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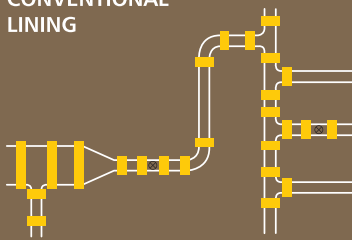
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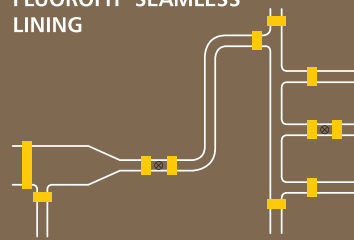
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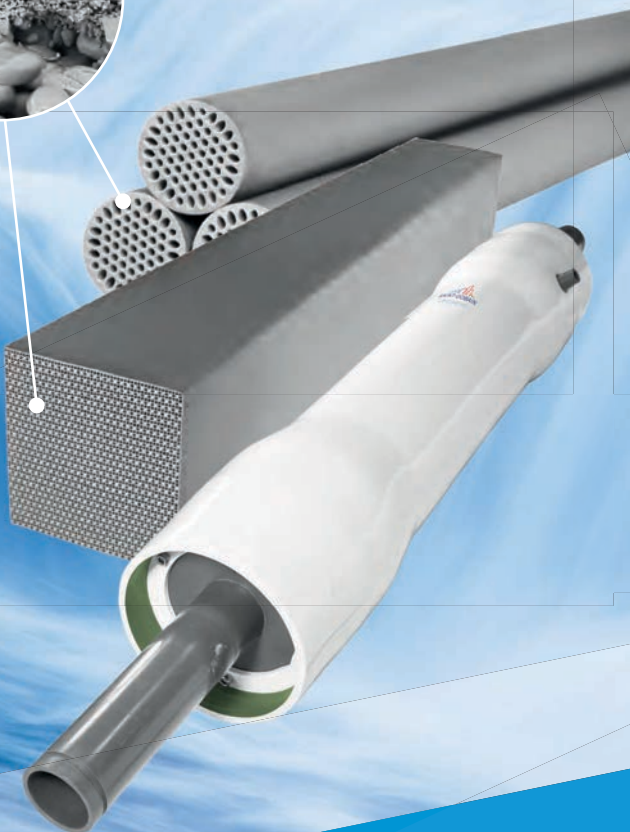
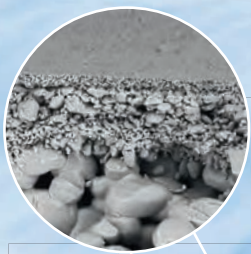
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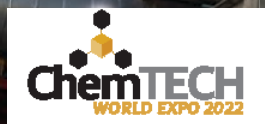
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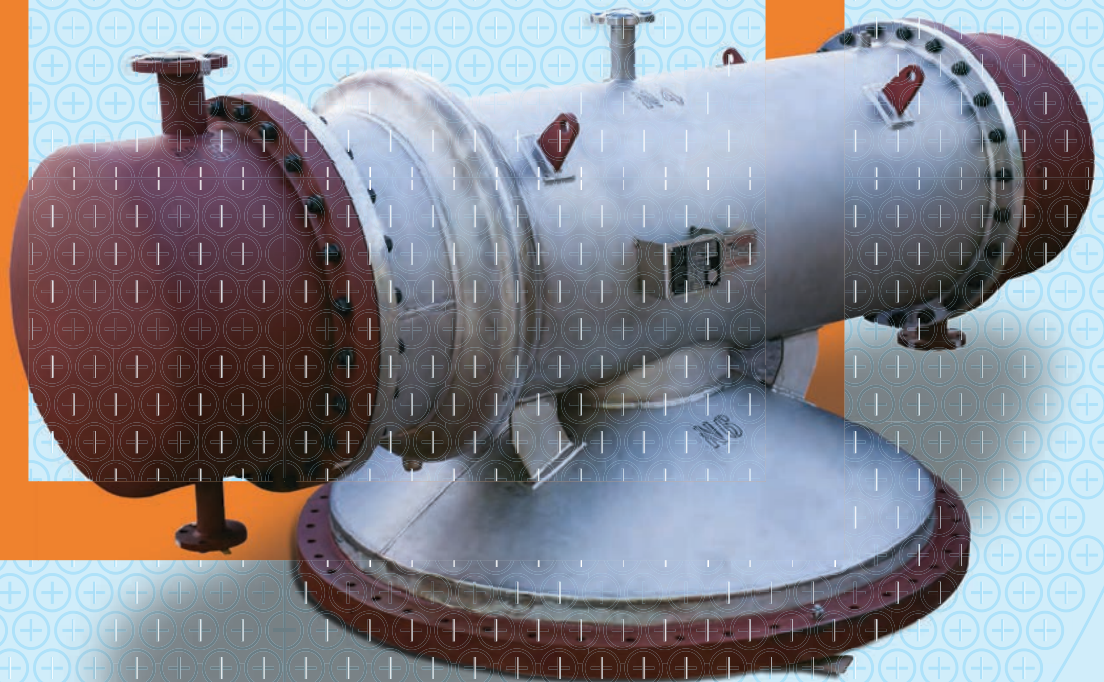
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Need help with designing or troubleshooting pneumatic conveying systems?

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## Facts and Figures of Oil & Gas + Gas World Tech+ Refining & Petrochemicals+ Power World Expo 2020

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Shri Bhagwanth Khuba takes charge as Minister of State for Chemicals and Fertilisers



Shri Raj Kumar Singh takes charge as Cabinet Power and New & Renewable Energy



Union Minister Shri Narayan Tatu Rane and Minister of State Shri Bhanu Pratap Singh Verma assume charge of MSMEs



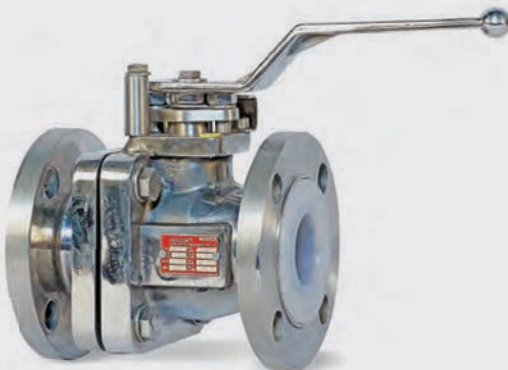
Shri Danve Raosaheb Dadarao takes charge as Minister of State Coal and Minister of State Mines



Shri Ramchandra Prasad Singh takes charge of the Ministry of Steel as the Cabinet Minister



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## Six Technology Innovation Platforms Launched For Development of Technologies



16

Minister of Heavy Industries and Public Enterprises Shri Prakash Javadekar inaugurated (through virtual mode) six Technology Innovation Platforms which will focus on development of technologies for the globally competitive manufacturing in India.

The Minister further stated that this will facilitate the development of the key 'mother' manufacturing technologies' indigenously through 'Grand Challenges' on the Platforms to help achieve the vision of an Aatmanirbhar Bharat and a globally competitive manufacturing sector in India.

The Six Technology Platforms have been developed by IIT Madras, Central Manufacturing Technology Institute (CMTI), International Centre for Automotive Technology (iCAT), Automotive Research Association of India (ARAI), BHEL and HMT

in association with IISc Bangalore. These platforms will focus on development of technologies for the globally competitive manufacturing in India.

These platforms will facilitate industry (including OEMs, Tier 1 Tier 2 & Tier 3 companies & Raw Material Manufacturers), start-ups, domain experts/professionals, R&D institutions and academia (colleges & universities), to provide technology solutions, suggestions, expert opinions etc. on issues involving manufacturing technologies. Further, it will facilitate exchange of knowledge with respect to research & development and other technological aspects. Over 39000 Students, Experts, Institutes, Industries and labs have already registered on these platforms.

## GEECL Shows Resilience during Covid; Reduces Debt and Generates Healthy Cash Profits

**Asansol, India:** Great Eastern Energy Corporation Limited ("GEECL"), the fully integrated, Coal Bed Methane ("CBM") company, is pleased to announce its Full Year Results for the 12 months ended 31 March 2021.

FY 2021 was an unprecedented year with the COVID-19 pandemic impacting global supply chains, amidst the biggest global health crisis ever faced.

As announced on November 11, 2020 in the Half Year Results to 30 September 2020, the COVID-19 pandemic had an adverse impact on Sales that were further compounded by the subsequent national lockdown that occurred in India. However, to mitigate this impact, the





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Company has taken appropriate measures to optimize costs and increase efficiencies.

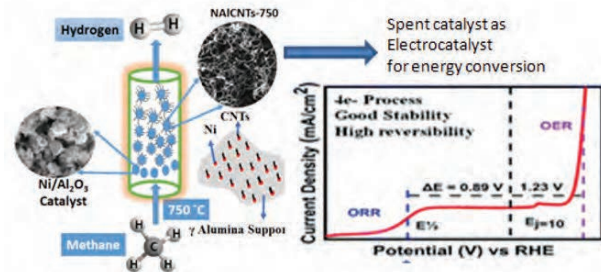
Sales volumes were impacted by the economic impact of the COVID-19 pandemic, reassuringly, the Company remained profitable. Encouragingly, operations continue to grow with gas production increased from a full year average of 15.20 mmscfd to an average of 15.88 mmscfd in June 2021, including choked production.

The Company continues to focus on optimising its debt coupon rate and has been able to reduce the same from 10.32% in FY 2021 to 9.58% in the ongoing FY 2022. Due to this, there will be an annual saving, in FY 2022, of ~ Rs. 37.50m.

GAIL (India) Limited partially commissioned the "Jagdishpur - Haldia & Bokaro - Dhamra pipeline" on February 6, 2021. Further work on laying the pipeline section to Kolkata is underway and it is expected to be completed by August 2022 as per the media reports. This will provide the Company with the opportunity to expand its customer base and sales significantly by accessing the huge market of Kolkata and also to the wider State of West Bengal. The transportation tariff of this pipeline has been fixed at Rs. 71.08/mmbtu (\$0.94/mmbtu) including 12% for Goods and Services Tax.

"Encouragingly, post balance sheet year end, World growth rates are rebounding and energy prices, that fell dramatically in March 2020, have returned to pre-pandemic levels with international oil prices currently above US\$70 per barrel.

## Wealth from Waste: Spent Catalyst from Industry can be an Efficient Catalyst for Batteries



We are perhaps looking at a future in which industrial waste will form the base for energy storage in batteries. Scientists have shown that the spent catalysts from the energy industry or the raw material for recycling operation that deliver fresh catalysts and valuable metals work as an efficient bifunctional oxygen electrocatalyst and can catalyze the core reactions that facilitate the operation of metal-air batteries.

It can help develop new strategies for effectively using industrial waste for energy storage in batteries paving the way to realize the dream of achieving 'today's waste is tomorrow's energy'.

Hydrogen energy offers a promising power generation route for the industry and transport sectors due to high energy density and clean output. One of the ways to produce hydrogen is by catalytic decomposition of methane using nickel catalyst embedded on alumina or zeolite. After several runs, the catalysts get spent due to carbon choking and lose their activity. The spent catalysts are typically subjected to energy-intensive processes such as high-temperature combustion for recycling, releasing a large amount of CO<sub>x</sub> into the





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Structured Packing

Mist Eliminators

atmosphere during the process or chemical treatment for the reclamation of metal constituents. These protocols are neither economically viable nor environmentally friendly, thus demanding alternative avenues to efficiently use the spent catalyst.

Dr C. Sathiskumar, Dr Neena S. John and Dr H.S.S. Ramakrishna Matte from the Centre for Nano and Soft Matter Sciences (CeNS), an autonomous institute under the Department of Science & Technology, Government of India, in collaboration with Hindustan Petroleum Corporation Ltd (HPCL) R&D Green Centre, Bengaluru, have demonstrated that the above-spent catalyst works as an efficient bifunctional oxygen electrocatalyst. It can catalyze both electrochemical oxygen evolution (OER) and oxygen reduction reactions (ORR), the core reactions that facilitate the operation of metal-air batteries. This research was recently published in the journal 'Sustainable Energy Fuels.'

The spent catalyst shows stable current density for 20 hrs and 8 hrs towards OER and ORR. The potential difference for overall oxygen electrocatalyst ( $\Delta E$ ) reveals a superior bifunctional activity of the spent catalyst. Furthermore, the spent catalyst employed in Zn-air batteries displayed commendable charge-discharge performance up to 45 hrs with high reversibility.

The work supported by the Centre for High Technology (CHT)-Oil and Industry Development Board (OIDB), Hydrogen Corpus Fund help in effectively utilizing industrial waste for energy storage applications, thus producing green energy in a sustainable manner.

## AVEVA Recognized as the Winner of 2021 Microsoft Energy Partner of the Year



Kerry Grimes, Global Head of Partners , AVEVA

**Mumbai, India:** AVEVA, a global leader in industrial software driving digital transformation and sustainability announced it has won the 2021 Microsoft Energy Partner of the Year Award and was also named the finalist (runner-up) of 2021 Microsoft Sustainability Changemaker Partner of the Year Award. The company was honored among a global field of top Microsoft partners for demonstrating excellence in innovation and implementation of customer solutions based on Microsoft technology.

"We are delighted to win Microsoft's prestigious Energy Partner of the Year award and be named a finalist for Sustainability Changemaker Partner of



# Mist Evaporation System for Zero Liquid Discharge

## Environment friendly solution for Liquid Waste Disposal

MREPL is recognized as pioneer of revolutionary Mist Cooling System having more than 30 years experience & over 350 installations in various industries. We now offer an innovative Mist Evaporation System for Zero discharge of effluent/RO reject.

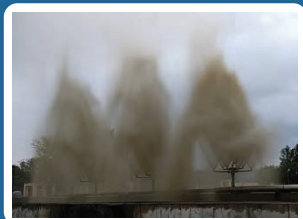
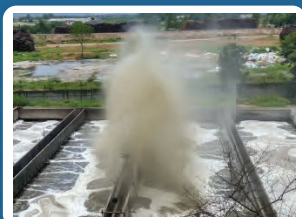


### Salient features of MES over Conventional Systems (MEE/MVCM)

- ✓ Lower OPEX due to Natural Evaporation.
- ✓ Lower CAPEX.
- ✓ Negligible maintenance due to choke less design of system and special material of construction.
- ✓ Vacuum and cooling system is not required.
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the Year. These awards recognize our industry-specific expertise in enabling energy and manufacturing companies to meet their sustainability goals and achieve business resiliency through advanced digital technologies during these globally transformative times," said Kerry Grimes, Head of Global Partners, AVEVA. "AVEVA empowers customers with real-time energy operational data management, integrated with AI and analytics to help manage their energy consumption and emissions. Our purpose, values and strategy create long term value and we are aspiring to a world, where economic growth supports environmental sustainability."

The Microsoft Partner of the Year Awards recognize Microsoft partners that have developed and delivered outstanding Microsoft-based solutions during the past year. Awards were classified in various of categories, with honorees chosen from a set of more than 4,400 submitted nominations from more than 100 countries worldwide. AVEVA was recognized for providing outstanding solutions and services across the energy sector.

By collaborating with Microsoft, AVEVA has the power to elevate how the energy industry can operate, by marrying the power of industrial data, AI and human insight with the scale, breadth and latency of cloud. Aligning efforts with Microsoft, AVEVA has templated its best practices and vertical solutions to become repeatable, scalable and adaptable to fit agnostically with other software stacks, thereby enabling rapid implementation and payback.

"I am honored to announce the winners and finalists of the 2021 Microsoft Partner of the Year Awards," said Rodney Clark, corporate vice president, Global Partner Solutions, Channel Sales and Channel Chief, Microsoft. "These remarkable partners have displayed a deep commitment to building world-class solutions for customers—from cloud-to-edge—and represent some of the best and brightest our ecosystem has to offer."

## GHCL's Demerger Gets a Nod from Shareholders and Creditors



R S Jalan, Managing Director, GHCL

**Mumbai, India:** GHCL, India's leading Chemical & Textile Company, announced that the secured creditors have approved the scheme of demerger of GHCL's Inorganic Chemicals and Textile businesses. The shareholders and unsecured creditors had already approved the scheme of demerger in a meeting held in April earlier this year. With this the Company will now approach the honorable NCLT for their approval.

As part of the restructuring which was announced in March last year, the Textile





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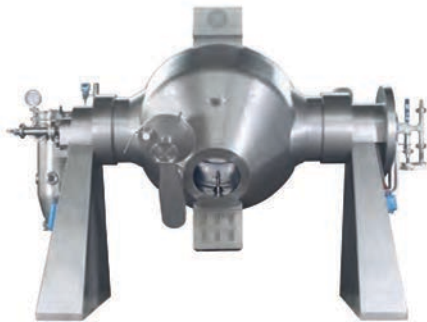
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business shall be demerged into a separate company and both businesses shall be listed as separate business entities. The company expects this demerger to deliver various operational and strategic benefits to each Business segment such as focused growth, concentrated approach, business synergies and increased operational and customer focus. In addition, it will address independent business opportunities with efficient capital allocation and attract different set of investors, strategic partners, lenders and other stakeholders, thus expected to result in enhanced value creation for stakeholders.

Commenting on the development, Mr. R S Jalan, Managing Director, GHCL said, "This is an important step towards the next phase of growth for the organisation as a whole. The demerger will go a long way in facilitating better opportunities, focus and business synergies for both businesses. It will also help us cater to the different needs of the diverse businesses in a better way and aid value creation for our stakeholders"

## Meeting the Limits - Reliable Coloration of Bioplastics

**Cologne, Germany:** LANXESS supports masterbatch producers in the process of formulating colored biodegradable plastics by offering pigment analyses. As a result, the Inorganic Pigments (IPG) business unit offers a unique service by providing its customers with recommendations regarding the maximum pigment concentration of iron oxide pigments of the Colortherm brand in so-called bioplastic formulations with a low heavy-metal content.

"Our Colortherm iron oxide pigments are ideally suited to the task of coloring compostable plastics. The decomposition of the polymer is not affected," says Stefano Bartolucci, Global Market Segment Manager for Plastics at IPG. "Based on the recommended pigment dosing, masterbatch producers can instantly develop individual formulations for colored biodegradable plastics – no expensive pigment screening is required," says Bartolucci. Thanks to the Colortherm-brand iron oxide pigments from LANXESS, which, unlike alternative products on the market, are proven to be almost completely free from heavy metals, the limits for biodegradable plastics can be reliably maintained, even with a high pigment content.

Due to regulated heavy-metal levels, certain pigment classes cannot be used for coloring biodegradable plastics made from renewable or fossil resources. This is the case with, for example, nickel-, chrome- or copper-based pigments.

"Green" products, recyclability, and compostability are in high demand and demand huge changes in the industrial sector because biodegradable plastic has to fulfill all the relevant usage standards applicable in various regions of the world before it can be sold. A host of regulatory directives apply, including the European standard EN 13432:2000 and US standard ASTM D 6400. These specifications encompass plastics and the resulting products destined for composting in municipal and industrial aerobic composting plants. Colortherm from LANXESS ensures that both of these standards can be easily complied with in accordance with the recommendation.



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The inorganic pigments from LANXESS are widely used in the coloration of plastics for a broad range of applications. "Our pigments can enhance the properties of plastics, make them more cost-efficient, and increase flexibility in production. Our application specialists can also help customers all over the world find solutions to their challenges," says Bartolucci. The company runs a global network of state-of-the-art laboratories and technical application facilities.

The Colortherm iron oxide pigments from LANXESS are available in red, yellow, brown, and black and also in numerous intermediate tones. They do not require special labeling, nor are they classified as hazardous substances. The consistently high product quality is achieved through the systematic use of controlled raw materials combined with continuous quality controlling. Production takes place to the highest standards of sustainability.

## Maire Tecnimont Group Expands its Footprint in India with an USD 170 Million EPCC Contract

**Mumbai, India:** Maire Tecnimont S.p.A. announced 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 polypropylene plant and the related product logistics facilities. The plant will be located in Barauni, in the State of Bihar, in North-Eastern India.



Pierroberto Folgiero, Chief Executive Officer, Maire Tecnimont Group

The overall value of the contract is about USD 170 million. The scope of work entails Engineering, Procurement, Construction and Commissioning activities up to the Performance Guarantees Test Run. The polypropylene plant will have a capacity of 200,000 tons per year and the time schedule is 30 months from the award date up to Mechanical Completion.

The new polypropylene plant will be part of IOCL's Barauni Refinery capacity expansion project, which entails the installation of large grassroots units as well as revamps and upgrades to increase the capacity of current units. The Barauni Refinery Expansion project is part of IOCL's plan to meet the growing domestic demand for added-value products needed to boost the Country's manufacturing industry.

Pierroberto Folgiero, Maire Tecnimont Group Chief Executive Officer, commented: "This is our sixth strategic EPC contract with a market



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leader such as IOCL, along with our recent joint initiatives in the green energy arena: we are really honoured to be IOCL's partner of choice to contribute to the sustainable development of India's energy transformation industry. We continue to expand the Group's industrial footprint thanks to our unparalleled technological know-how, a deep knowledge of the local market through our Indian entity Tecnimont Private Limited, as well as our strong commitment to ensure environmentally best performing products and processes".

## Energy Industry Rising to the Challenge of a Hydrogen Economy



Ditlev Engel, CEO, Energy Systems at DNV

**Oslo, Norway:** Energy professionals identify lack of investment in infrastructure as the joint-highest risk their organizations face in relation to hydrogen – and a significant majority (78%) say repurposing existing infrastructure will be crucial to developing a large-scale hydrogen economy.

DNV's report *Rising to the Challenge of a Hydrogen Economy* draws on a survey of more than 1,100 senior energy professionals and in-depth interviews with industry executives, on emerging hydrogen value chains, from production to consumption. It suggests that more than just ambitions, the hydrogen pledges, plans, and pilots of recent years have now evolved into concrete commitments, investments and full-scale projects.

Some 84% of senior energy professionals believe that hydrogen has the potential to be a major component of a global, low-carbon, energy system, while three quarters (73%) say Paris Agreement targets will not be possible without a large-scale hydrogen economy.

"To meet the targets of the Paris Agreement, the world needs to transition faster to a deeply decarbonized energy system. In addition to energy efficiency gains, this will require greater renewable power generation and electrification, and the scaling of technologies to remove the carbon from fossil fuels. Hydrogen will be needed to connect and enable these paths," said Ditlev Engel, CEO of Energy Systems at DNV.

By 2025, 44% of energy companies involved in hydrogen expect it to account for more than a tenth of their revenue, rising to 73% of companies by 2030. This is up significantly from just 8% of companies today.

On the other side of this new energy value chain, 33% of hydrogen consumers expect hydrogen to represent more than a tenth of their organization's energy and/or feedstock spending by 2025, rising to 57% by 2030. This is up from just 9% today.





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Several challenging questions remain, with the view split inconclusively on whether hydrogen trade will become a fully globalized market (42%) or regional market (52%), or whether hydrogen will be priced like oil and gas with free market forces (41%), or like electricity with a regulated or stable rate of return (43%).

## L&T Construction Awarded Contracts for its Various Businesses

**Mumbai, India:** L&T Construction, the construction arm of L&T has won a slew of orders in India and abroad for its various businesses.

### Power Transmission & Distribution:

The Power Transmission & Distribution Business has won an order to construct a 220kV

Transmission Line associated with system strengthening in the Ladakh region. The design and execution of this system involves traversing avalanche prone, hilly terrains and ice loading of conductors.

Another turnkey order has been received for urban power distribution in Ayodhya city under the Integrated Power Development Scheme.

In Dubai city, an order to design, supply, construct, install, test, and commission a 132/11kV substation with associated cable works has been received. Additionally, two transmission line packages have been secured in Africa.

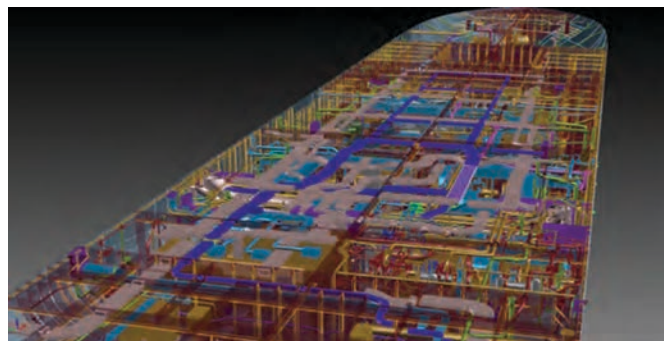
A package involving supply and construction of a new Gas Insulated Substation and

associated substation extensions has been won in Thailand. These works will enhance the transmission system security and support the rising demand for electricity in the upper northern parts of the country.

### Buildings & Factories:

The Factories business has secured a prestigious order from a leading cement manufacturer in India to construct a 1.8 MTPA Grinding Unit in Dolvi, Maharashtra. The scope involves Civil, Mechanical and Equipment Installation works.

## Siemens Acquires FORAN Software to Expand Capabilities in Marine Design and Engineering



**Munich, Germany:** Siemens Digital Industries Software announced today that it has signed an agreement with Spain-based SENER, a leading multinational company in engineering and technology, to acquire its FORAN software business. FORAN is CAD/CAE/CAM software for the design, construction and engineering of vessels and marine structures. The addition of the FORAN product and team to Siemens, together with its customer portfolio, brings experience and comprehensive know-how across complex commercial marine projects, defense industry





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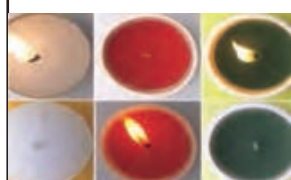
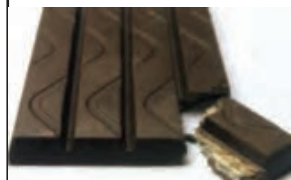


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standards and regulation compliance. SENER Group will keep and strengthen its traditional marine engineering business line, where it offers design, engineering and consultancy services for different types of ships and offshore vessels.

FORAN will be added to Siemens' Xcelerator portfolio, offering a comprehensive and integrated portfolio of software and services that covers all aspects of the ship lifecycle, from concept design through production to operations and optimized service lifecycle management.

"The acquisition of FORAN enhances our marine digital twin, adding preeminent capabilities to our integrated ship design and engineering digital thread solution," said Tony Hemmelgarn, CEO and President, Siemens Digital Industries Software. "By adding FORAN's extensive tools to the Xcelerator portfolio and leveraging the team's industry expertise, we will be able to offer commercial and naval shipbuilding customers better control of their ship design and manufacturing process as they transition to Shipyard 4.0."

"With over 150 shipyard and design office customers across 40 countries, FORAN technology provides a strong position for Siemens to better support customers across the marine industry. At the same time, Siemens' global reach and the integration of the FORAN team into Siemens helps guarantee current FORAN clients continuity and improvement to the services provided with a strategic vision for ongoing developments," said Gabriel Alarcón, Managing Director, SENER Engineering. "This transaction allows the FORAN product family to grow in line with the expanded presence that Siemens has in industrial software." ■

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**10 KL Twin Shaft Dispensor**



**25 KL SS 904L Reactor**



**62 KL Limpeted Storage Tank**

## Odisha Govt Approves Five Mega Steel Projects Worth Rs 1.46 Lakh Crore



HCLA, led by CM Naveen Patnaik

The Odisha government has accorded in-principle approval for five different projects having 27.5 million tonne steelmaking capacity at an investment of Rs 1.46 lakh crore.

The state, which started its steel making journey from just two million tpa in 2000, has so far enhanced the capacity to generate 30 million tpa and with addition of another 27.5 million tpa will take the capacity to 57.5 million tpa. The approval will also provide Keonjhar district with a mega steel plant of three million tonne capacity. This is the first big investment in manufacturing in Keonjhar.

Apart from this, the approval to JSPL's expansion plan of its Angul plant to 25.2 million tpa will make the company the world's largest single-location steel plant. The approval was cleared at the State High Level Clearance Authority, chaired by Chief Minister Naveen Patnaik.

The new investment to the tune of

Rs 1,46,172 crore in metal and metal downstream sectors during the COVID-19 pandemic also made the state one of the favoured investment destinations in the country.

The state has been able to attract investments to the tune of Rs 2.96 lakh crore in 2020-21 despite the COVID-19 pandemic, and with the additional investments the total investments since 2020 will be Rs 4.43 lakh crore in the state.

These five projects are expected to create employment opportunities for 26,959 persons. The projects will help to achieve the goal to produce 100 million tonne of steel by 2030. The state currently has a production capacity of 30 million tonne.

The projects which got approval included the expansion of Bhushan Power and Steel integrated steel plant from five million tpa to 15 million tpa at an investment of Rs 55,000 crore. The project will be set up at Rengali in Sambalpur district and generate potential employment opportunities for over 10,000 persons.

A proposal for the expansion of Tata Steel crude steel production from three million tpa to eight million tpa, hot rolled coil from three million tpa to seven million tpa, 2.2 million tpa cold-rolled products and two million tpa long products against an investment of Rs 47,599 crore to be set up in Kalinga Nagar, Jajpur, also received the government's nod. This will generate employment opportunities for over 4,625 persons.





# Solvent Recovery Systems

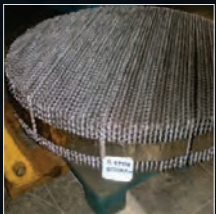
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## IndianOil to Build India's First Green Hydrogen Plant at Mathura Refinery



S M Vaidya, Chairman, Indian Oil Corporation Ltd

To strengthen its bouquet of clean energy offerings, IndianOil will build the nation's first 'Green Hydrogen' plant at its Mathura refinery. Hydrogen being the cleanest form of energy is the latest focus area across the globe to satiate the rising energy needs. Green hydrogen is derived from water electrolysis using renewable energy like solar or wind. Biomass-based hydrogen production technologies also qualify under the green category. On the other hand, Brown and grey hydrogen are produced through coal gasification and natural gas reforming, respectively. These production pathways generate

a significant amount of carbon dioxide. Integration with appropriate carbon capture and utilisation technologies results in Blue hydrogen. While IndianOil has been working on various hydrogen production pathways, the current project at Mathura Refinery will be pioneering the introduction of green hydrogen in the Indian oil & gas sector.

Speaking on this ambitious project, Chairman IndianOil, Mr Shrikant Madhav Vaidya, said, "IndianOil has drawn a strategic growth path to focus on its core refining and fuel marketing businesses while making bigger inroads into petrochemicals, hydrogen, and electric mobility over the next ten years". Sharing his insights on IndianOil's growing footprint in the green energy landscape, Mr Vaidya added, "IndianOil has a wind power project in Rajasthan. We intend to wheel that power to our Mathura refinery to produce absolutely green hydrogen through electrolysis". Mr Vaidya also elaborated on the project's rationale and said, "Mathura has been selected because of its proximity to TTZ (Taj Trapezium Zone). As we see it, the Green hydrogen will replace carbon-emitting fuels used in the refinery to process crude oil into value-added products such as petrol and diesel. Moreover, we have got several expansion plans down the line which are already approved. We will not have a captive power plant and will utilise power from the grid, preferably green power. This



will help decarbonise some part of the manufacturing”.

Underlining IndianOil's ambitious plans to consolidate the core businesses, Mr Vaidya remarked, “Petroleum refining and marketing with much higher petrochemicals integration will continue to be IndianOil's key focus area. We are going to add 25 million tonnes of refining capacity by the year 2023-24.” He also said, “Forecasts by various agencies sees Indian fuel demand climbing to 400-450 million tonnes by 2040 as against 250 million tonnes now. This demand surge offers enough legroom for all forms of energy to co-exist. And, while exploring the multiple energy avenues, environmental conscience will be a critical priority for IndianOil. We are pushing ahead with research on carbon capture, utilisation and storage technologies”.

Sharing his optimism about hydrogen as an emerging energy vertical, Mr Vaidya said, “There is a fresh momentum for scaling up hydrogen use across sectors globally. IndianOil R&D Centre has emerged as a pioneering institute undertaking cutting edge research in all facets of hydrogen, including production, storage and applications like fuel cells. Our HCNG experiment in Delhi, wherein we converted 50 CNG BS-IV buses to run on HCNG fuel, has revealed significant benefits in reducing exhaust emissions and improving the fuel economy. Also,

with the support of the MoPNG, IndianOil is in the process of setting up ~1 tonne per day capacity pilot plants based on four innovative hydrogen production technologies, and we would also be operating 15 fuel cell buses in the Delhi NCR region along with Tata Motors. We recently shared a Statement of Intent (Sol) with the Norwegian company Greenstat to set up a Centre of Excellence on Hydrogen (CoE-H) in India to accelerate a gradual transition from fossil fuels to renewable energy. We also intend to seed Hydrogen Mobility by commoditising the surplus quantities of hydrogen available at the Gujarat refinery with a hydrogen dispensing facility for Fuel Cell Electric Vehicles. Initially, this facility will be refuelling 25 buses per day with a ramp-up capability to refuel 75 fuel cell buses per day. The project is expected to be operational soon, running the first set of buses from Gujarat Refinery to the Statue of Unity and other iconic sites in the vicinity”.

## **JK Paper to Commission 2,000 crore Capacity Expansion Project**

JK Paper is all set to commission Rs 2,000 crore integrated expansion of paper packaging project in Gujarat during Q2/ FY22. The plant will increase the capacity of packaging board by 1,70,000 tpa and 1.6 lakh pulp unit and take its total production capacity close to 7.8 lakh tpa.



The new manufacturing plant located at Songadh near Surat was initially programmed to be commissioned by March-April 2021. It has been delayed by a few months due to disruption caused

AS Mehta, President and Director, JK Paper

during the COVID-19 pandemic wave, where workers and some experts were away. The trials will begin in Q2/FY22.

This is a virgin paper packaging plant and will have capability to add about Rs 1,000 crore in revenues for the company in a full year of operation. The plant includes 1.7 lakh tpa packaging material and 1.6 lakh tpa of pulp making capacity apart from boilers and related infrastructure.

While JK Paper now has a capacity of about 4.5 lakh tpa, this will take the total installed capacity to about 7.8 lakh tpa. Through internal expansion, this capacity could go up to 8 lakh tpa, making it a leading paper company in the country.

## Tata Steel Draws 10,000-12,000 Crore Annual Capex Plan for Five Years



T V Narendran, CEO & Managing Director  
Tata Steel Limited

Tata Steel is looking forward for the next phase of growth even as it continues to stay the course on deleveraging. Over the next five years, the average India capital expenditure (capex) is estimated at Rs 10,000-12,000 crore per annum and that excludes potential acquisitions. The investor presentation mentioned that among FY22 deleveraging priorities, over USD two billion gross debt reduction and prioritising offshore debt pre-payments.

In FY21, Tata Steel had reduced net debt by USD four billion. For the next two-three years, the priority will be at least a USD one billion of repayment each year prior to



the allocation of surpluses towards growth. If there are acquisition opportunities, it will revisit the level.

The net debt had been restored to FY18 level of Rs 75,000 crore despite the Bhushan Steel and Usha Martin acquisitions of above Rs 40,000 crore in the interim period. Tata Steel has a current capacity of 19.6 million tonne in India. The Phase-2 expansion at Kaliganagar in Odisha of five million tonne is expected to be completed by FY24.

Between FY25 and FY30, both organic and inorganic growth opportunities will be pursued. Even if it does organic, it can go up to 40 million tonne based on available land in Jamshedpur, Kaliganagar and Angul.

The company will also be participating in organic growth opportunities, particularly in long products. The company submitted an expression of interest (Eoi) for the strategic sale of government stake in Neelachal Ispat Nigam and may also be interested in Rashtriya Ispat Nigam when it comes up for privatisation. The company will look at setting up more electric arc furnace-based units in the north, west and southern India.

Tata Steel's existing iron ore mines will be available with the company till 2030. The company will be astute in bidding for mines that will come up in the next 10 years.

## **NTPC Invites EOI for the Sale of Fly Ash in Middle East and other regions**

NTPC Ltd, a Maharatna CPSU under Ministry of Power and India's largest integrated power producer, in its endeavour towards 100% utilization of fly ash has invited Expression of Interest (EOI) for sale of fly ash from the designated ports of the Middle East and other regions. The tender application commenced on 1st July 2021, and will conclude on 25th July 2021.

Sustainable Ash utilization is one of the key concern areas at NTPC and the Company is ensuring sustainable solutions for complete utilisation for it. Fly Ash is a by-product of power generation with coal. The Fly Ash generated at NTPC stations is ideal for use in the manufacture of Cement, Concrete, Concrete Products, Cellular Concrete products and for Bricks / Blocks / Tiles.

NTPC Ltd, has collaborated with Cement manufacturers around the country to supply Fly Ash. The power producer is leveraging Indian Railways' sprawling network to transport Fly Ash in an economical and environment-friendly manner.

To promote the use of Fly Ash bricks in building construction, NTPC has set up Fly Ash brick manufacturing Plants at its Coal based Thermal Power Plants. These bricks are being utilized in Plants

as well as township construction activities exclusively. On average, 60 million Fly Ash bricks are being manufactured annually by NTPCs own Fly Ash brick Plants.

As per the MoEF&CC directives, NTPC stations are keeping at least 20% of total Fly Ash produced in reserve for the issue to Fly Ash brick/ blocks/ tiles manufacturers and issuing Fly Ash free of cost to them. About 9% of the total Fly Ash produced in NTPCs stations, is being utilized by Fly Ash bricks/ blocks and tiles manufacturing units annually.

Further, during the year 2020-21, almost 15 NTPC station supplies Fly Ash to various Road projects and Ash utilization crossed by nearly 20 million tonnes. Over the last five years the fly ash utilisation has grown up by 80% in the country.

## Isgec Heavy Engineering Secures Order for Waste-To-Energy Boiler

Isgec Boiler Manufacturing & Piping division recently secured the order from Hitachi Zosen Inova, Switzerland for the Slough Multifuel Project in Slough, Berkshire, UK. Each of these boilers will have a capacity of 660 tpd.

This is the second order that Isgec has received from Hitachi Zosen Inova. The boilers will be manufactured to EN standards. The broad scope of the order includes detailed engineering, manufacturing and supply through Mundra Port on FAS basis.

The waste-to-energy is a sustainable technology with a huge potential and Isgec is actively playing a constructive role in not just promoting it but executing it on the ground.

## Aegis Logistics, Royal Vopak to Form JV for LPG and Chemical Terminals in India

Aegis Logistics and Royal Vopak of the Netherlands have decided to join forces in India with the aim to grow together in the LPG, chemicals storage and handling business.

The new partnership, Aegis Vopak Terminals (AVTL), will operate a network of terminals that are currently located in five strategic ports along the east and west coast of India.

With a total capacity of around 9,60,000 cu mtr, the partnership will become one of the largest independent tank storage companies for LPG and chemicals in India. LPG is earmarked by the Indian government to provide cleaner and safe cooking fuels for households.

The partnership is well positioned for further growth, which targets mainly LPG and also chemicals and industrial terminal opportunities. This investment is another step for Royal Vopak towards its strategy to allocate capital to grow in gas markets.

This joint venture with Royal Vopak will accelerate the growth of Aegis Logistics





Vopak will acquire 24 percent shareholding in the Hindustan Aegis LPG entity. This is currently a joint venture between Aegis and Itochu. After the transaction, Aegis will own 51 percent and Itochu will continue to hold 25 percent.

Aegis will continue to retain 100 percent ownership of its Mumbai Liquid and LPG terminals and its LPG

in the terminals business and has the potential to allow Aegis Logistics to diversify into new areas of gas storage such as LNG and other energy projects including renewables, in partnership with the independent tank storage company.

The transaction is expected to close early 2022, subject to customary closing conditions. This transaction entails two separate legal entities that Vopak will simultaneously buy on the basis of joint control:

AVTL is an entity in which Royal Vopak will acquire 49 percent shareholding. Royal Vopak's existing CRL terminal entity in Kandla will become a wholly-owned subsidiary of Aegis Vopak Terminals.

Aegis Logistics' network of terminal assets at five different locations in Kandla, Pipavav, Mangaluru, Kochi and Haldia covering the west and east coast of India will be added to the JV asset base.

retailing business.

The enterprise value for Vopak's shareholding in the joint ventures will amount to EUR 200 million. In addition to a net consideration at closing of EUR 115 million, Vopak and Aegis have agreed the following -- a payment of a minimum EUR 18 million and up to a maximum of EUR 40 million payable to Aegis via a call and/or put option in 2025.

## CMPDI and CCL ink MoA for Development of Solar Power Projects



Sri S K Gomasta, Director (T/CRD/ES), CMPDI and Sri Manoj Kumar, Regional Director, RI-III, CMPDI

MoA was signed between Central Mine Planning & Design Institute (CMPDI) and Central Coalfields Ltd (CCL), Ranchi today for development of Solar Power Projects. This MoA will open a new path for CIL in becoming a Net Zero Energy company.

The MoA was signed by Sri A. K. Singh, General Manager (E&M), CMPDI and Sri V.K. Singh, General Manager (E&M), CCL.

Sri S K Gomasta, Director (T/CRD/ES),

CMPDI and Sri Manoj Kumar, Regional Director, RI-III, CMPDI. ■



## SPECIAL FEATURE

### Sourcing & Procurement

The capital goods industry is getting significant support from the Government through multiple initiatives and forecasted to reach 115.17 billion by 2025 from USD 92 billion in 2019. Indian engineering and capital goods sector offers the comparative advantage in terms of manufacturing cost, services and technology which makes India a preferred alternative destination for Sourcing & Procurement for the global industry. However, the buyers are highly cost conscious savings & re-evaluating their procurement processes to leverage digitalization to drive incremental value & savings. For this issue of CEW July edition our special segment on 'SOURCING & PROCUREMENT' sought views of industry leaders to understand the evolving trends and expectations from the vendors.

## “Foreign companies are more professional in fulfilling their commitments on time”



### Suneet Prakash

Head – Projects, Chemicals Division  
Grasim Industries Ltd.

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Suneet Prakash is a Senior Program and Project Management professional with 33 years of international experience in managing projects in Chemical, Infrastructure. He shares an overview of Procurement aligning with the current times with CEW in this special issue.

**S**peaking about procurement evolving in the last few years, it has gone digital in a big way and E-tendering and reverse auctioning have substantially cut down lead time in procurement and brought about greater transparency as well.

About our in house strengths of the organization of engineering and project management, we have in-house resources for process engineering. However we rely on outside consultants for detailed engineering and PMC

Some crucial criteria while choosing the new suppliers and expectations from vendors, suppliers and project

management services providers would be availability of skilled resources, past references (especially in our Group), after sales service, financial strength and costing.

Comparing Indian services vis-à-vis foreign partners and or organization's reliability from Indian suppliers, we always to prefer to sources services and supplies from Indian suppliers. Foreign companies are more professional in fulfilling their commitments on time.

Our organization has moved to e-procurement in a big way, while addressing the challenges at different levels. ■



## “Indian suppliers are our first preference because of their flexibility & customizations per need ”



### Rajesh Kumar Tripathi

Sr. VP- Projects & Engineering  
SRF Ltd.

Rajesh Kumar Tripathi is handling Project, Engineering and Purchase of SRF, Specialty chemical business. He shares his thoughts in an exclusive CEW segment about the changing field of procurement.

**I**n terms of how procurement has evolved in the last few years and its drive leading to incremental savings in the budget, it has focused a lot on standardization to reduce the design cost. Bulk ordering is also preferred that allows vendors to optimize the cost and pass on to us.

As a project owner we have aimed to strengthen in-house abilities of our organization's engineering and project management. We do all our procurement ourselves and dependency on external agencies are limited to execution drugs. Complete project management is done by in house teams. This shift has taken place slowly with time as our team got experience of it.

While choosing new suppliers we follow some important criteria like following the

detail evaluation system which mainly covers facility, financial strength, technical knowledge, market reference, service support and reliability of the products and taking feedback from the market.

On the basis of comparing the services of Indian vis-à-vis foreign partners, Indian suppliers are our first preference because of their flexibility and customizations per need. We go for imported items only when equivalent of it is not available in India. On the other hand, the plus point of imported item is the robustness of design.

Talking about moving to e-procurement and its challenges at different levels, our organization addressees them by adopting partly and in process to evaluate and increase it further. ■

## Indian Suppliers & Service Providers First



**B K Namdeo**

Advisor (Project)  
RRPCL

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It is true that for project of the magnitude of RRPCL, Suppliers, EPCs and Consultants across the globe will be involved, however first preference is to be given to the Indian suppliers & service providers not only for complying to the Atmanirbhar Bharat mission but also getting the quality local supplies and services. In case of over dimensional consignments, it is always better to source the items based on the ease of transportation and handling from the suppliers works to the site irrespective of the place of origin. B K Namdeo, Head Strategic Projects, Ratnagiri Refinery & Petrochemicals Corporation Ltd (RRPCL) shares his views





## **How has procurement evolved in the last few years & how does one drive incremental savings in the budget?**

Procurement is critical for the success of the business to procure the best quality goods or services procured, on time, at the most competitive rates. The concept of procurement has always been in existence. May be not in the same regulated way that it is now; but people and businesses have always had to purchase goods, material, and labour to complete projects. In the earlier days, procurement was limited to local purchasers only because of the limitations pertaining to the closed economy & various restrictions, lack of information about the availability of suppliers / service providers network globally, non-availability of Information & Communication Technology, Logistics issues in supply chain network, stringent or biased Commercial Terms and Conditions, fluctuating Taxes & Duties structure etc. These limitations resulted into leading the procurement process less competitive and gradually allowed the evolution of the current method of procurement due to liberalised economy.

Modern procurement functions operate cross functionally with a much larger array of activities than in the past, ranging from selecting suppliers, maintaining supplier relationships, developing company supply strategy, and forging

collaboration between suppliers and buyer organizations.

After opening of the economy in late 1990s, lots of opportunities were generated in the procurement fields as given below.

Procurement cycle has come down significantly on account of emerging communication & Information technology which has overcome geographical boundaries and distances.

Opening of Global access has resulted in availability of latest technology & services at competitive cost.

As a result of all the above developments, India has emerged as the manufacturing hub for production of various products and engineering goods. In short, availability of world class Goods & Services in India has resulted into a major shift in procurement methods especially for the execution of mega projects. Major EPC global payers have expressed their keenness to participate in the growth story of India and seek opportunities in executing large projects and providing services in India.

Traditional approach of executing the large projects through the EPCM / conventional mode has been taken over by EPC mode on account of ease in access to global goods, services & technology in addition to benefits like single point responsibility and minimum risk to the owner. This approach has helped the Owners in reducing the project cycle

time by involving major global players who are adding a value in the process of engineering and execution of the projects with the help of latest world class technology ensuring high standards of quality. Apart from savings in cost, Owner can get the major advantage of smaller project execution periods and early revenue generation from the investments. Simultaneously, reduced cycle time have been able influence the cost also positively in the favour of owners. There are other advantages in the form of savings accrued on account of competition due to global sourcing of supplies and services.

48 The following factors have the potential of cost saving:

Non-core areas always cost high to the owner compared to the professionals who have the expertise in these fields. Now a days business professionals put more focus on their core business and prefer to transfer their non-core activities to other agencies who has got expertise in those field which can help in reducing costs with a better quality. Thus, Owner gets cost advantage, quality service and has spare time to focus into their core areas.

Increase in the competitiveness by involving players across the globe which can substantially lower the cost with reduction in delivery time which will help in completion of project in shorter cycle.

Concept of life cycle evolution while procuring goods ensures continuity of

services and availability of spare parts at the optimum cost.

Because of faster communication, transportation and logistics, products can be easily and quickly available at all the corners of the world. By eliminating bigger inventory, there are not only savings of huge space but also there are drastic reduction of manpower cost, manhour savings and avoiding cost of obsolescence. In fact, now days there is change in strategy for maintaining inventory like JIT philosophy i.e., shifting of responsibility of maintaining inventory from owner to the suppliers.

Due to modularisation entire packages can be made ready at the suppliers' shop, tested and then dispatched in modules to the construction site. It saves the hassles of fabrication space, quality, time and other resources at site. The modules can be erected and assembled in a much better and precise manner leading to quality work within the reduced time.

**As a project owner, tell us about the in-house strengths of the organization of engineering & project management. To what extent does your organization rely on external services providers?**

Successful projects are usually the result of careful planning and the talent and collaboration amongst the project team. Ratnagiri Refinery and Petrochemicals Ltd. (RRPCL) is a joint venture company promoted by IOCL, BPCL and HPCL apart



from foreign companies namely Saudi Aramco (SA) & Abu Dhabi National oil company (ADNOC).

At present RRPCL has access to the talent pool of these companies who have rich experience in running the refinery, pipelines and marketing of HC products, project management- from concept to commissioning i.e., planning, contracts & procurement, designing & engineering, Safety, Quality, Inspection and Construction etc.

Many mega projects have been successfully executed by all the JV partners. Their experiences and learning from the past will be beneficial in taking right decision at the right time, implementation of new ideas bringing value to the project and life cycle of the plants. However, Consultants are engaged almost invariably as an extended arm for timely execution of projects maintaining high standards of quality and safety. For smooth implementation of large & complex projects typically through a no. of LSTK/EPC contractors, PMC provides management advice/guidance to clients in defining scope and interfaces of various agencies with increased precision. Also, PMC shares responsibility for the overall co-ordination and integration of scope responsibilities of all agencies engaged in the implementation of the entire project execution cycle. Depending on the nature of project, the responsibilities of the consultant cover all aspects from

the concept, design stage through to completion and handover for operations.

Following are the major advantages of engaging a consultant:

- Project execution in any organization is not a perennial activity and is carried out intermittently depending on organization growth and need. Therefore, organizations should not maintain a pool of manpower & resources related to project activities. Requirement of manpower & resources will be mobilized by PMC as an extended arm of Owner.
- PMC, having multiple exposures to project management activities across the globe, bring their experience in engineering, procurement and construction with them.
- Vast network and database maintained by PMC helps in locating the suppliers and service providers across the globe.
- Exposure to the requirements and the conditions of Global suppliers and service providers and accordingly, help in attracting international players for successful execution of the project.

**What is the most crucial criteria while choosing the new suppliers? Tell us your expectations from vendors, suppliers & project management services providers**

Suppliers play a critical role in helping

companies succeed. RRPCL is a large project where a no. of stakeholders will be involved for its successful completion utilizing the latest technology available, latest equipment within an optimised schedule etc. The success of the project will depend upon the performance of the stakeholders and hence their selection will play a vital role in success of the project.

In order to find the right ones, it is required to focus attention on a no. of critical factors wherein the Proven track record (PTR) is of prime importance. The domain of PTR includes experience and credentials w.r.t. technical, Commercial and financial capabilities apart from Quality, Reliability, and repeatability of performances. At the same time, it is desirable to see whether they can offer services at competitive prices and should operate in the expected Estimated Price band of the owner.

It is always worth making sure that supplier has sufficiently strong cashflows to deliver what we want, and when needed. A credit check will help reassure that they will not go out of business when we need them the most.

When the nature of the Contract and Services demand high quality of intellectual and managerial resources and the concern for quality dominates the interest w.r.t. saving the cost, Quality based selection (QBS) is also adopted for services. In this process the bidders having a defined experience/credentials

share their vision about the upcoming assignment/project.

### **Expectations from vendors, suppliers & project management services providers**

The success of any project is highly influenced by the performance of the suppliers/contractors entrusted with the responsibilities to deliver. Even the best planned projects may fail to meet their objectives if they do not perform to the best of their abilities at the required moments.

Accordingly, Vendors/ Suppliers/ Project management service providers are expected to comply to the following:

- Fair and Competitive bidding
- Superior quality of the product or service to be provided
- Honouring the contract in letter and spirit both
- Ability to meet delivery schedules.
- Continuously upgrade themselves to bring new innovation into the delivery package

### **How do you compare the services of Indian vis-à-vis foreign partners? To what extent does your organization rely on sourcing from Indian suppliers?**

Companies should consider these pros and cons when deciding between international or local sourcing as there is no one-size-fits-all solution. Whether international or domestic, making the right decision is vital for supply chain success.



It is true that for project of the magnitude of RRPCL, Suppliers, EPCs and Consultants across the globe will be involved, however first preference is to be given to the Indian suppliers/ service providers not only for complying to the Atmanirbhar Bharat mission but also getting the quality local supplies and services. In case of over dimensional consignments, it is always better to source the items based on the ease of transportation and handling from the suppliers works to the site irrespective of the place of origin.

While selecting the suppliers, it is to be ensured that quality, delivery, reliability is not compromised at all.

**Atmanirbhar Bharat Abhiyaan** or Self-reliant India campaign is the vision of new India envisaged by the Government of India. The aim is to make the country and its citizens independent and self-reliant in all senses. There is a need to introduce a specific clause for promoting local content in procurement so that it seeks supplies from the local vendors to give a boost to our country's mission of Atmanirbhar Bharat.

Accordingly, complying to the guidelines, Global tenders of up to a value of Rs. 200 crore will be restricted to participation from Indian bidders only. However, Technology sourcing contracts may be an

	International sourcing	Domestic sourcing
<b>Advantages</b>	<ul style="list-style-type: none"> <li>▪ Availability of state of art technology products/ services / suppliers at competitive prices.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Shorter lead time</li> <li>▪ Used to Local Conditions</li> <li>▪ Consumers prefer locally sourced products because they are more assured of the quality.</li> <li>▪ Strong relationships with local suppliers</li> </ul>
<b>Disadvantages</b>	<ul style="list-style-type: none"> <li>▪ Potential communication challenges</li> <li>▪ Managing long-distance and often complex supply chain</li> <li>▪ Need to consider foreign tax structure and political climate</li> <li>▪ Political and Administrative Instability</li> <li>▪ Shipping/ Logistics/ insurance Costs</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited resources available locally</li> <li>▪ Small suppliers with fewer economies of scale</li> <li>▪ Local government policies and exchange rates</li> </ul>

exception keeping the availability of the lesser no of Indigenous Suppliers and long term impact on efficiencies and life cycle costing.

**To what extent have you moved to e-procurement, what were the challenges at different levels and how did the organization address them?**

100 % procurement is being done by e-procurement system by us similar to our JV Partners IOCL, BPCL and HPCL.

Benefits of e-procurement:

**I. 100 % transparency in procurement process**

e -procurement system is a transparent procurement system ensures that all the team members as well as the suppliers have equal access to all system elements, including procurement methods, legislation, evaluation criteria, technical specifications etc.

**II. Increased Productivity**

The e-procurement is less time-consuming than traditional procurement. Having the records stored electronically makes it easier to submit reusable tenders and the process leads to increased productivity.

**III. Eliminating Paperwork**

With e-procurement, everything can

be saved and stored electronically. This not only saves space, it also makes the process of retrieval and archiving process simpler.

**IV. Increased Transaction Speed**

E-procurement is both time-saving and efficient. As the electronic handling of tasks supports and simplifies the purchasing process, transaction speed is increased.

**V. Reduced Errors**

Electronic paperwork is streamlined and thus easier to check for errors.

During implementation, following challenges were faced both from internal as well as external stakeholders:

- Training of working team dealing with Procurement
- Onboarding of vendors in e-procurement portal
- Vendor Registration in portal
- Online EMD fee payment
- Bidding Process
- Upgradation of existing hardware & software for the systems for handling big volumes of data

To address these issues, various awareness programs were conducted regarding e-procurement by conducting



training sessions in which both the internal as well as the external stakeholders were familiarized with:

- The e-tendering portal
- Methodology to register in the portal with Digital Signature Certificate,
- Types of bidding
- Bidding process on the portal and online payment of EMD
- Hand holding/ assistance to new users
- Helpline, preferably, round the clock to provide assistance

Various toolkits related to e-procurement are also made available on the portal.

**Please share insights into some of the key projects of your organization.**

Ratnagiri Refinery and Petrochemicals Limited (RRPCL), is a joint venture of M/s Indian Oil Corporation Limited (IOCL), M/s Hindustan Petroleum Corporation Limited (HPCL) and M/s Bharat Petroleum Corporation Limited (BPCL) and intends to set up a mega refinery-cum-petrochemical complex on the West Coast of Maharashtra to cater to the growing fuels and petrochemical requirements of the country. Also, Saudi Aramco (SA) and Abu Dhabi national Oil company (ADNOC) have signed an MoU for sharing 50 % of the project cost as JV partners.

This integrated refinery and petrochemical complex of about 60 MMTPA capacity, targeting petrochemicals to the tune of 25%, was conceived based on the requirement of about additional 75 MMTPA of Refinery Capacity by 2030, as identified by PPAC, to ensure energy security of the country.

A Configuration Study for RRPCL has been done considering supply demand gap for fuel products as per PPAC report published in Jan 2018. For petrochemicals products, the demand supply analysis was done through a reputed International Consultant subsequently.

Other project related activities are continuing and at the same time, RRPCL is pursuing with the State Govt for allocation of 15,000 Acres of land on priority in line with the site feasibility report. ■

# Emerging Prospects of C1 Chemistry Driven Expansion of Chemical Industry in India



**Jayant D Divey**

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**N**atural Gas (NG) has huge proven reserves estimated at 206,000 km<sup>3</sup> which are expected to last for 150 years or more. C1 Chemistry based on NG is well advanced to make several products through reactions initiating from Synthesis Gas. Most of these products are precursors for host of important derivatives for example methanol, methyl formate, acetic acid, acetic anhydride, vinyl acetate, iso-propanol, ethylene, propylene and gasoline to name few key chemicals. India stands on a critical cross road to decide to move forward based on either entirely on imported petroleum oil or combination of petroleum and natural gas. It has never been brighter for India than

present times to adopt the combination strategy that is blend of petroleum and natural gas to remain flexible as well as versatile in future. This strategy will also insulate India to a considerable extent from volatility of petroleum pricing. Besides, major countries with large surplus reserves are geographically close to India which is a logistics advantage. C1 Chemistry is a bright star on the horizon for Indian chemical industry!

In recent years Natural Gas (NG) and C1 Chemistry have been the buzz words in Chemical Process Industry (CPI) for quite some time. Both are well known chemical entities for years. The three primary fossil fuels have been petroleum or crude oil



in liquid form, natural gas in gaseous form (though transported and stored as liquefied NG) and coal in solid form. They are source of primary energy as well as source of myriad chemicals for human application and utility. The estimated proven reserves of these also exist in same ascending order that is petroleum will last the shortest and coal will last the longest while natural gas will last in between them. The estimates keep on varying but it is safe to assume that petroleum is expected to last at least between 50 to 100 years, natural gas between 100 to 150 years and coal between 150 to 200 years.

The chemistry related to these fossil fuels has been fairly well developed over the last hundred years and the efforts are still continuing. The development spans from chemistry to commercial or industrial scale operation. Finally it is the economics of process technology which dictates the viability of commercial operation.

Few observations are strikingly noteworthy from the Table 1.

Russia alone has approximately 25 % of the estimated global reserves of 206,000 km<sup>3</sup>

50 % Reserves are shared by top three nations (Russia, Iran and Qatar)

Next eight nations make up for another 30 % reserves implying that top 11 nations possess 80 % of global NG reserves

Balance 20 % reserves are shared by some 100 nations. Thus the table clearly indicates the emerging centres of CPI based on NG

**Chemicals from Natural Gas:** Natural Gas or NG is primarily methane. As a fuel, methane is only next to hydrogen. NG however, is not only source of energy but also source of C1 chemicals.

Table 1: Estimated Proven Natural Gas Reserves in km <sup>3</sup> in 2018				
Rank	Nation	Reserve	% Reserve	Cummulative Reserves
1	Russia	47805	23.2	23.2
2	Iran	33721	16.4	39.6
3	Qatar	24072	11.7	51.3
4	USA	15484	7.5	58.8
5	Saudi Arabia	9200	4.5	63.2
6	Turkmenistan	7504	3.6	66.9
7	UAE	6090	3.0	69.8
8	Venezuela	5740	2.8	72.6
9	Nigeria	5475	2.7	75.3
10	China	5440	2.6	77.9
11	Algeria	4504	2.2	80.1
12	Nations with > 1000 km <sup>3</sup>	28645	13.9	94.0
13	Nations with > 100 km <sup>3</sup>	9620	4.7	98.7
14	Rest of the World	2700	1.3	100.0
	<b>World Total</b>	<b>206000</b>	<b>100.0</b>	

Natural Gas or methane is the major source of hydrogen production.

Steam reformation of methane or NG is the most widely used industrial route to produce mixture of CO and hydrogen which is called Synthesis Gas (SYN Gas) which becomes the starting point for several reactions as outlined later in this article. Steam reformation reaction proceeds as follows:

$\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2 \dots\dots\dots + \Delta H$   
 $= 206 \text{ KJ / mol}$  --- Steam Reformation of Methane

$\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2 \dots\dots\dots - \Delta H =$   
 $41 \text{ KJ / mol}$  -----Water Gas Shift Reaction

$\text{CH}_4 + 2 \text{H}_2\text{O} \rightarrow \text{CO}_2 + 4\text{H}_2 \dots\dots\dots +$   
 $\Delta H = 165 \text{ KJ / mol}$  (Net Endothermic Reaction)

First reaction of steam reformation produces Synthesis Gas (SYN GAS). Steam reformation reaction is followed by water gas shift reaction to produce hydrogen. Hydrogen is used for manufacturing ammonia and carbon-dioxide  $\text{CO}_2$  is used for producing urea.

**Hydrogen Production:** Hydrogen has two main applications; one is for the production of ammonia and other for hydrogenation processes in refinery for example in hydrotreaters and hydrocrackers. Besides, it is used in hydrogenation of edible oils and many reduction reactions.

Global ammonia production is of the order of 235 million metric tons per year as per the recent data available in public domain. Thus 45 to 50 million metric tons of  $\text{H}_2$  per year is consumed by ammonia synthesis.

Almost equal amount of  $\text{H}_2$  is used for other purposes as mentioned above making it to about 100 million metric tons per year.

There is also the consideration of  $\text{CO}_2$  emission. Whenever  $\text{CO}_2$  is captured or used subsequent to  $\text{H}_2$  production in making urea or for many other products, it does not pose much environmental problem. When  $\text{CO}_2$  has to be let to atmosphere in absence of any downstream application, then  $\text{H}_2$  produced is termed as GREY  $\text{H}_2$ . When  $\text{CO}_2$  is captured for downstream applications either directly or through storage, then  $\text{H}_2$  produced is called BLUE  $\text{H}_2$ . In both these cases,  $\text{H}_2$  is produced by using fossil fuel like NG by consuming conventional energy.

$\text{H}_2$  production by using neither fossil fuels like NG nor using conventional energy, is called GREEN  $\text{H}_2$ . For example hydrogen production by electrolysis of water by using non-conventional renewable energy like solar power is a topic of great interest and research for future development. But at present only about 5 %  $\text{H}_2$  is produced by such methods. So there is a long way to go on this route. Till such time for few decades until this route becomes economically promising, viable and sustainable, the attention has been

**Table 2: Direct Conversion of CO - Hydrogenation of CO**

No	Reaction	Product
1	$\text{CO} + 2 \text{H}_2 \rightarrow \text{CH}_3\text{OH}$	Methanol
2	$2 \text{CO} + 2 \text{H}_2 \rightarrow \text{CH}_3\text{COOH}$	Acetic Acid
3	$2 \text{CO} + 2 \text{H}_2 \rightarrow \text{HCOOCH}_3$	Methyl Formate
4	$2 \text{CO} + 4 \text{H}_2 \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{H}_2\text{O}$	Ethanol
5	$3 \text{CO} + 6 \text{H}_2 \rightarrow \text{C}_3\text{H}_7\text{OH} + 2 \text{H}_2\text{O}$	Iso Propanol
6	$4 \text{CO} + 8 \text{H}_2 \rightarrow \text{C}_4\text{H}_9\text{OH} + 3 \text{H}_2\text{O}$	Iso Butanol
7	$2 \text{CO} + 4 \text{H}_2 \rightarrow \text{C}_2\text{H}_4 + 2 \text{H}_2\text{O}$	Ethylene
8	$16 \text{CO} + 33 \text{H}_2 \rightarrow \text{C}_{16}\text{H}_{34} + 16 \text{H}_2\text{O}$	n-Hexadecane (Representative for Fischer Tropsch Reaction)

Methanol →  
Olefins

Methanol →  
Aromatics

Methanol → Fine  
Chemicals

Some of the key  
reactions are  
presented in  
Table 2.

focused on CPI based on C1 chemistry.

Therefore let us look at the various options presented by C1 or NG based chemistry and their commercialization in a big way. This has started shaping up commercially fairly quickly and with certain degree of certainty.

### Chemicals from SYN GAS & Methanol:

Synthesis Gas (SYN GAS) or CO + H<sub>2</sub> is the major source of some very important reactions as under.

Thus one can note that some of the very important precursor chemicals are produced via synthesis gas route like methanol or methyl formate.

How versatile is methanol can be seen from Table 3 below.

While all the above reaction products from MeOH route are important and have wide applications; MTG or MTO are particularly

CO + H<sub>2</sub> → CO or  
H<sub>2</sub>

CO + H<sub>2</sub> →  
Carbonylation

CO + H<sub>2</sub> →  
Hydroformylation

CO + H<sub>2</sub> → Fischer  
Tropsch Reaction  
Products

CO + H<sub>2</sub> → Methyl  
Formate

Methanol →  
Gasoline

**Table 3: Chemicals from Methanol Carbonylation**

No	Reaction	Product
1	$\text{MeOH} + \text{CO} \rightarrow \text{CH}_3\text{COOH}$	Acetic Acid
2	$\text{MeOH} + \text{CO} \rightarrow \text{HCOOCH}_3$	Methyl Formate
3	$\text{MeOH} + \text{CO} \rightarrow \text{CH}_3\text{COOCH}_3$	Methyl Acetate
4	$\text{Methyl Acetate} + \text{CO} \rightarrow \text{Acetic Anhydride}$	Acetic Anhydride
<b>Oxidative Carbonylation</b>		
5	$\text{MeOH} + \text{CO} + \text{O}_2 \rightarrow \text{Dimethyl Carbonate}$	Dimethyl Carbonate
6	$\text{MeOH} + \text{CO} + \text{O}_2 \rightarrow \text{Dimethyl Oxalate}$	Dimethyl Oxalate
<b>Reductive Carbonylation</b>		
7	$\text{Acetic Acid} + \text{CO} + \text{H}_2 \rightarrow \text{Propionic Acid}$	Propionic Acid
8	$\text{MeOH} + \text{CO} + \text{H}_2 \rightarrow \text{Acetaldehyde} + \text{Ethanol}$	Acetaldehyde
9	$\text{Methyl Acetate} + \text{CO} + \text{H}_2 \rightarrow \text{Vinyl Acetate}$	Vinyl Acetate
10	$\text{Methyl Acetate} + \text{CO} + \text{H}_2 \rightarrow \text{Ethyl Acetate}$	Ethyl Acetate
<b>Other Chemicals</b>		
11	$\text{MeOH} \rightarrow \text{Olefins (MTO)}$	Ethylene, Propylene
12	$\text{MeOH} \rightarrow \text{Gasoline (MTG)}$	Gasoline



significant milestones. Gasoline which is important fuel product of petroleum refinery can be produced from MeOH. Similarly, ethylene and propylene are key precursors for host of downstream products like polyethylene, polypropylene, ethylene glycol, propylene derivatives. These large volume derivatives of refinery – petrochemicals integration can be produced by MeOH route. Both these reaction routes that is MTG and MTO, have been commercially proven attractive proposals with high selectivity, high yield and high energy efficient operation [2].

**Indian Scenario** – India has very little share of proven reserves of NG with bleak future prospects of new finds. India also imports almost 90 % of petroleum required to operate its current refining capacity of 250 Million Metric Tons per Year (MMTPY). Government of India has announced intentions of expanding refining capacity to 450 MMTPY by 2030 which will again be fed by imported petroleum oil. India stands on a critical cross road to decide to move forward based on either entirely on imported petroleum oil or combination of petroleum and natural gas. It has never been brighter for India than present times to adopt the combination strategy that is blend of petroleum and natural gas to remain flexible as well as versatile in future. This strategy will also insulate India to a considerable extent from volatility of petroleum pricing. Besides, major countries with large surplus reserves are geographically close to India which

is a logistics advantage. C1 Chemistry is a bright star on the horizon for Indian chemical industry!

### Suggested Readings

1. US Energy Information Administration, International Energy Statistics, Jan 2019 (Accessed)
2. Gogate, Makarand R; "Methanol to Olefins process technology: Current status and future prospects", Petroleum Science & Technology, 2019, Vol. 37 (5) pp 559-565. ■

# Halar® ECTFE Dual-Laminate Stack For A Sulphuric Acid Plant



ECTFE dual-laminate part of the stack during the lamination process

The modernization of a sulfuric acid plant in Talara, Peru by PH Technology (Spain) also included the design and manufacture of this acid-resistant stack made with ECTFE dual-laminate from AGRU Kunststofftechnik.

**Distributor:** Agruquero

**ManufactureProject:** Manufacture of a OD 1600 mm ECTFE dual-laminate stack with a height of 46 m

**Product:** 2.3 mm ECTFE SK+ fabric backed sheets, ECTFE welding rod and ECTFE cap-strips

**Medium:** Sulphur Dioxide (SO<sub>2</sub>), Sulphuric Acid (H<sub>2</sub>SO<sub>4</sub>)

**Design pressure:** -0.1 to +0.1 bar relative to ambient pressure

**Design temperature:** 110 °C

**Manufacturer:** PH Technology (Spain)

## About the ECTFE liner project



Finished ECTFE/FRP dual-laminate part

The purpose of this project was the construction of a stack within a sulphuric acid plant in a refinery in Talara, Peru. By processing the flue gases, the formation of highly aggressive media such as SO<sub>2</sub> and H<sub>2</sub>SO<sub>4</sub>, can occur. Since these media are very corrosive to metals and many other plastics, a dual-laminate solution using **Halar® ECTFE liner material and fibre reinforced plastic (FRP)** was chosen.

Applications made of fibre-reinforced plastic are lined with fabric backed sheets to maintain chemical resistance and leak-tightness. Like an ECTFE piping system, the stack is also equipped against most aggressive media. The FRP ensures the compressive and mechanical strength. This ensures safe operation of the system (even under vacuum).

### Halar® ECTFE as a lining material

Halar® ECTFE possesses a unique combination of properties that are the

result of its chemical structure, which consists of a copolymer with ethylene and chlorotrifluoroethylene arranged alternately. Halar® ECTFE has an excellent chemical resistance and shows almost no property changes over a wide range of temperature. Furthermore, Halar® ECTFE is known for its good permeation barrier, which ensures, together with the highly chemical resistant fabric backing system "SK+", the durability and longevity of the bonding strength in dual-laminate applications.

## Welding training at AGRU Bad Hall



Hot-gas welding of ECTFE fabric backed sheets

AGRU was able to carry out a welding training with the staff from PH Technology and Agruquero who was in charge of the project. The main focus of the AGRU welding experts, who are certified according to DVS (German Association for Welding), was the processing of Halar® ECTFE. In addition, the design



and implementation of the project was discussed in detail.

## The solution and its design

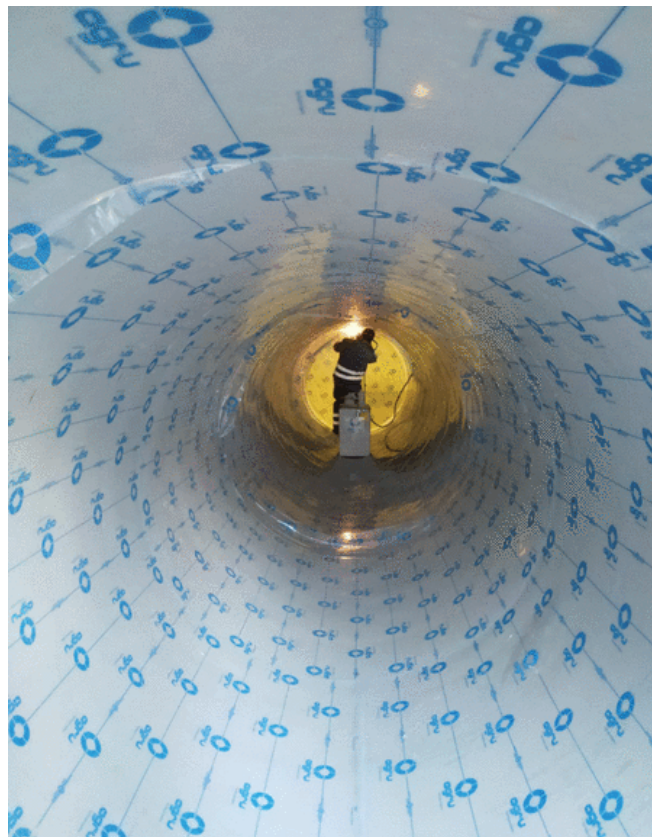


ECTFE sheets including a conductive element in the welding area

The stack was constructed out of five parts installed via flange connections. For the subcomponents within each part, 2.3 mm ECTFE fabric backed sheets were bent and hot-gas welded as shown in Figure 3. After this first step, the cylinders have been laminated with fibre-reinforced plastic. During this process a conductive element had to be placed in the welding area which was later used for spark testing to ensure the leak-tightness of each weld seam (Figure 4). Subsequently, the cylinders were aligned to each other, welded and laminated.

### Advantages of ECTFE SK+ fabric backed sheets and dual-laminate constructions

ECTFE has an excellent chemical resistance to both alkaline and acid solvents



FRP Stack from the inside

- ECTFE shows almost no property changes over a wide temperature range of up to 140 °C
- ECTFE is known for its good permeation barrier for many chemicals
- The excellent chemical resistance of the SK+ fabric backing system ensures the durability and expected lifetime of the dual-laminate construction
- In general dual-laminate applications are suitable for operation temperatures of up to 180 °C (depending on material and chemical), even under vacuum. ■

## HRS Heat Exchangers acquired by Exchanger Industries Limited



**Exchanger Industries Limited (EIL), the Canadian market leader and globally recognised designer and manufacturer of heat transfer products for the energy, petrochemical, industrial and clean power generation sectors, has acquired HRS Heat Exchangers Ltd (HRS). Financial terms have not been disclosed.**

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HRS is a specialist global supplier of heat exchangers and custom process systems across the environmental, food, beverage, chemical and pharmaceutical sectors. The acquisition by EIL creates new opportunities by combining HRS's capabilities and market sectors with EIL's accelerating expansion into power generation, Liquefied Natural Gas (LNG), renewable energy, power storage and biofuels applications. The combined business is positioned to create market growth by providing its customers with environmentally sustainable heat exchange solutions. The seasoned HRS management team will be retained by EIL and will play a critical role in executing plans for robust international expansion afforded by the strategic combination of two distinct, yet complementary industry leaders.

Mark el Baroudi, CEO of EIL, stated: "For decades, we've worked hard on behalf of our customers in Canada, the U.S. and 25 countries worldwide, consistently providing them with mission-critical, innovative solutions in some of the most demanding environments," stated Mark el Baroudi, EIL's CEO. "The HRS acquisition will provide numerous benefits to our customers including a broader capability to provide heat transfer solutions to environmentally sustainable projects in the biogas and wastewater treatment sectors, in addition to EIL's existing projects in clean power generation, Liquefied Natural Gas (LNG), emissions-free power storage and biofuels applications."

To deliver these projects competitively, the acquisition provides EIL immediate access to a cost-effective global footprint with scalable hubs in both India and Spain, and a combined portfolio of anti-fouling technologies that enhances differentiation and acts as a unique platform to create value for customers.

Additionally, Mark el Baroudi stated that the acquisition of HRS Heat Exchangers provides EIL an extraordinary opportunity to expand their exposure to an impressive

international customer base across rapidly growing geographic market positions in the U.S., U.K., Spain, Mexico, India, the Middle East, Malaysia, Australia and New Zealand. As evidence of this opportunity, HRS was ranked number 161 in U.K.'s prestigious Sunday Times HSBC international top league table that tracks the international growth of U.K. based companies.

Steven Pither, founder and CEO of HRS, said: "We're thrilled to join the EIL family and continue our journey to building a highly respected global supplier of heat transfer products. Leveraging EIL's expertise in designing innovative heat transfer systems, and their established track record in creating streamlined, highly efficient business processes will allow us to enhance our product offering and effectively scale our Spanish and Indian manufacturing operations; delivering timely, cost effective solutions to our customer base around the world. We are confident that this will drive growth to the next level."

"Our combined manufacturing capability and leading-edge product technologies will strengthen our value proposition and increase market penetration internationally," continued el Baroudi. "In short, this acquisition combines the capabilities of both parties to enhance an already differentiated market position. It creates better outcomes for everyone we serve." ■

# CHEMICAL ENGINEERING WORLD

Dynamic Platform  
to  
Connect with Chemical  
Industry Ecosystem

Direct Reach  
to  
**>200,000 Readers**  
across  
**>25 countries**

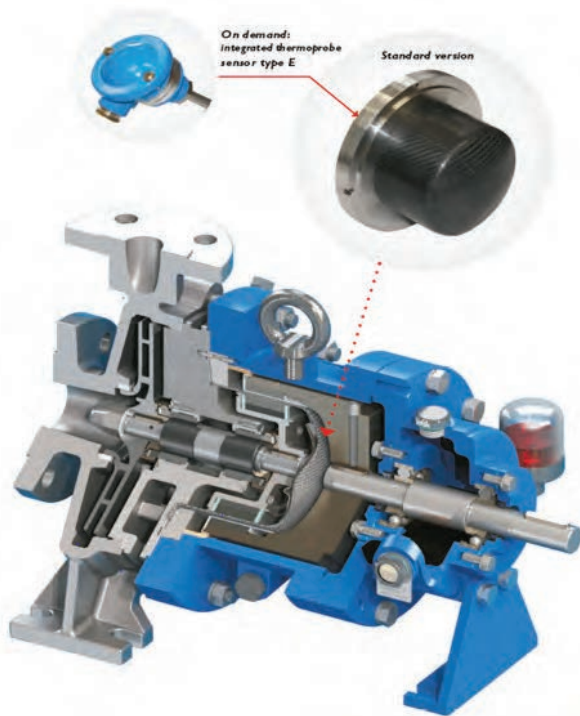
[sales@jasubhai.com](mailto:sales@jasubhai.com)

[www.jasubhaimedia.com](http://www.jasubhaimedia.com)





## "Hybrid Technology" (a Patented Solution)



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In a Mag-drive Pump, the heat produced by the eddy current (Foucault) in the rear shell area, is partially dissipated by the pumped liquid that circulates in the path between the rear shell internal wall and inner magnet external area, and partially by the air that circulates between the external magnet internal face and rear shell external wall.

Based on an accurate test, the results of these two thermal flows were measured to be around 60/40 ratio. It is evident that the "refrigeration" fluid has to move through a narrow section and for this reason the flow depend on the  $\Delta P$ .

It is to consider also the viscosity and the rotation speed. Liquid movement is helical.

Based on what said above, we know that the thermal flow increases linearly with the rear shell thickness, considering a fixed selected material, the temperature difference between the internal and external rear casing surface will increase, when increasing rear shell thickness.

Moreover, we have to consider that normally the materials used to fabricate the rear shell are Hastelloy®C276 or Titanium and both materials have a bad thermal conductivity ( Compared to brass Titanium is about 54 times worse, and HC®276 about 44 times worse).

Based on that it is easy to understand the importance to reduce, as much as possible, the rear shell thickness.

In order to verify it, M Pumps conducted a number of tests, using the new patented rear shell "Hybrid" compared with a traditional rear shell used by the competitors.

The Hybrid is composed by a rear shell in Hastelloy®C276 with reduced thickness but in conformity with API685 standard. This one is inserted into another rear shell made of a special fiber carbon composite.

HYBRID 0,5 kW			STANDARD 1,5 kW		
$Q_{mc/h}$	$H_m$	$TCP_{(°C)}$	$Q_{mc/h}$	$H_m$	$TCP_{(°C)}$
15	51,3	31,5	15	51,3	56,8
20	51	31,6	20	51	56,4
30	48,6	31,8	30	48,6	55,6
40	44,9	31,9	40	44,9	55,7
50	39	32	50	39	55,7
60	31,7	32,2	60	31,7	54

The standard rear shell is made of Hastelloy®C276 with a thickness of 1,5mm.

It has a built in micro temperature sensor in between the two rear shells (Hybrid) in the area that correspond to the internal magnet location.

We installed, on the standard metallic rear shell ( $S=1,5\text{mm}$ ), another temperature micro sensor.

The magnetic coupling we used, for this test was the one for our pump size 50-200 ISO 2858, our type B1- B1.

This are the results of the magnetic losses measured at 2960 RPM:

The water used for the test had an inlet temperature of  $30,2^\circ\text{C}$ . Measured temperature table in both cases.

These tests show clearly that using the "Hybrid" the temperature increased maximum  $2^\circ\text{C}$  while using the traditional rear shell in HC276 temperature increased up to  $27^\circ\text{C}$ .

It is evident that the "Hybrid" is a safe solution that prevents possible liquid flashing inside the pump and it is considered as the best solution for

condensate liquids.

The Hybrid is in conformity with API685 standard that allows a corrosion limit of 0,3mm.

As stated above the flow of the liquid that circulates in between the internal magnet and rear shell is fixed. If the process requires higher pressures, for the pump body is easy, just simply change the material to withstand the pressure, but the rear shell thickness must be increased.

Increasing rear shell thickness, means increasing the magnetic losses and as the flow through the internal magnet / rear casing is fixed, we will have a temperature increase.

In case where the process requires higher pressure, by using the Hybrid, the internal metallic side will still always have the same thickness while the external side in fiber carbon will be modified to withstand the pressure conditions. In these conditions there will not be a temperature increase inside the pump. ■

#### For more information

[www.shanbhags.com](http://www.shanbhags.com)  
[info@shanbhags.com](mailto:info@shanbhags.com)

## Determining Design Pressure and Temperature Limits for a New High-Speed, Very High Pressure Steam Turbine Casing

Paul Smith, Elliott Group, USA discusses how steam turbine casing analyses were used to create pressure and temperature limit maps to evaluate a new casing model for applications that require high speeds and very high pressure (VHP) inlet steam conditions. The R1420ES steam turbine casing is intended for applications that require high speeds and very high pressure (VHP) inlet steam conditions. Although the R1420ES casing can be used in other applications, it is primarily intended to drive compressors in ethylene service.

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**T**o ensure safe and reliable operation, steam turbine casings must have acceptable stresses and maintain sealing when subjected to internal pressures and temperatures. To show that turbine casings are acceptable, analysts conduct structural evaluations using finite element analysis techniques.

Finite element analyses of the main casing and steam chest determine stresses and sealing of the casing horizontal split-line and steam chest cover during normal operation. Sealing evaluations consider the sealing capabilities of the bolted joints when the casing is subjected to

internal steam pressure and include the effects of bolt stress relaxation at elevated temperatures, joint contact surface separation, and penetration of the internal pressure into the sealing surface. Acceptance criteria for the bolted joint sealing is based on the minimum width of the contacting surface and the minimum joint contact pressure

In this case study, Elliott Group, in collaboration with Design Automation Associates (Windsor Locks, CT, USA), conducted a series of analyses using several casing models to create pressure and temperature limit maps that plot maximum allowable working pressure



(MAWP) versus maximum allowable working temperature (MAWT). The maps provide a tool to quickly and easily determine the acceptability of a casing for a particular application and were used to evaluate a new casing replacement model.

## Materials and Methods Overview

Several analysis techniques were used to establish the design limits for a steam turbine casing. The equipment evaluated was a steam turbine design that consists of a main casing, a steam chest, and four crossover pipes that connect the steam chest to the main casing (Figure 1). Inlet steam is supplied to the four nozzle banks of the main casing by exterior crossover piping. Finite element analyses were conducted first to ensure the design would meet a specific set of pressures and temperatures, and then additional analyses were conducted to determine the design pressure and temperature limits.

Thermal analyses applied temperatures and convection coefficients to determine the temperature gradients through the finite element models. Figure 2 shows an example of the steady state thermal results. Structural analyses were conducted by applying the thermal loads from the thermal analyses, pressures at various locations, and pipe loads to simulate the operating loads on the turbine. The stress results were evaluated against allowable stress, and split-line

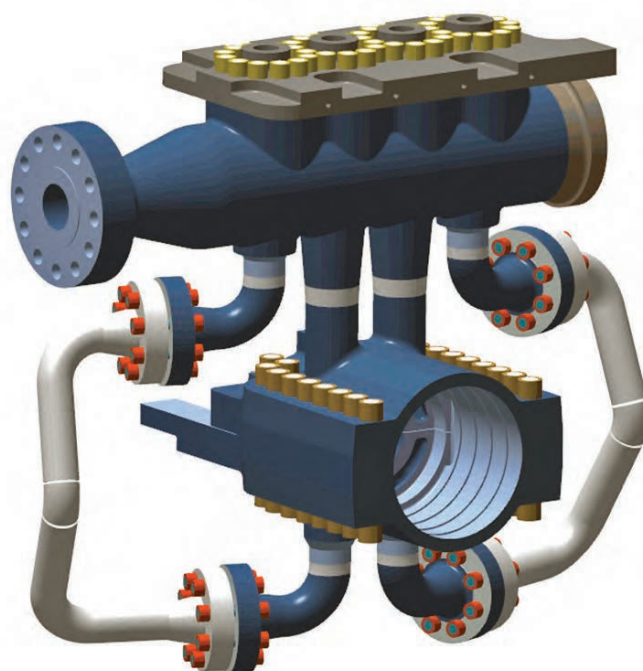


Figure 1. R1420ES Steam Turbine Casing.

contact element results were evaluated against sealing acceptance criteria to determine the temperature and pressure limits for the turbine. Four sets of analyses were conducted on the separate components of the turbine using models of the main casing, steam chest, pipe flange, and an overall representative model to evaluate the crossover pipes. The turbine main casing was analyzed to evaluate stresses and split-line flange sealing. The steam chest model was used to evaluate stresses and steam chest cover sealing. Both the main casing and steam chest models were evaluated for internal steam pressure and temperature.

The analyses followed the requirements of the American Petroleum Institute API Standard 612 ("Petroleum, Petrochemical, and Natural Gas Industries – Steam Turbines – Special-purpose Applications,"

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 Temperature - All  
 Type: Temperature  
 Unit: °F  
 Time: 1  
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1018.9 Max  
 986.02  
 953.09  
 920.16  
 887.23  
 854.3  
 821.37  
 788.44  
 755.52  
 722.59 Min

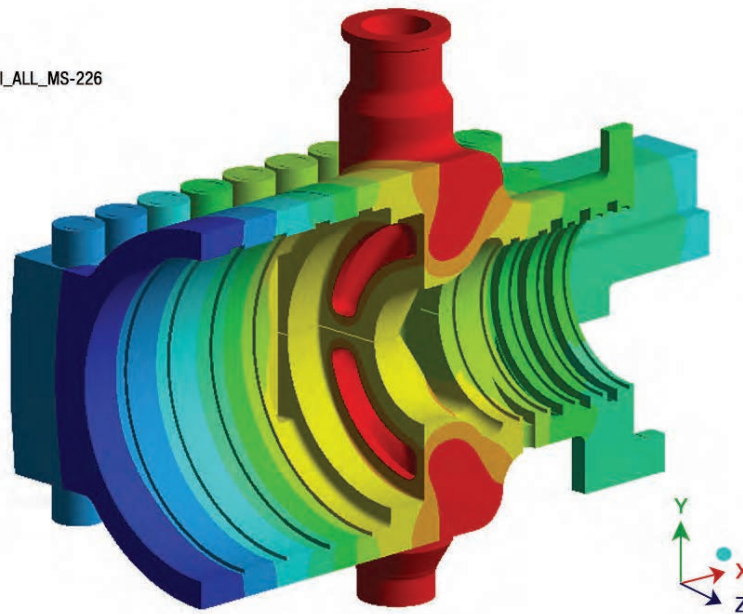


Figure 2. Typical steady state thermal results for main casing.

limits or stress limits. The combination of all curves allows for the most cost-effective selection of materials and bolt preloads for any anticipated MAWP and MAWT. Figure 3 shows a typical design limit map.

### Adaptable and Cost-Effective Casing

Elliott used the analysis techniques described

to evaluate a new steam turbine casing, the R1420ES, which was recently added to its fleet of steam turbines for industrial applications (Figure 1). Building on the successful implementation of its N1820E and N1820ES models, Elliott incorporated many of the same principles in the R1420ES design. The N1820E and N1820ES are larger casings with higher flow rates that produce more power than the R1420ES. Both the N1820E and N1820ES are designed to be used as cracked gas drivers in ethylene plants as well as other applications requiring high power and large steam flow. The R1420ES is intended for applications that require high speeds and very high pressure (VHP) inlet steam conditions. Although the R1420ES casing can be used in many applications, it is primarily intended for the ethylene plant market, where it would drive an ethylene

68 Seventh Edition) and the ASME Boiler and Pressure Vessel Code Section VIII, Div, 2. The crossover piping was evaluated for acceptable stresses following the requirements of ASME B31.3, Process Piping. Finally, a separate detailed model of the pipe flange was created and analyzed to evaluate the pipe flange sealing, using the loads from the crossover pipe analyses.

To develop a set of plots showing the limits of acceptability for each major component, analyses were conducted for a range of pressures and temperatures. The result is a series of design limit plots showing MAWP versus MAWT. Acceptability limits are presented as curves for each component, assuming a combination of casing materials, bolting materials, and bolt preloads. Each mapped curve shows the limits of use relative to either sealing

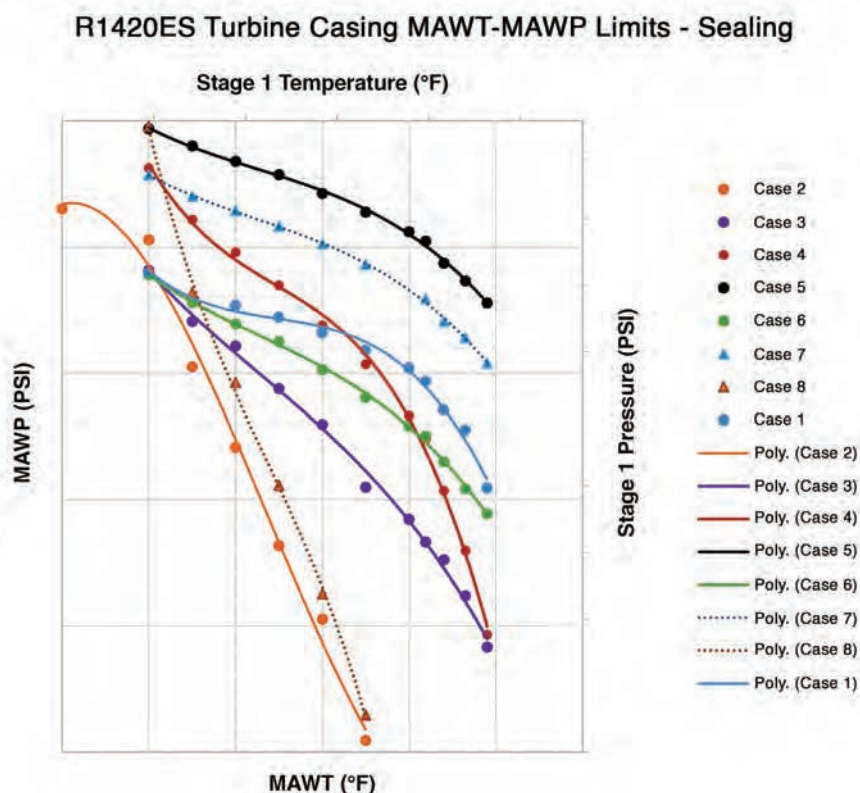


Figure 3. Typical MAWP/MAWT Acceptability Map for main casing sealing.

compressor. Other possible uses include as a generator set or in methanol and ammonia plants that use VHP steam, while also driving high-head compressors that require high speeds.

The R1420ES replaces Elliott's existing R1220 model, which only supplied steam to the casing top half (50% admission). The R1420ES has 100-percent admission and uses exterior crossover pipes to feed steam to the bottom of the casing. Crossover pipes eliminate the need for O-rings and special bolting to seal the internal steam path required to feed the casing bottom half.

The R1420ES casing design has a separate steam chest welded to the main casing.

This allows for two separate castings, making the casting process much more cost-effective and accurate with fewer out-of-tolerance dimensions. The design can handle a wide range of rotor blade base diameters and tip diameters. The casing uses four governor valves with either a bar lift or a cam lift, with two valves supplying steam to the top half of the casing, and two valves supplying steam to the bottom half of the casing.

The modular design can be paired with various bearing housings and connections to various extractions and exhaust ends. The steam end can be used with a condensing exhaust or in a backpressure machine. Depending on the temperature and pressure requirements, the turbine can be configured with different casing, steam chest, and pipe materials, and different stud materials for the main casing split-line studs, steam chest cover studs, and crossover pipe flange studs. This provides a very flexible, cost-saving design that only requires more expensive materials when absolutely necessary.

During the casing design process, Elliott conducted extensive thermal and structural analyses for normal operation and hydro-test conditions to determine



stress and sealing capacity to ensure that the casing would meet the pressure and temperature design targets. Transient thermal and structural analyses confirmed that the casing would operate properly during startup, cool down, and cold pipe conditions. Lift and turn analyses ensured that the casing could be lifted safely during maintenance operations.

To derive a set of design limit maps that show the casing MAWP and MAWT, Elliott performed several thermal and structural analyses with different temperatures, pressures, and material configurations. Multiple maps for different material configurations were developed for the major casing assembly components including main casing sealing, main casing stress, steam chest cover sealing, steam chest cover stress, crossover pipe stress, and crossover pipe flange sealing. Figure 3 shows a typical design limit map that can be used to determine optimum material combinations.

## Summary

Elliott Group, in collaboration with Design Automation Associates, conducted a series of analyses using several steam turbine casing models to create pressure and temperature limit maps that plot MAWP versus MAWT. The maps are a tool that can be used to quickly and easily determine the acceptability of a casing for a particular application. Elliott used this tool to evaluate a new casing design that has many advantages over other

steam turbine models. The R1420ES steam turbine has 100-percent admission for increased efficiency, and separate castings for the steam chest and main casing that allow for less expensive and more accurate castings. Multiple material options make the casing more cost-effective and tailorable to the specific application. ■

## Reference

- [1] American Petroleum Institute, August 2014, "Petroleum, Petrochemical, and Natural Gas Industries – Steam Turbines – Special-purpose Applications," API Standard 612, Seventh Edition.
- [2] American Society of Mechanical Engineers, ASME Boiler and Pressure Vessel Code (BPVC), 2019, Section VIII, Div. 2.
- [3] American Society of Mechanical Engineers, ASME B31.3, Process Piping.

**Bio :** Paul Smith is a Senior Engineer, Product and Technology, in Elliott Group's Research and Development group. His involvement with FEA began in 1981 when he worked for Westinghouse, first conducting seismic analyses for nuclear power plant equipment, and then conducting shock and vibration analyses for shipboard equipment for the US Navy. He joined Elliott in 1998 and is responsible for the development and analysis of steam turbines. He holds a B.S in Mechanical Engineering and is a registered Professional Engineer in the Commonwealth of Pennsylvania.



## Author

**Paul Smith**  
Elliott Group, USA

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



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

This mandate forced the process industries to use the conventionally known Zero Liquid Discharge Technologies, which use large Multiple Effect Evaporators that consume high amount of steam/ coal. Their capital expenditure is also very high

& at the same time their OPEX is also enormously high. So it was not possible for the small/medium sized industries to adopt this technology. Many industries still throw the dirty effluent water/ RO reject to open water sources/rivers thus polluting precious water or harm aqueous life.

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

MREPL is glad to announce that they have developed Mist Evaporation System (Natural evaporator) for Zero Liquid Discharge of RO Reject / Effluent, which use minimum utilities like steam/coal/ electricity. Effluent/RO reject is naturally evaporated by their unique patented technology of Mist creation with or without help of waste heat available in the plant. This helps the industry to adopt

this system at minimal OPEX compared to conventional system & even its first investment is about 50% or less in comparison to MEE.

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

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

and the effluent water starts concentrating.

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

Mist creator nozzles operate with a choke-less design as mist formation is achieved when water comes out in whirling motion through its bore of size more than 16 mm in diameter. Hence, MES can easily handle RO/Effluent water of TDS up to 40% concentration without any choking.

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## Technology of Mist Evaporation System

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

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

This ensures faster evaporation of water

## Mist Evaporation Effect:

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



## Mist Evaporation System for Zero Liquid Discharge :

Mist Evaporation System combines our unique Mist Cooling Technology with ambient Heat/ Solar plate effect to achieve Zero Discharge of Effluent / RO Reject. This unique system also can use waste heat available at the plant to heat the effluent on one side & evaporation is achieved through Mist Evaporation Tower on second side to achieve Zero Liquid Discharge with minimum use of energy.

### Salient features of MES over Conventional Systems (MEE/MVCM):

1. Minimal OPEX due to Natural Evaporation.

2. Lower CAPEX.

3. Entire operation happens inside a closed chamber only allowing pure water vapour to escape thus acting as a Natural evaporator.

4. Negligible maintenance due to choke less design of nozzles.

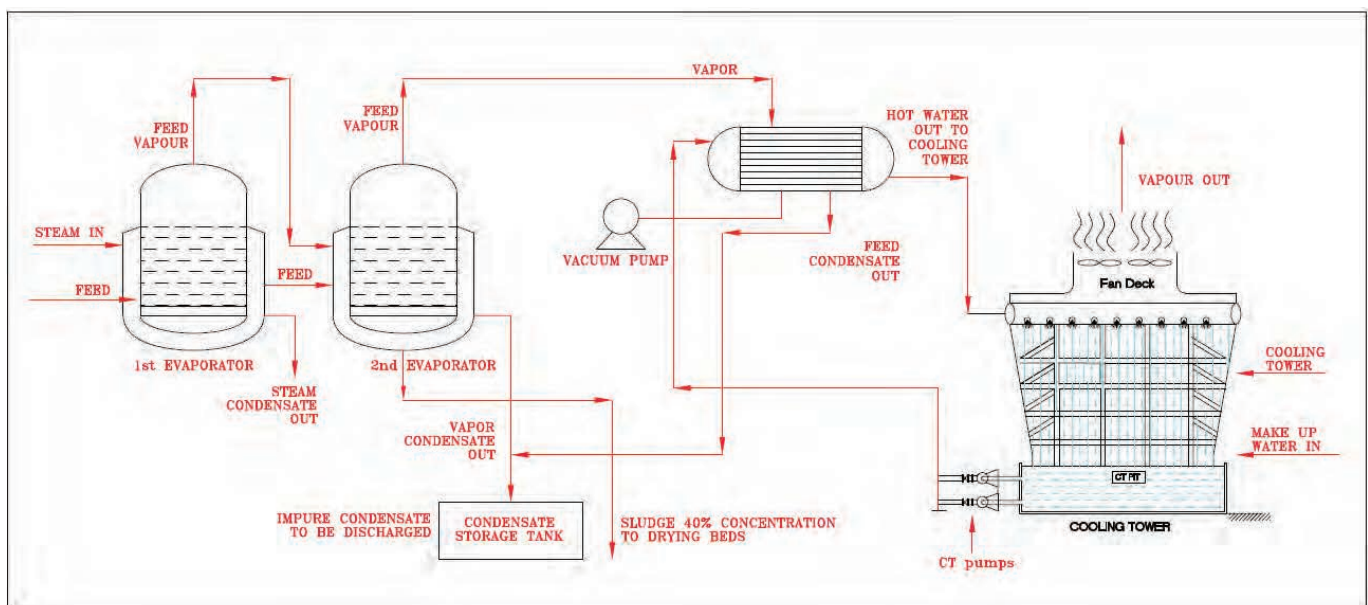
5. Vacuum and cooling system is not required.

6. No make-up water required.

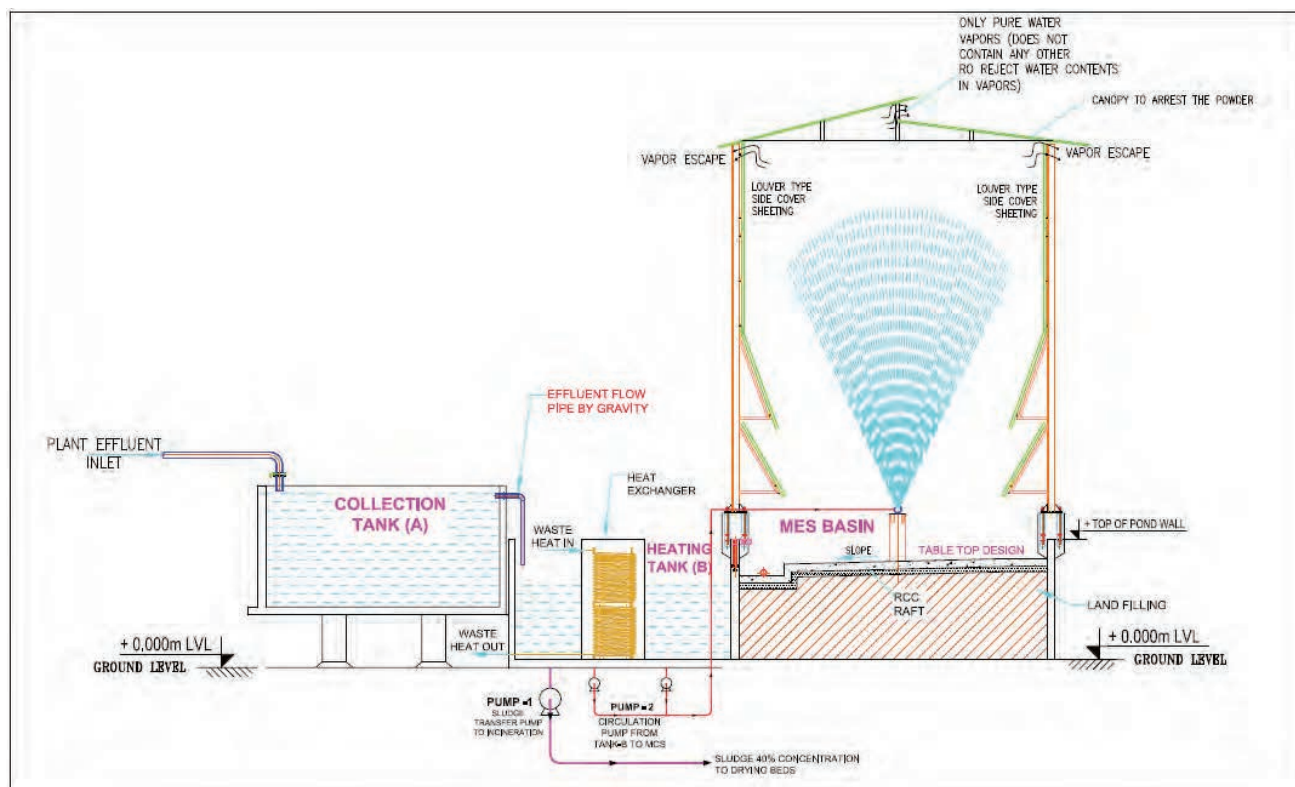
7. MES achieves complete zero liquid discharge as the process does not produce impure condensate which is generated by conventional MEE which is to be disposed.

8. Easy to operate.

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



A) Schematic Drawing For Conventional Multiple Effect Evaporator (Mee) System



74 B) Schematic Drawing For Mist Evaporation System For ZLD

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

Mes V/S Conventional Multiple Effect Evaporators With Various Options



## Types Of Mist Evaporation System (Mes):

### Open Type MES:

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



### Totally enclosed MES for Salt concentration/ Zero Liquid Discharge:



MES is closed from all sides up to 7 meter height by louvers and by canopy/ mist eliminators at the top.



This technology will now help any size of industry to adopt Zero liquid discharge policy easily and preserve nature.

Entire operation happens inside a closed chamber with top covered with Canopy/ Mist Evaporators. This allows only pure water vapour to escape from top & avoid carryover of any mist particle or impurities and also arrest entry of rain water. ■



### Author

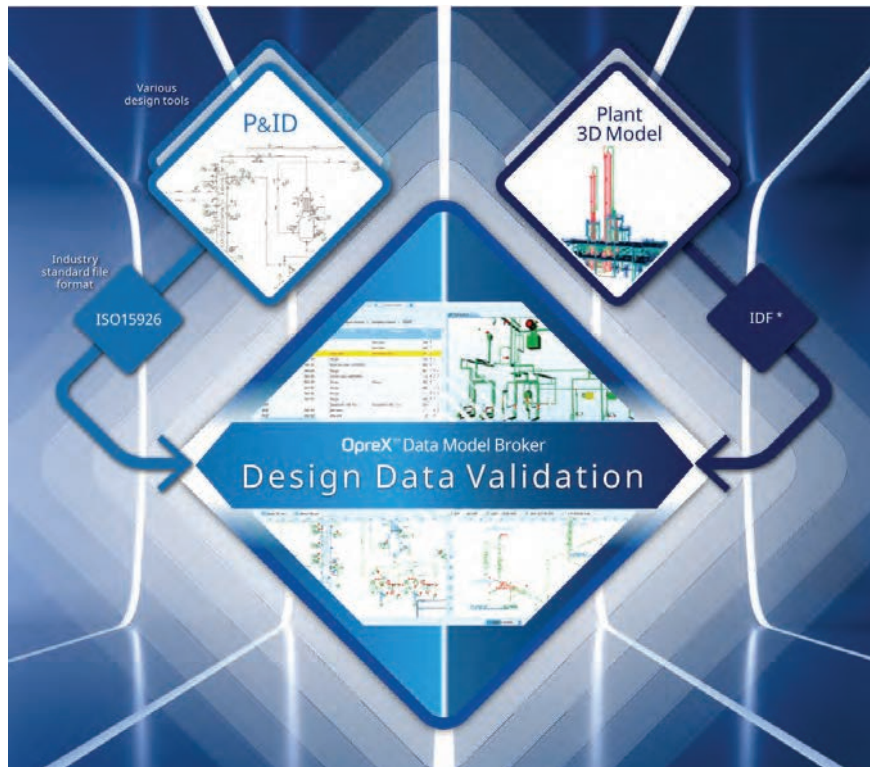
**Makarand A. Chitale**

Director (Technical)

Mist Ressonance Engg Pvt Ltd



## Yokogawa Launches OpreX Data Model Broker, a Plant Data Transformation Platform



OpreX Data Model Broker Design Data Validation  
IDF: Intermediate Data File

operation and management. Design Data Validation, the first component to be released by Yokogawa for this platform, assists in the complicated and time-consuming task of systematically identifying and confirming inconsistencies between piping and instrument diagrams (P&ID) and 3D piping diagrams. By automatically identifying such inconsistencies in massive volumes of data, this component greatly enhances work efficiency

and drastically reduces the number of man-hours required for such work.

Yokogawa Electric Corporation announced the development and release of OpreX™ Data Model Broker, a plant data transformation platform in the OpreX Connected Intelligence lineup. OpreX Data Model Broker automatically verifies the consistency of data in different plant designs and instrumentation systems and enables their inter-utilization by applying ontology\*, an AI technique, in database

Development Background With the increases in plant size and sophistication in recent years, the facilities installed in these plants have grown ever more complex. When a plant is built or expanded, the departments responsible for each area of work use different design tools. The same is true with systems, for which there

are not only design and specification documents but also diagrams from device and equipment vendors, and engineering data from different system suites. In many cases, vastly time-consuming manual checks must be performed to ensure there is complete consistency in all data. While 3D piping diagrams usually number in the few thousands, there can be 10,000 or more of these documents with a large-scale project, and all this data is currently checked manually.

As such, there is a strong demand for a system that uses digital technology to increase data interoperability and ensure its reliability.

### Features

The following consistencies are automatically verified by Design Data Validation in the OpreX Data Model Broker

Piping attribute information; Cross-checks the piping attribute information in P&ID and 3D piping diagrams.

Piping component attribute information and sequences; Validates attribute information for each piping component as well as the sequences of them.

Flange specifications; If a change to a piping specification is designated for

a valve end in a P&ID, it validates the piping specifications for the relevant valve and associated flange in the 3D piping diagram. Flow direction for piping components Checks that the flow direction for each piping component in the 3D piping diagram matches the process flow direction in the P&ID.

Ontology is one of the approaches in AI technology. It is a concept or mechanism for defining the meaning of information and aims to make computers mimic how humans understand the meaning of information.

Major Applications Verification of P&ID and 3D piping diagrams during the engineering, procurement, and construction (EPC) phase for petroleum, chemical, and other plant construction or expansion projects. ■

### Contact :

OpreX Data Model Broker / Design Data Validation | Yokogawa Electric Corporation

<https://www.yokogawa.com/solutions/products-platforms/oprex/oprex-transformation/oprex-connected-intelligence/oprex-data-model-broker/>

## Soft-Start for Injection Molders and Extruders



**78** B&R's mapp Temperature software package provides a new pre-programmed way to get manufacturing systems up to temperature

B&R's mapp Temperature software package provides a new pre-programmed way to get manufacturing systems up to temperature. At the push of a button, the Soft-Start function heats up machine components gently to minimize heating element fatigue – without any of the tedious programming that used to be involved. Homogeneous heating reduces mechanical stresses and allows for controlled evaporation of liquid residues in the machine.

With mapp Temperature's Soft-Start function, equipment such as filtration systems, extruders and injection molding machines can be brought to operating

temperature quickly and easily. This is done either by targeted heating with limited power or by using a defined temperature gradient to heat up all zones synchronously. Since the Soft-Start function avoids operating the heating elements at maximum power, it is particularly gentle on the machine's hardware.

All the necessary settings, such as the target temperature, are easy to configure in mapp Temperature. Individual heating zones can be adjusted individually, or even excluded from the Soft-Start process if necessary. This makes temperature control much more flexible and offers more options for different heating zones. The heating process is started at the push of a button without any of the tedious programming that used to be involved. ■

### Contact

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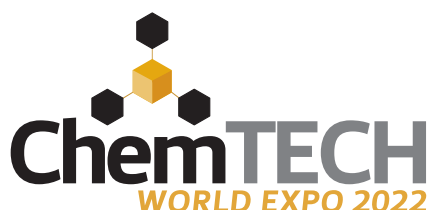
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## Process Industry's Gateway to Indian Market

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**22-25 February 2022**

Venue: Bombay Exhibition Center, Goregaon (East), Mumbai, India

Concurrent Events:



#### Scope for CHEMTECH + Biopharma World Expo 2022

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- Biotechnologies
- Chemical & Pharma Processing Equipment
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- Water & Wastewater Treatment Technologies
- Pumps & Valves
- Pipes & Fittings
- Packaging Solutions
- Material Handling Systems
- Analytical & Laboratory Technologies
- Consulting Services
- Equipment Fabricators

#### Scope for Specialty Chemicals World Expo 2022

- Agrochemicals Intermediates
- Adhesives & Sealants
- Agrochemicals & Crop Protection
- Bulk Drugs & Intermediates
- Enzymes
- Colorants, Dyes & Pigments
- Cosmetics & Personal Care Ingredients
- Hygiene & Cleaning Chemicals
- Laboratory Chemicals
- Surfactants
- Water Treatment Chemicals
- Catalysts
- Electronic Chemicals
- Flavours & Fragrances
- Contract Manufacturers

#### FACTS & FIGURES - CHEMTECH WORLD EXPO 2019

<b>612</b>	<b>18962</b>	<b>18</b>	<b>85</b>	<b>923</b>	<b>2150</b>
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