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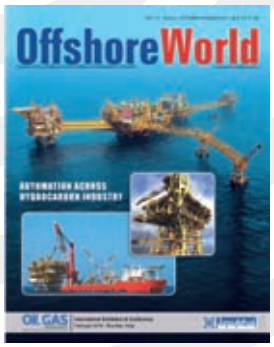

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INEOS Builds New Efficient Class of Barges to Supply Raw Materials on the Rhine

Frankfurt, Germany: INEOS has recently confirmed its acceptance of the delivery of three of four new gas barges in Europe. They will become the largest gas barges operating on the River Rhine and are the first to be fully built to the new ADN gas barge 2019 standard. The new barges will enable the efficient and competitive delivery of butane gas from the ARA region (Antwerp, Rotterdam, Amsterdam) to the INEOS ethylene cracker facility at Cologne, Germany. In addition, they will provide INEOS Trading & Shipping with options to effectively trade butane in Europe.

The build project was managed by Imperial Gas Barging, who will also operate the barges on behalf of INEOS. Carmichael added: "We are extremely pleased with the dedication of the Imperial team and the professionalism of the crews. We also were impressed with the focus and cooperation of the two lead shipyards in delivering these sister ships". The construction of the barges was split between 2 Dutch companies. One is: Teamco Shipyard in Heusden, who subcontracted Hull construction to Rensen-Driessen Shipbuilding BV of the Netherlands and then had work completed by the partner Stocznia Sp Zoo Shipyard. The other one is: Veka Shipbuilding Group in Werkendam, who completed all of the construction in Holland. The gas tanks were manufactured by Barlage GmbH. The barges all use a veth pod-drive system, rather than the more usual shaft propulsion.

The project was successfully completed with the support and performance of several subcontractors, with the last few weeks particularly challenging as COVID issues became more of a concern. The barges will be named Aloo, Brinjal, and Onion, taking their names from the Indian "Bhaji" theme.

There are two sizes of barge:

- Teamco: Aloo and Brinjal are 110m*15m with six cargo tanks holding a combined 4446 cubic metres.
- Veka: Onion is bigger at 110m*17.5m with 6 tanks holding 5538 cubic metres. A fourth sister ship will be delivered later this year.

These barges are part of the ongoing investment being made by INEOS in supply chain flexibility for its European cracker facilities. This announcement builds on the commitment already made of more than USD 5bn into the supply of feedstock ethane from the USA, securing the competitiveness of its gas crackers in Europe, located at Grangemouth, UK and Rafnes, Norway.

BASF and Security Matters Collaborate to Accelerate Progress towards a Circular Economy for Plastics

Ludwigshafen, Germany; Melbourne, Australia: Security Matters Ltd and BASF sign a binding joint development agreement to develop solutions for plastics traceability and circularity. Plastics, with unique characteristics and when used properly, contribute to a more sustainable and resource efficient future. However, to move towards a circular economy, more plastic waste needs to be recovered and reused. Though there is great progress towards chemical recycling, the more common method is to mechanically recycle plastic. Currently, recycled plastic loses its mechanical performance properties and quality compared to virgin plastic due to polymer degradation and residual impurities. The recycling infrastructure is also expensive and complicated, and simply does not exist in many parts of the world.

In their cooperation, Security Matters and BASF aim to offer a solution for this. Security Matters will contribute its technology to enable physical and digital tracking of closed loop recycling, authenticate sustainability claims and improve sorting of plastic waste. The partnership leverages BASF's extensive experience in plastic additives, regulatory know-how, and understanding of the plastics value chain. Both companies will also combine their research & development capabilities and required resources as part of the agreement.

Security Matters will provide its track and trace solution that marks physical objects with a unique and unalterable chemical-based barcode and connects them to a digital twin. The barcode withstands manufacturing and recycling processes, without altering the appearance or performance of the object. Using proprietary technology, the barcode captures a wide variety of information embedded in the plastic and can be used for closing the plastic loop.

"To tackle the global challenge, we have to rethink plastic applications with their end of life in mind. It is essential to progress towards a circular economy approach that closes the loop on end-of-life resources and allows us to recover and recycle plastics as efficiently as possible," said Achim Sties, Senior Vice President, Performance Chemicals Europe, BASF SE. "We are jointly developing this game-changing technology that could capture information of the polymer and how the plastic moves through the entire production and distribution process. We will be able to devise an appropriate additive package for our customers and other players in the value chain using recycled material to capture more material value and increase resource productivity."

"We are honored to be working with BASF as the global leader in Plastic Additives. This collaboration is the first step in demonstrating how our technology can be used in a circular application. By providing transparency of product lifecycles, we can create an entire technology-driven ecosystem that promotes circularity and sustainability for plastics. Together we can accelerate the progress of the plastic industry towards a more innovative, resilient and productive economy", said Haggai Alon, Founder and Chief Executive Officer, Security Matters Ltd.

SABIC Releases Sustainability Report Outlining Progress on Key Drivers, Moving toward a More Circular Future

Mumbai, India: SABIC has released its Sustainability Report 2019, covering performance over the past year and detailing how sustainability fits into the company's broader global business strategy. Titled "Toward a Circular Future," the report builds on the reputation of the company as a global leader in chemicals that embeds sustainable practices not only into its own business, but also into its entire value chain.

As reflected in the report's title, several landmark internal decisions in 2019 helped SABIC emerge as a pioneer in the development of the circular economy – where renewables, resource conservation, waste reduction, recycling, and repurposing don't impede, but actually contribute to business growth.

Dr. Abdulaziz Saleh Aljarbou, SABIC Chairman, said, "We are driven by concern for plastics in the environment, the search for new ways to reuse and re-purpose materials, and a desire for effective regulations, especially in packaging. These priorities have led to investments in circular product-solutions and our ability to accept chemically recycled feedstock."

Yousef Abdullah Al-Benyan, Vice Chairman and Chief Executive Officer, said, "SABIC witnessed excellent progress and we continued to recognize global concerns for creating a more sustainable society. Demand for circular solutions increased this year, as did opportunities for renewable energy and regional climate regulations. We have circular economy strategies that will lead to industry-leading projects in all our global regions."

SABIC's impressive and growing range of circular solutions include a chemical recycling mega-project that will turn mixed plastic waste back into the original polymer; a semi-commercial, pre-treatment facility to increase the supply of chemically recycled feedstocks; and the TRUCIRCLE™ portfolio of circular solutions, which are already helping SABIC's customers in several key markets to reach their own sustainable goals.

The Sustainability Report highlights how SABIC works with – and is sometimes a driving force behind – international organizations that are contributing to a sustainable world and helping to tackle some of the biggest challenges facing the industry and the planet. It is a transparent insight into SABIC's approach to delivering 'Chemistry that Matters™' to customers, suppliers, governments, NGOs, and communities all over the world.

Union Environment Minister Advocates for Making Environment Technology Open Source and Affordable

New Delhi, India: The eleventh session of Petersberg Climate Dialogue witnessed India along with 30 other countries deliberating over ways and means to tackle the challenge of reinvigorating economies and societies after COVID-19, while enhancing collective resilience and catalysing climate action while also supporting in particular those most vulnerable. Representing India in the first virtual Petersberg Climate Dialogue,Union Minister for Environment, Forest and Climate Change, Shri Prakash Javadekar said that, Today, as the World is unitedly engaged in findinga vaccine for novel Coronavirus, likewise we should have Climate Technology as open source which must be available at affordable cost.

Stressing on the issue of Climate finance, Shri Javadekar said the World now needs more. "We must plan for 1 trillion USD in grants to developing world immediately", advocated the Union Minister. Expressing solidarity with the world as it combats the COVID 19 pandemic the Union Minister highlighted how COVID – 19 has taught us that we can survive on less. The world must think of adopting more sustainable consumption patterns in line with requirement of sustainable lifestyles, as was first mooted by Hon'ble Prime Minister of India, Shri Narendra Modi during Paris COP,reiterated the environment Minister. He mentioned that India's Nationally Determined Contributions spanning a ten-year time frame are ambitious and are also compliant with the temperature goal of the Paris Agreement. The minister also spoke about the opportunity world has to accelerate renewable energy deployment and creating new green jobs in the renewable energy and energy efficiency sector.

The first virtual Climate Dialogue, was the eleventh session of Petersberg Climate Dialogue which has been hosted by Germany since 2010 to provide a forum for informal high-level political discussions, focusing both on international climate negotiations and the advancement of climate action. The virtual XI Petersberg Climate Dialogue was co-chaired by Germany and United Kingdom, the incoming Presidency of 26th Conference of Parties (COP 26) to United Nations Framework Convention on Climate Change (UNFCCC). The dialogue saw participation from Ministers and representatives of about 30 countries. This year's dialogue came at a crucial juncture when countries are tackling the COVID-19 pandemic to save lives, overcoming social and economic consequences of the pandemic while also preparing to move into the implementation phase of Paris Agreement under UNFCCC in post-2020 period. The key agenda of the dialogue was to discuss how we can jointly tackle the challenge of reinvigorating our economies and societies after COVID-19, while enhancing our resilience and catalyzing climate action while also supporting in particular those most vulnerable.

The Union Minister also participated in an Indo German bilateral meeting with Ms. Svenja Shulze, Minister, Federal Ministry of Environment, Nature Conservation and Nuclear Safety, Germany. This bilateral meeting was held via video conference just before the Petersberg Climate Dialogue. It covered discussions on a range of issues covering climate change, conservation of biodiversity and technical cooperation with Germany in these areas. The situation in both countries arising from the COVID 19 pandemic, and recovery efforts, were also discussed.

Source: Press Information Bureau

DNV GL Approves Carbon Capture Technology

Oslo, Norway: DNV GL, the technical advisor to the oil and gas industry, has approved as qualified, technology for a full-scale demonstration project in Norway to remove carbon emissions at a cement plant. Gassnova, the Norwegian state's agency for implementation of carbon capture and storage projects, initiated the project which will apply carbon capture technology developed by Aker Solutions at Norcem's cement plant in Brevik, Norway.

Globally, the cement industry accounts for 5-7% of total CO_2 emissions – from all industries and sectors. Aker Solutions' post-combustion technology is intended to capture and liquefy 400,000 tons per year of the released carbon dioxide at the Norcem plant. Once the technology is applied this will contribute to Norway's target of becoming a low-emission society by 2050.

DNV GL engaged with Norcem and Aker Solutions to verify the application of DNV GL's recommended practices DNVGL-RP-A203 Technology Qualification and DNVGL-RP-J201 Qualification procedures for carbon dioxide capture technology at the plant.

Novel elements of Aker Solutions' carbon capture technology and potential technological risks were evaluated and mitigation identified. Documentation was reviewed to provide a better understanding of the technology and the specific application and conditions at Norcem's plant.

Arve Johan Kalleklev, Regional Manager, Norway and Eurasia, DNV GL – Oil & Gas said: "Carbon capture, and subsequent storage, is currently the only technology that can achieve significant reductions in CO_2 emissions from industrial processes. Carbon capture can play a vital part in decarbonizing our planet. DNV GL's qualification review of Aker Solutions' technology is a great example of how we engage to enable implementation of this crucial technology."

As a result of the qualification procedure review, DNV GL issued a 'Statement of Qualified Technology' for Aker Solutions' carbon capture and heat recovery technology, applicable for the conditions at the Norcem Brevik cement plant.

Per Brevik, Director Sustainability and alternative fuels in HeidelbergCement Northern Europe states: "Aker Solutions have tested their technology at Norcem Brevik for 18 months. Their world class expertise, systematic work and the promising results from pilot testing in Brevik give us confidence that realisation of the full-scale capture plant will be successful. Based on the third-party technology qualification professionally executed by DNV GL, we trust that the project risk related to novel technology elements is low."

The Norcem Brevik carbon capture plant forms part of Europe's first industrial demonstration of CO_2 capture, transport and storage. The captured CO_2 is to be transported and injected into a CO_2 storage site offshore Norway, developed by the Equinor-headed Northern Lights consortium.

Oscar Graff, Head of CCUS in Aker Solutions said: "The extensive experience and systematic qualification procedures from DNV GL have been a great support for our engineers in our technology development. The procedure is an excellent tool to identify risk elements and to propose how to solve them. To get a statement of qualified technology from DNV GL, as a recognized third party, has high value for Aker Solutions and our clients."

Mitsui Chemicals to Boost Production Capacity for APEL™, Cyclic Olefin Copolymer

Tokyo, Japan: Mitsui Chemicals Inc has recently announced that it will establish a new plant within Osaka Works, Takaishi Osaka Prefecture to produce the APEL™ series of cyclic olefin copolymers. Finding its major application in smartphone camera lenses, APEL™ is meeting with surging demand driven by a recent trend toward multi-lens cameras in these devices. Mitsui Chemicals is therefore looking to set up a supply system able to deal with this increased demand.

By establishing the new plant, Mitsui Chemicals' production capacity for APEL™ will rise by approximately 50 percent. Construction on the new plant is starting this month and is slated to wrap up in March 2022.

Plans going forward are to further grow Mitsui Chemicals' APEL™ business by capturing new demand in applications such as automotive cameras, head-mounted displays and the medical sector.

Mitsui Chemicals is positioning its Performance Polymers Division – which includes APEL™ and is focused on ICT – as a growth sector. Through this latest production capacity increase, Mitsui Chemicals expects that it will be able to continue meeting increased demand here for the time being. But to properly respond to further demand growth going forward, Mitsui Chemicals will now begin to also consider its next production increase for the series.

Huntsman Announces First Quarter 2020 Earnings; A Strong Balance Sheet with Robust Liquidity

The Woodlands, Texas: Huntsman Corporation, a global manufacturer and marketer of differentiated chemicals, has recently reported their results for 1st Quarter of FY 2020 with revenues of USD 1593 million, net income of USD 708 million, adjusted net income of USD 65 million, and adjusted EBITDA of USD 165 million.

The result encompasses the verticals of polyurethanes, performance products, advanced materials, textile effects, corporate-LIFO-and-Other, and liquidity & capital resources.

Polyurathanes: The revenue for the quarter ending 31-Mar-20 hits a low compared to the same quarter of previous year primarily due to lower MDI average selling prices and modestly lower overall polyurethanes sales volumes. Decrease in MDI average selling prices has been caused by the respective component decrease in China and Europe. Overall polyurethane sales volumes have been lowered because of decreased demand across most major markets, partially offset by modest growth in MDI sales volumes. The decrease in segment adjusted EBITDA was primarily due to lower MDI margins driven by lower MDI pricing, partially offset by higher MDI sales volumes.

Performance Products: Alike polyurethanes, performance products also has shown a low revenue-trend, mainly due to lower average selling prices and lower sales volume owing to lower raw material costs, weakened market conditions for maleic anhydride business. However, adjusted EBITDA has been increased due to higher margins in our performance amines business and lower fixed costs.

Advanced Material: Here the revenue fall has been hit due to two main factors. The first one is lower sales volume across the most major markets particularly commodity, industrial and aerospace, primarily due to economic slowdown and customer destocking. The second factorial is lower average selling prices. impact of a stronger U.S. dollar against major international currencies, partially offset by higher local currency selling prices. The decrease in segment adjusted EBITDA was primarily due to lower sales volumes, partially offset by lower fixed costs.

Company's textile effects, liquidity and capital resources, corporate, LIFO, and other have also shown their downturn. The below table will narrate the scenario comprehensively:

	Three months ended March 31	
In millions,except share amounts	2020	2019
Revenues	$ 1 ,593	$ 1,669
Net income	$ 708	$ 131
Adjusted net income[1]	$ 65	$ 35
Diluted income per share	$ 3.16	$ 0.51
Adjusted Diluted income per share[1]	5 0.29	$ 0.36
Adjusted EBITDA[1]	$ 165	$ 204
Net cash used in operating activities from continuing operations	$ (40)	$ (40)
Free cash flow from continuing operations[2]	$ (101)	$ (101)

In this connection, Peter R. Huntsman, Chairman, President and CEO, commented: "Fortunately, we have been well prepared for this global economic crisis and the ongoing transformation has made us a much better Company. In this environment we are laser focused on what is in our control and protecting our balance sheet strength. Having learned from prior crises, we preemptively reduced unnecessary inventories and are reducing capital spending this year by 30 percent, amounting to approximately USD 90 million, by delaying discretionary spending. We have been proactively taking other measures, including suspending share repurchases, and various cost reduction measures yielding immediate benefit. We will accelerate our plans to achieve synergies with our recent and pending strategic bolt-on acquisitions, and aggressively press forward with the global scale up of our differentiated platform. Our Company is ready and able to take advantage of opportunities to come, and I am confident that Huntsman will emerge as a stronger Company from this global crisis".

Linde Leverages Technology to Sign Long-Term Agreement with Largest Refiner in India

Guildford, UK: Linde has recently announced that it has leveraged its extensive technology portfolio to sign a new contract with Indian Oil Corporation Limited (IOCL), the largest refiner in India.

Praxair India Private Limited, a wholly owned subsidiary of Linde, will build, own and operate an air separation unit (ASU) to supply oxygen and nitrogen to its incumbent customer, IOCL, for its refinery at Paradip, Orissa. The project will help support the expansion of the existing refinery into an integrated petrochemical complex. Following planned completion of the ASU in October 2021, the plant will have a combined total gas capacity of 660 tons per day. Praxair India currently supplies hydrogen and nitrogen to the IOCL refinery at Paradip. The ability to leverage the combined technology and applications of the Linde AG and Praxair businesses was key to creating a comprehensive proposal.

"We are excited to further support our customer, IOCL, as it invests in its future expansion," said Moloy Banerjee, Head of South Asia, Linde. He added, "This is another milestone project for Linde in India, reflecting our commitment to continue investing in the country. We are proud to have developed a world class solution for IOCL, leveraging Linde's global technology and operational capabilities. Our strong track record in safely and reliably delivering industrial gases gives us an edge over our competition. We are pleased to be selected by IOCL and look forward to working together towards our mutual success in the years ahead."

Evonik and Beiersdorf Engaging in Joint Research to Turn Carbon Dioxide into Care Products

Essen, Germany: Beiersdorf and Evonik have reached an agreement on a research partnership. Its aim is to develop sustainable raw materials for care products, using carbon dioxide (CO2) as the starting material. Beiersdorf is on the lookout for new sources of raw materials that will also reduce the company's carbon footprint. One option here is artificial photosynthesis technology. The idea is: with the aid of electricity from solar energy and bacteria, valuable raw materials are produced with water and CO2, drawing on natural photosynthesis as a model. The joint research project of Evonik and Beiersdorf is being funded by Germany's Federal Ministry of Education and Research (BMBF) with the amount of around Euro 1 million.

Dr. May Shana'a, Corporate Senior Vice President, Research and Development, Beiersdorf, says: "The research cooperation fits perfectly with our sustainability agenda, an ambitious program that we are implementing systematically and across all functions. We are pursuing a vision of becoming climate positive, and we want to play a part in closing the carbon cycle." If Beiersdorf succeeds in using CO2 as a source for the raw materials used in its care products, this will reduce the company's carbon footprint as well as the land used for renewable resources. Shana'a continues, "Together with Evonik, we are determining which raw materials can be produced with the aid of artificial photosynthesis and could potentially be suitable for our care products. While this has already been observed in the early stages of a number of other industries, this application is in its infancy in the cosmetics industry. We are therefore especially proud to be entering into this research partnership".

Thomas Haas, who is responsible for artificial photosynthesis at Evonik, says: "By using carbon dioxide as the starting material for the production of valuable raw materials, we can close the carbon cycle – exactly as demonstrated by nature with photosynthesis". Evonik is developing the technology platform needed for artificial photosynthesis together with Siemens in the Rheticus project funded by the BMBF. Evonik believes that the research cooperation just launched with the skin care specialist Beiersdorf, which is independent of the cooperation with Siemens, is an opportunity for the specialty chemicals maker to expand the future product portfolio for artificial photosynthesis. Haas says: "With Beiersdorf, we have a partner who is joining us in extending the value chain to include sustainable CO2-based products – in the interests of the consumer".

With this research project, Beiersdorf and Evonik are partners in the BMBF's P2X II project launched in September 2019 as one of the projects of Kopernikus, one of the biggest German research initiatives in the area of the energy transition. A total of 42 partners are involved in the P2X II project alone. The aim is to develop processes that use renewable energy to produce high-quality products.

GHCL Announced its Financial Results for the Fiscal Year ended with Mar'2020

New Delhi, India: GHCL, India's leading Chemical & Textile Company announced its financial results for the fourth quarter and the financial year ended March 31, 2020.

Commenting on the financial performance, Mr. R S Jalan, Managing Director, GHCL said : "The current COVID-19 pandemic has caused major disruptions in various business segments. The situation accentuated the need for a nationwide lockdown to comprehend the spread of the virus causing significant economic slowdown across the world.At GHCL we complied with all the regulations notified by the Government from time to time. We had taken the initiative of "Work from home" at our offices and the production facilities also remained closed for a major period of time thus impacting production and sales. We received continuous support from our stakeholders including Government agencies and supply chain partners. The nation is passing through a tough time today however; we believe that this disruption will create opportunities too. We assure our stakeholders that we will be agile and focused towards these opportunities".

Net Revenue for Q4FY20 is Rs.734 crores as compared to Rs.915 crores of Q4 FY19. The drop in revenue is equally attributable to both Chemical and Textiles which is largely due to softer pricing and COVID impact resulting in lower volumes. EBIDTA for the quarter is Rs.161 crores as compared to Rs.241 crores in the corresponding previous quarter. In the Inorganic Chemicals, the realisation is down by about 11% compared to Q4FY19. However, EBITDA is down by 4% balance has been recovered in cost and operational improvements. Due to COVID-19 the production and sales during the month of March was also impacted. In Textiles due to the COVID situation operations were impacted and One Time Cost of Rs. 30 crores has been considered on a prudent basis on account of potential markdowns. Net Profit (PAT) at Rs.80 crores as against Rs.119 crores in the corresponding quarter previous year.

If the financial score is compared between FY 20 and FY 19 on standalone basis, Net Revenue for the year ended March 2020 is down by 3% to Rs. 3272 crores compared to Rs.3385 crores in the previous financial year. Earnings before Interest, Depreciation and Taxation (EBIDTA) for the quarter is Rs. 763 crores as against Rs.784 crores in the previous financial year 2019, with margins maintained at the same level. Net Profit (PAT) grew by 13% to Rs 407 crores from Rs. 361 crores in FY19. In the Inorganics Chemicals division, Revenue for the year is at Rs.2198 crores as compared to Rs.2182 crores in FY19. The textiles business recorded a revenue of Rs.1074 crores in FY20 as compared to Rs. 1202 crores in FY19 mainly due to softer yarn pricing and COVID impact during the year.

Covestro Promotes Innovation in Electrochemistry

Mumbai, India: The growing circular economy in the chemical and plastics industry requires alternative raw material sources beyond crude oil, which urgently need to be further researched. Industrial electrochemistry can make a significant contribution to the development of new raw material sources by employing energy-saving processes and renewable energies. The necessity for innovation and the resulting expansion of research in electrochemistry are of great importance from this point of view. To this end, the materials manufacturer Covestro is supporting RWTH Aachen University with a donation, thus enabling a new professorship for five years.

"The increasing use of alternative raw materials and the overall transformation from a linear to a circular economy are essential to achieve a future-proof, sustainable economy and society," says Dr. Markus Steilemann, CEO of Covestro. "This objective demands a high level of innovative strength and increased investment in research and development at universities."

To this end, RWTH Aachen University is expanding the research branch "Electrochemical Reaction Engineering" with a new professorship. Here, electrochemical processes, which have long been known from chlorine production, are to be further developed using renewable energies. One of the aims is to make the climate gas CO2 even more usable as a raw material for the chemical industry. Methods for improved storage of the alternative energy carrier hydrogen are also being focused on here. This is an important contribution to establishing CO2-neutral value chains in the long term. The goal is to scale up electrochemical processes to industrial standards.

The university appointed Dr. Anna Mechler as Professor of Electrochemical Reaction Engineering on May 1, 2020. Mechler studied applied natural and material sciences in Wuppertal and Osnabrück and received her doctorate in electrochemistry at the Max Planck Institute for Iron Research in Düsseldorf and the Ruhr University Bochum. Before moving to the RWTH, she headed a research group for electrocatalysis at the Max Planck Institute for Chemical Energy Conversion in Mülheim an der Ruhr.

The professorship acts as a bridge between research activities in the field of industrial electrochemistry at RWTH Aachen University and the Forschungszentrum Jülich (Jülich Research Center), thus strengthening the Jülich Aachen Research Alliance (JARA). The integration of the professorship into the Competence Centre for Industrial Electrochemistry ELECTRA will further intensify the cooperation between the two institutions.

LANXESS Robust in First Quarter of 2020 despite Coronavirus Crisis

Thane, India: Specialty Chemicals Company LANXESS proved robust in the first quarter of the year, despite the weak economic environment prevailing due to the coronavirus pandemic. Earnings in the new Consumer Protection segment and in the Specialty Additives segment have been developed positively and significantly mitigating the impact of the coronavirus crisis. Exchange rate effects, particularly from the U.S. dollar, also had a positive impact. By contrast, a further decline in demand from the automotive industry as a result of the coronavirus crisis had a negative effect on earnings, particularly in the Engineering Materials segment. EBITDA pre-exceptionals declined by 9.9 percent from EUR 272 million to EUR 245 million in the first quarter of 2020. The EBITDA margin pre-exceptionals amounted to 14.4 percent after 15.7 percent in the prior-year quarter.

Group sales amounted to EUR 1.704 billion in the first quarter of 2020, down only slightly on the previous year's figure of EUR 1.738 billion. Net income from continuing operation declined by 27.6 percent from EUR 87 million to EUR 63 million. In the second and third quarters, LANXESS expects the impact of the coronavirus pandemic to intensify. Based on the currently available information, the company expects the EBITDA pre-exceptionals for the second quarter to be in between EUR 200 – 250 million. For 2020 as a whole, LANXESS now anticipates EBITDA pre-exceptionals of EUR 800 – 900 million. The company was previously expecting annual earnings of between EUR 900 million and EUR 1 billion. In the previous year, LANXESS had generated the EBITDA pre-exceptionals of EUR 1.019 billion.

At the start of the coronavirus crisis, LANXESS already took a wide range of measures to minimize the impact on the company. Employees' health is the top priority. Using protective measures such as – strict hygiene regulations, solutions to work from home for the majority of office workers, and changes in the shift model – the infection rate among LANXESS employees has been kept low. So far, 31 employees worldwide have contracted coronavirus and 27 of them have already recovered.

The specialty chemicals company has also taken important steps to further strengthen its already good liquidity situation. In April, LANXESS announced that it would suspend its share buy-back program until further notice. The company is expected to save between EUR 50 – 100 million by means of cost discipline in fiscal year 2020 and postponing some of the projects thus reducing its investment budget by Euro 50 million approximately. As a special mention, with the sale of its Current stake on 30-April-2020, LANXESS realized an equity value of EUR 780 million (after deduction of net debt and pensions) and a profit participation of EUR 150 million (both pre tax).

EUR million	Q1/2019	Q1/2020	Change %
Sales	1,738	1,704	-2.0
EBITDA pre exceptionals	272	245	-9.9
EBITDA margin pre exceptionals	15.7%	14.4%	
Net income[1]	87	63	-27.6
Earnings per share (€)[1]	0.96	0.72	-25.0
Net financial liabilities[2]	1,742	[3] 1,705	-2.1
Employees (as of March 31)	14,304	[3] 14,327	0.2

[1] From continuing operations
[2] After deduction of short-term money market investments and securities
[3] Reporting date December 31, 2019

Air Products and Haldor Topsoe Sign Global Alliance Agreement

Lehigh Valley, PA: Air Products, a global leader in industrial gases and megaproject development, and Haldor Topsoe, the world leader in high-performance catalysts and proprietary technology for the chemical and refining industries, has recently announced the signing of a global alliance agreement. The two companies will collaborate, using their extensive market network outreach for developing potential projects, and the combination of their expertise on large-scale ammonia, methanol and/or dimethyl ether plants to be developed and built globally.

The Alliance Agreement provides Air Products access to Topsoe's technology license(s) and the supply of certain engineering design, equipment, high-performance catalysts and technical services for ammonia, methanol and/or dimethyl ether plants to be built, owned and operated by Air Products. The collaboration allows for the integration of Topsoe's technology into many Air Products' technologies including gasification of various feedstocks, and synthesis gas processes.

"The global agreement with Haldor Topsoe is very important to Air Products as we continue to expand our scope of supply to customers in developing large-scale projects around the world. We have built a reputation for successfully executing megaprojects. Having this Alliance and access to Haldor Topsoe's technology-leading capabilities will serve to strengthen both our offerings and customer confidence in the reliability and quality of project development and performance," said Dr. Samir J. Serhan, executive vice president at Air Products.

"We are extremely satisfied to enter this Alliance. Air Products is an industry leader, and we share their commitment to providing customers around the world with excellent, innovative, and more sustainable solutions. This alliance forms the foundation for integrated large-scale projects that will benefit from the close collaboration and combined strengths of our two companies," said Amy Hebert, Deputy CEO and Executive Vice President at Haldor Topsoe.

Topsoe's technology enables companies in the chemical and refining industries to get the most out of their processes and products, using the least possible energy and resources. On the forefront of developing sustainable technologies, HTAS solutions enhance food production for the world's growing population and help protect the environment. Half of all the ammonia used to make artificial fertilizer is produced using Topsoe catalysts.

Topsoe's technology will be incorporated into Air Products' recently announced world-scale coal- to-methanol production facility in Bengalon, East Kalimantan, Indonesia. In addition, Topsoe technology will also be part of the previously announced world-scale Gulf Coast Ammonia production plant in Texas. Air Products will supply hydrogen and nitrogen for the ammonia production in part from its largest-ever steam methane reformer.

Air Products' involvement in these world-scale projects will capitalize on the alliance and deliver substantial sustainability benefits. These kinds of projects can serve as carriers of renewable hydrogen molecules as the world's interest hydrogen for mobility and energy transition continues to grow.

Numaligarh Refinery Limited Awards Refinery Expansion Project to Thyssenkrupp

Mumbai, India: Thyssenkrupp's plant engineering business has been awarded an order by Numaligarh Refinery Limited (NRL) worth approximately INR 300 crore for a refinery expansion mega project. Under the order, thyssenkrupp will provide engineering, procurement and construction management (EPCM) services for various units of a refinery located in Numaligarh in northeastern India. NRL is expanding its refining capacity from three to nine million metric tons per year. The project is expected to be completed by 2024.

The refinery expansion project is part of the government of India's initiative towards "Hydrocarbon Vision 2030" for the northeast region of India. The efforts are aimed at exploiting the region's hydrocarbon sector to facilitate economic development, enhance the access to clean fuels, increase the availability of petroleum products and create employment opportunities.

"We are delighted to partner with our customer Numaligarh Refinery, as it invests in its future expansion. This is another lighthouse project, which fits in with our aspiration to be a leading engineering company in India for the design and construction of petrochemical plants and refineries", said P.D. Samudra, CEO and Managing Director of thyssenkrupp's chemical plant business in India.

The scope of supply includes engineering, procurement and construction management services for a new petrochemical fluidised catalytic cracking (PFCC) unit with two million metric tons annual capacity, units for liquefied petroleum gas (LPG) treatment, gasoline desulphurization, MS blocks having naphtha hydrotreating, continuous catalytic reforming and isomerization units.

Salt Lake Potash Trusts Veolia to Pave the Way for the Soluble Fertilizer Revolution of Australia's Sulfate of Potash

Perth, Australia: Perth-based Salt Lake Potash Ltd. is developing the Lake Way potash mining project to produce 245,000 tons per year of SOP (K2SO4) from dry salt lake deposits in the Northern Goldfields region of Western Australia. To recover low-cost high-grade SOP, the production uses solar evaporation to concentrate the hypersaline, potassium-rich brines for salt harvesting.

To further process these solids, Veolia will design and supply two HPD® crystallizers: one to grow 32 tons of high-purity potassium sulfate crystals every hour, the other to recycle 54 tons per hour of solids to yield the maximum potassium recovery.

More performance, less risk: As part of this contract, Veolia provided bench-scale testing at Veolia's Phillip J. Stewart Technology center in Plainfield, Illinois (USA). The results validated the feed chemistry, simulated the optimal flowsheet design, and confirmed process performance projections that helped to de-risk the project.

To accelerate this fast-track project and achieve the delivery schedule, Veolia staged the progress to advance the basic engineering and testing simultaneously. These actions not only optimized capital investments but also lowered operating costs through a system design that minimizes fouling and cleaning requirements.

With its HPD® technologies tailored to growing fully-soluble crystals, Veolia helps global fertilizer producers to optimize their recovery operations and the value of its product portfolio with a focus on enhancing environmental sustainability as well as energy and resource efficiencies.

Fresh produce on the rise : With the rapid growth of a global middle class come shifts in dietary patterns towards more varied fresh food and vegetable consumption. Most of these high-value crops are chloride-intolerant which drives the demand for specialty agricultural inputs such as chloride-free SOP fertilizer.

Perhaps more important for fertilizer producers is that these trends, along with a stronger emphasis on sustainable agriculture and its benefits on human health and the environment, offer considerable growth opportunities. In the Asia Pacific region, the demand for premium fertilizers such as SOP is thriving thanks to the expansion of micro-irrigated, green-house grown horticulture, particularly in Australia and China that top the list of countries with the largest harvested area dedicated to certified organic farming.

Bachem and Jitsubo Enter Into Exclusive Licensing Agreement

Bubendorf/Basel, Switzerland and Yokohama: Bachem and Jitsubo Co Ltd has recently announced that they signed an exclusive Licensing Agreement for Jitsubo's Molecular Hiving™ technology. Under the License agreement, Jitsubo will develop selected manufacturing processes using their Molecular Hiving™ technology and transfer these processes to Bachem. Bachem will further optimize, scale up and produce for commercial applications. In return, Jitsubo will receive development fees and royalties.

Using this technology, Bachem expects reduced manufacturing costs, improved sustainability, greener chemistry, efficient scale up, and enhanced in-process controls. The two companies have been establishing a close collaboration and several projects for active pharmaceutical ingredients (APIs) as well as cosmetic peptides, have already been initiated and successfully realized using Jitsubo's technology at Bachem. Dr. Günther Loidl, Chief Technology Officer of Bachem Holding AG, comments: "We are convinced that Jitsubo's Molecular Hiving™ technology offers substantial advantages regarding efficiency, and towards greener manufacturing. It complements Bachem's current extensive technology base and is a great fit for us because Bachem is already offering unique capabilities in the area of solid phase, hybrid, and solution phase peptide chemistry. We are excited to be the only contract manufacturing organization to offer this innovative technology to our customers."

Dr. Kazuaki Kanai, Chief Executive Officer of Jitsubo CO., LTD. continues: "It is a great pleasure for us having collaborated with the industry leader, Bachem, in exploring applications of our unique technology, Molecular Hiving™, and now having reached an exclusive License Agreement which will provide opportunities to deliver products to customers much faster and at greater scale. We will continue our development efforts broadening the technology base to meet various requirements from the society and hope to deliver meaningful products to customers through this collaboration and more importantly, to the patients in the world and realize our vision of "Enrich the world with smiles".

Azelis Strengthens Its Position in Performance Chemicals and CASE with a New Mandate for Perstorp

Mumbai, India: Azelis is proud to announce its new distribution agreement with Perstorp, a world leader and pioneer in formalin chemistry, plastics and surface materials. Effective immediately, Azelis will distribute Perstorp's polyols and solutions portfolio in parts of Northern Europe. The new mandate enables Azelis to extend its product offering in this region for both the performance chemicals and the CASE market segment.

The new mandate covers Perstorp's polyols and solutions portfolio in parts of Northern Europe. This product offering consists mainly of decorative and industrial coatings, printing inks, synthetic lubricants and various plastic materials. This agreement supports the organic growth strategy of Azelis through a multi-national coverage with its partners.

Besides polyols and solutions, Perstorp is active in advanced chemicals and animal nutrition. Their polyols and solutions range consists mainly of decorative and industrial coatings, synthetic lubricants, polyurethane dispersions and various plastic materials.

Marnik Tack, Market Segment Director for Performance Chemicals at Azelis, comments: "Perstorp's high-quality portfolio is a great new asset in Azelis' lateral value chain in the respective countries, enabling us to offer innovative, tailor-made solutions to our customers. This new agreement is also an important acknowledgment of our continuous efforts to build strong and value-added partnerships in EMEA."

Klaudija Cavala, Director Channel Management, Business Area Specialty Polyols & Solutions at Perstorp, adds: "We are confident that the strategic partnership with Azelis will provide our customers with an outstanding customer service and strong supply chain. Perstorp's decision was driven by Azelis' commitment to growth and dedicated organization for each industry, its market knowledge, commercial drive and continuous focus on innovation".

Asia Petrochemical Shares, Oil Prices Rise on Further Easing of Lockdowns

Singapore (ICIS): Asian petrochemical shares rose on a recent date in cautious trade, while oil prices surged by more than USD 1/bbl as more countries are gradually lifting coronavirus-related restrictions on business activity and people movement. At 02:55 GMT, JXTG Holdings was up by close to 2 percent in Tokyo, Formosa Petrochemical Corp was up more than 2 percent in Taipei and LG Chem rose by 2.60 percent in Seoul.

Japan's benchmark Nikkei 225 Index rose by 0.70 percent, the Hong Kong Hang Seng Index was up by 0.54 percent, and South Korea's KOSPI Composite Index was 0.62 percent higher. The total number of coronavirus cases has grown to more than 4.5m, with more than 300,000 deaths, according to latest data from the World Health Organization.

"Fear and greed may continue to battle for the mindshare of investors as US-China trade tensions return to the fore amid growing concerns that key nations are also racing to obtain first rights to any Covid-19 [coronavirus disease] vaccine," Singapore's OCBC Bank said in a note. China's commerce ministry on Sunday said that it is opposed to the latest rules by the US against one of Chinese telecoms equipment giant Huawei Technologies and will take all necessary measures to safeguard Chinese firms' rights and interests.

The US has reportedly moved to block global chip supplies to Huawei which went into effect on 15 May with a 120-day grace period. Economic data out of Asia were mixed recently, with Japan's economy slipping into a recession, while Singapore posted a third consecutive month of export growth in April. The world's third-biggest economy posted a 3.4 percent year-on-year contraction in the first quarter of 2020 after shrinking 7.3 percent in the previous quarter. Japan has been under a state of emergency since April, but restrictions on some prefectures are gradually being lifted.

Neighboring China and South Korea have requested Japan to allow business travel. Singapore reported a 9.7 percent year-on-year growth in its April non-oil domestic exports (NODX), but petrochemical shipments slumped 25 percent, falling for the 20th consecutive month. Recently, China reported a surprise 3.9 percent year-on-year increase in April industrial production, reversing the 1.1 percent fall recorded in Mar'20.

India has extended its lockdown until 31 May even as more economies in the west such as Italy, Belgium, and Portugal prepare to lift some coronavirus-related restrictions. Oil prices rose by more than USD 1/bbl early on Monday, supported by hopes of

$/bbl (As of 03:05 GMT)	Last price	% change	Net change	Close	High	Low
July Brent	33.7	3.69%	1.2	32.5	33.89	32.69
June US TWI	30.75	4.49%	1.32	29.43	30.83	29.53

The June WTI contract expires on Tuesday.

Fluor to Provide Project Management Consultancy Services for Advanced Global Investment Company's Propane Dehydrogenation and Polypropylene Complex in Saudi Arabia

IRVING, Texas: Fluor Corporation has recently announced that it was named project management consultant for Advanced Global Investment Company's (AGIC) new propane dehydrogenation, polypropylene and utilities and offsites complex in Jubail Industrial City, Saudi Arabia. Fluor will perform project management consultant services for the front-end engineering design, detailed engineering, procurement and construction phases of the project. Fluor booked its portion of the undisclosed contract value in the first quarter of 2020.

"Fluor has supported clients and safely executed projects in Saudi Arabia for more than 70 years," said Mark Fields, group president of Fluor's Energy & Chemicals business. "Our legacy of execution excellence continues with this most recent award from AGIC. We look forward to helping AGIC and the Kingdom of Saudi Arabia meet the world's growing demand for polymers and support their efforts to diversify its economy and also become one of the world's leading global producers of polypropylene."

Once complete, the complex will manufacture 843,000 tons-per-year of propylene and 800,000 tons-per-year of polypropylene that will be used for the production of specialty polymers for the face masks, automotive, pipes, food packaging and textiles industries. Fluor's offices in Farnborough, United Kingdom and Al Khobar, Saudi Arabia will lead the project management consulting services with support provided by the company's network of global experts.

BASF is the Largest Provider of Ingredients for Natural Cosmetics

Mumbai, India: Five active ingredients by BASF for cosmetics and body care products have for the first time been approved as organic according to COSMOS-standard. This includes the active ingredients Dulcemin® from sweet almond seed flour, Lipofructyl® on the basis of Argan oil as well as the skin care ingredient Elestan® extracted from the leaves of the West African Manilkara tree.

BASF is the largest provider of raw materials for natural and organic products according to COSMOS: In Europe, 120 cosmetic ingredients by BASF have been approved according to COSMOS-standard, globally a total of 145 products received approval.

"Cosmetics manufacturers who want to receive certification of their products according to COSMOS will find that BASF offers the largest range of ingredients on the market – from basic raw materials such as surfactants and emollients to skin care additives and actives", says Ute Griesbach, Marketing Manager Personal Care Europe.

The COSMOS-standard (COSMetic Organic Standard) distinguishes between natural cosmetics (Cosmos-natural) and organic cosmetics (Cosmos-organic) and sets the respective requirements for certification. Ingredients used in cosmetic products are divided into five categories for each of which the necessary requirements are specified.

With a total of 92 products, BASF offers a large amount as well as variety of approved products for different applications in the category of "chemically processed agro-ingredients", e.g. raw materials from renewable feedstock. In addition, 24 registered ingredients for cosmetic products contain chemically as well as physically processed components, eight products merely consist of physically processed ingredients.

Furthermore, 150 ingredients from the product portfolio of BASF Personal Care are suitable for the production of cosmetics eligible to carry the EU Ecolabel for cosmetic products. About 200 meet the requirements of the Nordic Ecolabel.

New Application: Use of Tertiary Butanol in Cosmetic Alcohols

Essen, Germany: Up to now, tertiary butanol (TBA)* has been used mainly as a precursor in organic peroxides and antioxidants. Together with customers, it has now been proven that TBA can also be used as a denaturant in cosmetic alcohols. In particular, it may be useful in the manufacture of cosmetic products or odor enhancers.

The discovery was a result of the search for alternative raw materials for the production of disinfectants in response to rising demand.

"We are pleased that with TBA we can provide our customers with a quality product - and in combination with individual logistics options," explains Sarah Kranz, Marketing Manager at Performance Intermediates and Product Manager for TBA. And so, the product TBA can be delivered in tank containers, tank trucks and drums.

"We can supply our customers with two different TBA grades, produced simultaneously and fully continuously, according to their needs: anhydrous and azeotropic," adds Dr. Hinnerk Becker, Head of Market Segment Specialties at Performance Intermediates.

Evonik Performance Intermediates is a producer of C4-based materials for the rubber, plastics and specialty chemicals markets. The tertiary alcohol TBA has been part of the portfolio of the Marl site for more than 50 years, producing several thousand metric tons per year.

Analog Devices Announces Industry's First Software Configurable Industrial I/O for Building Control and Industrial Automation

Bangalore, India: Analog Devices, Inc. (ADI) announces the release of the industry's first Software Configurable Input/ Output (I/O) product line for building control and process automation, allowing manufacturers and industrial operators to achieve greater control system flexibility while reducing their own product complexities. Traditional control systems require costly and labor-intensive manual configuration, with a complex array of channel modules, analog and digital signal converters, and individually wired inputs/outputs to communicate with the machines, instruments, and sensors on the operating floor. ADI's new AD74412R and AD74413R enable flexible control systems to be designed with reconfigurable module channels quickly, easily, and remotely without requiring extensive re-wiring. This drastically increases speed of implementation, flexibility, and the ability to make changes without significant cost and downtime.

As Industry 4.0 emerges, manufacturers need flexible systems that can quickly and easily adapt to changing requirements, all driven by shifts in consumer behaviors and demand. As a result, they can no longer rely on fixed, large-scaled systems designed for mass-market products and predictable demand. Instead, flexible systems that can be reconfigured quickly with minimal downtime and capital investment are required. With ADI's software configurable I/O, manufacturers can more efficiently implement new projects and achieve more flexible automated control, resulting in reduced design and installation costs, as well as reduced commissioning delays.

In using software configurable I/O, manufacturers can develop a platform that replaces multiple aging fixed function I/O modules or be applied across multiple customer applications where the I/O dynamic changes with each installation. For systems traditionally reliant on control cabinets with multiple I/O modules and specified wiring for each channel type, the need for hardware diminishes as end users can now install a single module type programmable from the control room, helping to decrease logistic, manufacturing and support costs. Software configurable I/O also acts as a bridge to Ethernet-based control networks, as it can further be applied to brownfield installations requiring updates to 10BASE-T1L industrial ethernet systems. It enables development of standardized, configurable field I/O units capable of translating between installed HART-enabled 4-20mA sensors and actuators and 10BASE-T1L or 100M Fibre backhaul.

Pricing and Availability

Product	Production Availability	Price per 1,000 Units	Packaging
AD74412RBCPZ	Now	$7.47	64-Lead LFCSP (9mm x 9mm w/ EP)
AD74413RBCPZ	Now	$8.55	64-Lead LFCSP (9mm x 9mm w/ EP)

NIPER-Guwahati Designs Innovative 3D Products in Collaboration with HAL

New Delhi, India: National Institute of Pharmaceutical Education and Research - Guwahati (NIPER-G) have come out with two products of help in the fight against the pandemic outbreak of COVID-19.

The first product is a 3D-printed hands-free object that could be used to help open or close doors, windows, drawers (both vertical and horizontal), and refrigerator handle, or press elevator buttons, and laptop/desktop keyboards, including turning the switch buttons on/off. The researchers came up with the design for the fabrication of the 3D-printed object after detailed analyses of several resources for risk measurement and on how viruses spread through bare hands. The face shield is also easy to design and it is possible to have rapid development of prototypes. It is also low cost, easy to wear, has good chemical stability, non-fragile and is easy to clean with the existing sanitizers or any alcoholic disinfectant.

The second product is a 3D-printed antimicrobial face-shield to control the spread of novel coronavirus. It was designed after a thorough study to understand how viruses spread through oral, ophthalmic, olfactory and other body cavities NIPERs are Centres of Excellence institutes of under the Department of Pharmaceutical, Ministry of Chemicals and Fertilizers. The seven institutes are functional at Ahmadabad, Hyderabad, Hajipur, Kolkata, Guwahati, Mohali, and Raebareli.

A meeting was held through video conferencing yesterday under the chairmanship of Dr P D Vaghela, Secretary, Pharmaceuticals new delhi to review NIPERS performance in research & innovation activities especially with regard to the ways in which NIPERs have and can contribute in country's fight against COVID-19 pandemic.

All the directors and chairman took part in the meeting, , Dr. U.S.N Murty, Director, NIPER-Guwahati,informed that NIPER-G endeavored to help the country in fighting coronavirus through quick validated prototype/product development and deployment. "NIPER-G is committed to provide useful contributions cum solutions".He said that NIPER –G has also made a skin friendly herbal sanitizer. He informed that industrial scale manufacturing of its new products are being done in collaboration with Hindustan Antibiotics Limited ,(HAL) a departmental PSU.

Doors, windows, switch buttons, elevator buttons, drawers handle, refrigerator handle, and laptop/desktop keyboards are some of the most germ-infested objects in houses, hospitals, factories, companies, institutes, organizations, and other buildings. In this current situation of pandemic outbreak of COVID-19, this aspect may play a key role in transmitting infection from one person to another through bare hand contacts or contaminated surface source.

EPC and Chemical process industry- Role and responsibilities in Covid-19 situation

Chemical companies including process industries need EPC companies to accomplish a project to bring value for money for the investment that they have made. Secondly, EPC companies should be able to construct an energy efficient plant where the customer has reasonable energy consumption in contrast to the international standards.

There are already clusters of chemical companies in various parts of the country, while one state has a huge chemical industry cluster and another state does not hold even a single portion of the industry. However, there are new industrial policies which are being formed by the government presently which has taxation benefits and investment returns for the investors. Chemical will be a priority sector in the future and therefore there is a demand for EPC in all dimensions of chemical process industry.

Few states in India where the chemical ecosystem has developed have the advantage of reaping a bigger portion of the returns. But now with the new GST design, industries will be spread across the country which till now was limited in certain states. There are two issues which need to be resolved in the near future viz., chemical plants to be upgraded to the environment friendly standards which will open up a lot of necessities and potential for EPC companies to work in this area and make the plants compliant to the future environmental laws.

Moreover, modernization and up gradation certify lesser consumption of raw materials, increasing productivity and making the plant more energy efficient and these two factors as discussed above for plant up gradations in the future will give huge opportunities for EPC market.

EPC requirements in India will be emerging more because of the open markets there will be no domination in the access to technology and adoption. India is an exporter of different types of technologies; R&D is happening in the country and so is networking with technology proprietors all over the world. The only issue is that our energy cost is very high- power cost, oil or gas cost for running various processes in a chemical plant is very high. This is a blockade for the growth of the industry in India but as the country is working in all these issues aggressively, various energy cost is going down due to several government efforts.

Currently, in India, there are no in-house EPC companies and for this reason a more methodical approach, necessary skilled manpower, government support for the growth of this industry is required. Countries like China who are huge into the EPC business get various facilities such as softer loans, support bank guarantees etc. which give much needed stimulus to EPC companies.

The current global pandemic situation has dire consequences for the energy & natural resources sector, including on energy and petrochemical development projects and revamp / refurbishment projects across the sub-systems in the energy & natural resources plethora. The majority of such projects are usually governed by so-called Engineering, Procurement and Construction (EPC) Contracts, which often follow international templates prepared by international organizations such as the International Federation of Consulting Engineers (FIDIC).

Energy sector and petrochemical development projects are complex and typically involve longer-term commitments from both the Project Owner and the EPC Contractor, requiring a substantial period of time to bring such projects to completion, often in the range of 12 – 24 months or more. Needless to say, larger-scale energy sector EPC projects are very often of also high-value, in the several hundreds of millions of euros or dollars range, with high stakes for both the Project Owners and the EPC Contractors. As a consequence, the full scale of risks and exposures stemming from the global pandemic situation can hardly be predicted.

Different EPC Contract phases involving different key risks

In general, different exposures exist in different phases of the EPC Contracts which can be broken down according to the main constituent parts of the EPC Contract, i.e. the design and engineering

Design & Engineering Phase	• Workforce disruption and inefficiencies due to home-office working of engineers
	• Delay in delivery of engineering works by the Contractor
	• Longer response times by the Owner
	• Knock-on effect of the delays accumulated during the design & engineering phase to the procurement phase
Procurement Phase	• Supply chain disruption - one or more key suppliers unable to deliver, partly or entirely
	• Increase of the costs of supplies, goods and materials
	• Inability to perform in-the-shop observing of key equipment manufacturing due to travel bans
	• Transportation disruption - transportation routes becoming closed down by public authority or government intervention
	• Difficulties with replacing stranded suppliers and/or finding new transportation routes
	• Long-lead items becoming stranded whilst under transportation
Construction Phase	• Workforce disruption potentially arising from several factors including inability to bring workforce to the site, restrictions on using large-scale workforce on site, contamination among workers on the site etc.
	• Revisiting Health, Safety & Environment (HSE) policies and re-defining best HSE approach to on-site activities
	• Liability for contamination / spread of the coronavirus
	• Delays due to numerous factors, including lack of workforce, impairment of transportation of equipment, ban on travel to the site of required experts for e.g. installation works etc.
	• Breach of financing agreement by the Project Owner
	• Delays of the public authorities in issuing permits, or providing approvals/consents

Fig 01

phase, the procurement and then the construction phase. These may include the following risks connected to the COVID-19 crisis (Fig 01):

Mitigating the risks posed by the coronavirus crisis for EPC projects, some of which we have outlined in the table above, is not only complex and difficult due to the unpredictability of the situation, but requires careful and coordinated assessment of the current and the forthcoming period, alignment between the Project Owner and the EPC Contractor, even possibly with the involvement of key suppliers and subcontractors of the EPC Contractor. Moreover, with respect to several risk factors, the involvement of public authorities will also be desirable and often even required. Importantly, if a serious disruption affects a major EPC project in the energy & natural resources space, this could have very substantial economic impact for the economic viability of the entire project, as the Project Owner may not be able to start commercial operation at times when it would be badly needed to generate revenues or, in case of e.g. revamp projects, may run into huge losses by a delay in re-commencing the operation of its refurbished units.

This puts additional burdens on both the Project Owner and the EPC Contractor, whose teams are normally already under significant pressure during the implementation phase of any complex energy sector EPC project. This means that the parties to EPC Contracts will need to find novel ways to quickly identify, assess and find solutions for the most relevant risks for their common project – failing which disputes will become inevitable.

Ultimate Objective

Another essential point to determine is whether the Project Owner or the EPC Contractor is what the ultimate objective is in the crisis situation in terms of EPC Contract. Do the intention is to save the project and continue with the EPC Contract, or do rather seek a temporary relief from payment and/or performance obligations thereunder? Or actually want to terminate or cancel the project entirely?

In any case, having extensively assisted clients on both sides of the trenches, that this never-seen-crisis will ultimately show that both Project Owners and EPC Contractors have a genuine interest to promptly start good faith discussions with each other to properly assess the actual scale and scope of the risks affecting their EPC Contract due to the coronavirus pandemic, and also with a view to find amicable solutions to handle such risks as best as is possible in the fast-changing circumstances. In the course of such good faith discussions the Parties should address issues such as:

a) What impacts the Parties can identify to the works falling under the scope of the EPC Contract;

b) To what extent the project implementation schedule (including in particular the milestones and the final completion date), the procurement plan and the transportation study have to be revisited and, possibly, amended;

c) Does the coronavirus crisis constitute an event of Force Majeure under the given EPC contract and, if yes, has appropriate notice thereof been given by the affected Party;

d) Is there any delay at present or imminently threatening which qualifies as a material breach of the EPC Contract, has an event of default occurred or is it imminent;

e) Is there any circumstance, which could trigger either liquidates damages payment obligation or a termination right of either or both Parties;

f) Is there any Governmental or other local law or regulation which makes it impossible or unlawful for either or both Parties to fulfil their contractual obligations or which, under the governing law of the EPC Contract, entitles any of the Parties to be released from its obligations under the EPC Contract;

g) Does the change in law provision (if any) under the EPC Contract apply to the present situation and, if yes, with what consequences;

h) Are there any grounds to invoke the suspension or termination mechanisms under the EPC Contract and, if yes, what are those grounds and with what consequences?

The principle of, "Build it, and the buyer will come," is no longer applicable. The availability of low-cost feedstock is not enough to guarantee return on investment. The need to satisfy specific regional demands, as opposed to the complexity of a worldwide distribution chain, has grown in importance.

As a result of this scenario, licensors and EPC contractors must deliver their own new value propositions based on their worldwide regional networks and robust relationships with future-oriented investors. Market diversification and product innovation are the main drivers to be managed in the "new generation" of chemical EPC contractors. Therefore, technology and best-in-class engineering services are key factors. The market has already been utilizing strategies that flatten capital costs, such as leveraging global engineering centres of excellence or adopting modular construction, among other solutions.

In this respect, it is imperative to leverage a distinct, technology-driven business, as well as to embrace early involvement in clients' investment initiatives. From providing technical expertise to assisting with financing schemes, these methods will allow a company to contribute to overall project development.

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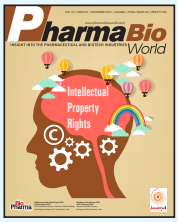
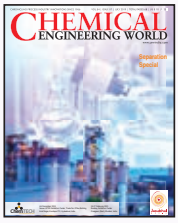
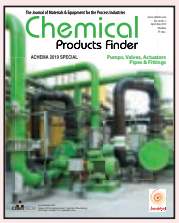


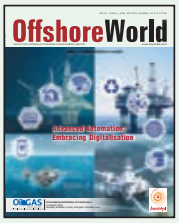
PharmaBio World
INSIGHT INTO THE PHARMACEUTICAL AND BIOTECH INDUSTRIES



CHEMICAL ENGINEERING WORLD



Chemical Products Finder



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Challenges for LSTK Contractor for Executing Large scale Brownfield Project in Oil Refinery

Many times, while executing the revamp project, the things that are not supposed to fail can also fail. The authors discuss some of the standard execution strategies across all stages of project execution out of available options to work on large scale refining projects in this article.

Type of Project Execution Philosophy:

- EP Mode: EP (Engineering and procurement) mode of execution, Owner sub-contracts engineering and procurement services to the Contractor. Construction and implementation of the Project is taken up by the Owner. Owner prefers this philosophy if they have significant internal resources available for executing the Project.
- EPCM Mode: EPCM (Engineering Procurement Construction Management) mode of execution, Consultant scope is engineering services, procurement services and construction management of the Project. Consultant plans and supervises construction activities and is responsible for the implementation of work and management of the Project. EPCM Consultant follows the Owners Procurement and Sub Contracting procedures for ordering and tendering process. Selection of vendor, supplier, sub-contractor and execution of work lies with Owner based on EPCM consultant recommendation. The Owner places the Purchase Orders and Work orders on the Vendors /Contractors and Pays to these agencies as well. Cost risk remains with the Owner under this arrangement.
- EPC Mode: EPC (Engineering Procurement Construction) mode is often known as turnkey contract. In this mode of project execution, contractor scope includes complete Engineering services, Procurement activity and Construction activity on the lumpsum basis. Risk under this mode of the contract remains primarily with EPC Contractor. EPC Contractor enters into separate agreements with sub-contractors / vendors; however, it retains the responsibility of their work. Owner minimizes its risk under EPC mode of contract, and this arrangement is well suited when the Owner has limited execution resources and tight schedule for finishing project.

Challenges for EPC Contractor:

There are several challenges for EPC contractor for Brownfield project execution. In this chapter, the author shares his practical experience in some of the significant challenges faced by EPC contractor while executing Brownfield project in LSTK mode during different stage of the Project, i.e. Proposal, Design, Construction and finally Pre-commissioning, commissioning and start-up phase.

Proposal Stage:

- Steep competition: LSTK Contractors often face fierce competition with other bidders during the bidding process; competitors are aggressive with their pricing. In some instances, LSTK Contractors are awarded job with a marginal difference in pricing with their competitor. In most of the tender costing of the job is a combination of OPEX and CAPEX, LSTK Contractors to give equal weightage for both while deciding the price for bidding.
- Tendering time: The duration of bidding time for EPC tenders is often tight and sometimes tendering period is only 2-3-months. Due to lack of time contractor may go for inhouse costing of some of the items which may deviate during execution stage leading to loss.
- Interface issues with Owner: One of the significant problems with Brownfield projects is the Interface between the Owners and Contractors scope of work. The scope demarcation is not always clear, and LSTK Contractor ends up

doing more work during execution than estimated

- Zero deviation contract: Often, most of the Oil Refineries prefer zero deviation in the tender. EPC contractor to sign the agreement as per the condition of the Owner. Most of the contracts are one-sided, and all significant risks and uncertainties are moved to the Contractor's scope.

- Feed verification: Before proceeding for EPC contract, Oil Refineries perform FEED which gives a clear understanding of the scope of work for LSTK Contractor. In many cases, the design is not frozen in the FEED stage, and LSTK contractor has to re-verify the FEED package during the proposal stage and clarify doubts in the form of Technical queries (TQs). However, there are always grey areas for which Owner/ PMC does not provide straight forward clarifications. It becomes a complicated situation to deal with in the execution stage; Costing of such issues becomes very difficult and impose a risk to the bidder.

- Proposal Budget: LSTK Contractors have a fixed budget for proposals. Contractors spend manhour in the bidding process if the proposal not successful, then it will be a loss for the LSTK contractor.

Design Stage:

- Schedule monitoring: LSTK contractor to develop level-4/level-5 schedule during the early stage of project execution and ensure it is in line with the achievement of critical milestones. EPC Contractor to conduct monthly review meeting with Client/PMC and monitor project progress is as per plan.

- Long delivery items: There are few items in the Brownfield project having the long delivery time and govern the schedule of the contract. Contractor to identify these items and ordering to be done at early stage of Project so that these items reach site on time.

- Critical Review meetings: LSTK contractor conducts various review meetings like P&IDs review meeting, 3D model review meeting etc. LSTK Contractor records meeting notes and ensure all points are closed on time. In these review meetings, apart from technical aspects; LSTK contractor's prime focus is to ensure compliance of all scope as per bid package.

- HAZOP/HAZID/SIL Study: LSTK Contractor to conduct HAZOP/ HAZID/SIL study and ensure all action items are closed. The delay of the closure of action item can impact the overall project schedule. HAZOP/SIL study is also to be conducted for the vendor package items.

- Existing Plant Health: Existing plant health is another concern for the Brownfield plant. LSTK Contractor rely upon the health check data / adequacy report provided by the Owner in the BID document. Measuring the thickness of existing line/equipment while the plant is under operation is not an easy task. LSTK contractor to make site visits and take feedback from Owner to assess the health condition of the plant at the early stage of the Project. In case of any significant concern, the same to be discussed with the Owner for finding a suitable solution.

- As-built verification: Existing unit's As-built document/drawing verification is one of the significant challenges for LSTK contractors. As-built P&IDs, Piping isometrics, GA drawing, Control logics etc. needs to be verified by LSTK contractor at the early stage of the Project. In many cases, the document available in the bid document will not be in line with the actual plant. LSTK Contractor must-visit site for verification of as-built documents. Sometimes 3D models, native files of the P&IDs are not available with the client, LSTK contractor can consider advance technology like Laser scan of the plant etc. Still, there are few cases like UG lines, Internals of columns/Reactors/ vessel etc. for which Contractor is dependent on the Owner as-built document; as verification is difficult or not possible.

- Tie-In verification: In brownfield projects, Interface of the new lines with existing lines are called Tie-In. These Tie-ins need to be indicated with a tie-in no in the P&IDs and isometrics. Location of the tie-ins to be verified at the site by contractor process and piping engineers to ensure these tie-ins can be executed during turn-around. If specific tie-ins are found difficult to perform during site tie-in verification, these tie-in locations should be changed. This exercise needs to be completed will 100% accuracy level, which is key for successful revamp of units.

- Constructability Study: In typical brownfield projects, there are few pieces of equipment which needs to be replaced in the same location or new location; few pieces of equipment are to be modified. There are cases of critical modifications where Contractor to replace tall

columns/vessels with new columns/ vessel in existing structure/location for which constructability study is essential. Constructability study to be conducted in the design stage to ensure equipment erection/ modification/replacement is possible in the given turn-around time.

- Compliance of Local regulations: Compliance to local regulations codes and standards like OISD is another challenge area for Contractor, especially for brownfield project. The units designed decades before are compliant to local regulations at that time. As regulations are updating, it is an opportunity for the Owner to make compliance with all updated regulations. However, in some instances, it is challenging for LSTK contractor to execute.

- Handling the OEMs: In some instances, LSTK Contractors have no option but to contact existing equipment manufacturer called OEMs in Brownfield projects to verify existing equipment for its adequacy for revamp scenario or to modify the existing equipment to suit revamp case. For example, adequacy of existing compressor needs to re-evaluate for the revamp operating condition. These types of works are shifted from Feed stage to EPC stage, by Owner, to save overall project execution time. As a result of adequacy check, certain unforeseen surprises can occur, which may have high cost and schedule impact to the LSTK contractor and becomes a risky proposition.

- Pre-com, Com and Start-up plan: The LSTK contractor to freeze Pre-commissioning, Commissioning and Start-up plan of the Project. The LSTK contractor discusses more elaborately with the Owner for the sequence of start-up activity. LSTK contractor to involve process licensor in these meetings to finalize the plan so that there will be no last min surprise during commissioning and start-up. Planning of pre-shutdown activities during the design stage is very critical. It is very much essential to prepare adequately in the design phase such that no pre-shutdown activities should overflow during the turn-around, causing delays to the project schedule.

Construction Stage:

- Segregation of Pre-shutdown and Shutdown work front: Construction stage is crucial for the successful execution of the brownfield project. LSTK contractor to segregate the construction work front into two types, i.e. prior-turn-around and during turn-around work front.

- Execution of work prior turn-around: Execution of work prior turn-around relatively more straightforward than during turn-around. LSTK contractor to select sub-contractor, ensure availability of material and resources to perform work front. LSTK Contractor's objective is to maximize work in pre-shutdown stage and lesser work in the shutdown stage to complete the brownfield project successfully. LSTK Contractor to take advantage of opportunity shutdown, i.e. intermediate shutdown of the units by Owner.

- Execution of work during turn-around: This is the most crucial time for the Contractor. Contractor to work in limited time considering all safety aspect of the plant. Any violation of safety can have a severe impact.

- Vendor Management: LSTK contractor to manage multiple vendors mobilization in the site during turn around, for overseas vendors mobilization, government approval is required. LSTK contractor to take proper permissions in advance for their visit.

- HSE: Ensure all HSE metrics are monitored in the site during execution of work as per LSTK contractor/Owner HSE procedure.

- Multiple agencies working in the same plant: Owners Maintenance team also perform their activity in the same plant during the turn-around, which will have interface issues for the LSTK contractor.

- Material Management: Local well-organized Storage at the site is crucial as several activities by numerous groups will be parallelly going around, and material management is going to be most challenging in the shutdown period.

- Shutdown Challenges: During the shutdown, when LSTK contractor executes the modification of existing systems, some internal damages may show up and will surprise the Contractor and Owner. Resolving such surprises may derail the shutdown schedule and possess the risk to the LSTK contractor.

- Critical Equipment: Preservation of critical and sensitive equipment's during the construction phase is one of the key points to ensure a quick and smooth start-up and to avoid any surprises during the commissioning period.

Expert Advise

Meticulous planning of commissioning activities. construction activities, pre-commissioning activities is must

Provide additional spools, positive isolations so that parallel activities can be conducted without their interference.

At the design stage itself, Licensor or Basic Design engineer must be consulted for the critical issues.

Many times, while executing the revamp project, the things that are not supposed to fail can also fail. In such cases new operation methods need to be developed so that the sequence of operation does not stop.

Any new operation needs to be discussed in detail, design and all necessary approvals must be taken before implementation.

Risk analysis must to be done to ensure that there are no loopholes.

- Unit Handover: Before handing over of unit by Owner to Contractor, units should be made hydrocarbon free, and suitable blinds are to be provided for positive isolation to ensure units are safe to start construction work. Several safety risks are associated if the Owner does not fulfil the above conditions.
- Tough work environment during the shutdown period: Considering that many contractors are competing to finish their respective scopes compete for limited space available in the plant. This creates a challenging situation to maintain a tidy work environment. At times this could affect the quality of work and the consequent problems.

Pre-commissioning-Commissioning and Start-up:

- Pre-commissioning: Pre-commissioning activity is performed along with Owner Operating team. Depending on the contractual requirement, in most of the brownfield project Owner takes the responsibility of Pre-commissioning and commissioning activity. In some cases, these activities are undertaken by the LSTK Contractor. The entire plant is divided into systems and subsystems, pre-commissioning activities are conducted system-subsystem wise. LSTK Contractor to approve pre-commissioning plan much before the start of these activities with Owner. There should be multiple review/meeting to be performed with the Owners' team to finalize Pre-commissioning plan.
- Selection Sub-Contractor: If LSTK Contractor owns resource is not sufficient for pre-commissioning work, Contractor to select suitable sub-contractor for Pre-commissioning activities. Pre-commissioning activity usually is different from construction activity as it is specialized work. There are few special activities like chemical cleaning, alkali boil-out etc. for which Contractor to select specialized vendor/sub-contractor.
- Material/tools and tackles: LSTK contractor should estimate materials for pre-commissioning like gaskets, fastener and tools and tackles with adequate spare margins so that there will be no shortfall.
- Arrangement of Utility: In few brownfield project utility requirements for the pre-commissioning activity is kept under the LSTK contractor scope. Contractor to estimate utility required and make a suitable arrangement.
- Licensor Management: Licensor arrangement is usually under Owner responsibility; however, few Brownfield project it is kept under the scope of LSTK Contractor. LSTK Contractor to maintain an adequate margin on Licensor costing as there can be many uncertainties and licensor services cost is generally high value.

Although there are many difficulties for the LSTK Contractor for implementing Brownfield Projects, with proper planning, execution, and identifying unforeseen risks, it can be successfully executed. On the other, there is a major privilege for Owner as Projects get implemented timely with minimum risk.

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Multipurpose Plant – the Need for Today

MPP plants are agile and allow the manufacturers to meet specific demands and quality requirements. This flexibility permits the use of various design strategies, from simultaneous optimisation of all problem decisions to a sequential optimisation of equipment.

The multipurpose plant (MPP plant) concept is not new to the chemical industry. Global demand is highly dynamic in nature and the requirements of the pharma, pesticide, bulk drug, and speciality chemical markets - and many more besides - change dramatically according to global requirements and necessities.

As a result of the COVID-19 pandemic, many countries are currently unable to meet the demand for these types of products, but versatile MPP plants could be the solution. MPP plants provide flexibility when it comes to delivering both low and large volume products within a single facility.

Many industries already produce a variety of products in a single plant, with products being manufactured based on demand and produced with and in different timelines.

The chemical industry is already dynamic when it comes to changes in demand, quality and product type. Each market cannot survive on a single product; food, pharma, intermediate bulk drugs, chemicals, pesticides, insecticides, general chemicals, speciality chemicals - all have different demands for their products, each on a changing timeline. It is simply not feasible for the industry to build product-based manufacturing facilities.

The key feature of an MPP plant is that it is flexible enough to meet specific demands and quality requirements. This flexibility permits the use of various design strategies, from simultaneous optimisation of all problem decisions (equipment, connections and schedule) to a sequential optimisation of equipment. Fine chemicals are complex in nature, produced singly and in limited quantities, but various speciality chemicals can be combined with a multistep process to produce these chemicals in a precise manner.

True, the MPP plant concept is already widely used in chemical industries, but these plants are often specific product based, and require modification or adoption of new equipment to alter their output. Smaller modifications can often be carried out easily and quickly, but in many cases the process is neglected, and more complicated nonlinear design solutions are necessary.

Multipurpose materials

Several pharmaceutical, bulk drug, pesticide, and general chemical companies have different process steps for production, but selected materials such as glass lined reactor, SS304, SS316, SS316L, and Hastelloy can be used within MPP plants. The more the selected management of change (MOC) facilitates, the more steps and processes for production. Installing various types of equipment for reactors, dryers, heat exchangers, columns, and pumps also provides more flexibility for plants.

Multipurpose utilities

The processing of various types of utilities, such as steam, process water, chilled water, chilled brine, hot oil, vacuum, instrument air, and nitrogen can be designed around future upgrades, and modular spaces can be provided based on the future requirements of utility equipment.

Currently, pre-planned product based MPP plants cannot operate outside their product scope, requiring major modification of equipment and materials to meet new product requirements. Companies often manufacture products on a contract basis for several multinational corporations, and specific product-based plants are unable to sufficiently meet the requirements of any increase in demand.

Specific product bulk drug and formulation plants can be designed to be easily upgraded to meet future requirements. Similarly, pesticide and intermediate chemical plants can house various types of materials, with equipment suitable for new product production.

In general, the chemical industry doesn't widely utilise automation, but recent advances in automation processes offer a high degree of accuracy and safety within plant production, providing plant batch mapping and optimisation for de-bottlenecking. Smart motor control centre (MCC) and distributed control system (DCS) frameworks provide accurate information for plant operation, while lowering operating costs. There are certainly challenges around product change over, start up and shutdown, but advancements in tools of safety can be used to minimise these risks. Advanced instrumentation systems can also provide a layer of safety.

Overall the concept of MPP plants provides a great deal of flexibility, which can handle the dynamic pressures of the chemical market, while multifunctional processes meet the requirements of greater global demand. ■

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EPC 4.0 Fast-forwarded: Quickly Adapting to the Current Economic Scenario

To put it simply, adopting EPC 4.0 starts with creating an integrated data-centric system to keep all the components of EPCM i.e. Engineering, Procurement, Construction, and Management in one location. In this article, Waldir Pimentel Junior, narrates the context, rationale, and the possibilities of EPC 4.0 adoption for the EPC companies.

The current pandemic, combined with the unprecedented fall in oil prices this year, has pressed the world's fast-forward button, especially when it comes to how the EPC (Engineering, Procurement, & Construction) companies will adapt to this new world order. The current EPC market is forced to rebalance the economic situation by accelerating internal projects; and in consequence, speed up the decisions from years to just months – switching to working-from-home is one such example of expeditious changes.

In pre-COVID-19 period, the EPC processes of industrial plants and other businesses have not been changed much in the past years. Recent plants are technically not much different from those which were built many years ago. This made the EPC industry to slow down in driving innovation, which was otherwise ahead in implementing the engineering / IT systems. This causes the industry to lose in the global competition for investments.

While ideating for some EPC customers, it is not unusual to hear them saying that they do not feel any real productivity increase has been achieved over the past 20 years. Although efficiency improvement is being talked about in this space for quite a while, in many a cases the EPC companies have still been struggling to close their projects even with a minimum profit or just making the ends meet to survive.

The reasons why this happens vary a lot depending on the nature of the project, the industry being served to, as well as the project location across the globe. Nevertheless, some similarities have become evident based on my discussions and observations with clients across the world:

- Technology is not being used by the EPC companies up to the fullest extent of their existing capacity. Imagine a company that uses only piping modeling instead of the full capability of their tools to model other disciplines (such as electrical, steel structures, etc.) of the 3D modeling system.
- Old technologies and software versions are being used by the Owner Operators (OOs) as they are obligated to do so according to contractual terms, which unfortunately does not act as an incentive.
- Many a cases technologies don't deliver what was promised.
- Lack of integration: EPC companies are still using their tools in silos in an inefficient and non-streamlined way without exchanging the data amongst them.

"Adapt Quickly or Die" – this is the challenge that the EPC industry is now facing more than ever, or at least more than in the last half-century. All of a sudden, adoption of EPC 4.0 (Industry 4.0) has become a mandate and is not optional anymore.

To keep everybody on the same page, let's define what we mean by EPC 4.0. This means creating an integrated data-centric system that keeps all E-P- C and even EPC *"M"* (EPC + Management) information in one place. It supports not only the design, but also the information management, change management, data reuse, and a proper digital handover to the OOs. EPC 4.0 includes the entire lifecycle of the plant and is a real change from a kind of hybrid model i.e. "paper + digital" to a full data-centric digital model.

Let's consider an example. As a global leader in sensor, software, and autonomous solutions, Hexagon has established partnerships with AspenTech and OSIsoft, which in the near future will allow Aspen tools to move data - automatically - from the conceptual and basic engineering to the detailed phase, and consequently to all the other EPC phases. During operations, the solutions will remain integrated to ensure that the

"Adapt Quickly or Die" – this is the challenge that the EPC industry, like many other industries, has been facing more than ever, or at least more than in the last half-century. All of a sudden, adoption of EPC 4.0 (Industry 4.0) has become a mandate and is not optional anymore. All of a sudden, adoption of EPC 4.0 (Industry 4.0) has become a mandate and is not optional anymore.

Modern web-based access to engineering data any time, any place on any device.

potential changes in process simulation are within the constraints of the design model, for example, flow rates as defined by the P&ID. In addition, populating the Manufacturing Master Data Model as well as visualizing advanced predictive and prescriptive analytics put everything in an easy and organized way to the engineers in the operation room.

We all know that the EPC industry needs to expedite the changes in the current scenario. What can we learn from the other industries that have successfully embraced the Industry 4.0 concepts? Let's take a look:

Benefit from Your Engineering Systems

- Get the full benefit of your engineering systems and don't just produce some intelligent P&IDs;
- Rather use all available engineering tools and model all disciplines in a 3D environment.

This way, there are no silos with simple input /output as everything is integrated and all the data so generated can be reused and checked efficiently.

In addition, it is recommended not to reuse only the data that being exchanged between the disciplines, but also to reuse the previously created designs that exchanged between projects. It's not likely for exactly same two EPC projects to exist, but much of the content created in a project can for sure be reused in other projects without reinventing the wheel, thus saving a lot of time and money.

You can also perform automated cross-checks of the data generated by the tools, thus avoiding the wasting of time in verifying each of the deliverable-s (list, drawing, report, etc.) before any handover. The data-centric model saves a lot of time on final-verifications. It is also recommended not to perform any adjustments in deliverables outside the data-centric system, for example, by using simple CAD tools or MS Excel.

If you are not using your EPC tools to their fullest potential, you certainly regard them as a burden, thus incurring extra cost. In this case, you might start to move back to earlier stages of digital transformation, going to perform the drawings in simple CAD tools, reports in spreadsheets, etc literally returning 20 years in time.

Improve engineering collaboration

As projects are becoming more complex and require global collaboration amongst the EPC companies located across continents and time zones, there's also a need for improved coordination amongst the offices and across the disciplines more than ever before. Do you have tools and processes that can support global engineering? To know the answer, you only need to answer a few questions:

1. Do you have the best-streamlined process design available with you? Or do you keep using xls, txt, cvs, xml files to exchange data; and simple CAD tools to produce deliverables?

2. How are you dealing with procurement and construction phases? Do you have a modern design tool but a spreadsheet control for your procurement? And is your documentation still inside that shared folder in the server where everybody has access?

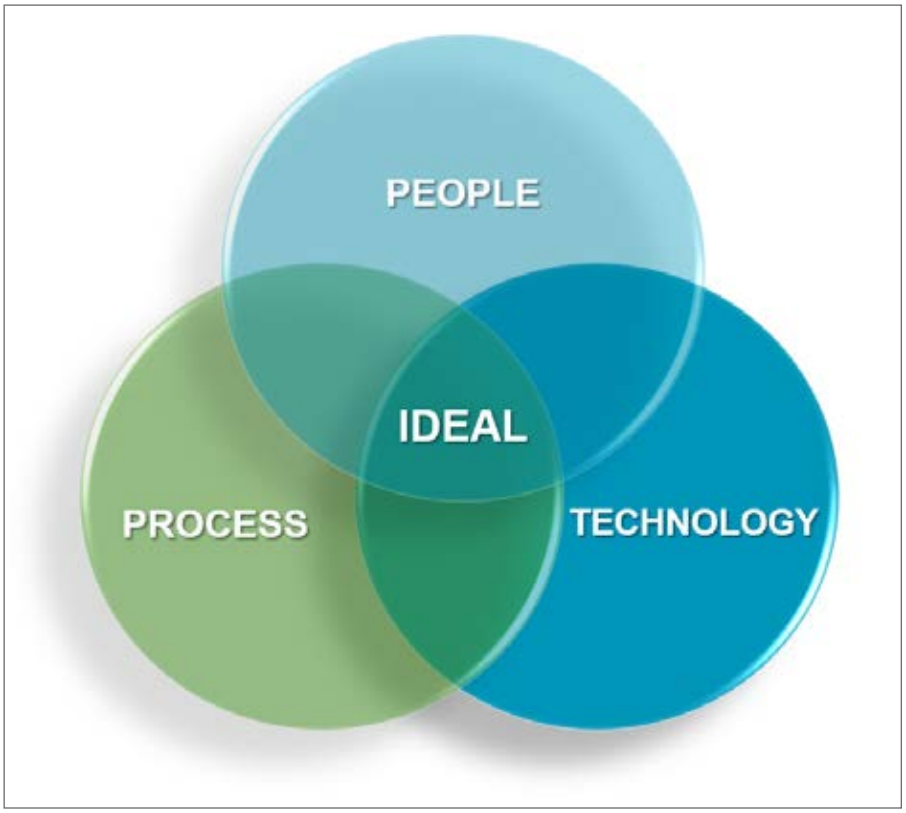
EPC Companies vary in size and type, ranging from companies only focusing on the engineering side to others solely focusing on procurement and construction. No matter the size or type, if you don't have all the necessary steps aligned, both internally and externally, you will be losing efficiency; and in this specific market at the current scenario, this can make a big difference.

Enhance project delivery

Are you still just delivering PDFs to your customers? If so, there is a better way. For most of the Owners Operators, importance of digital transformation and Industry 4.0 concept remained untouched even some years ago. Especially after the crisis occurred in 2014 – 2015, the interest in a Digital Twin implementation has risen quickly as the Owners understood that this brings in not only the efficiency but also the cost savings.

To perform efficiently during such a transformation, OOs are adopting standards such as CFIHOS, which define the data in detail, which is equired to be handed over from projects to operations to carry out all the necessary procedures for data-centric deliverables. Such alignment by OOs has been gaining a lot of momentum, and now due to the current scenario that we face, it will certainly

EPC 4.0 includes the entire lifecycle of the plant and is a real change from a kind of hybrid model i.e. "paper + digital" to a full data-centric digital model.



become even more important.

And now, more than ever, Owner Operators will look for companies mutually aligned with their requirements, putting aside the ones that cannot understand or work in their industry 4.0 world.

What to consider when adopting EPC 4.0 technologies?

Always look for a balance between the people, processes, and technologies when considering any system implementation.

That is because it is impossible to have tools & technologies that make all the professionals happy and that fit in to all the processes of a company. Though in-house development of such tools & technologies is possible, starting a tech company inside an EPC would seem a waste, as this brings a lot of extra costs unrelated to the EPC business. Rather than reinventing the wheel by yourself, you can rely on trust-worthy vendors.

Have you considered how you can make use of your engineering digital twin to enhance your offering to your Owner Operator customers and extend your footprint? Owner Operators do not necessarily have the resources or skill sets to maintain the digital twin; so why not to offer to do this on their behalf and manage the engineering digital twin into the operational phase? Many engineering companies have started to move down this path to increase revenues and to leverage their skills into the operational phase where there is a more stable revenue flow.

As per a recent study conducted by McKinsey[1], the oil and gas industry will continue to be affected by the COVID-19 situation and will lower the processes for the immediate future. It is worth noticing that the industry has been performing only slightly better than air and travel business, and frankly nobody can predict how the world economic recovery will be. In this way, it is better to remain prepared for serving other markets and having the right partners to support you on this.

Look for different markets

As per a recent study conducted by McKinsey[1], the oil and gas industry will continue to be affected by the COVID-19 situation and will lower the processes for the immediate future. It is worth noticing that the industry has been performing only slightly better than air and travel business, and frankly nobody can predict how the world economic recovery will be. In this way, it is better to remain prepared for serving other markets and having the right partners to support you on this.

In Conclusion:

Finally, as a golden rule for a successful EPC 4.0 implementation, my recommendation would be: do not try to go from Zero to Hero. As discussed earlier, EPC companies vary on size, specialization, and tech maturity level. Start solving first the issues that you have on your stronger side, even if this requires you to detach from the whole EPC offering. You may consider the start by focusing only on the engineering design or procurement management or construction, or even sub-areas of those main ones. As long as you're getting stronger in all areas – in other words – more profitable, you will be able to provide the whole portfolio of services again.

As you may have noticed, I did not mention here anything about IoT, disruptive technologies, or super-advanced AI to reach EPC 4.0. All the ideas discussed here have been around for some time and are still very powerful and feasible for implementation. I am confident that you can quickly organize all the ideas and prepare yourself as well as your company for this digital journey. And there is no better time than the present to get started.

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Fire Water Motor Reclassification: The Benefits

The paper is about the learning that derived during a refinery expansion project execution wherein one unit each of DHDT and HGU were added. The location review of fire water booster pump motors for both the units resulted in a motor reclassification from flame proof to increased safety type. The reclassification was achieved by increasing the foundation height of motors beyond the limit specified as per standard code. This reclassification offered two benefits. The first is the cost reduction of motors which has directly contributed to project cost saving by Rs 0.45 million. The second is the reduction in the delivery period by 50% for flameproof motors, specially when such motors are not readily available. Since post the receipt of motors, the related activities at site could be completed by 4 weeks ahead of schedule, and if the overall project could be completed matching the fire water system schedule, the projected turnover would be Rs. 21250 million. The spin-off benefit as a result of this learning is an opportunity to audit the entire layout of the existing refinery, or new refinery project at the proposal stage to achieve similar benefit and implementation in various other refinery projects which are under execution.

Fire Water System Design Requirements & Basis [1]

The refinery expansion work consisted of adding a DHDT and HGU to existing set up. Figure – 1 shows relative location of the units in the plot plan.

Diesel hydrotreater unit is installed for improvement of Cetane Number and reduction in sulfur content in raw diesel. Hydrogen required for DHDT was obtained through naphtha reforming.

The fire water system is designed to meet the minimum requirements of TAC. The other applicable requirements included OISD standards 113[2], 116[3], 117, 118, 144, 156, 169, and 173. Minimum requirement for process units and main buildings are as follows:

1. Water Spray as per OISD-116 and OISD-173 for equipment and Transformer/Cable cellar in sub station
2. Dry risers for elevated platforms and tall towers
3. Elevated water/foam monitors and long-range monitors (OISD 116 Section 5.6.9). The vessels up to 10 m height are accessible by grade level hydrant. The range of hydrant was 30.0 m. Each vessel was covered at least from two sides. For vessels up to a height of 25.0 m were covered by ordinary water monitor having a horizontal throw of 45.0 m and vertical throw of 25.0 m. The monitor was so located that the particular vessel was in full view for controlling the water throw on the vessel. The location was on the periphery of the unit area accessible from road side. Steel structural elevated platforms at 15-30 m height were provided to install remote monitors. Two such elevated monitors were provided to ensure the coverage of a single vessel or a group of vessels / columns. Similarly, the long-range monitors were located to cover the vessels which could not be covered by ordinary monitors due to obstruction in the horizontal throw. As an additional provision, water monitors were provided at the top of technological structures, wherever feasible, to handle emergency situation for incipient fires.
4. Header Pressure – The fire water system was designed for a minimum residual pressure of 7.0 kg/cm^2 (g) at the hydraulically remotest point of application at the designed flow rate at that point. (Section 5.3 OISD 116). The fire water network was kept pressurized at minimum 7.0 Kg/cm^2 at all the time.

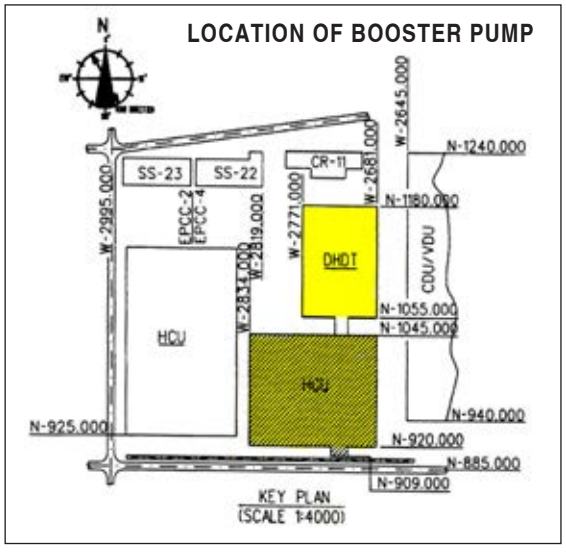

Fig-1: Refinery plot plan showing location of HGU & DHDT units

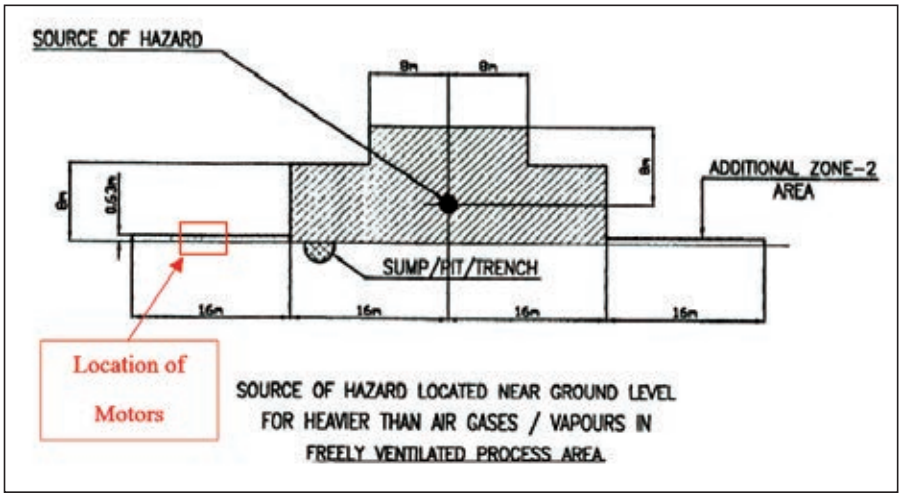

Figure-2: Source of Hazard located at grade level

5. Location of Pumps – Fire water pumps were located as far away as possible, not less than 60 Mts from hazardous areas to avoid any damage in case of fire/explosion (Section 5.3 OISD 116).

6. Booster pumps were provided for increasing the pressure of fire water as per specifications. These pumps could be operated from remote location.

Formulation of the Problem

Booster pump: A booster pump is a type of fire water pump used to supplement the water supply pressure available from public or private sources whenever pressure requirements of the protection system exceed the available supply capability. In the system, the booster pumps were to be used to augment the supplied water pressure to the fire water monitor nozzles located at an elevation of 24 meters and above.

The booster pump motors had to be located near battery limit of the units as specified in the design requirements for both the locations. The applicable area classification was "Additional Zone-2", shown in Figure – 2. Additional Zone-2 means where there is a possibility of hazardous vapour ingress.

The foundation drawing for the booster pump motors as per BID document is shown in Fig-3. The TOG was +0.3 M above grade level. As per job specification, the motor for booster pump shall be flameproof (Ex'd', IIC, T3).

Solution Adopted

It was realised that if the height of the foundation could be increased from +0.3 M to minimum +0.63 M specified under OISD-116 (Refer Fig-2), the motor could be located in the safe area. The proposed modification is shown in the Fig-4. Since the motors are relocated in the safe area instead of Additional Zone-2, these need not be flame proof (Ex'd', IIC, T3), or explosion proof as per job specifications. This modification resulted in re-classification of motors from flame proof / explosion proof to "Increased Safety" type. The proposed modification is shown in Figure-4.

The proposed foundation modification for both DHDT and HGU units was taken up with PMC who approved the same. PMCs comment are reproduced below:

"The area classification related information indicated as in data sheet (i.e. raising foundation) is noted. However, same shall also be suitably represented / incorporated in GA drawings as appended".

Discussions

The increased cost of foundation-material due to modification was ₹5000/-, whereas the difference in the cost of Explosion proof motors is ₹ o0.45 million which is 30% savings in the budgeted cost. Similarly, the installation and labour cost for Ex 'e' motor is lower by 65% compared to Ex 'd' motor, which is a direct contribution to savings. For increased safety motors, deliveries were better by 8 weeks compared to Ex' d' motors which has directly contributed to furthering the project schedule. Table – 1 shows the projected additional turnover due to the improved schedule. Additionally, we can derive a benefit in terms of increased turn over / profit depending upon the criticality of delivery with respect to the complete project schedule. By taking credit of 4 weeks only on total completion of the project schedule, the estimated contribution to turnover becomes 21250 million.

The longer deliveries for Ex' d' motors are due to the fact that each motor is tailor made as their applications are rare. Ameron (4) has concluded that the approach of some of the manufacturers to specify an Ex'd' motors from safety point of view as a sole criterion is incorrect.

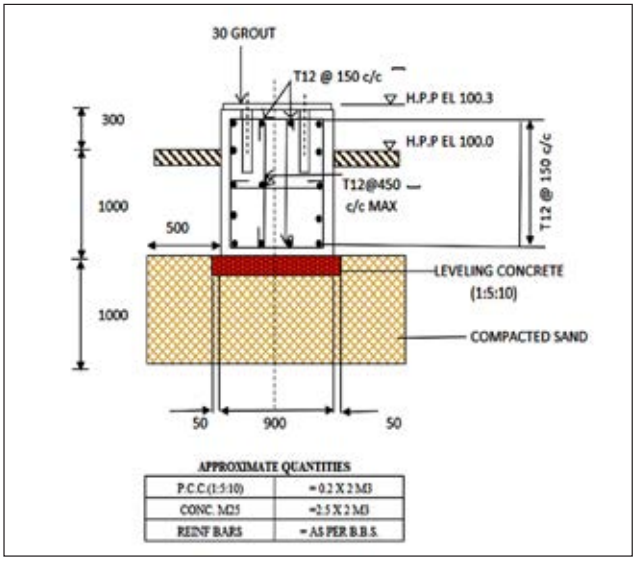

Fig-3: Elevation of Booster pump foundation (All dimensions are in mm)

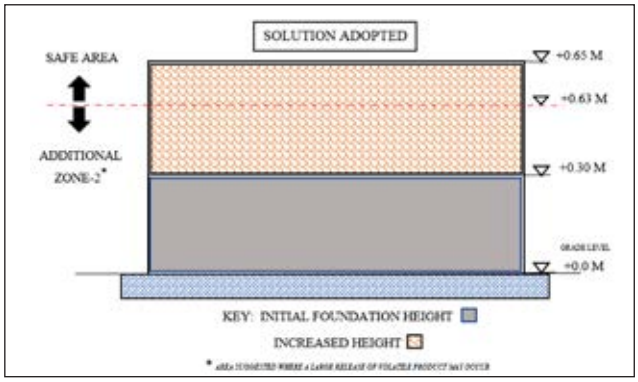

Figure-4: Proposed modification for Booster Pump Foundation

This is due to the fact that the installation costs for labour and material may be two to three times more than for increased safety Ex 'e' motors.

Stadler & Jackson (4) have discussed drive motor protection principles and selection criteria. Flameproof motors must meet three basic requirements. Firstly, the temperature of the outside surface must not exceed the allowable temperature class; secondly, explosion resistance must not allow the spread of explosion to external surroundings; and thirdly, the pressure resistance protection of the motor should prevent any permanent damage or deformation that may occur as a result of explosion inside the enclosure. The Ex'd' motors are suitable up to T4 temperature class, which is up to 135°C With special design, these can be put in to service up to T5 class – temperature 100°C max, or T6 class – up to 85°C maximum. Heating systems of the Ex'd' motors need not necessarily be Ex 'd' version. This is because the installed temperature is so selected and located that they trip prior to motor surface temperature limit. It is for this reason other inverters can be used with Ex' d' motors provided company operating drive system complies with the regulations specified by the motor manufacturer. The Ex' d' motors have enclosures and shields to withstand high explosion pressures, which makes them heavier than increased safety motors. The Ex'd' motors offer the best flexibility since the time they can be designed for normal line operation, intermittent duty, inverter operation, and heavy duty starting. The Ex'd' motors can be started immediately after a power failure; or even after a planned shutdown, whereas the increased safety Ex'e' motors require purging before restarting. And the purging can be time consuming.

The increased safety motors are always de-rated to prevent hazardous temperature, sparks, and arcs during start up and normal operation. This feature is little unattractive and limits usage in only specific cases. Similarly, it handles only T-3 temperature class, Max 200°C upon checking the stator winding ignition risk assessments required for motors > 1Kv, as per EN60079-14[7]. Space heater requirement is mandatory to prevent any condensation of moisture during the starting. Additionally, protection such as purging, measure of gas concentration, etc is also required.

The proposed modified foundation drawing was taken up with PMC and PMC approved the same for implementation.

SN	DESCRIPTION	UOM	₹
1	Capacity	TPA	3500000
2	Working Days		365
3	On stream Hours/Year		8000
4	Density of Diesel @15.6°C	Kg/M3	851
5	Credit for 30 days	Hours	720
6	Production / Hour	TPH	438
7	Diesel Price	Rs/Ltr	57
8	Diesel Turnover (Cu M)	M3 Prodn* Credit Hours	370370
9	Rupees Turnover (₹)	Crores	2125

Table – 1: Projected turnover with 30 Days Credit for schedule

In Conclusion

- The foundation modification has resulted in reclassification of motors for fire water booster pumps from Ex'd' Explosion proof / Flameproof to Ex'e' increased safety type
- A saving of ₹0.45 million in the DHDT and HGU project cost, and projected turnover of
- ₹ 21250 million due to improvement in project schedule
- Implementation of the learning in other ongoing projects such as Hydrocracker Unit including LPG treater, PGA and associated facilities, and Coke Drum System finally result in value addition
- Leveraging the learning benefits during audit of plot plans for future projects for possible cost saving and improvement in project schedule
- Similar recommendations were received from PMC for refinery project transformer foundations
- The motor reclassification was relatively easy as the fluid handled was non-flammable. For other fluids, a thorough study of Area Classification is recommended
- Proper planning at the onset of project, and knowledge of Class, Division and Hazard location are not sufficient to help in readily getting the Ex' d' motor of given specifications. As the applications of Ex'd' motors are rare, these are tailor-made

Temperature Codes of Motors (4)

IEC Method	NEC/CEC Method	Max Surface Temp., ^{o}C
T1	T1	450
T2	T2	300
	T2A	280
	T2B	260
	T2C	230
	T2D	215
T3	T3	200
	T3A	180
	T3B	165
	T3C	160
T4	T4	135
	T4A	120
T5	T5	100
T6	T6	85

Temperature class of motor for a given application should not exceed Auto Ignition Temperature of gas

NEC-National Electric Code, CEC-Canadian Electrical Code, IEC- International, and Electrochemical Commission

Hazardous area classification

These zones are defined on the probability of hazard occurring in that area

- Zone-0 has a permanent threat of an occurrence
- Zone-1 Area in which explosive gas/ mixture is likely to occur in normal operation
- Zone-2 Area in which an explosive gas/air mixture is not likely to occur in normal operation and if it occurs, it will exist only for short time
- Additional Zone-2 Area wherein a large release of volatile products may occur

Symbols & Abbreviations

B.B.S.	*Bar bending schedule*
DHDT	*Diesel Hydrotreater*
EPC	*Engineering Procurement & Construction*
Ex 'd'	*Explosion Proof Motor*
Ex 'e'	*Increased safety Motor*
HGU	*Hydrogen Generation Unit*
HPP	*Highest point of Paving*
LSTK	*Lump sum Turnkey*
M	*Meter*
M	*Million*
OISD	*Oil Installation Safety Directorate*
TAC	*Tariff Advisory Committee*
TPD	*Tons per Day*
TOG	*Top of Grout*
UOM	*Unit of Measure*

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Artificial Intelligence Drives Improvement in Maintenance

Today elongating the life span of a product is the crux of operational excellence and need of the hour. Maintenance is the prime contributor to it and technology is the foremost enhancer. Author, in this article, narrates the context, the situation, and the way forward.

My passionate belief is that technology supported by new-found data science techniques reveals the truth that facilitates fundamental improvements. For maintenance of Chemicals, Oil and Gas, and Mining, – the use of break-fix, calendar, usage condition, and reliability-centered maintenance (RCM) techniques has been the basis for 40 years of improvements. We have seen a definitive progression of increased machine reliability with the enhancements in inspection methodologies including the improvements due to risk assessments in RCM, but – at the excessive skills, time, and costs. The results assure: though the machines are more reliable, they still break down. There are a couple of reasons behind that.

Experimentation and word of mouth without science drove most of the improvements. Historically, improving reliability was fixated on the inspection and the service with progressively more complicated ways to decide. That progression is severely limited. In 2015, ARC Advisory Group highlighted that 82 percent of assets suffer from the breakdown that caused by errant process behavior in a seemingly random failure pattern.

Typically, such failures will not be found during periodic inspections. They are effectively caused by chance events in the manufacturing process that cannot be found during inspection. Such events include pumps losing feed or cavitation, and compressors suffering from almost imperceptible liquid carry-over which over the months can lead to catastrophic failure. Damaging events can also include an unintentional erroneous set-point entry that takes a machine out of its safety and design performance envelope. More recently, however, we have witnessed a sea change in terms of asset performance management (APM). The use of data analytics and artificial intelligence (AI) has been transforming APM. The intent herein is not to just manage the maintenance execution process, but to dispatch a notice about when the service and inspection is required.

AspenTech has led the way in this process, especially since the acquisition of Mtelligence Corporation (known as Mtell) in 2016. The new Aspen Mtell team has begun the maintenance and operations with decades of experience. Having seen the effects of all maintenance methods, the team set out to stop the machines breaking! We did not build a platform and then went looking for a problem to solve. Instead, we used our domain experience to craft the Mtell application to explicitly meet the reliability and maintenance needs. We specially emphasized on the product methodologies we prepared for not requiring any new skill or intense experience in process, mechanical and / or thermodynamic engineering, and emerging statistical & data science techniques. Instead, we assured that the product assembly and deployment must fit within the work processes and skills that already in deployment at our customers' place.

Consequently, it must not be just about technology; it is also about the customers being able to work with the softwares that are to deploy and to maintain fast and easily, thus scaling rapidly to the whole blanket of operation, to sustain and maintain over its lifecycle. In our product, the intense technology is hidden inside the deployment of users' experience about what they know already. They do not need the lifelines from expert engineering or data science. Similar to the iPhone, the technology is all there, but it's so hidden that even someone without any specific technology expertise can use it. This is a breakthrough in the industry where other products need expertise and a lengthy implementation time.

In our system, we brought real science in the way we use machine learning rather than anecdotal references. That truth shows the reality from which real improvements are being made. We deploy Autonomous Agents that operate within an interval of every few minutes in doing the work, that otherwise is for the customers to do. Our methodology

is accessible to employees across the organization which can make them productive within hours, thus building Mtell Agents to protect equipment. The Mtell application bypasses all the disadvantages of engineering/model/statistical solutions and provides the latest AI/machine learning technology. Mtell also has its own proprietary process to use the explicit pattern recognition to develop two types of Autonomous Agents, viz. Anomaly Agents with all the smarts to recognize normal machine behavior, and the deviations that indicate impending failures. Inline, in real-time with one click they adapt to drift and changes in process behavior.

Additionally, unlike alternative solutions, Mtell deploys Failure Agents that measure the exact timing and unique patterns of an explicit failure. Such Agents are not based on anomaly detection. As a result, they provide more accurate alerts earlier i.e. months and weeks in advance (not just the days) with exact timing of degradation to failure, along with prescriptive advice for what service is required or the operational changes to avoid a problem. Often the early detection and small operational changes can eliminate the maintenance altogether. The insight so gained goes beyond the wear-and-tear of the machine to address the fundamental root causes of damage. Lastly, Mtell Agents are not restricted to the models or the types of equipment. Agents detect the normal behavior and precise failure patterns across diverse chemical and manufacturing industries for all kinds of assets and failure modes: rotating and static machines, mobile vehicles, and process equipment such as heat exchangers or furnaces.

The ability to deploy prescriptive analytics helps to improve the earning potential of the businesses by making the assets more available. Typically manufacturing facilities can expect significant gains in plant throughput which outweigh the maintenance associated with a failure as far as possible. For example, a low density polyethylene (LDPE) manufacturer experienced 27 days advanced warning of mechanical failure avoiding production losses that were 5-10 times of the repair costs. Also, superior maintenance service management of planned maintenance will occur as your organization becomes comfortable with the accuracy of Mtell alerts. Chemicals, Oil and Gas, and Mining will also see fewer safety and environmental events when extremely early warnings allow the time to plan interventions.

In Conclusion:

A central pillar of AspenTech's mission is digitalization of the world's most capital-intensive industries. To increase the capability of our products for our customers, AspenTech is using the combination of domain knowledge and AI analytics. This is the most powerful and necessary combination that enables manufacturing companies to identify the sources of uptime losses and margin leakage to promote the best possible outcomes, in turn enabling them to achieve the operational excellence and competitive edge. . ■

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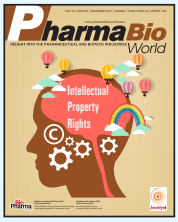

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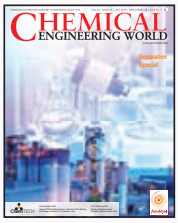

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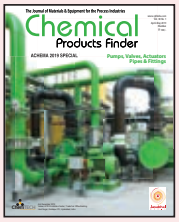

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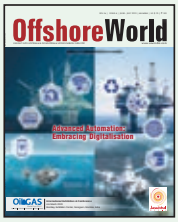

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Process Optimization & Efficiency: Above-ground Pipeline Survey using Integrated Indirect Inspection Technology (IIIT) with a brief Case Study

Oil and gas pipelines are an important asset for a nation's economy, making raw material / fuel readily and safely available for all. Case in point, the current times – when only essential items are allowed to be moved across the country, the pipelines remain operational! What better than pipelines in-lieu of road transportation risking the health of a human-being?

Hydrocarbon pipelines are generally externally coated and buried underground. Traversing through various kinds of soil, an environment that can change based on the local geography and geology. In combination with time, these natural environmental forces could work in tandem to constantly degrade the primary protection provided to the pipeline itself, the external coating.

Once the primary protection layer gives away, even at localized small sections, the elements does not take too much time to create entropy of the carbon steel back to its original component i.e. leading to rust. For this very reason, hydrocarbon carrying pipelines are provided with a complementary secondary layer of protection – cathodic protection (CP).

To ensure a CP system (secondary system) along with the coating (primary system) are protecting the pipeline at all times against the forces of nature – it is inevitable that routine inspections are performed. Performing aboveground pipeline survey using Indirect Inspection Technologies (IIT's) is one such methodology. Although, there are multiple IIT's available – traditionally in many cases this has resulted in numerous redundancies leading to multiple sources of error, as these surveys had to be conducted separately. This article articulates the advantages to a pipeline owner (Operator) when an Integrated-IIT (IIIT, per-se) approach is utilized for the purpose.

For the purpose of assessment and monitoring the health of the primary and secondary layer of protection of these pipeline systems, the types of IIT available are:

- CIPS – Close Interval Potential Survey
- DCVG – Direct Current Voltage Gradient survey
- ACVG – Alternating Current Voltage Gradient survey
- ACCA/CAT - Alternating Current-Current Attenuation / Current Attenuation Test
- DOC – Depth of Cover survey
- Interference survey

After applying the traditional IIT (aka legacy) survey techniques for decades, industry has highligted some of the drawbacks with these surveys. Few of them are:

- Tracing authenticity of the surveys and whether data has/has not been collected for the correct pipeline, as multiple runs are required over the same pipeline.
- No recording of raw waveforms of survey conducted to verify authenticity and any indications missed on field.
- Difficulties in integrating the various surveys in field and the collected data. This process of aligning the different surveys is time consuming and more often than not leads to alignment issues.
- Multiple survey runs conducted over the same pipeline is time consuming and may take months to perform all surveys on a single pipeline stretch which may be hundred's of km's long, when performed individually.
- Non encrypted data reports are provided for the obtained results which can be tampered and highly subjective.

This article takes the opportunity to bring forth to the user how an integrated-IIT (IIIT) have been developed and practiced in the recent times, to overcome the multifarious concerns of the industry in regards to legacy IIT. The particular IIIT, focussed within this article is known as the pipeline Spectrum eXternal Line

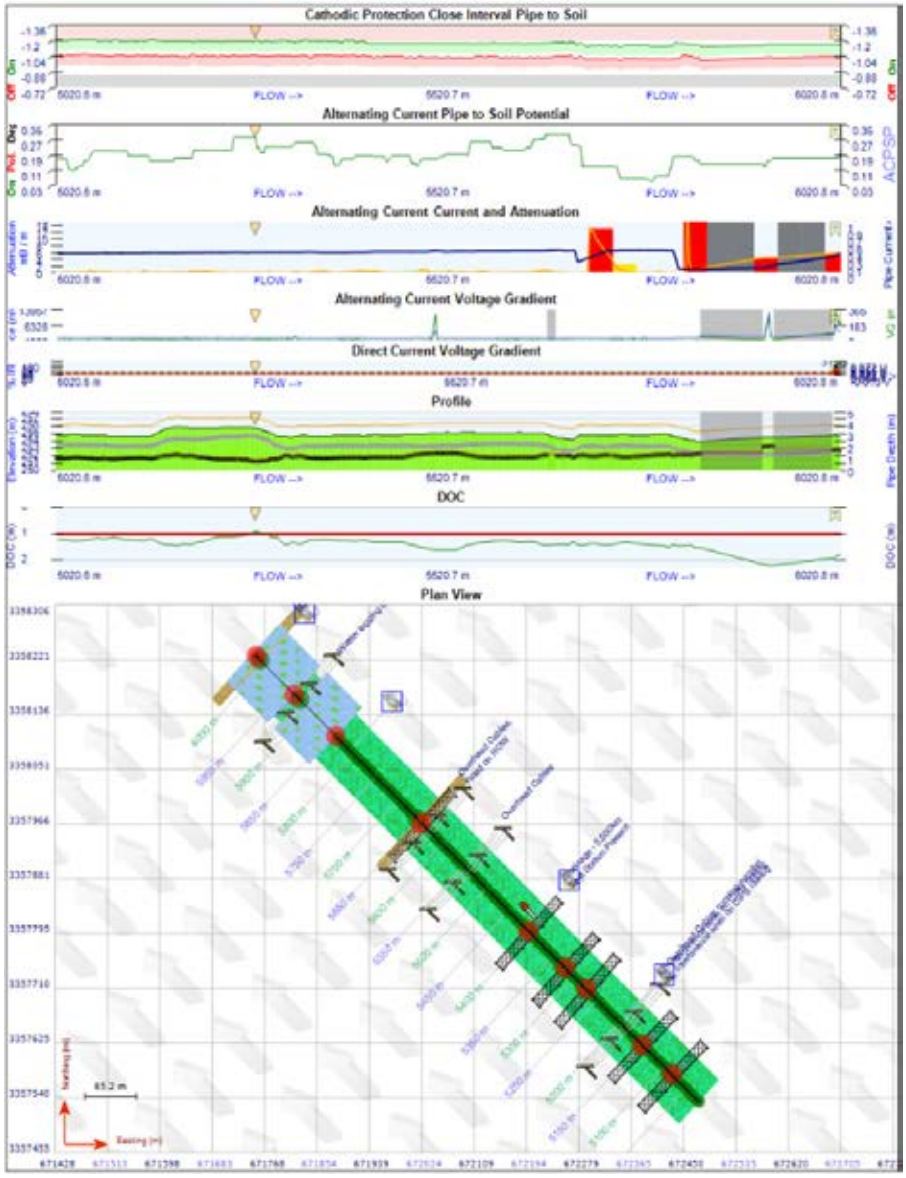

Figure 1: Integrated data of multiple surveys as seen on software

Inspection (XLI) with OEM as PureHM Inc., Canada.

The XLI IIIT has the capability to "automatically" collect upto ten (10) different data-sets in a single pass of the pipeline which would otherwise require multiple passes if legacy IIT were used. This allows for lesser human interaction with the public environment (safer when considered to todays' run of things in the world), yet allowing the cognitive abilities of the technology itself to collect the most accurate verifiable data providing useful information to the Pipeline Integrity Manager. This will allow for better decision-making at the quickest possible turn-around.

XLI IIIT comes with its own proprietary data acquisition, analyses and display software commonly known to the industry as 'Falcon'. With the softwares' highly field-intelligent algorithms along with the brainpower of the in-built 'G2' data processing unit allows for automatically aligning all the on-field survey data into a single visualization platform along with the visibility of the encryted raw logs as shown in below Figure-1.

Figure 1: Integrated data of multiple surveys as seen on software

Authenticity of survey data is maintained by trackability of the surveyor via any GIS / Google Earth based satellite mapping system. It is one of the few technologies in the market that also provide superior data encryption along with the raw logs with time-stamp, ensuring tamper proof data is provided to the pipeline owner as shown in Figure 2. It has been realized that this feature is highly appreciated in the industry due to the intensive data-secrecy laws within any country / oil & gas operating company.

Figure 2: Encrtyted Raw Logs with Time Stamp for Each Survey on software

After collecting all the survey data (in one pass) of a subject pipeline, the data is analysed by trained analysts – going through various levels of analysis (Level-I, II or III). The data analysis ensures false-positive or false-negative indications do not inadvertently make it to the Pipeline Owner records. Moreover, the software package allows complete autonomy to the user to be able to extract /print-out any kind of reports (PDF / Excel / GIS-based etc.) to enable optimized decision making.

Such IIIT's have been utilised over the past decade in North America and in the last couple years, have been introduced in Middle East and India with 2,500+ km of authentic IIIT surveys performed. The acceptance of the technology has resulted in multiple technical paper publications by Pipeline Owners themselves.

XLI based IIIT– An Oil India Limited (OIL) Perspective

Oil India Limited (OIL), whose fore-bearers Burmah Oil Company (UK) was the first to strike oil in Asia (1889) own a vast network of carbon-steel pipelines

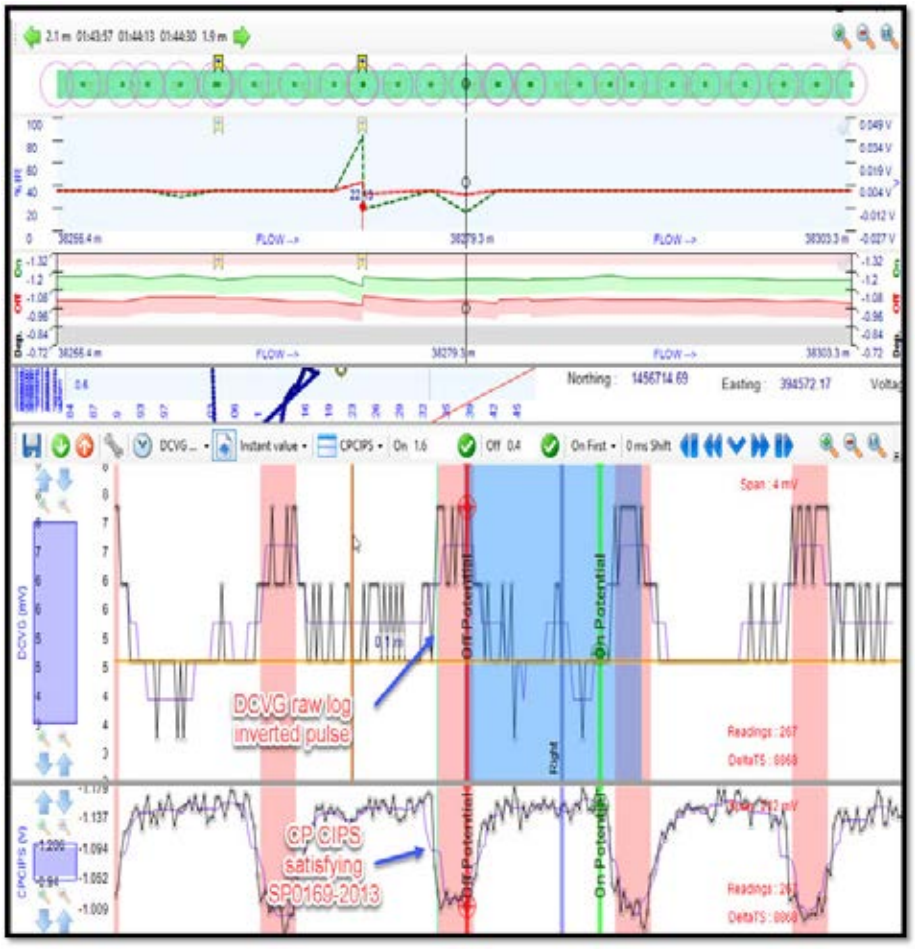

Figure 2: Encrtyted Raw Logs with Time Stamp for Each Survey on software

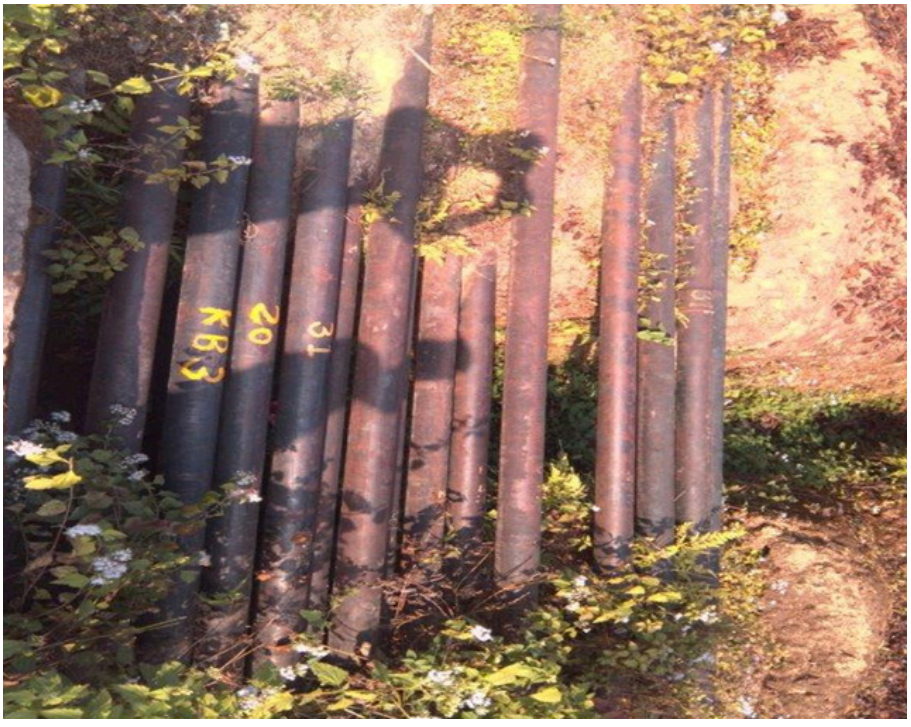

Figure 3: Complex network of pipelines

in the Upper Assam districts of Tinsukia, Dibrugarh, Sivsagar etc.

Taking into consideration the legacy of the pipeline assets owned by OIL and the intense complexity of their network (Figures-2 & 3 below are sample photos) – the technical excellence team from OIL's OGPL Office eschewed industry peer pressure in utilizing legacy IIT, instead proactively opting for the advanced proven new-age IIIT.

Figure 3: Complex network of pipelines

Figure 4: Complex network and difficult to navigate right of way

These pipelines which were historically laid with a lot lower human population in the vicinity, as expected due to urbanization, have a completely different population density and access challenges in the present times. Today, these lines are exposed to house-hold dwellings and gradual population growth along with being in the vicinity of Assam's famed tea gardens (a GI2 product). In any instance, wherein humanity exists in vicinity to energy roadways such as pipelines -> the onus of risk assessment and thereafter routine monitoring is always on the Owner of the pipeline. In this case, it was OIL. Their technical excellence team was not satisfied with the drawbacks of IIT, which may result in sub-par data that cannot be converted to usable information and therefore opted for IIIT.

IIIT is planned for assessing the external integrity of sixty-one (61) pipelines, out of which assessment for two (2) pipelines – were completed in all aspects. Figure 5 shows the IIIT survey ongoing for OIL pipelines.

Figure 5: IIIT survey of XLI being perofrmed for OIL pipeline network

The final results coordinated very well with

Figure 4: Complex network and difficult to navigate right of way

Figure 5: IIIT survey of XLI being perofrmed for OIL pipeline network

the survey results from the IIIT deployed. This allowed for the operator to obtain and calculate accurate remaining life for the pipelines as well as provide fitness for service for it to be continually operated without any downtime. Apart from assessing the external integrity utilizing the IIIT, it also helped obtain an accurate and continuous pipeline profile which enabled the owner to have performed assessment for the time-dependent threat of pipeline internal corrosion as well.

Legacy surveys have been in practical use for decades, however their efficient application for optimal detection and prioritization depends on various untraceable factors, which may result in inferior on-field verifications. This has led to extensive financial resources and time utilization with compromised results.

The overall goal of utilizing newer technologies in the field of pipeline integrity assessment for OIL (or any other pipeline owner) is to optimize the process by reducing overt conservativeness. This can only be achieved by utilizing latest proven know-how and technological methodologies such as the Spectrum XLI IIIT.

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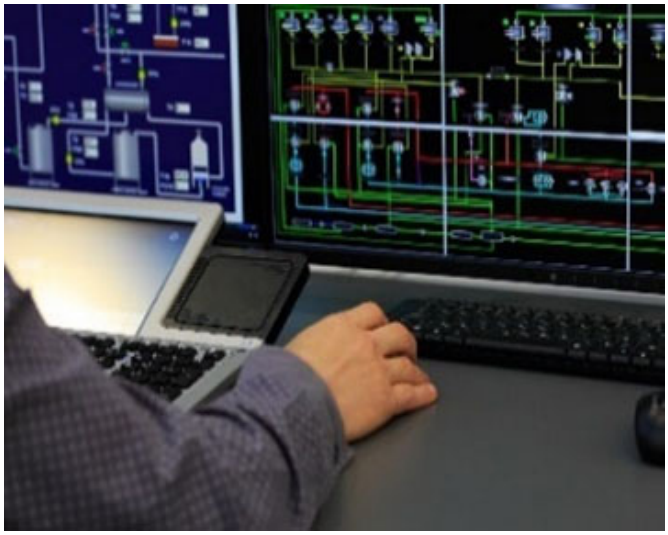
Remote Automation: Ensuring Continuity in Unreliable Times

EPC sector, being the backbone of industrial projects, adds immense value to industrial manufacturers. However, numerous challenges have been posed by the present unprecedented pandemic. Like all other industries, EPC has also been stepping into the new normal. The author in this article throws light on EPC's journey to the new normal.

The outbreak of the COVID-19 pandemic has left no sector or industry unaffected. Engineering, Procurement, and Construction (EPC) sector is the backbone of industrial projects consolidating three essential services which add value to industrial manufacturers. Because of the lockdown in the manufacturing industry, EPCs have been facing an unprecedented situation. For ongoing projects, restrictions on supply chain management, material availability, workforce availability, and people movement have created an impact on business continuity and challenged the existing cost structures. On the other hand, the sharp fall in crude prices and a global energy demand slump have been creating uncertainty in future investments and possible deferment of large CAPEX intensive projects. It is unclear that how long these challenges will last; but we must begin to prepare for a "new" normal – one that can be viewed as an opportunity for permanent change!



Solutions cemented in Industrial Internet of Things (IIoT) that connected remotely or virtually have been around for the last few years. EPCs have been actively exploring how these can improve their key business objectives around cost management and project scheduling. To adapt to the new normal and to maintain the business continuity, remote solutions and services become essential to manage cost variations, timely project execution, workflow simplification, and social distancing.

Honeywell's mission critical automation and control solutions were natively designed with the remote operation functionality. This was not an add-on or afterthought. Therefore, in a situation like the one presented by COVID-19, Honeywell was able to seamlessly roll out advanced automation and remote operation solutions for our customers which range from helping EPCs to continue their engineering work for ongoing projects while virtually interacting with Honeywell engineers to remotely test their automation and control equipment built in the Honeywell factories without having to travel to the Pune facilities. Honeywell's remote solutions have allowed project execution to progress smoothly. In addition, many of our industrial customers who wanted to continue with their plants' maintenance services have adopted our remote assistance services.

Honeywell's Remote Automation Project Services (RAPS) digitizes the project lifecycle and enhances project efficiency through the integrated data flow and automated tools. The collaborative nature of remote solutions reduces risk while maintaining the highest levels of quality. These solutions are already being adopted and normalized as the standard for successful project implementation services which include design, testing (software and hardware), integrating third-party software and hardware, remote site installation, and commissioning support. Some of the benefits of RAPS are listed below:

Time Saving	Cost Saving	Others
System Staging	Shortened Schedule	Business Continuity
Reduced Travel	Reduced Hardware	Maintaining Social Distancing
Accelerated Schedule	Reduced Real Estate	

Utilizing the following technologies and project delivery methods can create a safer and more productive environment:

1. **Remote / Virtual Engineering** – Cloud based Virtual Engineering Platform; access for anywhere.
2. **Remote Factory Acceptance Testing** – Remote testing of hardware and software eliminates the travel need to staging location and saves testing time.
3. **Remote Assisted Commissioning** – Control room operations can be viewed by authorized users from remote locations, camera on intelligent device records the actions to give live feed in addition to live support from experts.
4. **Remote Operations** – Extend the control room service to any remote location on the corporate IT network; Utilize engineering resources anywhere in the world.
5. **Real Time Location Solution** – Real time tracking of personnel at site; Knowing who, where, and what.

In Conclusion:

COVID-19 will continue to challenge everyone's way of working for the foreseeable future. We at Honeywell, have deep expertise and savoir faire in deploying remote operation technologies. Our experience drives us to believe in the value of remote solutions – not only in uncertain times like today, but also under normal operating conditions. We remain focused on the needs and requirements of the EPC community to execute projects faster and safer, while lowering the costs and eliminating the risks. To stay ahead and prepare for the future, change is essential. The key to delivering real value will come from building a strong and sustained dialog between EPC Companies and Automation Solution Suppliers. It is essential that both communities partner in the new normal to mitigate risks and to ensure business continuity, efficiency, and safety. ■

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Benefit from Your Engineering Systems

- Getting the full

Road to Recovery for Energy Industry

At the time of writing this article, WHO estimates suggest that the COVID-19 pandemic had spread to more than 200 countries worldwide, with the number of positive cases inching closer to the 2 million mark.

As the world comes to terms with the "new normal" of life and way of working in a lockdown, businesses are charting new paths to navigate through this unprecedented time. From shaky commodity prices, mounting economic pressures, supply chain disruptions, and unfamiliar work environments, energy operations as a whole are being significantly affected. This impact must be addressed on priority as the energy sector plays a critical role as an essential service for consumers and businesses. How are the power generation, mining, and oil & gas (O&G) industries getting impacted by this new world?

Power Generation

The power generation industry is witnessing a significant impact of the pandemic since the beginning of 2020, with the demand curve taking a new, unprecedented shape. To maintain electricity supplies, nuclear reactors, along with fossil fuels and renewable power technologies, will play a critical role. The need to reduce the use of fossil fuels due to climate change concerns in favor of low-emissions power sources, continues to be a focus area.

Any breakdown in the supply of power can lead to widespread disruption, as we have seen during outages caused by wildfires and other natural or weather-related factors. Supply chain disruption is likely to push power generation companies to focus on improving reliability and bring operational efficiencies that could help them tide over these challenging times.

Oil & Gas

The COVID-19 pandemic, coupled with the supply-side shock in the form of continued production by OPEC and Russia, has added further pressure on the price of crude pushing it below the critical $40/barrel mark. This makes offshore exploration and fracking economically less viable, and forces O&G companies to look at other avenues such as onshore oil drilling. We anticipate companies to adopt a cautious approach toward capital expenditure in the immediate and short-term while focusing on asset optimization and operational efficiency to derive maximum value in the interim.

Mining

Varying degrees of lockdown in countries across the globe combined with disrupted supply chains due to travel and cargo restrictions and the prevalent economic sentiment has brought non-essential industrial production almost to a grinding halt. This includes automotive, aerospace, engineering, and construction, as well as infrastructure development, which is among the biggest consumers of metals. This blow comes at a time when the sector was already dealing with environmental issues and tariff wars in a slowing global economy. While the industry balances the fine line between demand and supply, a key area of focus in the short-term would be lowering the cost of operations.

The Road to Recovery

As energy companies shake-off the initial upheaval and set off on the road to recovery, what are the top priorities for them, and what role will technology play in doing it successfully?

Increased Focus on Workforce Safety

Given the health risks associated with the pandemic, the people-intensive nature of all three industries and the geographical distribution of natural resources across the globe have brought the safety and well-being of the workforce to the forefront. To ensure continued supply, companies will need to innovate remote working models by leveraging digital tools and emerging technologies across their value chain.

The Emergence of New Team Structures

A distributed workforce is a relatively lesser-known concept within the energy sector because of the critical and sensitive nature of the business. Worldwide lockdowns have compelled operators and their extended teams to take unprecedented measures that enable teams to work from their respective locations. This crisis has served as a proof of concept that a diversified, dispersed, and flexible team can ensure quality delivery of engineering and operational services even in such times.

Process Automation for Service Reliability

As operators look to ensure uninterrupted service in trying times like now, it is an excellent opportunity for operators to fast-track their process automation initiatives. Applying disruptive technologies to automate as many processes as possible will be an accelerated focus to ensure environment and workforce safety as well as operational reliability.

Increased Focus on Digital Transformation and Asset Management

As operators focus on lowering operational expenses, existing assets and infrastructure will be under added pressure. Businesses will be required to do more with less by focusing on effective infrastructure management and making their assets smarter and resilient. The application of disruptive solutions, such as connected equipment and predictive maintenance, paired with strong asset management strategies, could hold the key to achieve operational efficiency.

The COVID-19 pandemic will transform industries as we know today. It is critical that companies embrace access to data and technology as a key differentiator to drive safety, automation, and efficiency. ■

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A Crisis is Too Big an Opportunity to Waste

In the history of humankind, a Pandemic has always come to an end in two ways – first on the medical front as the death rate plummets & the second on the social front as the fear of disease wanes. The first one is dependent on the behaviour of the virus as well as medical response to the disease whereas the second one is dependent on how we interpret the data & how much optimism we share for the future. In such circumstances, keeping the positive look is very powerful and works in the following ways:

1. Confidence about the times to come, similar to Placebo effect:

This is a mental state based on a variety of factors which aid in release of chemical Serotonin to make us feel happy. This can be nice weather conditions, your favourite sports team winning, camaraderie between friends etc. This optimism will lead us to working hard to somehow manage to survive inspite of difficult conditions, invest today to build tomorrow and search the silver linings amidst the clouds etc.

In this specific case of pandemic our perceptions about the health, economic & social events make a huge difference. There is a high chance of coming to wrong conclusions with constant bombardment of negative news (most of them unsubstantiated opinions tailored to surprise us) on social & mainstream media. We really need to make a conscious effort to avoid such information.

2. Multiplier effect on economy:

The biggest after effect of this pandemic seems to be a lack of demand due to cuts in consumer spending. There is a natural tendency during times of uncertainty as discretionary spending is stopped.

For example let us say that on an average a person in India spends 80 per cent of earnings in normal times & saves the balance. This creates an economic multiplier of 5 times as it leads to a chain of spending. The equation goes like 1/(1-X) as every elementary student of economics knows, & it is as also called the marginal propensity to spend. Due to some risk aversion like the present one, if this spending falls to say 60 % it devastates the economy as the multiplier falls to 2.5 times which means demand is halved just by spending cut back of 25 %.

The power of this effect is always taken into account by monetary economists when they undertake quantitative easing policies of loose money wherein they encourage people to come out & spend by reducing the cost of money & increasing its availability. In the final analysis, no amount of liquidity support can work if the animal spirits of entrepreneur & propensity of the consumer to spend does not fire up.

Instead of holding yourself back, one needs to do what one has always done best, instead of thinking too much about it. Ultimately balance will restore & winners will emerge out of this. Winners will be those who plan in advance, preserve resources, look for opportunities & most importantly are optimistic about the future. In fact there are several silver linings to the clouds looming large at this moment as world shows its first tentative signs of moving out of this pandemic. Some of these are:

1. Geopolitical rejig which may lead to creation of new opportunities for India. This specifically refers to new supply chains being drawn as the world makes an effort to decouple from China.

Several Industry Segments wherein India has traditional advantage getting a huge leg up: Some of these are:

- **Healthcare**: Healthcare spending is expected to increase world over & the ageing societies of developed countries will look for high quality & cost effective medical tourism. India has huge advantages here due to its large pool of caregivers, capable doctors & nurses.
- **Technology:** As the use of technology for various business applications & communications surges, India is uniquely placed to capitalize this opportunity in this domain as the country is through capabilities in IT Services & start-up architecture.
- **Traditional Medicine:** Many consumers the world over are being drawn to the traditional Indian immunity boosters as well as healing methods like Ayurveda .On one hand this will create a huge opportunity for the pharma companies engaged in producing Ayurvedic pharmaceuticals and the companies will also benefit from the increase in spending on health

2. A crisis is too big an opportunity to Waste - Shaken by the turn of events, some of the State Governments have been proactive towards taking a big decision to roll back the Labour laws that continue to inhibit the flow of foreign investments in labour intensive sectors

3. Self- learning & Rediscovery made by many persons during their long period of home stay --which can be a game changer in their life going forward.

Finally, one should not forget that the humankind has lived through hotter times & colder times, through floods, famines & wars. In the history, civilizations have been built even after they were wiped of completely; unprecedented peace & prosperity emerged after the World Wars. By these standards this event is only a small dot in the timeline of this world & all it is expected to do is to exacerbate a few trends & supress some others. ■

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The Chemical Industry's Response to a Crisis while in Crisis

We often forget how vital the chemical industry is to our well-being, safety, and daily lives. The stigma around the issue of plastic waste in the environment often overshadows the progress that the industry has made in becoming one of the more sustainable producers of critical products.

In recent months, it has never been clearer just how important and responsive this industry is when faced with a global health crisis. The world has been left reeling from the impact of coronavirus; and the chemical industry has stepped in with incredible speed and agility to help the struggling health authorities get the materials they need to help fight the virus, thus protecting our people on the front line to save lives.

Life-critical materials from chemical suppliers are required to produce antibacterial wipes, hand sanitizer, disinfectants, and surfactants for soaps and personal protective equipment (PPE) such as masks, gowns, and face shields. By supporting a robust supply of such products, the chemical industry is helping control the spread of the virus.

Alongside a huge swing of production towards isopropyl alcohol (IPA) and ethanol, used in the production of hand sanitizer, many chemical companies have acted to directly meet the massive spike in demand for the final hand sanitizer product.

INEOS built two new plants in the UK and Germany in just 10 days to produce hand sanitizer, which it is now distributing for free to health authorities. Two more such plants were built in the Arkansas and Pennsylvania in the US, in under 10 days. INEOS sites in Grange mouth, Scotland, Moers, and Herne in Germany and Lavéra in southern France have also been running at capacity to produce the IPA and ethanol needed to support the new plants.

Dow has announced four additional global sites for sanitizer production which, including its existing facility in Germany, takes expected production to more than 200 metric tons. Again, the sanitizer will be free of charge to health authorities. Dow has also designed simplified and lightweight face shields, and is producing 100,000 such units for donation to hospitals in Michigan, US.

There are many examples where our industry, like humankind, has come together, stepped up and pivoted to support our fight against Covid-19.

The industry has, and will, play a significant role in this crisis, its prevention and the recovery. ExxonMobil, Oleon, MOL, Shell, Cropenergies, Huntsman, LyondellBasell, BASF, Arkema, Perstorp, Indorama, PTT Global Chemical, SABIC, Unica, VCI and many others, have all responded in a huge global effort to support the fight against the virus.

The response from the chemical industry to this global crisis is not surprising. The industry has long stood as a major contributor to global GDP and a game changer in human history.

Innovation continues to evolve to improve and save lives, and enable critical technologies. Chemicals have helped deliver low and zero fat foods; make water safe; create new materials that are stronger, lighter and safer for electric vehicles; enabled more efficient aircraft and increased crop yields.

Indeed, almost every industry relies on chemicals for some part of its production processes. Its work today has focused on supporting growth and addressing sustainability challenges.

On 19 March, the US Department of Homeland Security (DHS) identified the chemical industry and its workers as "Essential Critical Infrastructure" - an industry sector critical to public health and safety, economic, and national security. The DHS noted to the chemical industry that there is "a special responsibility to maintain your work schedule", while following CDC (Centers for Disease Control and Prevention) workforce and customer protection guidance.

As the industry continues to pivot its production capacity in response to Covid-19, it is doing so in a market landscape in which chemical prices due to the virus have plummeted.

The ICIS Petrochemical Index (IPEX) in April plunged 18% from March, and 37% year on year on a global basis. The second quarter is expected to be the worst in terms of financial performance for the industry as demand collapsed amid the lockdowns.

Alongside cleaning and sanitizing products, polyethylene (PE) for food packaging and polypropylene (PP) for PPE are crucial in disease prevention. Although critical to the Covid-19 response, demand and pricing for these materials have also slumped on weakness in automotive, construction, and consumer durables.

In conclusion:

For an industry born out of innovation and pivotal to modern society, however, the chemical industry will remain strong. The effects of the Coronavirus pandemic will certainly echo through many industries and their supply chains, providing an opportunity to learn and most likely change the way they work in the future.

Under the pressures which a crisis brings, organisations will have to find better and new ways of doing old things, summoning creativity to adapt to a new normal with the conditions and opportunities this brings.

For an industry that is already turning to digitalization and analytics to help it become more efficient and robust; its resilience, purpose and agility have been demonstrated with its response to the world today and will help protect its future. ■

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Flexibility to Quickly Adjust to Different Product Slates will be the Key

Refining and petrochemical companies to more carefully study new capital investments in cleaner-burning fuels, greater flexibility to switch between different types of fuels production, and integration with petrochemicals production. Mike Banach, Regional General Manager, Honeywell UOP India talks exclusively to Chemical Engineering World about kerosene Unicracking and Hydrogen technology to enable the refiners move towards producing cleaner fuels.

Mike Banach
Regional General Manager,
Honeywell UOP India

How do you think the current Covid pandemic impact the refining & petrochemicals industry in India and the allied industrial sectors?

Covid-19 has caused a significant reduction in transportation, and therefore, a reduction in transportation fuels. Consumption of petrochemicals also has been affected, but not as strongly. This has created some dislocations in the supply chain, but adjustments are being made to accommodate these. While this has caused reductions in consumption of petroleum products, it also has led many refining and petrochemical companies to more carefully study new capital investments in cleaner-burning fuels, greater flexibility to switch between different types of fuels production, and integration with petrochemicals production. Interest in renewables remains strong, particularly for repurposing agricultural waste and cultivating feedstocks on land that cannot produce food.

Which are the key trends that refiners will have to follow in the near foreseeable future once the industries start to recover?

One of the primary trends is building flexibility to quickly adjust to different product slates. For example, outlawing kerosene as a cooking fuel in India stranded a lot of kerosene production capacity. Last year, we introduced a technology that converts this kerosene into motor fuel so refiners have an economical route for that kerosene capacity. This technology, which is unique to India, is called kerosene Unicracking, and it turns kerosene into gasoline-range molecules that can be used as a transportation fuel.

What is the market size for Hydrogen technology and what are the key drivers for its demand?

Hydrogen is more important to refining than anything, except oil. It is used to clean contaminants from crude oil, and is used to rearrange hydrocarbon molecules into specific products. The demand for hydrogen will continue to rise for many years because the demand for better fuels and more petrochemicals will continue to rise. UOP's Polybed™ pressure swing adsorption, or PSA, technology purifies hydrogen so it can be used most effectively in these processes.

Hydrogen is especially important in India because it allows refiners to produce the cleaner-burning fuels that are mandated by the Indian Government's Bharat Stage VI (BS-6) emissions standards, which were adopted on April 1. This places India in a select group of economies that adhere to the highest clean fuels standards in the world.

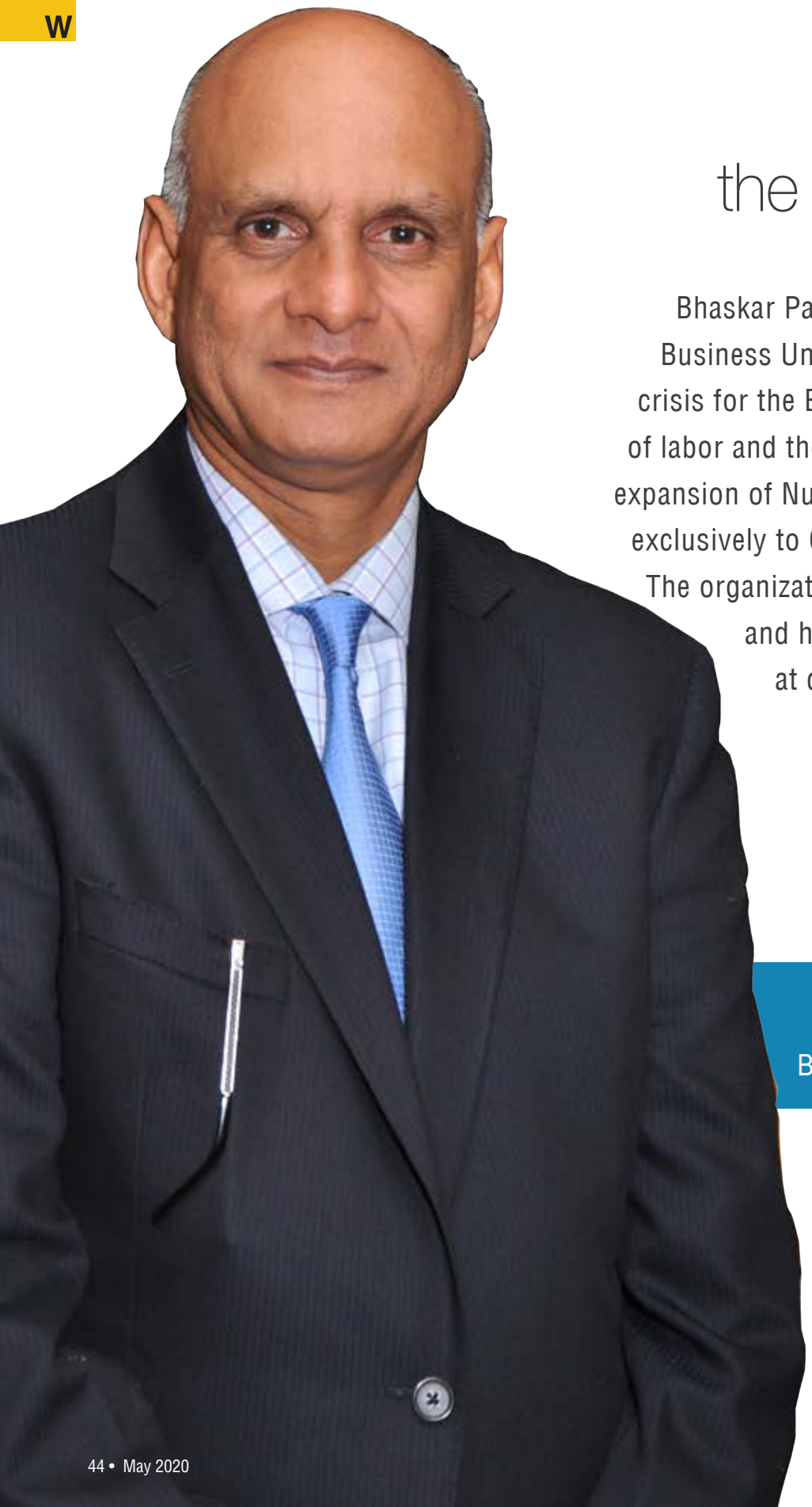
Tell us about Polybed PSA Hydrogen technology UOP is offering prior to supplying this technology to the largest Petrochemical Project in China, which the other refiners are already using this globally, and how have they benefited from this?

The Polybed™ PSA technology was first introduced in 1966, and has been continually improved ever since that time. UOP now has installed more than 1,100 of these units globally, including at the new world-scale Zhejiang Petrochemical complex under construction near Shanghai. In India we have delivered 75 PSA units to date and have five in various stages of executions

What are the other technologies offered by UOP that will enable the refiners in becoming more agile, integrated, & environmentally compliant

UOP maintains a portfolio of 75 process technologies, and 450 catalysts and adsorbents that are used throughout the refining, petrochemicals, renewables and gas processing industries. We offer design consultation and engineering services, process licensing, catalysts, adsorbents and key equipment, start-up and maintenance services and connected plant services to ensure greater reliability and process optimization.

The refining industry is critical to the world economy, providing the energy and chemicals that power our economies and ensure our health and well-being. UOP uses six critical performance factors to evaluate capital investment strategies for individual process units, entire refineries and petrochemical plants, and even combinations of those facilities. The UOP Six Efficiencies (E6) framework includes analyses of carbon, hydrogen, utilities, emissions, water and capital. The methodology shows how a new or existing facility compares to the latest technology benchmark for each of the constrained resources over time. The E6 methodology aligns a refiner's needs to its budget and financial requirements to develop a strategy to improve the financial returns on those investments.



Tide Over the Current Crisis

Bhaskar Patel, Managing Director, India Business Unit of TechnipFMC talks about crisis for the EPC industry non availability of labor and the recently bagged project for expansion of Numaligarh Refinery Ltd (NRL) exclusively to Chemical Engineering World. The organization has a healthy order book and has multiple ongoing projects at different stages of execution.

Bhaskar Patel
Managing Director, India Business Unit of TechnipFMC

What is the size of order book of Technip in India and which are the key projects your organization is working on at present across the upstream, LNG & CNG and Refining sectors.

The order book for TechnipFMC India in recent years is in the range of approximately 250 – 350 million USD depending on the local and the international market situation and how we strategically balance our workload between domestic projects and support to our Group offices. In 2018, the India office did almost a billion dollars of order intake in the year! We have a very diverse portfolio that spans from process and feasibility studies to full-fledged EPCs and all that lies between and beyond these – PMC, EPCm, Post EPC Services etc. across the business segments. We have recently completed revamping of HPCL- Vizag Refinery. IOCL Panipat.

Pan India there are multiple projects at different stages of execution. We are PMC for IOCL Gujarat Refinery Expansion Project from 13.7 to 18 MMTPA, PMC for IOCL Paradip - SRU, TGTU Tankages and Managing PMC for NRL NREP , which is the most recent order. And the EPCM services contractor for BPCL Hydrocracker and LOBS at the Mumbai Refinery.

On the LNG front, we are working on a couple of Regasification projects. With our Group offices however, we are executing some world scale LNG project, one of which is the massive Arctic LNG Project in Russia after we successfully completed the first train – Yamal LNG. We also have a strong portfolio in Renewables, Petrochemicals and Chemicals, Fertilizers and also in Offshore Projects.

Due to the ongoing pandemic, how are you overcoming the challenges in managing the projects? Tell us about the anticipated delays in completion of ongoing projects and major risks associated with these.

Projects at final stage of commissioning:

- IOCL Panipat 44 KTA Hydrogen Generation Unit (based on own technology from Benelux office)
- IOCL Bongaigaon Prime G
- IOCL Haldia - Diesel Hydrotreater

Projects at final stages of construction :

- HPCL Vizag – Naphtha Isomerisation Unit
- HPCL Vizag – Hydrogen Generation Unit – 2 trains of 113 kta (based on own technology from Benelux office)
- HURL Sindri and Barauni – Ammonia and Urea plants along with TechnipFMC France office and L & T as consortium partners

The Oil & Gas markets behave like a sinusoidal curve with highs and lows. Covid pandemic is a new situation and our first priority is to keep people safe, not just our own employees but everyone connected with us. And then of course there are business repercussions as well. We are discussing the repercussions of work stoppages and of migrant labor who have moved out. Even if we took care of labor working at our sites, they perhaps felt stranded, and wanted to go back to the safety of their families. We have had to invoke Force majeure clause in our contracts with clients, in some contracts the client itself has invoked the same. The Government too has declared COVID -19 pandemic a force majeure event and it has proposed extension of time for infra projects such as ours.

Although, we will be able to start work on all active projects but we face issues such payment of wages to stranded labor at the project sites through the lock down period and now even after lock down is lifted partially in some project areas, force majeure continues as there is lack of transport to reach project and labor is wanting to return to their home towns. Then we have to abide by social distancing norms for executing the works which will impact productivity for quite some time. All these issues have been presented to our client(s) for resolution. We are hopeful that we will arrive at amicable solutions with client(s). Nevertheless, we will ensure our projects are completed with no compromise on quality and resumed work at all the sites which include Bongaigaon , Haldia, Barauni, Sindri, Vizag and Panipat although at slower pace due to limited availability of workers with new working norms.

Talk to us about NRL project from the point of view to enable India achieve the clean energy goal and for the economic development of the North East region? What kind of opportunities will this project create in the North East region of India in long and short term?

In the Hydrocarbon Vision 2030, Indian government has prioritized the Oil & Gas sector in the North East and NRL expansion project is pivotal project in this region. The project aims to produce cleaner fuels and upgrading low value to streams to more valuable products committed to realize the country's vision for the hydrocarbons. The current NRL job is bigger in scope, it is spread over about four years of execution and will involve more than 3000 man months of construction supervision. NRL management is working proactively with strong determination

to forge ahead and taking fast decisions to achieve the goal.

We are quite excited about this work, not just because we have won against tough competition but also because it will significantly add to the economic strength of the North East, providing jobs and opportunities to the local populace. I believe, this expansion is going to bring about an all-round development in the region. Based on our project management and engineering capabilities, we will ensure we provide efficiently designed solutions to ensure success of the refinery expansion project.

Managing the projects especially at the stage of construction involves huge number of workers on site which has now to be cut down because of the social distancing. How do you plan to continue / restart the work?

At construction sites, we will further push for more prefabrication or modularization to minimize peak staff and duration for work at site to avoid long tenures of exposure to the entire peak workforce. Here too, remote support and more digital most of the migrant labor force has returned to their native places. We have multiple ongoing projects, though labor availability has reduced, we still have resources at site to drive our projects. For upcoming projects, there is some time before labor is required and we trust the situation should improve. However, from now to the end of monsoon, labor issue will remain a challenge to deal with.

How has crash in oil prices impacted the EPC industry globally and when do you see the markets will start to recover.

The crash in oil prices impacted the markets with slowdown in additional capacity installation upstream. Further, the slow economy in general, resulted in lower spending in 2019 which caused a slow down at the other end of the spectrum in terms of Petrochemicals & Chemicals. This slowdown was further amplified by the impact of Covid-19 as the clients have further reduced spending, deferred investment plans, are relooking at the planned investments thoroughly and have also cancelled projects as we have seen with many of our peers.

In the short term, the market is adversely impacted, which is true for most businesses globally more due to the fear of the unknown and preference to have liquidity coupled with temporary reduced demand. This would mean fewer projects with highly aggressive competition, which is always a challenge for all EPC players including us.

However, while there will be a dip in Q2/ Q3 of 2020, there is no doubt the markets will start seeing recovery by Q4 2020 and 2021 should see multiple awards moving forward. This will be driven by increased demand particularly in LNG, downstream chemicals & petrochemicals and possibly select renewables on the biofuels side of the business as the traditional fuels see slow growth. In India, due to the demographics, after a couple of quarters, I feel that refineries as feedstock to petrochemicals and chemicals will rebound fast.

For EPC players, what are the major risks at this point of time especially to manage the cash flows? How do you plan to hedge this risks at present and in the future?

Cash flows are one of the biggest challenges in project execution. As a Group, we would always try and ensure we have positive or at least neutral cash flow in our projects but in India it is rarely the case. For an EPC contractor, besides the risk of the EPC Project itself, we also have financial risk of putting in our own money or borrowed money to execute the project that is paid later to us. Our first approach is of course, to sensitize our clients and push for better payment terms, linked with a portion paid at mobilization in sync with our ordering cycles. If not, we have no option but to pass on this risk as additional cost to our clients. Cash flows are a challenge – though there have been some steps to improve the payment terms by Public and Private sector clients, there is still more work to be done on this front. Also it is a challenge to manage the 'Force Majeure' due to Covid-19 lockdown and recover these unproductive costs.

How favorable are the contracts usually for the EPC players and what kind of support do you expect from the project owners?

We cannot deny risk component of EPC business. The contracts are usually drafted to protect the interests of the owner and pass on most of the risk and responsibility to the EPC player adding further strict penalties and liabilities on the contractors. Most of the Clients today try to provide some support on most of the basic and essential terms & conditions after some negotiations and discussions. However we see that there is a lot of scope for improvement. The major requests would be for Project Cash Flow to be Positive which would mean better payment terms, realistic Project execution schedules, multiple currency payment and finally, with respect to the terms and conditions, our request would be to have reasonable capped liabilities in place. We do not want to shy away from ownership of our work but these should be reasonable without multiple unlimited liability exclusions. To add clauses for Steel,

Nickel, Titanium, Copper variations would be helpful.

Your thoughts on the shift from CAPEX & OPEX oriented approach to TOTEX . What are the new models for contracting that might be in vogue in the years to come?

The shift from CAPEX & OPEX to TOTEX would come in to play in the medium to long term. In the short & medium term, due to Covid-19 effect, more focus is being laid on reduced CAPEX. One of the existing models that might see more traction is OBE or Open Book Estimate where we are very transparent on the costs front with our clients and fix a percentage of total cost as our mark-up or 'FEED competition' where two or three competitors come up with paid proposals and the owner can chose the best amongst them. TechnipFMC Group has good experience of working on this model. We also hope to see more weightage given to partners with strong 'Value Engineering' capabilities (technical capabilities) which we pride ourselves in. We help optimizing the facilities to ensure Design Intent, Safety and Quality with lowest CAPEX, OPEX and Total Cost of Ownership or TOTEX to the customer. The Build Own Operate (BOO) concept for some plants seems to be getting slightly more prevalent as a means to reduce CAPEX and have the BOO contractor have the full life cycle ownership of the costs (TOTEX).

In your opinion, what would be the 'New Normal' for the EPC industry?

The EPC industry is well established and been in practice for decades. While there will be new Business Models, new Contractual Conditions, perhaps much more modularization, more digitalization like use of more sophisticated digital tools like digital twin and other 3D tools planned to be used for the entire life cycle of the plant, more instrumentation on rotating machines to probably help in preventive maintenance, more emphasis on safety and less work and manpower at Site. I do not see a paradigm shift in the market where we stand today. The market has seen many highs and lows and this is yet another low through which we – our clients and TechnipFMC - shall recover, stronger than before and cater to the global energy needs. In India, I have seen 'FEED competition' recently from a private owner and also the trend of weightage not only to price but also to technical competence in evaluation of bids, also more license plus EPC (LEPC) in certain projects.

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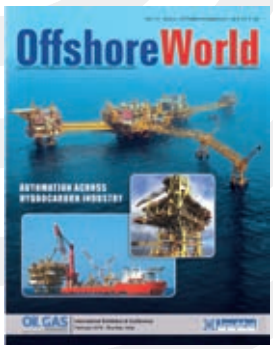

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