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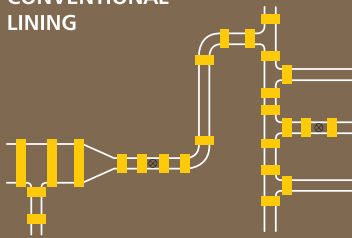
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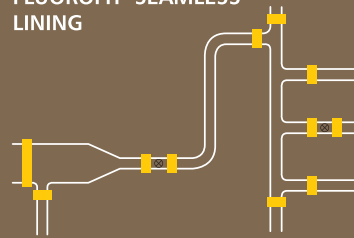
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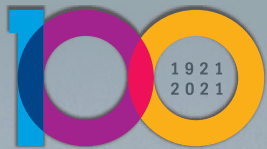
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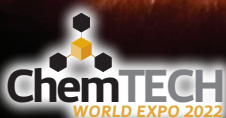
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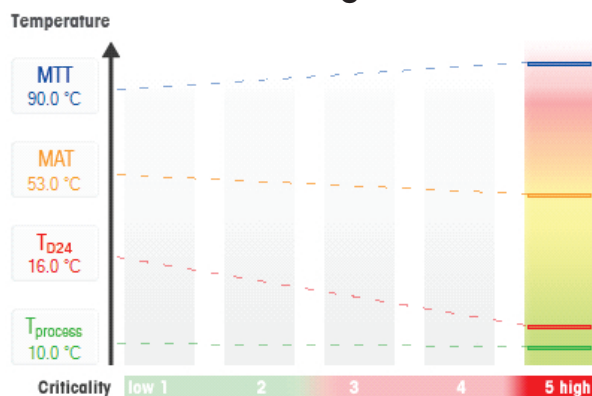
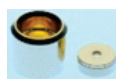
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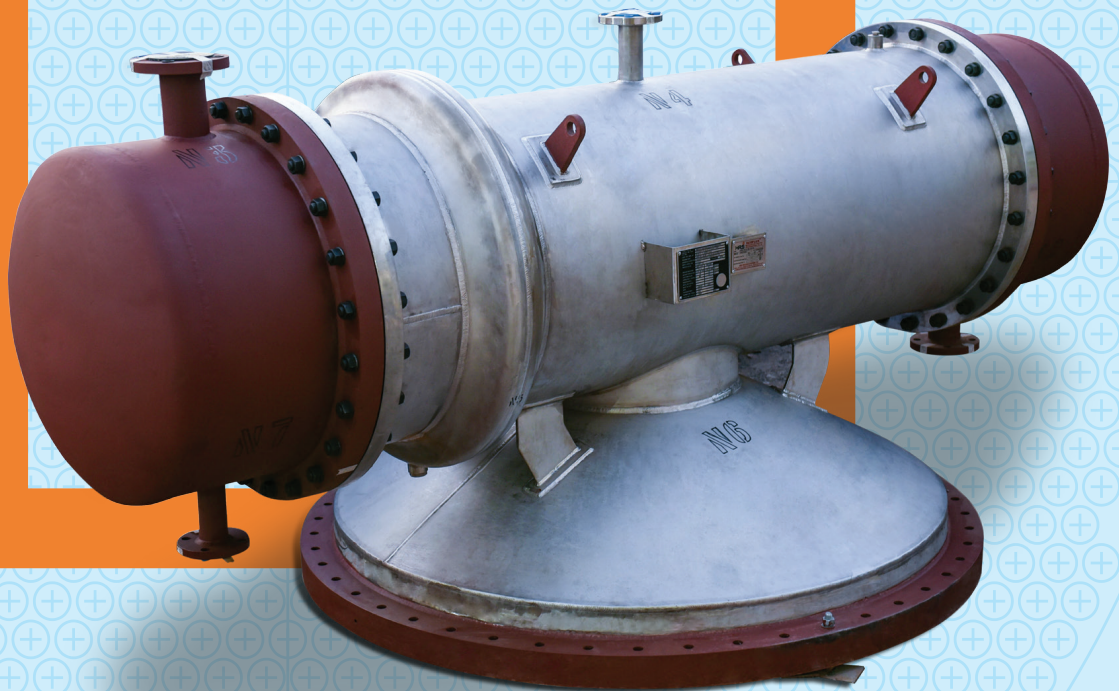
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2	Chilled Water Temp in °C (Assumed)	5°C	5°C
3	Supply Temp. from CT / LTMCS	33°C	30°C
4	Approach to WBT	4°C	1°C
5	ΔT for Chiller	28°C	25°C
6	Chilled Water Compressor Motor Kw for 1200 TR	720	643
7	Energy Saved in %	-	10.7%
8	Energy Saved in Kw	-	77 Kw/Hr
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10	TOTAL POWER SAVED PER ANNUM	-	6,65,280 Kw



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Uhde GmbH Completes 100 Years



PD Samudra, CEO & MD, Member of the Board
Thyssenkrupp Industrial Solution, India

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Dortmund, Germany: The Chemical Process and Technologies division formerly known as Uhde GmbH, plant engineering major and an important group company in the Business Area Thyssenkrupp Industrial Solutions India, completed 100 years since its foundation in Germany. Started by the late Friedrich Uhde on April 21 1921, the centenary is a momentous landmark in the history of the company. Uhde GmbH started out as an engineering contractor for implementing fertilizer plants, before venturing into petrochemicals and polymers, caustic soda and other sectors of the chemical industries. Known for its trademark attention to its projects as well as its systems, quality and customer-orientation, the company evolved into an engineering major building mega-projects in Europe and Middle East. It entered India as a site office in the mid-sixties, before setting up a branch office in Mumbai in the late sixties,

and converting it to an Indian company, Uhde India Limited, in 1977.

Uhde India Limited established itself as a leading provider of solutions for the Chemical process industries soon after inception. Amongst the first engineering companies to be allowed a transfer of technology under the 'License Systems' of those days, the company has gone on to establish itself as a leading engineering major with projects in a variety of contracting modes for India's leading chemical manufacturers. thyssenkrupp Industrial Solutions India as the company is now known, has made rapid strides in the group's core competencies of Nitrogenous fertilisers, petrochemicals, caustic sodachlorine, and cryogenic storages. In many of these areas like Caustic Soda-Chlorine, it has a market share in excess of 75% in India, while it accounts for over 50% of the low temperature Cryogenic Storage tank domestic market. In the last decade, the company further ventured into the refining, phosphatic fertilisers and metallurgical businesses in a big way, and is today one of the leading engineering companies engaged also in the setting up of these complexes.

Speaking on the occasion of the centenary, Dr S Pelkonen, CEO Business Unit Chemical Processes and Technologies said : 'The 100 year celebrations of Uhde help bring to mind the immense contributions it has made to not only the thyssenkrupp group, but also to the chemical industries across the globe. This is why we are especially proud to be named thyssenkrupp Uhde again – it is a name that is synonymous with world-class plants for many of the leading chemical manufacturers, using either technologies from its proprietary

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portfolio or based on licenses from other international licensors. It's a matter of pride to recount the role some of these technologies have played in the evolution of the chemical industries as we know them today. Through a systematic global programme, Uhde has a network of daughter companies worldwide – Russia, Thailand, Egypt and India, to name a few - that do not just reflect the competence of the parent company in Germany, but are also well-established names in their own countries. We are particularly proud of our India operations, which represent our largest subsidiary outside Germany.' PD Samudra, CEO & MD and Member of the Board said, "Uhde has been a lifeline for us. From the mid-sixties, when they began a systematic transfer of technology to India, Uhde has helped strengthen our plant engineering business on an ongoing basis. In India, the name Uhde is associated with leading technologies and quality engineering & implementation work. The plants we have built are a testimony to this. It is therefore not surprising that our customers, whose trust we are honoured to receive, readily recall our name. It is indeed a great honour to be celebrating this milestone in what has been a century of remarkable achievements and Landmarks."

L&T Completes 75 Years Of Construction & Mining Machinery Business

Mumbai, India: Larsen & Toubro, has completed platinum jubilee of one of its oldest businesses, Construction & Mining Machinery Business (CMB). The business has supplied over 60,000 units of various equipment in



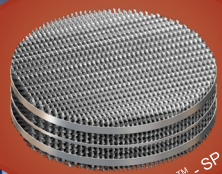
SN Subrahmanyam, CEO & MD, Larsen & Toubro

India during its 75 years association with the Construction and Mining Industry. These machines have been used to create landmarks of exceptional design and have significantly contributed to the growing infrastructure of the nation.

Mr SN Subrahmanyam, CEO & MD, Larsen & Toubro, commenting on the occasion said, "L&T has a legacy of pioneering critical equipment needed for Nation Building and has been at the forefront of indigenous development of engineering design and manufacturing capabilities. We are delighted that our Construction & Mining Machinery Business has been fulfilling the formidable needs of mining and construction sectors with innovative equipment and commendable service records for the last 75 years."

Mr Arvind K Garg, Executive Vice-President, L&T Construction & Mining Machinery while expressing his delight over the glorious journey said, "It has been our absolute commitment to serve valued customers over the last seven decades. L&T has pioneered and introduced global technologies,

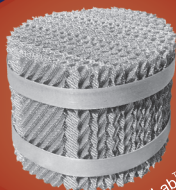
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equipment, and practices for the development of the nation. At this important juncture, we thank our customers for their association and patronage."

L&T utilized its deep knowledge and experience gained since 1945 and developed its own 'Make in India' road machinery comprising of Vibratory Compactors and Wheel Loaders. These indigenously designed and manufactured machines are now aiding road construction and highway development and enabling L&T move towards fulfilling the national mission of 'Aatmanirbhar Bharat'.

The company took a major step in 1973 by introducing Hydraulic Excavators in collaboration with Poclain SA-France. This was a revolutionary and pioneering initiative which needed efforts to establish a completely new concept in earthmoving and made L&T a strategic partner in Infrastructure construction. Some of the other collaborations included – Albaret-France, JI Case, USA, Vibromax-Germany, Detroit Diesel-USA.

Later in 1998, the two engineering giants Komatsu and L&T formed a Joint Venture to manufacture Komatsu's state-of-the-art, world class machines. Komatsu PC200-6 excavator turned out to be the benchmark in 'Quality, Reliability & Durability' and became an iconic model. With the introduction of several models of excavators, such as PC71, PC130, PC300 and PC450 in later years, L&T achieved a leadership position and built a large and loyal base of over 25,000 valued customers.

Continuing with the spirit of innovation, L&T recently introduced Komatsu PC210-10M0 Hydraulic Excavator which has been a runaway success and breached all records

to become the fastest growing model in the 22-ton class, reaching 1000 mark in 10 months period and is now well on its way to become the market leader.

As mineral mining expanded in India, Komatsu and L&T decided to transform mining to make it safe, environment friendly and sustainable and introduced large mining machines, such as Dump Truck HD785, Dozer models D155 & D475, Excavator models PC1250 & PC2000. These machines have created new benchmarks in performance, productivity, and long life at customer sites. L&T also delivered Komatsu's mammoth 240 Ton class 830E Dump Trucks and 16 CuM class PC3000 Hydraulic Excavators for mega mining operations, which reinforced its unmatched capabilities developed over time.

L&T has a long tradition of customer service with an underlying belief - "In Service, Lies Success". Hence, to support the large population of construction and mining machines, L&T focused on developing strong infrastructure for after-sales and service support. It now has six world-class Service Centres, a team of highly skilled and experienced service engineers, a Central Training Centre, 30 Dealerships for construction equipment and a network of parts depots across India. This has proved to be the real differentiator in machine uptime and utilization.

Reliance And BP Start Up Second New Deepwater Gas Field In India's KG D6 Block

Mumbai, India: Reliance Industries Limited (RIL) and BP Start Up announced the start of



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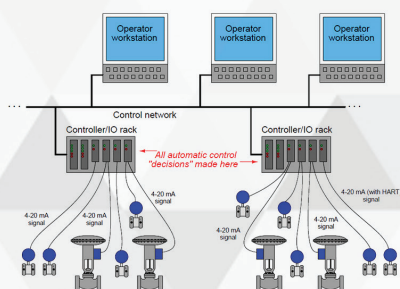


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production from the Satellite Cluster gas field in block KG D6 off the east coast of India.

RIL and bp have been developing three deep-water gas developments in block KG D6 – R Cluster, Satellite Cluster and MJ – which together are expected to produce around 30 mmscmd (1 billion cubic feet a day) of natural gas by 2023, meeting up to 15% of India's gas demand. The developments will each utilize the existing hub infrastructure in the KG D6 block. RIL is the operator of the block with a 66.67% participating interest and bp holds a 33.33% participating interest.

The Satellite Cluster is the second of the three developments to come onstream, following the start-up of R Cluster in December 2020. It had originally been scheduled to start production in mid-2021. The field is located about 60 km from the existing onshore terminal at Kakinada on the east coast of India in water depths of up to 1850 meters.

The field will produce gas from four reservoirs utilizing a total of five wells and is expected to reach gas production of up to 6 mmscmd. Together, the R Cluster and Satellite Cluster are expected to contribute to about 20% of India's current gas production.

The third KG D6 development, MJ, is expected to come onstream towards the latter half of 2022.

Perstorp To Set Science-Based Emission Reduction Targets In Line With Paris Climate Agreement

Malmö, Sweden: Perstorp Group, a world leader in chemical innovation, has committed to setting science-based targets to reduce



Anna Berggren, VP, Sustainability, Perstorp Group

greenhouse gas emissions, in line with the Paris Climate Agreement.

With ambitions to become the number one sustainable solutions provider within prioritized markets, Perstorp Group has already committed to becoming Finite Material Neutral. Now, the global chemical company has announced its commitment to emission reduction targets in line with Paris Climate Agreement and the Science Based Targets initiative. Targets will be set for both direct and indirect emissions (scope 1, 2 and 3 according to the GHG protocol) and calculated with projected future expansion and growth considered. The ambition is to apply for science-based targets in 2021.

“For direct greenhouse gas emissions, a challenge is to significantly reduce emissions

from our production plants while growing our production. To reduce our indirect emissions, we need to intensify the transition from fossil raw materials to more sustainable, lower carbon footprint alternatives, and grow our Pro-Environment product portfolio. We are already committed to a sustainable transformation and working with Science Based Targets initiative enables us to be transparent in the process, and will ensure that our low-carbon transformation is aligned with climate science," says Anna Berggren, VP Sustainability at Perstorp Group.

Science-based targets provide companies with a clearly defined pathway to future-proof growth by specifying how much and how quickly they need to reduce their greenhouse gas emissions. The Science Based Targets initiative advocate science-based target setting as a powerful way of boosting companies' competitive advantage in the transition to the low-carbon economy. It is a collaboration between Carbon Disclosure Project (CDP), World Resources Institute (WRI), the World Wide Fund for Nature (WWF), and the United Nations Global Compact (UNGC).

"The chemical industry, which is fundamental to almost all other industries and sectors, has an important role to play in reaching the goals set by the Paris Climate Agreement. As a business within the chemical industry we believe we can help enable a sustainable transition for all those other industries, sectors and products along our value chains, and we are committed to doing our part," highlighted Jan Secher, President and CEO at Perstorp Group.

IIT Mandi Researchers Develop Anti-Bacterial Material For Face Masks & PPE Equipment



Dr. Amit Jaiswal, Assistant Professor, School of Basic Sciences, IIT Mandi With his Research Scholars

Mandi, India: Indian Institute of Technology Mandi researchers have developed a virus-filtering, self-cleaning and antibacterial material that can be used to make face masks and other PPE equipment. This path breaking development of Dr. Amit Jaiswal, Assistant Professor, School of Basic Sciences, IIT Mandi, along with his research scholars, Mr. Praveen Kumar, Mr. Shounak Roy, and Ms. Ankita Sarkar comes at a time in which it has become imperative to develop techniques to stop the second wave of the COVID-19 pandemic in the country.

Results of this work have recently been published in the prestigious journal of the American Chemical Society – Applied Materials & Interfaces.

Facemasks have (or must) become a default piece of apparel to be worn in public in these pandemic times. They are largely designed to act as a physical barrier between the wearer and the external environment, but in reality it must also act as anti-microbial agents to inhibit or kill pathogens. This is especially important in the case of reusable masks, which are a necessary alternative to single use masks that add to littering and pollution issues, and secondary infections.

“Keeping the urgency of the pandemic situation and cost-effectiveness in mind, we have developed a strategy to repurpose existing PPEs, especially face masks, by providing an antimicrobial coating to these protective clothing/textiles,” said Dr. Jaiswal. For this, the research team has used such materials that are a hundred thousand times smaller than the width of the human hair to confer antimicrobial properties to polycotton fabric

Dr. Jaiswal and his team has incorporated nanometre sized sheets of molybdenum sulphide, MoS₂, the sharp edges, and corners of which act as tiny knives that pierce bacterial and viral membranes, thus killing them. “The ‘nanoknife’-modified fabrics demonstrated excellent antibacterial activity even after 60 cycles of washing,” said the lead researcher, which makes this an excellent way to reuse masks and reduce biological waste generation.

Dr. Jaiswal reminds us that improperly disposed off PPEs are a serious secondary source of transmission, and having reusable antimicrobial masks can help circumvent this risk. The reusability of the fabric will also

enable it to be integrated with homemade masks.

In addition to puncturing the microbial membranes, the nanosheets of molybdenum sulfide enable disinfection when exposed to light. Molybdenum sulphide exhibits photothermal properties, i.e., it absorbs solar light and converts it into heat, which kills the microbes. “Within 5 min of solar irradiation, all the MoS₂-modified fabrics showed 100% killing of both *E. coli* and *S. aureus*,” wrote the authors in their recently published paper. Thus, merely hanging out the masks in bright sunlight can clean the mask and make it ready to wear again.

The researchers have developed prototypes of a 4-layered face mask using the MoS₂ modified fabric. They report that these masks, in addition to killing microbes and being light-cleanable, can also filter >96% of particles that are in the size range of the COVID Virus (120 nanometres), without compromising on the breathability of the fabric, and could thus be a powerful tool to prevent the spread of coronavirus and other microbial infections.

IIT Guwahati Researchers Use A Hollow Fiber Membrane To Remove Micro-Plastics

Guwahati, India: Indian Institute of Technology Guwahati researchers have developed a microfiltration process to remove microplastics from seawater in order to prevent the inclusion of plastic residues in edible salt extracted from it. Prof. Kaustubha Mohanty and Dr. Senthilmurugan Subbiah, Department of Chemical Engineering, IIT



(L to R) Dr. S. Senthilmurugan, Prof. K. Mohanty, Naveenkumar A. Yaranal, IIT Guwahati

Guwahati, have recently published the results of this research in the journal *Environmental Technology & Innovation*, in a paper co-authored by their research scholar, Mr. Naveenkumar Ashok Yaranal.

Plastic pollution is rampant all over the world and while there is some level of awareness, the seriousness is not yet understood. Micro-plastics – plastic pieces smaller than one-fifth of an inch – are now found in almost all oceans and marine animals. What's worse, sea salt has been found to have considerable amounts of micro-plastic. Research performed in East Asia has shown that 90 percent of the table salt brands sampled worldwide has micro-plastics. Another study by IIT Bombay showed that eight brands of Indian sea salt were contaminated with micrometre sized particles of polyesters, polyethylene terephthalate (PET), polyamide, polyethylene, and polystyrene. Micro-plastics ingested by human beings can disrupt hormones, leading to infertility, and cause nervous system problems, and even cancer.

While there have been many studies to identify and quantify micro-plastics in various

food products, including salt, there have been fewer attempts at finding ways to remove them. The IIT Guwahati team has, for the first time, shown efficient removal of micro-plastics from synthetic seawater using hollow fibre microfiltration (HF-MF) membranes.

"In our hollow fibre membrane filter, hundreds of tiny straw-like tubes are bundled together to create a filter matrix," explained Dr. Mohanty. The walls of these tubes are filled with microscopic pores, and when water is passed through the tubes, the micro-plastics are trapped inside, thus freeing water of this pollutant.

Hollow fibre membranes are already used extensively in daily life applications such as RO pre-treatment, industrial water/wastewater, juice processing, and other biotech applications, including in dialysis membranes used for kidney ailments. The hollow fibres are made of many kinds of materials and the ones used by the IITG team was made of polypropylene and a silk protein called sericin.

"We were able to remove 99.3 % of the micro-plastics present in seawater, without

any reduction in the salt content", said the key researcher. If this filtered water is used to extract salt, it would be free from micro-plastics. The researcher clarifies that this can only remove micro-plastics from seawater before salt extraction, and obviously cannot remove micro-plastics that get added during salt production, such as through the use of descaling agents in the desalination process itself.

Some advantages of hollow fibre membrane technology that make it promising for pre-treatment of seawater include simplicity of installation and use, cost effectiveness, no need for power supply, no generation of waste, and operability under low water pressure.

Dow India Inaugurates STEM Center In Lote, With Partner, Agastya

Mumbai, India: Dow India recently inaugurated a science centre with mini-innovation hub at an educational premise of Jijamata Shikshan Prasarak Mandal in Lote, Ratnagiri district. The objective is to increase science, technology, engineering and math

(STEM) literacy and prepare tomorrow's workforce to develop innovative solutions. This centre will enable students to learn the process of design thinking which will include ideation and prototype development.

The facility has been created via its marquee corporate social responsibility (CSR) partner Agastya International Foundation and Freedom For You. Every year, it will aim to benefit 5,000 students spread across more than 50 schools. It will also provide training for more than 100 teachers and become a hub for science fairs and competitions in the region.

Dow India CEO and Country President Chandrakant Nayak inaugurated the facility recently. He commented, "It is essential to encourage curiosity, aid adoption of technology and multi-disciplinary learning experience for facilitators, teachers and students. As a Company, we are committed to help build the workforce of tomorrow by getting students excited about STEM subjects and supporting our educators. Engaging our employees and volunteerism is a vital part of that strategy and the center's success."



(L to R) Dr. S. Senthilmurugan, Prof. K. Mohanty, Naveenkumar A. Yaranal, IIT Guwahati

The center will also act as a training center for teachers. It will train more than 100 teachers on the importance of experiential learning which is aligned to the New Education Policy (NEP).

Spread over 3,000 square feet, the center will provide students with enriched and evolved learning. It will be equipped with more than 200 scientific models, chemicals, glassware and even modern tools and instruments like a 3D printer. It will act as a learning space where schools from Khed and Chiplun Taluka will be invited to participate in hands-on experiential learning, which is aligned to their curriculum, whereby students will go through a series of sessions focused on design thinking processes.

Clariant Collaborates With Indonesia's Pertamina In Advanced Biofuels Assessment

Munich, Germany: Clariant, a focused, sustainable, and innovative specialty chemical company, is working with Indonesia's state-owned oil and gas corporation, Pertamina, since 2018 to evaluate and test the feasibility of Clariant's sunliquid technology to process available regional feedstocks in Indonesia into the advanced biofuel, cellulosic ethanol. Indonesia has a vast potential of untapped biomass, from empty fruit bunches to palm leaves, that could be converted into cellulosic ethanol. Their present-day utilization is negligible and, until now, both feedstocks are frequently burnt, causing air pollution. In Indonesia, ethanol demand is expected to increase dramatically, spurred primarily by a nationwide E10 ethanol blending mandate.

Advanced fuel technology solutions, such as Clariant's sunliquid process, are vital to match the feedstock potential with the increasing ethanol demand in the country. Since 2018, Pertamina and Clariant have been assessing how to bridge this gap. The collaboration first focused on techno-economic performance analysis, and the testing of empty fruit bunches and palm leaves. The final results of the assessments proved that the sunliquid technology can successfully convert both feedstocks into cellulosic ethanol while achieving a good conversion yield.

Further, a recently conducted conceptual engineering study quantified process balance, facility specification, and process economics in detail. This lays the groundwork for Pertamina's continued consideration of investing in commercial-scale advanced biofuel production plants. "We are delighted that Pertamina, a renowned energy player in Indonesia, has chosen our sunliquid process for this technology and feedstock assessment, as well as for a process design study for a commercial-scale plant based on regional feedstocks," said Christian Librera, Clariant's Vice President and Head of Business Line Biofuels and Derivatives. Clariant collaborates with Indonesia's Pertamina in advanced biofuels assessment. Indonesian oil & gas company Pertamina and Clariant collaboratively evaluate the feasibility of sunliquid.

technology to convert available regional feedstocks into advanced biofuels. Technology evaluation and conceptual engineering study also cornerstone to the work.

Pertamina presented project collaboration details at Hannover Messe.

"The excellent results demonstrate once again the flexibility and efficiency of our sunliquid® technology platform for different lignocellulosic feedstocks," he added. "As other international oil companies start to navigate energy transition, Pertamina has committed to play its part by fostering clean energy development to reduce global carbon emissions. Our new and strong aspiration is underpinned by essential judgment about the forthcoming future, that clean energy is the key to energy sustainability," said Andianto Hidayat, Pertamina's Vice President of Downstream Research and Technology Innovation.

"As a result, we are strengthening our business portfolio by producing green fuel, such as biodiesel, green aviation fuel, and bioethanol using palm residues that are abundant in Indonesia. We are embracing a robust growth in clean energy by building two green refineries and optimizing domestic resources to ensure Indonesia's energy independence," he added. The realization of commercial-scale, advanced biofuels projects based on regionally available feedstocks, could help Indonesia become more independent from foreign fossil fuel imports and secure its national energy supply. In 2015, the Indonesian government introduced national biofuels targets. The bioethanol mandate in transport for the non-Public Sector Service Obligation (PSO) aims for a 10% bioethanol content as a gasoline additive and will be realized in the next few years. Pertamina presented the project results at the Hannover Messe held virtually from 12th – 16th April. Indonesia was this year's event partner country.

FMC Corporation Strengthens Commitment To Reduce Environmental Footprint

Panoli, India: FMC Corporation has started harnessing solar energy at its second manufacturing facility at the Panoli Industrial Estate in the state of Gujarat in India. The leading global agricultural sciences company has expanded solar power usage to the second facility after the successful shift to solar energy at its first facility in April last year.

FMC's Panoli operations is now sourcing 20 percent of its total power requirements from a 50 MW solar power plant, under an agreement between KPI Global Infrastructure Limited, Gujarat Energy Transmission Corporation Ltd, (GETCO), and the Gujarat Energy Development Agency (GEDA).

"FMC's global investments in energy-efficient processes have resulted in reduced usage of absolute energy with minimal disruptions over the past two years. Expanding the use of solar energy at the Panoli manufacturing plant is a step forward in this direction, reducing our overall carbon footprint and promoting the health and safety of local citizens," said Pramod Thota, President, FMC India.

The use of solar power is expected to result in zero greenhouse gas (GHG) emissions, reducing the overall emissions by about 2,000 tons.

Thota added, "We intend to further increase our energy share coming from renewable sources like solar and wind with an anticipated increase in power requirements onsite. Amidst the Indian government's efforts

to encourage the use of solar energy, FMC's sustainability initiatives will be instrumental in setting the benchmarks for the country's manufacturing industry."

According to a report by the International Energy Agency (IEA), India is expected to see the largest increase in energy demand globally over the next two decades and will overtake the European Union as the third largest energy consumer by 2030.

Small-Scale LNG Price Competitive With Diesel & LPG In India



Hemant Mallya, Senior Programme Lead, CEEW

New Delhi, India: Small-scale liquefied natural gas (ssLNG) could be delivered at prices competitive with diesel and liquefied petroleum gas (LPG) used in industry, according to an independent study released today by the Council on Energy, Environment and Water (CEEW). Considering a one-way distance of 200 km and the average 2017-18 LNG import price, the study estimates the delivered price of natural gas to be USD

11.11 (INR 815) per million British thermal units (mmBtu), as compared to the average industrial prices of USD 24.04 (INR 1,764)/mmBtu for diesel and USD 16.62 (INR 1,219)/mmBtu for LPG. Small-scale LNG offers an opportunity to replace as many as 41 million metric standard cubic metres (mmscmd) of LPG and 144 mmscmd of diesel in industrial facilities in states within 600 km of an LNG terminal.

Small-scale LNG systems transport liquefied natural gas from LNG import terminals in containers and re-gasify the fuel at consumer sites, instead of relying on transmission pipelines. In locations currently served by city gas distributors, who enjoy infrastructure exclusivity and charge high prices, ssLNG can offer a cheaper alternative. At the same time, they can enable new CGD networks in locations without existing gas transmission pipelines. In fact, ssLNG can accelerate the government's mission to connect 100 new cities to natural gas.

Hemant Mallya, Senior Programme Lead, CEEW, said, "Small-scale LNG could bridge gaps in natural gas coverage by catering to consumers without pipeline connections or those unable to procure gas from city gas distributors (CDGs) at economical prices. It also offers a better alternative to piped gas for consumers with fluctuating fuel needs, such as construction sites and mines. Further, small-scale LNG could help industrial MSME customers transition to a cleaner fuel to address air quality issues. Finally, scaling up ssLNG would be critical to service fuel stations that will support the use of LNG in heavy-duty vehicles — an initiative being promoted by the Government of India."

According to the CEEW study, the biggest contributors to the delivered price of ssLNG are truck loading charges, transport costs, and the Value-Added Tax (VAT) levied by states. VAT has the highest impact on price and varies greatly between states that currently operate LNG terminals. Reducing VAT to 3 per cent (as in Maharashtra) from 14.5 per cent (as in Kerala) could bring down the delivered price of natural gas by up to 8-10 per cent.

Sabarish Elango, Research Analyst, CEEW, said, "As a scalable, flexible, price-competitive fuel alternative, small-scale LNG could contribute significantly to India's plans to achieve a 15% share for natural gas in its primary energy mix by 2030. To scale up ssLNG in India, critical challenges such as the risk of transport disruptions, low consumer awareness, and the limited volume of gas that can be supplied need to be addressed. Further, to encourage investments in ssLNG, the government should issue a public note to clarify that while CGDs have the exclusive right to operate their own pipeline infrastructure in the areas they serve, this does not prevent ssLNG providers from operating in the same areas."

The CEEW study makes several recommendations for the promotion of ssLNG use and the expansion of natural gas access in India. These include standards for intermodal containerised transport of LNG, special railway tariffs for LNG transport, provisions in the Sagarmala initiative for the use of ssLNG as a fuel in waterway transport, and reduced VAT on natural gas consumption for small consumers.

AVEVA Recognized with Frost & Sullivan 2020 Product Leadership Award



Harpreet Gulati, SVP, Planning & Operations Business Unit, AVEVA

Mumbai, India: AVEVA, a global leader in industrial software, driving digital transformation for industrial organizations managing complex operational processes, has been recognized with the Frost and Sullivan Product Leadership Award for its Manufacturing Execution System (MES) for Food and Beverage (F&B). This best practice award is bestowed on companies that

consolidate or grow their leadership position by continuously innovating and creating new products and solutions that serve the evolving needs of their customers.

AVEVA was recognized for its success in

enabling F&B manufacturers to digitally transform their operations to achieve higher productivity and enhanced manufacturing flexibility and quality while reducing the cost of regulatory compliance in a complex environment. Citing AVEVA's approach as 'customer centric', the report states that AVEVA offers a model driven MES solution that combines the traditional advantages of an MES with a new digital workflow management approach to integrate people, processes, and businesses. AVEVA was also given recognition for delivering enhanced efficiency, capturing work procedures in digital workflows and relevant user experience models in contrast to competitors in this space that provide only standalone MES software.

The unique selling point of AVEVA's MES is its out-of-the-box connectors for both plant and enterprise applications, which provide greater flexibility to customers in terms of integrating the MES into their entire business. While competitors' platforms are designed to integrate only with their proprietary systems, the AVEVA System Platform is vendor-agnostic, working with any competitor's programmable logic controller (PLC), remote terminal unit (RTU), programmable automation controllers, IIoT devices and general IT applications. AVEVA Connect, which is also mentioned, allows clients to connect and optimize existing operations with advanced capabilities in the cloud – removing organizational silos. Furthermore, the ability to connect with automated manufacturing processes and integrate with asset performance management software or third-party applications, allows customers to achieve end-to-end process management

and to standardize processes across the enterprise.

For several years, AVEVA has been delivering a multi-site MES value proposition to the F&B market to digitalize manufacturing activities and integrate them with both ERP and automation systems. The Best Practices Award further highlights that AVEVA enables users to achieve the maximum level of automation, consistency of operational tasks, and collaboration across diverse teams. AVEVA's Model driven MES approach is based on the digitalization of operational processes, KPIs and reporting with sustainable reusability as a template and for governance of change across a multi-site enterprise. This standardization approach allows for rapid multi-plant optimization and lays the foundation for the optimization of the manufacturing value chain and for more agile, resilient businesses.

The MES benefits customers by reducing operating costs, increasing productivity and yield, and shortening the decision time. Vendors who can offer a real-time, plant-wide platform that can be easily implemented in a wide-scale manner without causing any disruptions in existing operations will be best positioned to stay competitive in the dynamic MES market.

"AVEVA supports manufacturing execution capabilities with its agnostic system platform, bringing state-of-the-art technologies, such as edge, cloud, machine learning, OPC-UA and the InTouch operations management interface to drive operational agility, responsiveness, and collaboration" said Ram Ramasamy, Global Client Leader at Frost & Sullivan. "The

cloud is inevitable in today's context, but it needs to co-exist with the edge. As customers start pivoting from site-level monitoring to fleet-level monitoring, the thirst for centralized applications has become unquenchable. Driven by forces such as an ageing workforce, resource efficiency requirements, and value-chain collaboration, AVEVA Connect brings together cross-functional teams, assets, and an end-to-end (E2E) view of the operations landscape."

"This award highlights AVEVA's leading edge in the global industrial F&B software market," said Harpreet Gulati, SVP, Planning & Operations Business Unit at AVEVA. "Frost & Sullivan's recognition of the value of our MES offering is a great testament to AVEVA's work in the sector. Amid a volatile and dynamic macro environment, AVEVA is committed to helping organizations optimise their value chain and streamline their businesses through digital transformation."

BASF Expands Ecobalanced Portfolio For Detergents And Cleaners Industry And Industrial Formulators

Ludwigshafen, Germany: Customers of BASF from the detergents and cleaners industry and many other technical applications will be able to formulate their products even more sustainably in future. BASF Home Care, I&I and Industrial Formulators' expanded EcoBalanced portfolio is designed to help customers in Europe formulate solutions that differentiate them in the marketplace while meeting consumer demand for

environmentally friendly products.

After launching a first biomass-balanced product last year, Trilon M Max EcoBalanced, BASF has now added a variety of Sokalan and Protectol grades to the portfolio: Sokalan HP 20 EcoBalanced, Sokalan HP 56 A EcoBalanced, Sokalan PA 25 CL PN EcoBalanced, Sokalan CP 5 EcoBalanced, and Protectol PE CO EcoBalanced. All these products are produced according to the principle of biomass balancing: Instead of fossil raw materials, 100 percent renewables are used in the production Verbund, which helps to reduce carbon emissions.

"This expansion of our EcoBalanced portfolio offers our customers more environmentally friendly, high-quality solutions without compromising on performance. It means we are contributing to the environment together with our

customers and making it possible to meet the demands of end consumers," says Soeren Hildebrandt, Senior Vice President, Home Care, I&I and Industrial Formulators Europe at BASF.

The biomass balance approach replaces fossil feedstock with renewable feedstock such as bio-naphtha or biogas right at the start of the production process. The renewable feedstock is allocated mathematically to a product using a TÜV Nord- certified method. According to this model 100 percent of fossil fuels can be replaced with renewables. As well as saving fossil resources, it also reduces greenhouse gas emissions. All EcoBalanced products are certified according to the global REDcert2 system.

Bentley Systems Brings Infrastructure Digital Twins to NVIDIA Omniverse

Exton, United States: Bentley Systems, Incorporated, the infrastructure engineering software company, announced that it is developing applications using the NVIDIA Omniverse platform for photorealistic, real-time visualization and simulation of digital twins of massive-scale industrial and civil infrastructure projects.

Bentley Systems has extended the Bentley iTwin platform integrate with NVIDIA Omniverse to provide a graphics pipeline for AI-enhanced, real-time visualization, and simulation of infrastructure digital twins. This integration allows engineering-grade, millimeter-accurate digital content to be visualized with photorealistic lighting and environmental effects on multiple devices including web browsers, workstations, tablets, and virtual reality and augmented reality headsets from anywhere in the world.

Bentley iTwin is an open, scalable cloud platform that enables engineering firms and owner-operators to create, visualize, and analyze digital twins of infrastructure assets. Digital information managers use it to incorporate engineering data created by diverse design tools into a living digital twin and align it with reality data, IoT data, and other associated data without disrupting their current tools or processes.

Bentley Systems CEO Greg Bentley said, "Visualization and simulation underpin many of the use cases for infrastructure digital twins. The collaboration of Bentley iTwin and NVIDIA

Omniverse is delivering real-time, immersive 3D/4D experiences that will enable true-to-reality, physics-based simulation of even the largest and most complex infrastructure assets. GPU-computing is transforming the world of engineering and construction and promises to unleash the potential of AI for simulation and advanced analytics in infrastructure digital twins."

"Modern infrastructure are magnificent feats of engineering. NVIDIA and Bentley share a vision of physically based digital twins – so accurate and realistically simulated that they will revolutionize everything from infrastructure design to operations," said Jensen Huang, founder and CEO of NVIDIA. "NVIDIA Omniverse was built precisely to realize this vision – to create shared virtual worlds that are simulated with physical and photo realism. We are delighted Bentley is developing applications for infrastructure digital twins on NVIDIA Omniverse."

Unmatched High-Fidelity Infrastructure Visualization

The combination of the Bentley iTwin platform and NVIDIA Omniverse provides an unmatched, high-performance user experience at a scale that had previously not been possible.

"The industry is moving in a positive direction toward more automated and sophisticated tools that improve client outcomes," said Donna DeMarco, plant information modeling, Jacobs. "Jacobs is proud to partner with Bentley in leveraging tools like iTwin linked with NVIDIA Omniverse to achieve strong results for our clients."

Scientist From IIT Kanpur Develops Washable Adhesive And Related Products

Kanpur, India: Scientists have developed a sticky mat which takes away dust from a contacting surface, ensuring a clean, hygienic, healthy, and refreshing atmosphere at our home, offices, hospitals, and laboratories as also smooth functioning of many expensive equipments. The mat is a low-cost one and remains washable and usable over many cycles.

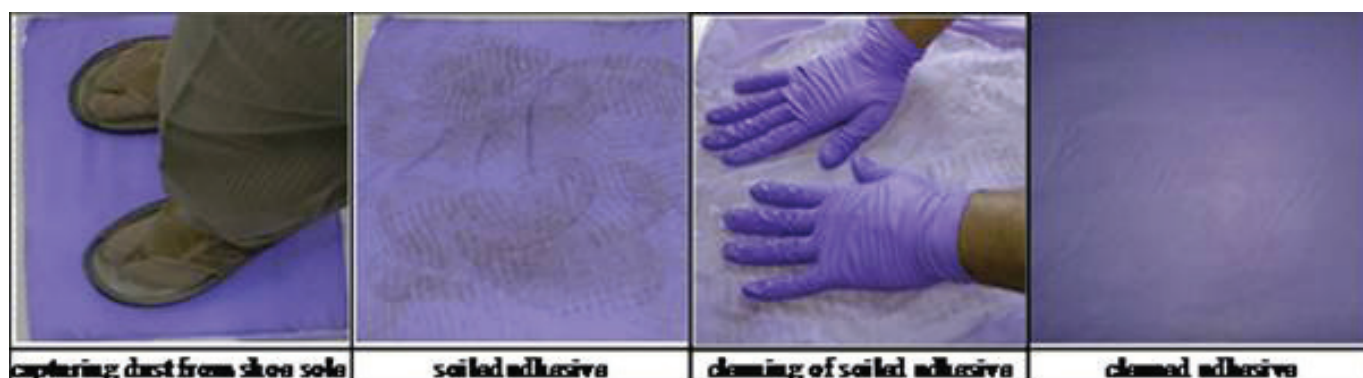
Prof Animangsu Ghatak, the Department of Chemical Engineering IIT Kanpur, who developed the mat with the support of Department of Science & Technology, Government of India under Make in India initiative, took inspiration from adhesive pad present at the feet of wall climbing animals, like house lizards.

The adhesive associated makes use of nanoscopic pyramidal bumps on its surface to attract dust particles towards it, thereby cleaning the sole of our shoes when we step on it. When the adhesive gets completely covered with particulate matter, it is washed in a way that we wash our clothes. At this,

the surface gets back its ability to stick and remains usable through hundreds of such cycles.

The scientists have used a bottom-up approach of preparation of nano- to micro-patterned surface on elastomer over a large area, control of geometry of surface patterns by simple methods, washability, and reusability of the adhesive over many cycles for the development of this mat. It has been validated, and an Indian patent application has been filed for the sticky mat. It is simple to prepare, easy to wash, environmentally benign, cost-effective, and can be a replacement for materials imported for the same purpose. The closest substitute is the 3M sticky pad that is not washable or reusable.

This mat can be used in ICU of Hospitals, clean rooms, facilities housing sophisticated equipment as a component of air filters. The technology is important wherever cleanliness and hygiene is desired. The product is in 7 – 8 level of technology readiness level and is yet to be commercialised. A pilot plant is being built to make the material in a scale larger.



Washable Adhesive example

McDermott Appoints Mahesh Swaminathan Senior Vice President

Kuala Lumpur , Malaysia: McDermott International, Ltd has appointed Mahesh Swaminathan as the Senior Vice President of its Asia Pacific region. In this role and as part of McDermott's Executive Committee, Swaminathan will lead all facets of McDermott's Asia Pacific business. Swaminathan succeeds Ian Prescott who is leaving McDermott to return to Australia. "I am confident that Mahesh's customer-focused approach will continue to bring value to our customers and organization," said David Dickson, President and Chief Executive Officer of McDermott. "He understands the challenges and opportunities for our customers and is committed to finding them the best solutions, something we have witnessed throughout his 15 years with McDermott. We appreciate Ian's service and wish him the best in his future endeavors."

Throughout his tenure, Swaminathan has held Vice President roles in operations, commercial and strategy within McDermott's Asia Pacific business. He has more than 28 years of operational, commercial and project leadership in the upstream energy sector across Asia, Australia, Middle East and Europe. He holds a Bachelor of Engineering, a post-graduate diploma in project management and a Master of Science and Law.

LANXESS Completes Acquisition Of Disinfection And Hygiene Solutions Provider Theseo

Cologne, Germany: Speciality chemicals company Lanxess completed the acquisition of the French Theseo group, a leading manufacturer of animal health and biosecurity solutions. LANXESS and the seller signed a corresponding binding purchase agreement on February 9, 2021, and the relevant antitrust authorities approved the transaction in mid-March.

With the acquisition, LANXESS is significantly expanding its portfolio of products for the growth market of animal husbandry – now comprising an extensive range of disinfection and hygiene solutions. In addition, the specialty chemicals company is adding products for pest control and for animal nutrition and welfare to its portfolio. The new businesses will be integrated into the Material Protection Products business unit.

LANXESS has financed the enterprise value of approximately EUR 70 million from existing cash. The acquired businesses represent sales of around EUR 33 million and EBITDA in the mid-single-digit million euro range. Within the next three years, LANXESS expects an additional annual EBITDA contribution in the same amount from synergy effects. The acquisition will already be earnings per share* accretive in the first fiscal year after its completion.

Yokogawa to Undertake Proof of Concept Test of 5G, Cloud, and AI for Remote Control of Plant Systems with NTT DOCOMO



Tokyo, Japan: Yokogawa Electric Corporation announces the signing of an agreement with NTT DOCOMO, INC. to jointly undertake a proof of concept test (PoC) for the remote control of a plant system by utilizing 5th generation mobile communications (5G), the cloud, AI, and other technologies.

The PoC will involve the use of cloud-based Yokogawa AI for plant control and a 5G communication module mounted on a three tank level control system*1 to remotely control the water level. This test aims to demonstrate the ease with which companies in the chemical, oil, and other process industries will be able to modify their existing systems to make use of cutting-edge 5G autonomous control devices with the latest cloud-based AI. With the goal of achieving autonomous control in plants in the future, Yokogawa will work together with DOCOMO to verify and optimize this technology.

Driven in part by the ongoing COVID-19 pandemic, there has been a dramatic increase in the need for the improvements

in production safety and efficiency that can be achieved through autonomous plant control. In a survey*2 of process industries that Yokogawa conducted last year, 64% of respondents said they anticipated that plants will have fully autonomous operations by 2030, and that autonomous control mechanisms using AI and other technologies and not requiring human intervention will become increasingly common. However, given the latency in communication that occurs between the cloud and device controllers when conventional wireless communication is used, there have been major technological challenges when it came to autonomous remote control of plant systems.

This PoC will examine whether the technical challenge of achieving low latency can be solved by using DOCOMO's high-speed, large-capacity, low-latency 5G communications network, the DOCOMO Open Innovation Cloud such requirements of the 5G era, as well as other cloud technologies. Yokogawa has already completed a trial of an autonomous control system based on its proprietary AI technology*5 that successfully controlled the water level in a three tank level control system, a task that is generally acknowledged to be very difficult, and the technology that was used is considered within the industry to be among the most advanced of its type. In the PoC, by the end of March 2022, Yokogawa will work with DOCOMO to construct a demonstration environment for the cloud-based remote

control of the water level in a three tank level control system using the AI, and undertake, among other things, comparison and evaluation of communication performance between LTE and 5G.

Based on its in-depth knowledge of plant control and operational technology, IT, and industry, Yokogawa is helping customers in a broad range of industries visualize issues that impact every area of their business activities, optimize their operations, and thereby create new value and sustain growth. Through this PoC, Yokogawa will work with DOCOMO to create new value and contribute to the development of not only process industries but all other industries as well.

Kenji Hasegawa, a Yokogawa vice president and head of Yokogawa Products Headquarters, commented, "Yokogawa has long played a leading role in the development of distributed control systems that control and monitor the operation of plant production facilities, and we have supported the growth of a wide range of industries. With a view towards a future in which industries adopt autonomous operations, we are now promoting IA2IA (Industrial Automation to Industrial Autonomy). Through the linking of 5G with the cloud, Yokogawa's AI, and device controllers, we believe that we can make a great contribution in achieving plants whose systems can be remotely controlled and are fully capable of operating autonomously. Along with NTT DOCOMO, we will work to create further value for our customers."

Indo-German trade in Engineering Sector in 2020

Germany: is India's largest trading partner in Europe. India was one of the first countries to grant diplomatic recognition to the Federal Republic of Germany; this March, the two countries celebrated 70 years of diplomatic relations. Germany and India have a strategic partnership; both have been holding cabinet-level bilateral consultations since 2011; in September 2020, the German government laid out its Indo-Pacific guidelines, illustrating its interest and commitment to a region where India is a key protagonist.

Germany is the 7th largest foreign direct investor in India. Germany's total FDI in India from April 2000 until June 2020 amounted to approx. USD 12 billion. There are more than 1700 German companies active in India and over 600 Indo-German Joint Ventures in operation. German investments in India are mainly in the sectors of transportation, electrical equipment, metallurgical industries, services sector (particularly insurance), chemicals, construction activity, trading, and automobiles.

The rapid spread of the Covid-19 pandemic the world over during 2020 led to a health crisis which resulted in an unprecedented crash in global economic activity, the repercussions of which would be felt over the next few years. Within this scenario, Indian and German enterprises have the opportunity to capitalize on each other's

strengths and seek new opportunities in commercial engagement with each other. For Indian businesses, Germany has been a source of high-quality, reliable machinery and equipment as well as aircraft and auto components.

Bilateral trade between the two countries in 2019 was valued at more than EUR 21.3 billion. In 2020, Indian imports from Germany amounted to € 10.7 billion, out of which machinery imports comprised 21.5 % and stood at € 2.3 billion.

India ranks 19th globally, in the list of top 50 destinations for the German Mechanical Engineering exports. In 2020, the total import of machinery from Germany reached a volume of € 2.3 billion. This was a drop by 23.6% compared with the same period of time in the previous year, owing to the pandemic. India exported machinery to Germany to the tune of € 688.2 million in 2020, which was a drop of 9.2% as compared to the previous year.

Among the machinery sectors, major demand of German equipment was for Power Transmission (12.7%), Valves & Fittings (5.8%), Machine Tools (5.7%), Air Handling Technology (4.9%), and Construction Equipment & Building Material Machinery (4.8%). There are other sectors like Plastics and Rubber Machinery, Fluid power equipment, Textile Machinery, and Food processing & packaging, which are growing steadily in India.

Out of the total export of German Mechanical Engineering to Asia of € 37.7

billion, India is the forth largest sales market in Asia for the German engineering industry, with a share of 6.2%, after China (48.1%), Korea (7.6%) and Japan (6.8%). In 2020, India imported machinery of the value € 19.6 bn globally. Germany is the 2nd most important supplier to India globally, share of around 11.8%.

Maharashtra, with around 44% share of German investments, remains to be the most attractive destination for German investments in India. In the last 4 to 5 years, Pune has become the hotbed for new German investments. Karnataka and Tamil Nadu are other important destinations. ■

Godavari Biorefineries Limited To Set Up India's Largest Capacity Sugarcane Syrup Based Ethanol Plant



Samir Somaiya, Chairman & Managing Director, Godavari Biorefineries Limited

Mumbai, India: Godavari Biorefineries Limited (GBL), one of the pioneers in the manufacture of alcohol and alcohol-based chemicals in India will be expanding its current distillery capacity to become India's largest syrup-based ethanol plant. Godavari has appointed Praj Industries for its expansion plans. As a part of this project, Praj will expand Godavari's existing ethanol manufacturing capacity from 400 KLPD to 600 KLPD, using sugarcane syrup.

While the world is moving towards sustainable practices to reduce carbon footprints, governments all over the world are promoting policies/programs to encourage companies/industries to incorporate green practices. The Government of India has also made several strategic interventions by way of expanding the ethanol blending programme, enabling the conversion of sugarcane juice/syrup to ethanol, other progressive policies, and conducive financial mechanisms. This helps India meet its energy security for transportation fuel by using biofuels, further helping fight climate change. It also helps bring more stability to farmer incomes by giving optionality to companies using sugarcane to make either sugar or ethanol. This capacity expansion planned by GBL is in line with the government's biofuel policy to increase the ethanol manufacturing quantity in India using various sugary feed stocks.

The expansion capacity at GBL Plant will continue to be a zero liquid discharge facility.

Speaking on the occasion, Samir Somaiya, Chairman & Managing Director of Godavari Biorefineries Limited said, "Responding to government's vision of Atmanirbhar Bharat, we decided to divert sugar cane syrup to distillery to manufacture Ethanol during the current season and expanded from 320 to 400

KLPD to continue our journey . We are happy to associate with Praj as our technology partner for our expansion plan. Praj will design, engineer, supply, install and increase our capacity from 400 KLPD to 600 KLPD ethanol production using sugar syrup as raw material. We look forward to building on our mutually rewarding relationship with Praj with our new ventures."

Godavari Biorefineries Ltd., one of the first companies to associate with the government's expanded program and supplied a large quantity of ethanol to the "Ethanol Blending Program" last year. Last year, the company delivered 45 million liters of ethanol to the program. Godavari Biorefineries pioneered the use of sugarcane syrup for making ethanol by diverting almost 30% of sugarcane directly following the Brazilian model. This year, the company is contracting to deliver more than 75 million litres for the ethanol blending programme. In the future, the company plans to produce more than 100 million litres in a single location.

Maire Tecnimont Group Expands Its Petrochemical Business In India With A New USD 450 Million Contract By IOCL

Mumbai, India: Maire Tecnimont S.p.A. announces that a consortium composed of its subsidiaries Tecnimont

S.p.A. and Mumbai- based Tecnimont Private Limited has been awarded an EPCC (Engineering, Procurement, Construction and Commissioning) Lump Sum contract by Indian Oil Corporation Limited (IOCL), for the implementation of a new Para-Xylene (PX) plant and the relevant offsites facilities. The plant will be located in Paradip, in the State of Odisha, in Eastern India. The overall value of the contract is about USD 450 million. The scope of work entails Engineering, Procurement, Construction and Commissioning activities up to the Performance Guarantees Test Run. Once completed, the new PX plant will have a capacity of 800,000 tons per year. The time schedule is 33 months for Mechanical Completion from the award date. The PX produced will be used to feed the adjacent PTA (Purified Terephthalic Acid) unit, thus ensuring availability of world-class feedstock that will provide a significant boost to the Country's manufacturing industry. PX is an intermediate building block for the petrochemical value chain, necessary for the synthesis of several polymers, particularly PET (polyethylene terephthalate, also known as polyester) which is used in numerous industrial applications in every day life in the packaging, cosmetic and pharmaceutical industries, to mention some. Pierroberto Folgiero, Maire Tecnimont Group Chief Executive Officer, commented: "We are really glad that our relationship with a

prominent player such as IOCL keeps on growing steadily with another strategic contract to boost the Country's natural resources transformation capacity with the best available technologies, thus ensuring environmentally best performing products and processes. As India is paving the way for a large wave of investments in the downstream segment to meet the fast-growing domestic demand for plastic products and intermediates, we are best positioned to seize new upcoming opportunities, thanks to our technological mindset as well as our historical local presence through our Indian engineering hub Tecnimont Private Limited".

L&T Construction Divisions Awarded Contracts for Water Treatment & Cement Plant

Mumbai, India: The construction arm of L&T has secured orders from its prestigious client for two businesses.

The Water & Effluent Treatment Business of L&T Construction has secured EPC orders from the Rural Water Supply and Sanitation Department, Odisha to execute individual Rural Water Supply Projects in the Kendrapada & Khorda Districts of Odisha. The scope of work includes design & construction of Intake structures, 4 Water Treatment Plants of a cumulative capacity of 105 MLD, supplying and laying transmission and distribution pipelines, overhead service reservoirs, a booster pumping station, house service connections and associated electromechanical & instrumentation works including measuring the input & output of the quantity and quality of water at each level. The projects will provide drinking water to 12.28 Lakh people across 780 villages in Kendrapada & Khorda Districts of Odisha.

The business is already executing several other rural water supply projects for the same client. The business has



(Pic courtesy: Intecc.com)

also secured a repeat order from the Water Resources Department of Odisha to construct an intake structure and pressure main along the right bank of Bargarh Main Canal of the Gangadhar Mehar Lift Irrigation Project in Bijepur, Odisha on EPC-TurnKey basis.

The scope includes design & construction of an intake structure, pump house, pressure main of length 34 Km and associated electromechanical & instrumentation works.

The factories arm of Buildings & Factories Business has secured an order from a leading Cement Manufacturer in India to construct a 10000 TPD Integrated Cement Plant in Pali, Rajasthan. The scope involves Civil, Mechanical and Equipment Installation works.

Uttam Group Purchases Catalina Composites; Will Invest More Than \$20 Million In Cng And Hydrogen Cylinder Production

Houston, United States: Uttam Group of Companies, a global manufacturer of ultra-lightweight composite cylinders and systems for compressed natural gas and hydrogen, announced today that it has closed on the purchase of Catalina Composites in Garden Grove, California. The entity will now be known as Uttam Composites.

"We're delighted to be acquiring this facility and we will be investing at least \$20 million to greatly expand staff, purchase new machinery and invest in research and development of new product lines," said Uttam CEO Karan Bhatia. "With demand skyrocketing for clean energy solutions, particularly in compressed natural gas and hydrogen, this expansion will help us grow."

The 107,000-square-foot facility, which produces thousands of cylinders a year, has already doubled its staff from 11 to 22 employees and will grow to around 50 people in the next two years, Bhatia said.

"Uttam is helping shape a new era of the energy industry through hydrogen, which is a growing solution to the world's energy needs," Bhatia explained. The acquisition will allow Uttam to expand to the U.S. and Europe, in addition to dominating the Asian market. Their business in India, Uttam Cylinders, has had a compounded annual growth rate of more than 60 percent in the last three years.

Catalina Composites said the company is in good hands. "The long-term prospects of the composites business under the ownership of the acquiring company are significantly more favorable than other available alternatives," Catalina wrote to its employees in announcing the sale.

Uttam Group of Companies is a family-owned conglomerate established in 1900

that serves a wide array of customers and locations — from the Indian Army at the Siachen Glacier, the highest battleground on earth, to the Indian Space Research Organization's mission to Mars.

IOCL & IDCO Sign Mou For Paradeep Plastic Park



Minister for Petroleum and Natural Gas & Steel and Chief Minister of Odisha jointly witness the signing

New Delhi, India: Indian Oil Corporation Limited (IOCL) and Odisha Industrial Infrastructure Development Corporation (IDCO) have signed Memorandum of Understanding (MOU) to develop Paradeep Plastic Park. The MoU was signed on a hybrid mode, in the presence of Minister of Petroleum & Natural Gas and Steel Shri Dharmendra Pradhan, Shri Naveen Patnaik, Chief Minister of Odisha and other dignitaries. Addressing on the occasion, Dharmendra Pradhan said, "Keeping the enterprise and employment

generation potential of the plastic sector in mind, Government of India has initiated the cluster development of the Industry through its Plastic Park scheme. Currently, six such parks have been approved by the Government of India, with Paradeep Plastic Park being one of them." Dharmendra Pradhan further added that Odisha would become the nerve centre of industrialisation

through rapid development in petrochemical, chemical, polymer, textile and fibre sectors.

The Union Minister also highlighted the importance of a skilled workforce in this downstream Industry for which the Institute of Chemical Technology, Mumbai and IndianOil have joined hands to set up a world-class Centre of

Excellence in Chemical Engineering and Technology at Bhubaneswar. The Minister also said that "Today's event is a significant milestone in the direction of Honourable Prime Minister Narendra Modi's vision of mission Purvodaya for growth of Eastern India." Speaking on the occasion, Naveen Patnaik, Chief Minister, Odisha, said, "I congratulate Union Minister, IndianOil and IDCO for coming together towards the development of Paradeep Plastic Park, which is going to be a real game-changer for the downstream plastic industry. This will

boost the petrochemicals and plastic infrastructure as well as auxiliary industries & MSMEs in Odisha as well as Eastern India.

As part of the MoU signing, to attract investments in downstream polymer industries at Paradip Plastic Park, IndianOil announced a Special Strategic Incentives scheme. An incentive of Rs 2000/MT on Polypropylene granules from Paradip Refinery shall be offered to the manufacturing units located in the Paradip Plastic Park till 31.3.2030. It is estimated that around 26 units will come up at the plastic Park with an estimated investment of 500 Crores and is likely to generate direct and indirect employment of 6,000. Dibya Shankar Mishra, MoS (I/c), Energy, Industries, Micro, Small & Medium Enterprises, Govt. of Odisha, Sanjay Kumar Singh, Chairman, IDCO and Shrikant Madhav Vaidya, Chairman, IndianOil were also present on the occasion.

Praj Wins Breakthrough Order To Set Up Compressed Biogas Plant From HPCL

Pune, March: Praj Industries bags the prestigious breakthrough order from Hindustan Petroleum Corporation Limited (HPCL) for setting up Compressed Biogas (CBG) project at Badaun in Uttar Pradesh. Praj is offering



Dr. Pramod Chaudhari, Founder & Executive Chairman, Praj Industries Limited

its State of the art, worlds' first of its kind RenGas™ technology developed using proprietary microbe to produce CBG from rice straw. The project has capacity to process 35000 MT of rice straw as feedstock to generate 5250 MT of CBG annually. In addition, the project will also generate 23,000 MT high quality solid bio- manure and 350,000 MT of liquid bio-manure for ferti-irrigation. This project has a potential to save up to 15000 MT of CO₂ emissions per year. The project will be completed and commissioned within 12 months timeframe.

The Best-in-Class RenGas technology, to process agri-residues for the production of CBG is developed at Praj-Matrix, Department of Scientific and Industrial research (DSIR) certified the R&D centre. Praj has incorporated unique dual plug flow digester design, in collaboration with DVO Inc of USA. This patented design technology has several advantages including higher efficiency, lower energy consumption and near zero maintenance. RenGas technology yields are considerably higher compared to conventional biogas processes. This project will contribute to the Ministry of Petroleum and Natural Gas (MoPNG), GOI's Sustainable Alternative towards Affordable Transportation (SATAT) initiative with an objective to promote CBG as an alternative, green transport fuel. The project will generate significant employment opportunities in surrounding farming and rural community. Agricultural waste in the form of rice straw procured as feedstock for the CBG project will provide additional income revenue stream to farmers, facilitating GOI's flagship program of Doubling Farmers Income.

Speaking on this development, Shishir Joshipura CEO & MD of Praj said, "We are delighted to partner HPCL for the CBG project at Badaun UP which will deploy RenGas technology an integral part of our Bio-Mobility platform. This project is a definitive solution to meet the challenge of air pollution related to

stubble burning while simultaneously enable sustainable decarbonisation. This project will facilitate India's pursuit of energy security, and also, a definitive step towards Atmanirbhar Bharat. We are already executing for HPCL advanced biofuels project at Bhatinda Panjab, based on our enfinity 2G technology that uses rice straw as feedstock to produce ethanol. We look forward to continue strengthening of our association with HPCL in future."

L&T Construction Secures Major Green EPC Order To Establish One Of The World's Largest Solar PV Plants By Capacity



Mumbai, India: The Renewables arm of Larsen & Toubro's Power Transmission & Distribution Business has secured a turnkey EPC Contract, from the consortium of ACWA Power and the Water and Electricity Holding Company (a subsidiary of the Public Investments Fund of Saudi Arabia (PIF)), for Sudair Solar PV Project of 1.5GW capacity. This

project is considered the largest Solar Plant in Saudi Arabia with PPA signed. It is also one of the largest such plants in the world.

The project that is coming up in Riyadh Province has a 30.8 square kilometre land parcel available to install a total capacity of 1.5GW PV Solar modules with associated single axial tracker and inverters.

The ambitions of Saudi Arabia's National Renewable Energy Program (NREP) are on track. As part of the NREP, Sudair Solar PV Project is awarded to PIF and its partner, ACWA Power. This project is part of the 70% of the target capacity of 58.7 GW of the Kingdom assigned to Public Investment Fund (PIF), while Renewable Energy Project Development Office (REPDO) would undertake competitive tendering for the remaining 30%, as announced by the Ministry of Energy in 2019.

"With several GWs of solar EPC experience, L&T has emerged as a global technology player for solar plants, said S. N. Subrahmanyam, CEO & Managing Director, Larsen & Toubro. "L&T has been a provider of EPC services for several green projects in recent years. We are India's largest EPC company to build hydel power plants, the largest market player to build nuclear power plants with a total capability of 9360 MWe, including some ongoing projects,

on an EPC turnkey basis with the capacity to make important critical components like steam turbines, generators, end shields and other critical equipment. We have the largest market share of the Flue Gas Desulfurization (FGD) units for fossil fuel power plants. L&T has over 2.1 GW of Utility Scale Solar projects commissioned and are also operating and maintaining several of them. We have a diversified renewable portfolio of 32MW Floating Solar Power Plants, 135 MWH of Battery Energy Storage projects, 500 Micro Grids and 14000 Solar Water Pumps. L&T is also working on potential solutions related to Green Hydrogen and Carbon Capture & Storage technologies. Securing this project is a major milestone in our clean and green energy path to fight the climate crisis that the world faces," he added.

Commenting on the development, T. Madhava Das, Whole-Time Director & Senior Executive Vice President (Utilities), L&T said "KSA aims to become a pioneer in Renewable Energy and we are happy to be a part of this journey. We have been building efficient power transmission and distribution networks with modern substations and transmission lines in this region for more than 2 decades. This is yet another recognition of our capabilities to construct mega projects to speed and scale". ■

Use of High-Efficiency Mist Cooling System as a Superior Alternative To Cooling Tower



Water Cooling has played an important role in all types of Process industries & Power Plants since its inception.

Efficiency of a Process or a Power plant largely depends on availability of designed cold water temperature through-out the year, but mainly in summer & monsoon. During these months when humidity is high, cooling tower fails to achieve desired cold water temperature which results in drop in vacuum maintained at exhaust of a turbine and in turn drop in Power plant capacity. Now it is time's need to find new solution to get desired cold-water temperature throughout year.

The ultimate Mist Creation Technology is the best alternative to conventional cooling towers. This advanced mist creation system can achieve an approach of 1 to 2°C to WBT as against 5 to 6°C approach for conventional cooling tower. Hence guaranteed cold water temperature of

around 30°C could be obtained throughout the year tropical climate. Also, the spraying head is equivalent to the height of cooling towers thus requiring same pumping power. As mist creation- system does not require fans for cooling it saves huge amount of power. Also, as there are no moving parts involved in Mist creation system the maintenance cost is negligible and system runs trouble free.

In Process / Chemical Plants, product vapour generated in the process is condensed in a Heat exchanger and is recovered back.

The condensation of steam / Vapour requires a cooling medium. In early days this was achieved by using water from a river, a basin or seawater. The cold water is pumped through a heat exchanger and the warm water is discharged back to the water source. This is called Once Through cooling system.

A once through system is an open loop system. The necessity to reduce the huge amount of water gave birth to the idea of closed loop system. Thus the Wet Cooling system came into effect.

In a wet cooling system, water is circulated to condense the steam in the same type of heat exchanger that is used in the once through cooling. The warm water, instead of being sent to the water source, is cooled in a cooling tower using air as the cooling medium. Only the water carried away due to evaporation, drift and blow-down needs to be replenished by make-up water. Thus requirement of water quantity is vastly reduced.

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Wet Cooling Systems

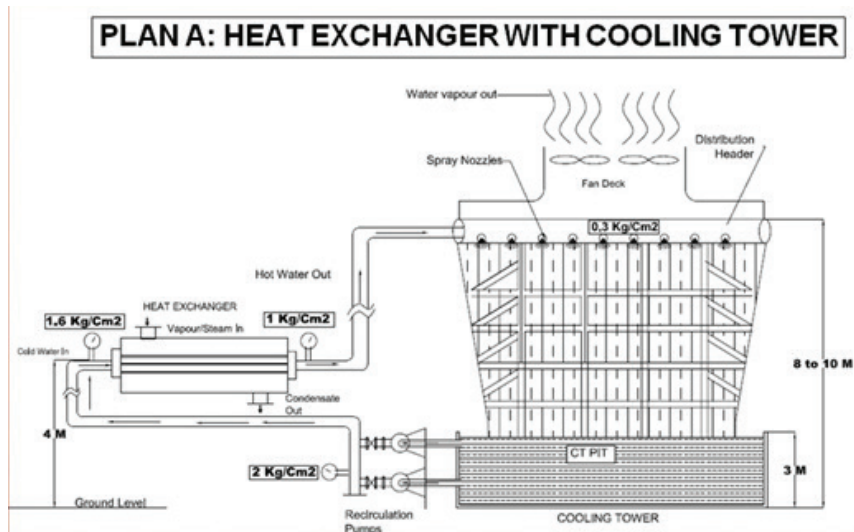
The wet cooling tower system is based on the principle of evaporation. The heated water coming out of the surface condenser is cooled as it flows through a cooling tower, where air is forced through the tower by either mechanical or natural draft.

Now a days, mostly, all wet cooling towers are mechanical draft cooling towers, where the air flow is accomplished by fans.

The Principle cooling device used in an Induced /forced draft cooling tower are Fans which run at the top of Cooling Tower (CT). Air enters through side louvers and escapes from the top. Water enters at the

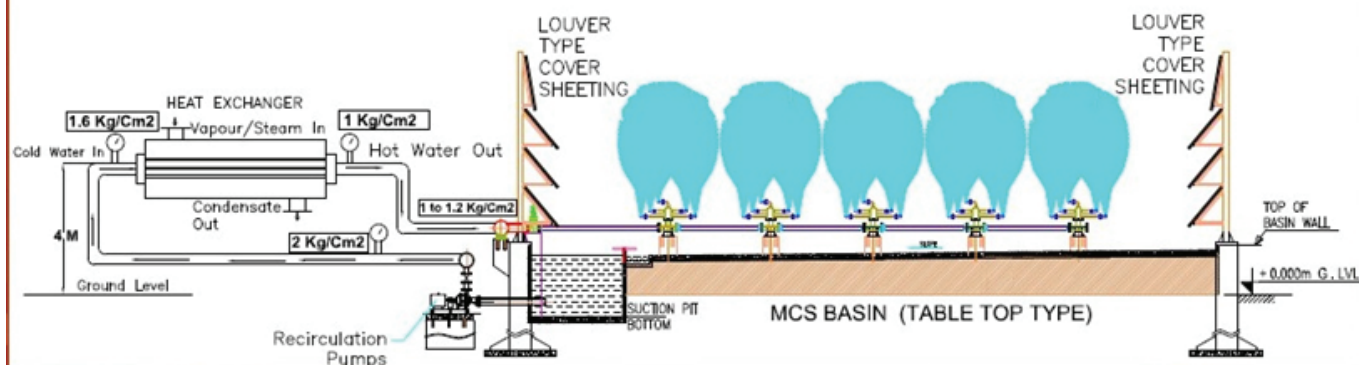
top and trickles down while getting cooled by air draft. A correctly designed induced draft CT can give an approach of 4 to 6°C to wet bulb temperature with a temp. drop of 10°C. Even a very highly efficient CT can not give an approach less than 4°C to WBT. Moreover, if ambient temperature or humidity levels rise, efficiency of CT reduces.

For a Chemical Plant, an induced draft cooling tower is designed to maintain Cold water temperature of 32°C at a WBT of 28°C with an approach of 4°C. Cooling Tower performs as desired during winter, early summer months. But during peak summer / Monsoon, efficiency of cooling tower reduces as humidity rises & its approach to WBT reaches beyond 6°C from design 4°C. Thus due to this rise in Cold Water temperature, these industries always experience loss in production by at least 5 to 7%. These losses do not occur in winter months. This means that the plant



Circulation Water Cycle in Cooling Tower Plan A:

PLAN B : HEAT EXCHANGER WITH MIST COOLING SYSTEM



Circulation Water Cycle in MCS Plan B :

will operate at a reduced efficiency for almost 5 to 6 months in a year.

Mist Cooling System

MREPL has come out with a solution by designing MIST COOLING SYSTEM which is a high efficiency system, which ensures an approach of 1°C to prevailing wet bulb temperature with a Temp. drop of 12 to 15°C even in adverse climatic conditions.

In tropical conditions, worst wet bulb temperature even at coastal applications is maximum 30.5°C. Hence MCS will always maintain Cold Water of around 31°C+1°C throughout the year. No other cooling system can operate with such efficiency and it makes cooling tower/spray pond systems obsolete.

Salient Features Of Mist Cooling System

Cold Water Temperature

Mist Cooling System ensures an approach

of 1°C to WBT with a temperature drop of 12°C to 15°C.

Energy Savings

Due to increase in DT, water quantity required at the process side is much less. MCS requires water pressure equivalent to the height of cooling tower as shown in the following diagrams. Hence, considerable amount of energy is saved on circulation water pumping. Also, MCS does not require any fans for cooling. Thus, a huge amount of energy is saved on circulation and cooling.

Maintenance

MCS has no moving parts. Also the material used in the mist cooling system is special grade saran polymer, a highly non-corrosive material having a life of more than 10-15 years. This makes MCS absolutely maintenance free. As against this, cooling towers require a heavy maintenance in form of replacement of louvers, fan blades, clamps etc. every year.

COMPARISON TABLE BETWEEN
INDUCED DRAFT COOLING TOWER / FAN LESS COOLING TOWER &
LOUVER TYPE MIST COOLING SYSTEM

Sr. No.	Feature	Induced Draft Cooling Tower (IDCT)	Fan less / Jet Cooling Tower	Louver Type Mist Cooling System
1	Approach to WBT	4 to 5 degrees.	6 to 8 degrees.	1 to 2 Degrees.
2	Temperature Drop	8 to 10 Degrees	6 to 8 Degrees	Regular: 12 Degrees. Advanced Model guarantees up to 40 Degree C in a single stroke
3	POWER CONSUMED (Comparison for a 1000 m ³ /hr circulation flow assuming IDCT's Total Power as 100%) (Please refer PLAN-A & PLAN-B)	100 HP : 100% $\left(\begin{array}{l} 70 \text{ HP : 100\% on} \\ \text{Pumping \& } \\ 30 \text{ HP : Fan} \end{array} \right)$	100 HP : 100% $\left(\begin{array}{l} 100 \text{ HP : 140\% on} \\ \text{Pumping \& } \\ 00 \text{ HP : Fan} \end{array} \right)$	70 HP : 70% $\left(\begin{array}{l} 70 \text{ HP : 100 \% on} \\ \text{Pumping \& } \\ 00 \text{ HP : Fan} \end{array} \right)$
4	Nozzles	Ordinary type which choke frequently	Ordinary Jet type which choke frequently	Special whirling type, choke-less design incorporating non-moving parts with 25 mm bore opening.
5	Water droplet size	5 mm	2 to 3 mm	Atomized to 5 to 50 Microns
6	Travel time	Less due to Downward fall only.	Less due to Downward fall only.	Two time travel due to upward & downward travel leads to Double air retention time
7	Fills/ fins	Various types used - prone to scaling, need Periodical changing	Various types used - prone to scaling, need Periodical changing	ABSOLUTELY NO FILLS / NO FINS REQUIRED.
8	Drift Loss	Same	Same	Same
9	Make Up Water	same	same	Same due to similar hold up.
10	Flexibility	Limited	Limited	Individual Line Isolation offers max. flexibility to use capacity as per requirement.
11	Standby	Required	Not Required.	Not Required.
12	Erection/delivery	Substantially high	Low	Fairly less
13	Maintenance	Very high due to replacement of fills/ fins/ fan blades etc. Also due to deposition of dust on fills, efficiency reduces with time.	Very high due to replacement of fills/ fins etc. Also due to deposition of dust on fills, efficiency reduces with time.	Negligible maintenance due to choke less operation and non-moving parts.
14	Aesthetics	Bulky, Generally most neglected part in a Plant	Untidy	Appears Fresh and Dynamic resembling active water like fountain
15	Civil Construction	Heavy due to static and dynamic load	Less	Simple due to table top construction with static load
16	Total Footprint	Less	Higher than CT	* More by 2 to 4 times to IDCT

* Note: As capacity (Flow, M3/Hr) through MCS increases, ratio of area required between MCS and CT reduces.

Chokeless Design

MCS operates with a chokeless design. Size of smallest opening in MCS is more than one inch (25 MM) in diameter. Hence chances of particles choking the system are minimum.

Various Designs Of Mcs To Suit Site Conditions



Open Pond MCS: Here, MCS ensures an approach of 1°C to WBT with a ΔT of 12 to 15°C . Water loss due to drift is 0.1 to 0.25% depending on wind load.

Louver Type MCS: Here MCS pond is closed from sides, up to a height of 8 to



10 mtrs. by louver type cover sheeting.

This reduces the plot size by 60% of open pond design. MCS ensures an approach of 2.5°C to WBT with a ΔT of 12 to 15°C . Drift loss comes down to 0.02% and also space requirement reduces considerably.

Hybrid Mist Cooling Tower : MCS/ LTMCS requires larger plot size in



comparison to the Induced draft cooling tower. To enable some clients having space limitation at site to get advantages of MCS, The Hybrid Mist cooling tower design is introduced. Here, technology of MCS and Cooling tower is combined by using lower power fans to operate in combination with MCS.

System Flexibility (Capacity Turn Down Ratio)

We offer MCS with individual line isolation

valve. MCS is the only system, which gives you such a high flexibility in operation.

Chemical Treatment

Chemical dosing requirements are similar to that of cooling tower as same hold up of water is maintained in suction pit due to Table top design of basin.

Make-Up Water Requirement

Due to latest Louver Type design, drift loss through MCS is reduced to 0.02% while maintaining an approach of around 2°C to wet bulb temperature. Hence, Overall make-up water quantity required is approximately same as compared to cooling towers. Pay Back Period: Considering All Above Benefits Of The Mcs Will Be Less Than One Year Only. ■

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Author

Makarand A. Chitale

Director
Mist Resonance Engg Pvt Ltd



Ensuring Energy Efficient Processing in Thermal Processing



*Under the visionary leadership of **V Gokul Das, Chairman & Managing Director, HRS Process Systems** has grown tremendously and gained the recognition as the leading heat transfer technology providers for the chemical processing industry. In an exclusive interaction with Chemical Engineering World, he shares the learnings from the last year, innovative technologies the company has to offer and how the company is getting future ready with the changing industry trends.*

V Gokul Das

Chairman & Managing Director
HRS Process Systems Ltd



What were the biggest challenges for HRS Process Systems in the last year that you had to address and the biggest learnings as an organization? How do you see this year from the growth perspective?

Our country and the world, were witnessing pandemic of this magnitude for the first time which needed preparation of war footing. The challenges were many and varied, each country and company rose to the challenge and created their own plan to tackle the pandemic. Lockdown across the globe was a necessity not only to contain the virus spread, but also give time to prepare for a remedy. Our biggest challenge was to maintain supply and service support to the key sectors that were necessary in fight against the pandemic – our huge Customer base in Pharmaceutical, Chemical and Food processing sector i.e. essential category. They worked to ensure we have the necessary medication to fight the pandemic and also food stuff to sustain. At HRS, we were able to quickly start back with proper care and precautions as define by the Government from time to time and support our customers without disrupting the supply chain. This also helped our vendors and suppliers to sustain their business. Our initiative helped us sustain our business and also post a small growth in a very challenging year.

The year has been full of learning for organisations and individuals. We have learnt the importance of first time

right approach, which has helped us immensely. We also realised that all our processes need to be evaluated to stand up to such challenges ever in future. As an organization we opened up informal communication line with our employees to connect, share and keep team motivated during the lockdown and on start back. We realised the power of teams and value of shared learning. Looking back, we feel proud that as a company we rose to the occasion and were able to help fight the pandemic by enabling our Customer.

How do you see this year from the growth perspective?

The year 2020 was full of challenges to each and every business, we were no exception. Our products mix enable us to work across multiple sectors- chemical and agrochemical processing, pharmaceuticals, petrochemical, fertilizer, cement, steel, power, edible oil, snack food, fruit and beverages processing, dairy, nutraceuticals, prepared food, etc. We were among the few fortunate to sustain and grow the business. Looking forward 2021 and beyond is very promising. Although currently we are facing the second surge, with vaccination roll out, better medication and health care and responsible citizens, we should be able to contain and overcome the pandemic. The economy will witness a dip in first quarter, however, during later part of the financial year, it will bounce back and we can witness a decent growth.

What are the biggest challenges in thermal processing and how does your organization help the customers address these?

The key challenge in thermal processing is to ensure efficient processing with low energy consumption. Additionally, in some sectors like food, there is also a need to ensure product consistency, flavour, aroma and taste. Thus the challenges vary from industry to industry and from application to application. In the chemical process segments the need is for better conversion, thermal efficiency, low process losses, better yield, long operating times (between maintenance), low fouling, flexibility in operations and low cost. Material compatibility for an application and equipment life cycle, are additional aspects that need attention.

HRS has been working in thermal processing segment sector globally for over three decades now. We have assimilated good technical know-how and knowledge on various types of heat exchangers and their applications. We offer a range of thermal processing products which includes Ecoflux corrugated tube heat exchanger, smooth tube heat exchanger, plate type heat exchanger and scraped surface heat exchanger (rotary and reciprocating). Shell and tube heat exchangers are widely used in the industry; with our corrugated tube technology we have been able to address all the industry challenges effectively.

Our Ecoflux range of heat exchangers are compact in size, have higher thermal efficiency, low fouling in nature and available in variety of materials like stainless steel 304 / 316 / L, 904L, duplex, super duplex, inconel, monel, hastelloy C276, C22, C2000, copper alloys, titanium and tantalum.

We have a proprietary thermal design program to design a suitable heat exchanger for our customer's requirement. We offer heat exchanger to various mechanical design codes, including ASME 'U' stamp units. We have the key types of heat exchanger and thus depending on application, process fluids and the thermal duty; we can suggest to customers the best suited heat exchanger for their application. With over 25,000 installation references in India and over 100,000 references globally, Ecoflux has become a brand of its own and HRS a highly valued heat exchanger company.

Please share insights into the evolving trends in thermal processing and the factors that are driving the change.

Thermal processing has seen developments in products based on application and cost of ownership. The driving force for change has been the process challenges. Our corrugated tube heat exchanger is an appropriate example. We developed Ecoflux* to ensure low fouling inside the tube which not only improve the thermal characteristic but

also reduces fouling. This ensures longer running times (between maintenance cycle) and thus is of immense advantage to our customers. Another product developed was the Unicus Scrapped Surface heat exchanger for food and pharma applications. Here we have heat sensitive products, highly viscous products, which need gentle handling during thermal processing. Unicus ensures uniform thermal processing without any fouling or product burn out. This heat exchanger can also be used for fluids with particulates too.

Globally thermal processing sector is evolving to look at compact heat exchangers that can take high thermal duty and at low cost. There is lot of work being done in material used for manufacture of heat exchanger. The material needs to be compatible with the processed fluid and resistant to corrosion, thereby leading to long running time and life cycle of the equipment. There are many heat transfer equipment's being tried for various applications however they are a combination of tubular, plate and fins, depending on process fluid, thermal requirement and fouling tendency. Shell and Tube heat exchanger remains the industry workhorse and new designs or types are available for critical process applications.

How focused is the group on R&D?

What kind of budgets have you allocated towards R&D, Team size & expertise. How

has this helped the group stay ahead in competition?

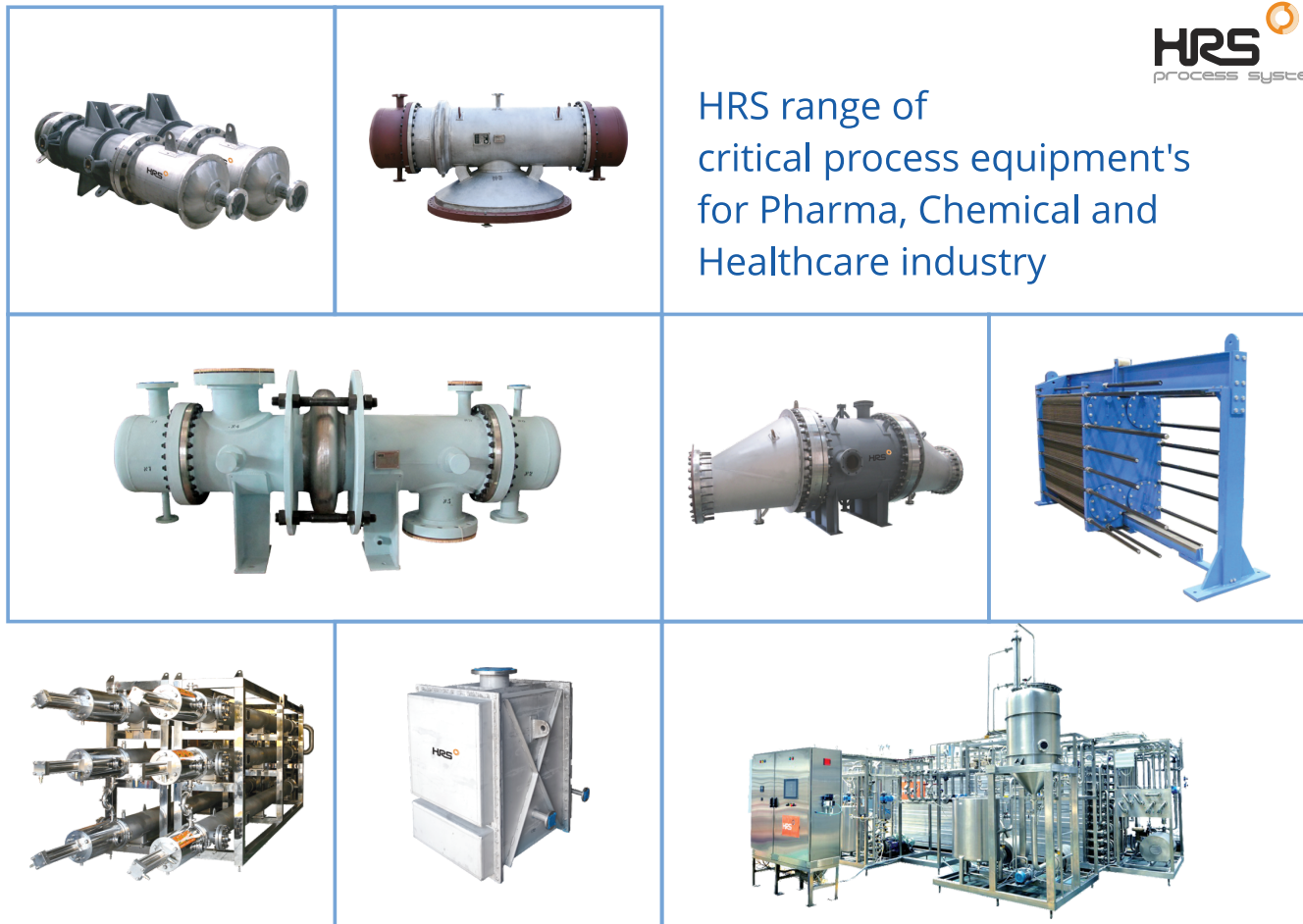
HRS always been focused on R&D and our products have been developed from our R&D Center in Murcia, Spain. As a group we allocate about 5% of the revenue in various R&D activities which includes pilot plants and test units and in some cases full scale plant along with the customer. We have a dedicated team to look after the R&D. Each company has a local team which interacts with the customer and understands the problem faced and solution anticipated. The details are fed to the main R&D center, Spain. These are then evaluated and depending on the need trials are conducted to understand the applications and the solutions engineered. Our products like the Unicus®, the Piston pumps, the Rotex have all developed in the R&D Center, from such customer requirement feedback. We have also made inroads in to the food waste conversion to energy which includes - food waste pasteurization, anaerobic digestion, effluent concentration, energy generation and utilization. We have also installed plants for these processes in Europe and US markets and now aggressively pursuing in the Indian market.

Please share insights into the latest innovative technologies developed by HRS Process Systems for industrial applications.

The chemical process and Pharma sector



HRS range of critical process equipment's for Pharma, Chemical and Healthcare industry



have always looked at having compact heat exchanger for various applications. For the chemical process sector we have developed Ecoflux* Corrugated Tube Heat Exchanger in various metal of construction like stainless steel 304 / 316/ L, 904L, duplex, super duplex, inconel, monel, hastelloy C276, C22, C2000, copper alloys, titanium and tantalum.

Further in Pharma sector we have developed special compact condensers for reducing solvent losses in various storage tanks. We have developed special box type condensers to satisfy compact heat exchanger requirement for Pharma sector. These are manufactured in exotic material

like hastelloy, higher nickel alloys. We have also developed special corrugated tube heat exchanger for the fertilizer industry for the carbon dioxide compression station which has not only helped in enhancing capacity but also reduced power consumption. Recently we have launched special heat exchangers for handling municipal sludge and waste. We have expertise in thermal processing of these to enable further treatment been mandated by various municipal corporations now in India.

How is the group leveraging Make in India, and what kind of support do the capital equipment manufacturers need for

India to evolve as a global hub?

HRS has always believed in Make in India with a global market vision. We started with our manufacturing facility in India in 2003 and thus we have been able to build HRS brand in the Indian market and globally. We are the global sourcing centre for our group companies and have supplied heat exchanges to customers in South East Asian countries like Malaysia, Indonesian, Philippines, Australia, our neighbours Bangladesh and Sri Lanka, Africa (Uganda & Zambia) South America, US and Europe. The capital equipment manufacturers in India need infrastructural support, to be able to manufacture and ship overseas. Also the industry needs good technology and engineering support to evolve as a global hub. We need to understand the different segments in terms of capacity and size of equipment and create clusters of similar size to have economic viability. We also need to brand our product and services as a competitive solution to the global market.

What kind of opportunities do you see for HRS Products in domestic & international markets in the near foreseeable future?

We see promising opportunity for HRS products in domestic, as well as international market. We all are aware of the growth of Pharma sector that is enabling growth in chemical and fine chemicals sectors. Growth in agriculture sector, the fertilizer requirement is increasing. However, the industry needs

to revamp with better thermal processing equipment to reduce overall cost and improve productivity and profitability. With the infrastructural thrust, key sector like steel, cement, power, will also witness a steady growth. The food industry has seen dramatic changes in the last decade with health food, beverages, juices and convenience ready to eat food becoming very popular. This segment is looking at good growth potential in the coming years. HRS with their vast experience, domestic and global references, products, application engineering and technical know-how, is looking forward to enhanced growth opportunity.

Tell us about the investments and future plans of HRS Process Systems

HRS plans to invest in expanding our global reach. We are looking to target the primary sector like oil and gas, petrochemical, etc. which has not been much of our focus. We are in the process of evaluating suitable thermal processing technology and products for this sector to be able to provide some niche services. In India we planned to expand our manufacturing facility and also expand the technology set-up to support more business. We are planning for necessary investment in infrastructure and resources including human resource to be able to start good growth in the coming years. ■

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India's Oil & Gas Developing Landscape

Video Link: <https://youtu.be/VjOXMQAKAIY>



Tarun Kapoor (IAS)

Secretary, Ministry of Petroleum & Natural Gas
Government of India

Tarun Kapoor, (IAS) Secretary spoke about India having massive scope in increasing the domestic production in Oil and Gas sector as well as our major industries flourishing. During a survey conducted onshore that maps the entire country, the data analysis revealed incredible growth opportunities in EPC and other areas of investment. Further, on the downstream side, India is ramping up its current capacity of 249 MMTPA to 450 MMTPA . These expansions across the oil & gas value chain will offer heavy investment prospects & ample job opportunities.

Digitalization Would Be A Game Changer To Build Sustainable EPC Industry

Video Link: <https://youtu.be/1pE-SXCZBgg>



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B Narayan

Group President Projects & Procurement
Reliance Industries Ltd

B Narayan from Reliance Industries Ltd presented the Inaugural Address during EPC World. IE 2021, the biennial EPC conference held online. He pointed out Digitalization as the game changer for the industries to build resilience & get ready for future growth.

Owner's expectations from EPC players in India

Video Link: <https://youtu.be/7F9Q0oiUCZw>



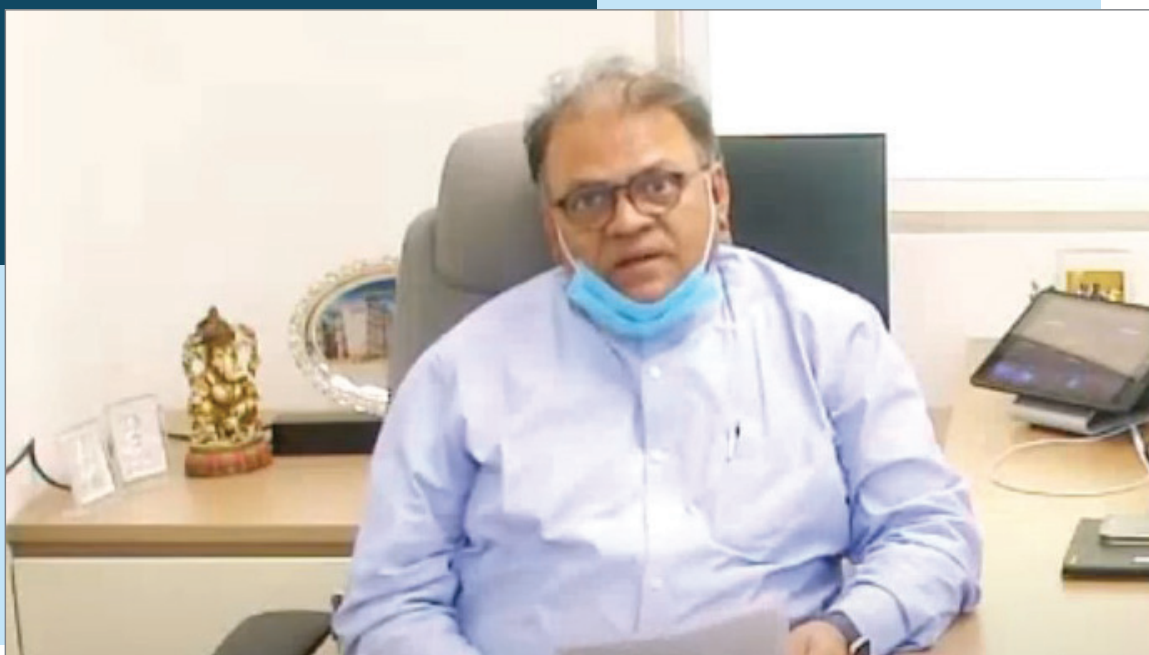
S K Barua

Managing Director
Numaligarh Refinery Ltd

S K Barua from Numaligarh Refinery Ltd. (NRL) presented the Keynote Address during inauguration of EPC World . IE 2021 conference 'Building Sustainable Resilience of EPC industry & Future Readiness for Growth'. Talking about the expansion plans of NRL to set up target capacity of 9 MMTPA and multiple projects in progress, he shared insights into overall industry growth & the expectations of project owners from the EPC players. There is good amount of projects coming up in the Indian refining sector and for the EPCs & stakeholder industries , it is time to showcase the capabilities , competitiveness ability to maintain quality & on time delivery of projects.

Refining & Petrochemicals: Managing the Current Challenges

Video Link: <https://youtu.be/2SS8h-nvIvA>



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Arun K Singh

Director Marketing with Addl.charge of Director (Refineries)
BPCL

There is a famous quote – “All great transformations are preceded by chaos”. This is the great chaos of our time and we got the opportunity for transformative change. COVID has changed the way people work and indeed it has transformed the business we do! Arun K Singh talks about the refining & demand scenario , the next big game changers Crude to chemicals , Carbon Capture & Utilization , Climate change & Evolving trends during the inauguration of Refining & Petrochemicals online conference scheduled during ChemTECH World . IE 2021

Upskilling Resources Spearheads All Fields of Engineering

Video Link: <https://youtu.be/6MltzaorZPE>



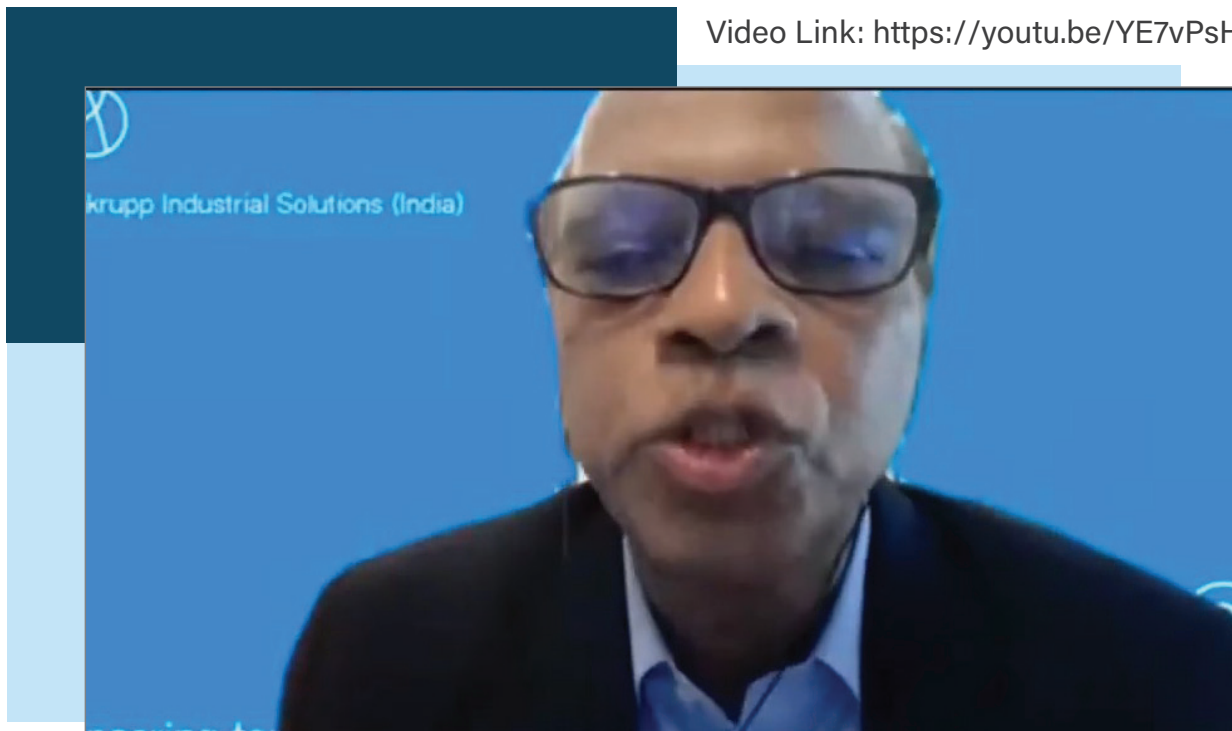
Subramanian Sarma

Whole-time Director & Sr. Executive Vice President (Energy)
Larsen & Toubro

Subramanian Sarma from L&T recognized the mighty impact, scale and penetration of Covid 19 and uncertainty of the life lying ahead. Drastic changes like digital outburst shaking the world as we know it, reckoning environmental conscience after facing the impact of coronavirus, has gained a lot of momentum. Up-skilling resources and increase in productivity has spearheaded all fields of engineering. The changing landscape of digitization has changed the field of brick and mortar and the paramount shift of the world shifting from a Globalization phase in the early 2000s, to adapting towards a new world of Self-Reliance.

Process Industry Sustaining Amid Pandemic

Video Link: <https://youtu.be/YE7vPsHEI7Q>



P D Samudra

CEO & Managing Director and Member of the Board
Thyssenkrupp Industrial Solutions (India)

P D Samudra from Thyssenkrupp Industries Solution talked about how the negative effect of the pandemic has been felt by most of the businesses world over. Customers in the process industry have taken a bigger blunt due to the loose demand of the end product and intense competition. Retaining the fixed asset, cost of the employee, expansion of the exiting plans and setting out new grassroots plans has been the major focus of the hour. Consumer investments are slowly shaping up in petrochemical, speciality chemicals, oil refineries, cosmetic fertilizer segments in the coming years. The greatest challenge of the century has been to stop the climate change. Renewable energy are on the uprising trends which are likely to overrun coal, oil and gas.

A Sustainable Solution To Rising Fuel Prices



Dr. Pramod Chaudhari

Founder & Executive Chairman
Praj Industries

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As petrol prices in India touch the three-digit figure and are in no mood to stop there, the government has advanced its plan to bring 20% ethanol mixed fuel into the market, from the earlier timeline of 2030 to 2025. It would be logical to welcome the step that would bring about self-reliance in fuel, substantial saving of foreign exchange, and significant reduction in pollution levels and growth in the rural economy.

It is said that a good deed must not be

delayed. By accelerating the process of achieving 20% ethanol mixed fuel 5 years earlier than originally planned, the government has acted upon these words.

Let us go back in history to set the context. The issue of finding sustainable alternatives to conventional fuel sources was underlined when fuel prices went through the roof in the 70s. After some lull it picked up again at the Rio Earth Summit in 1992 when concrete goals were set towards environment protection. However, the problem of environmental pollution

continued unbridled over years until 2015, when the issue was brought to the table at the United Nations led Paris Convention. The prime goal set during this meet was to bring down carbon emissions all over the world as early as possible and to keep the global temperature rise less than 2 degrees celcius. Country wise goals were determined. India accepted the 'Nationally Determined Contribution' of reducing carbon emissions by 33 to 35% and to create green cover adequate to absorb 2.5 to 3 crore tons of carbon dioxide, by the year 2030.

Transportation fuel is a large part of our total energy consumption. These fuels namely petrol and diesel come from the mineral source and are highly polluting in nature. However, in the absence of easily accessible alternatives, the world has been inclined to use it liberally over the years. The 60% increase in consumption of fossil fuels in the last three decades, as compared to the previous two decades is proof of this.

Speaking of our own country, consumption of conventional fuels has clearly impacted our economic, social and environmental health. India follows the US and China in fuel consumption. Ironically, we need to import 83% of the fuel and 46% of the natural gas we consume! The foreign exchange payout towards these imports in

financial year 2019-2020 was three times our Defence outlay and 1.75 times the provision for annual interest payment on debt. From the geo-political perspective too, this scenario can prove perilous since India relies on the Gulf and West Asian countries for 65% of the imports of fuel. In light of the political instability in this region, we might face severe irregularities in supply.

Let us understand the social and environmental hazards. Heavy use of fossil fuels has increased the levels of toxic gases like carbon dioxide, ozone, sulphate, formaldehyde and benzene in the air. These emissions can adversely affect photosynthesis which leads to a decline in agricultural yield. Pollutants cause pneumonia, asthma, throat and eye irritation, disorders of the lungs, heart and brain, and even cancer.

On this background we might take a moment to appreciate the government's decision to expedite the introduction of 20% ethanol mixed fuel into the economy. We have moved from 1% ethanol mixed fuel in 2014 to the present 8.5% and shall reach a 10% mix next year. With revised goals, this proportion shall be 20% by 2025. This announcement is highly encouraging not just to the ethanol industry but also to the rural economy and environmental scenario.

Presently, ethanol is produced from molasses which is a residue from the sugar manufacturing process. India produces 60 lac tons of surplus sugar. However, rising prices of sugar cane and storage overheads put considerable pressure on margins of sugar manufacturing units. Developing a new revenue model makes sense in this situation. Using bagasse and molasses, which are waste product and by-product respectively, of the sugar manufacturing process, is a pragmatic proposition.

According to the figures released by the Department of micro, small and medium industries, the ethanol-based economy is up to Rs. 20000 crore and the annual turnover from the rural region is about Rs. 88000 crore. The objective now is to step up these figures to 2 lac crores and 5 lac crores respectively. This entire movement will also help in bringing employment and revenue generation in rural India and preventing migration to cities.

The sugar industry by itself cannot be expected to supply the quantum of raw material needed to achieve these targets. My company Praj Industries has developed the technology to use agricultural waste to manufacture ethanol. I am happy to announce that we have been installing ethanol manufacturing plants for oil

companies. However, in order to draw the private sector into it, there is a need to demystify, simplify and speed up the operations of the sector including supply chain, licenses, financial and legal aspects. Fortunately, all this is being given the required boost.

Fuel is but one form of the total energy needs of the nation. It is the central government's aim to have 15% of the total demand for energy met by natural gas by the year 2030, since it is a much cleaner source. Presently this figure is merely 6%. Compressed bio-gas (CBG) is an even more environment friendly alternative to conventional fuel. Praj has developed the technology to produce it from biomass. The government announced the Sustainable Alternative towards Affordable Transportation (SATAT) policy in 2018. According to this, India can produce 6.2 crore tons of CBG annually. The government has fixed the ambitious target of setting up 5000 CBG manufacturing plants and an aggregate production of 1.5 crore tons of CBG by 2025!

Earlier, I mentioned about the technology to process stubble and farm waste into ethanol. According to the research on 'Future of Bio-fuels in India' published in December 2019 by the International Council on Clean Transportation (ICCT),

7.1 crore tons of agricultural waste can be available in India for the production of bio-fuel by the year 2030. This does not include the waste that is reused in the farm to maintain the carbon content in the soil. Similarly, about 26 lac tons of forest waste shall also be available to manufacture bio-fuel. Clearly, it is not so much the availability of raw material that is critical here, as the technology necessary to process it. We now look up to our government to create the infrastructure and eco-system to support the bio-fuel industry so that not only public sector oil companies but even the private players find it attractive enough to invest in and benefit from.

You would agree that all the alternatives of bio-fuel depend upon agricultural waste and by products. This will essentially fortify the rural economy. This is one of the worthy ways to attain India's goals of self-reliance and sustainable development. We appreciate government's earnest in encouraging this industry. The stakeholders including manufacturers and farmers to citizens as final consumers must now do their bit to support the initiative. ■

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Extruders for Polyethylene & Polypropylene Plants: Criteria for Selection Of Energy Efficient Design

Extruder or Pelleting is a critical package unit in every Polyolefins (PO) plant namely Polyethylene (PE) and Polypropylene (PP). PE can be either HDPE (High Density PE), LLDPE (Linear Low Density PE) or MLLDPE (Metallocene LLDPE) or LDPE (Low Density PE). PP can be either Homopolymer PP, Random Copolymer PP or Impact Copolymer PP (also sometimes called Hetero Phasic PP).

Extruder package has four main attributes which underline its importance in any PE / PP plant. First, it is the largest package unit in the plant. Second, it is the most expensive package in the plant. Third, it is the most power or electricity consuming item in the plant. It consumes approximately 65 to 70 % of power consumed by the whole plant. And four, to some extent, it is independent of the technology selected. In spite of the above, the Extruder package remains relatively less understood in any PE / PP plant. This article intends to focus on specifications and selection criteria in order to address the above attributes.

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Every PE or PP plant has proprietary reaction system which is licensed by the respective Licensor. The

reaction system is typically followed by resin degassing and product purge bin. The resin degassing separates the resin from the vent gases. Vent gases are processed further to recover monomers, other HC and N₂ (e.g. Ethylene, Propylene, Butene 1, Hexene 1, Iso Pentane, Iso Butane, N₂ etc.) and returned to the reaction system.

Polymer resin in powder form is collected in product purge bin wherein the residual catalyst and co-catalyst is typically deactivated and the resin is further fed to the Extruder package which converts polymer resin in powder form in to pellets or granules and is called product or product in pellet form. The product pellets are further conveyed to blending silos, storage silos and finally to packaging section to bag the product in desired packages typically 25 kg bags, jumbo bags or big bags (500 to 1000 kg) or simply filled in to containers for transport. The

Extruder package is preceded by the polymer additives section. The different type of additives depending on product application are added to resin and fed to Extruder. The polymer additives typically include primary antioxidants, secondary antioxidants, process stabilisers, slip agents, anti-block agents, nucleating agents, whiteners etc. in different composition required by specific polymer application.

The Polymer additive package can be procured separately or along with Extruder package as per the procurement philosophy of the licensee. The polymer additives and polymer resin powder are fed to the Extruder Feed Hopper which is the feed point for the Extruder package. At the end of the Extruder package, the pellets are collected in the Pellet Hopper from where the pellets are conveyed to the blending silos.

Thus the Extruder package starts from the Extruder Feed Hopper and ends with Pellet Hopper. This generally forms the entire scope of the Extruder vendor.

Extruder Package – Main Components

Extruders are either resin powder fed or resin melt fed. LDPE and solution PE process feed melt to the Extruder. Other PE and PP processes feed resin powder to the Extruder. This article is intended to cover only the resin powder fed Extruders. Also the Extruders will be of Co-Rotating Twin Screw type only which is the industry norm.

LDPE and solution PE process which are melt feeding Extruders can either be single screw or twin screw. Single screw Extruders are quite common while

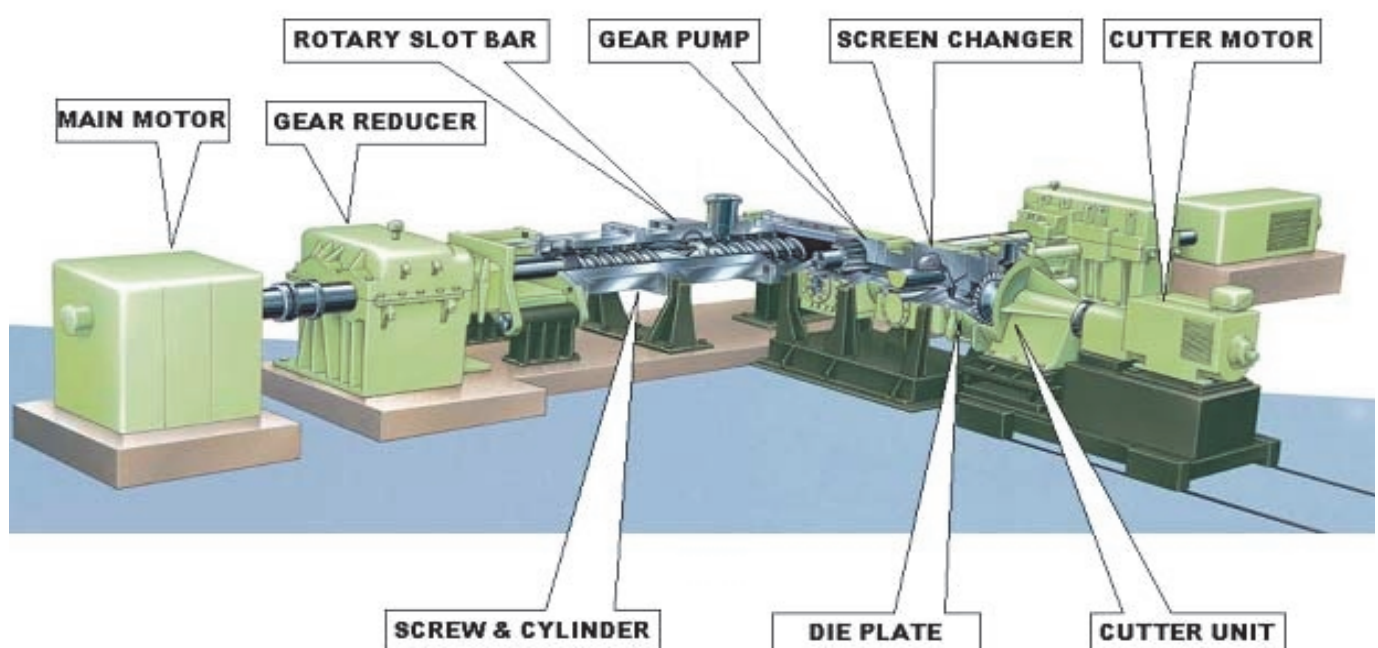


Fig 1: Typical Extruder Set-Up with Gear Pump

handling product MFI (Melt Flow Index) in excess of 1. Inherently duty demand by melt fed Extruders is low because of absence of melting zone and to some extent mixing zone. Twin Screw Extruders are preferred only when MFI is fractional that is less than one e.g. 0.5.

All other PE and PP processes are resin powder fed and use twin screw Extruders. Hence the focus of this article is only on twin screw Extruders which account for nearly 75 to 80% of all PE and PP. The Extruder package is a large unit in any polymer plant consisting of several components. (Fig.1)

68 Main components of the package include

- Main Extruder or Mixer as it is sometimes called which houses the Screw Elements
- The main Motor for Extruder
- The Extruder Gear Box
- Extruder Vent Housing
- Melt Pump or Gear Pump
- Melt Pump Motor or Gear Pump Motor
- Diverter Valve
- Melt Screen Unit
- Die Plate
- Underwater Pelletizer
- Pellet Water Tank
- Agglomerate Remover

- Pellet Dryer
- Pellet Water Pumps
- Pellet Water Cooler
- Pellet Screener
- Die Plate Hot Oil System
- Hydraulic System
- Extruder Feed Hopper
- Pellet Hopper

The Extruder main Motor Drive is invariably the largest motor by rating in any PE / PP plant and the entire Extruder package consumes approximately 65 to 70% of the electricity consumed by the whole PE / PP plant.

Extruders for PE and PP

The configuration of the Extruder package is essentially the same for PE and PP plant. However, the main Extruder design varies for the two on account of the nature of the polymer.

Differences between PE and PP

- PE Grades vary in MFI (Melt Flow Index), Density and MWD (Molecular Weight Distribution).
- On the contrary, PP Grades vary mostly in MFI and to some extent in MWD but very little in Density. PP has also property called Isotactic Index which is absent for PE.
- PE Grades can either be Homopolymer or near Homopolymer

with little incorporation of co-monomer or with large incorporation of co-monomer up to 10%.

- PP is made as Homopolymer or copolymer. The copolymer PP contains generally Ethylene up to 6% which is called Random PP. The Impact Copolymer PP contains "Rubber" phase in the form of PE and is also called "Hetero Phasic" for same reason. The Rubber phase in PP can vary approximately from 10 to 30%. PP therefore varies in MFI and in type in terms of Homopolymer, Random Copolymer or Impact Copolymer.
- PE is extruded at temperature ranging from 190-250°C due to inherent lower melting temperature of PE.
- PP is extruded at much higher temperature ranging from 230-290°C due to inherently higher melting temperature of PP compared to PE.

Extruder Specifications

Extruder package is specified either by the licensor for the new plant or by the licensee - either in consultation with the licensor or independently, based on the experience for the expansion. The licensor has obligation to provide the process specifications for the Extruder package for a new plant. The licensee has freedom to improve over it for their benefit. The following guidelines will outline the basic specifications, whether process or

mechanical, which can be used by the licensee or the purchaser to improve or optimize the specifications. These specifications will automatically assist in formulating selection criteria.

The Extruder package specifications comprise mainly of following parameters in terms of performance for capacity and product quality:

Capacity

Usually specified for three cases namely: Normal, Maximum and Minimum.

The typical range is:

- Normal = 100%
- Maximum = 110 to 120 %
- Minimum 50 to 60% of Normal which is = 50 to 60%.

For Example, Normal / Maximum / Minimum = 60 TPH (Tonnes per Hour) / 72 TPH / 36 TPH.

The Extruder vendor will typically offer performance warranty or guarantee based on the Extruder capability for the reference product mix (mix of different product grades). Vendor can either agree on all the parameters or suggest deviations for some of the product grades.

The commercially operational maximum Extruder capacities range from 80 to 100 TPH from the reputed vendors keeping in line with rising single line PE / PP plant capacities. Typical performance

Typical Performance Requirement for PE or PP

Description	Unit	Example Grade
Warranted Product		Name of the Grade
Product Type		HDPE / LLDPE / MLLDPE PP Homopolymer / PP Random / PP Impact Copolymer
Controlled Rheology		For PP Only
Melt Flow Index (I 2.16)	dg/min	Licensor to Provide Data
Melt Flow Index (I 21.6)	dg/min	For PE Only
Melt Flow Ratio (I 21.6/I 2.16)		For PE Only
Density	g/cm ³	Note 1
Resin Powder Bulk Density	kg/m ³	Licensor to Provide Data
Resin Pellet Bulk Density	kg/m ³	Licensor to Provide Data
Shear Rate Viscosity		Licensor to Provide Data
Enthalpy	kwh/kg	Licensor to Provide Data
Flow Rate - Minimum	kg/h	50 % + 1% Additives
Flow Rate - Normal	kg/h	100 % + 1% Additives
Flow Rate - Maximum	kg/h	120 % + 1% Additives
Normal Inlet temp at Mixer Hopper	C	Note 2
Melt Screen to Remove all Particles Greater than	mm	Note 3
Maximum Resin Temp at Die Plate	C	Note 4
Total Specific Energy Input at Normal Rate	kwh/kg	Note 4

Typical Values Only for Example

Note 1	0.905 for PP
	0.918 to 0.935 for LLDPE 0.940 to 0.963 for HDPE
Note 2	50 to 70 C
Note 3	Typical 1.4 to 2.5 for PP Typical 1.4 to 1.5 for PE Licensor to Provide Data for Each Product
Note 4	Typical 0.150 to 0.250 for PP Typical 0.140 to 0.250 for PE Licensor to Provide Data for each Product

Table 1: Typical Performance requirement for PE or PP

requirement template is shown in Table 1

Licensor to Provide Data for each Product

The performance requirement has to be specified for all the warranted PE and PP grades appropriately for Extruder vendor to configure and design the package suitably. The Extruder vendor will design the Screw Configuration optimally based on the required product performance range notably considering high melt flow grades, low melt flow grades, fractional melt flow index grades, LLDPE film, HDPE film, BOPP film, PPTQ film, blow molding grades from very small to very large size, Pipe grades, BM Pipe (Bi Modal) grades, Metallocene grades, PP Random grades, PP Impact Copolymers etc.

In short, the Extruder is expected to perform

optimally for range of grades, different applications, density, MFI i.e. low to very high molecular weight and wide range of molecular weight distribution with the given screw configuration.

Depending on the product mix, the vendor can sometime propose two Die Plates i.e. Die Plates of two different Hole Numbers or Hole Size or combination of both to cater to vastly different set of properties, e.g. vastly different MFI. Vendor can also propose two different speeds for Main Motor. The purchaser can suggest option of variable speed drive. Similarly requirement of Melt Pump is governed either by vastly different MFI or Die Plate temperatures or Extruder capacity. Some licensors can mandate not to use Melt Pump if the licensor proposes to use higher Die Plate temperature. Salient design features are summarised below for critical Extruder components. These guidelines have been developed based on the norms for the best practices and the industry experience with different licensors, different technologies and vendors who are industry leaders, supported by relevant reference literature [1] [2] [3] [4].

Main Mixer Motor

It can be single speed, two speeds or variable speed drive. Single speed motor is recommended if the product mix is not very large in range of MFI. Two speed motor

is recommended if the product mix is reasonably large in terms of MFI thus allowing to operate the Extruder at optimum speed based on the product mix. Variable speed drive or variable frequency drive is recommended as the energy conservation measure at the design stage if the product mix has large range of MFI and there is a strong possibility of operating the plant at different rates from Turn-Down (TD) to full capacity. The choice of motor speed is governed by the initial investment decision by the client e.g. large variable speed drive will be substantially costlier than single speed or two speed motor. Though variable speed drives appear attractive, very few really prefer it. The most common drives are one speed or two speed.

Melt Pump Motor

Variable speed drive - always a variable speed drive because of the nature of the service.

Underwater Pelletizer Motor

Variable speed drive- always a variable speed drive because of the nature of the service.

Mixer Processing Section

Twin Screw – Length/Diameter Ratio (L/D)		
Polymer	Without Melt Pump	With Melt Pump
HDPE	18-24	18-21
LLDPE	18-24	18-21
BM HDPE	Not Applicable	23-29
PP	24-30	21-24

Table 2: Twin Screw Extruders – L / D Ratio (Typical)

Diameter (D) and length to diameter ratio (L/D) depends on type of polymer, product mix and residence time or capacity as shown in Table 2.

It can be noticed that Melt Pump reduces the L/D ratio. The longer lengths would mean relatively higher residence time. The screw profile is optimised according to L / D ratio.

Melt Pump or Gear Pump

Inlet design pressure rating shall equal or exceed discharge pressure rating of Mixer. Design discharge pressure is usually minimum 300 kg/cm²g.

72 Screen Pack

It will cater to different opening specified in the product performance requirement. Clean pressure drop shall be generally 100 kg/cm² for all warranted products.

Die Plate

Single Die Plate will normally cover a Melt Flow ratio of 1:50.

Pressure drop can vary from minimum

of 20 to maximum of 180 kg/cm². The maximum pressure drop is guided by the “partially blocked” scenario which is time dependent as well as grade dependent and which restricts the flow and can constrain the Extruder capacity.

Die Plate Holes

Number of Die Plate Holes are typically in the following range:

Pelleting Water System

Pellet Water Tank

Tank working volume shall be minimum of 3 minutes of Pellet Water Pumping, e.g. for 600 m³/h pump, Tank working volume shall be minimum 30 m³.

Pellet Water Pump

Typically 12 to 16 m³/T of Pellet Rate with 12 as minimum, e.g. for 60 TPH Extruder capacity, 60 * 12 = 720 m³/h.

Agglomerate Remover and Pellet Dryer

Agglomerates are typically defined as polymer particles or pellets having

Die Plate Holes for PE and PP				
Type of Polymer	MFI	Maximum kg/h/Hole	Limitation Due To	Diameter of Die Holes
PP	Full Range	15 to 25	Delta P	3 to 4mm
HDPE	Full Range	12 to 17	Delta P	3 to 3.5mm
LLDPE	Full Range	8 to 12	Melt Fracture for Film Grades	3 to 3.5mm

Table 3: Die Plate Holes for PE & PP

equivalent diameter more than 13 mm (0.5 inch). Normal rate of removal of agglomerates:

- Normal = 0.015 % of total resin rate by weight
- Start-Up = 0.30 % of total resin rate by weight in first 2 minutes

Pellet Dryer: Moisture in the pellets at the outlet of Dryer = 0.05 % maximum by weight (500 ppmw)

Pellet Water Cooler: Design cooling duty shall be minimum of 15% above highest pellet cooling duty for each of the warranted products.

Pellet Water Piping (If supplied by the Extruder vendor): Minimum 15 seconds from Pelletiser to the agglomerate Remover assuming 55°C water temperature. Maximum pellet temperature allowed is 80°C for PE and PP.

Extruder Feed Hopper and Pellet Receiver

Extruder Feed Hopper to have minimum of 6 minutes and maximum of 12 minutes hold-up volume. **Pellet Receiver (also called pellet mass flow meter)** to have minimum of 5 minutes and maximum of 10 minutes hold-up volume.

Hold-up volume is required to provide a positive solid seal and absorbs flow fluctuations.

Resin Feed Properties for Granular PE or PP Bulk Density – Specify for PE or PP

Particle Size: Typically 75 to 850 micron (200 to 20 US Standard Screen)

Particles < 75 microns & > 850 microns to be maximum 1%

Polymer Additives are typically added up to 1% by weight of Resin Feed in the form of powder or pellets

Pellet Product Properties

- Maximum 0.05% moisture by weight
- Free of Agglomerates over 13 mm equivalent diameter
- Substantially free (minimum 98% of pellets) of tails (filaments, shreds or shavings attached to pellets) and marriages (joined pellets)
- Free of degradation (black spots)
- Free of single or multiple voids
- Uniform additive dispersion
- Uniform Pellet Size and Shape:
- Length of pellets, diameter of pellets, symmetry of pellets – all minimum 99%
- Bulk Density of Pellets: to be specified for PE or PP
- Pellet material particle size to be between 0.5 to 9.5 mm minimum 99%

Industry Leading Vendors Supplying Extruder Packages

The three vendors who dominate the Extruder market globally and offer machines up to 100 TPH are:

- Coperion of Germany
- Japan Steel Works (JSW) of Japan
- Kobe Steel of Japan

All the PE and PP technology licensors recommend these three as approved vendors.

Extruder Energy Input

The main source of energy input into Extruder package is from the Main Mixer Motor which is by far the largest motor in the polymer plant which accounts for approximately 65 to 70% of the total power consumption. Thus any attempt to reduce the power consumption in the Extruder package needs to start from the Mixer or Extruder itself.

The resin powder is fed to the Extruder and is converted to molten state or to melt by shear forces applied by co-rotating twin screw. This power is transmitted by electric motor or Main Extruder Motor through the Gear Box to the co-rotating screws. The resin powder in the Extruder Hopper at about 50- 60°C is fed to the Extruder and is heated generally by steam in the barrel to its melting range depending on MW and MWD of the polymer grade. Once fully melted in the melting zone, the melt is further heated for easier processing

i.e. kneading and mixing, then conveying through Screen Pack and through the Die Plate to eventually form the pellets in the pelletiser.

This entire energy; assuming there is no melt pump; is transmitted by Main Extruder Motor.

The Energy thus required is:

- $Q * MSEI / (MME * MGE * MTE) = MKW (KG / H * KWH / KG) / (MME * MGE * MTE) = (KWH / H)$

Where

- $Q = \text{Total Feed} = KG/H$
- $MSEI = \text{Motor Specific Energy Input} = KWH / KG$
- $MKW = \text{Mixer Power Input, KW}$
- $MME = \text{Mixer Motor Efficiency} = 0.92 \text{ to } 0.96$ (Typically when motor operates at or above 75 % of its rating)
- $MGE = \text{Mixer Gear Efficiency} = 0.95 \text{ to } 0.97$
- $MTE = \text{Mixer Thermal Efficiency} = 0.92 \text{ to } 0.97$
- Considering average values for example: $MME = 0.94$, $MGE = 0.96$, $MTE = 0.94$
- $Q * MSEI / (0.94 * 0.96 * 0.94) = Q * MSEI / 0.848 = 1.179 * Q * MSEI = MKW$
- **Or $MSEI = MKW / (Q * 1.179) = 0.848 * MKW / Q$**

Thus this becomes the simple but basic formula for computing Extruder energy efficiency which underlines the importance of efficiency of motor, gear box and mixing.

If the Melt Pump is also part of the Extruder, then the equation will include Melt Pump power input and its efficiency added to the equation.

Hence the best efficiencies are obtained when the Extruder is operated at higher rates i.e. at or around design rates or even higher without affecting product quality.

Specific Energy Index (kWh/kg) is also a function of MFI i.e. lower the MFI higher is the Specific Energy in general for PE as well as PP. Beyond a certain MFI, Specific Energy practically remains the same. Higher MFI will require lower energy input or lower SEI than lower MFI. Lower MFI would mean higher melt viscosity and hence higher melt temperature and the vice versa. This data is best obtained from the licensor.

Conclusions

- The specifications and selection of the extruder package has increasingly become important because of rising capacities of single line PE and PP plants which routinely range from 400 to 600 KTPA.
- The article elaborates the salient features of Extruders for energy

efficient design and accordingly the strategy for specifications and selection of the package unit which is the most expensive unit in the plant. The Extruder Operation consumes about 65 to 70% of plant's total energy in terms of power and hence the article focuses on items which are critical to power consumption for

- The monitoring of Extruder for energy efficient operation using empirical equations is a matter which can be dealt with in future work. ■



Author

Jayant D Divey

Polyolefins Technology Consultant

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Reference

1. Kohlgrueber K (2019) *Co-Rotating Twin Screw Extruders: Fundamentals*, Hanser, Cincinnati, USA
2. Kohlgrueber K, Wiedermann W (2008) *Co-Rotating Twin Screw Extruders: Fundamentals, Technology And Applications*, Carl Hanser, Munich, Germany
3. Osswald T, Hernandez-Ortiz J P, (2006) *Polymer Processing: Modelling And Simulation*, Hanser, Cincinnati, USA
4. Martelli F (2012) *Twin Screw Extruders: A Basic Understanding*, Springer, New York City, USA

Pipeline Integrity: Out of Sight does not Mean Out of Mind

Integrity of pipeline is now a major focus which may be attributed to a couple of factors, which include new legislation, technical advancements, strict penalties for accidental leakages, environmental concerns, ageing of pipelines and also considering the impact of pipeline related incidents have proven to be fatal. All elements of integrity are important since we know that the weakest part determines the strength of the entire system.

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ipelines are the energy veins of the world. Much of the world runs on pipelines.

From the time we get up in the morning until we go to bed at night, it's difficult to find a moment when we haven't used energy transported by a pipeline. Crossing the landscape largely buried, pipelines traverse quiet wilderness and bustling communities, providing the safest and most efficient method of hydrocarbon transportation in the world today. Out of sight does not mean out of mind. Integrity of pipeline is now a major focus which may be attributed to a couple of factors, which include new legislation, technical advancements, strict penalties for accidental leakages, environmental

concerns, ageing of pipelines and also considering the impact of pipeline related incidents have proven to be fatal. All elements of integrity are important since we know that the weakest part determines the strength of the entire system.

What should be the objective of a pipe integrity management program?

A pipeline integrity management program should Identify threats to pipeline integrity, potential consequences to the public and the environment in the event of a release, Rank segments of the pipeline system according to the risk each poses, Provide for assessment of the integrity of each segment in a timely manner based on

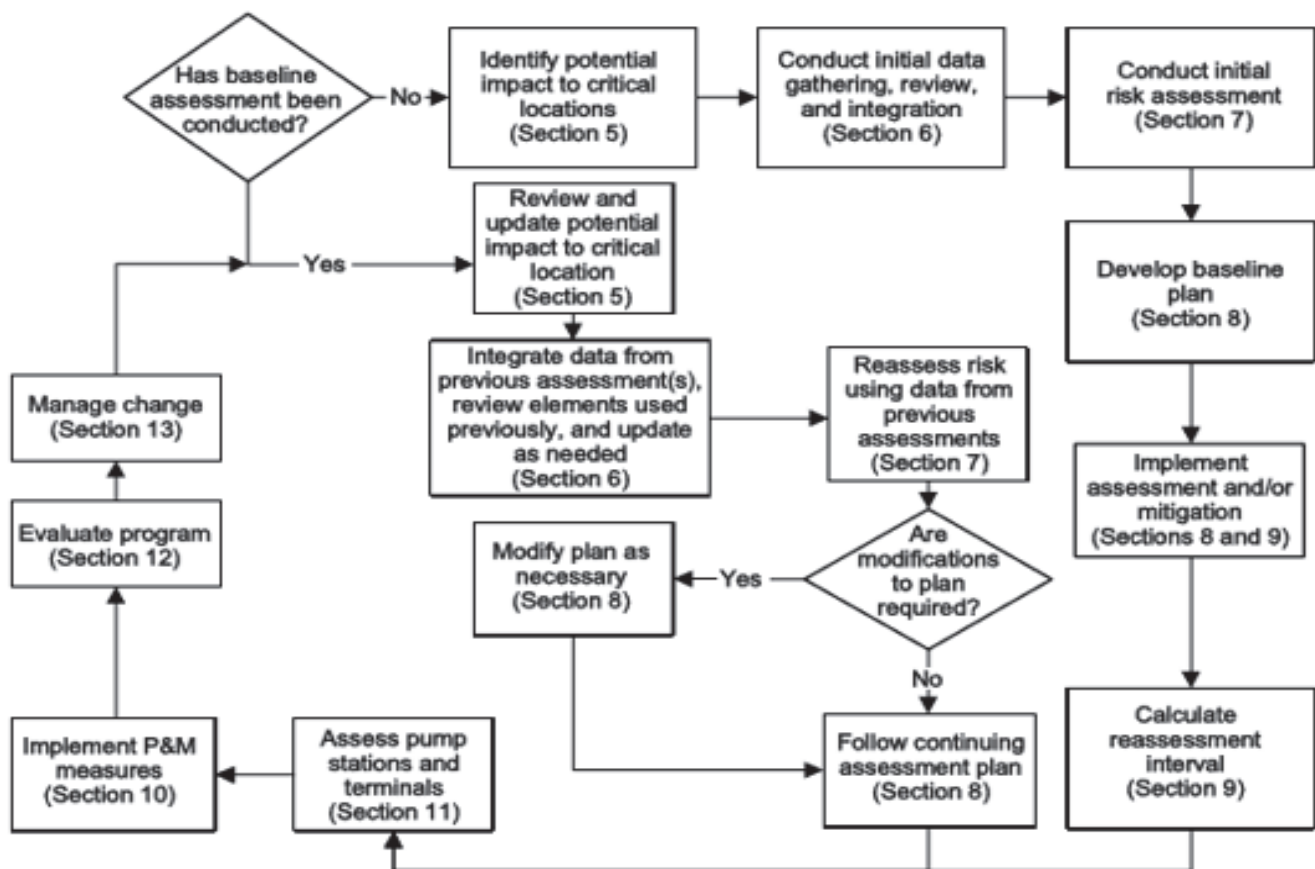


Fig. 1 Typical Process Flow for Integrity Management Programme
Source: - API 1160, 2013 version

identified threats and the risk to minimize the possibility of a release, Specify repairs or mitigative actions to carry out in a timely manner to prevent releases, Establish reassessment frequencies, Define preventive and mitigative measures to address relevant threats including those not covered by integrity assessments, Use the findings of integrity assessments to update and Improve the integrity management process.

What are the threats for pipeline integrity?

Pipeline Integrity threats are mainly

categorized to be Time Dependent, Stable and Time Independent. Reassessment of the integrity a pipeline segment subject to a time-dependent anomaly growth mechanism should be carried out at appropriate intervals to minimize the risk of a pipeline failure caused by an anomaly that was too small or was under the reporting size criteria detected in the last assessment growing to a size that would fail at maximum calculated surge pressure or 1.1 times MOP.

Accurate corrosion growth rates are needed to predict pipeline availability as

a function of time, to identify the need for and timing of field investigations or repairs and to determine optimum re-inspection intervals. The consequences associated with using wrong corrosion growth rates range from the inefficient use of resources (time, people and money) on unnecessary repair/inspections to unexpected pipeline failures. The identification of where corrosion is active on a pipeline and how fast it is growing is a complex process which is understood in the general sense but is highly variable

There are various approaches that can be used to define corrosion growth rates for use in pipeline integrity assessments. The major advantage of using repeat ILI

data to derive corrosion rates over other methods is that the ILI can provide growth rate information on the whole detectable corrosion distribution density giving visibility of what is happening along the entire pipeline. Further XYZ mapping plots the infrastructure and population density for risk assessment. Fingerprint ILI is warranted for the above to establish the initial pipeline health assessment post commissioning. In specifying a 'fingerprint' inspection the pipeline operator should consider why the inspection being is done, as this will affect the probability of detection (POD), probability of Identification (POI), defect reporting levels, assessment method and acceptance criteria that should be used.

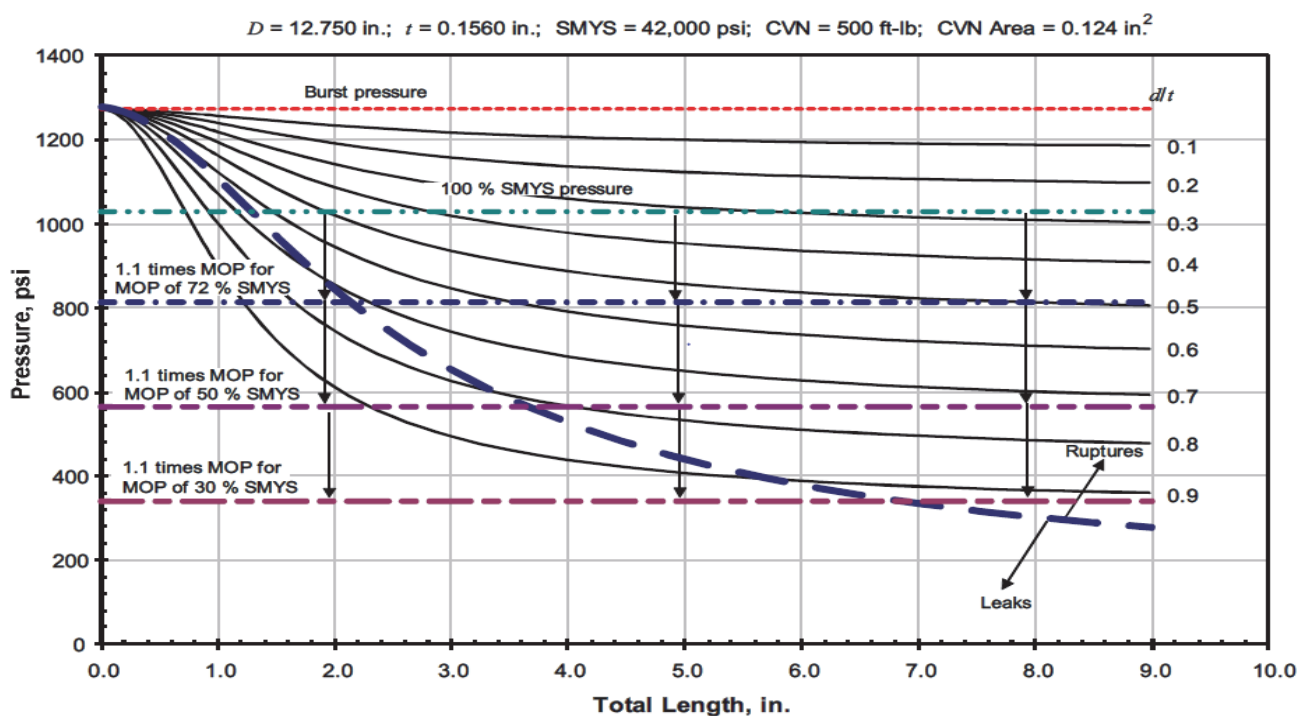


Fig. 2 Typical Reassessment Intervals Based on a Specific Failure-pressure-vs-anomaly-size Mode
Source: - API 1160, 2013 version

The application of fixed rates can be very conservative and will lead in many cases to unnecessary repairs or if the rates are too low to an unsafe assessment of the future integrity of a pipeline. Using location specific (variable) growth rates (both scenarios of applying the maximum rate per pipe joint and defect specific rates) has been found to provide more realistic and targeted predictions of repair needs. The location specific growth rates give accurate predictions of the corrosion severity over time. With the benefit of this hindsight, the predictive analytics employed for evaluating and applying ILI based corrosion rates can be further improved and refined to give more accurate predictions of the future pipeline condition, the response schedule and optimized timing of re-inspections.

Time is now to review multiple-data-set ILI results from several pipe joints with simulated defect locations from ILI surveys. The same has been implemented on BPCL pipelines as for ageing pipelines corrosion growth rates have been derived and very useful in aligning the reassessment intervals. Further the Fingerprint inspections have been implemented on our new pipelines creating a baseline data for the future advanced inspections. BPCL has established stringent inspection criteria at 0.95POD and 0.90POI to establish quality data for analysis. The ILI runs and

subsequent signature analysis and data treatment have been very useful in uprating of pipelines and remaining life estimation.

Time is now to convert data to information to add value to the initiatives being taken and the amount being invested towards data gathering. The information gathered over time has to be translated into effective corrosion mitigation/control programs. Reviewing from a deeper understanding of information from corrosion monitoring and other sources is required. For effective corrosion control it is important to understand “where, when and why” pipeline damage takes place – the proactive and investigative approach as discussed shall be of great use and the inputs derived shall have a positive impact on the pipeline integrity matters. ■

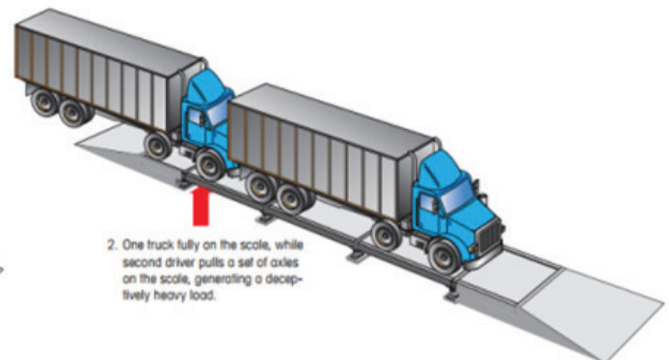
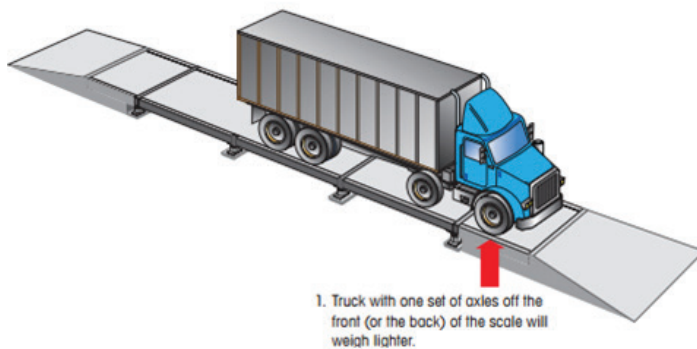


Author

Rituraj Mishra

Senior Manager – Pipelines
Bharat Petroleum
Corporation Ltd.

Fraud Prevention Kit with DataBridge MS



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ETTTLER TOLEDO offers a number of products to accompany your truck scale that will protect your business. Truck scales are convenient targets for fraud. Thieves constantly devise new ways to cheat businesses that buy or sell truckloads of material by weight. Protect yourself with the built-in security features of DataBridge MS software.

Many software programs rely on password protection alone. DataBridge MS software uses

password protection with defined access levels, but that is just the first layer of fraud prevention. The software provides an arsenal of anti-fraud features designed to stop the tactics that are being used to cheat truck

scales. i.e. weight curves, stored tare weights, camera capabilities, pre-loading, audit logs etc.

The most common way to cheat at the truck scale is also the simplest—improper positioning of the truck on the weighbridge. Several scenarios make this possible for a truck driver to accomplish.

Truck with one set of axles off the front (or the back) of the scale will weigh lighter.

One truck fully on the scale, while second driver pulls a set of axles on the scale, generating a deceptively heavy load.

Vehicle Positioning System

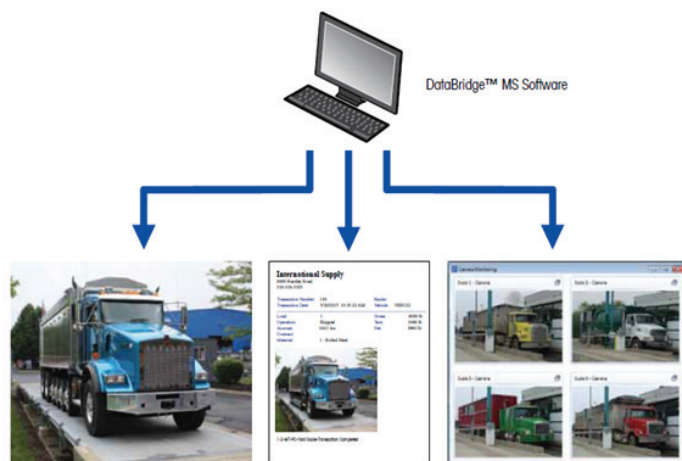
METTLER TOLEDO Help Prevent



Improper Positioning by Photo eyes i.e. Vehicle positioning system, which help to prevent more than one truck driving onto the scale. Photo eyes can detect this cheat, as well as improper positioning of a single truck.

Camera Capabilities

DataBridge™ MS software automatically captures still images and attaches them to a permanent record of each weighing transaction. Images are labeled by event and can be included on the tickets that are given to drivers as receipts. Using the software's built-in camera monitor, scale operators can view activity at a scale.



When positioned correctly, cameras can record images that identify vehicles, drivers, and license plates.

Cameras also protect against cheaters, such as drivers who position the wheels of their vehicles partially off the scale to get a lower weight reading. While a busy scale operator might miss the violation, properly positioned cameras will not.

DataBridge™ MS Scale Management System provides professional transaction management with METTLER TOLEDO innovation, offering powerful capabilities for large and growing organizations with features like Multiple Work station access, customer user roles & permissions, notifications, analytics, advance customer data entry and advance anti-cheating solutions.

This software is also having capability for complete unattended weighing system, which helps to avoid weighing attendant, improve data accuracy and faster weighing throughput. ■

For more information

Call us Toll Free: 1800 22 8884 /
1800 1028460

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Website: www.mt.com/pro-safety-TDL



How AI And The Cloud Can Deliver Innovation For Oil And Gas Companies In India

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The current pandemic has shown the oil and gas sector how dependable enterprise operations can be upended almost overnight. Workforce routines at extraction sites and refineries have been disrupted, causing unplanned outages, as we saw at the Sharara oilfield. With supply chains interrupted, parts manufactured in traditional source markets could not be delivered on time, delaying essential maintenance. Border closures and an unprecedented drop in demand have further constricted already tight economic operations.

Not only do these conditions look set to continue over the short term, but other challenges loom over the foreseeable future. A supply glut and a depressed outlook for hydrocarbon prices have been forecast over the medium term, and over the long-term, oil demand could peak within two decades as fuel demand drops



Jim Chappell Global Head of AI and Advanced Analytics at AVEVA

and pressure to act on climate change mounts.

To thrive in this brave new world, oil and gas players must respond with transformative action, taking inspiration from the industry's bold, pathbreaking history. At AVEVA, we have made it our

mission to help companies capitalise on current opportunities, while striving to protect lives and livelihoods for the companies and communities we serve.

Success in a post-pandemic world will require innovative thinking and action at scale. Here, two transformative new technologies will shape a sustainable future for oil and gas and its partner industries, and for the world around us. These are artificial intelligence, or AI, and cloud computing.

By leveraging artificial intelligence and the cloud in tandem, Indian oil and gas companies can thrive in the post-pandemic economy says Jim Chappell, Global Head of AI and Advanced Analytics at AVEVA

AI is enabling better decisions

AI has been with us for over six decades. As it becomes more sophisticated, with wider use cases, it allows organisations to improve productivity. With unified smart analytics that bridge complete data stacks, teams can leverage mathematical thought processes across all their activities. Individuals are thus afforded scale and capacity that would otherwise have been unavailable: knowledge, data-led intelligence, and the capacity to recognise new opportunities. AI enables people to make better decisions – and even recommends courses of action – that

enhance the capabilities of human staff. Overall, McKinsey predicts that AI will drive a 2% growth in manufacturing and energy for the next decade – or \$1 trillion every year.

At AVEVA, we have been using AI to enhance the value chain over the past 15 years, with specific applications for predictive analytics in the maintenance and asset performance space. Aramco, for example, uses AI and advanced analytics solutions to help eliminate unplanned downtime across its diverse operations.

The cloud offers connected insights

Leverage the cloud here and we are able to integrate standalone products, linking AI modules together into a broader intelligence for more efficient performance. With integrated systems comes integrated analysis. AI can produce increasingly more complex insights and recommendations for human workforces quicker and with less chance of error. If AI underpins better decision making, cloud is the glue that binds it all together.

The cloud helps scale the benefits of AI across the entire range of enterprise operations as opposed to the past, when narrow AI was infused into various products. This broader AI leads to general artificial intelligence – the ability to make a complex decision using combinations of different types of AI, to learn something

in one place and apply it elsewhere. The development of general AI is very much a continuum, and the potential benefits are enormous. Lessons from the resource extraction operation could very well be applied to another division.

With the shift to digital business models following COVID-19, the trend has gathered speed, and we are now partnering with clients worldwide to leverage those benefits. ■

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Ms. Srilakshmi Lakshmanan

AVEVA India Marketing

E-mail: Srilakshmi.lakshmanan@aveva.com

Website: www.aveva.com



Membrane Separation Technology For Clarification Of Acetic Acid (Organic Vinegar)

MEMBRANE HITEC
A division of Titanium Equipment and
Anode Manufacturing Company (P) Ltd

Vinegar as a nutritious sour condiment not only has a sour taste, but also has a certain sweetness and aroma. The source of this color, fragrance, and taste is mainly produced by the biochemical effects such as the hydrolysis on starch in the raw materials through enzymes secreted by microorganisms into sugar, the fermentation of sugar into alcohol, and the oxidation of alcohol into acetic acid. However, during the entire brewing process, the starch, cellulose, protein, fat and other macromolecular substances in the raw materials does not completely decompose causing the vinegar to become cloudy and precipitated, thus seriously affecting the quality and thus grade of the product as a commodity. Therefore, vinegar

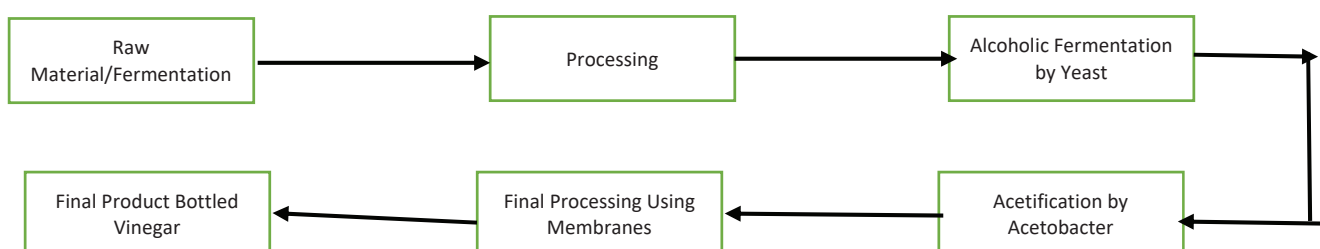
must be clarified before packing for consumers. At present, many vinegar brewing companies use traditional cumbersome methods to clarify vinegar.

Membrane Technology in Action

The principle of membrane filtration in organic acetic acid manufacturing is to filter the mother liquor vinegar through the surface of the membrane under low pressure. The organic acid and the substances that make up the vinegar aroma pass through the filtration membrane to become permeate and flow out. The membrane uses ultra to micron sized pores with appropriate pore sizes to filter out these impurities without affecting the flavour of vinegar. Speciality Membranes developed by Membrane Hitec were used in the separation and filtration of Vinegar.

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Steps involved in Vinegar manufacturing process



This demonstrated more obvious advantages than traditional filters and helped to improve color and Shelf life.

Membranes when fouled with the deposits from filtration is cleansed using alkaline chemical reagents as cleaning agents to remove organic matter such as proteins and grease. 0.1% sodium hydroxide solution is used to remove bio foulants. It was observed that the cleaning is efficient and the membrane regeneration effect is stable.

Typical Parameters Before and After Treatment with Membranes

Vinegar Mother Liquor Feed

Characteristics:

- Raw Feed Turbidity – 80 to 100 NTU
- pH – 2.8 to 3.2

Membrane Treated Output Quality:

- Product Turbidity – Less than 5 NTU
- pH – 2.8 to 3.2

Advantages of Vinegar Membrane Filtration

Impurity separation, product with high light transmittance, no muddy or precipitation after long-term storage.

It avoids the requirements of handling the waste from traditional filtration methods such as diatomite, Zeolite & Rotary Vacuum drum filter etc.

Membrane filtration simplifies the process and reduces production costs.

Normal temperature filtration replaces heat sterilization to ensure product quality as the product is free from bacteria and helps to retain the natural flavour of the product (which in traditional heat pasteurization is lost).

It adopts cross-flow filtration process design, which doesn't foul easily helping to keep the feed pressure low and can realize automatic control, which is beneficial to management and maintenance.

Membranes provide long service life, low regeneration cost, stable process and simple operation. ■

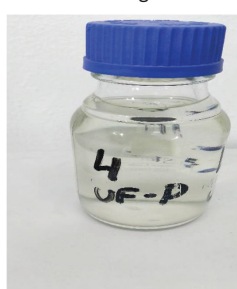
Feed Mother Liquor



Reject



Permeate Vinegar



For more information

Membrane Hitec (MHT)

(Division of Titanium Equipment And Anode Manufacturing Company (P) Ltd
& A Member of Dr. Rao Group of Companies)

Team House, GST Salai, Vandalur, Chennai - 600

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Tel : 044 - 22750323/ 66799595 / 66799544

Fax : 044 - 22750771

E-mail: membranehitec@drraoholdings.com

Sandvik's First Nickel-Iron-Chromium Alloy In Bar And Hollow Bar



Sandvik, a developer and producer of advanced stainless steels, special alloys, titanium and other high-performance materials, has launched Sanicro 825, Sandvik's first-ever nickel-iron-chromium alloy in bar and hollow bar, for improved performance in corrosive, high-temperature environments.

Sanicro 825 (UNS NO8825) extends the company's growing Sanicro portfolio of nickel alloys and austenitic stainless steels for aggressive wet, corrosive and high-temperature, pressure, acidic and seawater conditions.

A high-strength alloy with minimum 40% nickel content, Sanicro 825 has excellent corrosion resistance to acids and alkalis, superior resistance to stress corrosion

cracking (SCC) and good corrosion resistance to phosphoric, nitric, sulfuric, and organic acids, seawater, caustic chloride alkalis and ammoniac media.

Stable, easy to machine and weld, the new alloy is ideal for use in a wide range of components and installations including heat exchangers, evaporators, offshore piping systems, seawater coolant, valves and flanges. It serves a multitude of industries including oil and gas, chemical, petrochemical, pulp and paper, pickling equipment, nuclear fuel processing and food processing.

Available in three- to seven-meter lengths with an outside diameter (OD) ranging from 20mm-260mm, Sanicro® 825 offers a cost-effective alternative to superalloys such as Alloy 625 and Alloy 718. Its chemical formulation has been tailored within EN, UNS and ASTM standards.

"Sanicro 825 opens new high-performance possibilities for our customers. At elevated temperatures and in corrosive conditions, this new grade offers clear advantages to standard stainless steel or duplex grades and is more cost-efficient than some superalloys," said Martin Holmquist, Business Development Manager, Sandvik Materials Technology.

Contact: Sandvik

<https://www.materials.sandvik/en/>

New Technique from Hiden Isochema to Accelerate Materials Development for Gas Separations



Hiden Isochema Ltd (Warrington, UK) and Cleveland State University (Ohio, USA) have developed a new way of analyzing materials for separating gases. Although gas separation using porous materials is an established technology, analytical techniques for assessing the performance of materials tend to be slow and laborious. The new Integral Mass Balance (IMB) method is faster and more accurate than existing techniques, and promises to accelerate new materials development for gas separation technology.

Industrial gases affect many aspects of daily life. They are used to carbonate fizzy drinks, preserve food, and even to inflate balloons. Purified natural gas, meanwhile, is used across the globe as an energy source, for household cooking and heating.

"Scientists and engineers have been working on these types of measurements for decades, but most current techniques are very time-consuming," says Dr Darren Broom, Product Manager for Hiden Isochema. "A simple set of data can take weeks to measure. By combining two different methods, in a unique way, we have been able to speed up the process significantly."

To demonstrate the technique, the team has made measurements on a zeolite. Zeolites are porous materials with a range of uses, perhaps most notably in washing powder, but they are also particularly good at separating and drying gases. The reported measurements relate to oxygen (O₂) production from air, by separating O₂ from N₂.

In medicine, where purified O₂ is widely used, this technology is vital. Whilst small-scale and portable medical O₂ generators are widely available for personal use, larger PSA O₂ generators, filled with zeolites, have been installed at emergency field hospitals constructed to cope with the current coronavirus crisis,

where reliable O₂ supplies have been critical for treating patients.

"We chose these measurements because Professor Talu published similar data, measured on the same sample in two different laboratories, around 25 years ago," said Broom. "However, we also wanted to do something of practical interest. As zeolites are currently used in commercially available medical O₂ generators, this seemed an ideal choice."

"The IMB method can provide reams of accurate data quickly," added Professor Talu. "This will help accelerate the development of new materials and processes for such applications."

Contact: Hiden Isochema LTD
<https://hidenisochema.com/>

Brüel & Kjær Vibro Launches VIBROSTORE 100 for Cost-Effective Machine Health Monitoring

Brüel & Kjær Vibro (B&K Vibro), one of the leading worldwide independent suppliers of condition monitoring solutions for rotating machinery, has launched VIBROSTORE 100, a palm sized device that provides vibration level and bearing wear monitoring for balance-of-plant machines at the push of a button.

The lightweight device can be used single-handedly and enables even untrained personnel to take vibration



measurements and assess a semi-critical machine's overall vibration condition. The instrument is equipped with a pre-set cable-connected high-quality B&K Vibro acceleration sensor. Once the type and size of the machine based on ISO 10816 and its running speed are entered, a one-button push can perform the measurement.

A traffic-light display immediately indicates the severity of the vibration based on the built-in ISO 10816 alarm limits (velocity in mm/s or in/s). The main screen also shows the rolling-element bearing condition in bearing damage units measurement (BDU) and total g (RMS acceleration). The display of the vibration level in frequency ranges indicates the most common machine faults, such as imbalance, misalignment or looseness.

Florian Endres, commercial platform leader, B&K Vibro, said, "Whereas critical and semi-critical machinery is usually equipped with an online protection

system to avoid catastrophic damages, it is often too difficult and costly to install an online condition monitoring system on every semi-critical machine. With a combination of B&K Vibro quality and extremely competitive pricing, the VIBROSTORE 100 fills the gap in detecting the most common machine faults and delivers quick, reliable and cost-efficient machine health monitoring for semi-critical and balance-of-plant machines."

VIBROSTORE 100 is available either as stand-alone or packaged with the B&K Vibro Report & Route Manager software, a powerful and highly functional route editor and analysis software.

Contact: Brüel & Kjær

<https://www.bksv.com/en>

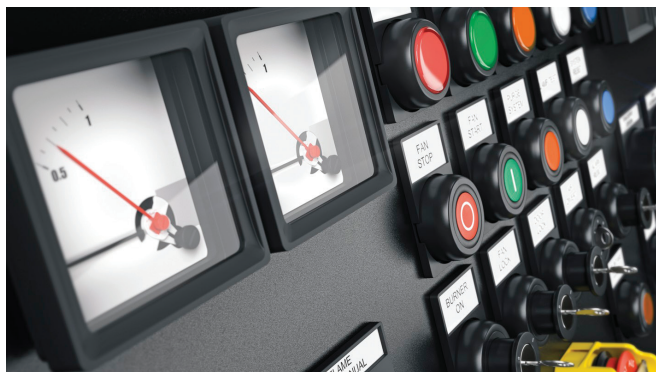
New Stainless Steel Enclosure Series Tops Off the Ex e Solution Portfolio from Pepperl+Fuchs

Pepperl+Fuchs has now reinforced its position as a supplier of Ex-equipment with the introduction of the SR series. The new stainless steel enclosure series joins the GR series, made of glass fiber-reinforced plastic, in the range of the process automation specialist. The new series tops off a portfolio of highly flexible and cost-effective control and distribution solutions in type of protection Ex e (Increased Safety).

Initially, several versions of remote I/O enclosures will be available following the market launch of the SR series, which is geared toward the requirements of the oil and gas, chemical, and pharmaceutical industries. These versions will be continuously supplemented by further options, such as terminal boxes and control stations, control units, switch disconnectors and safety switches, and fieldbus solutions, so that users can benefit from a complete portfolio in the future.

SR—Cost-Effective Ex e Stainless Steel Enclosures for Various Applications

The SR series—in durable stainless steel—comprises more than 30 enclosure sizes to meet the precise dimension requirements of every intended use. To further increase cost effectiveness, the IP66 / NEMA 4X enclosures are always reduced to a basic version. Any accessories, such as gland plates, hinges, 1/4 turn locks, and lid security, are only integrated by Pepperl+Fuchs in accordance with the corresponding customer specification. Various international approvals permit worldwide use in a whole host of applications. Depending on the application requirements, the enclosures, which are certified for a temperature range of -60 °C to +120 °C, can be mounted vertically or horizontally in the operating location. All SR series versions that are suitable for wall mounting can be screwed in



directly using mounting brackets that rotate by 90° or rivet nuts, without further adaptation. If the SR series is used as a control station, the contact blocks can be fixed either to a rail or directly to the enclosure cover.

GR—The Sister Series Made of Glass Fiber-Reinforced Plastic Material

In strategic and technological terms, the SR series complements the established GR series as an addition to the Pepperl+Fuchs portfolio. The GR series comprises a range of IP66 / NEMA 4X enclosures made of glass fiber-reinforced, antistatic, highly resistant polyester. The UV-stabilized material is highly durable and offers excellent corrosion resistance.

The innovative design of the GR series makes mounting considerably easier: decoupled mounting steps mean that even large and heavy enclosures can be installed by a single person. Like the SR series, the GR series offers many different dimensions and options to cover a wide range of application requirements.

Ex e Control and Distribution Solutions from a Single Source

The two Ex e enclosure series are linked by Pepperl+Fuchs' overarching service concept, which focuses on maximizing vertical integration and providing extensive support for users at all times. In addition to the regional field service, customers have access to product specialists in six globally distributed Solution Engineering Centers (SECs) who can assist with everything from the preparation of quotations to the engineering, design, and certification of customized control and distribution solutions.

Automation is our world. A Perfect application solution is our goal.

Then as now, our focus is directed squarely on the individual requirements of each customer. Whether as a pioneer in electrical explosion protection, or as a leading innovator of highly efficient sensors – the close communication with our customers is what allowed us to become the leader in automation technology. Our main objective is combining state-of-the-art technologies and comprehensive services to optimize our customers' processes and applications.

Contact: Pepperl + Fuchs SE

<https://www.pepperl-fuchs.com/india/hi/index.htm>

Pfeiffer Vacuum Presents Total Pressure Vacuum Gauges With Digital Signal Output



Profinet and EtherCAT interfaces

For more than 20 years now, Pfeiffer Vacuum's portfolio has included its comprehensive DigiLine range of digital total vacuum pressure gauges, which can be modularly adapted to suit any industrial vacuum application. These gauges allow reliable measurement of the total pressure and are easy to install.

Many vacuum applications operate only within a specific pressure range. DigiLine gauges determine and regulate the total pressure in a vacuum system. Thanks to their digital signal output, they ensure a high degree of accuracy and secure data transmission. DigiLine products are much more accurate than analog measuring methods: The measured data for process control and documentation are transferred without any errors or losses.

Pfeiffer Vacuum capacitance gauges, CCT



Pfeiffer Vacuum capacitance gauges, CCT

The M12 connector assemblies qualify these vacuum gauges for use in harsh environments. The gauges can be operated within a communications network, along with the HiPace turbopumps and other Pfeiffer Vacuum products.

All of the gauges have an RS-485 interface. The available options already included Profibus DP, DeviceNet and an additional analog output with two switch

points and an LCD display.

Now, additional options have been added to the series to keep abreast of changes in market requirements. This means that DigiLine is now also available with the industrial Ethernet interfaces ProfiNet and EtherCat. In comparison to conventional fieldbuses, these offer the advantage of very fast data rates and a significantly higher number of participants, which makes them an important factor in implementing Industry 4.0.

In addition, the capacitance gauge types, CCT, which were previously supplied only with an analog output, are now also available in the DigiLine series. These high-precision measurement instruments can be used independently of the type of gas, and find applications in the precise control of coating processes, for example, as well as in freeze drying and in calibration laboratories. The tried-and-tested ceramic technology in the CCTs has the advantages of good chemical resistance and a very low zero point deviation. The CCTs are available as a temperature-compensated version and a 45°C heated version.

All DigiLine gauges are manufactured in Europe ensuring fast availability and simplified processing.

Contact: Pfeiffer Vacuum GmbH
www.pfeiffer-vacuum.com

Signal Group Innovation Disrupts Gas Monitoring Market



‘Thinking out of the box’ is usually a phrase that R&D engineers use as a metaphor for looking at a challenge from a different perspective, but at Signal Group (UK), the technology development team have taken the phrase to a new level. Following an intensive development program, the company has announced that all of their main line S4 gas analysers are now available with a detachable Tablet instead of the traditional built-in screen.

“We are not aware of any off-the-shelf gas analysers with this capability anywhere else in the world, so this will dramatically disrupt the gas analyser market,” comments Signal Group’s Stephane Canadas. “No longer will customers have to manage their analysers, while standing, sitting or squeezing into inconvenient or even

hazardous locations; now they will be able to operate their equipment wirelessly from a convenient location nearby, using the instrument's built-in Wi-Fi.

"The even better news for our international customers, is that we can now confirm that the Tablet is available with user-selectable multiple languages."

The new Tablets are rugged with an IP65 rating, which means that they can even be used outdoors. However, the applications where the detachable Tablet will be of greatest value include: analysers in an ATEX enclosure; vehicle exhaust gas test cells; on a raised stack gantry; in a combustion test rig, or on any site where the location of analysis is not an ideal or safe working space.

The new S4 Tablet connects wirelessly to the analyser via an inbuilt 802.11 Wi-Fi which can connect up to 50 metres away, and the tablet's enhanced Graphical User Interface (GUI) uses intuitive graphical icons for all the main functions. This provides users with the ability to view live data remotely, and even manage data logging, alarms and calibration.

In addition to wireless connectivity between the analyser and the Tablet, all Series 4 instruments are supplied with software which provides users with

simple and secure access via RS232 or Ethernet at any time, from anywhere.

From April 2021, the new S4 Wireless Tablet will be supplied as standard on all new orders for the Series 4 gas analysers, which includes the SOLAR, QUASAR, PULSAR and AURORA models.

Contact: Signal Group Ltd

www.signal-group.com.

Improved Security During Data Transfer

New APROL Function Guarantees Secure Import And Export Of Engineering Data

B&R is constantly adding new security functions to its process control system APROL. This allows users to protect their projects from cyber threats in the best possible way. A new function enables automatic encryption of engineering data, guaranteeing the highest level of security during import and export.

In larger projects, tasks are often split up between team members scattered around the world. To guarantee the securest possible exchange of engineering data, all configuration data must be protected by encryption.



Automatic encryption saves time

The new APROL function "Data security for import and export" allows data to be encrypted with minimal effort. After commissioning, the entire project is handed over to the responsible archivist in a tamper-resistant manner. Subsequent manipulation without a password is impossible. Users benefit from a high level of data security and save a lot of time since manual encryption and decryption is no longer necessary.

A new function of process control system APROL guarantees secure data exchange through automatic encryption.

Contact:

www.br-automation.com. ■

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- Packaging Solutions
- Material Handling Systems
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- Consulting Services
- Equipment Fabricators

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- Cosmetics & Personal Care Ingredients
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- Electronic Chemicals
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FACTS & FIGURES - CHEMTECH WORLD EXPO 2019

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