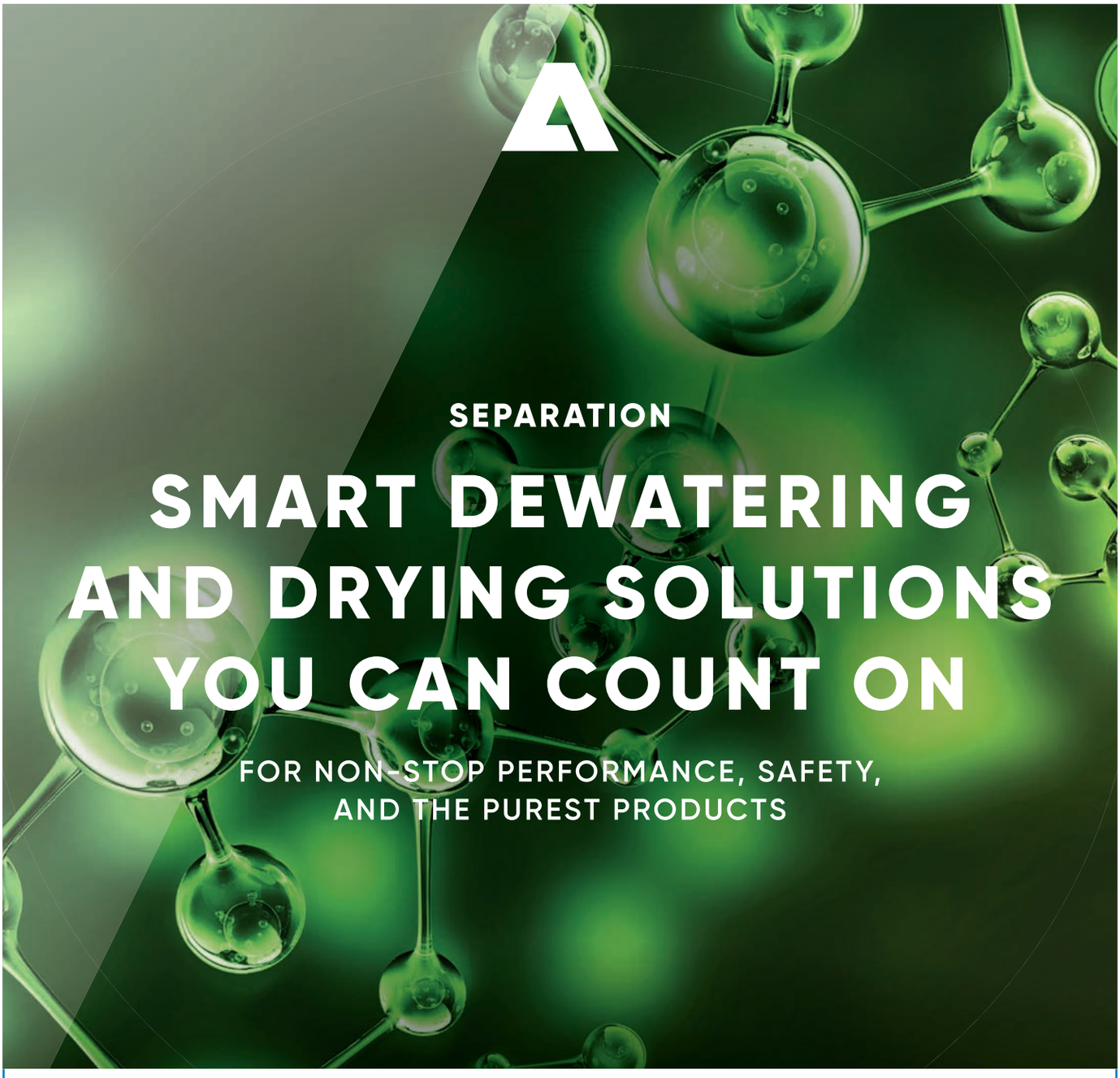
Mumbai, India: The Power Transmission & Distribution Business of Larsen & Toubro has achieved important milestones for the Power Elements and Grid packages of the world's largest green hydrogen plant being built by NEOM Green Hydrogen Company (NGHC) located at Oxagon in Saudi Arabia's region of NEOM. NGHC is an equal joint-venture by ACWA Power, Air Products and NEOM and NGHC will setup a mega plant to produce green hydrogen at-scale for global export in the form of green ammonia with a total investment of USD 8.4 billion. Supported by 23 local, regional, and international banking and financial institutions, the project has now achieved full financial close, and construction is moving forward.

A few quarters back, L&T received the nod to establish the Renewable Energy Generation, Storage and Grid

Linde CEO Sanjiv Lamba named Co-Chair of Hydrogen Council

Belgium, Europe: *Linde CEO Sanjiv Lamba has been named as incoming Co-Chair of the Hydrogen Council, an industry initiative that brings together leading companies with a united vision and long-term ambition for hydrogen to foster the clean energy transition. Linde is one of the founding members of the Hydrogen Council and has been a leader in the hydrogen business for more than 50 years.*

"Hydrogen plays a critical role in the transition to a low-carbon economy and will require significant commitment to scale up across the entire value chain," said Lamba. "The Hydrogen Council, as a CEO-led organization, is uniquely positioned to provide leadership in this journey. I am delighted to be appointed as a Co-Chair and look forward to serving alongside other hydrogen leaders at this pivotal time for our world."



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infrastructure, from Air Products, the system-integrating EPC Contractor and exclusive off-taker of green ammonia to be produced from the project. The value of the packages awarded to L&T aggregate to USD 2.779 billion. Since then, significant progress has been achieved in various activities including surveys, design & engineering, establishment of temporary facilities and procurement of long lead items. Under these contracts, L&T will engineer, procure, and construct a 2.2 GWac PV Solar Plant, 1.65 GW Wind Generation Balance of Plant and a 400 MWh Battery Energy Storage System under the Power Elements package. It will also construct 3 Nos of 380 kV Switching Stations, 306 KM of 380 kV Overhead lines and UG Cables required to the Kingdom's Grid network. The scope also includes the Energy Power Monitoring System (EPMS) for the complete network.

Appreciating the bold vision of the Kingdom and the project proponents, the CEO and MD of Larsen & Toubro, S. N. Subrahmanyan said, "Such initiatives at scale have the potential to speed up global energy transition. Also, these technology-led projects are aligned with L&T's aspirations towards propelling our next wave of growth and reflect the customer's trust in our commitment to professionalism, timely delivery, and quality".

Anupam Rasayan signs ₹2,186 crores LoI with a Japanese speciality chemical company

Sachin, Gujarat: Anupam Rasayan has signed a Letter of Intent (LoI) worth revenue of USD 265 million for

next 5 years with one of the leading Japanese Speciality Chemical company to supply new age patented life science active ingredient. The product will be in validation phase for the next eighteen months and upon the successful validation, the supply will commence from CY 2025. This product will be manufactured in our existing multipurpose manufacturing facilities.

Anand Desai, Managing Director of Anupam Rasayan, said, "We are pleased to announce that we will be the primary global supplier of this new age patented life science active ingredient to one of the leading Japanese specialty chemical companies with the support of our Japanese business development team. With the addition of this new customer, we are delighted to include another renowned Japanese multinational in our customer portfolio. As we are fully backward integrated for this molecule, we can provide supply chain assurance to the customer without dependencies on supplies from other geographies."

Amarendu Prakash is the new Chairman of SAIL

New Delhi, India: *Amarendu Prakash has assumed the charge as Chairman of Steel Authority of India Limited (SAIL) on Wednesday. Prior to taking charge as the Chairman of SAIL, he held the post of Director in-charge, Bokaro Steel Plant (BSL), SAIL.*

He is a Metallurgical engineer from BIT Sindhri and joined SAIL in 1991 as a Management Trainee (Technical). After working in various positions of responsibilities in plants and units, Prakash was selected as a Director in the SAIL Board in charge of Bokaro Steel Plant in 2020.

In his career spanning more than three decades in SAIL, Prakash has had exposure to plant operations at shop level, exposure to corporate functions in the head office and leading a large steel plant with mining operations. He was a key member of the team that was leading the business transformation and financial turnaround of SAIL in 2015-17.

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Adani Green: 1st in Asia for ESG performance

Ahmedabad, Gujarat: Adani Green Energy Limited (AGEL), India's largest renewable power producer and the renewable energy arm of the diversified Adani Group, has been ranked 1st in Asia and among the top 10 companies globally in the renewable energy sector by International Shareholder Services Inc. ISS ESG. AGEL has been placed in the 'Prime' (B+) band for its robust ESG disclosure practices and high level of transparency. This milestone takes AGEL a step closer to achieving its target of being rated among the top 10 ESG companies in the world in the electric utility sector by FY25.

AGEL has the largest operating renewable portfolio in India with 8,216 MW. Its operations provide clear environmental benefits through its contribution to fighting climate change and by enabling transition to a more sustainable energy system. Relevant social and environmental risks are addressed through dedicated management systems.

"At AGEL, there are four pillars to the ESG framework – guiding principles, policies, commitment and assurance – helping the company align with UN Global Compact, UN Sustainable Goals, India Business and Biodiversity Initiatives, Green Bond Principles, and IFC's E&S Performance," said Vneet S Jaain, MD, Adani Green Energy Ltd. "Our policies are aligned with these guidelines and ESG targets have been set keeping these policies in mind. Our aim is to be among the top 10 companies of the world in the ESG benchmarking of the electric utility sector by FY25."

Saint-Gobain Glass commences production of India's first low carbon glass

Mumbai, India: Saint-Gobain India commences production of a new glass with a low carbon footprint to address the need for low carbon building materials in the Indian construction industry. The product should have an estimated carbon footprint reduction of approximately 40% compared to the existing Saint-Gobain Glass

Sanjay Varma takes over as Managing Director of MRPL

Mangalore, India: *Sanjay Varma, who is serving as Director (Refinery) of MRPL, has taken over additional charge as Managing Director of Mangalore Refinery and Petrochemicals Limited (MRPL).*

Verma has rich exposure & expertise the oil and gas industry. During his three-and-a-half decades of service, he headed the organisation in operations management, project management, materials management and HSE management.

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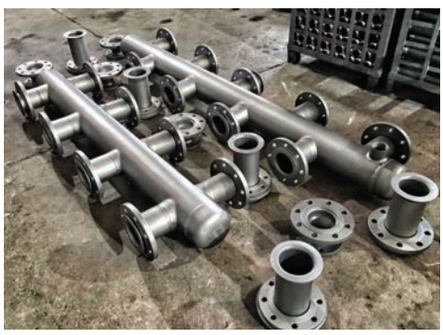

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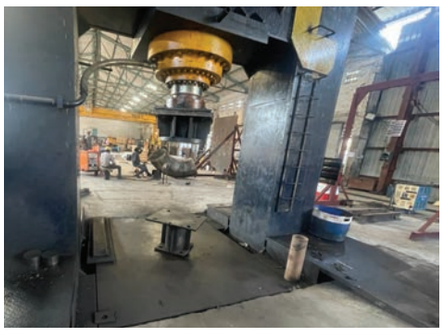

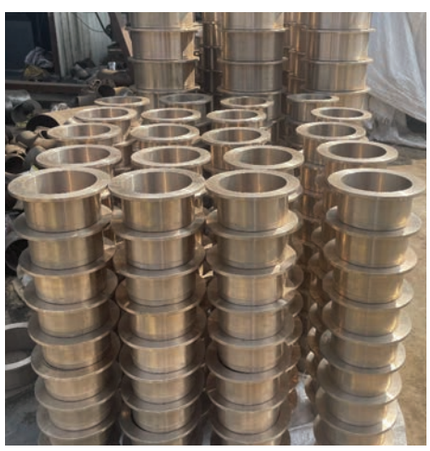

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India products. This low carbon glass will retain all the technical, quality, and aesthetic performance of regular glass and will soon be integrated as a substrate option in the energy-efficient glass portfolio of Saint-Gobain Glass. This new low carbon substrate in Saint-Gobain Glass India offer will give a boost to the embodied carbon reduction of buildings alongside the operational energy efficiency performance.

The building industry currently accounts for almost 40% of global greenhouse gas emissions and is at the heart of the decarbonization challenge. As stated in the joint study conducted by Engineering consulting firm Arup and Saint-Gobain Glass in 2022 on facades, it is key to act jointly on both reducing operational and embodied carbon. Saint-Gobain Glass Advanced Magnetron coating technology can already drastically reduce greenhouse gas emissions caused by artificial cooling and lighting for buildings during the use phase (operational carbon footprint).

Vipul Organics FY23 revenues marginally up despite multiple headwinds

Mumbai, India: Vipul Organics has reported standalone net sales at ₹31.39 crore during the quarter ended in March 2023 down 19.25% from ₹ 8.88 crore during the corresponding quarter in 2022. Quarterly net profit stood at ₹0.36 crore in March 2023 down 83.67% from ₹2.23 crore in March 2022. Meanwhile, EBITDA stands at ₹3.13 crore in March 2023 down 38.39% from ₹5.08 crore in March 2022.

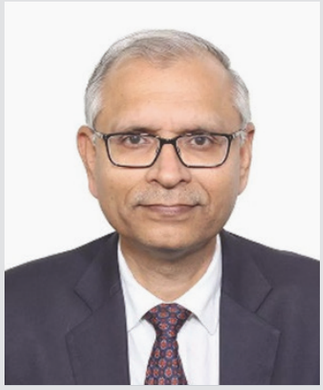
Commenting on the results, Vipul P. Shah, Managing Director, Vipul Organics Limited, said: "Financial year 2022-23 was a challenging one for us as well as the entire Chemical Industry with multiple headwinds. We have taken steps to de-risk our business from Global turbulence by increasing our Domestic business and bringing Value added products. Today, over 30 percent of our top line comes from domestic markets."

Speaking on the future outlook, Shah said: "We are in the process of creating a Pan India footprint for our products by strengthening our Distribution network. We have increased our Production capacities and entered new verticals like Paper, Special Applications, etc. While we are seeing Green Shoots in the Economy in India as well as Globally, the challenges remain. We are all geared up to take advantage of the improvement in Macroeconomic factors. We are hopeful that the coming year will be better, and we will be back to a growth rate of 15-20 percent."

Dhanuka Agritech launches BiologiQ range of products

New Delhi, India: Dhanuka Agritech Ltd., has announced its entry into the agri-biological segment with the launch of its BiologiQ range of products. BiologiQ is a unique range of sustainable solutions developed with the combination of traditional science and new-age agriculture practices. BiologiQ represents a broad category of crop protection, soil health, and plant nutrition products that are derived from nature.

Sanjay Kumar appointed as Director (Marketing) of GAIL



New Delhi, India: *The Appointments Committee of the Cabinet (ACC) has approved the appointment of Sanjay Kumar for the post of Director (Marketing) of GAIL (India) Limited. According to an order issued form the Department of Personnel & Training (DoPT).*

Kumar has been appointed to the post with effect from the date of taking over charge of the post till the date of his superannuation i.e., June 30, 2027, or until further orders, whichever is the earlier. Presently, he serves as Executive Director (Marketing) in the same organisation. He was recommended for the post of Director (Marketing) of GAIL by the PESB panel on March 29th, 2023.

M K Dhanuka, Vice Chairman & Managing Director, Dhanuka Agritech Ltd

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M K Dhanuka, Managing Director of Dhanuka Group said, "We are launching three biological products Whiteaxe, Downil, and Spornil in the bio-agri segment. This segment is increasing globally, and we see good demand for these products in India as well. We hope that in times to come we will be introducing some more biological products in our BiologiQ range."

SABIC expands chemically resistant LNP CRX copolymer portfolio

Riyadh, Saudi Arabia: SABIC has introduced three new LNP™ CRX copolymer resins to give customers in the mobility and industrial sectors new material options that can resist both harsh chemicals and challenging environmental conditions. The new polycarbonate (PC) copolymer-based LNP CRX products deliver the chemical resistance expected from this portfolio, in combination with exceptional weatherability (UL74C F1 rating, low-temperature ductility and ability to withstand high levels of heat and humidity).

These properties may help enhance the durability of components such as charging sockets for electric vehicles (EV) and housings for outdoor battery storage equipment. In turn, greater durability helps to extend the useful life of parts, thereby advancing sustainability goals through lower demand for raw materials, energy, water and other resources. Because of these durability and sustainability benefits, the new additions to the LNP CRX copolymer resin portfolio can be great options for applications across several market sectors, including healthcare and consumer electronics.

K V Suresh Kumar assumes charge as Director (Marketing) of BEL

New Delhi, India: *Kaipa Venkata Suresh Kumar has taken over charge as Director (Marketing) of Navratna Defence PSU Bharat Electronics Limited (BEL) on Friday. He was serving as the General Manager of BEL's Product Development & Innovation Centre (PD&IC) in Bengaluru before his elevation.*

On June 15th, 2023, the Appointments Committee of the Cabinet (ACC) has approved his appointment for the post. According to a DoPT order, Suresh Kumar has been appointed to the post till the date of his superannuation i.e., June 30th, 2026, or until further orders, whichever is earlier.

Best Agrolife to manufacture both AI and Formulations of Pyroxasulfone

Vimal Kumar, MD, Best Agrolife Ltd

New Delhi, India: Best Agrolife Ltd. (BAL) has been granted registration for the domestic production of Pyroxasulfone 85% WG and three other key technical. In its 447th meeting, the Central Insecticides Board & Registration Committee (CIBRC) authorized one of BAL's fully owned subsidiaries, Seedlings India Pvt Ltd, to manufacture Pyroxasulfone 85% WG domestically in accordance with section 9(3) FIM vs. FIT.

"This is a significant advancement for us. In addition to our proud innovation Ronfen, we launched a number of 9(3) and generic products in FY23, and we have similar intentions for FY24. With this new registration in hand, BAL has become the first and only agrochemical firm in India to produce both AI and formulations of Pyroxasulfone. We already hold the registration for the manufacturing of Pyroxasulfone technical. We will launch this product in October of this year as we have both product registrations. For the same, we have also applied for a special process patent, which we will receive soon. We have already submitted registration applications in other countries since we intend to manufacture this product for both national and international markets," said Vimal Kumar, MD, Best Agrolife Ltd.

BAL has recently received the registration for the indigenous manufacturing of the combination product Trifloxystrobin 10% + Difenoconazole 12.5% + Sulphur 3% Sc under section 9 (3) FIM. This combination effectively controls several crop diseases like Sheath blight, Powdery Mildew, Scab, and Alternaria in Rice, Tomato, Grapes, Chilli, Wheat, Mango, and Apple. BAL is all set to launch this product in July with the brand name Tricolour.

Petronas Chemicals reaches FID on maleic anhydride plant in Malaysia

Kuala Lumpur, Malaysia: Petronas Chemicals Group Berhad (PCG) has reached the Final Investment Decision (FID) to fully acquire the 113 kilo-tonnes per annum (ktpa) Maleic Anhydride (MAn) plant located in Gebeng, Kuantan from BASF Petronas Chemicals Sdn. Bhd. (BPC). The plant will broaden PCG's product portfolio and its derivatives to further strengthen PCG's derivatives product offerings.

The FID signifies the start of the plant's project execution phase that will upgrade and rejuvenate the facilities to produce refined MAn, which is targeted to be ready by second half of 2025. PCG Managing Director/ Chief Executive Officer Ir. Mohd Yusri Mohamed Yusof said, "The FID on the MAn plant signifies the strong commitment towards capturing new growth opportunities through diversification into derivatives and specialty chemicals. This will also allow us to produce MAn to meet rising demands from customers in Asia-Pacific and Indian subcontinents while exploring potential opportunities in European and Middle Eastern markets."

INEOS Nitriles launch Invireo bio-based acrylonitrile to deliver 90% reduction of GHG emission

Rolle, Switzerland: INEOS Nitriles has launched its first bio-attributed product line for Acrylonitrile. The new product is to be sold under the Invireo brand. Invireo represents innovation in the global acrylonitrile market and offers a more climate-friendly and sustainable alternative to existing acrylonitrile. Manufactured at INEOS Nitriles' site in Cologne Germany, Invireo is made using bio-attributed propylene, which enables the replacement of fossil fuel resources. INEOS Nitriles' certification by the International Sustainability & Carbon Certification (ISCC Plus) and Roundtable on Sustainable Biomaterials (RSB) allows the use of bio, bio-circular and circular feedstock into the supply chain according to a mass balance approach.

Acrylonitrile is essential to, and successfully used in, a variety of industrial applications such as wind turbines, automotive, aerospace, textile, chemicals for special applications and sporting goods. These applications are essential to our everyday life, and it is important that we continue to serve society's needs, whilst continually reducing carbon emissions.

BASF and CPGC accelerate onboard CO2 capture system development

Shanghai, China: CSSC Power (Group) Co., (CPGC) and BASF have formed a solid cooperation to expedite the progress of onboard carbon capture (CO2 capture) system for commercial maritime applications. CPGC has always been committed to providing green, low carbon solutions for the shipping industry. Combining CPGC's leading capabilities in research and development, manufacturing and supply of marine engines and power systems with BASF's gas treatment expertise, this cooperation helps to achieve sustainable developments in the global shipping industry.

Both parties signed a Memorandum of Understanding (MoU) during the 2023 Shanghai International Carbon Neutrality Expo in Technologies, Products and Achievements to commemorate the partnership. The cooperation aims to address the challenges of energy efficiency improvement and emission reduction in the maritime sector to meet the growing demand for decarbonization of vessels. The companies will conduct tests against different types of marine fuel and engines to accelerate the development of onboard carbon capture system using BASF's OASE blue gas treatment technology.

AkzoNobel launches online energy savings calculator for powder coatings

Amsterdam, Netherlands: An openly accessible online energy savings calculator for all users of powder coatings has been launched by AkzoNobel. For the first time, all powder coatings customers can instantly calculate the energy and carbon reduction they could achieve with the company's Interpon products and related services. It's the latest example of how the company is continuing to work towards its ambition of reducing carbon emissions across the full value chain by 50% by 2030.

"Sustainability is critical for all of us and helping customers to reduce energy is one of the many ways we can work with – and for – them in order to meet our shared ambitions," says Jeff Jirak, Director of AkzoNobel's Powder Coatings business. "We're proud to be the first in the industry to introduce this kind of openly available online resource," he continues. "It will enable us to create better awareness and enable customers to really get to grips with the potential energy and carbon reductions that can be achieved with low cure powder coatings." Jirak adds that in order to understand the full range of possible benefits for individual users, further details of customer-specific situations would be required.

LyondellBasell and AFA Nord form JV focused on recycling packaging materials

Rotterdam, Netherlands: LyondellBasell and AFA Nord, a leading recycler of agricultural film, have agreed to create a 50:50 joint venture that intends to recycle post commercial flexible secondary packaging waste. The joint venture company, LMF Nord GmbH, plans to build a mechanical recycling plant in Northern Germany to turn Linear Low-Density Polyethylene (LLDPE) and Low-Density Polyethylene (LDPE) waste into quality recycled plastic materials for use in flexible packaging. Start of production is expected for early 2025. Secondary plastic packaging, such as stretch or shrink film, is mainly used to hold packed consumer goods together and protect them during transportation and storage from contamination and damage.

Until today, this material is difficult to recycle into high-quality raw materials that can meet the requirements of the packaging industry regarding strength and transparency of their final product. "This Joint Venture will provide recycled LDPE and LLDPE materials and complements our existing CirculenRecover range of high-density polyethylene and polypropylene products," says Yvonne van der Laan, LyondellBasell's executive vice president, Circular and Low Carbon Solutions. "It adds to our efforts in advanced recycling and delivers against our integrated hub strategy, where we invest upstream to provide feedstock from various plastic waste streams. With this efficient full suite of solutions, we continue to be the preferred partner of our customers."

ANNUAL ARC INDUSTRY FORUM ASIA: Driving Sustainability, Energy Transition and Performance through Digitalization

Bangalore, India: July 12-13, 2023- Energy transition and sustainability are now being woven into the core business strategies of industrial companies, who now have the mandate and opportunity to tackle environmental and social challenges. Companies that are more advanced in their digital journeys are already integrating sustainability and energy transition initiatives, together with competitive excellence, resilience and agility, and workforce goals, into a comprehensive strategy driving towards becoming a focused, integrated, digital organization.

Technologies like digital twin, cloud, machine learning, edge computing, IoT, cybersecurity technology, additive manufacturing, augmented reality, and more are enabling new business processes and obscuring traditional functional boundaries. OT, IT, and ET teams are growing their skills and capabilities and transforming real-time operations. ESG, governance and compliance, workforce and skills, customer-centricity, competitive excellence, servitization, and change management all need management attention.

Executives charged with driving transformation are seizing this moment to innovate and deliver real value. Call it digital transformation, smart manufacturing, or Industry 4.0, industrial companies are driving to innovate, transform, and accelerate the future. ARC Advisory Group's Asia Forum for process and discrete industries is a not-to-be-missed event for all stakeholders – technology solution providers, end users, industry trackers, decision and policy makers, and the media.

Featured Topics: Improving energy efficiency; Advance control strategies; Smart grid and smart cities; Collaboration at the user and device levels; Managing legacy and aging infrastructures; 3D training and simulation; Social media; Advanced analytics and big data; Cloud computing; Impacts of mobile computing; Enterprise and plant asset management; Supply chain management including service lifecycle management; Cyber security & safety.

Register online at https://arc-industry-forum-asia.arcweb.com/en/registration/or

Email: RamanG@arcweb.com/citoh@arcweb.com

HP Green R&D Centre of HPCL completes indigenization of H2 PSA technology

Bengaluru, India: Hindustan Petroleum Corporation Limited (HPCL) is pleased to announce that its HP Green R&D Centre (HPGRDC) in Bengaluru has achieved a significant milestone by successfully completing the indigenization of Hydrogen Pressure Swing Adsorption (H_2 PSA) Technology. This includes all major technical elements such as the adsorbent system, PLC system and program, and plant design. As a result, HPCL is now ready to offer comprehensive technology solutions to the industry.

The HP Green R&D Centre in Bengaluru has been at the forefront of cutting-edge research and development, catering to the evolving needs of the petroleum refining and energy industry. In just seven years since its inception, HPGRDC has commercialized 55 technologies and products and has been granted 167 patents.

A major technological breakthrough achieved by HPCL is the development of India's first indigenous H_2 PSA Technology, widely used for hydrogen purification in refineries. This in-house technology was successfully demonstrated through the establishment of a commercial-scale Greenfield 6-bed H_2 PSA unit in the Continuous Catalytic Reformer (CCR) block of HPCL's Visakh Refinery, with a feed capacity of 36,000 Nm^3/hr. The unit has been operating successfully for the past eight years since its commissioning in 2015.

Leveraging its strong adsorption research facilities and expertise, HPCL has also developed efficient adsorbent systems for commercial H_2 PSA units. Adsorbent replacement was successfully carried out in the commercial-scale 5-bed H_2 PSA unit with a capacity of 33,400 Nm^3/hr at the Mumbai refinery, as well as in the 10-bed H_2 PSA unit with a capacity of 79,200 Nm^3/hr. Both units have demonstrated excellent performance over the past five to seven years.'

Sulzer to supply 50 pumps for one of world's largest green hydrogen project

Winterthur, Switzerland: Sulzer bags contracts to supply 50 pumps that will support the production of green ammonia, which is the most easily transported product that can be converted to hydrogen at import destination to supply local refuelling stations.

Green ammonia unlocks a number of opportunities for sustainability in the transportation sector. It is created using hydrogen that is produced by electrolyzing water and combining it with nitrogen captured from the atmosphere using an air separation unit. All the energy for these processes comes from wind and solar resources, avoiding any need for fossil fuels. Green ammonia can also be used as an agricultural fertilizer, but it can also be easily transported in a liquid state to fuelling stations where it can be converted to carbon-free hydrogen gas.

This technology is being developed on an industrial scale by the NEOM Green Hydrogen Project, which is building a production plant with a capacity of around 220,000 tonnes per year of carbon-free hydrogen, in the form of green ammonia, that will be used around the world.

Huntsman and V-Carbon Technologies Combine Expertise for End-of-Life Recycling Solutions for Carbon Fiber Composites

Texas, United States: There is no denying the advancements made possible through the use of composite materials in the world today. Aviation, transportation, and energy sectors simply could not deliver the 30+% fuel and energy efficiencies without the use of these strong and lightweight composites. While these achievements are significant, there is one area where efforts to improve the sustainability of products has lagged behind – recyclability.

A commitment to a CO2-neutral economy requires a sustainable approach to carbon fibre composite recycling, one that can address the waste volumes being produced by the composite industry and the end-of-life (EOL) volumes that are building annually with limited options other than disposing in landfills or incineration.

Experts in Huntsman's Advanced Materials division approached several recycling companies to propose collaboration efforts targeting the recovery or recycling of both the fibre and the resin and chemical components. They found an ally in V-Carbon Technologies, a UK-based advanced materials technology company.

V-Carbon has developed the first fully integrated carbon fibre (CF) circular economy for use in the aerospace, automotive, wind energy, and industrial sectors. A highly innovative and integrated process chain has been developed to deliver advanced materials systems using high performance second life carbon fibres. V-Carbon's technology driven approach is disruptive; it addresses the whole process chain from fibre to formulated products. Impressively, recovered carbon fibre material systems retain their mechanical performance for high performance, high value applications across the relevant market segments and are easily integrated into existing manufacturing platforms.

The V-Carbon technology is based on a patented "chemolysis" process that is able to deliver a complete circular economy with no waste where the carbon fibre as well as the chemical resins obtained at the end of the recycling process provides the opportunity for repurposing.

UPL spins off specialty chemical business for ₹ 3,572 crore

Mumbai, India: UPL has spun off Specialty Chemical business on a slump sale basis as a going concern to wholly owned subsidiary UPL Speciality Chemicals for consideration of ₹3,752 crore.

The international crop protection vertical has been transferred to UPL Corporation, Cayman. It has separated the global seeds business vertical under 'Advanta Enterprise and India crop protection business and digital business under UPL Sustainable Agri Solutions.

The company has raised USD 500 million by divesting minority stakes in Advanta Enterprises (13.3%) and UPL SAS (9.1%) to marquee global investment firms Abu Dhabi Investment Authority, KKR and Brookfield at a 'significant valuation premium' to the listed parent company UPL, said the company

The business realignment is expected to be completed in 3-4 months. ■

Haripriyaa Agro Energy to setup molasses/juice-based distillery facility in Maharashtra

Satara, India: Haripriyaa Agro Energy is planning to set up a molasses/juice-based distillery facility with a capacity of 220 klpd at Koregaon in Satara district of Maharashtra. The proposed unit will spread over 40 acres of land parcel and involve a 12000 TCD of sugar mill and 40 MW of a co-generation plant.

Haripriyaa Agro Energy has received terms of reference (ToR) for its upcoming manufacturing unit. In addition, the company is awaiting environmental clearance (EC) and financial closure. The company expects to begin the work on the project by December 2023 and is in the process of finalising machinery suppliers for the project.

Lubrizol plans to invest ₹1,200 crore for CPVC resin plant in Gujarat

Gujarat, India: Lubrizol Corporation is planning to invest over USD 150 million (approx. ₹1,200 crore) across multiple projects in India.

The investment will be made towards the setting up of a chlorinated polyvinyl chloride (CPVC) resin plant in Vilayat, doubling the capacity at its site in Dahej in Gujarat and opening a grease lab in Navi Mumbai. Lubrizol and Grasim Industries will jointly break ground on the first phase of the one-lakh-tonne CPVC plant during this year, which would earn it the reputation of being the largest single-site capacity for CPVC resin production globally.

Moreover, the specialty chemicals maker, which is firm on doubling its existing CPVC compound capacity at Dahej from the existing 70,000 tonne to 1.40 lakh tonne, also plans to serve the neighbouring markets like Nepal, Bangladesh and Indonesia with the expanded capacity.

Lubrizol is also planning to set up a local research and development (R&D) centre, as its second global R&D centre after North America.

Mahesh Raj Chemicals to set up a new unit in Bharuch, Gujarat

Bharuch, Gujarat: Mahesh Raj Chemicals is planning to set up a new dyes and Intermediates manufacturing unit with a capacity of 2,500 tpm at Industrial Estate Dahej-II in Bharuch district of Gujarat. The proposed unit will span over 2.88 acres of land parcel.

The company is currently awaiting environmental clearance (EC) for the project and expects to begin work on the project by October 2023.

Tata Group signs MoU with State Govt. of Gujarat for ₹13,000 crore lithium-ion battery plant

Gujarat, India: The Tata Group will set up a lithium-ion cell manufacturing facility in Gujarat, which will be the first in India, with an investment of ₹13,000 crore, its subsidiary Agratas Energy Storage Solutions on 2nd June 2023 inked a memorandum of understanding (MoU) with the state government as part of the new Gujarat Electronics Policy.

The plant will have an initial capacity of 20 GWh will help lower the state's dependence on China and Korea for the supply of battery cells to India. Setting up of a gigafactory is in alignment with the target of 50 percent carbon emission-free energy and 100% electric vehicle (EV) adoption by 2030.

Melker TTI Biofuels plans to set up a new ethanol plant in Goa

Goa, India: Melker TTI Biofuels plans to set up a grain-based ethanol plant at Navelim village in Bicholim taluka of North Goa. The proposed unit will span over 38.99 acres of land parcel and includes a 15 MW co-generation power plant.

The civil work on the project is expected to begin by November 2023 and presently, Melker TTI Biofuels is awaiting environmental clearance for the project.

Nakshtra Biofuels to expand capacity of its distillery unit in Haryana

Karnal, India: Nakshtra Biofuels is planning to expand its grain-based distillery unit capacity from 120 klpd to 500 klpd at Kadrabad village in Indri tehsil, Karnal district of Haryana. The proposed unit will also involve the expansion of the co-generation power plant from 3.5 MW to 10 MW.

Presently, the company is awaiting environmental clearance for the project, and they plan to commence work on the project by December 2023.

Shree Samarth Phosphates to set up a new manufacturing unit in Maharashtra

Solapur, India: Shree Samarth Phosphates plans to set up a powder single super phosphate/granulated single super phosphate unit with a capacity of 1,20,000 tpa at MIDC Chincholi in Solapur district of Maharashtra. The proposed project will cover over 2.97 acres of land.

Shree Samarth Phosphates is awaiting environmental clearance for the project and has scheduled to commence the work on the project in Q4/FY24 and expects completion by January 2025. ■

The Benefits of Standardizing Strainers for Asset Protection Applications

Asset protection is crucial for maintaining the longevity and efficiency of equipment in various industries. Strainers play a pivotal role in preventing damage caused by debris and contaminants, ensuring uninterrupted operation. This editorial focuses on the benefits of standardizing strainers for various asset protection applications, with a particular emphasis on Sungov Engineering's cost-effective solutions. By comparing custom-manufactured strainers to standard strainers, we highlight the advantages of standardization, supported by cost benefits between a fabricated custom-manufactured strainer purchased against a specific RFQ process and a standard strainer purchased through a long-term agreement contract.

Pumps are essential components in numerous industries, and their protection is vital for continuous operation. Custom-made strainers for pump protection often involve design complexities, increased costs, and longer lead times. For example, consider an RFQ (Request for Quotation) for a fabricated custom-made strainer specific to pump protection. The process includes engaging engineering resources for design, obtaining quotations from suppliers, and multiple iterations before finalizing the design. These additional steps incur costs in terms of design, engineering, and procurement.

Sungov Engineering's Cost-Effective solutions

On the other hand, Sungov Engineering's standard strainers offer several advantages. With a comprehensive range of strainers available, including Y and basket types, Sungov Engineering provides standardized solutions suitable for a wide range of pumps. The standardized design ensures compatibility with various equipment models, minimizing the risk of compatibility issues and simplifying the selection process. Additionally, Sungov Engineering offers strainers in different types, sizes, pressure ratings, screen ratings, and metallurgies, catering to diverse application requirements.

Standard strainers from Sungov Engineering present a cost-effective alternative. The company manufactures strainers in large quantities, benefiting from economies of scale and enabling competitive pricing.

Deriving from its 35+ years of experience, the company works with pump manufacturers to arrive at a standardized technical specification depending on the type and application of pumps. This avoids unnecessary over-the-top specifications like very fine screen ratings resulting in pressure loss, thereby energy loss for the end user. General process pumps centrifugal pumps, diaphragm pumps have relatively large clearances between moving parts. Using 40 mesh screen is adequate for most applications. A correctly sized strainer goes a long way in saving operating costs for the end user and helps extend the life of the pump and motor.

Similarly, Sungov Engineering offers solutions for for dry gas mechanical seal protection where standardization is easily feasible. Dry gas mechanical seals are critical components in applications such as compressors, turbines, and pumps, preventing gas leakage. Protecting these seals from contaminants is essential for their longevity and efficiency.

Sungov Engineering offers a comprehensive range of standard high pressure, small size Y strainers suitable for dry gas mechanical seal protection. These standard strainers are designed to fit a wide range of seal types,

Project specific procurement	Long term agreement (LTA) procurement
Every procurement involves multiple stakeholders, including at least one procurement engineer and one piping engineer. Their roles include sending RFQs, reviewing bids for compliance with project specifications, negotiating commercial terms, and placing orders.	For each OEM product line, the standardization process and long-term agreement (LTA) involve the collaboration of a procurement engineer, piping engineer, and application engineer.
In each instance, an inspection engineer or third-party inspector (TPI) plays a role in conducting physical inspections and providing clearance.	During the standardization process, an inspection engineer conducts a quality system audit once. For subsequent orders, the inspection engineer provides inspection clearance based on documentary evidence.

ensuring compatibility and ease of integration. The company's offerings include strainers with fine screen ratings (generally 100 mesh) due to the nature of the close tolerance precision machined components in the asset (dry gas mechanical seal).

Having a long-term agreement for standardized strainer procurement benefits OEMs (original equipment manufacturers) like pump manufacturers, dry gas seal manufacturers during the bidding phase for new projects. By having a predetermined agreement with a trusted strainer supplier like Sungov Engineering, the OEM can confidently include the standardized strainer specification along with their product technical bids. This ensures consistency, reliability, and cost-effectiveness, giving the OEM an advantage in the competitive bidding process.

Standardizing strainers for asset protection applications, such as pump protection, heat exchanger protection, and dry gas mechanical seal protection, offers significant benefits. Sungov Engineering's wide range of standard Y and basket strainers, available in various types, sizes, pressure ratings, screen ratings, and metallurgies, provides cost-effective solutions for diverse application requirements. By opting for standard strainers, customers can realize cost savings through competitive pricing, reduced lead times, and minimized maintenance and replacement expenses. Sungov Engineering's commitment to standardization, quality, and compatibility positions them as a trusted partner in the asset protection arena, delivering efficient and economical solutions. ■

DesaliTec™ Closed-Circuit Reverse Osmosis

DesaliTec™ Closed-Circuit Reverse Osmosis (CCRO) a DuPont brand, has set a new standard for RO, opening opportunities for dramatic cost savings and operational benefits. Ajay Bajaj of DuPont Water Solutions explains how this breakthrough technology works and its significance to industrial and municipal water and wastewater reuse.

Flexibility: DesaliTec™ CCRO systems automatically adapt to changing feedwater and allow the operator to modify recovery, cross flow, and flux in real time.

Reliability: DesaliTec™ CCRO systems naturally mitigate the fouling and scaling that typically plagues reverse osmosis systems. Automated operation with online monitoring provides additional protection.

Maximum Recovery: DesaliTec™ CCRO systems come with an elegant single-stage design, operating at up to 98% recovery, allowing you to achieve your sustainability goals.

Energy Savings: DesaliTec™ CCRO systems hug the osmotic curve as a function of time, reducing the energy consumption on higher salinity feed waters.

Return On Investment: Using DesaliTec™ CCRO, owners and operators can mitigate the risk of downtime, while the data-driven software maximizes operational efficiency in real-time. With savings in water, wastewater disposal, energy, chemicals, cleanings, membrane life and optimized pretreatment, ROI is typically recognized in less than a year.

It is no secret that fresh water supplies are limited and are under pressure almost everywhere in the World. With more people, more industries, urbanization, depleting resources, pollution, climate change, and massive difference in untreated and treated wastewater, the pressure on water supplies will continue to intensify.

A future where industry has the necessary water to make the products on which we rely. A future where we 'efficiently' optimize the circular nature of water so that not a drop of water is wasted.

Water management is being emphasized 'as a priority' at highest levels and there are several initiatives that

Cites / Credits: United Nations Sustainability Development Goals Reports

promotes management and conservation of water in an efficient possible manner, like 'Catch the rain', 'more crop per drop', 'rain water harvesting', and 'reuse' are few names of many sustainability development goals (SDG6) initiatives, refer image 1. Government and regulatory authorities are emphasizing on reuse / zero or minimum liquid discharge, promoting internal water reduction for Industries and making discharge norms stringent for discharge.

We know it is doable. Many of the technologies required to optimize water — at the residential level to the global level — exist today. We have one such breakthrough technology, known as Closed-Circuit Reverse Osmosis.

Breakthrough innovations often either fundamentally change a method of work or change how something is done. For example, smartphones are not merely used

only to make phone calls but with the introduction of digital tools it offers users to communicate, connect, consume, and share information and often addresses pain points of old ways of doing things.

DuPont has introduced DesaliTec™ CCRO systems formerly known as Desalitech CCRO, that fundamentally disrupts traditional reverse osmosis (RO) technology, sparking a technological revolution that delivers cost savings and operational benefits far beyond the capability of its predecessor. Traditional RO largely remained in a technological standstill following its academic inception in 1959 and commercialization beginning in the 1960s. Membrane evolutions and adding stages in series did manage to improve efficiency, yet many of the contemporary RO systems sold today use design principles dating back to the 1980s. DesaliTec™ CCRO, however, signals a new awakening for the industry, its practitioners, and users.

Traditional RO

RO is the primary technology used in the desalination of municipal and industrial water and wastewater for many years now. Effective at removing salts, its operational limitations include low recovery rates, fouling and scaling of membranes, high clean-in-place (CIP) frequencies, short membrane life, difficulty in managing variations in feed water quality, compromised permeate quality, high operating costs, and others. The key to solving all of these issues ultimately stems from an innovative solution that involves reinventing the basic filtration process.

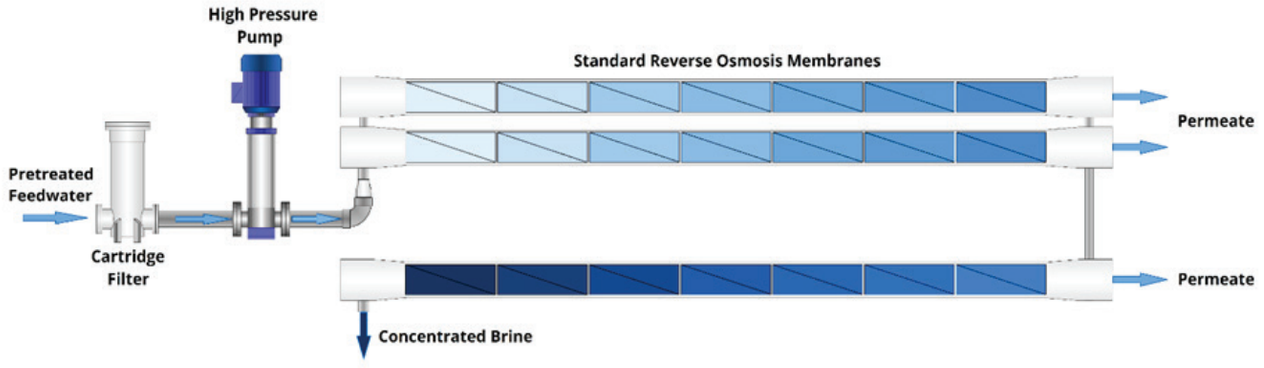
Every stage of the traditional RO process is comprised of multiple sequential membranes, and each stage can only achieve 50% recovery. It takes two stages to achieve 75% recovery, creating 25% waste. With every 5% increase in recovery over 75% mark, adds a different type of complexity to the traditional design like concentrate flow warnings, flux and flow unbalancing between stages, etc. To optimize this balancing act hybrid-staging or inter-stage booster pumps, back-pressures, low concentrate are used to establish hydraulic balance, but these approaches sacrifice operational flexibility and make it complex to operate at varying water temperatures. Even so, this is the standard configuration of most industrial and municipal RO systems.

In traditional multi-stage RO systems, recovery, flux, and crossflow are coupled, so managing efficiency and performance is a balancing act. The systems are either reliable but inefficient, or they are efficient but unreliable.

While the industry has made significant advancements to individual aspects of the RO process – including membrane elements, variable frequency drives, and analytical equipment – none of these advancements have been due to optimization of the fundamental design.

DesaliTec™ CCRO breakthrough

DesaliTec™ CCRO is one such fundamental design optimization with an uniquely configured closed circuit design. It is a semi-batch, single-stage elegant design where recovery, flux, and crossflow are uncoupled with automated triggers to purge concentrate based on volumetric recovery, pressure, and/or conductivity. This flexibility helps achieve a significantly higher level of efficiency and reliability than RO.



Typical representation of traditional RO System

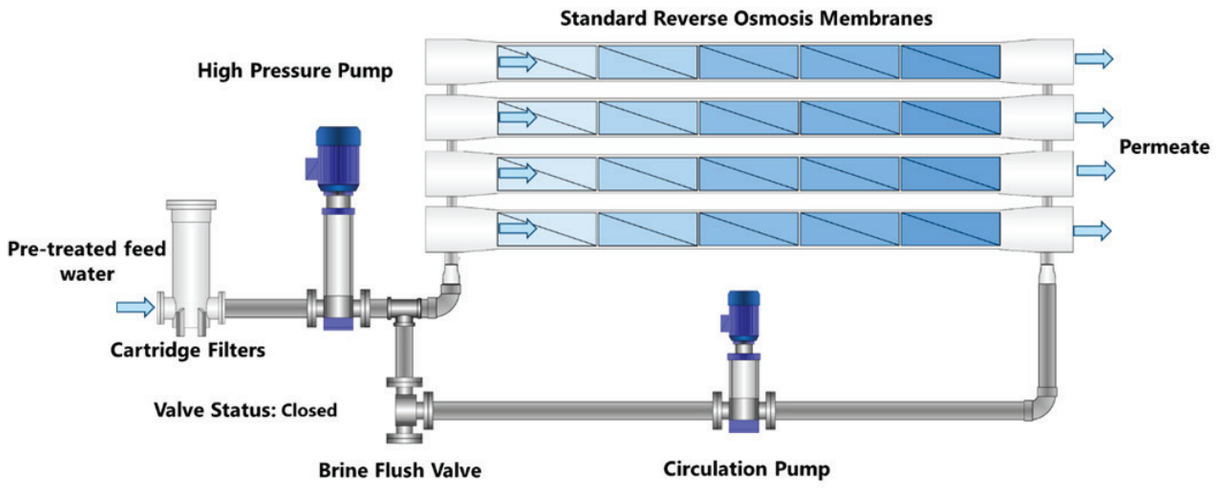
Industry	F&B	Non-Profit Foundation	Paper Mill
Application	Ingredient Water for one of the Fortune 500 Company	Mega Community Kitchen – Potable Use	Wastewater for reuse
Project Size	2 x 158 m3/hr	1 x 8 m3/hr	2 x 45 m3/hr
Challenges	A treatment method with maximum water utilization and minimum wastewater generation is necessary for achievement of corporate water replenishment goal.	Improved utilization of water for the mega kitchen as significant amount of water used to go down the drain due to challenging water source.	Company wanted to improve purified water supply for expansion for a High salinity water, with high silica content source.
Solutions	Proposed solution produces high purity ingredient water at recovery rates ≥93%, far exceeding what is achievable with traditional multi-stage reverse osmosis systems.	Proposed solution produces potable water at 85% to 90% recovery and saves 30 Million liters of fresh water per year.	Proposed DesaliTec™ CCRO solutions works at around 88% recovery as against 73% traditional RO.
Results	High recovery means better utilization of water supplies and less waste to dispose of. The facility was able to achieve a water neutral sustainability goal.	Approx. 30 Million liters per year water saved with DesaliTec™ CCRO. Estimated cost saving of approx. INR 37 Lakhs / annum.	200% increase in permeate production 26% less wastewater generated 5% less energy required 63% less use of Antiscalant 600% reduction in CIP frequency

Good resistance to fouling and scaling, along with high recovery operation, is important in most brackish water desalination, industrial water purification, and water reuse applications. The CCRO process provides new and enhanced means for addressing these challenges. Independently controlled crossflow supplied by a circulation pump efficiently washes the membranes, resulting in lower concentration polarization, and reduces the effects of scaling and fouling. As the salinity throughout the sequence cycles up to that of the most concentrated brine, and with freshwater ingress biofilm formation and scale precipitation can be disrupted – and even reversed. A high-recovery design is constructed in one stage typically consisting of four or five elements per vessel to optimally balance performance and costs.

Notably, the sequence time of purging concentrate is much shorter than the induction time for precipitation of most sparingly soluble salts. This is sharply contrasting from the steady-state conditions in traditional RO systems, which maintain nearly constant concentrations throughout their membrane arrays for months or even years. Additionally, because recovery can be easily controlled, the adaptive process can be adjusted if the concentration of scaling salts or other feed water properties change. Due to these properties, the CCRO process is inherently more reliable than a traditional, multi-stage RO.

System reliability is a key factor in the adoption of the autonomous, data-driven process for critical applications. Traditional RO systems are only reliable when operated at lower recovery rates. For example, a single-stage, 50-percent recovery RO system will typically have less fouling and scaling than a two-stage, 75-percent recovery RO system that will, in turn, have less fouling and scaling than a three-stage, 88-percent recovery RO system. While reliability is a primary operational driver for many customers, they find that they must choose to operate multistage RO systems that compromise efficiency.

In the CCRO process, this compromise is no longer required. In fact, the higher the recovery, the more



Typical representation of a CCRO System

significant the concentration variations between most concentrated brine and fresh water ingress will get, in turn providing better immunity to biofouling. In addition, the adaptive nature of the process will keep the system at optimal performance as feed or membrane conditions vary over time, providing a level of reliability and efficiency that cannot be achieved with a traditional RO system.

DesaliTec™ CCRO sets new standards

Overcoming the technical limitations of traditional RO, DesaliTec™ CCRO is fundamentally changing how companies and organizations in all industries approach municipal and industrial water and wastewater treatment. Automating applications previously thought impossible, DesaliTec™ CCRO demonstrates the following:

- High recovery is no longer a hydraulic limitation
- Fouling and scaling can be mitigated
- CIP frequency and membrane life can be extended
- Managing variations in water quality can be automatic
- Permeate quality can be a set point
- Reducing chemical and energy costs comes naturally
- Operating systems using data driven, autonomous IoT software is a reality

There is new disruption in reverse osmosis. Reverse osmosis will continue to be the primary technology for desalination of water and wastewater; however, CCRO is now the new operational standard. The inefficiencies and limitations of traditional multi-stage RO designs are no longer tenable when an elegant, single-stage design delivers a superior process offering clear operational, environmental, and financial benefits. With more than 250 installations delivering quantifiable payback on six continents and in over a dozen different industries, it's clear that the industry has also taken notice. ■

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- *Michael Boyd (April 2019). "Twenty-first century reverse osmosis disrupts traditional technology", World Water Magazine, pp. 26-28.*
- *Image1 courtesy UNWATER.org. .*

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Weighing automation solutions to boost productivity

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

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

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

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

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

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

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

IND360 includes the following key features

▪ Boost Machine Performance

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

▪ Simplify Integration

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

▪ Eliminate Programming Time

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

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

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

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

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

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

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

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

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

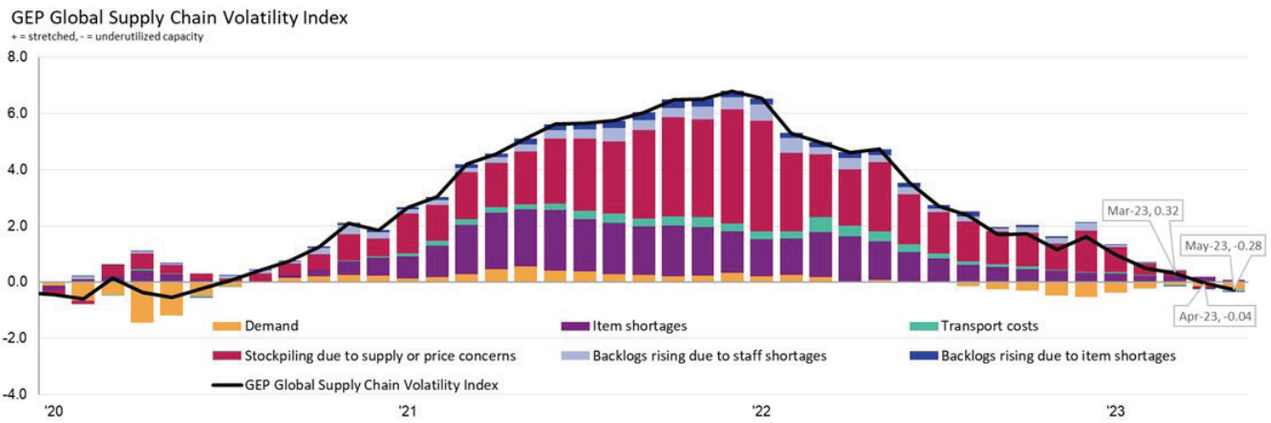
About Sanjeev Kumar Kapoor

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

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

Proactive Category Management for Era of Volatile Prices

The volatile and sudden changes in commodity prices experienced in recent years are expected to persist in the future. Companies lacking the necessary resources to effectively handle the risk associated with such sharp and rapid price fluctuations could face significant financial losses posing a significant threat to the sustainability of their business.



Sources: GEP, S&P Global.

The prices of key components like steel, food grains and logistics have undergone substantial fluctuations driven by factors such as shifting international trade policies, the war in Ukraine, shipping delays and ESG-related pressures. Consequently, numerous organizations have been compelled to either stockpile excessive amounts of materials or confront severe shortages. The repercussions of these factors have reverberated throughout the supply chain.

Although many companies possess risk-management expertise, only a few integrate this capability into their sourcing department. Typically, buyers lack access to timely information to adequately analyze, anticipate and effectively respond to market price fluctuations. They often also lack the right tools to manage the intricate risks associated with purchasing commodities, despite it directly impacting a significant portion of the cost of goods sold.

They unfortunately have to rely on suppliers to provide them with market information and, as a result, enter into negotiations at a disadvantage. This has meant that proactive category management has become an essential survival strategy in the competitive marketplace.

Need for Proactive Category Management

The majority of category management approaches are primarily reactive. It involves updating and analyzing the category after a specific aspect has already encountered a failure. In contrast, a proactive approach strives to anticipate and address potential issues before they arise, thereby mitigating challenges before the start of the procurement cycle. However, buyers often face issues like:

- Lack of visibility into internal and external insights that leads to delayed action by category managers, leaving a lot of value on the table
- Inability to forecast or predict disruptions, changes in supply, suppliers, and risks in the supply chain, impacting project lead time and costs

Where Do You Begin?

Procurement leaders often end up in tough spots where, despite all the planning and strategic category planning efforts, they struggle to meet yearly or quarterly savings targets. But they can offset this by creating and monitoring the right category-specific opportunity assessments.

Effective monitoring of category-specific opportunity assessments

To assess the effectiveness of current strategies and identify areas of improvement, the category plan should:

- Monitor category spend and identify trends by business unit, region and supplier
- Monitor category strategy over a period of time and create a project to track a category for analysis
- Monitor supplier regional spend, spend by payment terms, actual vs. budgeted, contracted vs. non-contracted spend by category, etc.
- Monitor supplier profiles and statistics to track performance on key metrics

While these parameters address internal risks, it is imperative to incorporate external risks and consider their impact as well.

The second step is to directly integrate external data with spending analytics and compare them with external market insights indices. This allows category managers to track performance to market, incorporating holistic procurement process data along with integrated commodity and internal and external constraint data.

Elevate your strategy with the dynamic cost model

A cost model is a critical tool for category managers to obtain greater visibility and understanding of the true costs required to produce a product or deliver a service. Should-cost technology uncovers the cost drivers and leads to overall cost savings through the identification of cost-saving opportunities and enabling improved product/service development and optimal pricing and every dollar saved drops straight to the bottom line.

At this moment, most category managers lack a unified perspective on all these steps.

Selecting appropriate tools to gain a holistic perspective

Having access to a centralized platform with access to spend and market intelligence data would enable category managers to develop strategic plans without being weighed down by the predominantly manual workload.

Using the wish list below, category managers can equip themselves with an effective category management tool:

- A holistic view of the health of the category based on external as well as internal events
- Access to industry-adopted pricing and engagement models, category-specific benchmarks, and prepopulated cost models and cost drivers
- Seamless integration with spend analytics to view realized savings at any given point
- AI-initiated recommendations and automated alerts, which help proactively track market developments and alert the user to these changes

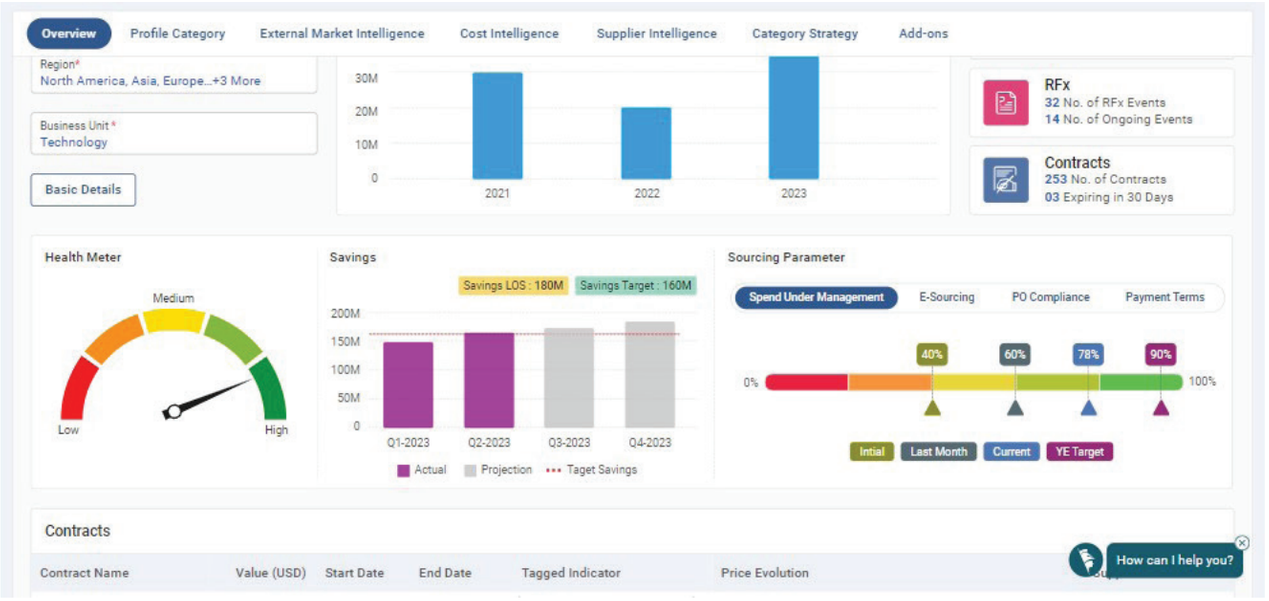
How a Leading Oil & Gas Company Transformed its Category Management

Background

Within a global corporation, coordinating efforts between dispersed teams can be a daunting task. This was the challenge facing a company, which had category managers and sourcing executives scattered across different geographical locations. Despite being integral to the company's operations, these teams often worked in isolation, resulting in a lack of coordination that hampered efficiency and synergy.

Company internally took steps toward an improved operational model, additional challenges surfaced. Data sources were readily available, but the lack of focus led to information overload, hindering the decision-making processes. Moreover, the existing practice of relying on suppliers for information raised concerns about potential bias and inaccuracies.

Additionally, cost models were developed on Excel sheets, leading to fragmented information and lack



Example of holistic category management solution (Illustrative)

of a single source of truth. This proved particularly problematic in the face of recent market volatility, which affected multiple cost drivers and thwarted the group's ability to accurately determine current-day prices.

Through these trials, it became increasingly clear that a more robust and coordinated strategy was essential for overcoming these obstacles. The company's commitment to refining its approach — coupled with an understanding of the critical importance of clear, unbiased information and effective cost estimation — set the stage for significant transformation.

Outcome

- The company adopted a single platform for its category management needs which showcased detailed cost insights in one place
- The timing of multiple sourcing events was changed based on opportunities and market softness in the categories. Supplier audits were conducted keeping in mind risks identified by external research
- The real-time cost view ensured the company was never blindsided by any significant external market movement. This also helped in more accurate budgeting

Conclusion

In these times, procurement functions that don't keep up with the fast-paced changes in category management will run the risk of falling behind. With new and constantly evolving factors coming into play, it's becoming increasingly important to prioritize monitoring of different categories.

As procurement undergoes a transformation from a tactical to a strategic business function, the performance of CPOs and other senior procurement leaders is being assessed based on the strategic value their teams bring to the overall success of the organization. To achieve this, procurement leaders need to have the right set of tools to push the levers of profitability. Procurement should investigate technological enablers that help with this objective, which are beginning to emerge in the market.

The bottom line. Increased visibility of supplier performance & changing market dynamics and the ability to respond to those is the general "punch list" for any effective and dependable category management solution.. ■

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Filtration: Operation – Selection – Mathematics

Filtration is a very important Unit Operation widely used in many Chemical Industries for Solid Liquid Separation. With the increase in volumes and requirement of quality as well as efficiency, it is very much important to study the filtration characteristics and select the right type of equipment with right operating procedure and parameters. The authors discuss the mathematics of Cake Filtration, where solid with minimum impurities is the product of interest

Filtration can be broadly classified in two categories, first, **Cake Filtration**, where the solid content in the slurry is high and solid is a useful product required in purest form and second, **Clarification,** where the solid content is undesired and less in concentration and the liquid is useful product.

Retention of Solids and **Driving out the Liquid** are the two main aspects of filtration. Retention of solids is accomplished by use of a suitable filter medium such as filter cloth, wire net or porous tiles etc. Different driving forces are used to drive the liquid out, gravitation force (inertia) being the simplest one which can be enhanced or multiplied by the centrifugal action. The other popular method of liquid removal is by making use of differential pressure by applying pressure, vacuum or a combination of both.

The old traditional filtration used to be in a simple basket or a funnel fitted with a filter paper or cloth. The improved version in the laboratory used to be the Buchner funnel where vacuum was used as driving force for faster filtration. Centrifuges and Pressure Filters were developed later.

The filtration equipment can be classified based on different criteria as follows:

- 1. Mode of Operation: Batch or Continuous
- 2. Driving Force: Pressure, Vacuum, a Combination or Centrifugal
- 3. Incorporation of Other Facilities: Agitation, Re-slurrying, Washing, Drying, Solvent Recovery, Mechanization, Labour Minimization, Automation, Hazard Minimization, etc.

The available types of filtration equipment are: Vacuum Nutsche, Horizontal Batch Filter Press, Vertical Semi Continuous Filter Press, Batch Centrifuges with various arrangements like Top Manual Discharge, Lifting Basket, Mechanized Cake Cutting with side / bottom discharge, Semi Continuous Peeler type Centrifuge, Continuous Pusher Type Centrifuge, Continuous Vacuum Belt Filter, Continuous Vacuum or Pressure Rotary Drum / Disc Filter, Pressure Filter, Agitated Pressure Filter etc. The selection is product and quantum specific and essentially based on the characteristics of the product and the volumes to be handled.

There cannot be a universal solution for every application. Some solids are crystalline where any type of driving force can be used. When the desired residual liquid content in the crystalline solids is very less, say 1%, centrifugal force may work quite effectively as in case of sugar crystals. Vacuum or Pressure filter are also useful, but the liquid may have to be pushed out by carrier gas like Air or Nitrogen from the gaps between solid particles. For sticky solids, some of them require centrifugal force for effective liquid separation, whereas some of them need high filtration area, low cake thickness and high pressure with the equipment like a Filter Press. Essentially, the selection for specific products is based on trials in the laboratory or on the pilot plant.

Filtration Mathematics

The following simple mathematical relations are useful in deciding the Filters and Operating Parameters.

The rate of filtration is directly proportional to the Differential Pressure and the Filtration area; and is inversely proportional to the cake thickness. This means

Rate of Filtration $m^3/hr\ m^2$
a Area (m^2)
a Differential Pressure (kg/cm^2)
a 1 / cake (height) thickness (m)

Rate of Filtration (R)
$m^3/hr = k \times A \times DP / h$
Filtration Time = Q / R = h / k A DP

k = Rate Constant depending upon characteristics of material

A = Filtration Area m^2

DP = Differential Pressure kg/cm^2

h = Cake height/thickness, m

Q = Quantity m^3

t = Time

It is generally considered that the resistance of filter medium is negligible in comparison with cake resistance.

It is important to note that when the solids are compressible, the cake becomes compact; and the increase in pressure may reduce the filtration rate in terms of m3 / hr m2 (kg/cm2). But, in general, Pressure Filter has an advantage of comparatively higher filtration rate, lower filtration time and lower filtration area. There is a misplaced notion in the industry that if one needs higher production, he goes for filter with higher cake thickness. In fact, this has an adverse effect.

The following example clarifies the fact:

Basis:
Slurry Volume (Q): 1 m^3
Solid Content : 10% by volume
Filtration Area : 1 m^2
Cake Volume : 0.1 m^3
Cake Thickness (h) : 0.1 m
Filtration Time (t) : 1 hr.
Processing Rate = Q/t: 1 m^3/hr.

If we double the Slurry Quantity for the same filtration area and the same pressure, the cake height doubles, and the time requirement changes as follows:

t = Original Time x (Quantity Ratio) x Cake thickness ratio = 1 x 2 x 2 = 4 hr.

Processing Rate = 2 / 4 = 0.5 m^3/hr.

This means, by doubling the cake quantity and cake thickness, the production capacity has actually reduced to half. In other words when cake height is doubled the filtration time goes to four times and if cake height is three times the filtration time goes nine times.

This basis is applicable to all types of filtration devices. Even for a continuous vacuum belt filter, if we double the cake thickness, say from 25mm to 50mm, the filtration time requirement goes to 4 times. The belt speed needs to be reduced to ¼th i.e. 25%; and the overall production capacity goes down to 50/25 x ¼ = 0.5 times.

On the other hand, if we reduce the cake height to 50%, say 12.5mm, the filtration rate can be increased, the belt speed can be increased to 4 times to get actually double the production rate. Of course, there is a limitation to the reduction in cake thickness, since the Filter Cloth resistance may govern. The cake thickness cannot be reduced below a certain limit. Even solid heal becomes a limitation for lower cake thickness.

A general **comparison of Centrifugal** Force and Pressure is as follows:

Type of Filter	Max. Cake Thickness (mm)	Possible Filtration Area (m^2)
Simple Vacuum Nutche	400	25
Filter Press	40	300
Vacuum Belt Filter	25-50	80
Vacuum Drum Filter	25	20
Centrifuge	150	2.5
Agitated Pressure Filter	500	20

Equivalent Pressure = g Force multiple x Liquid Level above the Cake x Density

If g force is 800 times gravitational force, Liquid Level is 0.1m and Density is 1,000 kg/m3

The equivalent pressure is 800 x 0.1 x 1000 = 80,000 kg/m^2 = 8 kg/cm^2.

This pressure keeps reducing as the liquid layer thickness keeps reducing with filtration.

One important factor for selection of Filtration Equipment is Filtration Area Requirement and the cake thickness. The following are the comparative figures

Washing Requirement & Strategy

Other than the solid separation, one very important requirement of filtration is **Removal of Residual Soluble Impurities by Washing** which is carried out using two methods. First one is **washing by re-slurrying or re-pulping** and the second is through **Displacement washing**. When the solids have their inner porosity and affinity for liquid, displacement washing may not be effective. Effective agitation and re-slurrying is a must for effective washing.

The simple mathematics for washing is as follows:

If the cake retains a fixed percentage of liquid; and the liquid contains initial percentage of impurities, Mixing with additional pure liquid dilutes the impurity in ratio of liquid volumes.

For Example,

This is equivalent to 0.5% x 1000 / 3,000 = 0.167% of Solid, which is half the concentration in comparison with single wash of 3,000 litres.

This means, by splitting the wash in 3 parts, we have increased the wash efficiency to double. Or, the same efficiency can be achieved by reducing the 3,000 litres wash to only 2 washes of 1,000 litres each totalling to only 2,000 litres.

There is another method of further improving the wash efficiency by giving a counter current wash as shown in the following example.

Counter Current Wash Method – Shank System

In this method, the washes of previous batches are retained and utilized for advanced washing in the following batch. The 3rd wash liquid is used for 2nd washing in the following batch, the 2nd wash liquid is used for 1st washing in the next batch and the final 1st wash with enriched impurities is discarded for solvent recovery or effluent.

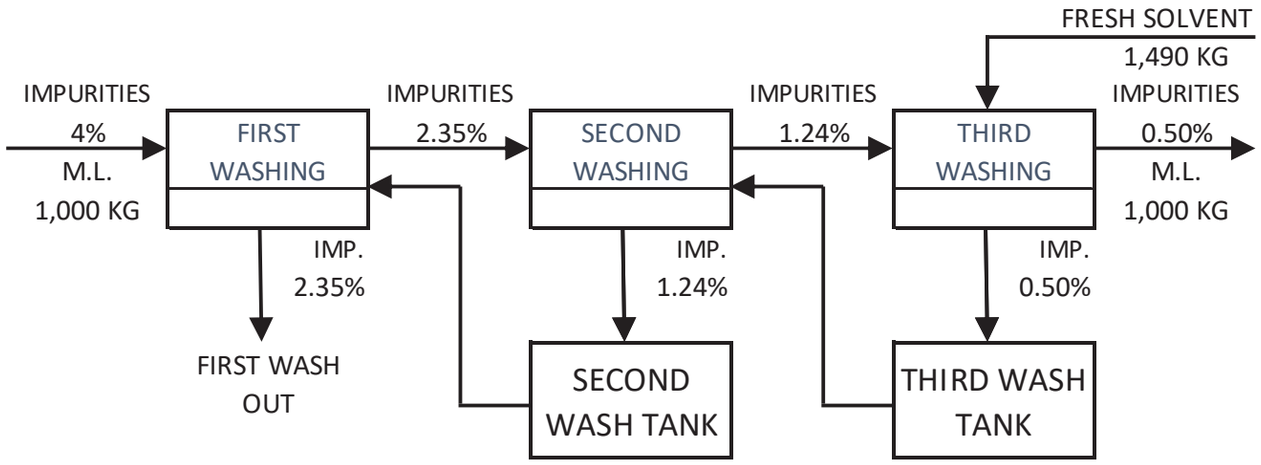
The above example shows that for achieving the same level of impurities in the residual M. L. in the cake, the overall wash quantity is reduced down to 50% with counter current washing arrangement.

This indicates that washing efficiency and product purity can be improved by having a repulping arrangement in the filter as in case of a Manual Vacuum Nutsche or an Agitated Pressure Filter. The above calculation is similar even for displacement wash for different types of filters, provided the cake does not have affinity for liquid and the retained liquid is easily displaceable by wash liquid.

Selection Criteria

Another important factor in selection of Equipment is Hazard Free, Leakage free closed operation, especially for solvents and other hazardous chemicals. By default, Agitated or Non Agitated Pressure Filter is a hazard free closed device. These days, even Centrifuges, Belt Filters and Drum Filters are available in closed construction, though difficult for manual operation and maintenance.

For higher capacities and physical loss free operation, closed feeding, mechanized solid discharge, Automation for filtration, washing and discharge are very much essential. Filters like Agitated Nutsche Filters, with all recent developments, provide the mechanized and automatic operation. They also offer additional facilities like built in drying, mixing, reactions etc. with all in one operations.



Counter Current Wash Method – Shank System

Sometimes, industries come up with the problem of selection of filter medium and the pore size. It is important to note in cake filtration that cake itself acts as a filter medium. The pore size of the filter medium is slightly bigger than the solid particle size. The solids form a bridge over the opening and help in filtration. Selection of lower pore size may lead to clogging of many pores with solid particles having a similar action of a closed non return valve.

Factors for Selection of Filters

- **Filtration Area and Cake Thickness**
- **Driving force, Pressure, Vacuum or Centrifugal**
- **Liquid Retention and Purity of Solids**
- **Facilities for Washing**
- **Facilities for Re-slurrying or Re-pulping**
- **Mechanized feeding and solid discharge with labour free operation**
- **Ease of Operation – User Friendliness**
- **Automation**
- **Closed, Contamination Free Working with minimum loss of solids, liquid or vapours**
- **Minimum Hazards**
- **GMP and Special Features**
- **Clean in Place (CIP) and Sterilize in Place (SIP)**
- **Facility for Drying**
- **Compatible Materials of Construction**
- **Overall Economy**

There are many materials for filter medium. The fabrics like poly propylene, nylon, cotton in woven or non woven form are used as filter media. Wire cloths and sintered multi layered wire meshes in Stainless Steel, Hastelloy and other metals are popular. Even porous ceramic tiles are available for filtration. The material of construction can be suitably selected for compatibility. The important factors for Selection of Filters based on the material properties, production capacity and quality requirement. The right selection can reduce the Capital Cost, Operating Cost and can ensure right level of production and quality with economy, safety and comfort. ■

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Techno-Economics of Sludge Dewatering

India, as a transitioning country, in efforts to become a developed economy, is realizing two significant challenges. First is the well-known exponential growth in population, where the metropolitan residency in India has climbed from 11.4% in 1901 to roughly 34% in 2019, and second is the shortage of infrastructure availability (World Bank Data, 2019). As a result, two self-surfaced problems India is encountering with, namely, water shortage and excessive sewage. Wastewaters are generally regarded as a burden on industries because of the considerable costs involved in treatment before they can safely be discharged into the environment.

According to the Order by National Green Tribunal (NGT) regarding the effluent discharge standards, the Class I and II cities generate about 61,948 MLD sewage in India (NGTPB, 2019). Further, about 60% of untreated wastewater has contaminated approximately 75% of surface water sources throughout the country. In India, in Class I metropolises, the activated sludge process is generally the adapted technology for treatment, covering nearly 60% of the total installed capacity.

The treatment scheme based on primary sedimentation followed by activated sludge process with anaerobic sludge digester and sludge drying beds for anaerobic sludge is quite a suitable scheme for metro cities where land availability is scarce. In India, most of the sewage treatment plants were developed under various river action plans (from 1978-79 onwards) and are located in cities/towns along the banks of major rivers (CPCB, 2005).

The effluent sludge is treated using any of the following three techniques:

1) Primary settling followed by Activated Sludge Process
2) Up-flow Anaerobic Sludge Blanket plus Polishing Pond
3) A series of Waste Stabilization Ponds

Out of the methods as mentioned above, the first technology (i.e., activated sludge process) has an ability to give the output of final effluent exhibiting biological oxygen demand (BOD) and total suspended solids (TSS) values below 20 mg/L and 30 mg/L, respectively. This is well below the norms set by the Central Pollution Control Board (CPCB) of India for various after treatment parameters for effluent. The treatment systems in a standard form of activated sludge process are based on treating both primary and secondary sludges in anaerobic sludge reactors. Thus, excess sludge generated in the anaerobic reactor is transferred to the sludge beds. This manifests an ever-increasing crisis of yielding an enormous volume of surplus activated sludge for an otherwise excellent treatment process even after assuring a minimal after-effect on the aquatic environment.

About 25 common effluent treatment plants are operating in the state of Maharashtra with a cumulative capacity of 203.35 MLD (MPCB website, 2020). Equipped with the activated sludge treatment, the plants can safely discharge the treated effluent. The excess activated sludge generated in these plants is generally sent to the waste management authorities for landfilling, and this creates the very problem of excessive landfilling. Infact, landfilling need not the last option for the disposal unless it contains hazardous waste materials.

The wastewater sludge or biosolids is a prolific source of nitrogen (N), phosphorous (P), and energy (C). Nearly 1.2 million metric tons or 22% of total treated wastewater sludge is utilized to develop the soil for

grasslands and crops in the United States (Chen et al., 2002). This utilization of the excess sludge should be, in fact, prominently practiced in agricultural countries like India for crop improvement and irrigation.

The Challenge: Excess Activated Sludge

Traditionally, dewatering or thickening of the excess activated sludge is a formidable task due to its ability to hold a large amount of bound water, which is around 98%. The excess activated sludge is usually associated with several microbiological problems that can occur in sludge dewatering. These include non-settleable growth, pin floc problems, zoogloea bulking and foaming, polysaccharide bulking and foaming, nitrification and denitrification issues, etc. Appropriate handling, treatment, and disposal of the excess activated sludge is expensive and comprises 60% of the total operating costs of a treatment plant (Li et al., 2016). A combination of all the aforementioned reasons causes a hold-back in exploring the usage of excess activated sludge for a country like India.

Our Efforts

Our team from the Institute of Chemical Technology, Mumbai, visited several Common Effluent Treatment Plants (CETP) in Maharashtra and performed filtration experiments to understand the sludge properties. The elemental analysis conducted on the excess activated sludge of one of the CETP is shown in Table 1.

As can be seen in Table 1, the excess activated sludge composition exhibits a high amount of carbon and nitrogen, which is in agreement with the claims made

Element	Mass %	Element	Mass %
C	24	K	2.6
N	7.8	Ca	10.9
O	8.2	Cr	0.6
Na	0.9	Fe	6.5
Al	15.2	Co	0.35
Si	16.2	Cu	3.15
P	0.5	Hg	3.1

Table 1. Quantitative analysis of a typical excess activated sludge

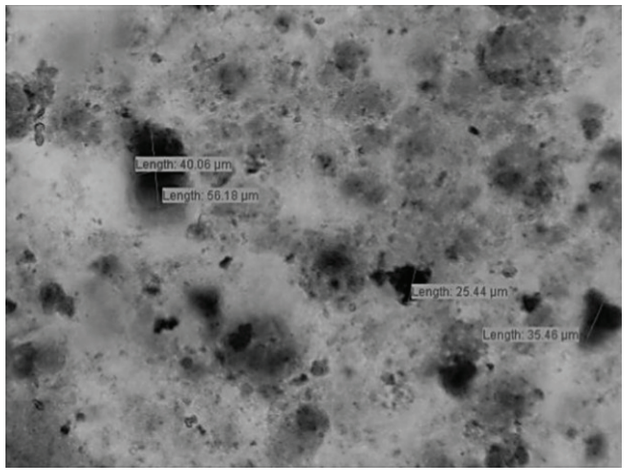

Figure 1. Optical microscopy image of excess activated sludge

in the earlier paragraph. Also, the optical microscopy image in Figure 1 reveals the particle size of the excess activated sludge flocs between 25.44 to 56.18 µm. This data is important and crucial in deciding the filter size and filtration methodology. This would also imply that, in this case, the filter size selection below 25 microns may work very well in filtering solids.

On further filtration experiments, the chemical oxygen demand (COD) of the filtrate was reduced to 500–700 mg/L. This is excellent and further treatment will decrease the COD values well below the CPCB standards of 250 mg/L. Also, the filtration time was considerably reduced by adding a suitable coagulant. In comparison, the time needed to filter the excess activated sludge by using a coagulant was almost 10 times less than the non-coagulated experiments. This is a significant finding, and this may very well be related to the particle agglomeration taking place at the calculated coagulant dosing above its threshold value. This also indicates that the common effluent treatment plant may need to revise its coagulant addition calculation for better separation results. In such cases, often the much-overlooked particle properties, the zeta potential, plays an additional role, where adding sub-optimum coagulant dose may be detrimental to particle cluster formation. This is because, at higher zeta potential, say about 40 mV or more, the intra-particle repulsion inhibits particle agglomeration. The zeta potential values close to 0 mV do assist in agglomeration because of the

Equipment	Fixed Cost (USD)	Fixed Cost (INR*)	Power required (kW)	Energy consumption (kWh/d)	Operating cost (INR/ year)
Gravity thickening	83,322	62,56,648	30 (min)	720	25,92,000
Textile bag filter	2,43,651	1,82,95,753	18	432	15,55,200
Volute filter	1,13,333	85,00,000	23	552	20,14,800
*1 USD = 75 INR					

stronger van-der-Waals forces (Kumar and Dixit, 2017).

The coagulants are added to exploit the commonly occurring forces between particles such as van der Waals forces and electrostatic forces. The tendency of the particles to become cohesive determines the state of dispersion of the particles and hence the type of settling i. e. particulate settling or aggregate settling. In dilute sludge, the particle settling velocity is higher for larger sized particles. However, in concentrated sludge, the larger particles are decelerated, and smaller particles are accelerated, resulting in all the particles settling at the same velocity. This is due to the fact that, at higher concentrations, the velocity of the rising displaced liquid is higher, which promotes hindered settling and inhibits selective settling.

Cost Analysis

The cost-benefit analysis is based on two key areas, namely, fixed cost and operating cost. Table 2 details the fixed cost of the commonly used dewatering technologies, such as the gravity settling system and textile bag filters (Sharrer et al., 2010). As clearly can be seen from the table, gravity thickening costs the least to install; however, it is also a time consuming and cumbersome process. Moreover, it requires a large footprint for the installation. The bag filter costs more to install, and they suffer from secondary waste generation from discarded bags. Table 2 also represents the estimated operating cost of the existing technology, assuming the typical cost of electricity per kWh as Rupees 10.

For a 10 MLD effluent treatment plant, a typical decanter-centrifuge produces 6400 L/day of surplus activated sludge, which translates into 160 kg/day dry solids after drying. The operating power requirements of the decanter-centrifuge is in the range of 30 to 40 kW, which operates to discard WAS. The dumping and transportation cost of this WAS is 1300 and 700 Rs/T, respectively. This cost is exorbitant considering both

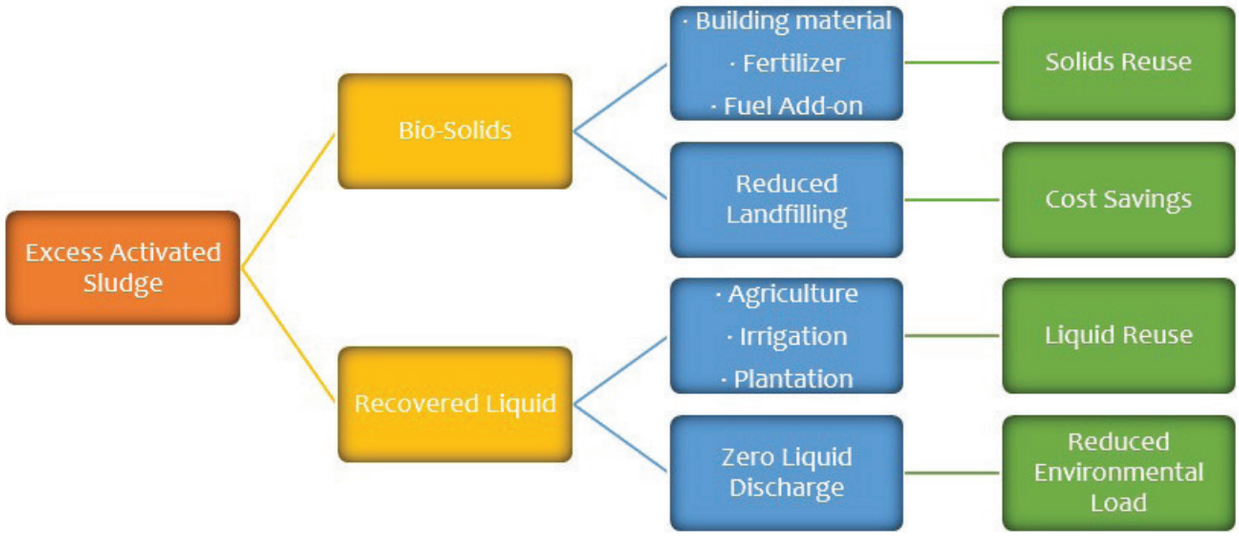

Figure 2: Benefits of utilizing excess activated sludge

operating as well as the disposal cost, yet it doesn't cover the long term cost of environment damage. These compulsions has driven several companies and centralized effluent processing plants to look for better option and yet economic and affordable. Any low cost material handling technology, be it for sludge handling and further processing (volume reduction) or for that matter any other sundry stream perceived as wasteful product, must come handy and useful. The volume reduction technology of sludge by volute filter is one of the key technologies that could be utilized elegantly. There are also some other compting technologies such as moving belt filter or mono-belt filtration technology. Here, it is important to note that the volute filter is in vogue only in recent time for waste activated sludge dewatering. This is already in use in couple of industries located in the Mahad Industrial area, konkan. It costs around 5 Lakhs for a 3 m3/h capacity unit and consumes only about 1.35 kW/h of power. Although slightly costly, the volute filter offers predominant advantages such as smaller footprint, automatic self-cleaning, and less filtration time.

Use Case Scenario and Future Prospects

The proper utilization of excess activated sludge may help a wide range of industries such as chemicals, food, fiber, steel, automotive, power, sugar, and pulp and paper. As portrayed in Figure 2, the treatment of surplus activated sludge may warrant greater access to safe and affordable (recovered) alternative water resources for irrigation for farmers and rural communities. The solids rich in biological content can be digested to provide an option to use as a fertilizer. In the test conducted, the calorific value of the dry sludge was found to be reasonable at 4000 kcal/kg. This opens an opportunity to use it as a fuel when combined with coal or biomass briquettes. The ash produced after burning can be used for the production of building and road surfacing products. Moreover, solid waste can be developed as an adsorbent or used as a cement filler material.

A reduction in the final volume of the solids by 80 to 90% may cause power and, sequentially, budget savings due to the decrease in upcoming costs to cope with excessive landfilling, increasing freshwater scarcity, and costly water treatment procedures. This may significantly benefit municipal corporations and industries from the reduced environmental burden. ■

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Water & Environment management technologies

Overview of chemical sector: The Indian chemical sector is growing rapidly and with the increase in production, the water requirement would also increase. Government through the Make in India campaign plans to increase overall manufacturing share of GDP over the next five years. The sector provides the building block for many downstream industries, such as finished drugs, dyestuffs, paper, textiles, synthetic rubber, plastics, polyester, paints, pesticides, fertilizers, and detergents. The largest use of water in the chemical industry is for cooling, with steam (e.g., heating) and process water (for mixing, dilution, reactants, wash, or rinse water).

Industrial waste management is a relatively new practice in India. Traditionally, the state did not have means to off-take hazardous waste and businesses are required to treat it in-house. Companies continue to inject wastewater into the ground posing huge risks and liabilities from soil and groundwater contamination. Companies should initiate efforts to assess potential groundwater contamination from past waste disposal practices and start working on a long-term, cost-effective plan to remediate the contamination.

Chemical industrial wastewaters usually contain organic and inorganic matter in varying concentrations. Many materials in the chemical industry are toxic, carcinogenic and contain a wide range of substances that cannot be easily degraded. These industries face formidable environmental regulatory challenges in treating their wastewater effluents. Treating the effluent to safe limits and disposal remains a major challenge for the sector.

Primary Challenges faced by Industry

- **Improving Energy efficiency**
- **Lower operating costs**
- **Improving the quality of wastewater & reducing the environmental impact**
- **Water recycling**

Water management solutions for chemical Industry

In chemical companies, there is a huge opportunity of recycling/ reuse of wastewater after necessary treatment.

Reduction of effluent can be categorized into 4 key stages:

- **Replace:** Replacement of inefficient processes and adoption of efficient technologies (pumps, advanced treatment solutions ozone oxidation / UV, water meters, leak detection solutions)

- **Reduce:** Adopt technologies to minimize water, chemical and energy usage

- **Recycle/ Re-use:** Implement recycle/ re-use water practices to conserve water.

- **Zero-Liquid discharge solutions**: to reduce discharge of harmful contaminants and comply with regulatory requirements to protect the environment.

4 Key Strategies for Reduction of Effluent	
Replace	Inefficient process with efficient alternatives
Reduce	Water, Chemical & Energy use
Recycle/ Re-use	Water to conserve fresh water
Zero-Liquid Discharge (ZLD) solutions	To reduce discharge of harmful contaminants

Solutions / Application	Treatment and supply of water	Transfer of process water	Cooling systems	Wastewater	Treatment of effluent
Oxidation	●		●		●
UV disinfection	●		●		●
Single-stage pumps	●	●	●		
Multi-stage pumps	●	●	●		
Pressure tank systems	●		●		
Hydrovar variable speed pump controller	●		●		
Wastewater pumps	●	●	●	●	●
Submersible stainless steel pumps for corrosive water	●	●		●	●
Mixers					●
Aeration systems					●
Filtration systems					●
Portable drainage pumps	●	●		●	
Monitoring and control	●	●	●	●	●

● Indicates solutions which can be available across value chain to conserve water & energy usage.

Highlighted below is a snapshot of broad technological solutions available across chemical industry value chain that can help improve energy efficiency by adopting efficient pumps, leverage meters and analytical solutions to monitor & conserve water, improve quality of effluent at source and promote re-use/recycle.

▪ **Sequencing batch reactor technology (SBR):** SBR is a continuous flow biological treatment system that provides multiple advantages versus conventional activated sludge and other SBRs by bringing together process, aeration, decanting, and control in a single treatment tank. It includes a completely integrated process design consisting of the aeration system, blowers, pumps, mixers, effluent decanters, monitoring and control equipment, and a comprehensive process control system. Unlike conventional activated sludge plants, there is no need for primary or secondary settlement tanks as all treatment is done in a single basin. The SBR process can also be designed to remove nitrogen and phosphorus from wastewater through biological nutrient removal (BNR) processes.

▪ **UV disinfection solutions:** UV Disinfection System is an extremely effective way to combat microbial contamination in water. It is recognized as a safer and more cost-effective way to disinfect water for industrial applications. UV water disinfection technology is used for the disinfection of bacteria, viruses, algae, and other microorganisms, which multiply and grow. Its technology can be used for process water and wastewater disinfection and requires small footprint. For smarter water utility management of UV systems and other plant assets, real-time remote monitoring and control solutions monitors and supports maintain the optimal operation of connected assets and sends alerts and data-driven insights to customers to make informed decisions.

▪ **Ozone Oxidation system:** Classical, conventional biological wastewater treatment processes are long term established and are typically the most economical way to treat large flows and reduce the organic load (expressed as chemical oxygen demand, COD) by more than 90%. There are recalcitrant organic compounds that cannot be eliminated by biological processes only. For these substances the strong oxidation power of ozone can be applied to further reduce problematic substances below the given thresholds.

List of ozone application for industrial wastewater treatment:

- Discoloration of wastewater (i.e., from textile processing or dye manufacturing)
- Removal of hard (recalcitrant) COD from refineries, chemical production sites, pulp & paper

processing, coke plants, steel processing

- Cyanide elimination from refinery wastewater streams (AOP needed)
- Elimination of aromatic substances from Hydrocarbons processing
- Removal of pharmaceutical residues from Pharmaceutical producers
- Removal of other stable organic molecules or aromatic structures
- Disinfection of water and wastewater

▪ **Energy Efficient pumps:** Pumping systems consist of the pump itself, a motor, piping, valves and instrumentation. It accounts for more than 20% of the world's electrical energy demand, and in certain industrial plant operations they can be responsible for between 25% and 90% of the energy usage. Improving the energy efficiency of the pumping system will reduce production costs and support green credentials. The best efficiency and further energy savings can be achieved by driving the pump with a variable speed drive (VSD). This allows the rotational speed of the pump to be adjusted to achieve the desired head and flow for the process application. A VSD can also be added to existing pumps and once installed it can accommodate changing system demands, including potential future expansion plans without changing the pump.

▪ **Digital solutions for improving overall operational efficiency:**

Condition monitoring solutions provides health guidance and predictive maintenance advice for rotating and fixed assets such as pumps and motors. It periodically monitors system vibration and temperature and allows everyday users to access simple-to-use monitoring tools from iOS or Android mobile devices. Using predictive analysis, the solution identifies potential problems with the equipment before they occur. It allows users to understand the current health and historical trends of your assets, create maintenance reminders and generate detailed reports.

24/7 Remote Monitoring & Control solutions help provide alerts and data-driven insights from a device connected to your water infrastructure assets. It allows users to connect their assets to cloud, get insights on their operational status remotely, thus significantly reducing the need of physical inspections. It collects and analyzes data from assets to give live data, trends and alerts via the web and mobile app data and helps make smarter decisions about how resources are used.

Conclusion

Availability of water can become a limiting factor for the chemical sector. There is a need to encourage technologies which are water efficient to facilitate sustainable growth of the industry. Efforts to conserve water, wastewater treatment and reuse need to be encouraged. It should be imperative for chemical companies to replace inefficient processes & equipment's by implementing (1) Energy efficient pumps along with monitoring & control solutions; (2) Reduce water & energy consumption and (3) recycle/ reuse the treated effluent by implementing advanced wastewater treatment solutions and adopting zero liquid discharge practices. ■

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