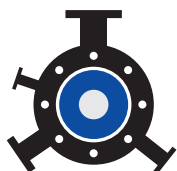


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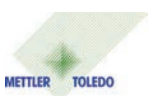


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India announces Green Hydrogen standard for India



New Delhi, India: In a significant move for the progress of the National Green Hydrogen Mission, the government has notified the Green Hydrogen Standard for India. The standard issued by the Ministry of New and Renewable Energy (MNRE), Government of India outlines the emission thresholds that must be met in order for hydrogen produced to be classified as 'Green', i.e., from renewable sources. The scope of the definition encompasses both electrolysis-based and biomass-based hydrogen production methods. After discussions with multiple stakeholders, the Ministry of New & Renewable Energy has decided to define Green Hydrogen as having a well-to-gate emission (i.e., including water treatment, electrolysis, gas purification, drying and compression of hydrogen) of not more than 2 kg CO₂ equivalent / kg H₂. The notification specifies that a detailed methodology for measurement, reporting, monitoring, on-site verification, and certification of green hydrogen and its derivatives shall be specified by the Ministry of New & Renewable Energy.

BioCNG and small biogas plants commissioned under National Bioenergy Programme



RK Singh, Union Minister MNRE

New Delhi, India:

The Union Minister for New & Renewable Energy and Power has announced that the Ministry of New and Renewable Energy notified the National Bioenergy Programme (NBP) in November 2022 for the period 1st April 2021 to 31st March 2026. This programme, with a budgetary outlay

of ₹ 1715 crore, shall be implemented in two phases. The first phase has a budgetary outlay of ₹ 858 Crore. This programme provides Central Financial Assistance (CFA) for setting up of Bioenergy plants. As on 31st July 2023, six BioCNG plants and 11,143 small biogas plants have been commissioned, sanctions for which have been issued under the NBP guidelines notified on 2nd November 2022.

National Bioenergy Programme, inter alia, promotes the utilization of biomass such as surplus agricultural residue, agro-based industrial residue, industrial wood-waste, forest residue, energy plantation-based biomass etc. for energy generation and therefore would not pose a risk of deforestation. This information has been given

Indian Oil Chairman SM Vaidya receives tenure extension of 1 year



*The government has extended the tenure of **Indian Oil (IOCL) Chairman & Managing Director (CMD) SM Vaidya** by one year until a regular incumbent is appointed at the top post of the company.*

The official order mentions, "The Appointments Committee of the Cabinet (ACC) has approved the proposal of the Ministry of Petroleum and Natural Gas for re-employment on contract basis of Shri Shrikant Madhav Vaidya, Chairman, Indian oil corporation Limited (IOCL) for a period of one year beyond the date of his superannuation, i.e., w.e.f. 01.09.2023 till 31.08.2024 or till the appointment of a regular incumbent to the post or until further orders, whichever is the earliest."

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by R.K. Singh, Union Minister for New & Renewable Energy and Power, in a written reply to a question, in Lok Sabha on August 10th, 2023.

ONGC to transform into a low-carbon energy player, invest ₹ 1 lakh crore by 2030



Arun Singh, Chairman, ONGC Ltd

Mumbai, India: Energy Maharatna has crafted a robust roadmap to scale up its low-carbon energy portfolio significantly. In line with the PM's vision on renewables, which was spelt out in his Independence Day speech on 15 August 2023, ONGC has aligned itself with India's ambitious goals and is wholeheartedly

contributing to the nation's aim to curtail carbon emissions by 1 billion tons and simultaneously reduce carbon intensity by 45% by 2030. ONGC has been a pioneer in adopting various de-carbonization levers resulting in significant amount of emission reductions over the years. Integrating sustainable practices into core operations have enabled reduction in Scope-1 and Scope-2 emissions by 17% in last five years. ONGC has reduced its emissions by 2.66% in FY'23. ONGC plans

to significantly increase its spending on green initiatives to reduce its carbon footprint as a broader effort to achieve Net-Zero for Scope-1 and Scope-2 emissions by 2038. ONGC is in advanced stage of crafting collaborations with leading players in the energy space on various low-carbon energy opportunities including renewables, green hydrogen, green ammonia and other derivatives of green hydrogen. The company's strategic partnerships in the Oil to Chemical (O2C), refining, and petrochemical sectors reflect an astute understanding of India's evolving energy landscape.

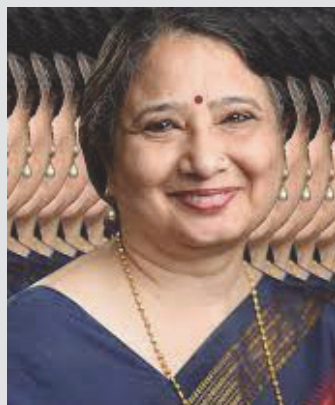
ONGC, will become Net-Zero by 2038 and invest ₹ 1 lakh crore by 2030 on energy transition projects to reduce carbon emissions. The Energy Maharatna has done internal workings and is now confident that we can achieve net-zero for Scope-1 and Scope-2 emissions by 2038, Chairman had informed in a recently held press conference.

Govt. introduces Ethanol blending in petrol

New Delhi, India: Government has introduced blending of ethanol in petrol under the Ethanol Blended Petrol (EBP) Programme with multiple objectives including reducing import dependence, savings in foreign exchange, providing boost to domestic agriculture sector and for associated environmental benefits.

The target of 10% ethanol blending set in the 'Roadmap for Ethanol Blending in India 2020-25' for ESY 2021-22 has already been achieved and Public Sector Oil

Parminder Chopra appointed as CMD of Power Finance Corporation Ltd.



Parminder Chopra has been appointed as Chairman and Managing Director (CMD), of Power Finance Corporation Limited (PFC) by Govt. of India w.e.f. 14th August 2023. Previously, she was holding the additional charge of Chairman and Managing Director (CMD), w.e.f. 01.06.2023 and was Director (Finance), PFC since 01.07.2020. With this, Smt. Chopra becomes the first woman to lead India's largest NBFC, PFC.

During her term as Director (Finance), she spearheaded the Finance Division, leading to the highest Net Profit, highest Net worth and lowest NPA levels. Such robust financial performance has also facilitated PFC getting the highest status of "Maharatna". She had also played a key role in the successful implementation of INR 1.12 trillion Liquidity Infusion Scheme (LIS) for the power distribution sector, which was rolled out as part of Atmanirbhar Bharat initiative by Govt. of India.



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Marketing Companies (OMCs) have started selling E20 (20% ethanol blended) petrol across the country. Further, the National Policy on Biofuels – 2018 targets 20% blending of ethanol in petrol by Ethanol Supply Year (ESY) 2025-26.

Numaligarh Refinery registers highest ever PAT at ₹ 3,703 Cr



Dr Ranjit Rath, Chairman, NRL during the AGM

Assam, India: Numaligarh Refinery Limited (NRL) has registered highest ever Profit After Tax (PAT) since its inception at ₹ 3,703 crore in FY 2022-23 as compared to ₹ 3,562 crore registered in FY 2021-22. NRL also recorded the highest-ever revenue from operations during the year at ₹ 29,786 crore, a surge of 26% YoY as compared to ₹ 23,547 crore in the preceding year. Chairman Dr. Ranjit Rath said, "It is the first AGM after the announcement of upgradation of NRL from Schedule - B to Schedule A CPSE by the Govt. of India. I take the opportunity to extend my hearty congratulations to

all of you for making it possible. This accomplishment has been the fruition of tireless efforts and outstanding achievements in every sphere of NRL's activities in its prolific journey of 30 years", as he addressed the shareholders.

REC extends ₹ 4,785 crore loan for HRRL project



Barmer, India: Rural Electrification Corporation Ltd (REC) has extended a loan of ₹ 4,785 crores to HPCL Rajasthan Refinery Limited (HRRL) for setting up a green field refinery cum petrochemical complex in Barmer district of Rajasthan. The loan has been extended as part of a consortium arrangement for ₹ 48,625 crores, wherein the share of REC Limited is ₹ 4,785 crores. The refinery cum complex will have a capacity of 9 Million Metric Tonnes per Annum (MMTA) and would require a total project cost of ₹ 72,937 crores.

The project also involves setting up a pipeline for transportation of Rajasthan Crude and imported crude; a pipeline for transportation of water to the refinery

Senthil Kumar N joins Indian Oil Board as Director (Pipelines)



Senthil Kumar N has joined the Board of Indian Oil Corporation Limited (IOCL) as Director (Pipelines), the Oil Maharatna said in an official statement. Before joining the Board as Director (Pipelines), Kumar was serving as Executive Director (Operations) at Indian Oil's Pipelines Division Head Office.

As the head of IOCL's cross-country pipelines network of nearly 18,500 kms, he will be responsible for the massive and complex pipeline infrastructure of the corporation that includes single point mooring systems, crude oil tank farms, city gas distribution networks and pipelines traversing through difficult terrain. Senthil Kumar N is an electronics and communication engineer with over 33 years of versatile experience in operations and maintenance of Indian Oil's countrywide network of oil & gas pipelines.

With the VEGAPULS 42 radar sensor, VEGA expands its IO-Link portfolio for factory automation and thus offers an optimal performance spectrum for all level, switching and pressure applications. The all-inclusive range of instrumentation from a single source makes everything easier – including the setup and operation of the most varied and complex processes.



VEGA expands radar portfolio for factory automation

Radar sensor in hygienic design

VEGAPULS 42 brings VEGA's decades of radar experience to factory automation. The sensor meets the special requirements of the industry for levels in small tanks or clocked filling processes. It is equipped with everything that hygiene-sensitive processes need: Its switching frequency enables high cycle rates and correspondingly fast level changes. Its flexible connection options range from standard threads to the universal connection for its 1-inch hygienic adapter. When delivered, it is immediately ready for operation and, in the 3-wire version, communication with IO-Link.

All the advantages of radar for automation

As a non-contact measuring principle, radar brings numerous advantages to the clocked processes in the food and pharmaceutical industries, such as filling, that other measuring

solutions cannot offer. The need for this is great, because reliable measured values are becoming increasingly important for efficient plant operation and optimal process control. With IO-Link, VEGAPULS 42 not only communicates universally, but can also be hooked up very quickly and inexpensively via a simple 3-wire connection. Sensor replacement is quick and automatic with the new Smart Sensor Profile 2, and adjustment is very easy using the VEGA Tools app on a smartphone with Bluetooth.

Double certainty through visualisation

With VEGAPULS 42, you can see at first glance if the process is running as it should or if there's a problem. An illuminated ring that changes colour allows the sensor to be read from all directions, and even from a distance. "This configuration not only gives you immediate certainty about the current condition of the sensor," explains product manager Marvin Moser, "but also another way to check the process status."

IO-Link

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Universal connection for hygienic adapter

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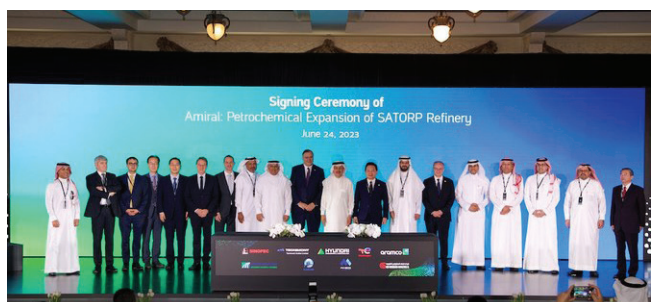
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Aramco & TotalEnergies award EPC contracts for Amiral petrochemicals project



Dhahran, Saudi Arabia: Aramco and TotalEnergies awarded Engineering, Procurement and Construction (EPC) contracts for the USD 11 billion "Amiral" complex, a future world scale petrochemicals facility expansion at the SATORP refinery in the Kingdom of Saudi Arabia. A signing ceremony took place in Dhahran attended by Amin H. Nasser, Aramco President and CEO, and Patrick Pouyanné, TotalEnergies Chairman and CEO. The award of EPC contracts for main process units and associated utilities marks the start of construction work on this joint project, following the final investment decision in December 2022. Integrated with the SATORP existing refinery in Jubail, the new petrochemical complex will house the largest mixed-load steam cracker in the Gulf, with a capacity to produce 1.65 million tons of ethylene

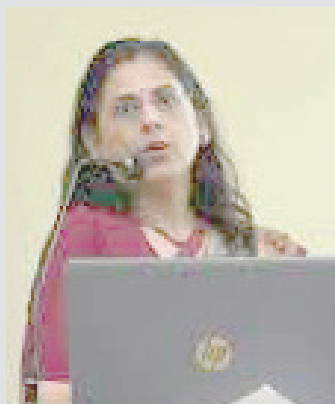
and other industrial gases per year. This expansion is expected to attract more than USD 4 billion in additional investment in a variety of industrial sectors (carbon fibres, lubes, drilling fluids, detergents, food additives, automotive parts and tires) and create around 7,000 direct and indirect jobs in the country.

Atlas Copco to expand manufacturing with new factory in Pune



Pune, India: Atlas Copco Group, a leader in compressors, vacuum solutions, generators, pumps, power tools and assembly systems, has begun construction of its new manufacturing facility in Talegaon, Pune. Atlas Copco's new state-of-the-art air and gas compressor system factory in Talegaon will manufacture systems for the local market and also for export. It encompasses a manufacturing plant and office building spanning a total of approximate 270,000 sq. ft. and the investment

NFL's Ritu Goswami to join RCF as Director (Technical)



Ritu Goswami is set to be next Director (Technical) of Rashtriya Chemicals & Fertilizers Limited (RCF), a PSU under the Ministry of Chemicals and Fertilizers. Presently, she is serving as General Manager (Technical) in National Fertilizers Limited (NFL), a PSU under the Department of Fertilizers. Goswami has been recommended for the post of Director (Technical) of RCF from a list of 11 candidates, who were interviewed by the PESB selection panel in its selection meeting held on August 9. Out of 11 candidates, five candidates were from RCF, two candidates from NFL and one each from Steel Authority of India Limited (SAIL), Engineers India Limited, ONGC Petro Addition Limited and DFPCL.

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planned is MINR 1400 (about MEUR 15.0). The new facility is planned to be completed by Q2, 2024. It will generate additional employment for over 200 people and add production capacity.

Philippe Ernens, President Oil-free Air division, commented on the announcement of the new facility, "We invest further in capacity in India to cater to the growing demand of the Indian and export markets. This expansion project is part of our strategy to remain first in mind, first in choice for our customers. It will enable us to reach new customers and markets and improve lead times to customers." Marcelo Kabilio, Vice President - Operations, Atlas Copco India, said, "Our passionate teams involved in designing and making these innovative products at this new factory will help support our customers' productivity and sustainability goals." At the Talegaon facility, around 80% of the energy will come from solar panels and three-fourths of the water consumed will be derived from rainwater harvesting. The construction will be in line with the LEED (Leadership in Environmental Energy and Design) concept.

Chemical recycling of polycarbonates reaches a major milestone

Leverkusen, Germany: Covestro has developed an innovative process for recycling polycarbonate, i.e., polychain plastics. In this process, plastics are converted back into their monomers, a precursor of plastics, so that they can be fed back into the production process as alternative raw materials. At Covestro in Leverkusen, the technical implementation of chemical



recycling is now beginning on a pilot scale. On the way to industrial scale, the process is still being optimized and is undergoing further development stages. Chemolysis can directly close the polycarbonate cycle as the newly developed process, which was driven by an international team, is a specific chemolysis process adapted to polycarbonate. "Pre-sorted waste streams containing a product content of more than 50 percent polycarbonate can be recycled this way. This has been successfully demonstrated with various polycarbonate-containing plastic waste streams," explains Markus Dugal, Head of Process Technology at Covestro. "With the help of this chemolysis, the cycle can be closed to a direct precursor of polycarbonate. This makes the recycling process very sustainable."

Rahul Tikoo joins Innovative chemicals company Optime as MD & CEO



*Optime, an innovative and differentiated specialty chemicals company, announced appointment of industry veteran **Rahul Tikoo as its Managing Director and Chief Executive Officer** with immediate effect. Tikoo takes over this leadership position after having recently served as the Managing Director for Huntsman's South Asia Business and as a member of its European Leadership Team, driving sustainable growth across EMEA markets. He brings over 25 years of exceptional and rich leadership experience, having successfully driven business growth at renowned companies such as Agfa, Akzo Nobel, and BYK.*

Advantages of metallic evaporators in phosphoric acid production



In the construction of wet process phosphoric acid plants, various materials such as stainless steels, nickel alloys and graphite are required depending on the corrosive conditions. As such, material selection is extremely critical for the equipment used, including tanks, filter sections, and concentration units. This article focuses on the application of stainless steels in the evaporator heat exchangers for phosphoric acid concentration. The advantages of metallic heaters are compared to the graphite heaters, with considerations of the types of corrosion.

Metallic heaters are more efficient than graphite heaters

Traditionally, graphite has been the material of choice for constructing phosphoric acid evaporator tubes. However, metallic tubes offer significant advantages over graphite tubes. While graphite's higher thermal conductivity appears advantageous on paper, in practice, as scale builds up, heat transfer efficiency

rapidly decreases, nullifying the benefit. Instead, it is important to reduce scaling as much as possible by, for example, increasing acid velocity through the tubes. Nevertheless, higher acid velocity can lead to substantial erosion and wear problems in the inlet of graphite evaporators. This is where the superior mechanical strength of metallic materials comes into play, as they minimize erosion and allow for higher acid velocities to be used.

A theoretical comparison in Table 1 presents differences between graphite tubes and special stainless steel tubes for a given evaporator unit. Assuming the flow of 40% P₂O₅ at 75°C in the tubes and saturated steam at 125°C is used as the heating medium, the first alternative, the stainless steel replacement, provides insights into the area required for graphite tubes and the area required for replacement with metallic tubes. The second alternative considers a new unit, leveraging the better mechanical strength of the metallic material. Thus, the acid velocity can be increased, without any risk of tube breakage, resulting in a higher acid coefficient and significantly lower fouling rate. This combined effect leads to a 20% increase in capacity over the graphite unit, all while maintaining a constant

	Graphite*	Stainless steel** Replacement	New unit
Tube, inner diameter, mm	38.1	33.9	33.9
Acid velocity, m/s	2.3	2.3	4.0
Coefficient, acid	5.350	5.500	8.550
Coefficient, fouling***	1.250	1.250	2.000
Coefficient, tube wall	20.000	5.500	5.500
Coefficient, steam	6.650	5.600	5.600
Overall coefficient	840	750	1.020
Required area (relative)	1	1.13	0.82
Capacity	1	1	1

* 2 in x 1.5 in

** Sanicro® 28, 38.1 x 2.11 mm (1.5 in x 14 BWG)

*** Estimated values Coefficients are given in kcal/m²hC

Table 1. Comparison of heat transfer data for graphite and special stainless steel heat exchanger tubes in a 40% P₂O₅ evaporator



Figure 1. Fractured graphite tubes in Phosphoric Acid evaporator.

IMPACT FEATURE

heat transfer area. By effectively designing shell-and-tube heat exchangers, using metallic tubes proves to be a better choice, compared to graphite tubes.

Regular cleaning of evaporator tubes is essential to remove gypsum and other salts. However, due to the brittleness of graphite, graphite tubes are prone to breakage during scale removal, even with high-pressure washing. Metallic heaters are easier to clean and require less frequent cleaning operations, which brings a positive effect on production economics. Additionally, graphite tubes require a thicker wall of 6mm, whereas metallic heaters can be constructed with a thinner wall of 2.11 mm. Therefore, this risk is eliminated with metallic tubes.

Corrosiveness of phosphoric acid

The corrosion resistance of stainless steel is attributed to its capacity to form a protective oxide layer, primarily composed of chromium. Consequently, materials with higher chromium content exhibit an enhanced ability to create this protective oxide layer. Additionally, there are a few other elements that can also influence the overall corrosion resistance of the alloy. For example, if the stainless steel can maintain a protecting oxide layer that resists the corrosive environment, it can last indefinitely. However, if service conditions change and become more aggressive, this could cause the oxide layer to lose its protective properties.

Pure phosphoric acid is less corrosive than sulphuric acid and nitric acid, making stainless steels like Sanmac® 316/316L or 317L from the 300 series suitable for handling pure phosphoric acid. However, the corrosiveness of phosphoric acid during wet-process concentration is quite complex and depends on several

Constituent	Range	Median
P ₂ O ₅	29-38	33
CaO	46-54	51
SiO ₂	0.2-8.7	2
Al ₂ O ₃	0.4-3.4	1.4
MgO	0.1-0.8	0.2
Na ₂ O	0.1-0.8	0.5
CO ₂	0.2-7.5	4.5
F	2.2-4.0	3.7
Cl	0.0-0.5	0.02
SO ₃	0.0-2.9	1.0
CaO:P ₂ O ₅ weight ratio	1.35-1.70	1.5

Table 2. Typical analysis of commercial phosphate rocks.

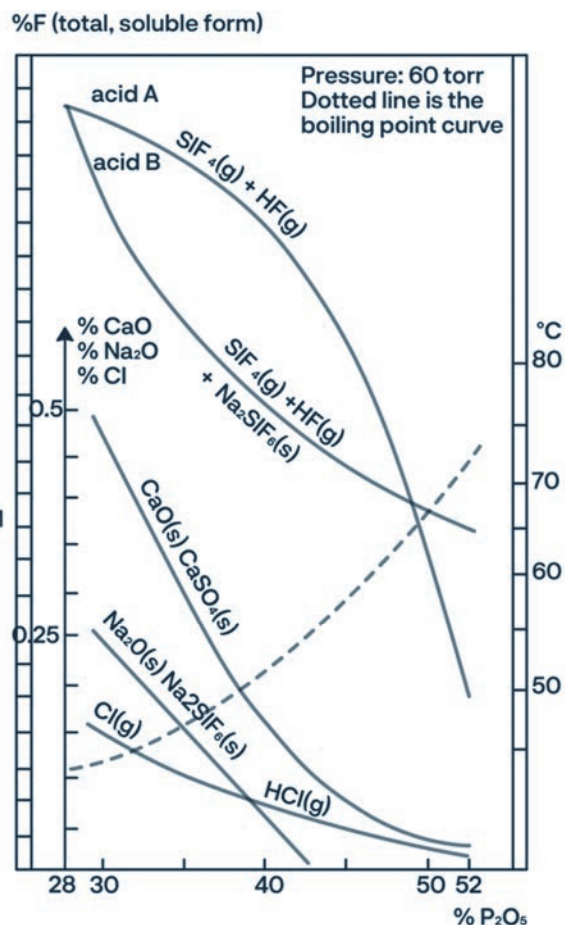


Figure 2. Change in acid composition during concentration.

factors, such as impurity levels. Impurities including sulphuric acid, chlorine, and free fluorine can increase the corrosivity of the medium. While Aluminium (as Al³⁺), Iron (as Fe²⁺), Ca, Na, and Silica can reduce corrosivity by forming fluorosilicates. However, excessive content of these elements may lead to increased corrosivity due to the formation of salts.

The composition of phosphates from different sources varies considerably. Table 2 provides an illustration of this diversity by presenting the typical compositions of fifteen commercial phosphate rocks. The data includes ranges and median values, although compositions beyond these ranges are also found. The most corrosive phosphate rocks originate from Syria, Jordan, Israel, and Mexico.

Corrosion parameters during acid concentration

When phosphoric acid is concentrated, the concentrations of certain impurities including fluorine, calcium oxide, sodium oxide and chlorine can decrease, while the iron, alumina and magnesium concentrations

	A. Low impurity		B. High impurity	
	Filter acid	Concentrated acid	Filter acid	Concentrated acid
P ₂ O ₅	28	52	28	52
F	2.4	0.6	2.4	1
Cl ⁻	0.15	0.01	0.15	0.01
SiO ₂	0.6	0	1.2	0
Fe ₂ O ₃	0.3	0.5	1.1	1.85
Al ₂ O ₃	0.3	0.5	1.1	1.85
Na ₂ O	0	0	0.25	0
F in SiF ₆	1.15		2.05	
F in HF	1.25		0.35	

Table 3. Chemical composition of acids before and after concentration (wt-%).

may increase at the same rate as the P₂O₅ content. Additionally, the temperature varies across different parts of a plant, leading to changes in corrosion parameters over a wide range. This is illustrated in Figure 2, depicting the variations in these parameters during the concentration process for two acids (direct from the filter) with different impurity levels.

Table 3 provides the compositions of the two acids. Acid B demonstrates lower corrosiveness compared to acid A right after it is removed from the filter, mainly due to the presence of SiF₆²⁻ binding most of the fluorine. Acid B also shows a sharp decrease in fluorine content in the 28% to 45% range, due to higher evaporation of SiF₄ and precipitation of Na₂SiF₆. At 52% P₂O₅, the relationship of the fluorine content in the two acids shifts, resulting in a reversal of corrosiveness.

Alloys for phosphoric acid applications

Standard stainless steels, including Sanmac® 316/316L or 317L, have been widely used

Alloy	C max	Cr	Ni	Mo	Cu	Others
AISI 316L	0.03	17	12	2.5	–	
AISI 317L	0.03	18	14	3.5	–	
2RK65*	0.02	20	25	4.5	1.5	
Alloy 20	0.07	20	34	2.2	3.3	Nb
Alloy 825	0.05	21.5	42	3	2.3	Ti
Sanicro® 28**	0.02	27	35	3.5	1	
Sanicro® 35	0.03	27	35	6.5	0.2	
Alloy G	0.03	22	45	6.5	2	W,Co,Nb
Alloy C	0.08	15.5	54	16	–	W,Co
Alloy 625	0.1	21.5	60	9	–	Nb,Ta

Table 4. Compositions of alloys used in phosphoric acid service.

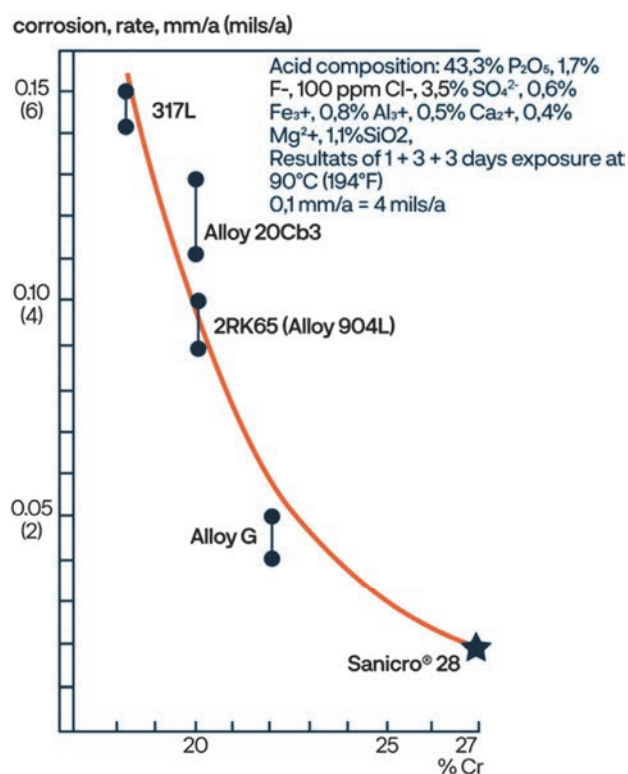


Figure 3. The corrosion rate of certain alloys with respect to the chromium content.

in phosphoric acid plants for piping systems, filters and pumps. However, for the most severe conditions, special high-alloy stainless steels and nickel-chromium-molybdenum alloys are necessary. The effect of chromium is two-fold; it significantly reduces the corrosion rate in the passive state, which is important in preventing corrosion, and in the active state. Molybdenum also facilitates passivation, but it does not have any marked effect in reducing corrosion in the passive state, and the same applies to copper.

Sanicro® 28 was originally designed for the production of phosphoric acid, especially for use in heat exchangers within the concentration unit, where corrosive conditions are most severe. Sanicro® 28 serves as a replacement for graphite tubes in heat exchangers handling concentrated phosphoric acid. The effect of chromium is illustrated in Figure 3, which is a compilation of laboratory test results using synthetically produced "Florida acid".

The life expectancy of metallic heaters is typically around ten years, but Sanicro® 28 has been proven to have successful applications for up to twenty years. Since 1980, over fifty heaters worldwide have been equipped with Sanicro® 28 tubes, with the largest single delivery for twenty-four heaters in Romania.

IMPACT FEATURE

Phosphate	% P ₂ O ₅	Temperature °C	Alloy	Corrosion rate mm/year
Kourigba	54	110	Sanicro® 28	0.14
			Alloy 625	0.26
			Alloy G-3	0.21
Morocco + Togo	52	110	Sanicro® 28	0.17
			Alleima® 2RK65	0.65
Tunisian	54.4	100	Sanicro® 28	0.04
Apatite	54	110	Sanicro® 28	0.16

Table 5. Comparative test results for some alloys exposed 1+3+3 days in technical phosphoric acid.

In the early 1980s, four plants with six lines each for producing phosphoric acid were installed in Romania, initially with graphite heat exchangers. In 1984, all lines used for producing phosphoric acid were converted to Sanicro® 28, resulting in over 85% of the original tubing still in operation in 2001. Sanicro® 28 has demonstrated successful performance in several plants, utilized in both forced-circulation evaporation and Prayon heating element types of systems. When made with a proper heat exchanger design, Sanicro® 28 tubes outperform graphite tubes, extending their lifespan by several years.

Table 5 shows that Sanicro® 28 has a lower corrosion rate compared to other alloys when exposed to different phosphate sources.

Acids with 42-43% concentration are produced from a

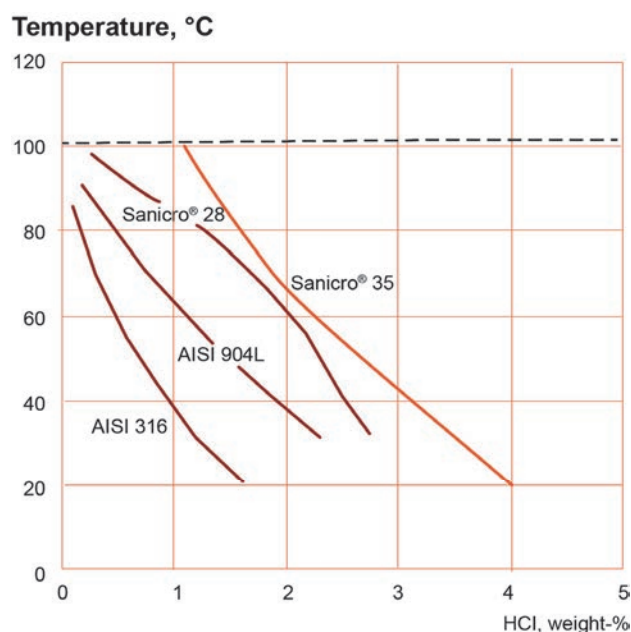


Figure 4. Isocorrosion in hydrochloric acid. The curves represent a corrosion rate of 0.1 mm/year.

mixture of rocks from Morocco and Togo. In the past, rocks from Kola and Florida have also been used. Each line produces 250 tons/day, with cleaning every ten days. The steam temperature for the graphite heaters was 160°C at 4 bar, which was reduced to 125°C at 1.1-1.2 bar for the heaters in Sanicro® 28.

Our award-winning super-austenitic stainless-steel alloy, Sanicro® 35

Building on the success of Sanicro® 28, Alleima introduced Sanicro® 35 in 2020. It has similar Cr content and higher Ni and Mo content; the higher Mo content significantly increases its localized corrosion resistance against halides (chlorides and fluorides), reflected in its higher Pitting Resistance Equivalent number of 52 compared to ~40 for Sanicro® 28.

Figure 4 demonstrates Sanicro® 35 general corrosion resistance in hydrochloric acid. Sanicro® 35 outperforms Sanicro® 28, particularly in cases where severe corrosion mechanisms involving pitting and general corrosion due to halides are prevalent. The impressive test results in phosphoric acid make Sanicro® 35 a promising choice, with multiple installation cases being considered. ■



Author

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Lead Scientist
Alleima



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BP to use Honeywell technology to increase sustainable aviation fuel production



Nigel Dunn, Sr. VP - biofuels growth, bp

Charlotte, USA: Honeywell has announced that bp selected Honeywell's Ecofining technology to help support the production of sustainable aviation fuel (SAF) at five bp facilities across the globe. Honeywell UOP Ecofining technology will be installed at the following bp sites:

Cherry Point refinery in Blaine, Washington; Rotterdam II refinery in Rotterdam, Netherlands; Lingen refinery in Lower Saxony, Germany; Castellón de la Plana refinery in Castellón, Spain and Kwinana Oil refinery in Kwinana, Australia. Ecofining is a proven, ready-now technology, and its simplified design provides bp a capital and cost-efficient solution to increase bp's SAF production from renewable feeds. It will help bp achieve its aim to supply 20% of the SAF market globally by 2030. SAF produced from Honeywell's Ecofining technology is certified for use according to international standards. It can be used as a drop-in replacement without engine modifications and currently can be used in blends of up to 50 percent with the remainder as conventional

(fossil-based) jet fuel. "bp has an established global biofuels business that is positioned for rapid growth utilizing Honeywell's technology. The world's demand for SAF is set to increase dramatically and bp seeks to play an important role in helping the airlines to decarbonise," said Nigel Dunn, senior vice president biofuels growth, bp.

Mitra Chem announces first close of USD 60 million Series B Round led by GM



California, USA: Mitra Future Technologies Inc. ("Mitra Chem"), a leading innovator in North American production of lithium-ion battery materials, announced the completion of a USD 40 million first close of USD 60 million Series B funding round led by GM. The investment will fuel Mitra Chem's mission to develop, deploy and commercialize U.S.-made iron-based cathode materials in an effort to enable mass-market electrification for electric vehicles, energy storage solutions, and beyond.

Anant Maheshwari named Honeywell High Growth Region President and CEO



*Honeywell announced that **Anant Maheshwari has been named President and CEO of Honeywell's High Growth Region portfolio, effective September 4, 2023. He will succeed Ben Driggs, who will be taking another leadership role in the company. Maheshwari will be a Corporate Officer of the Company, reporting directly to Honeywell CEO Vimal Kapur and will be located in Dubai, United Arab Emirates. In his new role, Maheshwari will lead business growth across Honeywell's geographies in China, India, Southeast Asia, Central and Eastern Europe, the Middle East, Central Asia, Africa, and Latin America. He previously had leadership roles of increasing responsibility at Honeywell from 2004 to 2016, launching new businesses and leading mature business portfolios. He ultimately became President of Honeywell India as a key driver in the company's high growth region strategy.***

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As part of the partnership with GM, Mitra Chem will develop iron-based cathode active materials (CAM) like lithium manganese iron phosphate (LMFP) to power affordable and accessible EV batteries compatible with GM's EV propulsion architecture, the Ultium Platform. GM's funding will enable Mitra Chem to scale its current R&D and pilot operations to expedite bringing their battery materials to market. Mitra Chem has been at the forefront of battery technology research, focusing on developing sustainable and high-performance energy storage solutions.

Rondo Energy secures USD 60 million from to speed industrial Decarbonization



California, USA: Rondo Energy, a leading provider of zero-carbon industrial heat and power, has raised \$60 million in a new financing planned to speed the rollout of Rondo Heat Batteries worldwide and to transform the global energy storage market. The financing brings together funding from current Rondo investors Breakthrough Energy Ventures, Energy Impact Partners, SCG, and Titan, industrial leaders including Microsoft's Climate Innovation Fund, Rio Tinto, SABIC, Aramco Ventures, and climate investors SDCL Energy Efficiency Income Trust (SEEIT) and John Doerr. Rondo will use this funding to grow its international operations and to develop and build storage projects around the world.

"We are honoured and excited by this opportunity to go faster by working with these leaders, Our Strategic Investor Advisory Board will help Rondo focus on the simplest, fastest ways to power their operations with low-cost clean energy and shape our priorities for ongoing research and development," said John O'Donnell, CEO of Rondo Energy. "To tackle our climate challenge, we need tools to build big, low-cost, clean energy infrastructure fast. The Rondo Heat Battery is one of those tools. This investment will help us grow our capacity to meet customer demand and begin to build at scale."

India's first cathode active materials plant inaugurated by Altmin-ARCI



Hyderabad, India: Battery materials firm Altmin and ARCI, under the Union Ministry of Science and Technology, have launched a 10 MW pilot plant for producing Cathode Active Material (CAM) - first of its kind in India - at the latter's campus in Balapur, Hyderabad. The facility is poised to make 100 kilos of CAM per day, marking India's foray into the local production of CAM meant for the manufacturing of advanced chemistry Li-ion battery cell. The maiden product under the partnership would be Lithium Ferrous Phosphate (LFP) that has humongous market demand for making electric vehicle batteries. The International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) is supporting Altmin as a technology partner and has backed the company's R&D endeavours as well. Altmin strives to become a leading producer of indigenously developed battery materials and develop its own cell chemistries. In this specific partnership with ARCI, the licensing of the CAM produced lies exclusively with Altmin internationally, while at the domestic front, the private firm has a non-exclusive arrangement. Altmin claims to have already secured interest from major battery players in India and across the globe. The company has partnered up with Yacimientos de Litio Bolivianos (YLB), Bolivia for a consistent and secure supply of battery-grade lithium carbonate, which is pre-requisite for the planned CAM production and future scale-up. ■

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PROJECT UPDATES

GAIL plans ₹ 30,000 crore capex over next three years

Mumbai, India: GAIL India is planning to invest ₹ 30,000 crore over the next three years. The investment would be used for pipelines, ongoing petrochemical projects, city gas distribution (CGD) projects, as well as operational capex, equity contribution in group companies. The company also expects its natural gas transmission volumes to expand 12 percent and polymer sales to double in FY24. The company said that it has issued an expression of interest (EoI) to explore equity acquisition in LNG liquefaction terminal. The company has also taken steps to provide connections with its natural gas pipelines to the upcoming new gas sources.

L&T bags order for Perdaman's Urea Plant in Australia



Subramanian Sarma, Whole Time Director & Senior Executive Vice President (Energy), L&T

Mumbai, India: The Saipem & Clough JV (SCJV), Australia has awarded a contract for fabrication and supply of process and pipe rack modules for a 2.3 MMTPA urea plant for Perdaman Chemicals and Fertilisers Pty Ltd to L&T Energy Hydrocarbon. The plant will be constructed on the Burrup Peninsula,

approximately 20 km north of Karratha, Western Australia. On completion, this state-of-the-art facility will be the largest urea plant in Australia and one of the largest in the world. The scope comprises about 50,000 MT of modules to be delivered in 32 months. These modules will be fabricated at L&T's Kattupalli Modular Fabrication Facility. Fabricated Modules will be shipped in a fully tested, pre-commissioned and ready to install condition to the project site in Australia. Commenting on the occasion, Subramanian Sarma, Whole Time Director & Senior Executive Vice President (Energy) said, "This project award is yet another testament to our capabilities, reinforcing our position among the leading module fabricators globally. This milestone aligns with our strategic goal of expanding geography and client base and underscores our commitment to extend the concept of modularization to onshore projects."

Lubrizol commits USD 150 million investment in India



Rebecca Liebert, President & CEO, Lubrizol

Cleveland, USA: The Lubrizol Corporation, a global leader in specialty chemicals, is advancing its commitment to continued growth in India with several significant projects across its portfolio. The company is pledging more than 150 million USD of in-region investment, including breaking ground on

India's largest CPVC resin plant in Vilayat, Gujarat, doubling capacity at its site in Dahej, Gujarat, opening a grease lab in Navi Mumbai and enabling significant in-country job growth and innovation. "India is among the fastest-growing global economies with a favourable climate for business investment, including regional growth in many of the industries we support," said Lubrizol President and CEO Rebecca Liebert. "We are building on 50 years of success in India by adding new manufacturing, lab and R&D sites, supporting in-country innovation and adding jobs that capitalize on the great expanding workforce and business conditions in India, allowing us to serve needs not only in India but in surrounding countries."

Nakshtra Biofuels to expand capacity of its distillery unit in Haryana

Karnal, India: Nakshtra Biofuels is planning to expand its grain-based distillery unit capacity from 120 klpd to 500 klpd at Kadrabad village in Indri tehsil, Karnal district of Haryana. The proposed unit will also involve the expansion of the co-generation power plant from 3.5 MW to 10 MW. Presently, the company is awaiting environmental clearance for the project, and they plan to commence work on the project by December 2023.

thyssenkrupp bags EPC contract from Indian Oil Corporation

Mumbai, India: Indian Oil Corporation Limited (IOCL) has awarded an EPC contract to thyssenkrupp Industrial Solutions India Private Ltd. (tkIS India) of approximately more than USD 100 Million for 60

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PROJECT UPDATES

KTPA Poly Butadiene Rubber Plant (PBR) for their Panipat Refinery & Petrochemical Complex, Haryana in India. Polybutadiene rubber, manufactured from the polymerization of butadiene finds its applications in the manufacture of tires and additives. thyssenkrupp Industrial Solutions India Private Ltd. with its experience in implementing various refinery and petrochemical projects will execute this project on an LSTK basis based on technology from a reputed licensor. The lump-sum EPC scope includes residual process engineering, detail engineering, Project Management, Procurement, Construction, & Commissioning of the plant.

Jakson Green to build methanol production unit at NTPC's Vindhyachal plant



Vindhyachal, Madhya Pradesh: Jakson Green has won a first-of-its-kind project from National Thermal Power Corporation (NTPC) to establish a Methanol synthesis facility at Vindhyachal, Madhya Pradesh. The subject Methanol synthesis plant will be a part of NTPC's Vindhyachal Thermal Power plant with a production capacity of 10 tonnes-per-day (TPD). Methanol is a cleaner alternative fuel that can be used for various purposes, including Power generation and transportation. The Methanol production unit is being designed to convert 20 TPD CO₂ to 10 TPD Methanol through a catalytic hydrogenation process, utilising CO₂ from thermal plant flue gas through a carbon capture unit and green hydrogen produced by electrolysis. Jakson Green will oversee the entire design, engineering, procurement, and construction of this project on turnkey basis, in partnership with NTPC. Jakson Green will oversee the entire design, engineering, procurement, and construction of this project on turnkey basis, in partnership with NTPC. The

company will establish the plant on a fast-track basis and is confident that the project's success will pave the way for more such projects in the coming future.

Linde India receives LoA from IOCL for air separation unit

Mumbai, India: Linde India has received a letter of acceptance (LoA) from the Indian Oil Corporation (IOCL) in connection with the job-work contract for setting-up of Air Separation Unit (ASU) on a site licensed by IOCL within its Panipat Refinery Complex for production and supply of Instrument Air, Plant Air and Cryogenic Nitrogen to IOCL Panipat Refinery Expansion Project (P25). On completion of the construction and the performance test of the aforesaid ASU, Linde India will enter into requisite Agreements with IOCL for operating and maintaining the facility for a period of 20 years from the first delivery date. Linde India expects to fund the capital expenditure by its own funds/internal accruals.

Shell Energy India to invest ₹ 3500 crore in Gujarat

Gujarat, India: Shell Energy India has signed a memorandum of understanding (MoU) with the Gujarat government. Under the MOU, the company is planning to invest ₹ 3,500 crore in Gujarat to set up a renewable energy facility, EV charging stations, and an LNG regasification terminal. Shell Energy India will invest ₹ 2,200 crore for the RE production facility on 1,200 acres in Banaskantha district, North Gujarat as per MOU. The facility would create employment for more than 1,000 people. The commercial production is expected to begin by 2027.

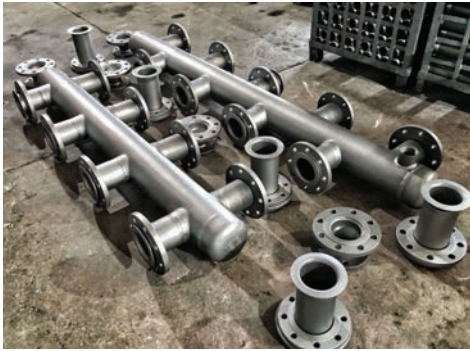
KKR-Vedanta JV ties up ₹ 2,600 cr loan to finance green projects

Mumbai, India: KKR and Vedanta joint venture (JV), Serentica Renewables, has tied up a loan of ₹ 2,600 crore from Power Finance Corporation (PFC) to finance green power projects, which are being built to meet captive needs of Vedanta Group companies, and BALCO in particular. The total cost of those projects is around ₹ 3,500 crore. Serentica Renewables would build solar and wind projects in Karnataka. The company added that it is in the process of building renewable power projects with a capacity to generate over 1.5 GW of power. The company is also planning to install 5,000 MW of carbon-free generation capacity along with storage technologies. ■

Manufacturer of Piping Products (Pipe Fittings), Hot Induction Bends & Piping Spools.



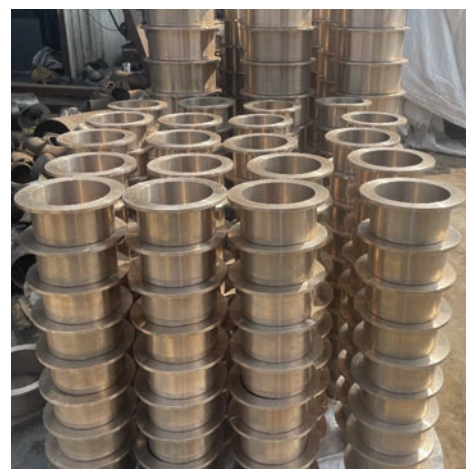
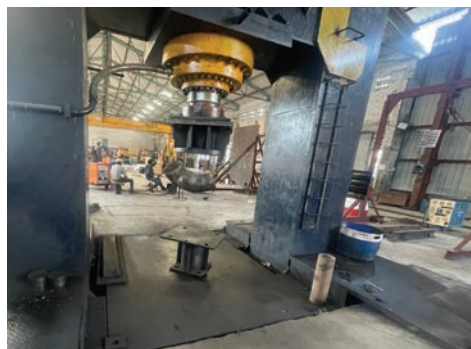
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Digital Technologies Increasing Resilience of Inspection and Safety Services

The process industries as well as the testing, inspection, and certification (TIC) sectors are undergoing considerable transformation as a result of digital technology, with new entrants and technological advances frequently driving the change. These developments will have a significant impact on all the stakeholders who provide, receive and implement these services, as well as how, where, and when they are delivered over the next ten years. In addition to enhanced safety of the factories, refineries, plants, this will affect revenue streams considerably and merits attention from CXOs.

Safety is a quality or state of being “safe”, the condition of being protected from harm or other danger to person, property or the environment, brought about through changing how people behave and/or how the physical environment of equipment and systems is designed to lessen the likelihood of occurrence of potential hazards to an acceptable level of risk.

Process safety generally refers to the prevention of unintentional releases of chemicals, energy, or other potentially dangerous materials (including steam) during the course of chemical processes that can have a serious effect to the plant, personnel and environment.

Demand In the Industry And Revenue Stream Changes

TIC processes, regardless of industry, strive to confirm the effectiveness, safety, and security of a product, service, process or system. TIC verifications can be divided into two groups based on when they occur - design/ type examination prior to putting in service, or in-service examination. The first type is done before launch of the product while the second type is carried out when the product is in use or service.

In addition to in-house verifications, TIC businesses make an invaluable contribution by independent verification of new or installed - companies, processes, systems, services, EPC projects, process plants such as refineries, chemical plants, power plants, heavy engineering, light engineering, food, textile and other diverse industries as well as items and equipment, on

behalf of regulators, plant owners and buyers. The TIC industry experts conduct the verifications at their desks, on-site, or in laboratories. The demand for these outside services is increasing along with the growth of global trade, regulatory restrictions, and outsourcing. The TIC market grew by about 8% yearly on an average during the last ten years, with EBIT margins of 10% to 15%.

According to a survey by leading company, biggest mistakes leaders make concerning the digital transformation of their companies are:

- Lack of understanding of digital trends and the impact on the company
- Lack of strategic direction
- Organizational resistance to change

Now, Inspection companies are embracing digital transformation by replacing paper forms with mobile data collection, utilizing connected systems for data communication and analysis, capturing data from IIOT devices, using Virtual Reality or remote viewing devices, drones, robots, creating a central repository for advanced analytics, reducing human error, and

Benefits of Safety Studies

- Hazard Identification
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- Improved Reliability
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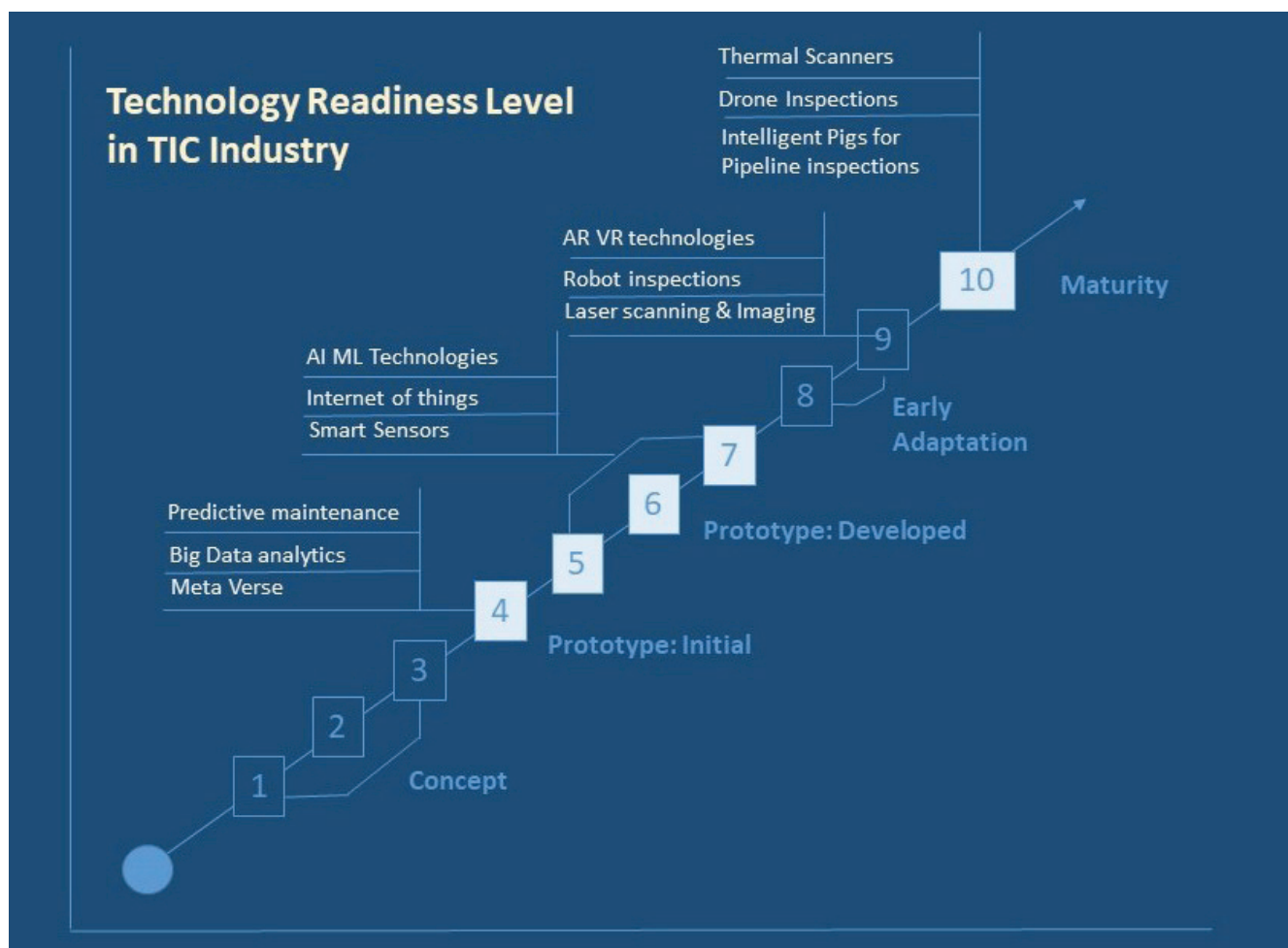
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improving decision-making for increased uptime, safety, and equipment longevity. The systems need to be developed in-depth to increasingly integrate the human intelligence/ expertise.

The Possibilities of Meta verse Technology in the Oil and Gas Industry

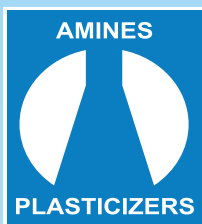
The Meta Verse is a topic of much discussion and speculation as the world continues to move closer to digital transformation. The pandemic has shown that digital transformation is essential for a company's long-term resilience and competitiveness. It is still in its early stages, but new technologies are making it possible, with digital twins as the foundation.

In oil and gas production, the Meta Verse has the potential to improve efficiency through predictive maintenance and increase safety through simulations. The ability to pipe data from the physical world into a digital model allows for software techniques such as analytics, simulations, and autonomous control. This can save companies time and money by reducing the risk of equipment breakdowns and improving safety on oil rigs.

The energy sector must participate in the Meta Verse to remain competitive and avoid negative outcomes. Fast-track innovation offers the opportunity to implement smaller projects with less cost, allowing for quicker and decentralized implementation. This has already made important projects possible due to its lower effort compared to regular innovation processes.

AI-based Evaluation of Simulation Data for Wind Turbines

At OBS Renewable Energies, simulations of wind turbines and wind farms are conducted to identify safety-critical anomalies and ensure the certification of the plants. Previously, this process involved manual evaluation of a large amount of data generated by the simulations. However, with the advancement of technology, the use of AI-powered software for load analysis is being considered to streamline the process, enhance accuracy, and quickly detect previously identified anomalies. This solution is cost-effective and can be quickly implemented, making it ideal for rapid innovation.



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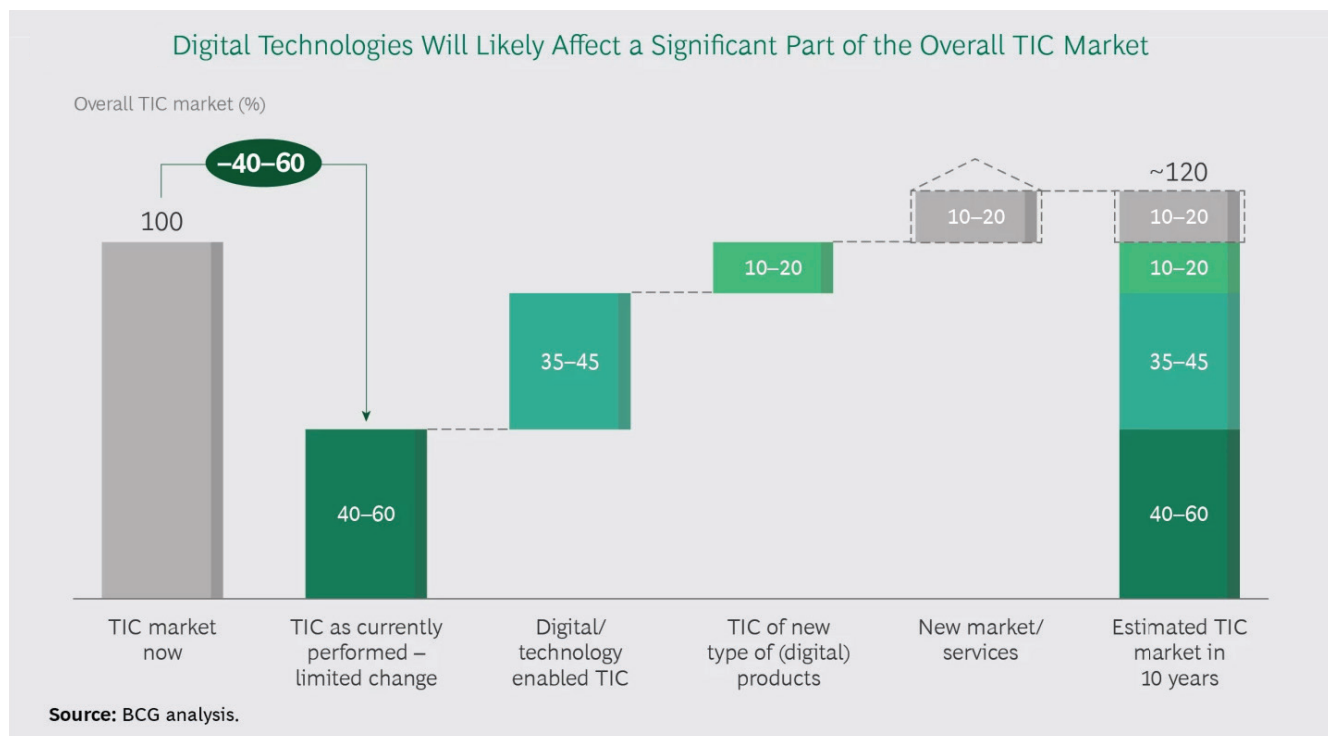
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Integration of Block-chain Technology for Demonstrating Green Hydrogen

Block-chain technology can also execute decentralized programs, including smart contracts. Smart contracts are digital contracts that can automate the execution of agreements based on predefined conditions. This can make business processes faster, safer, and more transparent, and ensure that contracts remain fair and enforceable in the digital environment.

In addition to financial transactions, block-chain technology can also be used to map and verify supply and value chains, making them fairer and more transparent. For example, the production of hydrogen, which is considered one of the energy carriers of the future, can be verified for sustainability using block-chain. This would provide a high degree of automation and unprecedented transparency for customers and regulators, as information about the production process would be fully visible and unalterable once recorded.

Overall, block-chain technology has the potential to revolutionize the way we conduct transactions, enforce contracts, and verify supply chains, making them safer, fairer, and more transparent.

Big data and Analytics

TIC providers will need to manage and analyse growing amounts of data from tested and inspected objects. Big data and analytics can provide better insights and

lead to new services such as predictive maintenance and data-based consulting in new industries. Advanced data analysis capabilities will be necessary to keep up with increasing data complexity, and new entrants with these capabilities will have an advantage.

Connected Devices

Thanks to the growing demand for connectivity standards in IoT (Internet of Things) innovations in manufacturing, pharma, chemical and fertilizer industry to achieve critical factors is leading to an increase in demand for TIC services. However, non-TIC companies that become gatekeepers to connected data may limit opportunities for traditional TIC players. Consumer product companies that have access to large amounts of consumer data can use it to offer testing and inspection services.

Adoption of Virtual/Augmented/ Assisted Reality (VR/AR) for Inspection Resilience:

The increasing adoption of VR and AR devices for real-time assistance in various tasks is expected to create a significant opportunity in product testing. Some TIC companies are already exploring AR for inspections to enhance their service quality and efficiency. However, traditional TIC players should consider that they may be reliant on non-TIC players such as Google and Microsoft for the newest VR/AR technologies being developed by them.

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FEATURES

Smart Sensors and digital processing

Smart sensors embedded in products continuously supply data, allowing for 24/7 remote monitoring and inspection, as well as safety and security checks and predictive maintenance. This reduces the need for in-person inspections and increases the demand for secured data generation and analysis. TIC companies are currently testing online monitoring of equipment such as elevators and pressure vessels.

Challenges in digital transformations of the industry

Well, though we often say, "Change is the only constant", the initial resistance won't lose your back easily with any change in industrial space. For me, it was particularly difficult to bring together communication, and the interests of the stakeholders, especially because it was a cross-divisional project. For example, it was about which services to prioritize in the project, which markets we wanted to cover and how the new services could fit into TÜV NORD Group. Majority of the time being spent to hold the threads together, i.e. involving, convincing and informing all stakeholders. If those affected are not sufficiently involved, you more quickly encounter a negative attitude towards the project.

Digital TIC Companies

Traditional TIC players are getting more and more competition from start-up and incumbent TIC companies with a digital focus. For example, within 48 hours of scheduling an appointment, the inspection is conducted and a detailed report is available online the same day.

A report by leading consulting company, predicts that, in the next 10 years, digital technologies will impact 40-60% of the current TIC market. This shift will result in more TIC activities being performed digitally and the creation of TIC services for new digital products. The availability of additional data through these digital trends will allow TIC companies to offer new, value-adding services.

Tapping the expectations by customers, as a step towards operational excellence with aim of digitalizing the processes and bringing customer delight, TUV India also launched digitalization in TUV India's Inspection Services as "TUV INDIA Inspection Management & Execution Software: TIIMES" to eliminate traditional operational challenges. TIIMES is meticulously developed in-house, with active participation from

process owners across multiple phases. Stringent safeguards have been instituted to ensure the preservation of confidentiality.

Employing an intuitive interface, this tool is seamlessly adopted by all team members, guiding them through tasks ranging from inquiry reception to inspection report submission, each aligned with their designated responsibilities. TUV India will soon launch the customer interface for reports, feedbacks, interactive dashboards for expediting services in TIIMES.

Conclusion

Safety inspection, an essential step in ensuring the safe operation of critical systems and processes, plays a crucial role in reducing the risk of harm to people, equipment, and the environment, reduce absenteeism and increase turnover, productivity and quality and raise employee morale. In other words, safety is good for business. Plus, protecting workers is the right thing to do apart from being a regulatory concern.

And to support that, although the evolution of digital technologies in safety inspections to provide resilience has only just begun, it's clear that they will exert an enormous impact on the inspection industry as we know it today as well as the process, manufacturing and service industries which it serves. Companies that actively embrace digitization and adopt digital strategies will be well-positioned for greater success in the future. ■

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INTERVIEW

Navigating Oil Market Volatility through resilience and innovation : The CEO Perspective



PRABH DAS

MD & CEO
HPCL-Mittal Energy Limited (HMEL)

Prabh Das, MD & CEO, HMEL has been at the helm of HMEL's growth story since its inception in July, 2007. He was instrumental in implementing this joint venture of HPCL and Mittal Energy Investments. Under his leadership, HMEL set up the greenfield 9 MMTPA Refinery at Bathinda and rapidly grew to an 11.3 MMTPA Refinery with world-class safety practices and robust processes. He spearheaded HMEL's massive over US\$ 3 Billion expansion in the field of petrochemicals with the setting up of world-class 1.2 MMTPA cracker unit at Bathinda. Team CEW catches up with him to understand his perspective on navigating the oil market volatility. He shares illuminating perspectives in this exclusive interview addressing the current challenges of oil market. He delves into the transformative petrochemical complex at Guru Gobind Singh Refinery, positioning HMEL as a significant player in the Indian and global markets.



HMEL Petchem HDPE Unit

What are your thoughts on the recent volatility in the oil market?

The oil and gas industry isn't new to supply disruptions and price volatility. A confluence of economic, geopolitical, trade, policy, and financial factors have exacerbated the issue of underinvestment and triggered a readjustment in the broader energy market. The situation highlights the need for both short-term adaptability and long-term resilience in the global energy landscape. This volatility also accentuates the significance of diversifying geographies, investing in intelligent tools, and fostering collaborations to ensure stability and sustainable growth in an ever-changing market environment.

Please share insights into the petrochemical complex in Guru Gobind Singh Refinery, how will this investment position HMEL in Indian and global markets?

HMEL is responding to reduce the country's dependence on imports and meet the ever-growing domestic demand for Polypropylene (PP) and Polyethylene (PE) and has undertaken a massive over USD 3 Billion expansion in the field of petrochemicals at Bathinda. Our world-class integrated complex now has 2.2 Million MT Petrochemical capacity with a Dual Feed Cracker Unit of 1.2 Million MT/annum

of Polyethylene (PE) and 1 Million MT/annum of Polypropylene (PP) capacity to cater to all major application segments. With this investment, we aim to diversify the business by reducing our dependence on fuel-intensive products and establishing HMEL as one of the largest PP/PE producers in the Indian petrochemical market.

Tell us about the procurement budget & strategy and how have you balanced risk management, supply chain optimization and green purchasing?

HMEL has Enterprise Risk Management Policy to manage the risk associated with commodity price and protect the margins from the price variations due to market volatility. We have in place enterprise risk register that helps in identifying, scaling, and controlling the organization risk in the changing environment. Concurrently, HMEL uses technology, including integrated LP model for feedstock procurement planning and optimizing software for scheduling, which enables us to take strategic decisions and optimize supply chain. Additionally, we have taken initiatives to continuously purchase solar/wind energy in some of our units. HMEL is working towards linking our facilities to renewable and circular feedstock contributing to the carbon neutrality vision of India.



HMEI Petchem Dual Feed Cracker Unit (DFCU)

What is the product mix and targeted markets for supplying these petrochemical products?

HMEI's Guru Gobind Singh Polymer Addition Project consists of downstream polymer units to produce LLDPE (Low Linear Density Polyethylene), HDPE (High Density Polyethylene) and Polypropylene. Products from these plants are the building blocks of multiple key industries ranging from packaging material manufacturing to the healthcare industry for the manufacture of disposable syringes, surgical masks; household furniture; consumer durables, textiles, pipe manufacturing; automobile dashboard manufacturing industries etc. The key markets for these polymer products would be the Northern and Western zones of the country as well as overseas.

What are the key challenges in the near foreseeable future to be globally competitive and how are you navigating these to drive the growth?

The volatility in oil prices is likely to continue due to geopolitical tensions and complex supply chains, which could keep the industry under pressure in the short run. It requires the players to innovate, invest in technology adoption and forge strategic partnerships. We at HMEI are at the forefront to embrace the latest technologies such as Artificial Intelligence, Robotics Process Automation and Advanced Analytics, etc., which will make our operations more efficient, safe and reliable. Following the mantra of Improve, Integrate and Innovate, we have deployed cutting-edge technologies like Real Time Optimizer, Advanced Process Control, Supply Chain Automation, IIoT, Virtual Reality, Advance Analytics and many more

steps are planned towards the digital transformation of HMEI.

Talk to us about the plans to get into Green Hydrogen and investment that have been earmarked.

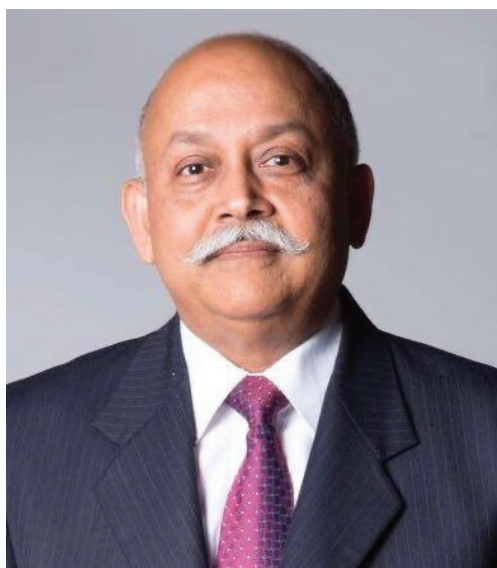
HMEI is actively exploring strategic opportunities in Green Hydrogen and Green Ammonia, recognizing its potential and supporting the country's sustainable development goals. HMEI has recently forged a powerful partnership with NTPC Green Energy Limited (NGEL) to collaborate in the field of renewable energy and also

explore opportunities in the area of green hydrogen & its derivatives (Green Ammonia & Green Methanol). Our Bioethanol Project is in the advanced stage of completion and we have commissioned pilot scale Hydrogen Fuel cell for the supply of power required for charging Forklift Batteries. Moreover, we have implemented multiple schemes to significantly reduce our energy consumption.

How is HMEI adapting to the changing energy landscape balancing the energy trifecta of sustainability resilience & affordability for energy security?

Balancing the energy trifecta is an ongoing process that requires adaptation to market dynamics, changing technologies and environmental considerations. HMEI's future strategy is aligned to achieve the optimal balance of energy supply and demand fulfillment encompassing purported investment in renewable energy for a more secure energy mix and fostering sustainability by marking its footprints in the green sector. Secondly, with our diversification into petrochemicals, HMEI is bolstering resilience by mitigating high dependence on fuel products. And lastly, HMEI continues to leverage advanced technologies and innovation which can lead to breakthroughs that enhance the country's energy efficiency, resilience, and sustainability. ■

Digital Transition will Drive Paradigm Shift in Human Resources Management & Skill-set Development



ALOK KHETAN

Managing Partner
Cornerstone

In recent years, the manufacturing sector has undergone a significant transformation due to the increasing adoption of digital technologies. The digital transition has resulted in paradigm shifts in human resource management and skillset development. This essay will examine the anticipated paradigm shifts in human resources management and skillset development in the manufacturing sector courtesy of the digital transition. It will also explore how industry and job seekers can prepare to deal with this challenge.

The digital transition is expected to bring about several paradigm shifts in human resource management. One of the most significant changes is the adoption of data-driven decision-making. Manufacturers will increasingly rely on data to make hiring and promotion decisions. The use of data analytics will enable companies to identify the most suitable candidates for open positions based on their skills, experience, and performance.

Another significant shift in human resource management is the move towards more flexible work

arrangements. The manufacturing industry is notorious for its traditional work arrangements, including fixed schedules, mandatory overtime, and limited work from home options. However, digital technologies such as cloud computing and the internet of things (IoT) are enabling manufacturers to adopt more flexible work arrangements. This change will allow employees to have more control over their work schedules and promote work-life balance.

The digital transition is also expected to bring about a shift in the way manufacturers approach employee training and development. The traditional approach to training involves classroom sessions and on-the-job training. However, digital technologies are enabling companies to adopt more innovative approaches to employee training. For example, virtual reality and augmented reality technologies are being used to simulate real-life situations, providing employees with hands-on training in a safe environment.

Paradigm Shifts in Skillset Development

The digital transition is also expected to bring about significant changes in skillset development. The most significant change is the increasing demand for digital skills. Manufacturers will require employees with skills in areas such as data analytics, artificial intelligence, robotics, and cybersecurity. These skills will be critical in helping manufacturers optimize their operations, reduce costs, and enhance their products' quality.

The digital transition is also expected to increase the demand for soft skills. Soft skills such as communication, critical thinking, and problem-solving will be essential for employees in the manufacturing sector. Manufacturers will require employees who can communicate effectively, work in teams, and think critically to identify and solve problems.

Preparing for the Digital Transition

The digital transition presents a significant challenge for both the manufacturing industry and job seekers. However, there are steps that both can take to prepare for the changes ahead.

For the Manufacturing Industry

Manufacturers must be proactive in preparing for the digital transition. To prepare for the increasing demand for digital skills, they should invest in digital technologies, develop a culture of innovation, and partner with educational institutions to develop training programs that align with the employers' needs. This environment would also enable & encourage employees to experiment with new technologies and processes.

Additionally, manufacturers should focus on developing a flexible work environment that promotes work-life balance and attracts top talent.

For Job Seekers

Job seekers must also prepare for the changes ahead. This involves developing a diverse set of skills that align

with the digital transition. Job seekers should focus on developing digital skills such as data analytics, artificial intelligence, and robotics. They should also focus on developing soft skills such as communication, critical thinking, and problem-solving.

To develop these skills, job seekers should consider taking online courses, attending seminars and workshops, and participating in hackathons and other innovation-focused events. They should also focus on building a strong online presence, including a professional social media presence and a portfolio of their work.

Manufacturers and job seekers must also be prepared to adapt to new work arrangements that the digital transition may bring. With the rise of digital technologies, it is expected that more employees will work remotely, and flexible working arrangements will become more common. Manufacturers and job seekers must embrace this change and learn to work effectively in a virtual environment.

Additionally, manufacturers and job seekers must prioritize cybersecurity. With the increasing use of digital technologies in the manufacturing sector, there is a higher risk of cyber-attacks. Manufacturers must ensure that their systems are secure, and their employees are trained in cybersecurity best practices. Job seekers, on the other hand, should consider developing skills in cybersecurity to make themselves more attractive to potential employers.

Finally, the manufacturing industry and job seekers should keep an eye on emerging technologies and trends. The digital transition is ongoing, and new technologies are emerging all the time. Manufacturers and job seekers must stay up-to-date with the latest trends and adapt accordingly to remain competitive.

Conclusion

The digital transition in the manufacturing sector presents both challenges and opportunities. It is bringing about significant changes in the manufacturing sector's human resource management and skillset development. Manufacturers and job seekers must be proactive in preparing for these changes by investing in new technologies, developing a culture of innovation, and developing the necessary skills to succeed in the new digital era. By doing so, they can ensure that they remain competitive and relevant in an increasingly digital and fast-paced world.. ■

How sustainable supply chains are driving business transformation

A large proportion of the socio-environmental impact that organisations cause, including the overall impact on the climate, comes from their supply chains. This can be as high as 90% or even more. As per “CDP 2020 Global Supply Chain Report”, the greenhouse gas (GHG) emissions from an organization’s supply chain can be as high as 11.4 times of its own operational greenhouse gas emission. Therefore, as more companies take urgent actions and set ambitious goals towards sustainability and decarbonization in order to mitigate the adverse impacts of climate change, these figures suggest, supply chains have to be an integral part of their sustainability agenda. Without focusing on the sustainability of their supply chains, the embedded socio-environmental footprint of the procured materials/services for an organization cannot be managed and this may lead to serious challenges for organizations to progress well on their sustainability commitments.

Earlier, many companies were primarily concerned with their own operational impact on the environment, on its stakeholders, and on the society at large. The solutions for making the organizations sustainable were also focused more around their operational impacts. However, the understanding that supply chain operations can significantly influence the environment, society and corporate governance has triggered a fundamental shift in how organisations approach sustainability and responsible business.

With multiple adverse evidence of global warming, various companies are setting their climate goals around reducing greenhouse gas (GHG) emissions, conserving natural resources and protecting ecosystems, there is a surge in Environmental, Social and Governance (ESG) factors being incorporated into supply chain management. The global ESG guidelines and frameworks have significant focus on design of sustainable supply chains in order to ensure product stewardship and long-term value creation for the suppliers and the consumers. Companies across sectors have therefore started embedding sustainability

considerations in their supply chains - to create a sustainability driven DNA for their organizations as well as a sustainable ecosystem, and also comply with the requirements of the global standards/frameworks.

Several other factors are tilting the scales towards enterprises with sustainability strategies. Increasingly companies are acknowledging the fact that sustainability goes beyond mere compliance and risk management, and that it serves as a competitive advantage. Many investors, too, consider the long-term sustainability, and ethical impact of the companies they are investing in. Growing stakeholder expectations and recognition of the potential advantages for businesses have driven companies to adopt ESG as a strategic priority. They perceive ESG as a way to foster innovation, enhance reputation, achieve cost-saving and create long-term value.

One of the sectors to have gained significant attention under the ESG lens is chemicals. It is one of the largest industrial energy consumers and an industry sub-sector in terms of direct CO₂ emissions. Therefore, it is vital to manage the entire supply chain of the chemical industry, which entails managing the full lifecycle of products, starting from raw material sourcing to production, distribution, and end-of-life management.

Easier said than done but a global chemical major has implemented various sustainable supply chain practices, and developed a “Sustainable Solution Steering Methodology”, which assesses the sustainability performance of their products. The company also actively engages with suppliers to promote sustainable practices, conduct audits, and provide training and support to help them improve their sustainability maturity.

Currents trends

Several factors are at play in supply chain management, and each has a critical role in making it sustainable and seamless. As organisations address climate change, there is a need to actively measure and manage GHG

emissions across supply chains. To this end, businesses are setting science-based targets, incorporating renewable energy sources, optimising transportation routes, and promoting energy-efficient practices. A US-based multinational retail corporation's initiative has set the target of reducing 1 billion metric tonnes of GHG emission from its supply chain by 2030. Similarly, there are examples of organizations recommending their suppliers to follow similar standards on energy and emissions management, water management, waste management, health and safety management, and promote diversity and inclusion, equal opportunity etc. Many organizations have also started collecting information on supplier's sustainability practices.

But even the best laid plans can fail if the data lacks credibility. To ensure transparency, companies are employing technological solutions such as blockchain and traceability platforms to achieve comprehensive visibility throughout their supply chains. The integration of technology enables improved risk management, identification of inefficiencies, and effective resolution of environmental and social concerns. For instance, there are blockchain-based platforms that empower consumers to trace the origins and trajectory of food products, fostering transparency and sustainability within the food supply chain. Many organisations have seen positive results from such interventions. For high end speciality products, global consumers have also started demanding such information in order to ensure that they consume products which are made sustainably, and procured from organizations that promote good governance and sustainable behaviours.

Climate change is a reality for the entire world and mitigatory measures need scale and speed. It is, therefore, crucial that sustainable practices are built as well as implemented in collaboration with stakeholders. Various collaborative initiatives and multi-stakeholder partnerships are being established to address intricate supply chain challenges such as deforestation and carbon emissions. Such collaborations have enabled knowledge sharing, pooling of resources and collective action in mitigating the impact of climate chain. The Fashion Industry Charter for Climate Action, initiated by the United Nations, brings together stakeholders from the fashion industry to collectively tackle climate change impacts and commit to sustainable practices.

When discussing sustainability, one cannot ignore the importance and relevance of adopting circular economy.

With the aim to reduce, reuse and recycle, companies are redesigning products, implementing closed-loop systems, and emphasising recycling and waste reduction across the entire value chain. Embracing circularity helps minimise resource consumption, which also saves on cost; decrease waste generation, and establish a more sustainable and resilient supply chain. A multinational electronics company, for example, has successfully implemented a closed-loop recycling program to recover valuable materials such as gold from used products and reintegrating them into manufacturing. The effect is widespread, from lower natural capital costs to reduced social and environmental impact of mining.

While environmental considerations have traditionally taken centre-stage in ESG discussions, the social aspect is now receiving greater attention. There is increasing emphasis on matters such as diversity and inclusion, fair labour practices, human rights, and community engagement.

The road ahead

In building resilient and adaptable supply chains, ESG considerations will continue to play a crucial role as by incorporating these principles, organisations can enhance supply chain agility, adaptability, and sustainability. However, to reach that level it is imperative for them to assess and address risks associated with climate change, resource scarcity, social disruptions, and technological advancements.

Technology has much to offer in the form of artificial intelligence, Internet of Things (IoT), data analytics and more. These enable more advanced monitoring and measurement of ESG performance across supply chains. Integration with different functions will facilitate real-time decision-making, predictive analytics and improved risk management. For example, IoT sensors can provide instant data on energy consumption, waste generation, and worker safety, empowering organisations to take proactive measures.

Even as the corporate world moves forward on its sustainability agenda, the regulatory landscape is also changing. More governments and regulatory bodies are expected to introduce stricter regulations and reporting requirements related to ESG practices in supply chains. Notably, some countries have taken the taxation route to further the sustainability agenda. Some developed countries are imposing taxes on imported goods based

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on the latter's carbon footprint. This tax aims to reduce carbon leakage while incentivizing companies to adopt more sustainable practices and reduce carbon footprint. This is especially relevant for companies with operations spread across geographies. And this is even significant for investors as they continue to prioritise ESG considerations in their investment decision-making.

Along with internal sustainability targets, external factors such as consumers demand, investors evaluation etc. are also driving organisations to further embed the principles into their supply chain strategies, ensuring overall compliance and accountability.

Conclusion

Sustainability in supply chain management is set to witness advancements in technology, a heightened focus on social impact, increased regulatory and investor influence, and a greater emphasis on supply chain resilience. Organisations will create more resilient and sustainable supply chains, benefiting not only their bottom line but also the society and environment. For any organization, sector or even a country to effectively move towards a sustainable transformation, sustainable supply chain management would eventually become one of the key enablers to bring a positive change in their entire ecosystem. ■



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Improving Safety and Reliability Through Proper Solenoid Valve Selection

Solenoid valves are widely used in the process industry for process automation. As the final control element, they play a crucial role in the reliability of the process. Normally, the solenoid operates a spool valve to open and close the process ball valve, butterfly valve, or plug valve. This spool can be a simple O-ring packed or other innovative sealing technology. During continuous or batch process operations, highly reliable solenoid valves can help reduce production losses and maintenance costs.



Automated Solenoid valves play a crucial role in process safety. Wherever the process safety situation occurs, shut down of safety valves is absolutely essential. If this device does not work, disaster can occur. This is why selecting the correct solenoid valve is so important. Choosing the right valve can help increase plant reliability, enhance safety, and reduce maintenance costs.

How solenoid valves improve plant reliability

The way a solenoid is designed affects its reliability. A solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. The reliability

of these components depends on the magnetic wire insulation, coil encapsulation, ferromagnetic plunger and plug nut options selected.

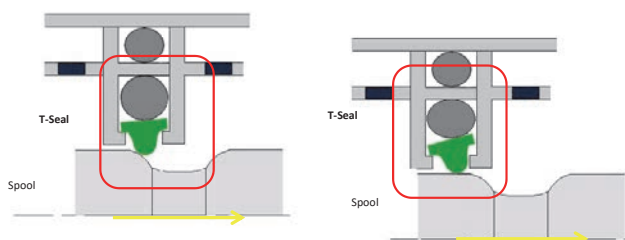
There are key characteristics to look for. For example, magnetic wire insulation determines thermal aging, and the right encapsulation can prevent moisture ingress. The selection of a higher temperature class can exponentially improve coil life. And transfer molded coils provide filling without air pockets, which can lead to corrosion of the magnetic wire, compared with potting process. It's also important to seek out solenoid valves that use ferromagnetic components and low residual magnetism, both essential for reliability. Altogether, magnet wire, ferromagnetic material, and encapsulation specifications can help in increased reliability.

For hazardous areas, flameproof and intrinsically

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safe options are available. Regarding reliability, intrinsically safe valves are scored over flameproof valves in the chemical industry. Intrinsically safe valves are operated at very low power; hence, heat generated in the coil is minimal, providing very high coil life.

The importance of sealing technology



- T-seal helps to break stiction while movement of spool.
- O-ring above T-seal gives compensation against constant wear over the life of the valve
- Lesser contact area leads lesser friction and higher life.

Stiction and friction can both affect reliability. Stiction occurs when elastomeric seals are held in place for longer; they stick to the metal part. In dynamic sealing, this will not allow pieces to move. There are different ways to measure this effect. One of the tests to measure this effect is the "dormancy test." This test will find whether the spool design has growing stiction.

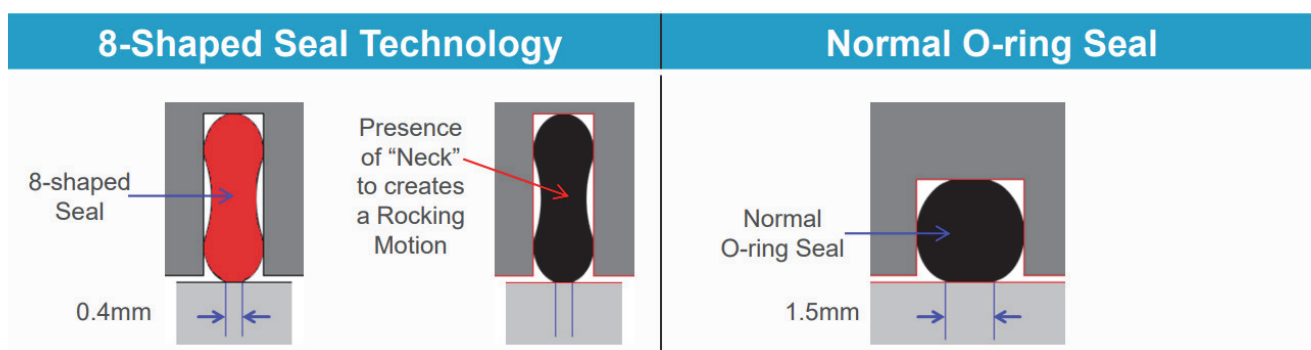
Friction plays a critical role in dynamic sealing. A standard O ring-packed spool has a larger contact

area and, in turn, higher friction. This leads to lower response time and lower life. The right sealing technology can help reduce stiction and friction. There are a few types of sealing technology to consider.

T-seal technology is a non-pack spool technology; the spool is a plane-machined component with dynamic seal seals over it. It is self-compensated sealing technology for lower stiction, lower friction and longer life. When a solenoid is not operated for a long time, then there is a chance of stiction and jamming of the spool. This will cause the spool valve not to operate when the solenoid is on. T-seal technology helps avoid this problem.

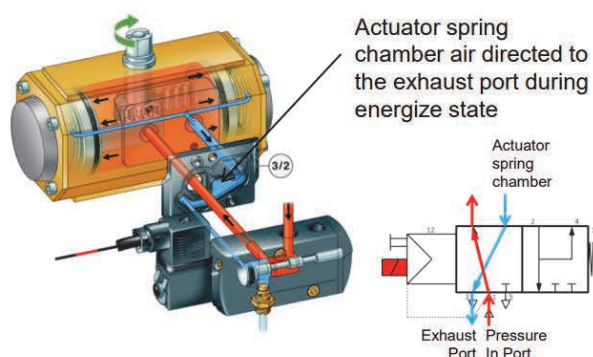
It usually is seen that the standard O-ring design gives 100K to 500K cycles of life, whereas T-Seal technology enhances life more than 5M cycles. This is 10-50 times of standard O-ring format.

8 Shape O-ring sealing technology is like the packed spool O-ring design. However, the seal used has a very innovative shape. These seals are assembled on the spool and effectively lower the stiction effect. The neck in the center gives the flexibility to break stiction while shifting the spool. Further, lower contact reduces friction and, in turn, provides higher life. See below for functions and comparisons with the O-ring design. This can provide life 5-10 times more than the standard O-ring design.

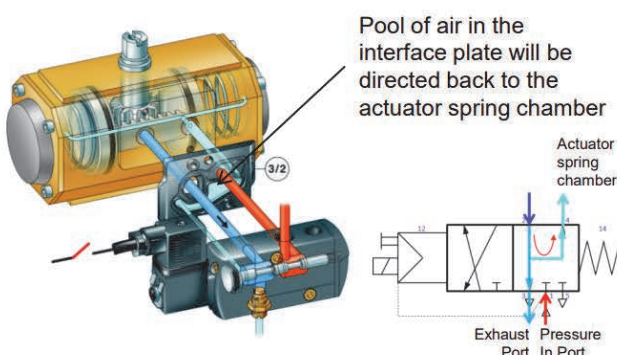


- 8-shape seal helps to break Stiction.
- Lesser contact area leads to lesser friction & higher life.

Coil Energised



Coil De-energised



How actuator breathing can extend solenoid spool valve life

Actuator breathing is essential for small-size spring return actuators. This breathing can be internal or external. External breathing will remove dust, dirt and moisture inside the actuator and valve, which can reduce the life of the actuator. This also prevents corrosion of actuator springs. Solenoid design can help with the internal breathing of the actuator.

See the illustration below. Select a solenoid having this feature for your plant or mention this requirement in the specifications.

All the above features deliver long-term value compared to upfront cost by reducing maintenance cost, downtime, and production loss through higher reliability. This can be quickly handled while selecting solenoid valves for the projects.

To further enhance reliability, it's important to look for solenoid valves with redundant architecture. For example, the 2002 architecture improves the equipment's availability, and the 2003 architecture enhances both the safety and availability of the equipment. These methods can be adopted as and when required in the process industry.

Conclusion

Solenoid valves are critical components for the process industry, and their selection plays an essential role in plant reliability and safety. It's important that a project team puts proper specifications related to critical factors, such as solenoid insulation, encapsulation, sealing technology and breathing method. By doing so, plants can significantly enhance their reliability while reducing maintenance costs and increasing productivity. ■

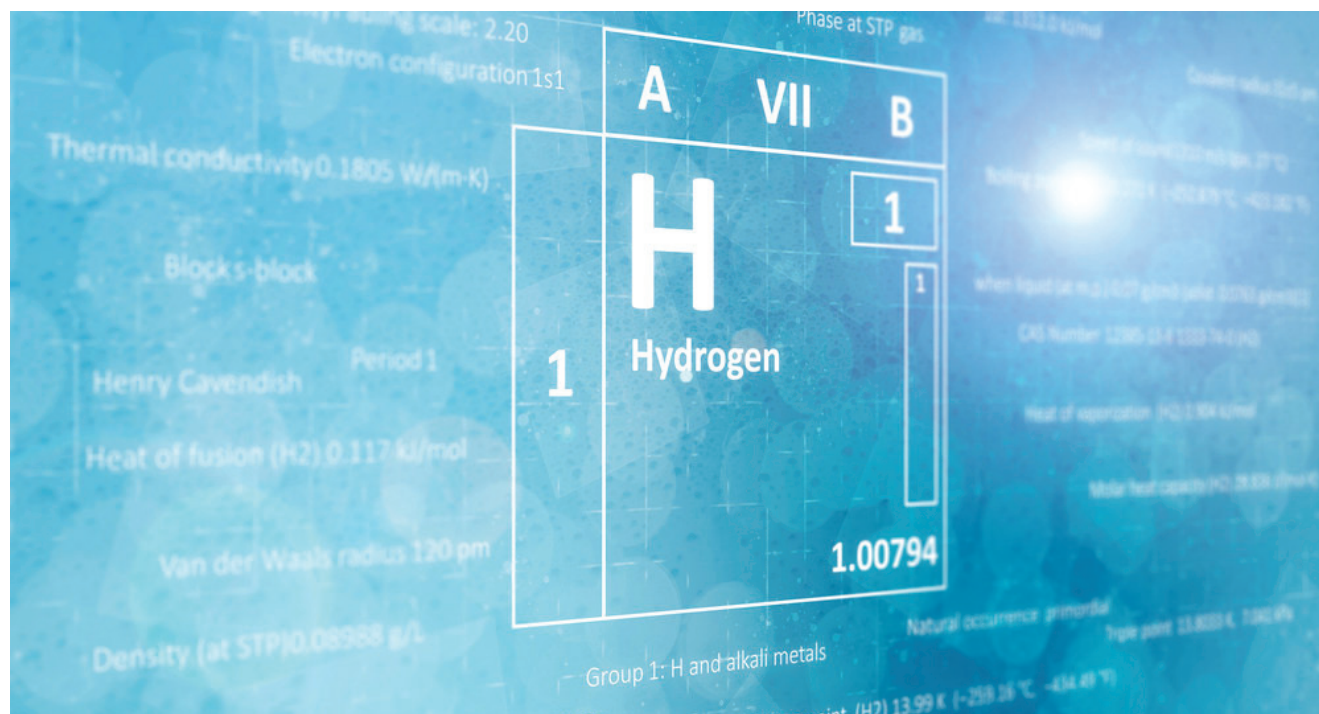


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Green Hydrogen: An Alternative Fuel That Could Assist Energy Transition



The government and the private sector are jointly working toward finding clean energy resources that will replace fossil fuels amidst the energy transition towards decarbonization. Using alternative fuels instead of conventional helps lower emissions in the environment, a step that will ultimately reduce greenhouse gases.

Hydrogen is an abundant fuel source with many great potential applications ranging from transportation to industry, refining and more. In India, the needs fuelling demand for green hydrogen plants will grow exponentially as the country seeks to transition into more sustainable energy while targeting reductions in emissions. Among all future fuels or methods, green hydrogen has emerged as one of the most promising.

What is green hydrogen? To answer that question, we must first take a look at hydrogen as a chemical element.

Hydrogen is the most abundant element on the planet, but it's difficult to find in its pure form. Hydrogen is an important feedstock within the refining and fertilizer

industries but most hydrogen must be obtained from fossil fuels through a process called steam methane reforming (SMR). Unfortunately, SMR emits significant volumes of carbon dioxide into the environment.

Green Hydrogen as an Alternative Fuel

As hydrogen is an essential gas used by key industries, it's important to know what type of hydrogen is produced by different processes. Among different methods for hydrogen production are blue, grey and green. Grey hydrogen is created from natural gases utilising methane via SMR. The blue hydrogen process utilises conventional SMR, but the carbon dioxide is captured and either stored or sequestered underground.

Advantages of Electrolysis process

- Zero emissions
- Clean energy storage
- Decarbonizing potential for heavy-emissions industries like cement and steel
- Clean transportation via fuel cell vehicles powered by green hydrogen



Unlike the conventional SMR hydrogen process, green hydrogen is produced using a process called electrolysis, where the water molecule is split into its constituent elements of hydrogen and oxygen using electricity generated by using renewable sources like solar, wind or hydro. The process is considered green because the entire process is emissions-free and does not release any harmful greenhouse gases into the atmosphere, making it a truly green and sustainable energy.

Fuel cells, for example, emit only water vapor, offering a truly zero-emissions alternative to traditional internal combustion engines. Green hydrogen would make long-haul trucks, ships and airplanes more environmentally friendly. Green hydrogen has the potential to revolutionize industries, transportation and even household utilisation of power.

Reliance Industries, an industrial giant in India, has launched key initiatives for using hydrogen as a fuel or feedstock in refineries. Reliance has set an ambitious target of achieving net zero carbon by 2035 and is investing over \$10 billion (USD) (₹ 75,000 crore) in building the most comprehensive ecosystem for new energy and new materials in India. The goal is to secure the promise of a sustainable future for generations to come.

The government supports development of green hydrogen plants by various initiatives. One of them — the National Hydrogen Energy Road Map (NHERM) — aims to reduce India's dependence on the import of petroleum products. It also looks to promote the use of diverse, domestic and sustainable new and renewable

energy sources, all as part of an effort to provide electricity to rural and other electricity-deficient areas.

Pilot Projects Show Promise

Per capita consumption in India is eight to 10 times less than in developed countries, so hydrogen could be a good alternative. Sectors of the Indian government have already started the journey towards a green future.

Do refineries see green hydrogen as an alternate fuel or feedstock? Hydrogen truly offers great potential for the refining industry to reduce the current rate of greenhouse gas emissions, which currently ranges between 8% and 10% per ton of crude oil refined.

India has been actively working on adopting renewable energy sources and advancing hydrogen technologies. The government has shown interest in promoting green hydrogen and has announced various initiatives and projects to encourage its production and use. India has discussed a possible deal to supply around 15 million metric tons of green hydrogen annually to the European Union and Singapore.

Hydrocarbons, which are compounds primarily composed of hydrogen and carbon atoms, are the primary source of fuel used globally, but when hydrocarbons are burned in the presence of oxygen (combustion) they undergo a chemical reaction that releases energy in the form of heat and light. The primary byproducts of this combustion process are carbon dioxide and water vapor. Carbon dioxide produced from burning oil depends on the type of oil and its carbon content. However, as a general estimation, the

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combustion of 1 ton of oil typically results in the release of approximately 3.15 metric tons of carbon dioxide.

A pilot green hydrogen project for the energy transition journey has been initiated, and three refineries are working on green hydrogen generation in India. A renewable energy plant with 20 megawatts of capacity available for electrolyzers-production of green hydrogen is expected to break ground soon, and a 66-mw capacity renewable plant is expected to follow soon after.

Understanding the need, engineering companies are working on many green hydrogen projects, including multiple feasibility studies. Some green hydrogen studies that have been completed indicate that both government and private sector industries are ready to commit significant resources to the development of green hydrogen and other alternative fuels.

Challenges and Barriers

Green energy is a new technology and multiple companies need to get involved in it for further advancement. Different licensors are working to improve hydrogen systems. Renewable power cost and availability are barriers that need to be addressed for green hydrogen; otherwise, lower-cost process technologies in the grey and blue hydrogen categories will be seen as options even though they do not result in clean processed fuel.

Marketing of green hydrogen is essential to motivate researchers, scientists and engineers to work on the technology innovations that could reduce costs and achieve more efficiencies. Currently, PEM (proton exchange membrane) and AEM (anion exchange membrane) electrolyzers are available in the market, though the cost of the rare metals iridium and platinum needed for those processes are high. Supply chains for these important commodities are also a concern, as India generally imports them from China.

However, there is a great deal of optimism that business related to green hydrogen manufacturing and supporting infrastructure will see significant opportunities. L&T is moving forward on research and development of pathways to optimise electrolyser technology that will reduce green hydrogen costs. India currently is generating 0.5 gigawatts of power through green hydrogen with a goal to reach 5 GW by the year 2030, a level that would abate nearly 50 million metric tons of annual greenhouse gas emissions.

Safeguarding Our Planet

Green hydrogen represents a beacon of hope as many stakeholders pursue a sustainable future. Its ability to decarbonise industries, store renewable energy and power clean transportation opens up a world of possibilities.

The world is progressing towards net zero through different means. Among the multiple technologies being researched and developed, green hydrogen is one with many attractive attributes. With research focused on challenges posed by the cost and availability of renewable power, storage and transportation barriers, and current complexity of fuel cells, the true potential of green hydrogen can be unlocked.

Embracing green hydrogen is not just an option; it is a necessity if we are to safeguard our planet and achieve a sustainable future for future generations. It's time to unite our efforts and harness the power of green hydrogen. ■

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Graphalloy® Bushings Excel in Pumping Anhydrous Ammonia



A customer with ammonia pumps wanted to increase pump mean time between repair (MTBR) by finding a solution to the current frequency of bushing failures. The low temperature, liquid pumped, and dry running episodes were causing the metal bushings to fail within two months of service. After digging through his archives, the plant manager found the name "GRAPHALLOY" on some drawings and realized that this material had been used in similar pumps in the past.

The manager searched for "Graphalloy" on the web and found the contact information for his local Graphalloy representative. A few days later, the plant manager scheduled a meeting with the Graphalloy rep and factory engineers to discuss the pump specifics.

Graphalloy engineers recommended Nickel-grade Graphalloy bushings to replace the metal bushings on one of the pumps currently in their shop. Graphalloy was able to meet the requested expedited delivery request.

Due to the tight schedule, the bushings were going to be machined onsite. Even though the plant has an experienced machine shop, this was their first time machining Graphalloy materials. With help from Graphalloy engineering, they calculated tolerances

using the supplied pump calculation form and installed the bushings.

The plant manager said he wanted to evaluate the Graphalloy bushings in this pump for one year, before declaring success. After over two years in service, the manager is "more than satisfied" with Graphalloy's performance and is in the process of upgrading his 14 additional liquid ammonia pumps to Graphalloy.

With a boiling point of -28.01° F at a pressure of one atmosphere, Anhydrous Ammonia requires special equipment and technology to transport, store, and apply. The refrigeration or pressurization system can fail and the pumps can flash, run dry and ultimately fail.

The Graphalloy material, a graphite-metal alloy, can handle flashing and dry run due to its self-lubricating, non-galling qualities. It can also handle temperature extremes where other materials fail. It is often chosen as a solution in tough pump applications due to these qualities. ■

For more information

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Historian-based Advanced Asset Condition Monitoring and Analytics

The chemical industry is a good potential user of a data historian-based condition monitoring and analytics platform since there are so many machines and processes being monitored and sometimes by several different systems. B&K Vibro has been a proprietary CMS system supplier for more than 23 years. There are many machines that have been monitored in the chemical industry, both balance of plant and critical. From B&K Vibro's experience, a historian-based condition monitoring solution in the form of AVEVA PI-based condition monitoring analytics has been proposed, which is relatively new to the industry, but has proven to provide improved benefits.

In the beginning, there were only stand-alone proprietary systems available for condition monitoring, but with the development of a historian-based condition monitoring analytics solution, new and better monitoring opportunities have been opened up.

For those plants that have installed a historian that is also capable of condition monitoring and analytics, chances are that there is already a traditional proprietary condition monitoring system on-site that has its own stand-alone server. This means IT must review two systems for security, for storage, for network access and many more tasks. With a condition monitoring system based on a historian, much of this work will be reduced. Once the historian has already been deployed, it just needs to be extended to also serve the condition monitoring needs. The advantages of doing it this way is that the IT department only needs to maintain one system and can generally do this in-house without relying on multiple vendors. A modern historian, like the PI system, can support more than one million writes per second, which is more than sufficient to support a condition monitoring system. The PI system itself already has the necessary tools to run the condition monitoring functionality and even perform analytics. The focus of this article will be about the analytics portion of the data historian-based condition monitoring solution and how the PI system can be used to provide an open architecture solution to enhance plant operations.

Conditional monitoring visualization in the data historian

Figure 1 is the visualization screen of the PI system, which is called PI Vision. Here you can see the measurement values and the alarm status for all the process and vibration measurements monitored on a LM6000 gas turbine. This particular gas turbine is used as a genset, but it can be representative of any gas turbine application. Interactive icons can be clicked to receive more information on sensor measurements, calculated values and diagnostic plots. Clicking the icon enables the user to, for example, do a deep dive to find out why the accelerometer measurements are an alarm situation. This is shown in Figure 2.

KPI analytics based on the maintenance performance of the machine

The analytics icon shown in Figure 1 displays gas turbine calculated KPIs when clicked. An example of KPIs for incident and service metrics for any machine type is shown below:

- Mean time to failure rate (MTTF)
- Mean time between failures (MTBF)
- Mean time to repair (MTTR)
- Mean time to detection (MTTD)
- Overall equipment effectiveness (OEE)

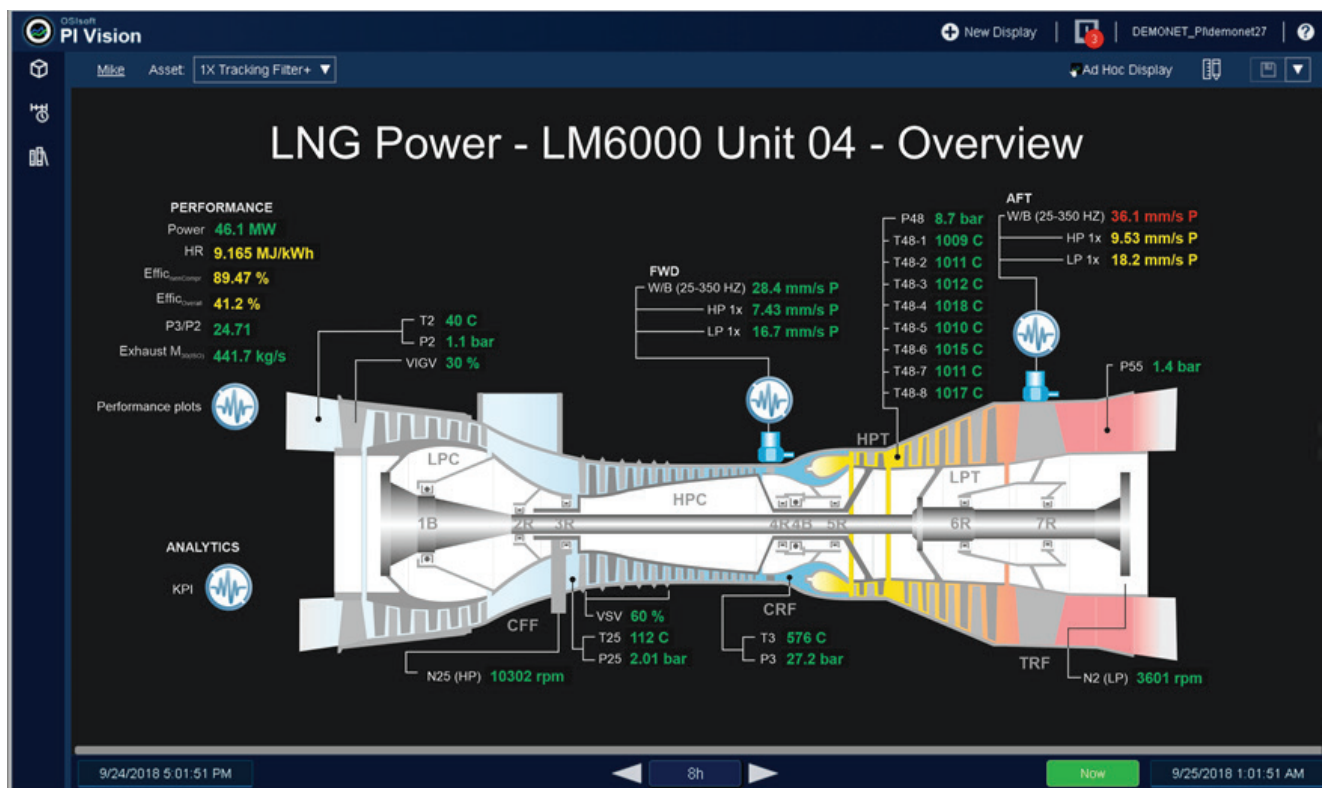


Figure 1. Alarm Status Visualization showing process, performance and vibration data. Four icons (white circle with blue signal) are shown for opening up diagnostic plots. These icons include one for performance monitoring (upper left), analytics (lower left), forward-end vibration (middle) and aft-end vibration (right side). This is a PI Vision display.

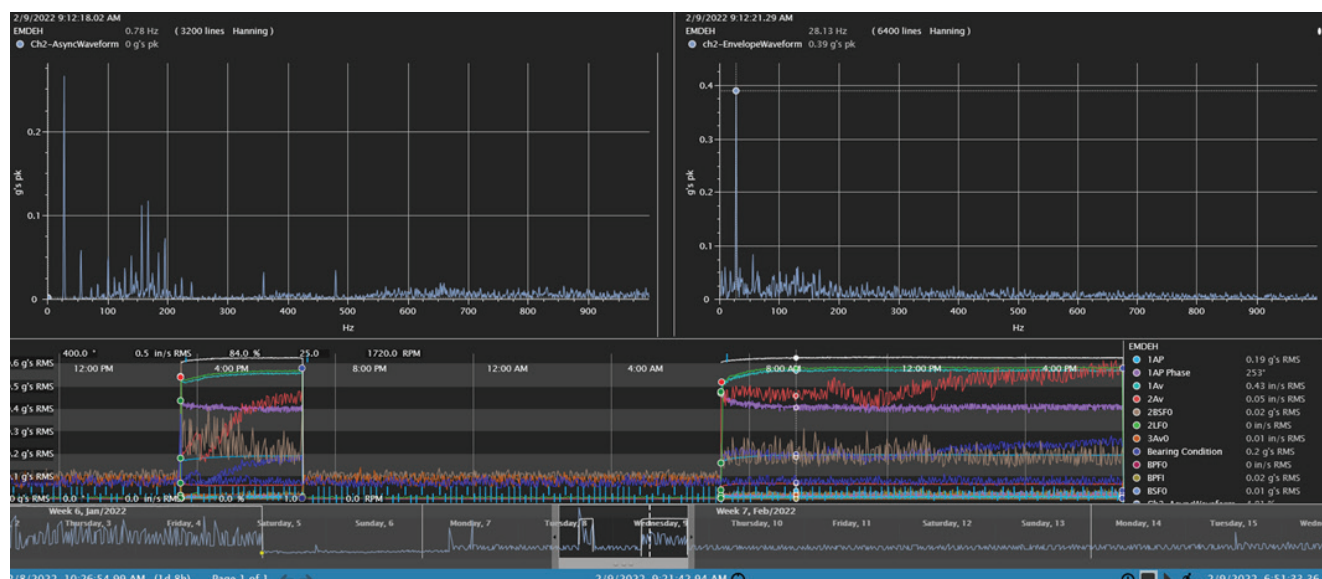


Figure 2. Vibration diagnostic plot visualization for the aft end of the gas turbine (opened by clicking the aft icon shown in Figure 1). This is a proprietary CMS display.

Other calculated maintenance KPIs can be specific for gas turbines, such as:

- Forced outage factor (FOF)
- Service hours per start (SH/ST)
- Service factor (SF)
- Capacity factor (CF)
- Output factor (OF)
- Starting reliability (SR)
- Availability factor (AV)
- Reliability factor (RF)
- Scheduled (SOC), unscheduled outage factor (USOF)

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Gas turbine counter data can also be included in the KPIs:

- Operating hours per year
- Scheduled, unscheduled and forced outage shutdown hours per year
- Number of trips per year
- Number of starts per year (successful and attempted)
- Operating hours between trips
- Power production

These are general asset maintenance metrics for this particular gas turbine. These calculated KPI values can be correlated with 'and/or' displayed next to the normal condition monitoring functions displayed on the visualization system. Users are notified when KPI or condition monitoring alarms occur. For a specific asset, you can see how problematic the machine has been by just correlating this monitored information with the KPIs. The computerized maintenance management system (CMMS) software does a lot of this, so these values can be accessed and searched in the CMMS data if there is an interface with such a system, or they can just be calculated directly in the PI asset framework part of the system.

The data historian analytics is not necessarily limited to the machine being monitored; it can also be applied to the condition monitoring system itself. Below we can see examples of metrics on the accuracy of the condition monitoring system for fault detection diagnostics and estimating lead time to repair:

- Time from detection to diagnosis for faults
- Time from diagnosis to service action

- Planned avg. time from detection to shutdown
- Actual avg. time from detection to shutdown
- % accuracy for detection
- % accuracy for diagnosis
- % accuracy for lead time to shutdown

This can be used for evaluating the performance of the condition monitoring system, but more importantly used for fine-tuning the estimates to improve the performance of the condition monitoring system and its diagnostics and analytics. It is possible a condition monitoring system provider may not necessarily provide these measurements by default, so this is one of the benefits of a historian-based condition monitoring solution.

Historian-based analytics on performance monitoring using the LM6000 gas turbine

One of the icons shown in Figure 1 is for opening up the performance monitoring plots and calculated parameters. Figure 3 shows the typical process values used for calculating the LM6000 performance parameters.

These process parameters can come from the DCS or data historian but will have to be imported into a standalone condition monitoring system for calculating performance values, so this data becomes duplicated. It is not only process data that is needed, but also machine data and machine performance curves from the gas turbine supplier. All this data represents the input parameters for calculating the performance values and determining the alarm limits.

Typical process parameters that are calculated for a gas turbine can include:

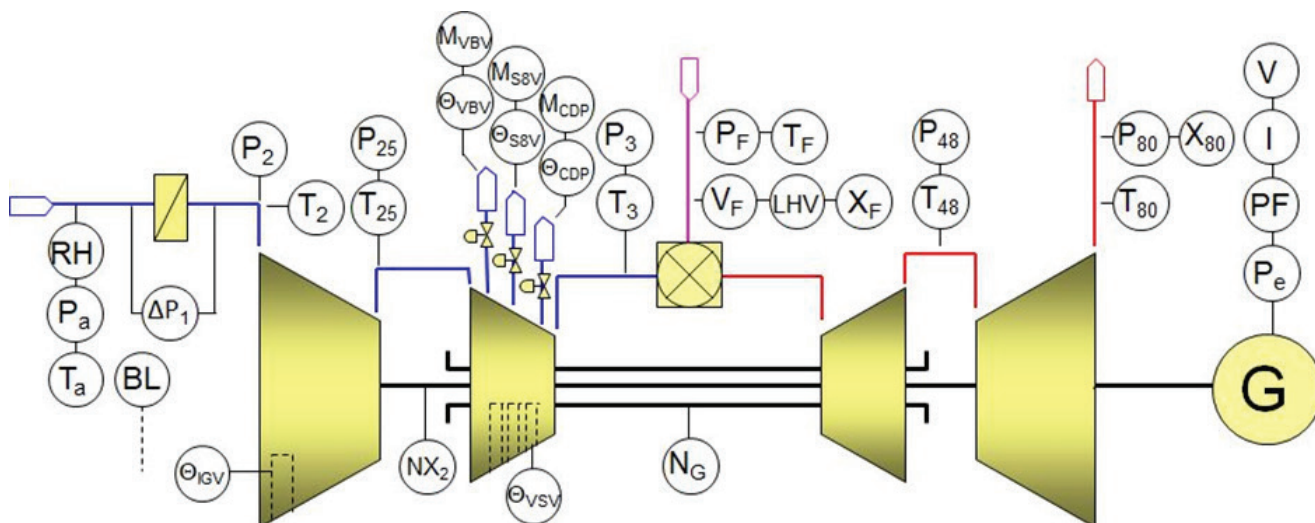


Figure 3. Typical process values shown for a LM6000 gas turbine, which are used to calculate performance parameters and create performance plots.

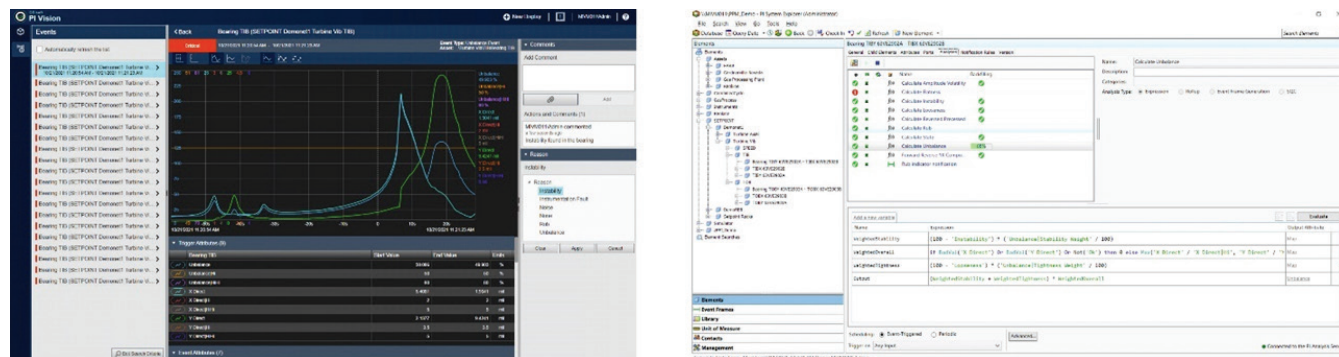
- The performance calculated functions are used for both monitoring to alarm limits, and also as input into a number of plots for diagnostic purposes. These plots are normally not provided by the data historian, but by the CMS or third-party service providers to the data historian. These typically include:

- ## A more successful digitalization initiative

The PI system is a fully capable condition monitoring, analytics and decision support system. It can aid operators, engineers, and monitoring maintenance technicians in monitoring and optimizing the health of their machines at each stage of the life cycle of a machine.

The PI system includes automatic decision support to reduce the workload of the diagnostic specialists. The CMS compliments the PI system by providing diagnostic tools such as specialized plots to better understand the fault, its severity and the estimated lead-time for maintenance. If the user doesn't have that expertise, they have the option to export that data to a third-party service provider that has that expertise. With the AF database, analytics can be set up in a template and deployed to various assets in a fleet of machines. AF analytics provides a powerful tool set that makes it easy to work with time series data. It allows the machines to be modelled for vibration and process attributes. It allows users to calculate various failure indicators from that raw data. For example, it is possible to measure the flatness, the reverse procession instability, and many more indicators of a potential failure mode of the bearings and other components. These indicators can then be combined to identify the origin and severity of a particular failure mode more accurately. With this information, an analyst can focus their efforts and more quickly determine the next course of action.

With those analytics in place, the PI Vision software also provides tools for root cause analysis. It allows users to reliably compare historical events. With the knowledge of historical faults that may have happened on that machine as well as those related to other machines, users can get more confidence in estimating lead-time to maintenance and avoiding the same fault occurring again. When it comes to specialized plots, users can go from the PI system to a CMS that allows further analysis with specialized plots. As users move through the process of analysing and acting on an event that has happened to their machine, maintenance will implement actual fixes and upkeep on the machine. But through that process, users will learn things about the machine that that can then be captured and put back into the PI system. With the event that is initially generated, users



Picture 1: Developing and fine-tuning automatic decision support; monitoring results are combined with maintenance feedback (left) and rule-based automatic support is modified to reflect this feedback (right).

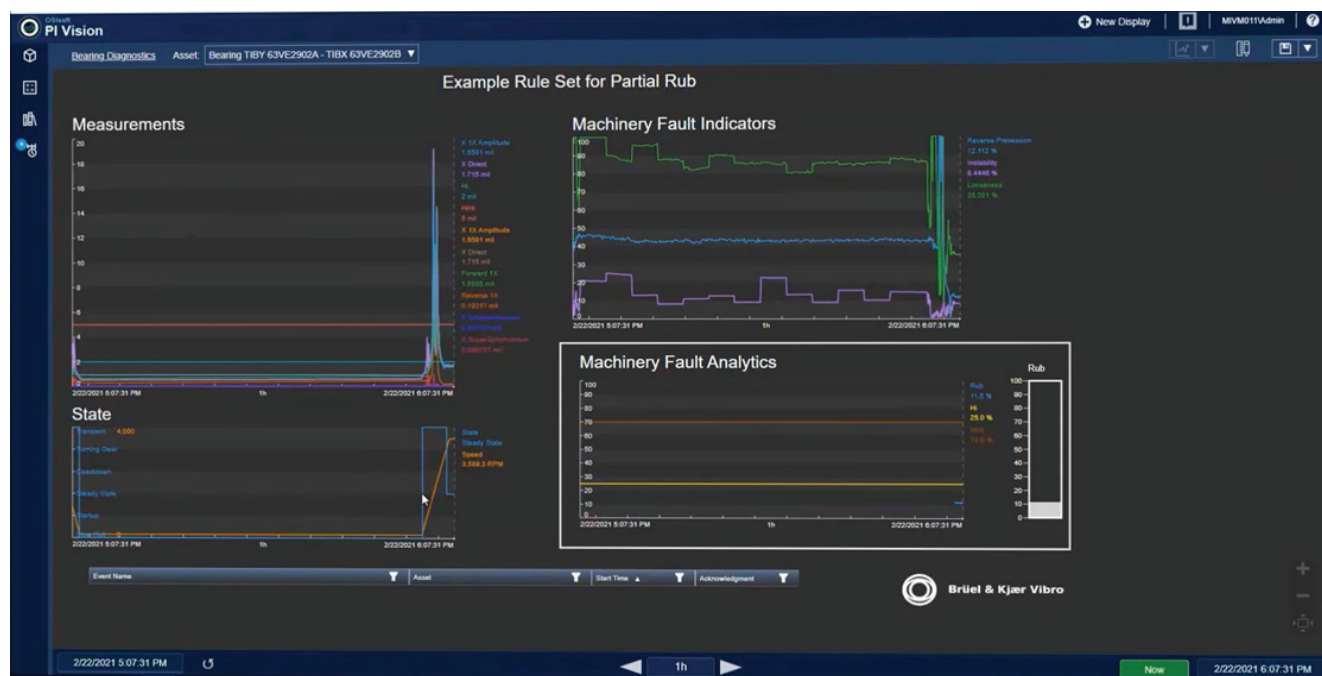


Figure 4. Automatic decision support example for shaft bearing rub.

can capture notes and documents as well as document the reason for the failure. Based on the information that maintenance and the engineers learn, the analytics that are in place can be adjusted to capture that knowledge and a better solution can be developed going forward. Because the PI system is not a siloed solution and all the data is available, not just some of it, this enables you to have a more successful digitalization initiative on the asset healthcare that would otherwise not be possible.

Figure 4 gives an example of how these analytics would work. In the upper left we have the measurements that are coming in from the condition monitoring system hardware, and then in the upper right are indicators that are being calculated from those measurements to look for the different things that inform the user of what the fault is. The lower left area enables the user to determine what state the machine is currently in, so the most appropriate analytics can be applied to it. Then finally, in the lower right, all that can be combined to determine a likelihood of a particular failure happening - in this example, the likelihood of a rub occurring on a particular bearing.

Conclusion

The typical chemical plant has a wide range of machines, both critical and balance-of-plant, where some are even monitored by different systems with their own proprietary data servers. Proprietary data and analytics can be expensive, not transparent and not always

readily accessible. The plant could benefit immensely by storing the monitoring data in a central historian for correlation and fleet monitoring purposes, which could also offer more data for AI and ML statistical analysis.

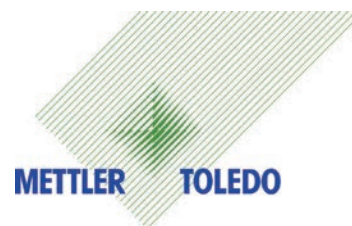
There is a lot of powerful functionality and capability with the PI-based analytics. There is also a lot of data available in the historian for analytics, which of course, can be used for more effectively monitoring machines, even if these are using different condition monitoring systems. It is possible to even measure the performance of the different condition monitoring systems. The PI AF calculator engine is relatively easy to program and transparent. There are specialized plots that will still have to be provided by the condition monitoring supplier or the third-party service provider, but oftentimes, these can be integrated in the PI system the PI Vision. Automatic fault analysis and automatic decision support is possible in PI. ■

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Five critical measurements for the Chemical Industry



O₂ Measurement for Combustion Control

Eliminating Extractive Systems: METTLER TOLEDO offers a TDL solution that not only eliminates the alignment problem, but also simplifies analyzer installation and maintenance. The GPro 500 series of O₂, CO, and moisture analyzers uses a unique design whereby the laser light emitted from the sensor head travels down a probe that is open to the process gas and is returned by a retroreflector back through the gas to a receiver which is also within the analyzer's head. This design means that alignment of the analyzer is not required, even if the process involves a significant temperature ramp. As sender and receiver are in a single instrument, only one flange needs to be installed into the duct, greatly simplifying installation. A range of unique process adaptations (such as the wafer cell for very narrow pipes) significantly increases the range of applications for the GPro 500.

pH Control in Aggressive Conditions

500% increase in sensor lifetime: pH measurement is necessary in many stages of nitrogen-based fertilizer production, but the conditions are very tough on sensors. The InPro 4260i pH sensor is designed to tolerate extreme chemical processes. It contains a solid polymer reference electrolyte that provides excellent resistance to contaminating substances. And instead of a diaphragm that would quickly become clogged, it features an open junction. The long sensor lifetime of the InPro 4260i would reduce technicians' exposure to the production environment, as well as lower sensor costs. The sensor's Intelligent Sensor Management (ISM®) technology provides further valuable benefits. ISM sensors can be calibrated in any convenient location, such as a maintenance shop.

ORP and Conductivity

Fighting corrosion, scaling and fouling: It is estimated that the global cost of oil and petrochemical refinery corrosion and deposition exceeds US\$ 15 billion annually. In cooling water systems a lot can be done to minimize it, with the help of dependable, intelligent measurement systems. The InPro 3250i is a pre-pressurized, liquid electrolyte sensor that delivers fast, accurate measurements. It features an auxiliary platinum electrode that offers a major benefit to Sinopec Sabic, the sensor can also measure ORP. Therefore, the number of measurement points in the recirculated water system could be reduced.

Sodium and Silica Measurement

Protect on-site power generation equipment: To shield turbines from corrosion and scaling, sodium and silica in the power cycle must be maintained at negligible levels. Determining contamination at low ppb levels requires highly capable equipment. METTLER TOLEDO's 2300Na Sodium and 2800Si Silica Analyzers combine industry proven technology with innovative design to provide assurance of water purity in power cycle chemistry applications. The 2300Na Analyzer determines sodium levels by first conditioning the sample to prevent hydrogen ion interference by controlling the input flow and the pH, then uses a sodium ion selective sensor to precisely determine sodium levels. For silica determination the 2800Si Analyzer employs the colorimetric method, which involves adding reagents and then measuring the color change in the sample. The analyzer features automatic zeroing before each measurement, plus automatic sample conditioning and calibration.

Inductive Conductivity

Durable and sensitive for concentration determination: Ensuring correct dilution of chemicals is important for process and cost efficiency. Conductivity measurement is a highly accurate determinant of concentration for a wide range of chemicals. Robust inductive conductivity sensors are ideal for this purpose. Modern inductive sensors such as the InPro 7250 have the sensitivity to detect very small changes in conductivity, which is necessary for accurate measurement. The media-wetted parts of the InPro 7250 are coated with perfluoroalkoxy alkane, a material that is highly resistant to organic and inorganic acids including nitric and hydrofluoric. As the surface

is immune to contamination and deposit formation, high measurement accuracy and process reliability are always ensured. The large measuring range and concentration determination capability of the InPro 7250 PFA make it uniquely suitable for use in concentration control applications.

About METTLER TOLEDO

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

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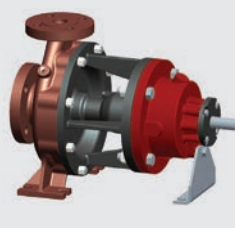
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