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OffshoreWorld

INSIGHT INTO UPSTREAM & DOWNSTREAM HYDROCARBON INDUSTRY

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OFFSHORE WORLD
JUNE - JULY 2019
VOL 16 ISSUE 4
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OffshoreWorld

Next Issue Focus - August-September 2019 : 'ADIPEC 2019' Special Issue – EPC in Oil & Gas Industry'

Greetings from Offshore World, a bimonthly publication of Jasubhai Media, disseminates into the entire Oil & Gas Industry – Up-, Mid-, & Downstream Hydrocarbon. Since 2003, the niche publication has been provided authentic, critical and well-researched information on global hydrocarbon industry innovations.

We are glad to inform that Offshore World is the Official Media Partner of **ADIPEC 2019**, world's largest Oil & Gas and Marine Show, scheduled on 11-14 November 2019 at Abu Dhabi. The August-September 2019 issue of Offshore World is **'ADIPEC Special'** and based on **'EPC in Oil & Gas'.** The special issue will circulate among the visitors, delegated, exhibitors and speakers during the show.

We invite Application-oriented and Technical article, write-ups, Guest Column, Case Study on the various aspects of EPC in the entire Oil & Gas Industry.

- Detailed Engineering Excellence in Oil & Gas EPC
- Efficient Project Management Practices in Oil & Gas Project
- Detailed Engineering in Brownfield Oil & Gas Field Development
- EPC Management at Deepwater & Subsea Oil & Gas
- Design Optimisation at FEED Stage in Oil & Gas EPC
- Digital Transformation in Oil & Gas EPC
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- EPC in Natural Gas Process Plant
- Pipeline Integrity Management in the Oil & Gas Industry
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- Indian Oil & Gas EPC Market - Overview, Growth Drivers, Challenges & Opportunity
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- The article will be generic in nature and will not showcase any organization's offering solutions and product.
- The word limit of the article will not be more than 2000 and Max. 3-4 images and figures, etc can be accommodated with the article.
- The article has not been published anywhere before (Offline and Online).
- Along with the article, please share the Author/s' name, Designation/s and organisation/s along with his/her latest photograph and official email id.

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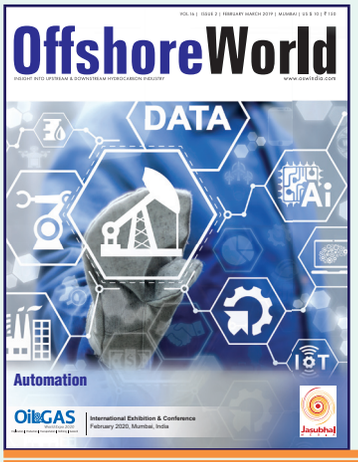
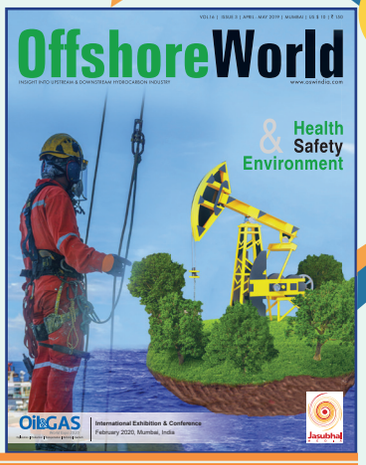
OffshoreWorld

INSIGHT INTO UPSTREAM & DOWNSTREAM HYDROCARBON INDUSTRY

Offshore World is an all-encompassing magazine for the hydrocarbon and allied industries. A bi-monthly magazine, launched in December 2003, Offshore World disseminates authentic, critical and well-researched information on global hydrocarbon industry innovations. The magazine offers latest and strategic information on the upstream and downstream hydrocarbon industry. The endeavour of Offshore World is to become a vehicle in making "Hydrocarbon Vision 2025" a reality in terms of technologies, markets and new directions, and to stand as a medium of reaection of the achievements and aspirations of Indian hydrocarbon industry.

Circulation: 28,000





OSW Region-wise Presence

- 53% Western Region [including Mumbai,Gujarat, Pune, etc]
- 23% Northern Region [including Delhi, UP, etc]
- 10% Southern Region [including Bangalore, Hyderabad, Chennai, Coimbatore, etc]
- 9% Eastern Region [including Kolkata, Assam, etc]
- 5% International [includes USA, MiddleEast, Russia, Brazil, Iran, China, Germany, Italy, France, etc]

OSW Reader's Profile

- CEOs & Senior Management of Oil Companies
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- Project Managers
- Refining & Pipeline Engineers
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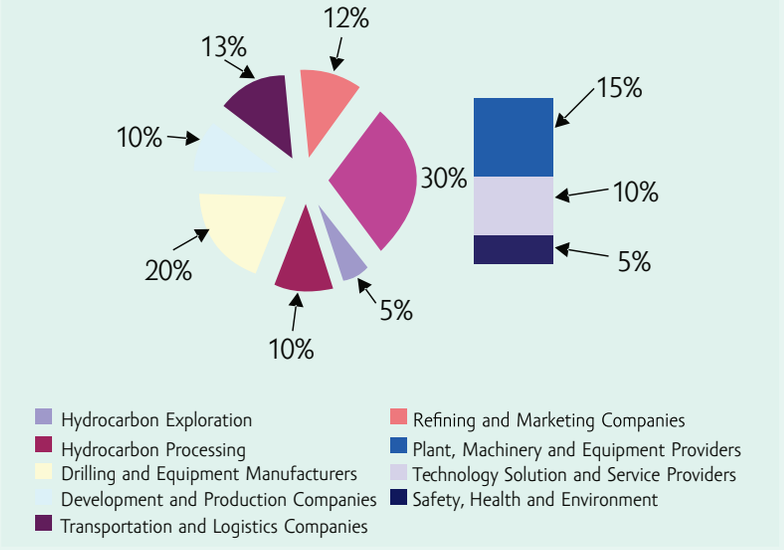

OSW Target Segments

- 5% Hydrocarbon Exploration
- 10% Hydrocarbon Processing
- 20% Drilling and Equipment Manufacturers
- 10% Development and Production Companies
- 13% Transportation and Logistics Companies
- 12% Refining and Marketing Companies
- 15% Plant, Machinery and Equipment Providers
- 10% Technology Solution and Service Providers
- 5% Safety , Health and EnvironmentZA

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'HSSC to complement National Skill Mission of India in Hydrocarbon Sector'

The Hydrocarbon industry is among the 8th core industries in India and plays a key role in the country's economic growth. In pursuit to create a set of skill and talent manpower for the industry on global par, Hydrocarbon Sector Skill Council (HSSC) has been set up in line with the National Skill Mission of India. **Biswajit Roy, CEO, Hydrocarbon Sector Skill Council,** expresses his views on various aspects of HSSC in developing and creating a world class skill council catering to a range of skill requirement of the hydrocarbon industry, and increasing the employability and opportunities, locally and globally, with **Rakesh Roy** of **Offshore World**.

> ***HSSC skill development programs provide skills training, in line with best global practices specific to hydrocarbon sector, to common and underprivileged youth and access to employment opportunities in hydrocarbon sector.***

What was the objective of setting up Hydrocarbon Sector Skill Council (HSSC) and how far it has succeeded in its direction?

Under the National Skill Mission of India, Hydrocarbon Sector Skill Council (HSSC) for the Oil & Gas sector has been set up with its primary objective to execute skill development activities in Indian Hydrocarbon Sector and meeting the entire value chain's requirement of appropriately trained manpower in quantity and quality on a sustained and evolving basis.

The key objectives of the setting up Hydrocarbon Sector skill council are as under:

- To initiate, carry out, execute, implement, aid and assist activities towards skill development in the Indian Hydrocarbon Sector and meeting the entire value chain's requirement of appropriately trained manpower in quantity and quality on a sustained and evolving basis.
- Develop a skill development plan for the sector
- Identify skill development need of the sector, review international trends and identify sector Skill Gap and technology
- Develop National Occupational Standard (NOS's) for the job roles of covering the entire sector/sub-sector
- Identification and enlistment of Training Providers as outlined by NSDC
- Affiliation and accreditation process for assessment agencies
- Create a pool of skill manpower and develop benchmarks for new skills.
- Setting up a robust and stringent certification and accreditation process
- Plan and execute Training of Trainer's (ToT)
- Establish a well-structured sector specific Labour Market Information System (LMIS) to assist planning and delivery of training

How do you view the current workforce and skill set in the oil & gas industry looking at the volatility and harsh and hazardous working environment pertaining to the industry? What are the steps taken by HSSC to develop the future manpower ready to match the global practices?

India is one of the fastest growing economies of the world. It is estimated that 250 million people are set to join workforce by 2030. There is a need for market aligned skill development programs to address the gap of skilled population in harsh and hazardous working environment pertaining to the Hydrocarbon sector Industry.

HSSC skill development programs provide skills training, in line with best global practices specific to hydrocarbon sector, to common and underprivileged youth and access to employment opportunities in hydrocarbon sector. Various Steps have been taken by HSSC to address the systemic imbalance between millions of India's youth lacking technical education and employable skills for Hydrocarbon Sector by providing them comprehensive skills training, knowledge through vocational or technical hands-on training to meet the industry requirements and to ensure competitiveness in the global market.

A total of 118 trades have been identified by the industry committee for imparting skilling in the Oil & Gas sector; 12 of them are already approved under National Skill Qualification Framework (NSQF). The process of development of the qualifications, which are in line with global practices, has been initiated.

In order to create the pool of skilled manpower in the Hydrocarbon Sector; Skill Development Institute (SDI's) have been set up by the Oil & Gas PSU's at six locations;

S. No.	Lead Company	Location	Focus Area
1	IOCL	Bhubaneswar	Downstream Sector
2	HPCL	Vizag	Downstream Sector
3	BPCL	Kochi	Overseas placement
4	OIL	Guwahati	North East
5	ONGC	Ahmedabad	Upstream Sector
6	GAIL	Rae Bareli	Midstream & Gas

All these SDI's had started operations in last two years and in short span of time, over 6500 candidates have been skilled and employed in Hydrocarbon and allied sector industry.

"HSSC, primarily focuses to attract the right talent and provide them with market aligned skill development programs to address the gap of skilled population in Hydrocarbon Industry by enabling maximum number of youth to undergone formal skill training relevant to oil & gas industry."

The council is endeavouring to Zidentify more training partners for creating more centres in various locations on pan India basis.

With the rapid technology advancements and advent of Digitalization in the Oil & Gas Industry, what are the steps taken by HSSC to cope with the emerging trends?

To meet this challenge, HSSC, recently had collaborated with M/s VEATIVE Labs Pvt. Ltd. for developing 3D, augmented reality (AR), virtual reality (VR) content in Hydrocarbon Sector where the trainees can understand and learn the job before landing at site. Along with the same, to offer a first-hand experience of digitalization to trainees, most of theory-based assessments have been carried out through online digital platforms and basic knowledge of digitalization has been made integral part of almost all the skill courses.

Aging workforce and attracting the right talent are still challenges for the hydrocarbon industry. How does HSSC plan to address these issues?

The average age of workforce employed in the oil and gas sector in INDIA is high and this is a major challenge. India is a country with the population of over 1.2 billion people and will have a surplus of active population (in the working age 15-59 years) - about 60 per cent of total population in coming years. HSSC, primarily focuses to attract the right talent and provide them with market aligned skill development programs to address the gap of skilled population in Hydrocarbon Industry by enabling maximum number of youth to undergone formal skill training relevant to oil & gas industry. By 2026, around 64 per cent of the population of India is expected to be in the category of active population (age bracket of 15–59 years), with merely 13 per cent aged above 60 years, INDIA is poised to become the youngest country of the world by then.

What are the future plans of HSSC to sync with 'Power for All' initiative of Hon'ble PM in terms of creating quality manpower and technical expertise for the entire Oil & Gas Industry?

HSSC future plans include providing adequate skilled manpower to Hydrocarbon sector where huge employment generation opportunities are envisaged in days to come due to various projects that may lead to higher demand of work force in near future ;

• New Petrol Pumps:
These will require staff to run the establishment and hence the demand of skilled workforce may go up. Also, there are many new petrol pumps planned to be set up in Tier II and Tier III cities by the private and public sector enterprises.

Oil & Gas field discovery:
Would require new oil & gas extraction platform being setup and hence fuelling the demand for highly skilled workforce in exploration, production as well as maintenance.

• Pradhan Mantri Ujjwala Yojana:
The objective of the scheme is to provide natural/petroleum gas based cooking fuel in every household and will be requiring a higher number of skilled labour at the local storage & distribution station and delivery boys. This would also lead to an increase in demand for workforce trained towards the repair and maintenance of these new gas stoves and other apparatus.

• Focus on City Gas Distribution (CGD) Infrastructure
To make available natural gas to public at large, Government has put strong emphasis on expansion of City Gas Distribution (CGD) network coverage across the country. CGD will expand the coverage of CGD networks to about 70% of country's population spreading over 50% of India's area. The growth of CGD coverage has potential to attract total investment of more than Rs 1,20,000 crore in gas value chain with generation of over 3 lakh employment opportunities in coming years.

• International Requirement:
With demand for oil & gas to increase in near future to meet the demand of the sector, the international labour force requirements for skilled manpower is estimated to grow, India with its large manpower pool can try and leverage upon this opportunity and skill & train people in field of exploration, extraction & refining to equip them with latest technological knowhow and expertise and thus become a supplier of skilled workforce to the world. ●

Digital Transformation Making the Chemical Processes Smart

Imagine no routine manual collection of maintenance, reliability, and data integrity with portable testers or time-consuming interpretation. Imagine no delays waiting for an expert to mobilize to site or trying to explain a problem in the field to a supervisor over a telephonic conversation. Instead, data is collected automatically, transmitted digitally, and analyzed by software to detect early signs of problems. Digital Transformation is about changing from manual paper-based tasks to data-driven tasks. This article, written by **Anil Bhatia, Vice President & Managing Director, Emerson Automation Solutions India,** acquaints us in depth with the various features of the automated Smart Plant Concept.

Most chemical companies have been using sensor technology for decades. However, Digital Transformation represents an entirely new model for how data from these sensors becomes part of the company's end-to-end process. Not only does DX offer optimization of the production process, but it can also improve efficiency, while reducing both energy consumption and operational costs.

With advancement in new technologies, such as non-intrusive and wide area sensing along with wireless communications, it is now easier and more cost-effective to add measurement points throughout a chemical plant. These technology-shifts have empowered the development of Pervasive Sensing solutions.

Pervasive Sensing solutions enable automatic data collection and analytics for applications that were previously either monitored manually or ignored. Enabled with predictive analytics, this technology makes predictive maintenance possible by providing actionable information, such as abnormal operation or imminent failure alerts. By examining networks real-time to spotting anomalies and taking timely corrective action in applications such as pumps, motors, steam traps, heat exchangers, valves and piping systems, operators can maximize production and improve overall plant reliability, safety, and efficiency.

Unscheduled outages and production slowdowns, classified as mechanical unavailability, occur due to common problems such as – rotating equipment failure, exchanger fouling, piping corrosion, and fired equipment constraints. Energy loss occurring from heat exchanger fouling, failed steam traps, and process unit inefficiencies—all of which may go undiscovered from a lack of complete energy measurements. Chemical Plants understand macro energy performance through their Energy Intensity Index. However, determining exactly where energy is lost in a chemical plant tends to be a typical challenge when driving an energy improvement program.

Smart Process or Smart Plant

In plants, the basic process control and safety are already automated. Yet, around the plant there are still lots of manual tasks being carried out for supporting functions. Digital Transformation is about changing from manual paper-based tasks to data-driven tasks. This article narrates Smart Solutions for a typical chemical process plant driven by the leading technology providers like Emerson Automation Solutions.

Smart Inspection

Imagine no routine manual collection of maintenance, reliability, and data integrity with portable testers or time-consuming interpretation. Instead, data is collected automatically, transmitted digitally, and analyzed by software to detect early signs of problems. Overall Equipment health index is also tracked by software.

"With advancement in new technologies, such as non-intrusive and wide area sensing along with wireless communications, it is now easier and more cost-effective to add measurement points throughout a chemical plant. These technology-shifts have empowered the development of Pervasive Sensing solutions"

"Digital Transformation will have a profound effect on chemical process operations and will transform the way we do business. What leadership will have to ensure is a correct execution strategy with the right processes and organization culture."

Smart Collaboration

Imagine no delays waiting for an expert to mobilize to site or trying to explain a problem in the field to a supervisor over a telephonic conversation. Instead, a two-way digital video and audio between field technician with a wearable camera at site enables an expert anywhere in the world to see the problem up close and live, to provide immediate solutions.

Smart Distress Calls

Imagine no walkie-talkie required for distress calls. Instead, automatic detection, digital transmission, and alarm on safety shower activation or man-down, not moving, in operator software and location tracking software help early detection of issues for smoother operations.

Digital Safety Checks

Imagine no ad-hoc visits to the plant to check if a manual valve was closed or dipping to see if tank is nearly full, and similar safety checks. Instead, automatic detection, digital transmission, and indication in control room software, as well as use in interlocks always ensure a seamless production process.

Digital Mustering and Locating

Imagine no paper lists and walkie-talkie to account for people during emergency evacuation mustering and no search parties required to find missing personnel. Instead, the location of every person is digitally tracked in real-time and automatically tallied in software.

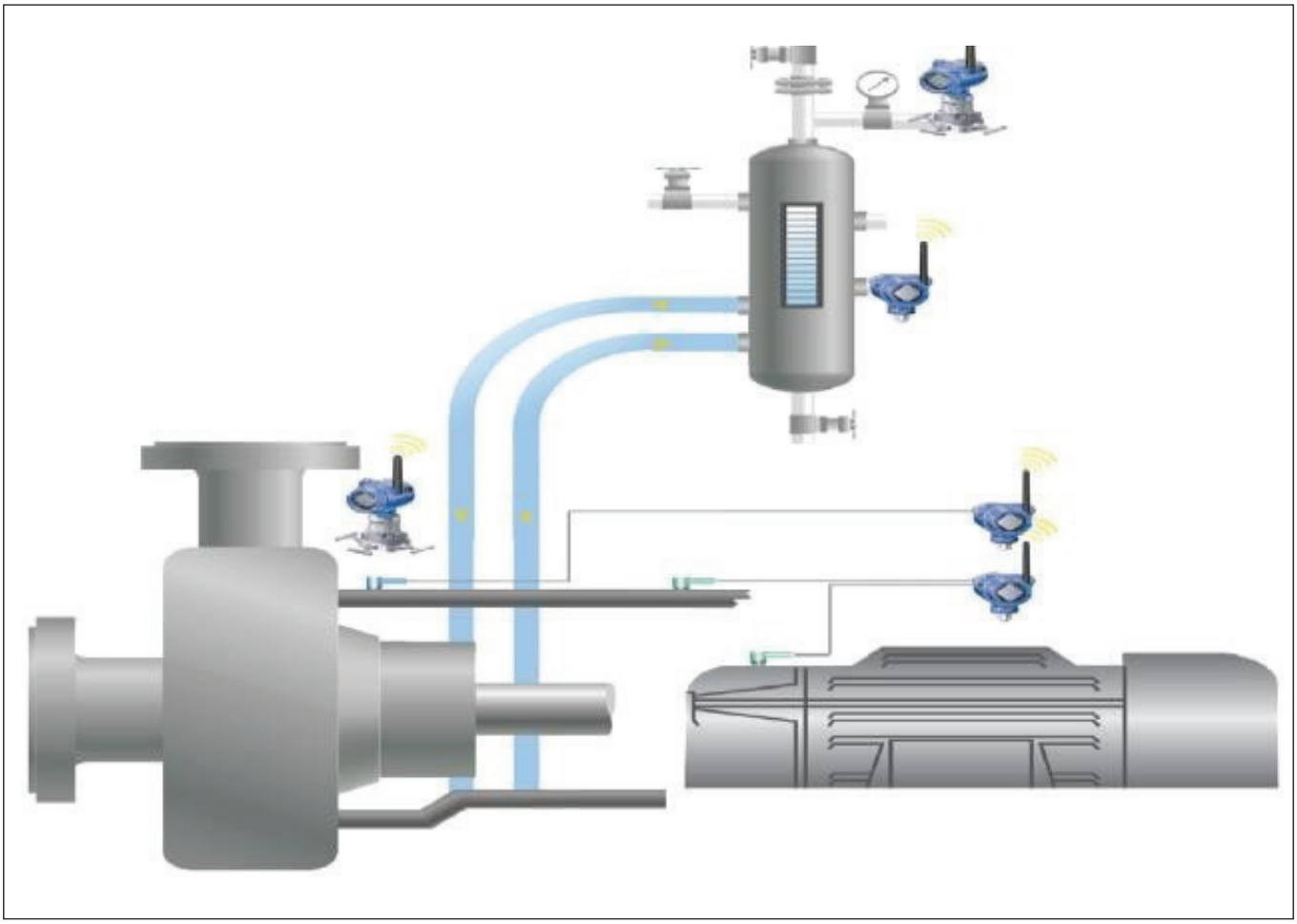
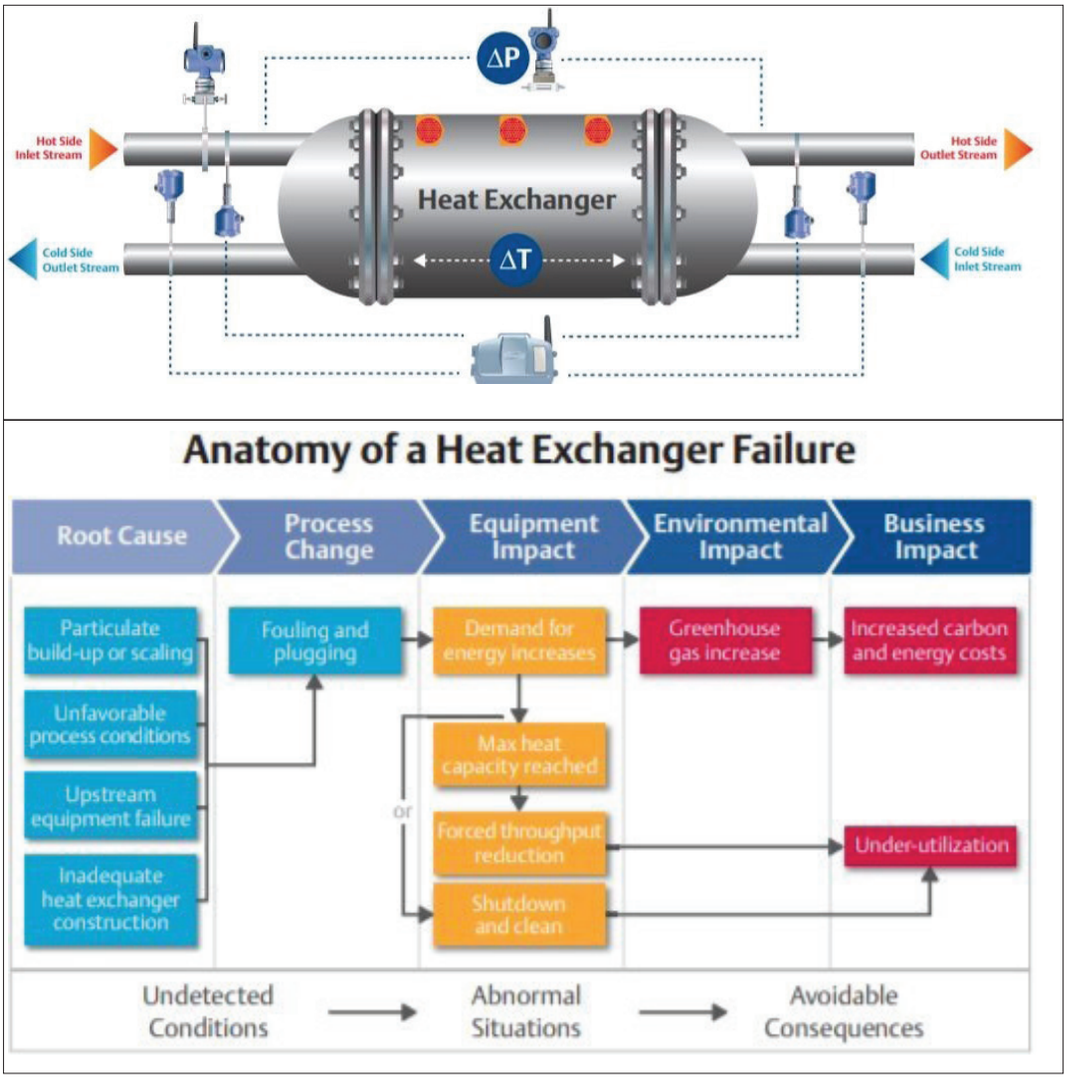


Figure 1: Pump Health Monitoring using Wireless Pressure, Temperature, and Vibration Transmitters



Digital Logbook

Imagine no paper notebooks for jotting down near miss incidents, hazards, and maintenance needs etc. Instead, management / operations team receives real-time notes and digital photos of incidents, hazards, leaks, and damaged equipment that are captured on software enabled tablets.

Application Note 1: Availability Loss – Pump Monitoring

For example, consider the light end areas of a chemical plant. Typically, there are 10-15 pumps in a plant that are usually checked manually once in a month for vibration, and bad factors are checked once in a week. With ever-changing process conditions, such manual and sporadic spot inspections are insufficient to detect pump problems and seal failures. In this application, even chemical leaks that take place due to seal failures leading to production loss, fires, and other safety incidents can be avoided. Online monitoring of pumps through the addition of wireless measurement of vibration, pressure, and seal fluid levels allows early detection of excessive vibration, cavitation and seal failure problems. By monitoring and creating predictive alerts, maintenance staff can be notified of impending problems before they occur. This can lead to improved production through fewer unscheduled outages.

Application Note 2: Energy Saving Example – Fouled Heat Exchanger

Most of the heat required by chemical process plants comes from heat exchangers. Unanticipated fouling can drive up energy costs and, if severe enough, result in an unscheduled shutdown to clean bundles or a process slowdown until the next shutdown. Online monitoring of heat exchangers through addition of wireless measurements of temperature and vibration allows you to improve operational efficiency by detecting accelerated fouling early, allowing you to clean your exchangers according to a more optimal schedule.

Conclusion:

Closing this article with a practical thought viz. Steam Powered Engines revolutionized transportation – Digital Transformation will have a profound effect on chemical process operations and will transform the way we do business. Organizations will start implementing this in a small way and by tasting success, will see the benefit of scaling it up very quickly. Organizations will have to relook their hiring process and upskill existing talent at a very fast pace to optimally handle this transformation.

There is no question about the fact that in today's highly competitive market, chemical plant operators who can quickly adopt innovations like Digital Technologies and Industrial Internet of Things (IIoT) will reap most of the benefits. What leadership will have to ensure is a correct execution strategy with the right processes and organization culture. ●

Refining & Petrochemicals World Conference 2018:

Underlining the Emerging Trends in Refining & Petrochemicals with today's Changing Business Dynamics

Date: 21-23 February 2018
Venue: CIDCO Exhibition Centre, Vashi, Navi Mumbai

Chemtech organised the **9th edition of Refining & Petrochemicals World Conference on 22 February 2018 at Mumbai India,** along with **Oil & Gas World Expo 2018.** The theme **"Emerging Trends in Refining & Petrochemicals in the Face of Global Uncertainties"** was designed to highlight the recent exponential growth trajectory of India's refining sector, along the challenges arising from the use of renewable energy, alternative fuels and strong inclination of Indian government to shift the automotive industry from fossil fuels to electric vehicles.

Over 100 delegates from refining, petrochemicals, EPC services and other allied sectors attended the one-day conference. Eminent Speakers delved over Integration of Refinery & Petrochemicals and latest Hydrogen Technology, Integration of Engineering & Operations, New Technology Trends in the whole day technical sessions.

The first technical session focused on Integration of Refinery and Petrochemicals, and Hydrogen Technology

Commencing the session, the Session Chairman - **D M Katre of Reliance Industries Ltd,** emphasized the need of integration between Refinery and Petrochemical to improve Refinery margins.

The fact that most of the petrochemical produces invite a higher degree of margin vis-à-vis the fuels, there is a strong case for integration between

(L-R) Kishore Sonawane, Senior Business Development Manager, Thyssenkrupp Industrial Solutions (India) Pvt Ltd; D M Katre, President, Reliance Industries Ltd; Claes Tigerstrand, Head - Southern Europe & Overseas Technical Market Development & Customer Service, BA Europe - Outokumpu; and Nandakumar V, Chief General Manager (Petchem and R&D), Mangalore Refinery & Petrochemicals Ltd

(L-R) Elvis Joseph, Chemtrols Industries Pvt Ltd; Nitin Gupta, Chemtrols Industries Pvt Ltd; Timur Zaripov, Global Sales Director, Lotus; Dr Debesh Patra, Chief General Manager (Planning), Bharat Petroleum Corporation Ltd; Martin Hawkins, COO, HPCL-Mittal Energy Ltd; and Tobias Botzenhardt, Vice President Asia Pacific, Enterprise Data Intelligence and Analytics, Siemens Industry Software Pte Ltd

refinery and Petrochemical Complex, wherein, both feed as well as energy integration can be exploited for soliciting higher revenues, he said.

Nandakumar V of Mangalore Refinery & Petrochemicals Ltd, said that while refining capacity additions are a need to meet the primary energy demand in the country, growing demand-supply gap of the petrochemicals also need to be addressed while adding refining capacity.

Right Technology sourcing and government policies can support production of petrochemicals and creating clusters of manufacturing with allied industries, he added.

Claes Tigerstrand, Outokumpu, stressed on the use of high-end stainless steels and Nickle & Nickle alloys at refining & petrochemical industry due to their excellent properties such as corrosion, heat and pressure resistance.

He said that the materials are resistant to both aqueous and gaseous corrosion plus they can be used in environments from cryogenic to very high temperatures.

Kishore Sonawane, thyssenkrupp Industrial Solutions (India) Private Limited, said that while the demand for energy is increasing, the demands for more stringent product specifications for cleaner fuels, reduced fuel oil demand and the economic advantages in processing heavier sourer crudes are increasing. Thus, the demand for hydrogen in refineries continues to grow.

'New Technology Trends' was discussed on the second session

The session was chaired by **Dr Debesh Patra of Bharat Petroleum Corporation Ltd.** He said that the refining industry will continue to grow in the coming days with the increased demand from the developing countries being the principal driver for that growth.

He said that the global refining capacity was around 3.6 billion tonnes in 2016 and is expected to rise about 4.2 billion tonnes in 2030.

The Session Co-Chairman, M**artin Hawkins of HPCL-Mittal Energy Limited,** believed that a lot of brownfield and greenfield refining & petrochemicals projects are coming up worldwide in the coming years and companies will likely have to take a more disciplined approach to capacity additions and all petrochemical players will need to work much harder on core capabilities and strategy.

This will include using digital and advanced analytics to reach a new level of productivity, and attaining higher capital productivity on the industry's large-scale projects. Companies must also work on reinventing the interface with oil refining as the gas-driven era winds down, he said.

Tobias Botzenhardt of Siemens Industry Software Pte Ltd, described how does Digitalisation changes all areas of today's life: The way we stay informed, the way we travel, the way we buy things – and the way we manufacture products.

He said that Electrification, automation and digitalization – E-A-D in short – are the three main drivers of growth and innovation in any organization in the future.

(L-R) Dr Kamaraj Duraisamy, Partner – KAC International; Sourabh Mukherjee, Director of Global Sales, Jacobs Engineering; Dr Debesh Patra, Chief General Manager (Planning), Bharat Petroleum Corporation Ltd; Parag Chepe, Executive Director – Technologies (Fertilisers, Electrolysis, Polymers), thyssenkrupp Industrial Solutions (India) Pvt Ltd; Dr Pramod Kumbhar, CTO & Executive Vice President, Praj Industries Ltd; and D M Katre, President, Reliance Industries Ltd

Nitin Gupta & Elvis Joseph of Chemtrols Industries Pvt Ltd, said that the Safety Instrumented Systems (SIS) of Refinery is very critical because of chemicals and processes involved in it and stressed on considering several factors for the selection of Control Valve including performance needs, testing procedures and lifecycle requirements, and environmental requirements such as fugitive emissions or reducing/eliminating flares.

Although, there is a need of what technology will be utilized, from the logic solver to the final control element (valve) and contract management, considering budgets, suppliers and schedule needs, they added.

Timur Zaripov of Lotus, emphasized on improving the efficiency of heat transfer at refinery & petrochemicals complex to reduce costs.

Session on Transition of India's Energy Basket looking at the COP

The last session was in the form of panel discussion and moderated by **Parag Chepe of thyssenkrupp Industrial Solutions (India) Private Limited.** He said that the transition from current usage of Coal & fossil fuel to unconventional mode is a mammoth task. However a flexible alternative of fossil fuel as sources of clean energy can be achieved through measures like; Coal conversion development, materials technology, technical support to major liquefaction projects, process analysis and engineering evaluations, fossil energy environmental analysis, flue gas desulfurization, atmospheric fluidized bed coal combustor for cogeneration, etc.

Dr. Debesh Patra of Bharat Petroleum Corporation Ltd, in highlighting India's energy share in global energy consumption said that India's share of world energy consumption was 4.4% in 2000, increased to 5.6% in 2013 and is expected be 11% in 2040. That is much less than 18% of share of India's population (India -1.6 billion, World - 9.1 billion).

Sourabh Mukherjee of Jacobs Engineering, said that the fall in the price of clean energy is driving massive capacity build across Asia and that is an opportunity that even conventional energy firms can't ignore.

D M Katre of Reliance Industries Ltd, pointed out the need of timely investment in green technologies to achieve the target set for energy integration of the country.

This is significant, given India's burgeoning electricity demand and the persistent supply demand gap - the pursuit towards cleaner energy sources will have a crucial role in enabling the country's transition to a fully sustainable energy system, he added.

Dr Kamaraj Duraisamy of KAC International, said that while India has leapfrogged Euro IV to Euro VI Fuel emission standard in last few years, the integration of Selective Catalytic Reduction (SCR) Technology and Diesel Exhaust Fluid in vehicles will play key role to meet stringent NOx emission standards adhere to Euro VI.

Dr Pramod Kumbhar of Praj India, highlighted the concerns about the rapid economic growth, energy security of the country, coupled with global climate change which have created a new landscape for fossil energy exploration, production, and utilization. He said that while efficiency improvements, fuel conservation, and deployment of nuclear and renewable supplies will help those concerns, however are unlikely to offset growth in the coming decades.

As such, new technologies and undertakings must both provide high quality fossil energy with minimal environmental impacts. Oil and gas supply can be partially sustained and replaced through exploitation of unconventional fossil fuels such as tar-sands, methane hydrates, coal-to-liquids, and oil shales, he added. ●

– Rakesh Roy

Innovating Supply Chain Collaboration to Create New Value for Oil & Gas Industry

The continuous plunging crude price since last few years due to various reasons has raised the bar on investments over RoI in the Oil & Gas sector. This article stresses on building of a collaborative supply chain that interweaves the myriad stakeholders in the O&G ecosystem to drive greater on efficiencies by reducing operational cost while simultaneously increasing productivity. Also, the article emphasises on adoption of Digital Technologies is the need of the hour to deliver astounding cost savings through automation and predictive analytics, giving companies more wriggle room to increase profits.

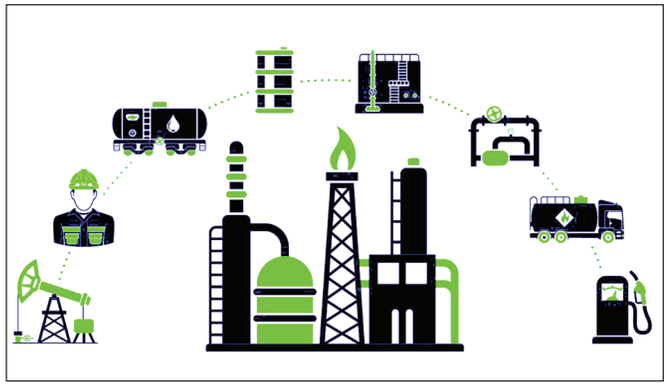
The 2014 price crash shocker is a good example of why the word 'volatile' is often used to describe the oil and gas sector. With a voracious appetite to fuel economic growth, developing countries like China and India sent prices soaring in the early part of the new millennium. Then came the 2008 recession, where prices plummeted in a historic plunge. Whatever recovery the industry could salvage in the aftermath was lost a few years later in 2014, when a host of factors - political turmoil in major exporter nations, economic sluggishness in high consumption markets like Europe and Japan, plateauing growth rate in China and rising North American domination in oil production - signalled a steady downward spiral in demand.

Consumer windfall in O&G is never a good idea - being a 'price inelastic' sector, a supply glut of crude oil or natural gas can be the dominoes falling for the global economy. Singed by lowering prices, if oil companies scale back on new production, they cannot immediately address fluctuations in demand, causing upheaval in oil hungry sectors that run an economy – electricity and transport being the most crucial. For oil exporting nations, there is also the impact on GDP and employment.

In the current scenario, the growing focus on renewable energy and escalating trade tensions have only accentuated the market sensitivity of the oil and gas sector.

While we are still a long way off from being a zero carbon world, O&G companies are feeling the heat. A recent report by Carbon Tracker, a UK-based not-for-profit organization that tracks the impact of climate change on fossil fuel companies, called out the dangerous new trend in the sector where executive pay is linked to increasing production avenues rather than maximising returns with existing reserves. In other words, leaders are rewarded for risking investment in what could potentially turn out to be dead assets, instead of aligning their strategy to the demands of the Paris Agreement on climate change.

Driving Value over Volume – Streamlining the Supply Chain is Key



The deep-seated vulnerability of the Oil and Gas sector is ironically, its main strength - the diversity of the ecosystem that defines the role it plays in shaping global geopolitics. Spread across multiple locations and run by a decentralized workforce, the O&G market traverses multiple political, trade, infrastructure, regulatory, labour, environmental and safety considerations.

Given the complexity of the market structure, there is no simple answer to how much it costs to drill an oil well – budget companies have to allocate for capital spending (feasibility study, equipment), production costs, administrative & transport charges and taxation. In totality, the cost may vary anywhere between USD 20 million to 1 billion, depending on the type of rig.

With the cataclysmic changes in demand, shareholders and energy experts are now clamouring for the O&G sector to follow a new mantra - do more with less, strategize value over volume. A crucial factor to achieve this is the building of a collaborative supply chain that interweaves the myriad stakeholders in the O&G ecosystem. Such restructuring drives greater efficiencies by reducing operational cost while simultaneously increasing productivity.

This inevitable reality is not just based on the pressures of an unreasonable market, it has roots in the way the O&G industry is structured. For instance, according to a 2017 report by Mckinsey, even in a low price environment, the rise in cost of major projects can only be partly attributed to inflation, about 70 per cent of the expenses are 'self-inflicted'. This is mainly because of the insistence on bespoke requirements for each project rather than standardized specifications.

Through industry-wide collaboration, that harmonizes specifications for material and manufacturing requirements, Mckinsey's research has shown that such streamlining the O&G supply chain can 'unlock five-year industry-wide savings of USD 90 billion to USD 240 billion on purchases of commonly used exploration and production equipment'. Citing the example of the synergies in the automotive industry, the report also goes on to state that harnessing collaboration with key suppliers, like engineering and procurement contractors and equipment providers to evolve 'supplier-led solutions' can lead to reduced cost and increase in output.

The Impact of Digitization on O&G Supply Chain

The 'capital project supply chain', as the Mckinsey report puts it, is only one part of the picture. The other, more significant aspect, is the impact of digital disruption on the Oil and Gas sector. Next generation technologies like Big Data, Industrial Internet of Things, Machine Learning and Artificial Intelligence are making headway in this legacy ridden sector. Whether upstream, midstream or downstream, these technologies have the potential to deliver astounding cost savings through automation and predictive analytics, giving companies more wriggle room to increase profits.

Take the case of IoT. Considering the low level of digital maturity in the sector, a Deloitte Insights article succinctly spells out the benefits of implementing IoT in O&G companies. "Increased data capture and analysis can likely save millions of dollars by eliminating as many as half of a company's unplanned well outages and boosting crude output by as much as 10 percent over a two-year period. In fact, IoT applications in O&G can literally influence global GDP. Industry-wide adoption of IoT technology could increase global GDP by as much as 0.8 per cent, or USD 816 billion during the next decade, according to Oxford Economics", the report says.

With data being central to derive value from the implementation of technology, O&G companies have to innovate to synergize suppliers in the information supply chain. From the vendor that supplies the sensors to the cloud storage provider and the engineering service company that makes sense of the data to drive operational efficiencies, streamlining the information supply chain presents as many opportunities as it does challenges.

As the sector undergoes the inevitable evolution of digital transformation, what oil and gas players will increasingly look for is a partner that takes the lead in developing a collaborative platform that allows the seamless flow of data.

Being a leader for more than two decades in the oil and gas industry, QuEST is uniquely positioned in this sector. QuEST undertakes projects in its entirety and works on the complete life cycle of a plant and we provide engineering service / solutions during entire concept to commissioning phase of the plant. This helps the team to garner an in-depth knowledge on equipment, processes, systems, and utilities across multi – disciplines. QuEST assists customers in their digital transformation journey as a one-stop solution; right from software installation to its final execution. The company's expertise of the domain makes it a leader in collaborative supply chain management which helps its clients to adopt to latest technologies such as AI, ML, and DL efficiently. ●

Srikanth Subba Rao
Manager - Technology Excellence Group
QuEST Global

Digital Transformation in Oil & Gas Industry

Looking at the current business dynamics, the entire oil & gas industry – be it up-, mid- & downstream hydrocarbon – is now facing a lot of pressures in terms of, investment vs RoI, compliance with environmental regulatory & policy framework, enhance knowledge & skill along with retaining workforce, etc. The white paper describes the benefits of digital transformation in the industry which can offer to develop agile business models with higher margins, improve regulatory compliance, streamline process innovation, capture and retain workforce knowledge, and enable a zero-accident culture focused on operational excellence.

Given the existing market dynamics, enterprises in the oil and gas industry are facing increased pressure across multiple dimensions of their enterprise. Heightened regulatory compliance requirements, while put in place for good reasons, create new and complex pressures manufacturers have never faced before. At the same time, the industry strives to improve knowledge creation and retention as its workforce undergoes a generational transition exposing potential risk to business continuity.

Upstream producers seek maximized production of oil and gas from onshore and offshore wells safely and economically. Amid increasing demand, environmental pressures, and potential security threats, the primary concern of hydrocarbon pipeline operators in the midstream oil and gas market remains the same: to ensure safe, reliable, and compliant operations, 24/7 - all while managing energy costs and minimizing time and installed costs. While downstream refining and petrochemical producers strive to achieve superior performance through better management of their energy usage and costs, optimization of their process yields, reduction or elimination of safety-related incidents and improved operator performance.

Coupled with these challenges is the uncertainty caused by digital technology's increasing disruption in the oil and gas industry. Pivotal technologies like cloud computing, the industrial Internet of things, digital twins, and augmented and virtual reality are precursors of the next industrial revolution. How can producers in the upstream market, pipeline operators in the midstream market and refineries in the downstream market all ensure they make the right technology investments? Digital Transformation is the key to oil and gas companies driving new and better customer experiences while maximizing value creation across asset and operations lifecycles to improve profitability, maximize return on capital and improve their overall competitive edge.

Executive Summary

This whitepaper discusses:

- Understand the key challenges and opportunities facing oil and gas companies today.
- Learn how digital transformation empowers oil and gas companies to deliver increased value across asset and operations lifecycles.
- Develop your strategy for implementing digital transformation

The Digital Twin

A digital twin is a digital representation of a physical asset; like a pump, motor, turbine, even an entire industrial process or plant. Digital twins enable full lifecycle management of physical assets, starting with the design of the asset or process itself and continuing throughout its operational life. As the operational life continues, a digital copy is updated in real time. By creating digital twins data generated by the asset or process during its design and operational life is collected, visualized and analyzed to maximize return on capital and increase enterprise profitability.

PROCESS OPTIMIZATION

In today's economic environment, capital budgets and overhead are constantly being cut. Oil and gas producers are faced with rising manufacturing costs, global competition, and soaring energy costs. To meet these challenges, companies are forced to optimize manufacturing operations and make performance improvements to positively affect their bottom line.

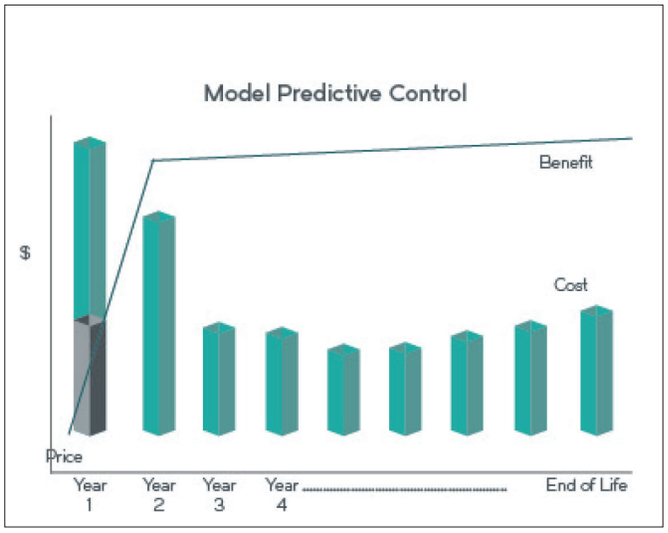
Feedstock prices shift dramatically over very short periods of time. This forces manufacturers to stay on constant alert with economic conditions and forecasts. Energy costs are also increasing, forcing manufacturers to identify new opportunities for optimizing and reducing energy costs across all facets of process design, implementation and production.

Digital Transformation offers new toolsets that enable oil and gas producers to increase their competitive levels in their market and industry. These digital toolsets help to improve yield of valuable product while reducing energy consumption and increasing throughput. Using digital technology, manufacturers can create a complete digital twin of their processes and assets allowing them to evaluate what-if scenarios in batch processing and manufacturing.

Through digital transformation operators can mash up real-time process data with current economic conditions giving operators the ability to make informed decisions at an expedited rate. Information sharing increases while stakeholders increase their ability to visualize results and key performance indicator data across process and overall plant production. Online process optimization and reporting offers a large potential impact on process yield, energy usage and throughput optimization.

Increase Profitability

APC Model Predictive Control is comprehensive, advanced process control software that improves process profitability by enhancing quality, increasing throughput, and reducing energy usage. It uses modern, state-of-the art technology to provide automatic control systems that are capable of releasing process potential. Predictive control helps process operations realize their full potential by moving the process closer to active constraints — resulting in reduced process variability and increased profits.



CLOUD-BASED PROCESS DESIGN

Cloud computing offers several opportunities to reduce costs in process design. By leveraging the almost infinite processing power and storage available through cloud-based architecture, process design can accelerate while also reducing capital investment costs for process modeling and training. Oil and gas producers can spin up cloud based servers and computing resources as needed. This also accelerates the flow of information throughout process design. Through a cloud based architecture for process design information accessibility is increased, availability is enhanced and total cost of ownership (TCO) is significantly reduced.

As process design moves to the cloud the production process can be continually improved through revamp and process improvement. They can also digitally connect process and control strategy design to accelerate startup after plant turnaround and quickly debug control application design. Through a cloud-based architecture offering an open model writing environment, simulation benefits can be extended to areas not well covered today. Like many reactors, polymers and specialties. Process innovation becomes seamless through collaboration by separating the content from the product allowing the content, such as simulation models, to be managed easily with file history logs in a central repository.

Efficiency is significantly increased using cloudbased architecture as refineries can adapt to changing needs. Computing power can be scaled up or down with varying numbers of virtual machines or instances to facilitate simulation templates for engineering test or training scenarios. Secure user access control allows administrators to add, delete or edit users and privileges as needed. IT overhead is simplified to a pure on-demand cloud-based architecture where machines are accessed via a secure URL, and new versions of process designs are available as soon as they're released. Companies in the upstream, midstream, and downstream markets can also adapt their plants and facilities to changing legislative and market requirements faster through a cloud-based architecture. As process design information is digitally stored in the cloud it becomes easier to mashup this information with other sources of data and drive the enterprise towards a completely digital planning and operations model.

Accelerate Operational Excellence

Simulation Platform supports the entire engineering lifecycle; from representation of actual P&ID, mapping each equipment object to a detailed engineering database; to building/testing the dynamic stimulation early in the process design; to optimizing the process and control design, comparing capital versus operating costs; to the continuous improvement of operations, as the simulation model becomes a plant's Digital Twin.

DIGITAL PLANNING AND OPERATIONS

Integrated petrochemical production networks are highly complex and difficult to visualize for planning and operations. While at the same time, increasing volatility of supply and demand in feedstock enables opportunities for margin improvement. Through digital transformation business units that have historically been disconnected silos can connect in real time to create a unified supply chain model that maximizes profitability by taking advantage of data mashups between real-time economic and market data sources and current plant and production status data.

In a unified supply chain model planning and operations are fused together across the digital value chain. A complete 360-degree view of the digital value chain emerges allowing all aspects of the enterprise to be visualized, analyzed and optimized. Inputs to the enterprise such as feedstock and raw materials are analyzed in realtime against planning, operations, scheduling and distribution. Full plant models are managed simultaneously within a supply and distribution network. Fast optimization, combined with userconfigurable visualizations and reporting, allows the impact of uncertainties and data changes to be evaluated and understood in real-time.

Feasible and robust schedules emerge that lead to business decisions that are simpler to understand and explain across the entire enterprise. Reconciliation and back casting allows businesses to understand how and why deviations from plans occurred, enabling increased planning efficiency while making it easier to generate feasible and robust schedules that shrink the gap between planned and actual operations. The amount and accuracy of production information increases substantially, equipping users with tools and insights to go beyond basic data, OEE and lean manufacturing principles to discover the real metrics that are driving performance, availability and quality throughout all levels of supply chain management, planning and operations.

Metrics generated by newly tapped digital data sources enable users to gain immediate insight into economic decisions across a range of scenarios. Direct integration of operational data and reconciliation environments enables rapid and continual updating of production

schedules. Powerful modeling tools and drill down analytics allow users to discover bottlenecks, and understand how to design more efficient operational workflows.

Through digital transformation oil and gas producers can explore opportunities, reduce operational risk and shrink the gap between plan and actual results. Product value streams can be maximized within the petrochemical value chain through a site wide planning model. Optimal feedstocks can be selected based on real-time economic data and for feed flex crackers to maximize margin. And maintenance costs can be reduced through optimized part inventory and the combination of multiple logistics facilities into a single envelope. Digital transformation also offers opportunities to improve workforce training, productivity, safety and regulatory compliance.

Unified Supply Chain Management

BP implements industrial software from AVEVA with advanced modeling to optimize supply chain management from source materials and feedstock to planning, scheduling, operations and distribution. Information is easily shared between users and business functions, improving understanding and collaboration between traders, planners and analysts and delivering a complete visualization of the digital enterprise value chain.

DIGITAL WORKFORCE KNOWLEDGE CAPTURE AND RETENTION

A generational shift is occurring in the oil and gas industry. As a generation of highly experienced refinery and pipeline operators begins to retire it's critical for oil and gas companies to accelerate the onboarding and training of new operators as much as possible to ensure safety and performance.

At the same time training budgets are also being tightened increasing the need to deliver training through a sustainable, efficient and effective model. Digital transformation offers several options to address these challenges.

Virtual Reality (VR) and/or Augmented Reality (AR) are digital toolsets capable of connecting control room operators, maintenance, and field personnel in a single realistic learning environment. Through an immersive 3D environment and high-fidelity dynamic simulation operator training is accelerated across several categories:

- Equipment understanding
- Hazop design evaluation
- Operator training (OTS): Procedure training, Safety scenarios, Crew training
- Maintenance planning and execution
- Real-time enterprise asset management

Augmented and virtual reality training solutions facilitate minimized project risk by preventing delays during plant commissioning and start-up and also maximize return-on-investment in plant personnel training. Mobile technology enables workers to become a data capture point, collecting data from non-instrumented and stranded assets, enhancing operational visibility and acting as a data input point for an Asset Performance Management strategy focused on increasing plant and asset uptime and driving reduced maintenance and operations costs.

Mobile technology also offers the ability to bring teams together in virtual settings no matter where they're physically located. People can perform their duties from wherever they are, accessing, monitoring and managing the refinery, plant or process in real time from their handheld devices. Workers are no longer tied to the physical location but instead carry a virtual version or digital twin of the plant or facility in their pocket at all times. New operators for greenfield sites need to be qualified for startup and operation quickly to meet specifications.

Through mobile technology new maintenance technicians are trained faster as maintenance procedures and decision support workflows are delivered directly to their mobile devices. Mobility is also a tool that millennials, having been born digital themselves, are already accustomed to. This helps to accelerate their assimilation into the workforce. AR/VR Enhanced Operations based training through IntelaTrac Mobile Operator Rounds can accelerate that process while laying the foundation for improved safety and regulatory compliance.

IntelaTrac Mobile Operator Rounds

As the industry-leading mobile workforce and decision support system IntelaTrac Mobile Operator Rounds includes configurable software and ruggedized mobile hardware solutions that enable workflow, data collection and general task management for plant operations, maintenance management, production tracking and compliance applications. As part of their overall "Visual Factory" initiative Ascend Performance Materials implemented IntelaTrac Mobile Operator Rounds

along with other software solutions from AVEVA Software and achieved significant results:

- Savings of USD 500,000 in utilities and materials costs
- More than USD 1 million in savings from reduced maintenance costs
- Avoided potential plant shutdowns equating to a savings of USD 2 million

IMPROVED SAFETY AND REGULATORY COMPLIANCE

Environmental, health and safety compliance is a paramount focus in the oil and gas industry. One of the main drivers of this focus is the implementation of a "Zero Accidents" culture. In terms of accident prevention strategies, a Zero Accident culture can be viewed as the idea that all accidents can be prevented through policy and procedure adherence. Many factors contribute to a good safety culture, including skilled employees, continuous safety risk assessment (HAZOP) and good practices and standards, next to primary and secondary process safety.
Environmental regulation and emissions targets have continuously tightened over the past several years. As well as the need to document and audit compliance of new regulations. Examples are the Industrial Emissions Directive by the EU (IED) and implementation into local legislations like TA-Luft in Germany. For example, emissions include flaring activities, which requires the increasingly efficient start up and shut down of plants through tighter process design tolerances and strict, auditable operational adherence to processes and procedures.

Mobilizing the operator workforce helps ensure regulatory compliance as stacks of paper maintenance reports, audit logs and repair procedures become digital versions of themselves.

Information is stored digitally in a central location and backed up to the cloud. Regulatory audit trails are automatically generated. As comprehensive operations efficiency models are deployed, visualizing which equipment, processes, teams or sites are underperforming becomes easier and provides part of the foundation for developing an asset performance management strategy that maximizes return on asset investment for oil and gas producers and pipeline operators.

Capital expense constraints limit investment in new equipment across all markets of the oil and gas industry. While demand increases, requiring greater production from existing machines. A complete digital

Asset Performance Management (APM) solution combines enterprise data capture with asset management, advanced workflow, mobility, predictive analytics and risk-based management to drive maximum return on asset investment through reduced downtime, lowered total cost of ownership, decreased maintenance costs and improved overall equipment effectiveness.

A complete APM solution allows operators and maintenance engineers in upstream production, midstream transportation and downstream processing to automatically generate work orders to relieve maintenance issues as soon as they're discovered. While advanced data capture and analytic capabilities provide detailed insight into the health of production assets. The integration of these capabilities with advanced workflow facilitates continuous process improvement while ensuring assets are not overly maintained and MRO inventory costs reduced.

A study of common failure patterns by ARC Advisory Group found that a full 82 per cent of failure types are random. Only 18 per cent are predictable and preventable with traditional maintenance methods. Machine learning helps identify inefficiencies and abnormalities in equipment operation long before regular inspection. Engineers can reference operational models and digital twins for recent abnormalities in design versus operational performance. As data is collected at an operational level and fed into other digital toolsets it imperative that oil and gas enterprises make the right digital technology investments.

Catch Asset Failures Before They Occur

In a large regulated and non-regulated utility with over 60+ plants in 6 states, including coal, simple cycle combustion turbines, combined cycle and integrated gasification combined cycle plants, AVEVA helps monitor and optimize the maintenance of critical power generation assets with PRiSM Predictive Asset Analytics software. A single early warning of a crack in a turbine rotor saved the utility over USD 7.5 Million.

OIL AND GAS TECHNOLOGY INVESTMENT PILLARS

Choosing the right technology investment requires analysis of four key technology pillars to ensure successful digital transformation and optimum ROI.

Comprehensive Value Chain

Modern digital platforms must deliver returns across the comprehensive value chain of the enterprise. Technology Investments must enable the digital integration of engineering, planning and operations, control, visualization, information and asset performance solutions to create a 3600 view, from the shop floor to the top floor

Open and System Agnostic

Interoperability and cross platform support accelerate a path towards continual process improvement. Rapidly sharing big data and insights across multiple platforms including cloud, mobile, augmented and virtual reality requires open, system agnostic technology solutions that augment rather than rip and replace existing asset investments. An open, system agnostic approach to digital transformation drives long-term value and lower total cost of ownership (TCO).

Digital Ecosystems

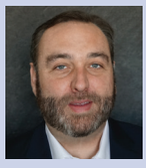
Technology investments should be backed by a multidisciplinary ecosystem of technology partners. Ecosystems should include capabilities of design, development, delivery, maintenance and support of industry specific solutions on a global scale. Ecosystem partners may include software developers, technical distributors, system integrators, OEM providers and technology partners, all focused on extending value and driving innovation across industries.

Flexible and Agile Implementation

Adapting to unforeseen events becomes automatic through flexible technology implementation options. True digital transformation platforms provide the ability to choose between deployment options including on premise, cloud or hybrid rollouts. Agility in procurement options allows enterprises to obtain the required tools through several options, including perpetual licensing or subscription based services Solutions for implementing technology on an as needed, staged approach help the enterprise reduce upfront costs and decrease time to value of new technology investments while accelerating a path toward increased profitability.

START SMALL. START NOW.

Digital transformation is part of an ongoing journey towards continuous process improvement involving the collaboration of people, processes and assets through digital technology. It doesn't happen all at once but instead gains speed and velocity over time as people, processes and assets are digitally fused together to eventually bridge the operations technology and information technology gap. Start small in your strategy and adoption. But start now to maintain or improve your competitive market and industry position. ●



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Digital Strategies for Petrochemical Industry

Digital transformation has emerged as key to business services to improve customer experiences, operational efficiency and agility by fundamentally changing the way business services are delivered across industries. The article describes how the new and emerging Digital Technologies can transform the Petrochemical Industry for not only optimising the production but the entire supply chain. The author emphasises on the right strategies to implement these technologies for a true digital core through continuous agility, adaptability, and innovation.

"There is no project without close customer interaction – even to the extent of co-innovation. This increases the quality and the customers get what they need."

Digital Transformation in Business Services refers to improving customer experiences, operational efficiency and agility by fundamentally changing the way business services are delivered using digital technologies as the enabler of holistic transformation". New and Emerging Digital Technologies are: Smart Automation: RPA, Cognitive, AI, Machine Learning, Algorithms, Block chain and Virtual, Augmented, Mixed Reality.

Petrochemical companies can use advanced analytics to extract management-relevant information from the large amounts of unstructured data that they generate. This information can then be used to improve how plants are run and to make better-informed and speedier decisions across the full range of a chemical company's business processes. In the wider world, the chemical industry is an essential supplier to myriad other industries, and so the ways these industries are being changed by digital is in turn translating to opportunities and challenges for chemical companies.

There are three main ways in which digital will affect the Petrochemical industry. The first is using digital-enabled approaches to improve companies' business processes, which we call functional excellence. Second is the potential for digital to affect demand patterns in end markets, with implications for the chemical industry's value chains. The third is where digital developments lead to changes in the business models through which chemical companies capture and create value for customers.

Besides this advanced-analytics-based opportunity, there are other digital-enabled advances that may create significant value in the manufacturing operations area. Examples include the use of automated guided vehicles, such as self-driving forklifts, and the use of robots to fill big bags. These advances should reduce costs and improve process stability and safety performance. At the same time, deploying an automated and centralized plant performance-management system should make it possible to steer operations better and to react faster when corrections are needed.

For many subsectors of the chemical industry, this opportunity extends beyond production to the entire supply chain, including inbound and outbound logistics and warehousing. Advanced analytics will make possible more accurate forecasting, leading to improvements across the entire sales- and operations-planning process. This will also make possible better scheduling of batch production, shorter lead times, and lower safety stocks with a higher level of flexibility. Integrated 'no touch' ordering and scheduling systems will help to stabilize production planning even further.

Sales and marketing also offers major value-creation potential through digital. The biggest opportunity for sales and profitability growth lies

in digital data-led decision making. We estimate that digital-enabled initiatives in marketing and sales could improve the industry's average return on sales (ROS) by two to four percentage points. Specialty chemicals could see higher ROS gains in the range of three to five percentage points, with chemical distribution seeing one- to one-and-a-half-percentage-point gains.

Digital initiatives in marketing and sales include applying advanced-analytics-enabled pricing systems, generating growth opportunities from data, and using algorithms to predict churn at the individual-customer level and then suggesting countermeasures to the sales force. The impact of these initiatives can be significant. One leading global nutrition player used internal and external data sources to create transparency at a detailed customer-product segment level. Advanced analytics then scanned these millions of lines of data to develop suggestions for additional sales to individual sales reps, with the suggestions delivered via an easy-to-use app. The company saw 8 per cent growth in pilot markets, after experiencing no organic growth in the previous five years. A large specialty-chemical company used advanced analytics to reset prices for hundreds of thousands of product-customer combinations in seven core countries, based on individual risk and willingness to pay. By combining analytics, capability building, and change management, the company was able to achieve price increases of 3 to 7 per cent, compared to 1 per cent increases in previous years.

The second area that will gain importance is customer experience and digital go-to-market channels. Our latest proprietary research shows that 85 per cent of B2B chemical purchasers would prefer digital channels when reordering a product rather than interacting with a salesperson. Combining a digital channel with process digitization will create an improved customer experience, while lowering cost to serve. Again, how much of that potential will actually become bottom-line impact will vary, depending on the competitive situation in specific chemical markets.

A significant opportunity in research and development is to create higher-value-added, higher-margin products at a faster pace, in particular in specialty chemicals and crop-protection chemicals. Chemical companies will be able to use high-throughput optimization

to develop and adjust molecules that offer more value. They will also be able to deploy advanced analytics and machine learning to simulate experiments, to use digital's predictive power to systematically optimize formulations for performance and costs, and to data-mine information available from past successful and failed experiments. Not least, they will be able to identify the best possible resource allocation to enhance the performance of R&D teams and the innovation pipeline. Many of these practices are already established in the pharmaceutical industry but were largely unaffordable for chemical companies. With the emergence of inexpensive computing power on a massive scale, this is likely to change.

Digital and New Business Models in Chemicals

Will digital change the ways that chemicals are sold and distributed, and as a consequence, how value will flow? Will we see a shift from sales of products to sales of services and solutions? Will attackers emerge that disinter mediate established producers from their customers, as we have seen with B2C platforms in other industries? Different segments of the chemical industry will have different answers to these questions: as a general statement, while crop-protection chemicals and some specialty-chemical segments are at risk of business-model disruption and some chemical distributors see themselves as potential actors' in future possible disruptions, petrochemicals will probably be less affected.

First, business models that remain connected to the product in use might provide a substantial opportunity in some areas of the chemical industry—for example, through systems that monitor chemical applications in industrial processes. One example drawing a lot of interest is catalysts, where process catalyst manufacturers are increasingly moving toward "performance pay" models, instead of simply selling the product. Staying connected to the catalyst in use allows the catalyst manufacturer to optimize the production process of its customers and presents the opportunity to build a large and valuable knowledge base that can be used to improve catalyst use across its customer base and charge for the service. A number of such models have been in development for more than a decade in parts of the specialty-chemical industry, and there is the potential for an acceleration in their adoption linked to digital. But such approaches will not be applicable for all of the chemical industry: the main focus is where a specialty chemical does a particular job, such as a catalyst or water-treatment chemical.

Second, opportunities for intellectual-property-based business models that generate licensing or consulting fees appear to be emerging. Under this model, a company could charge a fee for providing guidance on how best to use its product, or it could license production of a proprietary molecule to another producer. But examples so far appear to be isolated and as yet unproven.

There is a huge potential for the use of these solutions. IIoT is the key to gathering information, and to automate the physical processes. In terms of Industry 4.0 paradigm, it is the base for a fully digitized facility since this technology combined with cloud, analytics, and AI can enable new operational models based on automation and augmented human activities, that rely on predictive analyses for operations and maintenance, production and inventory monitoring, and improving security.

One of the key factors to keeping the downstream business profitable depends on the adequate handling of Safety, Shutdowns, Turnarounds and Outages. This is the result of being proactive with regard to different decisions and IIoT is the basis to achieve such success.

This technology can help prevent human and monetary loses, reduce costs and improve performance. According to Accenture research, IIoT could help increase productivity by as much as 30 per cent due to the introduction of automation, saving up to 12 per cent in scheduled repairs, reducing maintenance costs up to 30 per cent, and eliminating breakdowns by up to 70 per cent. The US Department of Energy identified that 92 per cent of the maintenance related shutdowns from 2009 to 2012 were unplanned, and some researchers estimated a daily cost per refinery in between USD 340,000 and USD 1.7M5. In the safety arena, the explosion of a Petrochemical Plant in the Czech Republic in 2015 cost about USD 177 million, while a similar event in Canada in 2005 cost USD 870 million.

Conclusion:

Digital technology, and the data it brings, holds tremendous promise for the chemicals industry. These technologies can all play a role in driving business value.

- The Internet of Things (IoT), leveraging sensors to capture data from manufacturing, storage, and distribution
- The cloud, a platform to support a common system of record for both suppliers and customers
- Analytics, to correlate supply data to product quality and customer satisfaction
- Machine learning, to assist in predictive maintenance of operational equipment
- Block chain, to better track transactions for assets, materials, and products

But technology alone isn't the answer. In the chemicals industry, it's the use of technology against the right digital strategy that holds the real value. This requires a focus on implementing a true digital core that enables a common system of record through the business. It also requires a corporate mind-set that embraces agility, adaptability, and innovation. It requires a mind-set that is driven by a customer-first, design thinking perspective. ●

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Digitalisation for Future Refinery

Today's Refineries are adopting newer technologies in digital way to optimise margins and operations. Needless to say the digital transformation helps refineries to become highly reliable, versatile, and well integrated in terms of technology and workflow. This paper aims at evolving landscape and roadmap for BPCL refineries digital transformation moving to next level for achieving business efficiency and excellence at par with industry and leaders.

While the oil and gas industry remains to be of continual operational nature, achieving a revolution on performance stresses a fresh outlook on field operations. Today's modern systems include additional features not found in legacy systems, such as embedded advanced process control, statistics based data monitoring, smart device checking, asset health monitoring and more. Refineries have to constantly adopt new technologies to earn more refining margins. Needless to mention the industry needs a significant investment in upgrading and augmenting fixed assets, which are expensive to maintain and always subjected to on-going environmental, health and safety regulations.

BPCL has been a forerunner in implementing new technologies and as a result, our refineries are highly reliable, versatile, and well integrated in terms of technology and workflow. In the past few decades this leap has been substantial with IT enabled applications in all the disciplines viz operations, technical services, Human resource management, finance, purchases, projects etc.

A significant number of experienced refinery personnel will superannuate in coming years. Younger and less experienced personnel need to gear up to run refineries safely, reliably and efficiently by utilising the recent advances in automation such as smart devices and accompanying embedded human center designed systems.

This paper aims at evolving landscape and roadmap for our refinery's digital transformation moving to next level for achieving business efficiency and excellence at par with industry and leaders.

What is Digital

Digital Refinery is single concise view of Refinery operations for greater operational productivity & optimisation, by effective data gathering, data management, better projections through advanced analytics and data modeling keeping safety and security in the forefront. In this age of connectivity and mobility that has enhanced user-oriented patterns in every aspect of life, there is an imminent need to apply this concept to industries and more specifically to a traditional industry like ours. Connecting process, people and finally product is already creating far-reaching changes to the industry.

Digitalisation is enabling extensive monitoring, integrated operations, remote configuration, and self-management, in turn more efficient field operations. As a successful Oil refining and marketing company, we are in the process of weaving digital thread through our processes and building an ecosystem, to enable combined effort and there is continuous interlinked development of value-add applications and services.

Merits of Digitalisation

By aligning to cultural shifts within the organisation, implementing updated technology and digital-based maintenance systems can help to address some operational inefficiencies, significantly improve margins and increase worker safety.

- **Operations and Process Improvement:** Delivering insights including event prediction to enable flawless execution and to highlight how to maximise profitability across operating equipment.
- **Worker Safety:** Ensuring workforces are kept safe from hazardous substances and can be safely located in the event of any incidents.
- **Asset Reliability:** Using data and analytics to provide insight into equipment operations and ensuring maintenance is performed on a timely basis, while increasing uptime and reducing costs.
- **Worker Productivity:** Providing relevant information to the employee on time, at the right location and in the right format, including training to help increase effectiveness.
- **Analytical Insights:** Utilising artificial intelligence (AI) and machine learning to help to predict and avoid potentially detrimental operational parameters or situations in a timely manner

Considering all aspects of refining including the core and support functions, various initiatives that can be taken up for improving operational efficiency are:

FEATURES

1. **Operations:** The core of refining industry are the raw materials i.e. crude, the unit operations and processes which converts the crude into valuable products, equipments that perform various functions, blending of various component products into final grade products and finally the product dispatches which send the products out to marketing terminals via various modes like pipelines, road, rail etc. The entire value chain, of supply, support services and logistics get interconnected. The digital levers are available to improve efficiency. Various strategies that can be undertaken for this are:
   a) Wireless transmitters for equipment health monitor, not being measured but do form part of critical monitoring like suction discharge pressures for pumps, vibration of bearing, motor amperage and temperature etc., reciprocating and centrifugal compressor performance, steam traps, Furnaces.
   b) Furnace efficiency closed loop handling through oxygen analyzer, Stack emissions control through sulfur analyzer for fuel oil handling.
   c) Analytics: App based monitoring for all equipments by connecting wireless transmitters in all process units. Alerts for malfunction and suggestions for corrective actions for unforeseen shutdowns.
   d) **Online simulation based unit optimisation:** Real Time Optimizer (RTO) for feedstock and product quantity and quality. Across units and for blended products.
   e) Blend property control (BPC) through integration of Real time optimizer with BPC in blending section to automate product properties for property prediction thus reducing giveaway and time lag from laboratory based results analysis.
   f) LPG carasoule Automation using robots.

2. **Maintenance:** One of the most important support functions for operations is maintenance department which takes care of reliability, equipment health check, electrical, instrumentation and civil support. The heart of operations is equipment and critically the rotating ones like pumps, compressors which are subjected to severe conditions and wear and tear can be overhauled only during turnarounds.

   At the same time electrical supplies, substations management, instrument cables, valves, positioners, marshalling blocks, accurate measurements through sensing elements are the key to smooth running and monitoring of process operations.
   a) Electronic marshalling for all units.
   b) Wireless transmitters and app based monitoring for critical indications.
   c) Smart positioners and their monitoring through interface for critical valves.
   d) Integration of Bentley systems to app based monitoring for deviation from compressor operation.
   e) Cyber security of all the instrument hubs in control rooms through automatic patch updates for antivirus solutions.
   f) Substation improvement.
   g) Reliability improvement for equipments using predictive and prescriptive analytics like deviation from design or desired specs and warnings, alerts for malfunction.

3. **Inspection:** Equipment health, life and importantly pipelines etc are being monitored for thickness, remaining life, corrosion and material failure etc through Inspection department. With new practices about equipment life check, there are new age systems available for robust database to automate scheduled checks and inspection. The typical turnaround times can be widened using proactive inspection systems which can certify healthiness of equipments and pipelines to avoid opening them during major turnarounds.
   a) Use of Industrial Drone technology for stack inspection.
   b) Wireless non-intrusive integrity (corrosion monitoring) systems.
   c) Implementation of Asset performance management (APM) which is integrated with the information systems to automate data inputs and generate alerts m\based on operating conditions and health check of equipments.

4. **Safety:** Safety is the key to any industry for productive and risk free working. Since all manufacturing industries are associated with hazardous materials .While safety standards are always complied with, there are number of incidences where safety can be enhanced with new solutions
   a) **Real Times Location Sensors for employees and contractors:** Tracking of these devices to constantly track location of staff while they move inside refinery to quickly approach for help in case any measures are required from Fire and Safety control room.
   b) Continuous monitoring of the manpower inside hazardous area.
   c) **Process Safety:** A digital solution allows refineries the flexibility to input all kinds of data and create benchmarks focused on safety. When hazards exceed the values outside the acceptable range, it creates an alert in the system. This means that a refinery can examine all the rules and regulations, input them into the system, and constantly remain in full compliance.

5. **Technical services:** The complimentary support function any operating unit needs is Technical Services. While the units gets commissioned with the help of licensors, its constant performance, yields, catalyst and chemicals requirements. The digitalisation avenues available for the function are plenty.

"Digital Refinery is single concise view of Refinery operations for greater operational productivity & optimisation, by effective data gathering, data management, better projections through advanced analytics and data modeling keeping safety and security in the forefront."

a) Integration of Advanced process control with simulation for real time optimisation of unit for maximising value.

b) Integrating crude blender outputs for crude quality with Indigenous crude quality estimator for generating crude oil TBP to link with simulation solutions for optimising high volumes of crude unit.

c) Integration of laboratory QC with automated production values for quick actions for off spec or giveaway reduction.

d) Solutions for estimating and reducing GHAG, SOX, emission. Using non-intrusive solutions to track relief devices leakage or fugitive emissions.

e) Comparing current usage of resources such as energy to its expected usage under current conditions and determining possible causes of variation.

f) Energy supply/ demand optimisation. Steam and water balance. Prediction of flare vents and subsequent actions in units to reduce them automatically.

g) Financial Optimisation.

i. increasing yields of most valuable products

ii. Detecting and dissecting complex interacting constraints on production

iii. Determining reasons for product quality/ yield issues

iv. Understanding patterns and relationships – developing statistical models that explain them

6. Purchases and Contracts: This function is the key to all the relationships that get built with vendors, customers and suppliers. The best place to use smart technologies to reduce cycle time and improve transactional time and experience for all concerned be it internal or external. Purchases and contracting systems helps convert proposals into actions using tools like SAP, vendor management and related applications.

a) Auto PO generation once all evaluations and Technical evaluation committees approvals in place.

b) Purchase requisition to purchase order cycle reduction through automated tender acceptance route for single party/proprietary / OEM proposals.

c) Analytics for analysing contract adherence, invoicing behavior, and supplier performance; and generate supplier profiles and scorecards.

d) Application for Total Cost of Ownership (TCO) calculations for high volumes of similar parts.

e) Create predictive order configurations for repeat buyers, reducing processing time and encouraging the use of standard order templates. Systems will interconnect with those of suppliers to transmit digital POs and invoices, eliminating the need for invoice matching.

f) Receipt of goods and services to be automatically tracked using radio-frequency identification (RFID), quick-response (QR) codes and other automated techniques.

g) Extend digital technologies, such as the internet of things, predictive analytics, and artificial intelligence to machinery and equipment, and consumables. This can have a substantial impact as planning and inventory management are key requirements.

h) Enhance contract management tools and workflow with natural language processing and RPA-based applications that help scan contracts, search and extract relevant metadata, and create outline agreements and catalog content.

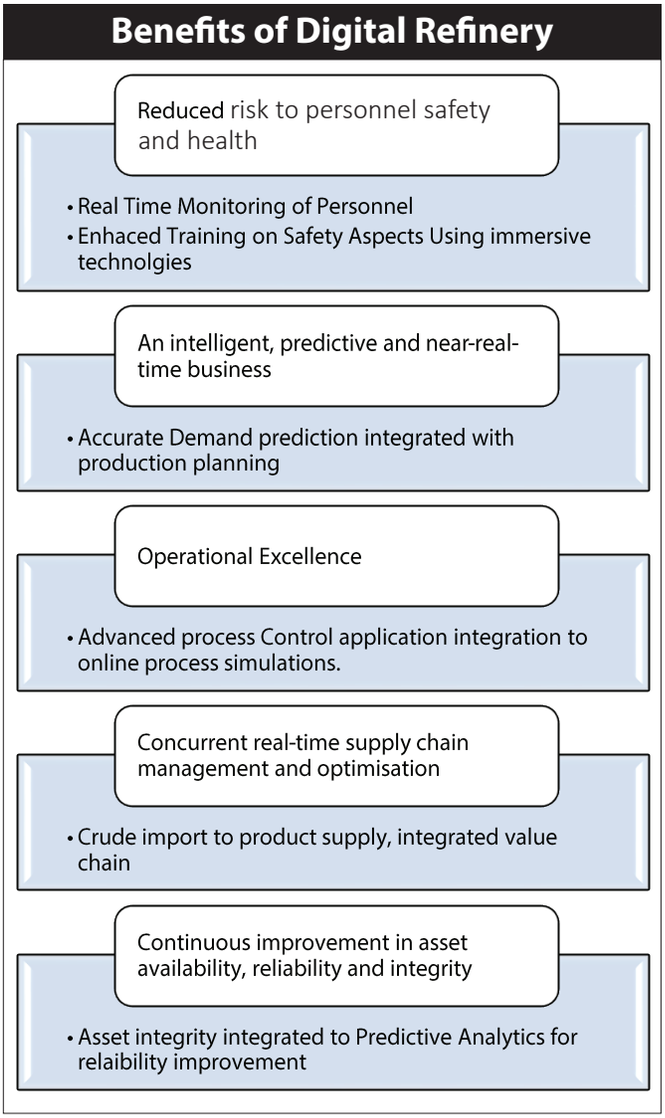
7. Projects: As in every industry, new capital construction projects in the refinery sector are decided upon and dictated by economics today and forecast for tomorrow. Capital expenditure is the most visible and arguably the most critical facet of undertaking a new refinery project. Risk mitigation is a high priority; leveraging experienced resources and key stakeholders early in the project can mitigate risk. The continuing evolution in digital computing and communication capabilities as well as the application of these technologies has led to fundamental differences in the way refineries are designed, commissioned, operated, and maintained.

a) Project tracking system for physical and financial progress with respect to plan.

b) Intelligent P&IDs and documentation system.

c) Integration of FEED(Front End Engineering and Design)and Main Automation Contractor.

d) Inclusion of Predictive maintenance software, safety instrumented systems (SIS), fire and gas systems, pressure and temperature transmitters and digital valve controllers – all using FOUNDATION™fieldbus, HART, OPC and Modbus communication



technologies and delivering information to a real-time database, as part of the integrated refining and petrochemicals project.

e) 6D project tracking to reduce cost and time overruns.

f) Online monitoring of remote sites from headquarters using CCTV monitoring systems.

8. Estates and Colony: The workforce management which includes township around refinery forms an important place to take the digital initiatives and improve management.

a) Automatic Waste Segregator (AWS-ONE)
b) WIFI at major locations
c) Access control system for guests and visitors
a) SMART parking
b) RFID and GPS based school bus tracking
c) Smart Solar LED Streetlights with sensor technology
d) Smart metering & energy optimisation
e) Water conservation & management
f) Cash less transactions
g) Developing or adopting "feature packed town ship management app".
h) Building management system

Realising this early, BPCL Mumbai refinery embarked on the journey of Digitalisation in May 2018. A good number of digital initiatives in various areas were identified and by now have gained good grip.

With this, the roadmap for Mumbai refinery is being shaped out for period of about next 3-5 years to reach the next level of Industrial Revolution 4.0. There are parallel adoption processes underway. The first (operational digitalisation) to help deliver immediate benefit, the second (strategic digitalisation) is long term and addresses organisational change. While the extent of change the fourth industrial revolution will bring is little known, BPCL Mumbai refinery is capitalising on this and has plans to embrace it in a timely fashion.

Refinery of the Future

As we leap frog ahead, our vision is to be beyond Maharatna and be recognised globally for excellence in Operations, HSSE, Reliability with enviable margins, all enabled with the right blend of Digital Strategy, Vision, Processes leading to happy employees, customers and stakeholders.

Digitalisation can take us towards being a silent Refinery focusing on greener environment. We aspire to not only augment the processing capacity with world-class quality products but be digital leader in refining industry and compete successfully in the agile market. ●

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Functional Safety for Managers – Process Safety and Cyber Security in Oil & Gas Industry

Frequent industrial accidents led to the creation of IEC61508 Standards; however there is a scope for improvement by Companies operating in the Process Industry (chemical, petrochemical, refining, O&G and others) to adopt recommendations of the Standard. Cyber attacks are also venerable to the industry. The article details on Functional Safety and Cybersecurity Management to safeguard the Industrial Automation Control Systems (IACS) & Safety Instrumented Systems (SIS) across the industries.

It is correct to state that frequent Industrial accidents led to the creation of IEC61508 Standards. Studies conducted by HSE[1], EPA & OSHA[2,3] found that human errors (Systematic Failures) are the main cause of accidents and that focussing on programmable equipment & software alone is insufficient; 'A Lifecycle approach is needed'. There are numerous ways in which human factors might impact functional safety and cybersecurity.

The lessons learned over the past 3 decades, have been compiled into a series of standards resulting in the release of the first draft of IEC61508[4] in 1998, followed by a full release in 2000 and subsequent revision in 2010. The IEC61508 standard became the 'umbrella' or 'base' safety standard for Industry mainly targeted at the manufacturers of products. The IEC61508 Standard has branched into different Sector specific standards; The IEC61511[5] standard targeted at the process industries released in 2003, and subsequent release in 2016.

It is 15 years since the IEC61511 Standard was first released and there is significant scope for improvement by Companies operating in the Process Industry (chemical, petrochemical, refining, O&G and others) to adopt recommendations of the Standard. Presently companies have adopted the Standard recommendations to varying degrees; some companies have a reasonably well-defined safety programme complying to many of the Standards recommendations, while some companies are still non-starters. Most companies have implemented safety practices in snippets without a complete understanding of the Safety Lifecycle.

With time, Cyber-attacks have taken many forms and threaten Industrial Automation Control Systems (IACS) & Safety Instrumented Systems (SIS). An unprecedented number of security vulnerabilities have been exposed in industrial control products. The 2016 version of IEC61511 Standard emphasises the need for cybersecurity through-out the entire lifecycle of the IACS & SIS. The IEC62443[6] series of standards are probably the most widely used set of standards in the industry for IACS & SIS cyber security.

Functional Safety and cybersecurity have similar and related thought processes throughout the lifecycle. Management of Functional safety and Cyber for IACS can be illustrated in Figure 1[7].

Integration of cybersecurity into the overall process safety lifecycle is a means to achieve improved safety in a manner that is both efficient and cost effective. In doing so, the requirements to address cybersecurity in IEC 61511 are addressed.

Experience has shown that many companies management teams have little or no understanding of Management of Functional Safety and Cybersecurity (FSM). The purpose of this paper is to provide managers with an overview of their role and responsibility with regards to FSM.

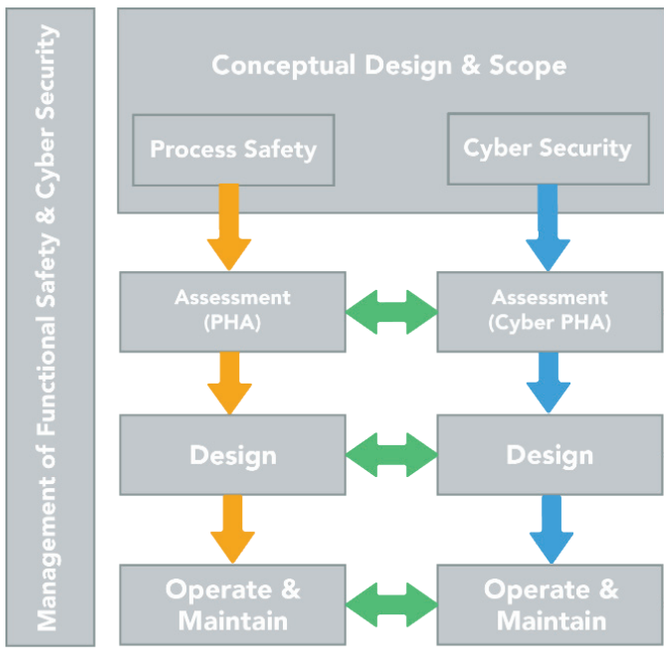

Figure (1): Management of Functional Safety & Cyber Security

Following Best Practices

Both IEC61511 and IEC62443 series of Standards are User Focused Standards (IEC62443 also has recommendations for manufacturers of automation products); Both standards are based on implementation of Best Practices and strongly recommend a Safety Lifecycle (SLC) approach towards safety. The Safety Lifecycle approach is a sound, methodical and holistic approach towards safety to

- Ensure the problems of the past are not repeated
- Provide a consistent approach to identifying and mitigating risk in accordance with a company's tolerable risk, following best practices.
- Provide a means of achieving optimum design that balances risk reduction with performance
- Provide a means to consistently measure perform

The Safety Lifecycle approach towards Functional Safety and Cybersecurity are divided into the following three main phases[8]. The basic need of the Industry is to develop a proper understanding of all the Safety Life-cycle phases.

– Assess Phase

– Design & Implementation (or Realization) Phase and

– Operation & Maintain Phase

The comprehensive goals of each phase are shown in Table 1[8,9]:
Each phase consists of multiple process steps. Additionally, there is an overall program governing the entire lifecycle i.e. Management of Functional Safety and Cybersecurity (FSM) which is vital to the long-term success of the Safety Lifecycle.

Functional Safety Management[10]

As stated above, the FSM embodies those activities that are vital to the long-term success of the program. By definition, FSM governs the whole of the SLC and its associated activities; it's essentially the 'glue' that holds everything together. The primary purpose of FSM is to ensure that SLC roles and responsibilities are defined and assigned

Phase	Functional Safety (Process)	Cybersecurity
Assess	• Process Hazard & Risk Analysis • Allocate Safety Function to Protection Layers • SIS Safety Requirement Specifications	• Identifying and classifying key cyber assets • Identifying and quantifying vulnerabilities, threats, and consequences, • Determining risks • Establishing risk reduction targets
Design & Implementation (or Realization)	• SIF Design (Technology and Architecture) • SIF Test Plan • SIL Verification of SIFs • SIS Testing (FAT)	• Defence-in-depth strategies • Selection of countermeasures • Revised zone and conduit model • Updated architecture diagrams • Access control strategies
Operation & Maintain Phase	• O&M planning • Inspection & proof test planning / execution / Equipment repair • End of life refurbishment and replacement • Failure event data collection • Functional safety process auditing • Modification / decommissioning approval and validation	• Maintenance of implemented counter measures • Monitoring security, modification / decommissioning • Incident Response Planning and Periodic Assessments

Table 1: Safety Lifecycle approaches for Functional Safety and Cybersecurity

"It is essential for managers working on SLC tasks to also be competent to understand the importance of complying with procedures and following the SLC activities and documentary requirements."

to competent and empowered individuals and / or groups. It requires specifying the key activities of those responsible and developing procedures to support these activities.

FSM essentially deals with the 3 Ps:

- Personnel – ensuring personnel involved in SLC activities are properly trained and competent to perform those activities
- Procedures – are developed that are easily understood, are being followed and implemented correctly
- Paperwork – documentary evidence to support competency and to demonstrate that procedures are being followed and implemented correctly;

It is essential for managers working on SLC tasks to also be competent to understand the importance of complying with procedures and following the SLC activities and documentary requirements. The fundamental purpose of implementing FSM is to help eliminate and / or reduce the risk of human errors being introduced during SLC activities, that could have a detrimental effect on overall safety and cybersecurity.

FSM is driven by corporate culture. Organizations need senior management support for the success of a FSM program. Implementing cost reduction measures across the board without understanding the repercussions on safety can, and has, in some cases, been the direct cause of accidents and loss of life. Managers need to be aware of this and to understand the role they play in ensuring functional safety and cybersecurity management programs are well maintained.

Developing a FSM Program

The IEC61511 and IEC62443 Standards require that a policy and strategy for achieving functional safety / cybersecurity needs to be identified together with the means and methods for evaluating their achievement, which is required to be communicated within the organization.

Developing a FSM program starts by examining the existing quality management system and programs in place. Many end user companies have some form of ISO9000 compliant Quality System and procedures in place. This is the best place to start, thereby looking to leverage the existing quality system. A simple 'gap' assessment can be performed to see where the existing system has 'gaps' in relation to the Organizations tolerable levels of risk and security. For example -

- Looking for an organizational chart that defines the roles and responsibilities of the people, department and organizations responsible for SLC activities
- Supporting documentation that specifies the management and technical activities required for each phase of the SLC, which could be in the form of a flow diagram
- Specifying the roles and responsibilities for key positions, departments and organizations
- If a supplier or third party sub-contractors are used for key activities, then this needs to be defined. Furthermore, all supplier and sub-contractors to be competent to carry out SLC tasks, so there needs to be a process, procedure and method for qualifying and approving the use of sub-contractors.

How to Accomplish FSM

The first task in implementing FSM is to appoint at least one (or more) qualified and competent person(s) to lead the functional safety and cyber security activity. This person(s) or team will be responsible and accountable to management for ensuring that the SLC is being followed and that the relevant phases are being complied with.

As part of the FSM plan, procedures will need to be developed and implemented to ensure that each of the SLC goals listed in Table (1) are achieved. As with most plans, it's essential to ensure that the plan is monitored and updated as necessary throughout the entire SLC. The level of detail required will need to be appropriate for the role that the individual or organization is performing in the SLC.

It is important to ensure that procedures are in place to investigate to root cause and to remedy any non-compliances and/or recommendations highlighted during any phase of the SLC. Documentary evidence needs to be available to substantiate and/or support any decisions.

Conclusion:

Just because a company hasn't had a major accident or security breach,

"A common phrase in cybersecurity is - It's not a question of 'If' you have cyber-attack, but a question of 'when' you have a cyber-attack."

doesn't mean an Organization can become complacent and ignore or neglect the SLC approach. A common phrase in cybersecurity is - It's not a question of 'If' you have cyber-attack, but a question of 'when' you have a cyber-attack.

It was the late Trevor Kletz, Professor of Process Safety at Texas A&M11, and world-renowned expert in Process Safety, who coined the phrase "if you think safety's expensive, then try an accident". The reason is that accidents can cost a company a lot of money, plus loss of its reputation and company image. Moreover, if the company is found to be negligent then there could be further repercussions in terms of penalties and / or fines for safety violations and even potential jail time for its executives.

So, what is the benefit of adopting a SLC approach to functional safety and cybersecurity? The short answer: it pays.

In conclusion, having the right culture within the Organization towards Functional Safety and Cybersecurity is very important. Managers need to take responsibility for their own competency and to make sure they are suitably educated so they know what to look for and what measures to be taken to ensure an effective FSM program is in place. If there is an incident and/or security breach that results in the loss of life, financial losses and/or environmental damage, then ignorance will be no excuse. ●

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Intelligent Structure Jacking & Movement Technology

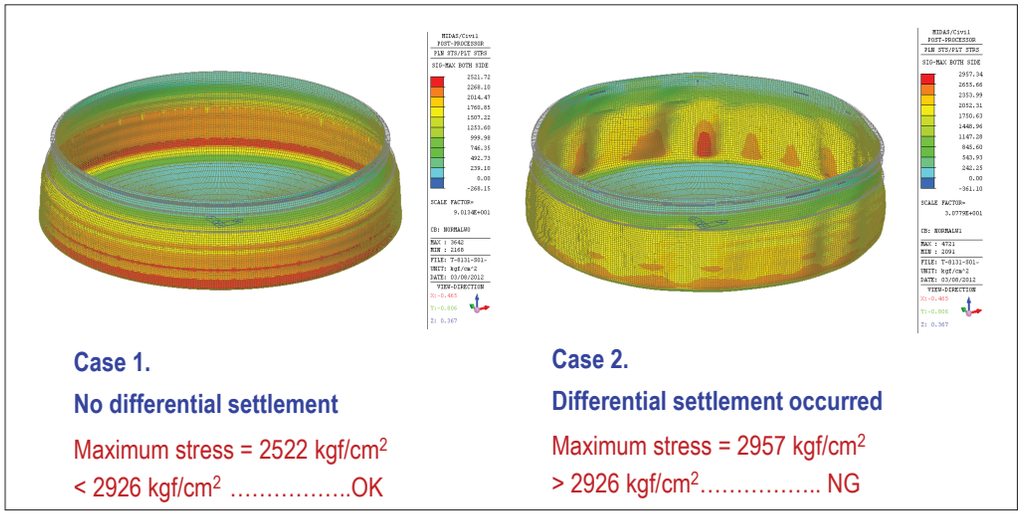
Extend the Service Life of Near-shore Facilities: A Solution to Resolve Settlement-induced Issues on Reclaimed Lands

Petrochemicals plants are generally build near to the seashore or on the hydraulic reclaimed lands. Its adjacent facilities such as storage tanks, pipe racks, and buildings are also constructed either on piles or directly on soils on the reclaimed land. Thus 'Renovation' or 'Demolish & Rebuild' of the plants and its facilities is a matter of concern.

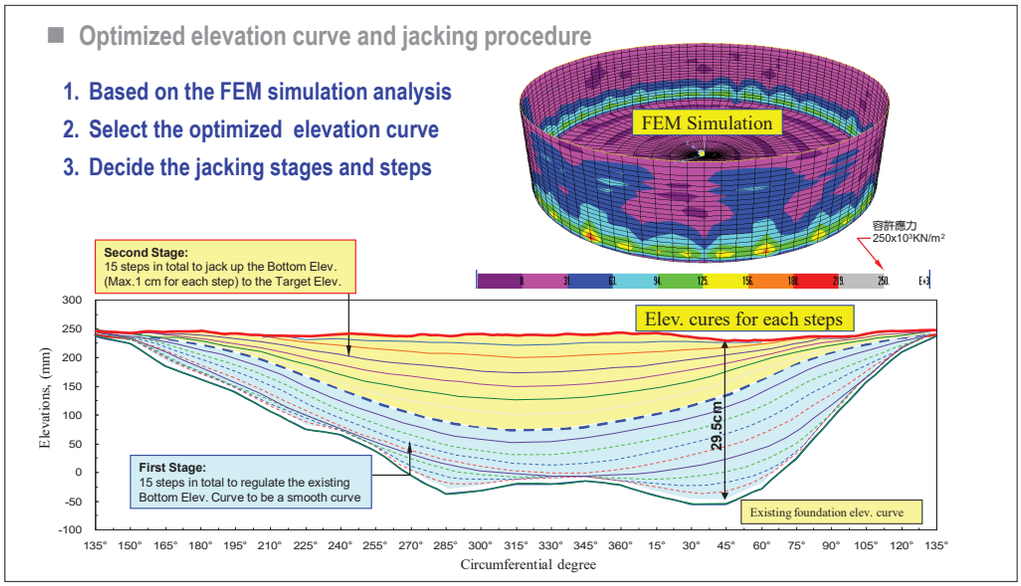
The paper describes on Structure Jacking Technology to renovate or demolish & rebuild of petrochemicals plants and its adjacent facilities in a cost-effective manner and to enhance their service life for another decade.

Petrochemical plants have been set up away from urban areas in many countries to avoid the possible environmental impacts. Instead, they are usually built in the Industrial zones near seashore or on the hydraulic reclaimed lands. Facilities such as storage tanks, pipe racks, and buildings are constructed either on piles or directly on soils on the reclaimed land. Subsequently, the land naturally settles downwards as its own weight acting on the existing sea bed and results in the facilities suffering the settlement-induced problems during construction or in the later operation, i.e. facility tilts or structure angular distortion exceeding the allowable limits. The plant therefore faces a dilemma of 'Renovation' or 'Demolish & Rebuild' as it has no idea which choice will give a cost-effective result.

Case studies performed on storage tanks in Taiwan indicated that both the cost ratio and the time ratio



Figures 1 : Structure stress analysis for tank operation at designated high level



Figures 2 : FEM Simulation for optimized elevation curve and structure jacking stages/steps

Figures 3 : Renovation of storage tank by using intelligent structure jacking system

Figures 4 : Extend Pipe Rack service life by using computerized jacking system

Figures 5 : Pushdown Caisson using ground anchors and computerized jacking system

of 'Renovation' to 'Demolish & Rebuild' roughly went to 1 to 3 subject to the local available resources. The renovation technology took use of structure jacking system together with a computer-controlled synchronous jacking module to precisely control hundreds of hydraulic jacks to renovate the tilted storage tanks or pipe racks successfully and extend their service life for another decade.

Prior to performing the structure jacking, 3D-scanning and FEM stress analysis/ simulations on the deformed tank are done to check the existing stress distribution and to determine the optimized elevation curves for the next renovation procedure (see Figures 1-2). The structure jacking system integrates the conventional hydraulic jacks with the advanced computerized system to control solenoid valves and wireless displacement transducers, so that the hundred jacks will be able to push the structure simultaneously with designated movements (see Figures 3-4). It resolves the settlement-induced problems and extends the service life of huge oil storage tanks, multi-layer pipe racks, shop buildings, etc.

In addition, the same technology is also applied in historical buildings relocation and pushdown caisson construction (see Figure 5). This structure jacking technology provides an intelligent solution to perform the 'Upward, Downward and Horizontal movement' and satisfy various demands in engineering and construction. ●

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Securing Oil & Gas Infrastructures Gone Digital

The entire Oil & Gas Industry is now in the path of digital transformation and implementing IIoT & IoT devices to improve efficiencies and reduce operational costs. However, the risks associated with exposing Operational Technology (OT) systems to the outside world are also there. The article outlines the IIoT threats while introducing these new access points into a company's network, plus the current lack of security standards for IoT devices which can create holes for punching through perimeter defenses. Also, the article highlights the top security flaws while deploying and operating the devices, and the defense measures to protect insider and outsider threats.

While the benefits of implementing Industrial Internet of Things (IIoT) devices to improve efficiencies and reduce operational costs are undeniable, so are the risks associated with exposing Operational Technology (OT) systems to the outside world.

These new access points into the network, plus the current lack of security standards for IIoT devices, can create holes for punching through perimeter defenses.

There are also inherent risks associated with upgrading systems. Case in point: the Columbia Gas incident in metropolitan Boston last year, which produced a series of explosions in Andover, North Andover, and Lawrence, and resulted in more than 70 fires, one death, dozens of injuries, and the destruction or damage of more than 100 structures. Approximately 9,000 customers were left without power.

The New York Times reported that a system upgrade caused gauges that monitored pressure levels to be taken offline, and that unchecked over-pressurization triggered the blasts.

While human error was probably the cause of the Columbia Gas incidents, it could just as easily have been the work of terrorists.

Oil and gas executives are now acutely aware that once isolated OT networks charged with refining, mixing and the distribution of petroleum are increasingly connected to the 'outside world' via the Industrial Internet of Things (IIoT).

In addition, modernization inevitably involves some degree of digital transformation, which exposes facilities to more security threats that ever before.

Attacks such as BlackEnergy, Industroyer, VPNFilter, and Wannacry are just a few of the recent malware campaigns that have affected critical infrastructures. The actors in some cases were rogue factions including nation states that hacked into industrial networks and caused havoc.

However, the threat from within is also omnipresent and highly significant, as insiders have 'the keys to the kingdom' — or at least know how to find them. Some studies show that insider threats account for more than 50 per cent of all industrial cyber security incidents.

The IIoT Threat

The Internet of Things (IoT) and the IIoT hold tremendous promise for improving oil and gas operations. Increasingly, companies are investing in the cost-saving and the productivity-enhancing benefits of networked smart devices that can communicate and coordinate with one another via the Internet.

The downside of IIoT is that few vendors and customers have fully considered the security risks associated with the technology. The introduction of new access points into a company's network, plus the current lack of security standards for IoT devices, can create holes for punching through perimeter defenses.

However, the planned or (worst-case scenario) unplanned introduction of IIoT devices into an enterprise network creates opportunities for a host of external and internal threat actors, including:

- Terrorists acting alone, independent of an organization or group, or is incited by an organization or group.
- State-sponsored adversaries acting on behalf of a government, whose activities can span computer-based as well as physical attacks.

- External cyber attacks caused by Hacktivists to promote a political agenda or a social cause.

- Internal attacks created by Malicious insiders such as a disgruntled employee or third-party contractor who is paid to exfiltrate information and/or cause damage to the organization.

- Or unintentional mistakes due to human error that causes damage and/or downtime because of incorrect changes to industrial processes or equipment.

- Yet another variation, account compromise, resembles an insider attack since it occurs when an external attacker hijacks an authorized user's account (employee, vendor, integrator, etc.). These are typically achieved using social engineering techniques such as phishing emails and a 'call from the IT department' requesting the user's ID and password.

Top Security Risks

- **Default Passwords**

  Most IIoT devices are pre-configured with a default password, which is clearly a time-saver for IT staff. However, this benefit is also a major security flaw. When hundreds of thousands of devices share the same default password, attackers can easily compromise organizations that have neglected or intentionally decided not to change it.

- **Missing Patches**

  This is another huge problem area for organizations, because many IIoT devices cannot be patched or vendors do not issue patches for known vulnerabilities.

- **Too Many Devices to Manage**

  In many organizations, the list of IIoT devices is endless and extends beyond traditional operational technology (OT) to alarm systems, cameras, thermostats, vending machines, etc. Even the most apparently harmless device, can pose a threat. For example, an IoT coffee-maker should never be connected to an IT or OT network as the machine has no security features.

  Regardless of the IIoT device type, all of them can be used by attackers as a stepping stone to compromise IT and OT networks. For example, many IIoT devices use ports that are exposed to the Internet, and which can be used to bypass the firewall. Once inside the network, a hacker can do extensive damage to IT and OT infrastructures and move laterally between them. Think data breaches, viruses, ransomware, sabotage, and data exfiltration.

"The Internet of Things (IoT) and the IIoT hold tremendous promise for improving oil and gas operations. Increasingly, companies are investing in the cost-saving and the productivity-enhancing benefits of networked smart devices that can communicate and coordinate with one another via the Internet."

Defense Measures

Protecting refining, petrochemical, and distribution networks from insider and outsider threats, involves the following key best practices:

- **Asset Management**
  Identifying and mapping all devices in the OT environment and keeping an up-to-date inventory of them — even of those that aren't actively communicating over the network is vital first step. Some software can collect granular information on each device, including the firmware versions, PLC backplane configurations, and serial numbers.

- **Risk and Vulnerability Assessment**
  As there are so many potential attack vectors to defend, it's best to focus on the greatest sources of risks and vulnerabilities. This involves automating the process by which new vulnerabilities are identified and processed. A vulnerability management system can generate periodic reports of risk levels for each asset in the industrial control system (ICS) network. When new vulnerabilities are discovered or disclosed, a mechanism should be in place to identify affected devices, remediate threats and verify a fix has been successfully applied.

- **Device and Configuration Management**
  Monitoring and managing changes in the ICS environment to ensure that device and system configurations are secure and well documented is essential. This requires maintaining a continuously updated list of the version numbers of all installed software and firmware, and comparing it regularly against a list of known vulnerabilities.

  Meanwhile, regular scanning of OT networks can detect unknown devices and unintended changes made to them.

  The best solutions issue notifications whenever a new vulnerability appears. They also combine network monitoring with device queries to provide in-depth vulnerability assessments. For example, they provide information on current device firmware versions and associated CVEs, list open ports, and calculate accurate, up-to-date risks.

  Security policies should also be enforced to control which devices can perform certain (privileged) actions such as a code or firmware download to industrial controllers. In addition, policies should mandate that certain devices do not access the internet.

- **Unifying IT and OT Security**
  With increasing pressure to increase production and minimize extraction and refining costs, modernizing sites and systems is inevitable. Meanwhile, extending the life of mature sites has become a requirement to maintain supply levels, since developing new sources as well as extraction, transportation, and refining infrastructure, are a more costly and complex alternative.

  As a result, monitoring control systems and processes for unintended changes, whether they are the result of malicious attacks or human error, is central to preventing shutdowns. This is an important beneficial byproduct of implementing an OT security program.

  In addition to these market pressures, the oil and gas sector must also comply with stringent environmental regulations and standards that cover production, extraction, and distribution processes. Here again active monitoring of OT networks, devices and activity can help detect and prevent problems before they can lead to environmental incidents.

  One way to combat the broader attack surface created by modernization initiatives, and mitigate the threat cyber incidents and human error pose to production and environmental control systems, is to converge IT and OT security groups. While challenging, such collaboration can mitigate the risks and vulnerabilities that span these two infrastructures, simultaneously facilitating the implementation of security best practices. ●

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Indegy

Integrated Project Management: Harnessing Technology for Success

Any project is complex in nature in terms of different stakeholders viz; Owner, EPC contractor, Consultant, Sub-contractors, etc involving in it. Similarly, a lot of data, information, controls system, software from these stakeholders are using for completion of the project. To deliver a successful project, it requires a more sophisticated level of control, and to have that kind of control of an Integrated Project Management System (IPMS) where people, processes, and software are part of one contiguous whole. The article explains the need of Integrated Project Management in any project and the benefits IPMS to connect all those stakeholders in a way that is fast enough and efficient enough to achieve synergy.

Imagine this: you're driving to a new destination. You've got a map and you're an experienced driver, but this is new terrain, you don't know the landmarks, the signposts are in an unfamiliar language, the weather is unpredictable.

And you don't have GPS (global positioning system).

Daunting, isn't it?

We've grown accustomed to GPS because it is effective. GPS calculates the best route to the destination, tells you where you are, whether you're on track, what course-correction to make, even what traffic conditions to expect. It does all this by intelligently integrating car, driver, and map - in real time.

Now imagine this GPS-like integration in a construction project.

Imagine how many problems would be pre-empted, how many delays avoided, how many overruns nipped in the bud.

The good news is you don't have to imagine it; GPS-for-projects is already here.

It's called Integrated Project Management.

Why you need Integrated Project Management

A project has complex data that flows through multiple systems. Each system is powerful but doesn't talk to the others. (It's like an archipelago of islands where each island has its own ecosystem of 'best-in-breed' software and each island can be part of the same ecosystem (like cost, schedule, progress, risk information) or a separate ecosystem (like Owner, EPC contractor, Consultant, Sub-contractors)). So you rely on a project manager's ingenuity in managing the various ecosystems to get work done.

The mindset in most organizations is 'why fix what's not broken' i.e. the old systems still work fine, so why bother to change?

The answer is that in order to deliver projects successfully you need a more sophisticated level of control, and to have that kind of control you need an integrated project management system where people, processes, and software are part of one contiguous whole.

Benefits of an Integrated Project Management System

1. Real-time Control

A typical EPC organization may have an engineering island, a project management/controller island, and multiple stakeholder islands. Each island works with its own 'language' (i.e. tools and technologies); in fact, each vendor and contractor has his own system which evolved over time.

In theory you could train people from each island to learn enough of the other's language to work together collaboratively, but in realistic terms only a project-wide system (that doesn't rely on human ingenuity) could do the trick. Only an automation-driven system could possibly connect all those islands in a way that is fast enough and efficient enough to achieve synergy.

2. Transparency, Predictability, and Proactivity

If you're building a house, you want to first visualize how it will look. You start with old-fashioned photographs and plans, but they don't really give you a good picture. So, you invest in a 3D walkthrough - and now what a difference!

"In order to deliver projects successfully you need a more sophisticated level of control, and to have that kind of control you need an integrated project management system where people, processes, and software are part of one contiguous whole."

"To achieve real integrated project management, you need an integrated project management system across the entire organization, and it must be a centralized system driven by technology, not human effort."

You can clearly see your house from any angle, you can see the whole house or only a part, you can move around and 'slice and dice' to visualize how the rooms flow and how you will use them. In the same way, an IPMS lets you zoom in or out on your project with ease. You can keep an eye on contractors and subcontractors to see the overall progress or to focus on one particular component. You can analyze information to predict and prevent a potential delay, you could calculate what effect that delay will have on other components of the project.

In effect, integrated project management gives you a three-dimensional view of your project, in time and space.

3. EVM

The industry has embraced EVM (earned value management), which is a good thing. But EVM cannot be enforced without integrated project management.

Consider what EVM is: in theory it means linking cost with schedules. But in practice, earned value calculation requires meticulous planning and rigorous updates, which is possible only with an IPMS and cannot be done by human effort alone. So to implement EVM you need to build it into the project management process itself ie integrate it, in such a way that events (tasks, activities) on completion get automatically recorded, and count towards the milestone.

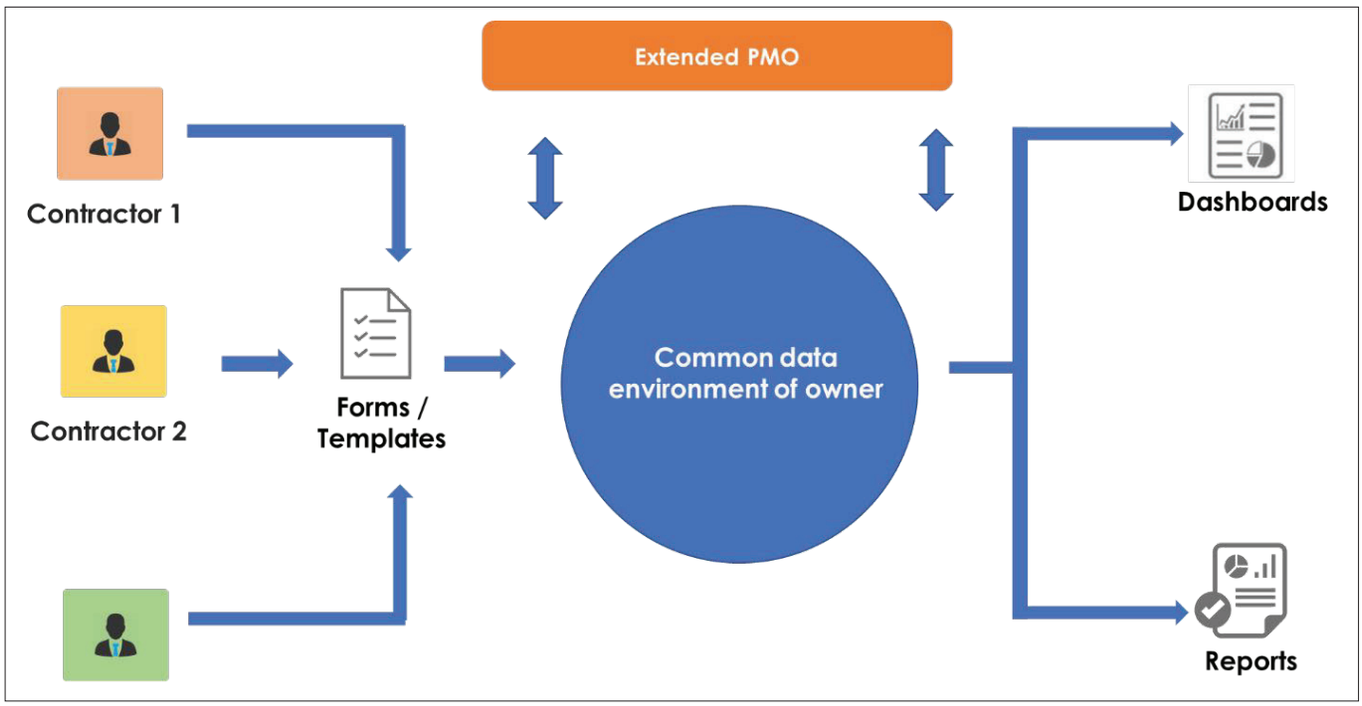
4. Technology

Perhaps the most important factor that will catalyze change in the construction industry is Technology. Advances in information technology like the cloud, mobile devices, smart computing, AI, and machine learning have opened possibilities that were unthinkable just a few years ago. Cloud computing, for example, has already bridged the communication chasm between stakeholders, and even the most conservative companies are reluctantly facing up to the fact that their 'best-of-breed' systems are redundant.

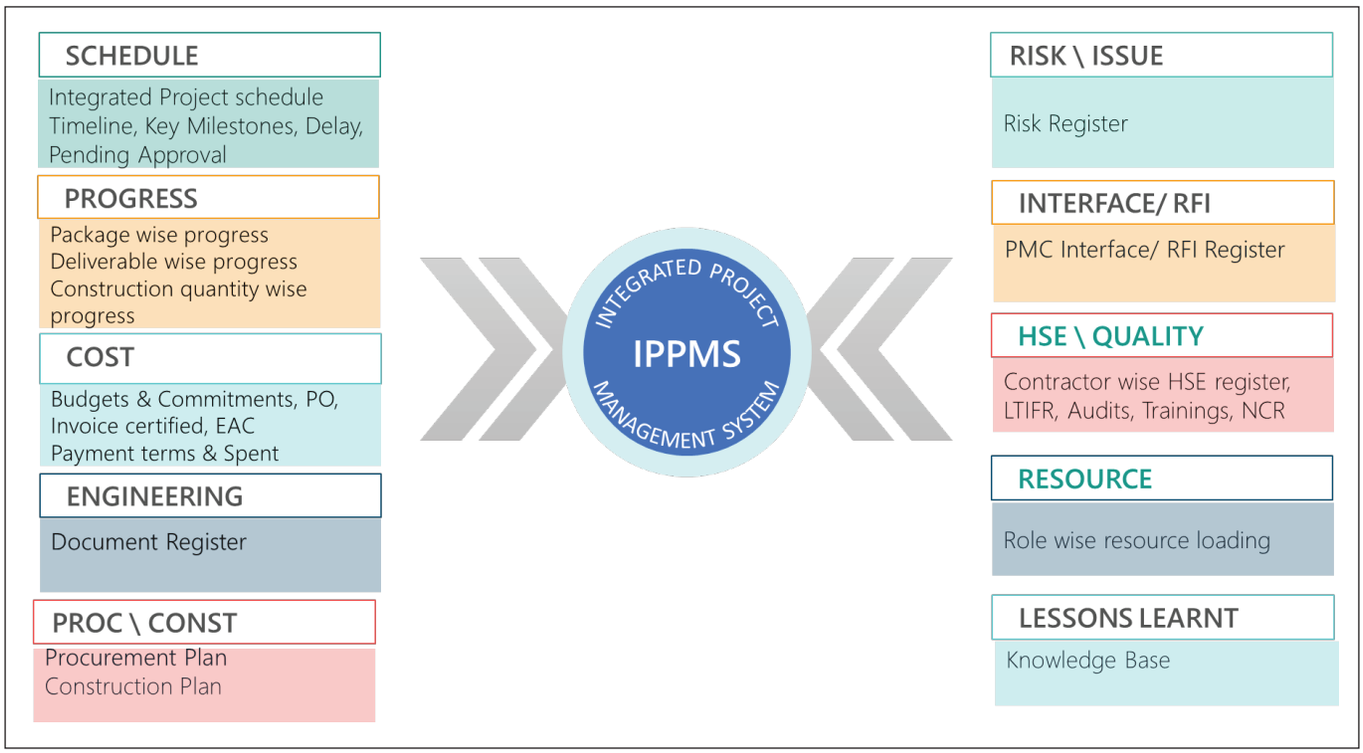
So, from a global perspective, a new kind of project management, which once sounded like Science Fiction, is becoming commonplace in developed construction markets. It's only a matter of time before it reaches us as well.

How does IPMS work?

An Integrated Project Management System (IPMS) works in real-time (ie throughout the lifecycle of the project) to identify and collect useful information from various inter-linked Business Information tools, and make that information available in the form of accurate (and up-to-date)



The IPM Workspace



IPM Inputs

reports and dashboards. This gives decision-makers valuable insight about the status of each deliverable and resource.

What happens in an Integrated Project environment?

- All stakeholders collaborate in a common data environment, which ensures transparency and accountability.
- Information is linked between different functions so that everything is up to date by default. For example, when schedules are shifted the cashflow forecast get automatically updated, Change Requests trigger risk actions on schedules and cost items, and so on.
- Dashboards and reports are shared across stakeholders and top management along with Analytics, so that it is easy to conduct post-mortems (if required) and to extrapolate future trends.
- Accurate and timely summary reports get generated using Information from different tools, with the option to drill down to the last level of detail, so every aspect of the project is clearly visible.
- Alerts, reminders and escalations are set up to provide mission-critical information to the right people at the right time, so they can take action to mitigate issues and manage risk.

Conclusion:

The GPS-for-EPC is a good analogy because projects and road trips have similar trajectories.

Both are vulnerable to real-world changes and human whims, both suffer from Acts of God and other uncontrollable and unpredictable circumstances, both rely heavily on real-time information, both require constant checking and course-correcting. But in real life the analogy falters because project organizations by their very nature defy integration. There is no centralized control, and there are many stakeholders. Hence, GPS-like solutions for EPC must start in the organization itself, not the project process.

In other words, to achieve real integrated project management you need an integrated project management system across the entire organization, and it must be a centralized system driven by technology, not human effort.

Today such solutions are available, but acceptance is low because of the industry's reluctance to change. EPC organizations need to be willing to incorporate a new way of working and become comfortable with technology-led processes.

Hopefully, this change is not too far off. ●

Manesh Alias
COO
Wrench Solutions

CASE STUDY

Oman Gas Company Digitalizes its Reliability and Integrity Program

Bentley's AssetWise Reduced Equipment Failures and Improved Reliability Performance by 9%

The case study describes the digital journey of Oman Gas Company (OGC), the principal gas transportation company in the Sultanate of Oman, through an advanced reliability and integrity program to achieve operational excellence as a world-class, midstream gas value chain company. The initiative was aimed to eliminate human fault analysis and improve resource effectiveness by digitalise and automate all data and processes within its reliability and integrity program.

Established in 2000, Oman Gas Company (OGC) is the principal gas transportation company in the Sultanate of Oman. OGC operates a 2,500-kilometer, high-pressure gas transmission network spread among more than 40 facilities, including three compressor stations and 38 gas supply stations that run the length and breadth of the Sultanate. With annual gas transmission volumes of around 21.549 billion cubic meters, the company distributes gas to 4.4 million people, as well as to the majority of the Sultanate industrial sectors, from power and desalination plants, to fertilizer, methanol, petrochemicals, refineries, and cement plants. Truly "powering the nation," OGC must ensure reliable product availability.

The Challenge

The company's small reliability team manages the performance and reliability of the numerous plants and widely distributed assets throughout Oman. These engineers conducted manual performance calculations for reliability and availability using manually collected data stored in disparate databases. With scattered data, lack of resources, and manual processes prone to human error, OGC recognized the need to initiate an advanced reliability and integrity program to achieve operational excellence as a world-class, midstream gas value chain company.

A Connected Digital Solution

To eliminate human fault analysis and improve resource effectiveness, OGC sought to digitize and automate all data and processes within its reliability and integrity program. The company determined that Bentley's AssetWise Asset Reliability was the most cost-efficient technology solution that also allowed the entire framework to be managed and maintained within one platform. OGC began the

Project Summary	
Organization:	Oman Gas Company S.A.O.C.
Solution:	Utilities and Industrial Asset Performance
Location:	Al-Khuwair, Muscat, Oman
Project Objectives:	• Digitize the reliability and integrity program and establish digital workflows for equipment inspections • Manage all elements of asset performance and integrity within a single platform. • Automate asset reliability and maintenance functions to minimize human intervention.
Products used:	AssetWise Asset Reliability
Fast Facts	• AssetWise provided a single platform for risk-based inspection program, analysis, and inspection data management. • Previously manual performance calculations are now automated in AssetWise. • Workflows and approvals are streamlined and support timely and accurate decisions.
ROI	• AssetWise provided a connected data environment and established digital workflows that reduced equipment failures and improved reliability performance by 9 percent. • Leveraging the capabilities within AssetWise, OGC optimized maintenance and operation costs. • The successful implementation of Bentley's technology transformed OGC's approach to asset management from reactive to proactive, significantly impacting revenue and profitability.

All elements of asset performance and integrity were managed and analyzed within AssetWise's single platform, enhancing operational reliability.

digitalization process in 2017, working with Advisian, a top consulting firm, to implement AssetWise and support their advancing processes and practices to maximize asset value and maintain safe, secure, and reliable operations.

The integrity framework features risk-based inspection workflow sequences based on American Petroleum Institute guidelines API 581 and supports an integrity database management system, including calculation of remaining asset life. Bentley's interoperable technology is integrated to operational technologies like OSIsoft PI, as well as enterprise asset management system SAP EAM for work execution. Integration of AssetWise asset performance management to SAP is an important part of OGC's digitalization strategy. OGC captures full, partial, and potential failure data from the maintenance work completed in SAP to update the reliability and integrity program in AssetWise. With this closed loop process, OGC achieves a living and continuously improving program. The asset performance management system serves as the basis for calculating overall equipment effectiveness (OEE), identifying bad actors, performing root cause analyses (RCA), and eliminating defects. Tracking key performance metrics in AssetWise dashboards has ensured adherence to process and has assisted in shifting the work culture to be more proactive and reliability-focused.

The flexibility and interoperability of AssetWise Asset Reliability enabled OGC to consolidate and analyze all condition monitoring and operation maintenance data from manual and Internet of Things (IoT) sources, providing visibility into condition degradation trends and critical health parameters for proactive maintenance. Having a centralized system using AssetWise, OGC established digital workflows, streamlining all processes within its reliability and integrity program and accelerating accurate communication and equipment analysis to facilitate timely maintenance and optimize asset reliability.

Automating Reliability and Integrity Processes

OGC automated several reliability and integrity processes that were previously completed manually by a reliability engineer using Excel spreadsheets. With the software, all reliability-related analyses, approvals, and associated recommendations from bad-actor analysis, RCA, reliability-centered maintenance (RCM), and risk-based inspections (RBI), are automatically performed. Now, the system is configured to calculate weekly reliability and availability of individual assets, in series and in parallel, based on an exponential reliability model. The software identifies the bad actor equipment and uses that information to perform RCA. The application also triggers alerts and emails recommendations and reminders to the appropriate personnel until the corrective work is implemented.

"The auto-alert notification in Bentley's AssetWise has been a key enabler helping us to improve our reliability at a significant rate of about 9 percent a year."

- Fahmi Reza, Head of Reliability and Condition Monitoring, Oman Gas Company

If a due date is approaching, AssetWise automatically sends the line manager a notification, establishing accountability at every level. This approach significantly increased equipment reliability because implementing recommended changes is the most important aspect of RCA. Similar automated workflows for equipment criticality analysis and reliability-centered maintenance were also integrated as part of the reliability digital framework.

Not only did OGC use AssetWise for reliability and availability performance, the company also incorporated automated RBI processes to meet requirements of API 581, the established asset integrity guidelines. Having a digital, automated framework to manage asset reliability and integrity has eliminated human fault analysis, improved resource effectiveness, and facilitated a proactive approach to asset maintenance, ensuring all anomalies are identified and rectified by the appropriate personnel. The AssetWise system increased reliability performance by 9 percent, which is worth significant savings to OGC.

Integrating Handheld Devices

As part of its automation and digitization efforts, OGC integrated handheld devices for routine operator duties to help bridge the disconnect between the engineers and the field operators by mapping trends, monitoring operational parameters, and providing necessary remote technical support. The introduction of barcodes and handheld devices interlinked with AssetWise enhances quality in the field and ensures reliability, availability, and maintainability of the facilities. Operator readings and first line maintenance (FLM) are remotely recorded and automatically uploaded from the mobile devices to AssetWise to update asset health performance. Clear visibility to current asset health, degradation trends, and historical performance on dashboards makes the day-to-day work much easier for reliability and maintenance professionals. Additionally, the interoperability and connectivity established proper digital workflows and standardized processes to promote safety, quality, and accountability in the field.

Utilization of handheld devices as part of the reliability and integrity system ensures that operational key performance indicators (KPIs) are achieved through regular monitoring of the equipment compliance status. If any value is out of range, similar to other automated procedures, AssetWise triggers an alert and an email notification. This certifies that all anomalies for each asset at every facility are noticed by the appropriate operational and maintenance personnel, and potential problems are rectified through timely and planned corrective actions. Integrating handheld devices increased reliability performance, reducing the number of breakdowns and improving the execution of routine duties by operators.

Successful Digitalization of Processes Drives Cultural Change

The successful implementation of AssetWise as the digital solution for OGC's reliability and integrity program has driven a cultural transformation toward asset performance from a reactive to a reliability-centered approach. Fahmi Reza, head of reliability and condition monitoring at OGC, obtained his Certified Reliability Leader (CRL) designation from the Association of Asset Management Professionals (AMP), leveraging the Uptime Elements Framework to help with reliability cultural awareness. He leads the transformation and stays on top of important priorities set by the company. Reza initiated operators' training and created awareness for reliability as a culture among all stakeholders in the organization.

Using the AssetWise dashboard to digitalize and share asset information ensured focus on adherence to process with accountability and continuous improvement built-in. The transparency of information motivated the people in each plant to internally compete for better reliability performance and management than their sister facilities.

With a top-down commitment to synergize all resources to support digitalization using AssetWise, OGC has moved from time-based maintenance to a risk and reliability focused strategy, supporting its vision to achieve operational excellence. Bentley's asset performance management application has significantly impacted OGC business. With reliability-centered maintenance now at the forefront, OGC is prepared to move into Industrial 4.0 Digitalization by 2024 using AssetWise as the digital platform supporting this goal. ●

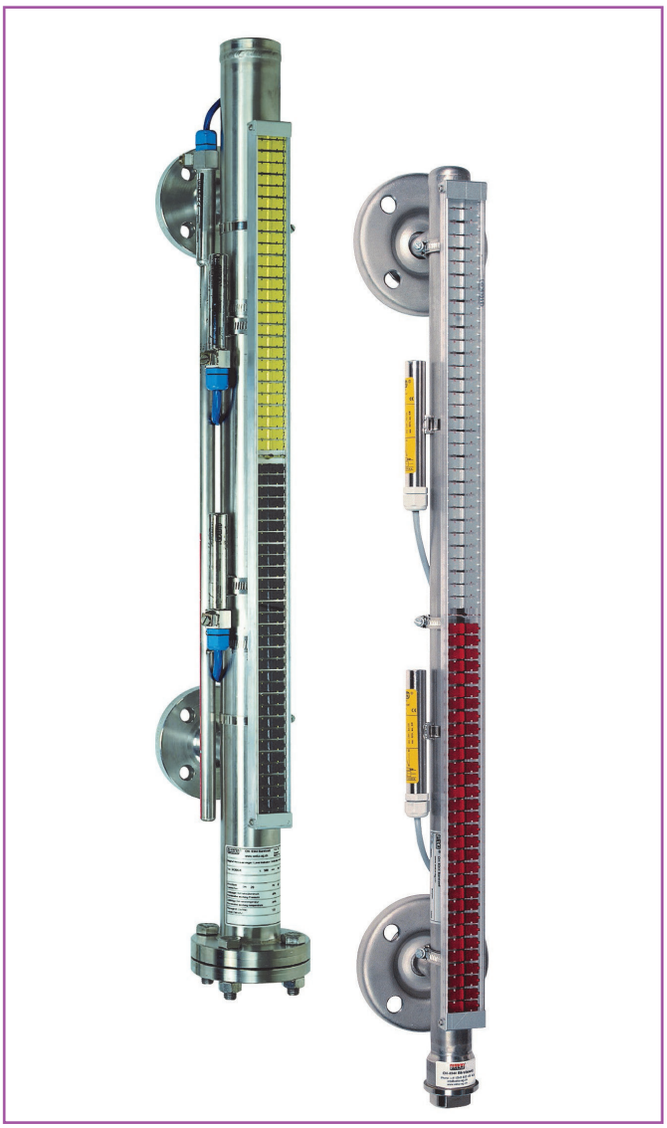
Sandra DiMatteo
Global Marketing Director - Digital Twin Solutions, Industrial
Bentley Systems

Visual Level Indicators – Three Functions In One Instrument

Visual level indicators combine up to three functions in one instrument: Level indicator, level switch and level transmitter. The display that can be read even over large distances works without energy and automatically as a result of the physical law of liquids in communicating vessels. The WEKA visual level indicators are characterized by their compact design and the wide range of applications.

Wide Application Range

Operating pressures can range from a vacuum up to 500 bar as well as calculation pressures for the float standpipe up to the nominal pressure PN 630. Liquid densities > 0.27 g/cm^3 as well as a temperature range from 77 K to 673 K (-196 °C to 400 °C) allow use in applications for cryogenic liquid gases as well as in water hydraulics and steam boilers. Hermetically sealed floats for condensing media are available up to a maximum operating pressure of 320 bar.



Flexibility through Choice of Suitable Materials

- Standard materials: 316/316L 1.4435/1.4404, group A4 stainless austenitic steel.
- Other possible stainless austenitic steels: 304/304L 1.4301/1.4306, 1.4571, 321, 1.4541.

Energy-free, Automatic Operation

The WEKA visual level indicator is ideal for the commissioning of systems. The display works without energy and automatically as a result of the physical law of liquids in communicating vessels. Independent of a controller - and thus also independent in the event of a power supply failure - visual level indication on site is ensured.

Excellent Readability

The wide, red- and silver-colored flag indicator system is easily and clearly readable, even from over large distances. The fully transparent flag indicator system made of polycarbonate (PC) also ensures readability from the side. The liquids, which are not always unproblematic and sometimes also hazardous, are safely enclosed in the dense and pressure-tight float standpipe and separated from the indicator.

Level Measurement

As described, WEKA visual level indicators offer the ideal solution for almost all operating conditions. For most applications, you will find a suitable device from our standard program. Again and again, however, customized solutions are also required for special operating conditions. Many designs can, for example, also be used in hazardous areas according to ATEX or IECEx. (ATEX is a widely used synonym for the ATEX guidelines of the european union.) The designation ATEX is derived from the french abbreviation for atmosphere explosibles. Our instruments can thus also be used in potentially explosive atmospheres.

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Dripping tap	140 litres/week	28 buckets
Washing machine	65 litres	13 buckets
Dish washing	20 litres	4 buckets
Washing car with bucket	10 litres	2 buckets
Hosepipe/sprinkler	540 litres/hour	108 buckets

**Figures based on bucket with 5 litres capacity*

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GAIL Appoints Ashutosh Karnatak as Interim CMD

New Delhi, India: GAIL Ltd, the largest state-owned natural gas processing and distribution company in India, has appointed Ashutosh Karnataka as the interim CMD. He has been serving as the Director (Projects) at GAIL since March 2014.

Ashutosh Karnatak, CMD, GAIL Ltd

Karnatak is an Electrical Engineering alumni of Harcourt Butler Technical University, Kanpur and a post graduate from IIT, Delhi. He is also a Fellow Doctorate of UPES, Dehradun, a company statement said. He took charge after former GAIL (India) CMD, B C Tripathi was denied a third extension.

Senegal President to Honour as 'Africa Oil Man of the Year'

Cape Town, South Africa: Africa Oil & Power will honour the 'Africa Oil Man of the Year 2019' award to HE Macky Sall, President, Republic of Senegal. HE Macky Sall will be bestowed with the prestigious award during the Africa Oil & Power conference, to be hosted October 9-11, 2019 in Cape Town.

HE Macky Sall, President, Republic of Senegal

Senegal is a global hotspot for oil and gas discoveries — well-known as the place in Africa to make major oil and gas finds, due in large part to a decades-long campaign by Sall to improve transparency, create an attractive investment environment and spark new growth.

"As African countries across the continent aim to spur growth and diversify economically, Senegal is a prime example of a country making energy work — creating an enabling environment for business to succeed, attracting huge international investments, while providing for a strong local capacity and downstream investment options," said Guillaume Doane, CEO of Africa Oil & Power. "HE Macky Sall is one of Africa's top leaders, not just in oil and gas, but as an advocate for overall economic success. We are honored to present him this award."

BASF Launches Durasorb HG, a New Product for Mercury Removal from Natural Gas

Mumbai, India: BASF continues to add new solutions to its portfolio for natural gas processing applications with the launch of Durasorb HG, a mercury removal adsorbent. Durasorb HG is a non-regenerable, mixed metal oxide adsorbent containing a dispersed and promoted copper sulfide phase. As a robust adsorbent, Durasorb HG is designed to work in wet conditions. The fast kinetics and maximum mercury penetration allow for the most efficient use of the adsorbent bed. The addition of a mercury removal adsorbent complements the Durasorb product line providing complete pre-treatment solutions for mid-stream gas processors and LNG operators including heavy hydrocarbon removal, BTX removal and dehydration.

"This is an exciting time for our Durasorb team. The LNG market is fast growing, and we are poised to provide a broad range of superior solutions to our customers," said Detlef Ruff, Senior Vice President Process Catalysts at BASF. "BASF is now able to provide the complete LNG pre-treatment package, which provides unique advantages over competition and positions BASF as a complete solution provider for our customers," adds Adrian Steinmetz, Vice President Global Chemical Catalysts and Adsorbents at BASF.

GRC Opens New Facility in Oklahoma

Tulsa, Oklahoma: Sercel-GRC (GRC), an oil and gas service company that designs, manufactures and markets downhole data acquisition instruments and surface equipment, has opened a new state-of-the-art-facility in Tulsa, Oklahoma.

Operations at the facility include research and development, design, engineering, manufacturing, testing, servicing and sales of downhole and surface data acquisition tools. It also contains sophisticated calibration equipment, which allows GRC to manufacture products with high sensor accuracies to optimize oil and gas well production.

The 67,000 square-foot facility increases manufacturing efficiency and productivity through layout improvements and equipment positioning. The changes improve communication, routing time, cost and quality, while enhancing the health, safety and welfare of GRC employees. The new facility is equipped with one clean room to manufacture proprietary pressure transducers, one ESP motor test laboratory, four automated pressure controllers, five CNC machines and 12 calibration ovens. There will also be more than 70 key employees based at the facility.

Bud Missel, president, GRC, said, "The arrangement of our previous building restricted our manufacturing capabilities. The new layout allows us to incorporate an improved streamlined manufacturing process, and provides our research, engineering and qualification groups a better workspace to design and qualify new products. The location was strategically kept in Tulsa, OK due to the proximity to oilfields, major transportation hubs and the headquarters of our key U.S. customers including Valiant, BHGE, Summit and APERGY. We have 94 years of history in Tulsa and are happy to stay here to support our city and state. We are looking forward to leading GRC into its next phase of growth at this specialized location."

Oil India, IOCL, ONGC get New Diectors; PGCIL gets New CMD

Rajesh Kumar Srivastava, Director (Exploration), ONGC

Harish Madhav, Director (Finance), OIL

Sandeep Kumar Gupta, Director (Finance), IOCL

Kandikuppa Sreekant, CMD, PGCIL

New Delhi, India: The Appointments Committee of Cabinet (ACC) has approved the proposals of the Ministry of Petroleum and Natural Gas and recommended Directors to the boards of Oil India, IndianOil and Oil and Natural Gas Corporation Limited.

Rajesh Kumar Srivastava has been appointed as the Director (Exploration) at ONGC. He was a Group General Manager at the company. In another order, Harish Madhav, Executive Director at OIL has been appointed to the post of Director (Finance), OIL. The ACC has also appointed Sandeep Kumar Gupta, Executive Director at IndianOil to the post of Director (Finance) at IOCL.

In other orders, the ACC has approved the proposal from the Ministry of Power, and Kandikuppa Sreekant, Director (Finance) at Power Grid Corporation of India Limited has been appointed to the post of Chairman and Managing Director, PGCIL.

IPCO Acquires Extruwork SRL

Fellbach, Germany: IPCO (former Sandvik Process Systems) has acquired the Italian company Extruwork SRL, a manufacturer of extruder lines for powder paint. Core capabilities are within design, production, service and spare parts supply. Extruwork SRL has high technical reputation and knowledge of powder coating applications, including over 300 reference installations worldwide.

The acquisition further strengthens IPCO's position in the Powder Paint segment. All key individuals are intended to be transferred to IPCO's Italian operation in Milan, Italy.

"The acquisition is in line with IPCO's long-term strategy for profitable growth. Through the acquisition, we strengthen our technology base and intend to further develop the global business for these products in the Powder Paint segment," says Johan Sjögren, Managing Director for IPCO's Equipment Division.

Mahanagar Gas Limited inks with Maruti Suzuki for its 'Go Green' Endeavour

Induction new CNG WagonR cars into MGL's fleet by Mr. Sanjib Datta, Managing Director – MGL and Mr. Vikas Kohli, Associate Vice President, Institutional sales and leasing, MSIL in the presence of senior officials.

Mumbai, India: Mahanagar Gas Limited (MGL), one of India's leading city gas distribution companies, in association with India's largest automaker - Maruti Suzuki India Limited, has inducted a fleet of CNG version of newly launched WagonR. It was MGL's continues endeavor for a greener environment initiative. The induction of the new CNG WagonR cars was formally done by Sanjib Datta, Managing Director, MGL and Vikas Kohli, Associate Vice President, Institutional sales and leasing, Maruti Suzuki India Limited.

Speaking on the occasion, Mr. Sanjib Datta, Managing Director, MGL said, "We are happy to partner with Maruti Suzuki, which shares our vision of making transportation eco-friendly as well as economical. Maruti Suzuki has pioneered in factory fitted CNG models and offers over 6 models with CNG option. We look forward to building this association with Maruti Suzuki for years to come, which will go a long way in contributing for a cleaner and greener environment for Mumbai".

On the occasion Shashank Srivastava, Executive Director, Marketing and Sales, Maruti Suzuki India Limited, said, "We are thankful to MGL for over a decade long partnership in their endeavor for eco-friendly transportation. We are delighted that our factory-fitted CNG range of cars are appreciated and helped MGL in their environment friendly initiatives. At Maruti Suzuki, we always believe in introducing technologies which are greener, safer and cost-effective for our customers. Our factory fitted CNG range of cars goes through a strict quality test. We currently have 8 CNG vehicles in our fleet."

MGL has made constant efforts to spread the awareness for using CNG and with over 7 lakh vehicles running on CNG in its network area, the region has benefited with this environment-friendly, safer and economical fuel option.

AG&P Receives Landmark Equity Investment from Osaka Gas and JBIC

Key representatives from AG&P, Osaka Gas, and Japan Bank for International Cooperation, sign the equity investment agreement in Manila Philippines. Present during the signing ceremony are (from L-R): Mr. Takahito Marushima, Director, Division 1, Equity Investment Department, Equity Finance Group, JBIC; Mr. Shinji Fujino, Managing Executive Officer, Global Head of Equity Finance Group, JBIC; Dr. Jose P. Leviste Jr., Chairman, AG&P; Atty. Marie Antonette Quiogue, Legal Counsel, AG&P; Mr Tetsuji Yoneda, President & CEO, Osaka Gas Singapore; and Mr. Kei Takeuchi, Senior Executive Officer, Osaka Gas.

Tokyo, Japan: AGP International Holdings Pte Ltd (AG&P) has received a major equity investment from two Japanese institutions to support AG&P's success in innovating and disrupting the global natural gas value chain.

Osaka Gas Co Ltd, through its affiliate Osaka Gas Singapore Pte Ltd (Osaka Gas) and the Japan Bank for International Cooperation (JBIC) have invested in a minority stake in AG&P. This capital will be used to execute AG&P's multiple LNG initiatives worldwide.

"We are humbled and privileged by the trust that both Osaka Gas and JBIC have placed in AG&P. These are amazing institutions that possess tremendous expertise and experience in their respective fields. We have a great responsibility to work very hard for them and our other shareholders to continue to grow AG&P's unique business model that captures a large portion of the LNG value chain after the molecule has been shipped," said Dr Jose P Leviste Jr, Chairman AG&P.

Dr. Leviste continued: "AG&P and Gas Entec, working together, bring innovative, in-house engineering, project management, manufacturing, licensed LNG tank and handling system outfitting, construction, project development, customer marketing and operations management for LNG-related projects and for our modularization, site-work and other customers. We look forward to changing how the LNG industry works."

DTEK Oil&Gas to invest at Zinkivska Block

Kyiv, Ukraine: DTEK Oil&Gas and its subsidiaries have been selected as winners in a competition for the largest Product Sharing Agreement (PSA) in Ukrainian history. Subsequent to signing the PSA, the company will invest over USD 37 million USD into the development of Zinkivska block.

DTEK Oil&Gas plans to reanalyze previously attained data from dynamic gas studies, 3D wide-azimuth seismic studies as well as drill three prospecting wells. The aim is start production within two years of the start of the project.

The PSA competition, which included nine oil and gas blocks with a total area of 11,400 sq km, generated huge interest in the market, attracting 23 proposals from 14 different production companies.

DTEK Oil&Gas CEO Igor Schurovsa, said: "During five years DTEK Oil&Gas invested over 400 mln USD into Ukrainian gas production, that is a large contribution to the industry development. Conducting such a large PSA competition is a next important step to improve investment climate of Ukraine, since cooperation in PSA format will open new opportunities to increase investments, grow production and strengthen energy independence of our country".

CapitaLand to Install Solar Farms in Singapore

Singapore: CapitaLand will partner with Sembcorp Industries to install about 21,240 rooftop solar panels atop six CapitaLand properties by end 2019. The installation will form the largest combined rooftop solar facility in Singapore by a real estate company. These solar farms can collectively generate around 10,292 megawatt hours of energy annually, equivalent to powering about 2,300 four-room Housing & Development Board (HDB) flats each year.

The energy generated through this renewable source will significantly lower CapitaLand's carbon footprint. The combined rooftop solar facility will avoid over 4.3 million kg[2] of carbon emissions each year. These latest efforts will also bring the Group closer to its new sustainability targets to generate at least 20% energy consumption from renewable energy for its enlarged global portfolio by 2025. Furthermore, there is no installation cost incurred by the Group, making this initiative a good business case for sustainability.

Ms Lynette Leong, Chief Sustainability Officer for CapitaLand Group, said: "CapitaLand is committed to growing our business in a sustainable manner, and this initiative is an example that sustainability can create value-add propositions. Following CapitaLand's recent integration with Ascendas-Singbridge, we can now leverage a wider network of properties to contribute meaningfully towards sustainability. We are also exploring the use of Renewable Energy Certificates resulting from the excess energy generated by the solar panels installed at the six properties to offset the carbon emissions from CapitaLand's corporate operations at its Singapore headquarters in Capital Tower and Galaxis. We will further review opportunities within our enlarged global portfolio to deploy clean energy technologies to power our real estate operations."

World's only Natural Gas-to-Gasoline Plant in Operation in Turkmenistan

The world's first TIGAS plant monetizes Turkmenistan's huge natural gas resources by producing 15,500 barrels per day of high-value gasoline.

Ashgabat, Turkmenistan: In a grand event marked the official opening of the world's only natural gas-to-gasoline plant close to Ashgabat, the capital of Turkmenistan. His Excellency President Gurbanguly Berdimuhamedov and a large number of dignitaries attended the event.

Start-up of the plant has proceeded according to plan and the initial product meets the agreed specifications. During the coming months, the performance test run is expected to be completed. At full capacity, the plant will produce 15,500 barrels of gasoline per day.

"We are proud to be part of this forward-thinking and ambitious project. It sets a new world standard for monetizing gas resources in a very effective way and will be a model for other nations and companies around the globe. This is the definitive demonstration that TIGAS is a technologically and financially viable way to produce gasoline from natural gas," ssaid Bjerne S Clausen, CEO of Haldor Topsoe.

The plant is an important step forward in Turkmenistan's plan to monetize the country's huge natural gas resource – the fourth-largest in the world – and diversify its export potential. In addition, the production will supply the Turkmen home market with synthetic gasoline that complies with the highest environmental standards, contains no sulfur and very little unwanted byproducts.

Oil Marketing Companies (OMC) Leverage Increased in FY19; may Moderate in FY20: Fitch

New Delhi, India: India Ratings and Research (Fitch Group) has predicted that credit profile of oil marketing companies (OMCs) will improve marginally in FY20 driven by higher EBITDA generation on account of better gross refining margins (GRM). Ind-Ra further expects subsidy receivables to streamline and reduce with the Government of India's (GoI) likely higher petroleum subsidy budget allocation for FY20, and lower dividends and buybacks as cash balances with the OMCs have declined significantly. However, the improvement in leverage will be limited by capex outflows for transition to BS-VI, refining capacity and petrochemical expansion.

The weighted average GRM of the OMCs had declined to USD 5.1/bbl in FY19 (FY18: USD 7.8/bbl) driven by higher crude prices leading to inventory losses and a steep fall in crack spreads of gasoline. Ind-Ra expects GRMs to improve in FY20 driven by increasing crack spread on diesel, supported by International Maritime Organisation (IMO) regulations, and improvement in refining complexities, distillate yields and capacity utilisations. However, GRMs will remain susceptible to movements in the crude price.

Ind-Ra expects shareholder returns (dividends and share buybacks), which increased to ₹ 223 billion in FY19 (FY18: ₹ 170 billion) to reduce in FY20 given that the cash balance available with OMCs has already depleted to ₹ 2.8 billion in FY19 (FY18: ₹ 14.6 billion). Further, OMCs witnessed increased subsidy receivable of ₹ 370 billion in FY19 (FY18: ₹ 170 billion) on account of increase in the total petroleum subsidy burden to ₹ 432 billion (FY18: ₹ 282 billion). Although, subsidy allocation in the interim budget was higher at ₹ 374.8 billion compared with FY19's ₹ 248 billion, the same would not be sufficient given the rollover from the last fiscal. Therefore, Ind-Ra expects GoI to allocate higher petroleum subsidy in the final budget to streamline the subsidy receivables.

However, OMCs are undertaking large capex to expand and upgrade refineries to comply with BS-VI regulations and expand their pipeline network and petrochemical segments. Capex of the three OMCs increased to ₹ 424 billion in FY19 (FY18: ₹ 305 billion), which is further likely to increase to ₹ 510 billion in FY20 driven by continued investments in the aforementioned factors. As a result, any meaningful improvement in leverage is likely to be curtailed by capex outflows.

Consequently, Ind-Ra projects the combined gross leverage of the three large state-run OMCs- Indian Oil Corporation Ltd (IOCL), Hindustan Petroleum Corporation Limited (HPCL) and Bharat Petroleum Corporation Limited (BPCL) - to be between 1.9x and 2.2x during FY20 (FY19: 2.5x; FY18: 1.7x). However, any higher-than-expected shareholder payout or subsidy receivable (driven by the GoI's policies to manage fiscal position) could have a negative impact on the expected credit profile.

The higher leverage of the rated OMCs- IOCL (INDAAA/Stable) and HPCL (INDAAA/Stable) - is not expected to have any material impact on the companies' ratings as Ind-Ra continues to factor in the strategic importance of these OMCs in the domestic energy sector. These OMCs continue to function as GoI's extended arm for policy implementation, as reaffirmed by the GoI instructing them to absorb INR1/litre towards the petrol and diesel price cut announced on 4 October 2018. Further, despite deregulation of petrol and diesel, OMCs continue to sell subsidised liquefied petroleum gas (LPG) and kerosene.

Furthermore, Ind-Ra assesses the OMCs-GoI linkage to remain strong and these linkages could be re-assessed, in accordance with the agency's parent subsidiary criteria, if there are further fuel reforms in LPG and kerosene. Additionally, Ind-Ra will assess the ability of the OMCs to maintain pricing freedom in decontrolled products in the wake of rising crude prices.

Anil Chaudhry Conferred the Horasis-KPMG Indian Business Leader of the Year award

Anil Chaudhry receiving the award from Akhil Bansal, Deputy CRO KPMG India and Nitin Atroley, Managing Partner North, KPMG India.

New Delhi, India: Anil Chaudhry, Zone President and Managing Director, Schneider Electric, India has been conferred the Horasis-KPMG Indian Business Leader of the Year award for 'Business Transformation'. The award ceremony was held in Segovia, Spain at a glittering function that saw participation of a galaxy of business leaders and global corporates.

A veteran of the energy and automation sector, Chaudhry was recognised for the outstanding work done in the field of energy and infrastructure segment. A strong votary of usage of technology and smart grid initiatives with extensive learning of digitisation, Chaudhry has played a pivotal role in transforming India's rapidly expanding power sector with a focus on providing access to energy for all.

Speaking on the side-lines of the Horasis India Meeting in Segovia, Spain, and after the award ceremony, Anil Chaudhry, Schneider Electric India – Zone-President & Managing Director, shared: "I am extremely honoured and humbled to receive the Horasis Award. This acknowledgement is a testimony of Schneider Electric's commitment to energy efficiency across the globe and particularly in an emerging market like India. Aligned with the company commitment to provide access to energy, we at Schneider Electric we will continue to be a part of the journey to 'Make New India, Energy Positive'."

Emerson helps Enhance Production at BPCL Refinery

Mumbai, India: Emerson, a global technology and engineering company, has announced the completion of the Bharat Petroleum Corporation Limited (BPCL) Kochi Refinery upgrade. Throughout the project, Emerson provided engineering and project management services as well as automation technologies that helped BPCL in its goal of increasing the production capacity from 9.5 million to 15.5 million metric tonnes per annum.

BPCL leveraged Emerson's deep refining expertise and Plantweb digital ecosystem—a scalable portfolio of technologies, software and services to enable digital transformation—to modernize plant operations for greater production and continuous, safe operations. The project is among the largest installations of Emerson control systems and wireless sensing in the world and will provide operators advanced insight into refinery processes and performance.

Ashok Simon, Former General Manager – Projects, BPCL Kochi said, "Emerson's large project management and engineering teams put in tremendous efforts in helping us complete the commissioning of all nine process units and achieve significant milestones in record time. The highlight of this extraordinary collaboration was the development of sequential logic for the PRU reactors beds (PFCCU), and its flawless operation to much critical acclaim from even our process licensor."

The refinery located in Kerala and part of BPCL's Integrated Refinery Expansion Project, utilizes Emerson's wireless sensing technology. Critical information is communicated from the refinery's nine process units to the plant's DeltaV integrated control and safety systems, which the personnel monitor via centralized command centre and control room. Emerson's Ovation control system helps BPCL manage the refinery's electrical load to optimize operational efficiency and safety.

"The success of the BPCL project demonstrates the value advanced digital automation technologies can bring to the Indian refining sector," said Anil Bhatia, Vice President and Managing Director, Emerson's Automation Solutions business in India. "This critical foundation of process control will help improve production, operational efficiency and safety and prepare BPCL for the next steps in its digital transformation journey."

Centurion CEO Invites Chinese Oil and Gas Investors to Africa

Beijing, China: Nj Ayuk, CEO, Centurion, invited Chinese Oil and Gas Investors in sub-Saharan Africa. Participated in the EG Ronda Licensing Roadshow in China, Nj Ayuk and A team of attorneys from Centurion met several high-profile Chinese executives and energy companies seeking to invest in the rich African hydrocarbon industries.

The roadshow is organized by the African Energy Chamber on behalf of Equatorial Guinea's Ministry of Mines and Hydrocarbons. With the biggest names amongst the Chinese energy companies attending, including companies such as CNPC, PowerChina Group, Sinopec, Sinochem, CNOOC, Shenergy, CMEC and China Minmetals Corp, Centurion has had the opportunity to discuss considerable deals in several African oil markets.

"Centurion's presence in China for the EG Ronda Roadshow is a mark of our commitment not only to Equatorial Guinea, but to the promotion of Chinese investments across Africa," declared Nj Ayuk from Beijing. "China is serious about investing in Africa, and Chinese investors and companies are looking for reliable African legal advisors and partners to efficiently do business in our continent. This represents billions of dollars of investment ready to support the development of the African oil industry."

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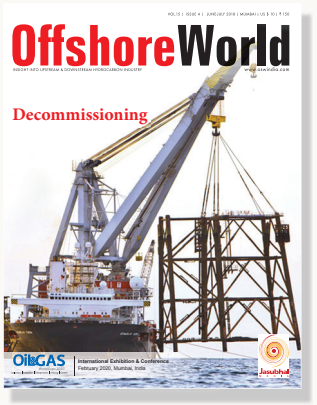

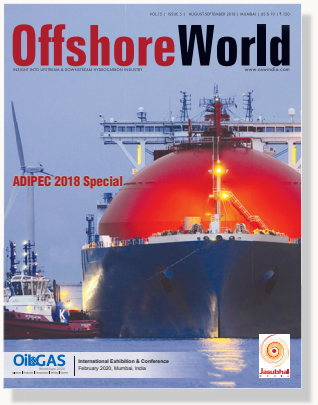

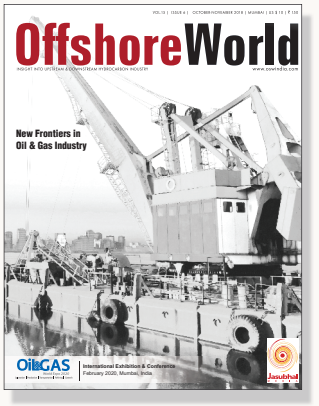

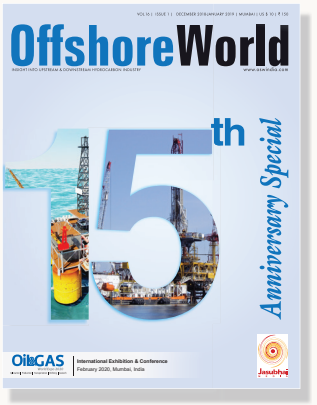

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Universal power supply accepts any voltage from 90 to 265 V AC.

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The operation of the water flow meter is a simple user-friendly way to operate easily. The water flow meter is an impeller multi-jet type flow meter with measuring inserts made up of engineering plastics. The water meter has a provision for fixing of external digital pulse sensors suitable for remote and digital pulse transmissions for monitoring through BMS systems and batching purposes with PLC, etc.

This flow meter is used to measure the water consumption in apartment/ flats, IT park area, hospitals and malls.

Features removable/interchangeable element; sealed register water-proof (IP 67); corrosion-free powder coated body; EEC pattern approval; unaffected by external magnetic fields; used for cold (50°C) and hot water (130°C); and pulser's coated body fitted without breaking the seal for remote flow totalisation and flow-rate indication.

For details contact:

Toshniwal Hyvac Pvt Ltd
267 Kilpauk Garden Road
Chennai 600 010
Tel: 044-26448558, 26448983
Fax: 91-044-26441820
E-mail: sales@toshniwal.net

Vortex Meter

The VTX2 vortex meter is used for flow and volumetric measurements of conductive and non-conductive fluids, gases and vapours in all industrial branches.

An excellent flow meter designed for your process. It is extremely rugged, stable and maintenance-free, insensitive to pulsations, pressure bursts and temperature shock. It has excellent metrological characteristics and vibration compensation. Smart electronics measurement of the operational state patented sensor for reliable sensing of vortexes. No re-calibration required when replacing the sensor. Sensor design independent of nominal width. Highest possible application flexibility suited for high media temperatures.

For details contact:

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267 Kilpauk Garden Road
Chennai 600 010
Tel: 044-26448558, 26448983
Fax: 91-044-26441820
E-mail: sales@toshniwal.net

Gastech 2019

Date: 17-19 September 2019
Venue: Hoston, Texas

Event: For over 45 years, the Gastech exhibition and conference has been at the forefront of the international gas, LNG and energy market. This world renowned event is regarded as the most significant meeting place for upstream, midstream and downstream gas, energy and LNG professionals, where they convene to do business.

Gastech has fast become a next generation energy event, hosting major NOCs, IOCs, integrated energy companies, global utilities, EPC contractors, shipbuilders, pipeline companies, manufacturers, technology providers and service companies all of whom play an active role in the global energy value chain.

For details, contact:
Aideen Mannionquinn
Operations Enquiries
Tel: +44 (0) 203 615 5901
Email: operations@gastechevent.com

ADIPEC 2019

Date: 11-14 November 2019
Venue: Abu Dhabi International Petroleum Exhibition & Conference, Abu Dhabi

Event: ADIPEC 2019, the largest Oil & Gas in Middle East, will bring together the global leaders of Energy, Power, Oil and Gas, Petroleum, Drilling, Offshore and Natural Gas, and Marine industries in a single platform to discuss and deliberate the current issues and trends in entire hydrcarob industry and the future opportunities laying in the industry. Since its inception in 1984, ADIPEC has provided an unrivalled platform for industry experts to come together and share knowledge and meet with peers.

The multi-disciplinary conference is intended for international and regional oil and gas professionals, who are involved in both the technical and non-technical functions within the industry.

For details, contact:
DMG Events
5th Floor, The Palladium,
Cluster C, Jumeirah Lakes Towers,
P.O. Box 33817
Dubai United Arab Emirates
Tel: +971 4 438 0355
Email: info@dmgevents.com

Oil & Gas World Expo 2020

Date: 4-6 March 2020
Venue: Bombay Exhibition Centre, Goregaon (East), Mumbai, India

Event: The 9th edition of Oil & Gas World Expo is scheduled from March 4-6, 2020 in Bombay Exhibition Centre, Goregaon (East), Mumbai, India. The Global Hydrocarbon show is aiming to connect, discuss and comprehend the views of leaders, policy makers, regulatory authorities, and service providers of the Indian and Global hydrocarbon industry. The 3-days Exhibition and dedicated conference will provide a platform to showcase innovative technologies and services, encompassing current and future trends in the entire value chain of hydrocarbon industry ranging from upstream to midstream and downstream.

Oil & Gas World Expo 2020 along with GASTech + Refining & Petrochemicals World Expo 2020 will provide a holistic platform to showcase latest trends in technologies, equipment & services to the right buyers from E&P, Natural Gas, LNG, CNG, CGD, Refining & Petrochemicals along with hydrocarbon infrastructure & services providing sectors.

For details contact:
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http://chemtech-online.com/oil-gas-world-expo-2020/about-event

OPES 2020

Date: 8-11 March 2020
Venue: Oman Convention & Exhibition Centre Muscat, Oman

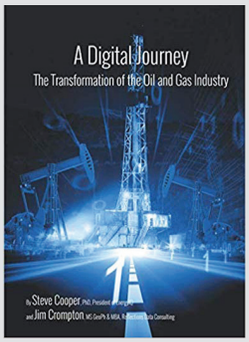
Event: OGWA is a biennial international exhibition and conference that brings together local and international oil and gas companies from the GCC, technology and service providers, equipment suppliers, and other companies directly serving the industry's requirements.

It is a platform for discussing the latest developments and directions of the industry, as well as for trade and business opportunities among the local and international oil and gas companies. Launched in 1998, it has since been under the patronage of the Ministry of Oil & Gas and has consistently received the support of Petroleum Development Oman (PDO), Oman LNG, and many other leading oil and gas companies.

For details, contact:
Ebrahim Taher Exhibition Director
OmanExpo
P.O. Box: 20,PC:117 Wadi Kabir 1st Floor, SABCO Building, Wattayah, Muscat, Sultanate of Oman
Tel: +968 24660124 Fax: +968 24660125/126
Email: ebrahim.taher@omanexpo.com

A Digital Journey: The Transformation of the Oil and Gas Industry

Authors: Dr Steve Cooper and Jim Crompton
Price: USD 75
No of Pages: 351 (Paperback)
Publisher: Independently published

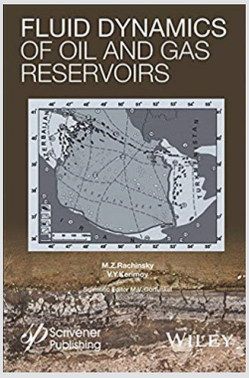


About the Book: The book illustrates the author's proactive approach towards developing a digital strategy from the bottom up, avoiding pitfalls from the tempting short cuts, to deliver data the business needs to gain a sustainable competitive advantage. Best practices are identified from an organization, process, and technology perspective, providing insight into how companies should prepare for and begin the digital journey. It is apparent to everyone within the Industry that significant changes are underway. These changes are being driven by the need to operate more efficiently and with fewer people. Picture a general flow of getting more for less, but on steroids! A catalyst for this change has been the application of digital technology, wherein lies a new focus on data science and analytics. This is starting to result in real and significant improvements to overall business performance for some operators. While big data and analytics get most of the attention, it is only one aspect of a broader movement that is popularly referred to as the Digital Transformation and which we have categorized as the Digital Oilfield 2.0; the next phase of the Digital Transformation.

One critical aspect of the Digital Transformation that typically gets overlooked is the need for effective data management across the full Well lifecycle. The result of this lack of focus on the fundamentals is that many big data and analytics projects fail to deliver fully on the promised benefits with the occasional spectacular failure. In this book, the authors investigate and analyze the industry and technology trends that are driving the next phase of the Digital Transformation. They break this down into the component parts and present a framework for building an effective master data management platform and organization – it is not just about the technology. Combining this framework with best practices gathered over decades in the business, the authors present an approach to building out a Digital Strategy to help companies that are struggling to define their own journey towards a Digital Transformation.

Fluid Dynamics of Oil and Gas Reservoirs

Authors: M Z Rachinsky and V Y Kerimov
Price: USD 63
No of Pages: 640 pages
Publisher: Wiley-Scrivener



About the Book: Whether as a textbook for the petroleum engineering student or a reference for the veteran engineer working in the field, this new volume is a valuable asset in the engineer's library for new, tested methods of more efficient oil and gas exploration and production and better estimating methods. In this book, the authors combine a rigorous, yet easy to understand, approach to petrophysics and how it is applied to petroleum and environmental engineering to solve multiple problems that the engineer or geologist faces every day. Useful in the prediction of everything from crude oil composition, pore size distribution in reservoir rocks, groundwater contamination, and other types of forecasting, this approach provides engineers and students alike with a convenient guide to many real-world applications.

Fluid dynamics is an extremely important part of the extraction process, and petroleum geologists and engineers must have a working knowledge of fluid dynamics of oil and gas reservoirs in order to find them and devise the best plan for extraction, before drilling can begin. This book offers the engineer and geologist a fundamental guide for accomplishing these goals, providing much-needed calculations and formulas on fluid flow, rock properties, and many other topics that are encountered every day.

The approach taken in Fluid Dynamics of Oil and Gas Reservoirs is unique and has not been addressed until now in a book format. Readers now have the ability to review some of the most well-known fields in the world, from the USA to Russia and Asia.

Useful for the veteran engineer or scientist and the student alike, this book is a must-have for any geologist, engineer, or student working in the field of upstream petroleum engineering.

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Central Advisory Board
GASTech World Expo 2020

Mr Rajeev Mathur
Executive Director (Corporate Affairs)
& OSD to CMD, GAIL Ltd

Facts & Figures 2018

EXHIBITORS	VISITORS	SPEAKERS	DELEGATES	STUDENTS
150	6000	100	500	100

Concurrent Events

Oil&GAS World Expo 2020
Refining & Petro CHEMICALS 2020
POWER World Expo 2020
SMP WORLD EXPO 2020

Who Can Exhibit

- LNG producers, suppliers, importers and end users
- Shipping companies
- EPC companies
- Leading ports and terminal companies
- LNG terminal & Tanks
- Equipment suppliers
- LNG Technology Providers
- FLNG, RLNG services providers
- LNG carriers
- Pipeline Manufacturers & Service Providers
- Instrumentation & Automation
- Natural gas producers
- Gas marketers/suppliers
- Pipeline operators
- Infrastructure & Logistics
- City Gas distributors
- NGV Manufacturers
- NGV station Operators
- Policy-makers & Regulators
- Public Transport Systems
- Infrastructure Builders
- Project Consultants
- Original Equipment Manufacturers
- Technology Providers
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- Consulting & legal firms
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Facts & Figures - Oil & Gas World Expo 2018

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150	6000	100	500	100

Guidance of Leaders

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Director (Onshore)
Oil and Natural Gas Corporation Ltd

Technical Chairman, Central Advisory Board, Oil & Gas World Expo 2020

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Executive Director - Kochi Refinery
Bharat Petroleum Corporation Ltd

Chairman, Central Advisory Board, Power World Expo 2020

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Director (Commercial)
NTPC Limited

Convener, Power World Expo 2020

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