

Oil Review

Oil · Gas · Petrochemicals

Middle East

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EPC prospects looking up

- Oman pushes ahead with green energy developments
- Improving oil spill preparedness
- Disrupting existing assets with Digital Twins
- The evolving role of well integrity
- Addressing the issue of liquid loading

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→ Editor's note

WITH OIL PRICES on the rise as economies rebound, oil market prospects are looking up. Global oil demand is set to return to pre-pandemic levels by the end of 2022, rising 5.4mn bpd in 2021 and a further 3.1mn bpd next year, according to the IEA's June oil market report. This is reflected in a more positive outlook for EPC projects, as we report on p16. ADNOC, for example, recently awarded EPC contracts amounting to US\$318mn to connect smart wells with production facilities, while Saipem has been awarded the extension of two important contracts for onshore drilling activities in Saudi Arabia which it regards as a "positive sign of a gradual resumption of activities following the COVID-19 pandemic".

With the energy transition and emissions reduction now at the top of the agenda, we look at Oman's push into clean energy developments (p12), while our technology section covers a wide range of areas from well integrity and flow control to artificial lift, data management and Digital Twins.

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→ Executives' Calendar, 2021

AUGUST			
16-19	OTC	HOUSTON	2021.otcnet.org
SEPTEMBER			
7-10	SPE Offshore Europe Virtual Conference	VIRTUAL	www.offshore-europe.co.uk/en-gb.html
13-15	Oman Petroleum & Energy Show	MUSCAT	www.omanpetroleumandenergyshow.com
13-16	Gastech	DUBAI	www.gastechevent.com
21-23	SPE ATCE	DUBAI	www.atce.org/about-dubai
OCTOBER			
4-7	GEO 2021	MANAMA	www.geo-expo.com
NOVEMBER			
8-11	Africa Oil Week	DUBAI	www.africa-oilweek.com
15-18	ADIPEC 2021	ABU DHABI	www.adipec.com
28-1 Dec.	Middle East Oil & Gas Show (MEOS 2021)	MANAMA	www.meos-expo.com

Readers should verify dates and location with sponsoring organisations, as this information is sometimes subject to change.

Gastech to set the agenda for the global gas, LNG, hydrogen and energy industry

GASTECH, ONE OF the leading global exhibitions and conferences supporting the gas, LNG, hydrogen and energy industry, has been relocated from Singapore due to COVID-19 uncertainties and travel restrictions and will take place in Dubai, from 21-23 September 2021.

Organised by dmg events, the event is to be held under the patronage of His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai.

Gastech 2021 is supported by the Ministry of Energy and Infrastructure of the UAE. HE Suhail Mohamed Al Mazrouei, Minister of Energy and Infrastructure, commented, "Gastech comes at an important time for the energy industry with a shared global mandate to lower carbon emissions and provide clean affordable energy for all. Gastech is a key enabler of conversations and connections that drive the energy transition agenda."

Christopher Hudson, president, dmg events, said, "Thanks to its robust, world-leading vaccination programme and well organised testing and travel measures, Dubai is one of the safest and most accessible places in the world to travel to. It is a world-class location with a long and strong track record of successfully hosting major events, making it an ideal location for the global energy industry, partners, exhibitors and attendees to conduct business."

He added, "Gastech 2021 will provide the leadership that will enable the gas, LNG, hydrogen and energy industry to thrive in post-COVID-19 energy markets. Alongside the disruptive forces accelerating the transition to cleaner energy, Gastech provides unparalleled opportunities to build the long-term sustainable business relationships required to address climate change issues, and the decarbonisation of energy."

Gastech will set the tone for the future direction of the global gas and LNG industry in the post-COVID context as the industry seeks to strike a balance between business priorities and the social license to operate. With an emphasis on technology innovation; supply and demand dynamics; evolving partnerships; people and talent; and governance and influence, Gastech provides the widest commentary on the most urgent issues impacting global gas, LNG and energy market dynamics.

The event will be attended by more than 25,000 visitors, including senior

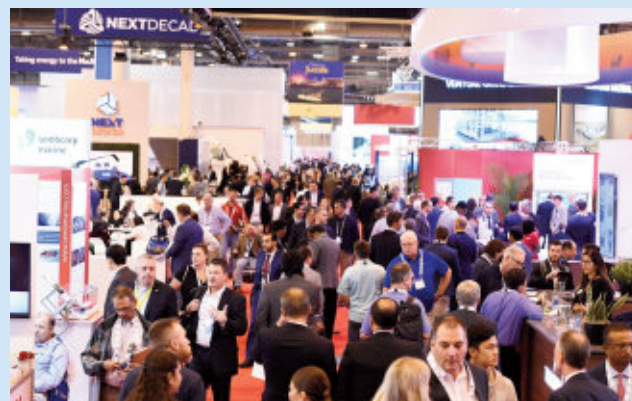


Image Credit : DMG Events

Gastech has relocated to Dubai.

decision-makers and energy industry thought leaders, and 400 exhibiting companies. Speakers at the conference include HE Suhail Mohamed Al Mazrouei, Minister of Energy and Infrastructure, UAE, HE Dharmendra Pradhan, Honourable Minister of Petroleum & Natural Gas, India, HE Chief Timipre Sylva, Honourable Minister of State - Petroleum Resources, Federal Republic of Nigeria, HE João Galamba, State Secretary for Energy, Portugal, Patrick Pouyanné, chairman & CEO, TotalEnergies, Dev Sanyal, executive vice president, Gas & Low Carbon, BP, Klaus-Dieter Maubach, CEO, Uniper SE and Peggy Liu, chairperson, JUCCCE.

Topics covered at the conference include FLNG and FRSUs; HSE; shipping, storage and terminals; small-scale LNG and bunkering; alternative fuels; gas processing, liquefaction and regasification; EPC; transmission, pipelines and distribution; digitalisation, automation and AI; and power generation, utilities and energy end-users.

For further information see www.gastechevent.com

Pipeline specialist STATS Group bolsters Qatar base

STATS GROUP, PROVIDER of specialist engineering services for the maintenance, integrity and repair of oil, gas and petrochemical installations and infrastructure, has strengthened its Qatari operation, recently recruiting additional project engineers and technicians as the company continues to create significant in-country value.

The company has established a strong reputation for its market leading technology in Qatar with significant awards for the supply of pipeline isolation and intervention equipment to major Qatari operators as part of their Emergency Pipeline Repair Systems (EPRS).

The equipment, which is stored in Qatar, is in a state of readiness for pre-planned and emergency situations and offers a safe double block isolation solution to carry out effective repairs to both subsea and onshore pipelines,



STATS Group working on a Remote Tecno Plug project in Qatar.

with the additional significant benefit of supporting clients progress towards their sustainability goals by reducing the need to depressurise or flare large volumes of inventory.

Baker Hughes provides remote operations solution for Aramco

BAKER HUGHES HAS deployed its remote operations digital technology across Aramco's drilling operations, encompassing more than 200 sites, the largest deployment of its kind in Baker Hughes' history.

Building upon Aramco's existing data management infrastructure and capabilities, this project provides the company with a single solution that covers data aggregation from the edge; real-time, unified data streaming and visualisation; data management; software development services; rig-site digital engineers; and monitoring personnel. The project supports Aramco's ongoing efforts to further drive digital opportunities and initiatives and to enhance operating performance and reduce emissions.

By connecting all drilling sites with an integrated solution, Aramco enhances its view of its drilling operations in real time. Following the contract award to Baker Hughes in 2020, the combined teams worked in close collaboration and deployed the technology 50% faster than originally planned, despite working under pandemic constraints. Baker Hughes teams conducted more than 400 onshore and offshore trips across 350,000 km to install rig-site edge devices and integrate data streaming, monitoring and visualisation capabilities into Aramco's existing digital infrastructure.

Furthermore, to support the needs of more than 2,000 end users and 24/7 drilling operations, Baker Hughes and Aramco established a dedicated centre staffed by a multi-disciplinary team of software engineers, data professionals and field service technicians. As part of Baker Hughes' localisation strategy, the team is staffed with 90% Saudi nationals who are being cross-trained on essential digital competencies in data operations.

"This remote operations deployment, the largest in Baker Hughes' history, is a strong example of how we are investing for growth with customers who are driving digital transformation at a rapid pace, such as Aramco," said Maria Claudia Borras, executive vice president of Oilfield Services at Baker Hughes.

She added, "We will continue to expand our upstream digital capabilities to transform core operations, improve efficiency and reduce emissions. I am proud of the Baker Hughes team's resilience in safely executing this complex project amid the challenges of the pandemic."

Shamaran announces cumulative oil production milestone of 45mn bbl at Atrush

SHAMARAN PETROLEUM HAS announced that the Atrush block, in the Kurdistan region of Iraq, has surpassed the cumulative oil production milestone of 45 million barrels since its first oil in July 2017.

In addition, a new development well, CK-17, has been drilled to TD with completion activities currently ongoing. The well is expected online within the next two weeks.

Dr Adel Chaouch, president and CEO of ShaMaran, commented, "These recent operational achievements are noteworthy as the production milestone and development drilling have been achieved following 2020's significantly reduced development programme due to the global pandemic and collapse of world crude oil prices. This is clear evidence that Atrush operations in 2021 have begun to return to normal."

In February 2021, ShaMaran reported that the Atrush field achieved a cumulative production milestone of 40mn bbls on 4 January 2021 despite the reduced 2020 development programme. Of that volume more than 16.5mn bbls were produced during 2020, which included over 1.3mn bbls of heavy oil.

BP CEO sees strong oil demand recovery

BP HAS PREDICTED a strong recovery in global crude demand which is also expected to last for some time, according to BP CEO Bernard Looney.

Speaking with Bloomberg News in St Petersburg, Russia, BP's CEO said that there is much evidence to suggest that demand will be strong, and the shale seems to be remaining disciplined.

Many other industry experts also see a robust rebound from the COVID-19 impact in the USA, China and Europe. For example, Igor Sechin, CEO of Russia's Rosneft PJSC, stated that energy demand will continue to grow. In addition, Mike Muller, head of Asia at Vitol Group, added that economic growth in China is also set to accelerate this demand, bringing down crude stockpiles, the source has further reported.

A Standard Chartered Plc report has stated that oil's demand recovery will be at the point of maximum velocity in June and July, and it is expected to reach 100mn bbl a day by December.

As reported in the source, it is suggested that the OPEC+ should manage the risk of the potential return of Iran barrels, while also managing any instances of COVID-19 cases.

Louise Dickson, Rystad Energy's oil market analyst, commented, "With demand growing, as long as US production doesn't rise enough to fill the supply void, the momentum is poised to remain bullish for prices this summer."



BP's CEO has predicted a strong recovery in global crude demand.

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Adnoc awards US\$500mn sour gas plant contract

THE ABU DHABI National Oil Company (ADNOC) has awarded a US\$510mn engineering, procurement, and construction (EPC) contract to Italy's Saipem to expand the capacity of its Shah Sour Gas Plant.

The EPC contract for the Optimum Shah Gas Expansion (OSGE) project was awarded by ADNOC Sour Gas (ASG), a subsidiary of ADNOC. More than 50% of the award value will flow back into the UAE's economy under ADNOC's In-Country Value (ICV) programme, reinforcing ADNOC's commitment to ensuring more economic value remains in the country from the contracts it awards.

The OSGE project is expected to be completed in 2023 and will increase the processing capacity of the Shah Gas Plant by 13%, from 1.28 to 1.45bn standard cubic feet per day (SCFD). Shah, located 210 km southwest of Abu Dhabi city, came on stream in 2015 and the OSGE project represents a cumulative expansion to 145% of the plant's original capacity. The scope of work of the OSGE project includes engineering, procurement, construction, pre-commissioning, commissioning, and startup of facilities to increase plant production capacity as well as the extension of the existing gas gathering network and new pad facilities.



Image credit: ADNOC

The investment supports ADNOC's objective of enabling gas self-sufficiency for the UAE.

Japan, UAE reinforce trade ties as official country partner for ADIPEC 2021

Abu Dhabi International Petroleum Exhibition and Conference (ADIPEC) has announced Japan's Ministry of Economy, Trade and Industry (METI) as its latest sponsor and official Country Partner of the 2021 edition of the event.

The partnership between ADIPEC, which is hosted by the Abu Dhabi National Oil Company (ADNOC), and METI supports bilateral trade ties and solidifies Japan and the UAE's partnership to develop technologies that reduce carbon emissions. This theme will be an integral part of ADIPEC 2021.

Japan is ADNOC's largest international importer of oil and gas products with approximately 25% of its crude oil imported from the UAE. The total value of non-oil trade between the UAE and Japan reached US\$130.8bn over the past ten years from 2009 to 2019.

ADIPEC looks forward to welcoming METI live and in-person in Abu Dhabi from 15-18 November for the 2021 edition of the show, which marks a special occasion as celebrations will commence to mark 50 years of the UAE and ADNOC.

Kuwait Oil Company selects Halliburton for digital transformation projects

HALLIBURTON COMPANY HAS received a contract from Kuwait Oil Company (KOC), to expand KOC's digital transformation journey by implementing solutions to maximise operational efficiency and increase production. The scope applies to all Kuwait fields including West Kuwait, South and East Kuwait, and Heavy Oil, complementing a recently awarded contract for similar services in North Kuwait.

Halliburton will collaborate with KOC to accelerate their data-to-decisions cycle by implementing automated work processes and digital twins across KOC's major assets. The solutions will leverage DecisionSpace 365, Halliburton's cloud-based subscription service for E&P applications, to automate work processes to accurately plan, forecast, and optimise production throughout the KOC portfolio. Built on an open architecture, the service integrates Halliburton and third-party technologies to enhance operational performance and increase ultimate recovery.

"This award signifies our strong relationship with KOC as we collaborate and innovate across their company-wide digital transformation initiatives," said Nagaraj Srinivasan, senior vice-president of Landmark, Halliburton Digital Solutions and Consulting. "This contract further demonstrates Halliburton's strategic priority to accelerate the adoption of our digital services. Our software and consulting services will support KOC to optimise their assets, reduce production costs and increase recovery."



Image credit: Adobe Stock

Halliburton will collaborate with KOC to accelerate their data-to-decisions cycle.

S&P Global Platts launches CNL assessment

S&P GLOBAL PLATTS, an independent provider of information, analytics and benchmark prices for the commodities and energy markets, has announced the launch of the world's first daily carbon-neutral LNG price assessment (CNL), which tracks the cost of carbon credits purchased and retired to offset the carbon emissions for an LNG cargo on the world's most active trade route.

The assessment brings transparency to this growing portion of the LNG market as the industry seeks to mitigate greenhouse gas (GHG) emissions and deploy further efforts to reduce the climate impact of their activities. CNL involves offsetting the carbon emissions associated with the upstream production, liquefaction, transportation and, where required, combustion of the gas – through the purchase and retirement of carbon credits, which in turn support the protection and restoration of natural ecosystems or other renewable projects.



Image credit: Adobe Stock

The assessment brings transparency to this growing portion of the LNG market.

Ciaran Roe, global director of LNG Pricing, S&P Global Platts, said, "We are already seeing LNG consumers around the world demand action on emissions associated with LNG use amid an increasingly carbon-conscious economy. Providing increased transparency around the carbon footprint of LNG cargoes is vital to aid buyers' and sellers' decision-making in the market."

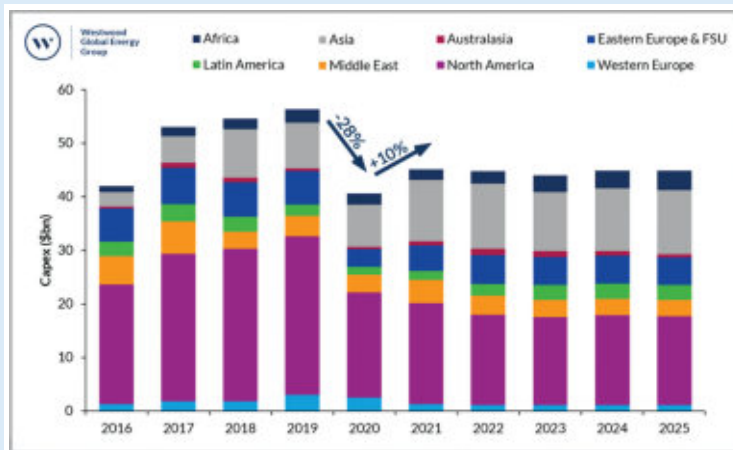
"The CNL assessment for well-to-tank emissions was developed in close consultation with the industry, which showed a keen interest in Platts adding greater transparency to the cost of offsetting emissions associated with an LNG cargo. The next steps for the industry are to decide on the development and implementation of GHG quantification and reporting methodologies, as well as how the industry will lower emissions associated with the production and consumption of LNG."

Pipeline capex forecast to rise 10% in 2021 from 2020 lows

IMPROVED OIL PRICES, recovering demand and increasing focus on natural gas for power generation is expected to drive demand (from the lows of 2020) for pipeline installations from 2021-2025, according to Westwood Global Energy Group.

Improving sentiment and outlook for commodity prices is expected to help projects progress through to completion, as well as boost demand for new pipelines installations in regions where increases in production capacity will require new pipeline infrastructure. Pipeline installation spend is forecast to increase by around 10% to US\$45bn in 2021, following a drop of 28% in 2020, and hold steady from 2021-2025. Gas infrastructure will lead new installations, accounting for around 66% over the 2021-2025 period as companies increasingly pursue energy security and clean energy agendas. Examples include Saudi Arabia, where MGSE Phase 2 and North & South Haradh GCP gas pipeline projects will drive demand for pipeline installations.

Operational expenditure (Opex) was far more resilient to the 2020 oil price crash (compared to Capex), dropping by around 5% relative to 2019 as operators largely maintained essential operations on the installed base of pipelines globally.



Onshore pipeline capex by region.

Image Credit: Westwood Global Energy Group

Aramco closes US\$12.4bn infrastructure deal

AN INTERNATIONAL INVESTOR consortium, consisting of investors from North America, Asia and the Middle East, has acquired a 49% stake in Aramco Oil Pipelines Company, a subsidiary of Aramco, for US\$12.4bn, with the successful closing of the share sale and purchase agreement.

As part of the transaction, announced in April 2021, Aramco Oil Pipelines Company and Aramco entered into a 25-year lease and leaseback agreement for Aramco's stabilised crude oil pipelines network. Aramco Oil Pipelines Company will receive a tariff payable by Aramco for stabilised crude oil flows, backed by minimum volume commitments. Aramco continues to hold a 51% majority stake in Aramco Oil Pipelines Company and retains full ownership and operational control of its stabilised crude oil pipeline network.

Aramco president & CEO, Amin H. Nasser, said: "We are pleased to conclude this transaction with the global consortium. The interest we have received from investors shows strong confidence in our operations and the long-term outlook for our business. It is a significant milestone that reflects the value of our assets and paves the way forward for our portfolio optimisation strategy. We plan to continue to explore opportunities to capitalise on our industry-leading capabilities and attract the right type of investment to Saudi Arabia."

Eni signs agreement for Meleiha concessions

ENI HAS SIGNED an agreement with the Arab Republic of Egypt, the Egyptian General Petroleum Corporation (EGPC) and Lukoil for the merger of the concessions of Meleiha and Meleiha Deep, in Egypt's Western Desert, and their extension to 2036, with the possibility of a further extension to 2041.

The agreement will unlock, through enhanced contractual terms, the area's considerable resources, thanks to a high-resolution 3D seismic acquisition and an intensive exploration and development drilling campaign. The construction of a new gas treatment plant, which will be connected to the Western Desert Gas Complex in Alexandria, will allow the company to further exploit the region's gas reserves.

The concession will be operated by Agiba, the JV between EGPC and Eni, through its subsidiary IEOC that holds a 76% interest in the concession, while Lukoil holds a 24% interest.

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IEA highlights need to refocus energy investments



Image credit: Adobe Stock

The MENA region's renewable potential is underutilised, according to the IEA.

CAPITAL NEEDS TO flow towards a different set of energy priorities in oil and gas producer economies, if they are to position themselves well for energy transitions, according to a new report from the International Energy Agency (IEA). In the report, entitled: *Financing Clean Energy Transitions in Emerging and Developing Economies*, the IEA highlights five key areas that can accelerate these shifts:

Reducing the emissions intensity of oil and gas production –

This may be the single most impactful short-term measure many producers can take to reduce emissions, comments the IEA, noting that the emissions intensities in producers, such as Saudi Arabia and the UAE are low and these countries should have an active interest in greater global scrutiny of upstream emissions. Alongside action and regulation on methane leaks and flaring, other options include using renewables to power upstream operations, with good examples underway in Oman and Algeria, or attaching CCUS to liquefaction facilities, as Qatar is planning. Innovative financing instruments have emerged to support action in these areas through the use of special purpose vehicles (SPVs) that conduct due diligence, measurements and repairs and then monetise emissions reductions through direct gas sales, by generating carbon offsets, or through operator fees.

Improving energy pricing and efficiency –

Energy pricing is often a huge barrier to a more sustainable allocation of capital. Subsidies to fossil fuels encourage wasteful consumption, but also distort investment incentives across the economy. Egypt provides a good example of a reform process; in 2013, energy subsidies accounted for more than 20% of the government's budget, but now, most prices now move in tandem with global indices and the fiscal burden has been reduced considerably. A low production cost base can provide a stable low domestic price, especially in electricity and natural gas. Reform provides a platform upon which energy transitions can be built and financed.

Cost-effective deployment of renewables –

The Middle East and Africa have some of the best solar irradiation rates in the world and where projects have gone ahead, e.g. in Saudi Arabia and the UAE, they have received some of the lowest bids seen worldwide for solar projects. This opens up significant possibilities to produce not only clean electricity, but also low-carbon hydrogen via electrolysis. Yet the amount of solar PV that has been installed in these regions, in total, is around 10GW. Recent announcements by Saudi Arabia (the Saudi Green Initiative) and others could change this outlook considerably, but policy and regulatory changes will be required to step up renewable investments in today's major oil and gas producers.

Getting more value from hydrocarbons –

Many producers, including those in the Gulf and the Russian Federation, are moving into downstream to capture additional value from hydrocarbons resources, often co-locating new petrochemical facilities with refineries to capture operational synergies. Expansion into more complex petrochemical products offers the potential to loosen price correlations with oil and gain from the relative resilience of demand for petrochemical products. However, expansion into downstream markets moves producers away from protected upstream markets into much more competitive market segments; often only established, well-capitalised players are able to forge ahead with such large-scale projects.

Making liquids and gases compatible with energy transitions –

Technologies that offer the possibility to monetise hydrocarbon resources without the associated emissions include the production of low-carbon hydrogen via steam reforming with CCUS or pyrolysis, the manufacture of other synthetic fuels, the downstream application of carbon capture to stationary uses of hydrocarbons, research into new non-combustion uses of oil and gas, and innovative ways to convert emissions into industrial materials.

Oil & gas majors push forward with renewables

THE OIL MAJORS are actively pursuing renewable power projects for long-term sustainability, according to data and analytics company GlobalData, which has issued a report on Renewable Power in Oil & Gas.

Expected low demand for fossil fuels is compelling companies, such as BP, Total and Shell to actively restructure their businesses to add renewable power projects in their portfolio. This will help them reduce their carbon intensity and align with the changing energy mix in the long run, says GlobalData. Moreover, oil and gas EPC vendors are enabling the energy transition by building capabilities to set up renewable energy infrastructure.

Ravindra Puranik, Oil and Gas analyst at GlobalData, commented, "Global power demand is expected to grow at a compound annual growth rate (CAGR) of 2.5% from 2020 to 2030, according to GlobalData. A significant portion of this will be fulfilled by renewable power generation. This growth outlook makes renewable power a key market for players across the energy sector, including oil and gas companies whose traditional market is at risk amid the transition to low-carbon sources."

Puranik continued, "Solar power generation, including solar PV and solar thermal, is expected to grow at a CAGR of 11.9% between 2020 and 2030. Meanwhile onshore and offshore wind segments are expected to collectively grow at a CAGR of 9.4% over the same period. Various governments are actively focusing on reducing carbon emissions and have enacted laws to facilitate decarbonisation in their countries. Electrification, based on renewable energy sources, is an ideal approach to reduce carbon emissions. It also marks a strategic shift away from fossil fuels in the global effort to mitigate the threat to climate change."

A key driver enabling the transition to renewable power is falling cost.

Puranik added, "Traditionally, renewable power projects had a significant cost disadvantage over coal- and gas-fired power plants. However, in recent years, their economic competitiveness has improved significantly due to government policies and incentives, as well as technological advances. This has incentivised oil and gas majors such as BP, Equinor and Shell to invest in wind power generation. BP and Total are also leading the way in terms of upcoming solar power capacity."

Partnership to deliver drilling solutions



Image credit: OSSO

John Dick, business development director, OSSO.

OSSO, THE SPECIALIST fluid temperature control and separation solutions provider, has signed a partnership agreement with Medra Arabia, the national diversified oil and gas service company, in Saudi Arabia, to meet clients' needs for advanced drilling solutions with direct access to its rental fleet of equipment, along with rig site support and heat transfer solutions.

The partnership will enable OSSO to significantly reduce turnaround time of equipment and personnel – providing a greater economic support structure with added expert local knowledge. The partnership provides additional on the ground technical support to customers – overcoming current travel restrictions due to COVID-19. Additionally, OSSO will provide in-country training on its technology and equipment, further upskilling Medra's in-field engineers in the local area of Dammam, enabling additional In-Kingdom Value Addition.

Abdur Rahman Adil, general manager at Medra Arabia, commented, "Through this collaboration our engineers will have the opportunity to expand their upstream oil and gas knowledge which will be invaluable to the region, our business and customers, and is in line with Saudi Vision 2030."

The partnership meets the current need for advanced drilling solutions due to the high temperature and deeper wells in the region. Currently customers are looking for a solution that enables them to actively manage the mud and downhole well temperatures, to mitigate risks, preserve tool life, and avoid any costly delays due to thermal fracturing.

John Dick, business development director at OSSO, commented, "This partnership also enables us to grow our mechanical separation services by offering wastewater and lube oil cleaning expertise as well as diesel purification solutions. COVID-19 has been a major challenge for suppliers but one that hasn't stood in the way of delivering for our customers."

Amarinth wins pumps order for Ruwais Refinery

AMARINTH HAS SECURED a US\$1mn order with its agent NAMA for 14 API 610 VS4 vertical pumps from ISCCO for the ADNOC Ruwais Refinery East, UAE.

The 14 API 610 11th edition VS4 vertical pumps with Plan 53B seal support systems and top-up trollies will be installed at the Ruwais East Refinery for closed drain duties, condensate and oil transfer. Depending on their duty, the pumps will be manufactured in either stainless steel or carbon steel, and all are ATEX Zone 2 compliant.

Amarinth will also provide on-site support during installation of the pumps from its engineering commissioning team.

Oliver Brigginsshaw, managing director of Amarinth, commented, "We are delighted to be working with our agent NAMA to secure and deliver this significant order from ISCCO for the ADNOC Ruwais Refinery. We will leverage our strengths in providing bespoke pumps on short lead times and our ability to work with customers in a flexible way to meet the demands of this project, which once again underlines our support of the oil and gas industry in the United Arab Emirates."



Image credit: Amarinth

Amarinth API 610 VS4 vertical pump undergoing final test before delivery.

Qatar Petroleum receives offers for NFE project

HE SAAD SHERIDA Al Kaabi, Qatar's Minister of State for Energy Affairs and president and CEO of Qatar Petroleum, has said that Qatar Petroleum received offers for double the equity available to potential partners in the bidding process for the North Field East (NFE) Project, the largest LNG development in the world.

The minister said that Qatar Petroleum is evaluating commercial offers received for participation in the project, which has a capacity of 32mn tons per annum of LNG, and that it had received commitments / sales and purchase agreements for double the 32mn tons per annum value on offer.

HE Al Kaabi made the remarks at Bloomberg's Qatar Economic Forum, where he also addressed the ongoing energy transition. "We see natural gas and the energy transition joined at the hip, and gas/LNG is part of the solution for a longer term transition," he commented, adding that Qatar started decarbonising its LNG some time ago, and currently captures and sequesters two million tons per annum of CO₂, which will grow to nine million tons by 2030. "We are doing it responsibly and we will be part of the solution for the long term," he said.

Schlumberger commits to net zero by 2050

SCHLUMBERGER HAS ANNOUNCED its commitment to achieve net-zero greenhouse gas (GHG) emissions by 2050. The oil services company has drawn up a decarbonisation plan focused on reducing Scope 1, 2 and 3 emissions across the oil and gas value chain, including the introduction of its Transition Technologies portfolio to assist its customers and the wider industry in their decarbonisation commitments.

"There is a new industry imperative to address climate change while meeting the demand for energy both today and in the long term, sustainably. We have a 2050 net-zero carbon emissions ambition which I believe is unique in our industry due to our capabilities as a technology company and our culture grounded in science," said Olivier Le Peuch, chief executive officer, Schlumberger.

"Our decarbonisation plans are based upon climate science and focused on three key



Image credit: Shutterstock

Schlumberger will reduce its emissions across the oil and gas value chain.

areas: operational emissions; customer emissions; and carbon-negative actions," said Katharina Beumelburg, chief strategy and sustainability officer, Schlumberger.

The Transition Technologies portfolio will address fugitive emissions, flaring reduction, electrification, well construction emissions, and full field development solutions.

Oman presses ahead with green energy projects

Momentum is building for clean energy developments in Oman in line with Vision 2040 objectives, and the country's oil and gas companies are playing a leading role. Louise Waters reports.

Image Credit: PDO



The Amin solar PV project.

OMAN HAS BEEN hard hit by the impact of the pandemic and the accompanying fall in the oil price, with its economy estimated to have contracted by 6.2% in 2020, according to the IMF.

Developing renewable energy is critical to reducing the reliance on hydrocarbons and diversifying the economy, as well as reducing greenhouse gas emissions (GHGs). Around 3GW of wind and solar PV projects are at various stages of development throughout the sultanate, with the ambitious target of deriving at least 30% of electricity from renewables by 2030, in line with Oman's Vision 2040 objectives.

They include the 500MW Ibr 11 solar PV plant being developed by a consortium of

Acwa Power, GIC and Alternative Energy Projects Company, which is set to begin production in H2 2021; the Duqm 300MW wind plant (Wind 2023), Oman's first utility-scale wind power project, set to commence operations in 2023; two solar IPPs in Manah; 11 solar-diesel hybrid facilities; and the 'Sahim' initiative to install small-scale solar panels on residential and commercial buildings, to mention just a few.

Oil and gas companies play a leading role

Oman's oil and gas companies are playing a leading role in driving renewable energy developments, as they transition to a lower carbon future. Petroleum Development Oman (PDO) is aiming at generating 30% of its power capacity from renewables by 2025, commissioning its first solar IPP project, the 100MW Amin project, in March 2020 in furtherance of its ambitious energy transition and sustainability objectives. Located near Nimr approximately 300km northeast of Salalah, the Amin IPP is the first utility-scale PV power plant in Oman, providing power to PDO's operations as an alternative to natural gas. The generated energy is sufficient to power 15,000 homes, and could result in an annual CO₂ emission reduction of more than 225,000 tonnes. State-of-the-art technology

has been utilised in the project including bifacial photovoltaic modules and backtracking facilities to maximise the energy production over time.

"This flagship project is another building block in support of PDO's continued transition to a fully-fledged energy company," said Raoul Restucci, PDO's managing director.

"We look forward to continuing to make further progress in our plans to gradually increase the utilisation of renewable resources in our activities, and are currently in the process of evaluating a number of exciting opportunities including wind power installations in our southern locations."

PDO is aiming to commission its first wind farm by 2023, and is also studying the feasibility of a green hydrogen pilot in two possible locations; PDO's solar-panelled car park at its Mina Al Fahal headquarters, with the output used to help power passenger buses, cars and trucks; and the site of the Amin Solar Project, where the green hydrogen is proposed to be injected into the gas pipeline, as well as used as an alternative to diesel in generators.

Meanwhile, Oman-owned energy company OQ, whose business is rooted in oil and gas, is developing a portfolio of alternative energy projects encompassing solar and wind projects, as well as industrial scale production of green

“ We look forward to continuing to make further progress in our plans to gradually increase the utilisation of renewable resources in our activities.”

hydrogen, green ammonia and green water, as part of its new alternative energy business line, utilising its downstream and commercial verticals to market green products. The company aims to become a “holistic provider of conventional and alternative energy”, with a key objective being to reduce GHG emissions and thus enhance its licence to operate.

Strong hydrogen potential

Oman’s strong renewable energy potential, along with the presence of industrial clusters in its free zones and industrial zones, favours the development of green hydrogen, given the role of hydrogen in decarbonising hard-to-abate industrial sectors. Oman’s Ministry of Energy and Minerals announced last year that it is undertaking a feasibility study to devise policies supporting investment in hydrogen technologies, and moves are afoot which could see Oman become a net exporter of green hydrogen.

In January 2020, the Oman Hydrogen Centre was launched at the German University of Technology in Oman (GuTech), which will serve as a knowledge centre in hydrogen technology for Oman and the GCC region, enabling Oman’s competencies for the green hydrogen economy.

“Oman’s geographical position and geological structure offer the chance to position Oman as a leading global producer and supplier for green hydrogen, satisfying the fast-growing worldwide demand,” said GuTech in a statement. “The production, domestic use and export of green hydrogen can be fundamental for the economic future of Oman, and will play a key role for the economic diversification and job creation efforts in the local energy industry and economy in general.”

In early May 2021, Ireland-based Fusion Fuel Green PLC, a green hydrogen technology company, announced that it has entered into a partnership with Consolidated Contractors Group (CCC) to develop green hydrogen plants in three countries in the Middle East, one of those being Oman. The green hydrogen demonstrator plants will support local refining and petrochemical companies to reduce their carbon footprint.

Joao Wahnou, head of business development at Fusion Fuel commented that the Middle East represents “a big opportunity and a very promising region for us, given the high levels of solar exposure, strong appetite for green hydrogen projects and strategic geographic position between Europe and Asia.”

Hydrogen hubs

In December 2020, the alternative energy division of OQ, Oman’s integrated energy company and Concessions, a subsidiary of Belgian dredging company DEME, announced the launch of a project to develop a world leading green hydrogen plant in the Special Economic Zone at Duqm (SEZAD), in

cooperation with The Public Authority for Special Economic Zones and Free Zones (OPAZ).

“The Special Economic Zone at Duqm provides a strategic and competitive location to develop large-scale green hydrogen production, given its centrality to global trade, the favourable wind and solar resources, the existing large port facilities and the proximity to a booming industrial zone,” said DEME.

The HYPOR Duqm Green Hydrogen Project will significantly contribute to the decarbonisation of the regional industry in Oman, as well as providing green hydrogen and/or derivatives (such as green ammonia) to international customers in Europe. The envisaged electrolyser capacity for the first phase is estimated between 250 and 500MW, following which the upscaling of the installation is on the cards.

His Excellency Dr. Ali bin Masoud Al Sunaidi, chairman of the board of directors of the Public Authority of Special Economic Zones and Free Zones (OPAZ), commented, “The start of this cooperation between DEME and OQ is very important, not only for the project, but towards the biggest cause of placing Duqm as hub in the hydrogen value chain. The step also complements the

“Oman’s geographical position and geological structure offer the chance to position Oman as a leading producer and exporter of green hydrogen.”

recently announced decision of the Public Authority of Special Economic Zones and Free Zones of dedicating 150 sq km of land for green energy projects in the Special Economic Zone at Duqm, in line with the Oman Vision 2040.”

OPAZ has commented that it has seen significant interest from international investors in green hydrogen projects in Oman’s economic and free zones, notably SEZAD and Sohar Freezone, to produce green hydrogen from renewable energy for export.

In May 2021, OQ, InterContinental Energy and EnerTech, announced it is developing an integrated green fuels mega project in the Al Wusta governorate. The project will consist of 25 gigawatts (GW) of renewable solar and wind energy at full capacity to produce millions of tons of zero-carbon green hydrogen per annum. The hydrogen can be used locally, exported directly, or converted into green ammonia for international export. The consortium partners will leverage their

broad existing commercial relationships and partnerships to secure long-term product sales agreements. Given the site’s strategic location between Europe and Asia, as well as excellent solar irradiance and wind resource facing the Arabian Sea, the development is well positioned to offer a secure and reliable supply of green fuels globally at a highly competitive price, OQ says.

The project will help transform Oman’s skills base and technical expertise in renewable energy, providing a significant number of high value jobs during site construction and operation, the company adds. Given the amount of equipment required at a project of this scale, it could also support the development of Oman’s renewable energy supply chain manufacturing and expertise.

Salim Al Huthaili, CEO Alternative Energy at OQ said, “OQ is proud to announce our biggest project in this field, which aims to maximise utilisation of Oman’s natural resources of wind and solar to produce green hydrogen. Alternative energy is a key driver for OQ’s long-term growth and a cornerstone of its strategy. It is also in-line with the country’s ambitious Oman Vision 2040 that aims to diversify the nation’s resources and maximise the financial value derived.”

Sohar Port and Freezone has a similar vision to Duqm, with plans to host a large-scale green hydrogen generation hub powered by solar power plants as part of its strategy to diversify energy sources and become a greener port and free zone, thereby increasing the attractiveness of Sohar as an investment destination. In a whitepaper, the Port’s CEO Mark Geilenkirchen, says, “The planned facility will create carbon-free hydrogen from low-cost solar power, stored for use on demand. The hydrogen will be used by the port’s industries and tenants for clean transport and industrial purposes.

“With declining costs for solar PV generation, building electrolyzers at our Sohar location with excellent renewable resource conditions could become a low-cost supply option for hydrogen.”

The Port is working in collaboration with the Port of Rotterdam as well as research institutes to identify competitive solutions for the adoption of hydrogen as an alternative to natural gas.

“Scale up will be critical to bring down the costs of technologies for producing and using clean hydrogen,” observes Geilenkirchen.

OPAZ plans for solar projects equating to 1GW in Sohar. In January 2021, Shell launched the 25MW Qabas solar plant, Sohar Solar Qabas at Sohar Freezone, Shell’s first utility scale solar PV project in the Middle East and Oman. The renewable electricity output is supplied to a large ferrochrome production facility, displacing the equivalent gas-fired power generation taken from the grid and avoiding more than 25,000 tonnes of CO₂ emissions annually. ■

Petroleum Development Oman (PDO) powers on

Although the past year has been anything but business as usual, Oman's energy sector remains in good shape under the stewardship of its national oil and gas champion, Petroleum Development Oman (PDO). Martin Clark reports.

DESPITE ALL THE challenges of the past year, not all things have changed. Petroleum Development Oman (PDO), Oman's national oil and gas champion, maintains steadfast production in the field, as ever, and continues to explore new projects and opportunities. Indeed, even in the face of unsettled markets, the company has taken bold steps to secure its long-term position upstream – oil and gas production is nearing record highs, standing at 740,000 bpd in May 2021.

At the same time, it has been bolstering its commitment to local jobs and services, a key strategic priority for years, and a move that will place it on a more sustainable footing for the future. In March, the company signed US\$4bn worth of contracts for long-term services support covering project delivery and maintenance and integrity work in the north and south of its vast Block 6 concession area, Oman's largest field producing around 650,000 bpd. The agreements, with Arabian Industries Projects (AIP) and Special Technical Services (STS), encompass the design and execution of more than 200 on-plot projects and will run for seven years with an optional three-year extension.

It also means current Omanisation levels will double over the lifespan of the contracts, with the creation of several thousand employment opportunities for Omanis, with a focus on skilled jobs, supervisors and engineering positions.

AIP will carry out project delivery in the north of Block 6 and maintenance and integrity work in the south, while STS will be responsible for project delivery in the south and maintenance and integrity in the north.

"These strategic agreements create a win-win culture for PDO, our partner contractors and Oman, in that they maximise capital efficiency, generate multi-million-dollar savings and enhance in-country value opportunities," said PDO's outgoing managing director Raoul Restucci.

Restucci – who has been the head of PDO for 10 years and has steered it through a



Image Credit: PDO

PDO signed US\$4bn worth of contracts for long-term services support with AIP and STS.

great number of changes and challenges – is succeeded by Steve Phimister on 1 July, 2021. But the departing boss leaves the company in a strong position, as one of the most innovative and forward-thinking state-owned energy firms in the Middle East.

PDO has not only embraced local content initiatives enthusiastically under his tenure, but actively deployed state-of-the-art technologies in the field, aiding Oman's push into new downstream areas and clean energy projects. The new services contract with AIP and STS will also benefit local sub-contracting firms and small and medium enterprises with specific targets for inclusion in the project work.

Going forward, there is a further plan to develop a new domestic entity to execute maintenance and integrity tasks in a selected cluster in the PDO oil and gas portfolio within the next five years. This builds on a broader strategy to nurture a domestic contractor to carry out facility maintenance in scheduled shutdowns for PDO and other major clients,

such as Oman LNG.

In May, PDO Services (PDO-S) was launched to leverage the talent, knowledge and skills of PDO staff to offer niche technical and non-technical services to clients in a wide variety of areas. Based at Mina Al Fahal, it will provide services in seven main areas, from field development planning and front-end engineering design, to support in logistics and innovative technologies. It marks a significant stride in PDO's efforts to pursue commercial opportunities outside its core concession area.

Industry restructuring

PDO's incoming managing director, Phimister, formerly Shell's vice president of upstream in the UK, will take over a company in good shape, but – like all energy firms worldwide – one facing a time of transition and great uncertainty with the push to cleaner, low carbon energy and other challenges.

In Oman, that also includes an industry restructuring following the creation of Energy

Development Oman (EDO), a new holding company established in 2020, with a mandate to oversee the sector and represent the government's stake in PDO, which is co-owned with international investors Shell, Total and Partex.

At the start of this year, PDO's finance director, Haifa bint Juma Al Khaifi, was appointed as its first CEO, stating that, "EDO will play a central role in the Sultanate's energy transition as well as economic diversification." It signifies yet another transition for PDO, with the commercialisation of its services and shift to renewables – underpinned by the launch of PDO-S and EDO – transforming the very nature of the company way beyond its original remit.

The new task is to support the nation's Oman 2040 principles of productivity and sustainability.

Yet, in the face of massive change, the group has not taken its eyes off the main goal of securing the nation's energy supply. International contractors likewise continue to support PDO in this vital role.

Engineering group Petrofac was recently handed work, worth US\$300mn, by PDO for two key projects. The Marmul Main



Image Credit: PDO

Outgoing managing director Raoul Restucci is leaving PDO in good shape.

Production Station (MMPS) Gas Compression project will eliminate permanent flaring and manage associated gas at a site about 800km from Muscat. Petrofac will also play a supporting role in various project and

engineering work for AIP at selected concessions in the North of Oman under its seven-year term.

The UK-listed company has a long track record in Oman and as a PDO client, investing US\$30mn in a technical training centre with its partner Takatuf Petrofac Oman to nurture and develop the local skills base.

It is also working on PDO's flagship Yibal Khuff project, which is now nearing completion after hydrocarbons began flowing into the US\$1bn central processing facility. Once it comes on stream – anticipated to be later this year – it will add a further 20,000-plus bpd to PDO's overall crude production.

It underscores the company's determination not to shy away from a challenge, given the ultra-high sulphur content and other contaminants present that must be stripped out during recovery. And, the additional output will push PDO's production tally a little closer to its new target – now 700,000 bpd by 2024 – a figure that creeps up on the back of past successes. Oil production is now at its highest level in years, for both PDO itself and Oman overall.

Despite these unprecedented and uncertain times, PDO continues to power on. ■

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Al Yasat has awarded an EPC contract to NPCC, worth US\$744mn, for the full field development of the Belbazem offshore block.

Image Credit: ADNOC

Prospects for EPC contractors looking up

EPC contractors in the Gulf are enjoying a steady project pipeline despite global challenges and uncertainties, says Martin Clark.

DESPITE SOME FAIRLY obvious challenges over the past year or more, project activity levels across the Gulf's energy market have held up rather well. The Middle East continues to provide fertile opportunities for engineering, procurement and construction (EPC) contractors. That is evident from a raft of contracts allocated to major players in recent months.

ADNOC, for example, recently awarded EPC contracts amounting to US\$318mn to China Petroleum Pipeline Engineering Co and Robt Stone (ME) LLC to connect smart wells with production facilities, while Saipem has been awarded the extension of two important contracts for onshore drilling activities in Saudi Arabia which it regards as a "positive sign of a gradual resumption of activities following the Covid-19 pandemic".

These awards are, however, just the tip of the iceberg in a market that is now rebalancing after the volatility of the last 18 months.

Overall, there is plenty of encouraging news for the EPC market and reasons for optimism, even in the face of the pandemic

tailwinds. Robt Stone has enjoyed a flurry of contracts in the UAE in the past few months, for instance. In June, that meant landing an award for the AIG Mirfa Train Interconnection Project by ADNOC Linde Industrial Gases. The month before, it was awarded a new EPC contract for Bu Hasa Wells Tie-Ins by ADNOC Onshore, for well work and approximately 153km of flowline construction. This work is expected to roll on through to around 2025.

ADNOC advances

ADNOC and its various subsidiary companies have been among the more active developers, as the UAE upgrades and expands its oil and gas sector. In May, Al Yasat Petroleum Operations Company Ltd, ADNOC's joint venture with China National Petroleum Corporation (CNPC), awarded an EPC contract to the National Petroleum Construction Company (NPCC), worth US\$744mn, for the full field development of the Belbazem offshore block. Belbazem is now expected to achieve crude oil production capacity of some 45,000 bpd, with first oil expected in 2023. Work will include three offshore Well Head Towers

(WHTs), one in each of the block's three fields, interconnecting subsea pipelines, and cables to Zirku Island, around 60km from Belbazem field.

Unlocking value

It is also clear that operators and project sponsors are seeking to extract maximum value from contractors and any work allocated.

Shaheen Al Mansoori, acting chief executive at Al Yasat, said that the front-end engineering and construction (FEED) competition and EPC award for Belbazem highlighted the company's focus on costs and a competitive approach.

"Al Yasat will continue to drive cost efficiencies as we unlock value from those Abu Dhabi's fields which are comparatively smaller and require a lean operating model to optimise their production and value potential."

The Belbazem work will see a large chunk of the award value – approximately 65% – flow back into the UAE economy under ADNOC's strategic In-Country Value (ICV) programme.

Aramco LTAs

This is likely to be a theme across the Gulf, as the region and world energy markets adjust after the economic shocks brought about Covid-19 and its ensuing lockdowns. These awards in the UAE follow a contract from Qatargas for the North Field Production Sustainability Offshore Project, among many others.

There is plenty going on too in the region's biggest energy producer, Saudi Arabia. Last November, Saudi Aramco awarded long-term agreements (LTA) to eight companies for the company's oil and gas brownfield and plant upgrade projects. These were signed with globally recognised EPC players, including Technip, Hyundai Engineering and Construction and Snamprogetti. The scope of the LTAs includes EPC, start-up, and pre-commissioning of each project and will run for a period of six years with an option for another six year extension.

Similarly, Aramco has built into its contracts firm commitments from the successful contractors to nurturing homegrown talent and employment targets to increase local content.

Competitive market

It seems likely that EPC contractors will continue to face ever-greater challenges and demands from project sponsors in a tighter market. The Arab Petroleum Investments Corporation (Apicorp), a multilateral development financial institution, has estimated that gas investments alone across the Middle East and North Africa (MENA) region will hit US\$75bn for the period 2021-2025. That is US\$9.5bn less than the previous outlook, but still a significant chunk of work up for grabs nonetheless.

"We anticipate a slow but steady recovery of the energy sector from the fallout of the Covid-19 pandemic, supported by continued investment from the public sector and an upswing in demand," said Apicorp's chief executive Ahmed Ali Attiga.

Saipem success

One global EPC leader, Saipem, has been especially active in recent months, showing that there is good business to be won despite the testing market conditions.

In March, it received a new contract worth over US\$1bn from Qatargas related to the North Field Production Sustainability Pipelines Project. The scope of work includes three export trunklines from offshore platforms to the Qatargas North and South Plants in Ras Laffan Industrial City at a total length of almost 300km, as well as associated onshore tie-in works and brownfield activities on existing onshore and offshore facilities.

Stefano Porcari of Saipem's E&C Offshore Division, called it "a sign of success of our positioning strategy in Qatar". Project

completion for this work is expected by mid-2024.

Technical prowess

In the UAE, Saipem also bagged an order from ADNOC for work on the Shah gas plant, the largest gas plant in the world, worth around US\$510mn. The EPC contract includes engineering, supply of materials, construction and commissioning, to increase gas treatment daily capacity by 13% – from the current production capacity of 1.28 to 1.45 billion standard cubic feet per day.

But it also shows that cost competitiveness is not the only consideration for sponsors, but also technical prowess and a long-term track record. Due to its higher sulphur content, the plant requires specific technologies to ensure safety and respect for the environment, which narrows the choice when selecting a contractor.

Maurizio Coratella of Saipem's Onshore E&C Division said the project award "is an additional recognition of our ability to carry out high-tech and complex projects in accordance with the highest safety and environmental standards". ■



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Keeping the seas clean

Oil and waste spills can lead to disastrous consequences for local health, wildlife and economies. Robert Daniels reports.

AS GREATER EMPHASIS continues to be placed on environmental and humanitarian concerns, more technology and expertise has been dedicated to reducing the number of oil spills that occur around the world. According to data maintained by ITOPF, the number of oil spills internationally has been in sharp decline since the 1970s, with decade averages of oil spills greater than seven tonnes falling from 78.8 at the end of 1980 to 6.3 with the closing of 2020. While this is a statistic that should rightly be celebrated, this is not an area where complacency can be allowed to set in as oil spills and general waste can cause immense damage to local wildlife, have adverse effects on communities such as crop and water contamination, not to mention the financial effects to the operator for the lost oil and resultant clean-up fine. The disastrous effects caused by the MV Wakashio oil spill in Mauritius last year are still fresh in the memory for most where more than 1,000 tonnes of oil leaked into the ocean after the bulk carrier vessel ran aground on coral reef. The fuel was a severe threat to the local marine ecosystem and a state of emergency was called after fears that the spill could threaten Mauritius' economy, food security and the health of citizens residing in the area. According to UNCTAD, Mauritius could be entitled to approximately US\$286mn in

liability and compensation for the incident, although the case is ongoing.

Fairdeal Marine

Acknowledging the need for continued and consistent vigilance on this topic, Fujairah-based Fairdeal Marine has placed their environmental services at the heart of their business and, since their operations began in 1978, has accrued extensive experience preventing and dealing with oil spills and waste material around the Middle East. To give a taste of some of the challenges pertaining in the region, the company outlined the problems posed by the straits of Hormuz which include:

- Heavy traffic
- Illegal discharges and oil pollution from unknown resources
- Only a small percentage of passing vessels deliver their waste to existing reception facilities
- No enforcement of calling vessels to have an oil spill response contract with a local contractor (which will protect them in case of oil pollution)
- No enforcement of calling ships to deliver their oily wastewater to authorised reception facilities operations as per the MARPOL 73/78 Convention.

To tackle these issues and prevent/clean oil spills in the region, the company offers a

range of oil spill response management solutions including spill response services, accredited training, management of recovered oily wastewater, customised hands-on drills and boats/tugs conversion to spill response operations. Fairdeal also has its own marine waste reception facilities, including designed and converted classed floating reception and procession facilities, and has introduced NANO technology for waste processing and the safe disposal of remaining non harmful material, such as oily waste.

To ensure each challenge can be met rapidly, the company stressed the need to constantly explore new technologies to improve eco-friendly material collection and handling operations. For instance, Fairdeal is ready to introduce the Geochemical Active Clay Sediment (GACS) Technology, for waste treatment, to the Gulf Region.

The company also emphasised the importance of collaboration in these endeavours, as exemplified by their strategic alliance with a team of inventors in Greece for field water and waste treatment.

For their services, Fairdeal has been presented with several awards including the environmental protection award of the Maritime Standards Awards 2020 and the winner of Best Service Provider – Marine award of the Shiptek2021. ■

Ten things to do to improve oil spill preparedness

Oil spill preparedness within oil companies may have waned during the pandemic. Lucy Short, principal consultant at Oil Spill Response Ltd (OSRL) provides some guidance to help organisations put in place some prevention barriers and readiness actions.

AS WE START to return to a new normal Lucy Short, principal consultant at OSRL, advises oil companies to assess the level of investment in oil spill preparedness over the last 12 months; the knowledge lost through headcount reductions; and the short-term actions to ensure they remain prepared to respond to an oil spill incident. In a blog, she highlights 10 steps which can help companies to do this:

1. Make sure your Oil Spill Contingency Plan (OSCP) or Oil Spill Response Plan (OSRP) is current, referencing the correct hydrocarbons and risks ratings, and reflecting your company's latest HSE protocols. Refresh your mind on oil spill response procedures, roles and responsibilities.

2. Review your relevant government guidelines and protocols to check whether anything has changed, which your plan needs to reflect if there is a new protocol or a new level of adherence to a convention required, then you will need to check how this will impact your OSCP/OSRP response model, communication lines and equipment.

3. Check your equipment to see if it looks in good working condition. Note any anomalies and capture them in a central system for further action. Assemble and run the equipment with trained and competent personnel if you can, and assess whether the equipment is commensurate with the risk and suitable to mount a tier 1 response.

4. Restart your team exercises or do an oil spill scenario. Whether your emergency response team is still remote, fully back in the workplace, or half/half, now would be a suitable time to do this. Including an oil spill scenario would be beneficial to test/refresh team knowledge. It would also be good to test the communication lines between those still working from home, those at the facility and those at the exercise site.

5. Review the oil spill response knowledge and competence retained in your Incident Command Team. Speak to everyone about their role in the incident management team



Image Credit : OSRL

Now is a good time to restart team exercises.

(IMT) and see how competent they feel regarding their knowledge retained. Assess their confidence in their ability to support an oil spill response incident and review their training and exercise records. See what extra training they could do to further their knowledge. If an employee's accreditation has expired, they will need to attend a refresher course to maintain their accredited training standard.

6. See what free relevant oil spill response courses there are online to refresh your knowledge from companies such as IPIECA, GIWACAF and OSRL.

7. Check out the IPIECA/IMO/IOGP websites for up-to-date knowledge sharing, good practice guides and industry updates.

8. Communicate with the Incident Command/Management Team, Crisis Management Team and the wider business regarding the oil spill response status of your business/operation/facility. Taking the time to share the status of your OSCP/OSRP, the equipment and response techniques with relevant staff ensures that they remember the importance of remaining skilled and knowledgeable on the subject and that they are confident to be part of an oil spill response team.

9. Empower your team to share knowledge and do further (free) training if necessary and available. As part of your incident/emergency command team meetings, have a knowledge sharing session where each team member shares something they have learnt or something that resonates with them about oil spill response.

10. Use an online oil spill response capability review tool. Check out this tool, it is simple to use and freely available to undertake a simple capability review of your operations: <https://www.oilspillresponse.com/tools/ready-check/> ■

To view the full article and links to further resources, see

<https://www.oilspillresponse.com/news--media/blog/how-to-improve-your-preparedness/>

Oil Spill Response Limited (OSRL) is the largest international industry-funded cooperative which exists to respond to oil spills wherever in the world they may occur, by providing preparedness, response and intervention services.

<https://www.oilspillresponse.com>

Behaviour-based safety for enhanced safety performance

Yusra Kindi, senior behavioural safety adviser, Petroleum Development Oman (PDO), discusses PDO's IHTIMAM programme, which has had a major impact on safety performance throughout PDO and its contractor companies.

Can you outline PDO's behaviour-based safety programme, and its role in improving safety culture? What do you think are its main achievements?

Behaviour-based safety, when implemented correctly and sustained, can improve safety performance by raising awareness and the ability to recognise hazards among the workforce, reinforce positive safe behaviour, promote intervention, encourage proactiveness to eliminate hazards in the workplace, improve communication and ultimately improve the safety culture.

IHTIMAM (Care), is a highly targeted behaviour-based safety system to cater for the safety requirements of the oil and gas sector and other industries. Launched in 2018, IHTIMAM has already led to a step change in safety culture at the company, exemplified by significant improvements in safety metrics including Lost Time Injury and Total Recordable Case Frequencies. It assists in the identification of the root causes of unsafe behaviour, enabling the system's users to develop targeted solutions before an incident occurs.

The basic principle of IHTIMAM is that all injuries and occupational illnesses can be prevented. The main objective of the IHTIMAM programme is to train each member of the line organisation to eliminate incidents and injuries by skillfully observing people as they work, talking with them to correct their unsafe acts, and encouraging them to follow safe work practices.

There has been a major business impact of implementing IHTIMAM, both in terms of cost, and in safety performance. Its impact on safety leadership and safety performance can be confirmed from the companies that have piloted IHTIMAM since January 2017. One particular company which had a Lost Time Injury Frequency (LTIF) of six per million man hours recorded a massive drop in LTIF to zero after implementing IHTIMAM.

As the programme is developed in-house, it has resulted in total cost savings of over US\$2,189,332 per annum, when compared to

Image Credit: Yusra Kindi



Yusra Kindi, snr. behavioural safety adviser, PDO.

the costs of using BBS consulting services.

The implementation of IHTIMAM has been completed in 74 companies, with the training of around 34,000 employees. We are currently working to increase the BBS maturity level of enrolled contractors.

How is the IHTIMAM BBS system using digital technologies to enhance safety systems, identify issues and prevent incidents occurring?

The BBS system encourages everyone within an organisation to observe, report and comply with behavioural changes based on a thorough analysis of root causes, safety

reports, and audits. The IHTIMAM database is customised and available to all employees and contractors. Reports are pre-designed to provide a pro-active approach to data analysis. Employees can report their observations in the system online in which it will reach the supervisor who is responsible for verification and assigning action to close it. Data is analysed for areas of improvement and towards correcting unsafe behaviours and recognising safe behaviours.

The system allows users to:

1. Observe and report safe/unsafe behaviour remotely
2. Monitor activities and trends to ensure they fall in line with corporate safety principles
3. Turn statistical data into actionable insights
4. Analyse the data periodically for areas of improvement.

What is your process to maintain the sustainability of the system?

A periodically set meeting (time and date agreed by PDO and contractor staff) is to take place to discuss implementation progress, statistics and any support required.

Management are required to be part of IHTIMAM implementation, to ensure IHTIMAM is included within the management review agenda.

Sustainability reviews are conducted to review progress and identify any gaps within the implementation process. This is done through a data deep dive. It is an extensive overview of the overall effectiveness of the system and targets the following key indicators:

- Improvement in safety performance in regards to safety statistics, such as reduction in LTIF
- Improvement in communication and engagement
- Improvement in action close out rates
- Improvement in safe percentage scores
- Improvement in safety culture
- Improvement in management involvement.

This is done in three steps:

- 1- Employee perception survey
- 2- Data deep dive
- 3- Site visit to review actual implementation.

“ The BBS system encourages everyone to observe, report and comply with behavioural changes.”

Has the pandemic impacted your BBS safety programme and standards?

Indeed, the pandemic has impacted the whole world; however, we have put in lots of effort to cope with the new situation. All our communication with the system users shifted to virtual meetings. The main challenge was the training, as we cannot implement the system for new batches of employees unless they are well trained. We were able to shift all our training to virtual tools, changing the material to fit with online display.

As we were not able to conduct site visits due to travel restrictions, we tried our best to make them virtual as well. We stopped most activities and events that require gatherings of people, which has impacted the marketing of the system and its visibility to the community.

Despite all the challenges, we successfully progressed in our plan of the implementation process with new users, and introduced IHTIMAM to 32 new contractor companies as part of the 2021 implementation plan. ■

Yusra Kindi presented on this topic at the HSE Oman Forum, which took place virtually from 22-23 June. See www.hse-forum.com

New national lifting operation management system

PDO HAS HELPED to drive the introduction of a new national lifting operation management system for the oil and gas industry in Oman.

The new standard defines the minimum compliance and implementation requirements for a robust lifting management system for any party involved with the management or execution of lifting operations in the sector.

It also means there is now one national training programme for lifting operations, which is certified by the Accrediting Bodies Association (ABA). The ABA was established in the UK in 2012 to maintain a common set of standards for the basic skills and underpinning knowledge required to operate workplace transport equipment in line with all relevant legislation and approved codes of practice.

Oman's new system followed the success in lifting operation industrial certification which was introduced by PDO in 2016 to enhance safety, competence and professionalism. Operators then approached the Oman Society for Petroleum Services (OPAL) to develop a uniform management system for lifting and hoisting.

Lifting lead Fahad Al Raba'ani said, "Having one system in Oman will enhance safety in lifting operations and will standardise the requirement among other operators, which can boost such operations without compromising safety or quality. In addition, it helps our oil and gas contractors to understand the requirement of a safe lifting operation and equip themselves accordingly."

Fahad Al Raba'ani presented on this topic at the HSE Oman Forum. See www.hse-forum.com

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ICAEW: Strong rebound in Middle East economies

According to the Economic Insight report for the Middle East, business confidence in the region has strengthened as vaccines have been rolled out and COVID-19 restrictions have eased.

THE REPORT WAS compiled by Oxford Economics, a leader in global forecasting and quantitative analysis providing advice to corporate, financial and government decision-makers, and shows that the Middle East's regional GDP will grow by 2.4% this year, a similar rate to the region's average growth trajectory in the last decade, and an improvement from the 4.4% it shrank by in 2020.

The Institute of Chartered Accountants in England and Wales (ICAEW), a membership organisation that promotes, develops and supports chartered accountants and students across the world, commissioned the report which highlights how the recovery process has been disrupted by stricter lockdown restrictions in recent weeks and oil production cuts weighing on output. Despite this, strong Purchasing Managers' Index (PMI) readings indicate growth accelerating in the coming months, boosted by rapid vaccine rollouts in several countries.

Preparation for various regional events, such as Expo 2020 in Dubai and the 2022 FIFA World Cup in Qatar, an easing of regional tensions and spending by the Saudi Public Investment Fund (PIF) will also support growth. Overall, GCC GDP will grow by 2.1% this year, after the 5% contraction seen in 2020.

Although global COVID-19 cases are still high and new outbreaks are being reported daily, the pandemic looks to be under control in China, Europe and the USA. With the tourist season approaching, oil demand is increasing. This, along with ongoing supply reductions from OPEC+ producers, has stabilised the oil price at above US\$65/bbl in 2021. However, given the continuously fragile demand outlook and plentiful scope for stronger supply growth, the upside for oil prices will remain limited through 2022 and 2023, and the report forecasts Brent to average US\$61/bbl during that period.

Michael Armstrong, FCA and ICAEW regional director for the Middle East, Africa and South Asia (MEASA), commented, "The

Keeping infection levels low will be essential to ensuring economies in the Middle East can return to growth.

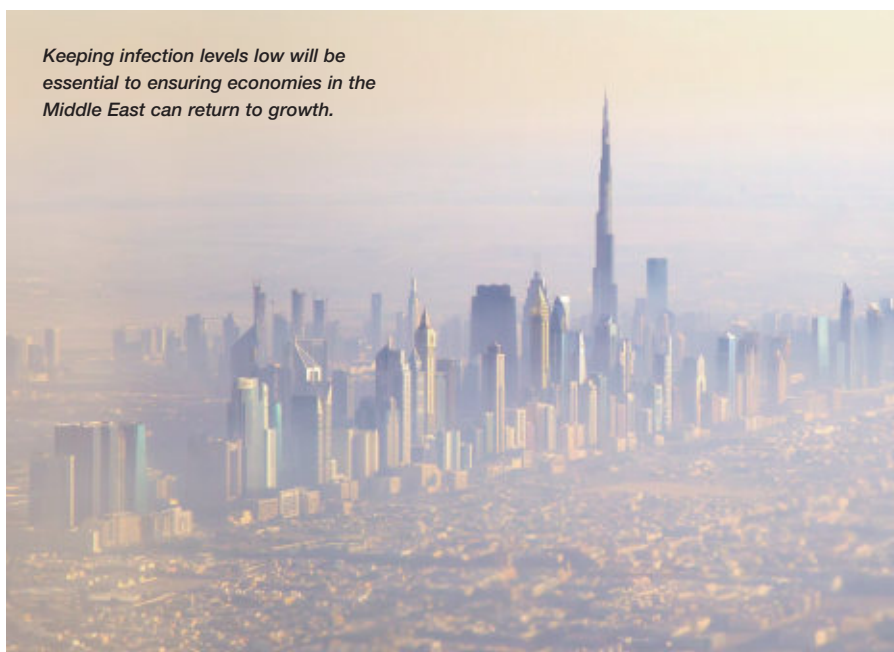


Image Credit : Adobe Stock

outlook for most Middle Eastern economies looks positive this quarter, but keeping coronavirus levels low will be essential to ensure economies can return to growth. Governments across the region must keep developing sectors and industries that foster innovation, and continue implementing reforms to diversify economies and accelerate them into the post-COVID era."

The climate emphasis

Given the high reliance on the oil sector for growth, and countries' vulnerability to rising temperatures, climate change is also an increasingly important issue in the GCC region and is receiving a sharper focus in diversification plans in countries such as Saudi Arabia and the UAE. For instance, Saudi Arabia's Green Initiative aims to cut CO2 emissions in the Middle East by 60% by 2030 and ensure that half of the country's electricity is generated from renewable sources. With many sectors oil-intensive, the

authorities have recognised that business models must change as otherwise they risk exposure to international policies to tackle climate change such as carbon taxation and border carbon adjustments.

"The rise in the oil price has boosted revenue prospects for GCC producers, which derive 40-90% of total fiscal income from oil. Higher oil revenue gives governments more scope to support post-pandemic recoveries without undermining efforts aimed at improving medium-term fiscal sustainability," said Scott Livermore, ICAEW economic advisor and chief economist at Oxford Economics.

"Climate change is a big risk to the economy and society. Without a significantly expanded mitigation effort, the MENA region, which already suffers from climate-related issues like water scarcity, is likely to have major economic consequences that could have pronounced economic impacts by 2050." ■

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How to be certain of the uncertainty of an MFM

Dr Bruno Pinguet, multiphase domain senior advisor at TÜV SÜD National Engineering Laboratory, discusses the importance of measurement uncertainty analysis for multiphase flow meters.

MULTIPHASE FLOW METERS (MFMs) have been employed as complex measurement systems for the oil and gas sector for many years. As they can eliminate the need for a test separator, which are big and difficult to maintain, smaller platforms are possible. Existing facilities can also be upgraded to take subsea tie-backs without having to add an extra test separator. MFMs also give continuous measurements, allowing better reservoir management, well optimisation, and a quick response to water break-through and similar events.

As MFMs are becoming drastically cheaper, most oil and gas operators could now take advantage of this capability. However, while they reduce CAPEX, fundamental questions remain over the reliability and capability of such equipment to perform accurately when compared to previously used systems. This is because the claimed theoretical uncertainty of meter manufacturers does not always match that of a more conventional test separator setup, making some oil and gas companies question their accuracy in service. The buying process therefore very often involves some comparison tests being made either before delivery, or later in the field on a regular basis, or as a spot-check against standard equipment, such as separators.

While flow meters are calibrated under ideal laboratory conditions, the environments into which they are installed vary greatly. It is therefore incredible to see today in this billion-dollar oil and gas industry that most flow measurement systems are reporting flow rates without any consideration of measurement uncertainty. Uncertainty analysis is therefore essential to determine whether measurement systems are capable of meeting required performance targets.

What is uncertainty?

It is a popular misconception that measurement is an exact science. In fact, all measurements are merely estimates of the



Image Credit: TÜV SÜD National Engineering Laboratory

Dr Bruno Pinguet, Multiphase Domain senior advisor, TÜV SÜD National Engineering Laboratory.

true value being measured, and the true value can never be known. The terms ‘accuracy’ and ‘uncertainty’ are also misused in the oil and gas industry.

Accuracy refers to the agreement between a measurement and an expected true value. Therefore, accuracy requires two measurements with two different meters. Accuracy cannot be discussed meaningfully unless the true value or most probable value is known or can be recognisable.

On the other hand, uncertainty is an

interval defined around the average, which is based on the data collected over a given period that is considered a stable flow condition. The true value can be expected to be within the confidence level inside the interval defined during the measurement. The size of the interval is described as a confidence interval or in terms of sigma (i.e. standard deviation from a statistical point of view). To make MFMs easily comparable and effectively report their performance, the multiphase flow metering community has decided to follow the 95% confidence level or 1.960 multiplied by one sigma.

From a practical point of view, this means when a measurement is made repetitively (under continuous stable flow), then a standard deviation can be calculated using the numerous collected data. This is defined as one sigma (σ) which means that there is a 68% chance that the true value is within this interval. This standard deviation “ σ ” is multiplied by 1.960 and provides the performance or uncertainty interval with a 95% confidence interval. This is shown in Figure 1.

Uncertainty elements

So, how can operators effectively allow for this uncertainty? The ideal approach would be to calibrate each individual device for the specific conditions it will encounter. However, this is not financially realistic, and to establish the performance of an MFM, an uncertainty budget must therefore be constructed, taking account of additional uncertainties arising from interpolation and extrapolation from calibration conditions.

Firstly, calibration against a single-phase meter at least three to four times better than the device in question is needed. This is done in a third-party flowloop facility, the best being a primary calibration facility. Secondly, the repeatability performance of the MFM must be established. The repeatability of the device-under-test (effectively the closeness of agreement between successive measurements made under the same conditions) is its estimation of the overall

“ It is a popular misconception that measurement is an exact science.”

uncertainty of the calibration. The repeatability is demonstrated by maintaining the flow conditions of operation and simply switching the device off and on. Any possible deviation that appears will need to be taken into account as repeatability.

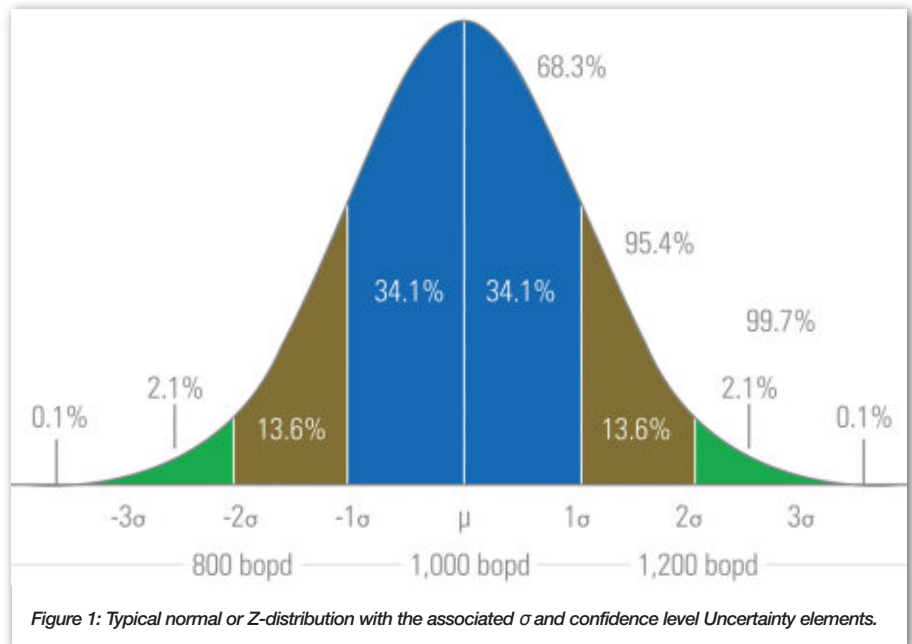
Reproducibility is another essential parameter from the end-user's point of view. This is established by moving from a given condition, such as pressure or choke opening etc., to different conditions, and then returning to the previously given conditions. Meter drift is a systematic uncertainty that should also be accounted for, as this determines how the error in the measurement process will change over time. Bias is very well documented and addressed in ISO 21748, and it could also be a source of uncertainty.

Stability is another parameter to consider, as if there have been multiple calibrations of the same flow meters over the years, this will be the standard deviation of the calibration results. The standard uncertainty and the associated stability on the reference measurement should also be taken into account.

Ensuring a proper comparison

To establish the performance of an installed MFM against a reference flow meter, some prerequisites are necessary. For example:

- Both devices must be physically as close as possible so changes between them in line pressure and temperature are minimal.
- Both devices must record data at the same time.
- Both devices must use the same pressure-volume-temperature (PVT) package to perform the conversion from line to standard conditions, or from the MFM conditions to reference flow meter conditions.
- If the devices are not close to each other, the cumulative volume measured must be three times larger than the storage volume between both flow meters. It is important to remember that the longer the recording, the more accurate the established uncertainty of both devices will be.
- If the devices are far away and the flow reaches the MFM long before the other



“To ensure validity of an MFM’s measurements, comparison tests can be conducted either during the buying process, before delivery or sometimes later.”

device, then the reference flow meter recording time should be defined in order to capture the same type of flow passing through both meters.

- No choking should occur between both devices to keep the PVT package consistent and for the quick evaluation of the line or standard conditions of both devices.
- Both devices should be within the sweet spot of their working envelope.
- Both devices should be set with the relevant intrinsic fluid properties package,

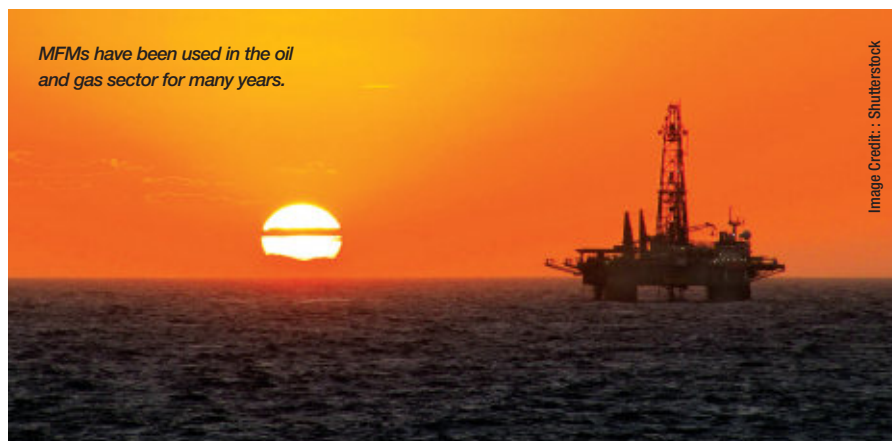
or equations of state (EOS) to ensure proper calculations.

- The reference flow meter’s transmitters or sensors should be within the specification and zero trimmed or corrected for deviation in order to account for any potential bias.

Although MFMs have been available on the market for more than 30 years and deliver many commercial benefits, their acceptance within the conservative oil and gas sector is slow. To ensure validity of an MFM’s measurements, comparison tests can be conducted either during the buying process, before delivery, or sometimes later when results do not match client expectation or reservoir model forecasts.

Validation of test comparisons in well-controlled conditions and with very good uncertainty of the reference measurements can be achieved by a third party that is familiar with field well test operations. This helps to avoid any conflict about who is right or wrong and provides a clear final statement based on statistical analysis, physics, and field expertise. This work should therefore not be left in the hands of the MFM manufacturers who can be over-optimistic about their product performance. ■

TÜV SÜD National Engineering Laboratory www.tuvsud.com/en-gb/nel is a world-class provider of technical consultancy, research, testing and programme management services. Part of the TÜV SÜD Group, it is also a global centre of excellence for flow measurement and fluid flow systems and is the UK’s Designated Institute for Flow Measurement, with responsibility for providing the UK’s physical flow and density measurement standards.



MFMs have been used in the oil and gas sector for many years.

Image Credit: Shutterstock

The mitigation of sour corrosion at lower treatment rates

Hussen Ouji, technical lead engineer, ChampionX, discusses how the company performed a chemical qualification study of corrosion inhibitors (CI) for an international oil company in Iraq and customised a treatment programme to alleviate corrosion risk in the field.



Figure 1: ChampionX participated in corrosion testing for a wellhead and central processing facility in Iraq.

Image Credit : ChampionX

CORROSION IS ONE of the most prominent and costly issues facing the oil and gas industry today. With pipelines and associated equipment exposed to extreme environments, from production through to refining, failure to consider or mitigate corrosion can lead to the costly shutdown of operations and potentially create a hazardous and unsafe working environment.

It is estimated that the total annual cost of corrosion in the oil and gas industry is US\$1,372bn. This figure can be broken down into US\$589mn on surface pipeline and facility costs; US\$463mn annually in downhole

tubing expenses; and another US\$320mn in capital expenditures related to corrosion (<https://www.nace.org/resources/industries-nace-serves/oil-gas>).

Unlike general corrosion, pitting corrosion is the proliferation of cavities or "holes" in the

material. This form of irreversible, localised corrosion is considered more dangerous as it is difficult to detect, predict and design against. Even a small, narrow pit with minimal overall metal loss can lead to the failure of an entire engineering system.

Pitting corrosion, which, for example, is almost a common denominator of all types of localised corrosion attack, may assume either a hemispherical or a cup-shaped appearance and can produce pits with their mouth open (uncovered) or covered with a semi-permeable membrane of corrosion products.

While working on a project for an international oil company in Iraq, concerns

“ It is estimated that the total annual cost of corrosion in the oil and gas industry is US\$1,372bn.”

were raised around the presence of pitting corrosion across the well head, through trunklines, and in the central processing facility (CPF). The company was producing more than 55 barrels of oil per day from several wells with sour conditions and a low water cut, where the H₂S environment can intensify corrosion risk (Figure 1).

ChampionX, a global leader in upstream and midstream oilfield chemical and technology solutions, was awarded the chemical management and services contract to perform a chemical qualification study of the corrosion inhibitors (CI) and customise a cost-effective and sustainable treatment programme to enhance operations and alleviate corrosion risk in the field.

Background

Carbon steel remains the dominant choice for the construction of oil and gas pipelines and infrastructure. However, as operating conditions become increasingly extreme, assets age, equipment is used beyond its design life and materials are pushed to their limits. This can ultimately contribute to a heightened risk of materials failure.

As the effectiveness and efficiency of any CI product can be viewed as soon as six months after implementation, it is critical that testing and optimising of the chemical selection is carried out to maximise the lifespan and safeguard the integrity of the plant.

Since the start-up of the oilfield in 2014 and over a period of two years, different types of CI had been implemented at the CPF by the operator. However, neither a chemical qualification study nor a field trial had been conducted for these products before, or during, the implementation period.

The corrosion level in the pipelines and the CPF was monitored with corrosion probes and corrosion coupons.

Based on the monitoring data, these CI products showed positive pitting corrosion results. Due to the lack of a corrosion control programme, the injection rate of the products was not optimised, leading to increased treatment cost for the operator.

Chemical qualification and remediation

ChampionX and the company agreed to carry out laboratory testing to qualify the corrosion inhibitors at a third-party laboratory in UAE. Three chemical products were selected for the qualification study: two were the company's own and the other was the incumbent CI.

The testing programme consisted of performance tests under laboratory conditions to simulate as closely as possible the corrosion-related conditions in the operation. The laboratory testing parameters were agreed by both companies and closely monitored by the ChampionX assist integrity RD&E team.

The company collected and delivered a



Image Credit: ChampionX

Figure 2: During the CI implementation period, the treatment programme was closely monitored by the field team to ensure the set KPIs/specifications were met.

one litre sample of produced water from the customer's oilfield where it was analysed for full ionic composition required for CI qualification work. The performance of the CIs was evaluated by High Performance Liquid Chromatography (HPLC), microscopic analysis and 3D Profilometry.

The company's highly water partitioning, film forming CI, CORR10697A is particularly suited for high water cut applications, where laminar flow leads to water separation and corrosion at the bottom of the line. It can be applied by continuous injection to both wet crude and gas systems.

The study showed that CORR10697A significantly outperformed the tested products, and at lower treatment rates, in terms of general corrosion and pitting mitigation. Based on the study, the company issued a comprehensive treatment protocol to the customer. The CI was then injected in two locations simultaneously:

- 1. Wellheads:** to control the corrosion in the trunklines;
- 2. CPF:** to control the corrosion in oil dehydration process.

As the wells were located up to 30km away from the plant, CORR10697A was injected up through the wellhead to essentially protect all lines connecting the CPF equipment. Based on corrosion coupons and probes data, the CI has effectively controlled and reduced corrosion in the field at lower injection rates when compared to previous products.

During the CI implementation period, the treatment programme was closely monitored by the field team to ensure the set of

KPIs/specifications were met.

In comparison to the incumbent CI, the chemical volume or consumption of the qualified inhibitor was reduced by up to 40% at the time and remains at this reduced level today. This not only realised a financial saving to the operator but also a logistical improvement by lowering the storage space required and the frequency of deliveries, meaning a less impactful carbon footprint.

Creating and maintaining value

In the presence of an inhibitor, the design life of a typical pipeline is around 20 years with an allowable corrosion rate of 0.05mm per year. Without it, corrosion can accelerate by up to 3mm a year, leading to pipeline loss within just two years. As there is no 'one size fits all' CI, it is vital that testing and qualification is undertaken to ensure the correct chemical package fits the design specification of the facility.

ChampionX and its team of PhD-level synthetic organic chemists specialise in molecular designs for superior corrosion inhibition. This knowledge and the resources to accurately simulate the corrosive environment helps customers avoid costly damage to equipment and downtime that can impact revenue. As well as sour environments, its wide range of simulation capabilities include low and high shear conditions, HPHT, surface analysis and thermal stability and compatibility.

The company continues to work closely with the operator following a three-year extension of the initial contract. ■

Addressing the issue of liquid loading

Upwing Energy outlines its new subsurface artificial lift technology which alleviates liquid loading and extends productive well life.

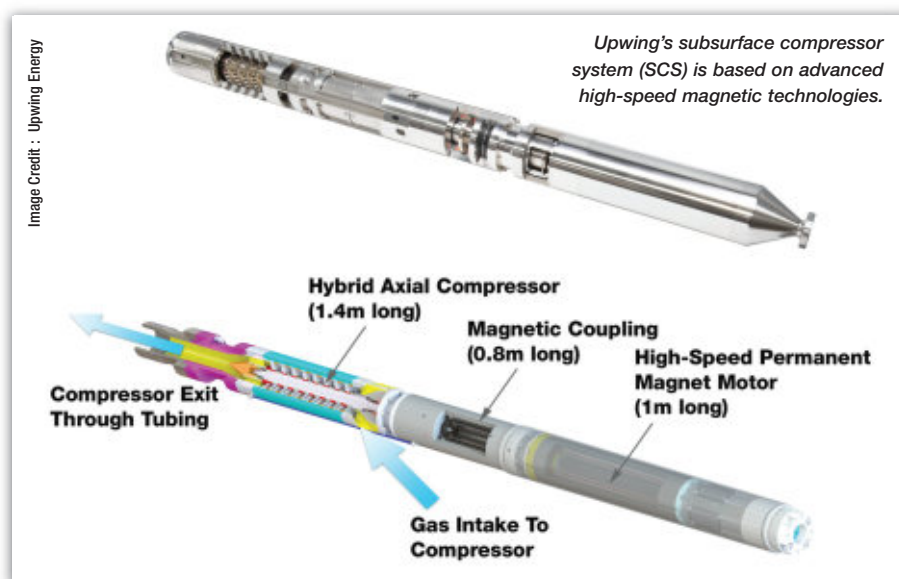
NATURAL GAS PRODUCERS in the Middle East are growing increasingly concerned about the persistent problem of liquid loading, which is negatively affecting productivity. Accumulation of liquids in the well creates blockages and backpressure that reduces gas velocity, causing a falloff in production and potentially leading to premature abandonment.

Various artificial lift solutions, such as surface compressors and electric submersible pumps (ESPs), have been employed to remove liquids and increase production with less than satisfactory results. A promising new patented downhole artificial lift technology has been developed and demonstrated by Upwing Energy, a US-based technology and service company. Upwing's subsurface compressor system (SCS) is based on advanced high-speed magnetic technologies. According to Upwing's CEO Herman Artinian, the Upwing SCS has been designed to provide reliable performance in the downhole environment by eliminating the common points of failure in conventional ESPs.

Artinian explains that the hermetically sealed downhole tool consists of a high-speed permanent magnet (PM) motor, a shaftless magnetic coupling between the motor and compressor, and passive non-contact magnetic bearings with electronic dampers. The hybrid axial wet-gas compressor is driven by the high-speed PM motor. Torque is conveyed from the motor to the compressor with no mechanical shaft or seals, eliminating the need for a motor protector to isolate the motor from downhole fluids. This "protector-less" architecture, according to Artinian, eliminates a frequent source of vulnerability for conventional downhole artificial lift systems.

The system also includes a sensorless wide-frequency variable speed drive (VSD) at the surface that controls the downhole motor at speeds of up to 50,000 rpm.

The Upwing SCS lowers the bottomhole well pressure, increasing the velocity of the gas stream, removing liquids from the vertical and horizontal sections of the well. The



Upwing's subsurface compressor system (SCS) is based on advanced high-speed magnetic technologies.

lowered backpressure from liquid loading increases gas production, which in turn accelerates liquid unloading. Once the liquid is carried upward by the gas stream, the lower pressure at the compressor intake and the higher temperature at the compressor discharge prevents vapour condensation and enhances the carry-over of liquids to the surface by the gas stream.

"Upwing's unique downhole turbomachinery can maximise gas and condensate production, recoverable reserves, gas-in-place recovery efficiency and liquid unloading at the same time," says Artinian. "All of these benefits can be realised in any type of formation and wellbore geometry in both the onshore and offshore environments regardless of where the well is within its life span."

Modelling tools make it possible to evaluate and predict the outcome of conventional wells with the SCS. This is due to better understanding of the conventional reservoir, existing verified models and available historical data. Operators can insert the SCS compressor maps into their reservoir models and verify the incremental improvement in production and recoverability.

As Upwing continues with its trials, the results are being verified with comprehensive in-house models that incorporate the SCS tool, reservoir, wellbore and top-side equipment. For conventional reservoirs, these modeling tools can predict results fairly closely. SCS gas well simulations and trials have shown gas production increases ranging from 20 to more than 200% and increased recoverable reserves ranging from 20 to more than 70%.

"It is significantly more cost effective to increase production and reserves of existing conventional wells than drilling new unconventional ones," says Artinian. "Using simulation modeling tools developed by Upwing Energy, we have demonstrated that reducing liquid loading with the SCS to extend the life of a conventional liquid loaded well would require 96% less capital expenditure than drilling a new unconventional well, and produce 28% more gas and condensate within the initial 10 years."

Upwing Energy has experienced significant interest from the Middle East, North Africa and Southeast Asia, where most of the gas wells are starting to face liquid loading issues, and is working on putting together trials in these regions. ■

Automation making multi-sector appeal

Automation helps the oil and gas workforce to work faster and helps asset owners save time and money without compromising safety. Organisations are increasingly looking to deploy automation to improve their operational performance and make vital efficiency gains.

AUTOMATION OF ENERGY technology is important for mastering the future challenges of sustainable energy supply. It is already being established across oil and gas operations, and some of the latest technologies and collaborations are helping operators with highly specific tasks in sectors and subsectors.

For example, in a recent move to deploy workflow automation software that is specifically tailored to the requirement of the oil and gas industry, Petrofac has signed a three-year partnership with Intoware. The development of 'WorkfloPlus Oil and Gas' will further optimise the efficiencies that Petrofac has gained from digitalising maintenance and inspection activity for its clients. The software has been designed to automatically generate digital workflows, schedules and reports for users, eliminating the traditional manual and time-consuming preparation required.

Steve Johnson, vice-president of digital for Petrofac's Engineering and Production Services business, commented, "The tool empowers teams to work faster and more efficiently, ultimately saving asset owners time and money without compromising safety."

Honeywell technology plays a major role in providing automation solutions in large petrochemical complexes. In February 2021, in

North Africa, Sidi Kerir Petrochemicals Company (SIDPEC) selected Honeywell technology to upgrade the production capabilities of its flagship petrochemical complex in Alexandria, which produces ethylene and polyethylene for the Egyptian market. Honeywell has replaced SIDPEC's legacy Honeywell TotalPlant Solution (TPS) production system with the latest version of its Experion Process Knowledge System solution at SIDPEC's complex in Alexandria.

Also, Anchorage Investments Ltd will use Honeywell UOP's C3 Oleflex technology to produce 750,000 mt per year of polymer-grade propylene for its new Anchor Benitoite petrochemicals complex in Suez, Egypt, near the southern terminus of the Suez Canal. Honeywell UOP's C3 Oleflex technology converts propane to propylene through catalytic dehydrogenation. The technology is

designed to have a lower cash cost of production and higher return on investment when compared to competing dehydrogenation technologies.

It is not just all about the strategic collaborations – companies are developing sophisticated technologies too. The latest on the list is Emerson's Rosemount TankMaster Mobile – the world's first cross-platform inventory management software application for tank gauging systems – providing immediate secure access to critical tank data. By making real-time data available to a wider range of stakeholders via smartphones, tablets and computers, this easy-to-use mobile solution facilitates better decision-making and improved operational efficiency and safety.

Per Skogberg, solutions manager with Emerson's Automation Solutions business, said, "By facilitating secure mobile access to this

information, Rosemount TankMaster Mobile provides the opportunity to increase efficiency, drive productivity and improve collaboration throughout the supply chain." ■



Emerson's tank inventory software application aims to improve operational efficiency.

Disrupting existing assets with cloud and Digital Twins

Data-centric engineering and shared project information on the cloud enables value-added Digital Twin creation for capital maintenance and brownfield projects, explains Vanessa Erickson, capital project portfolio expert, AVEVA.

OVER THE PAST 10 years, Capital expenditure (CapEx) projects – both brownfield and greenfield – have become more complex and challenging due to many factors, not limited to ever-changing environmental, societal and government (ESG) standards and requirements, increased end-product specialisation, and a move towards larger, more distributed global project teams. As a result, industrial capital projects are commonly delivered over-budget and beyond the originally planned project schedule by an average of 20 months or more. Pile on a common project design and execution approach that involves the use of outdated technologies and methodologies, disconnected systems and tools, siloed working with lack of data integration, and duplicity in data creation, and an industry ripe (and ready) for change is revealed.

As the industrial sector emerges from the global pandemic with a clearer view of future process plant and market requirements, operators and their engineering, procurement and construction (EPC) contractors have doubled down on digital transformation to build the plant of the future.

Age doesn't matter, but Digital Twins do

The Digital Twin of a plant captures the as-is version of the physical plant digitally, and can help to generate the necessary insights to drive savings, improve safety, sustainability and productivity, and enhance the overall asset life cycle.

As companies adjust to new market demands and shift to cleaner operations and more sustainable end-products, the majority of the capital projects that will be delivered in the next couple of years are planned for existing, ageing, or operational assets. Unlike on a greenfield (or net-new) project, when forming the Digital Twin on an existing asset, sometimes called a brownfield asset, there will already be data in place from when it was designed and constructed, and there are likely



Image Credit : Adobe Stock

years of operational and maintenance data to consider as well. All this data is commonly spread across disparate systems, in multiple versions, and may even be conflicting, but when aggregated and contextualised, it becomes a strong foundation for the asset's Digital Twin.

The greenfield vs. brownfield difference

On an existing, operational asset, there are two critical elements to getting the most out of your Digital Twin. The first is to systematically connect engineering data from the plant as it stands today. Laser scanning of the physical plant is particularly useful here to quickly and accurately create or verify the 3D model, which has likely changed from how it was originally designed. It is ideal to also incorporate all available process simulation data, material and equipment specs, and construction and fabrication vendor data, as well as any operational data collated over time to gain a contextualised understanding of your plant and how it behaves.

The second critical success factor is to deploy on a secure cloud platform to make

verified, up to date asset data accessible to internal teams and external contractors around the world. Aggregating asset data into a cloud platform is like joining the dots between related information from different places. It aligns all teams around a single source of truth no matter where they are based in the world. This allows for faster and more precise decision-making capabilities and reduces the possibility of expensive errors at the end of the project.

Lack of data integrity or access to trusted data can be disastrous, especially for brownfield and maintenance projects, with costly consequences when planned operations are expected to be resumed and do not happen, or worse, it could become a factor in missed regulatory compliance issues or safety incidents later on.

Integrated asset data creates opportunity in operations

Whether executing a project or gathering project data to form the Digital Twin, the approach remains the same. A strongly integrated approach to the technologies that create and utilise your data is crucial. This

should include process simulation, equipment lists, P&IDs and the 3D model, as well as vendor, procurement and construction information. This data-centric strategy minimises leakages from offline collaboration, reduces the time spent finding and verifying data, and provides deeper understanding of processes that would otherwise stand alone in the legacy, disparate approach. Integrating the engineering and project data together in a single place is, in effect, the first form of the Digital Twin.

Once you have the foundation of your Digital Twin in place, you can easily layer in advanced operations efficiency programmes such as operator training simulators (OTS), visual asset performance management (APM) and other maintenance predictability programmes throughout the asset lifecycle.

By its nature, creating an integrated Digital Twin of your plant generates its share of project and operational benefits, as follows:

- Project teams have full visibility of required data with all relevant context in one central location
- Shared data, specifications, and standards reduces risk of costly errors and rework
- Teams can focus their time on critical tasks

instead of data management

- Capital project status updates can be determined instantaneously
- Communication and collaboration improvements can be seen throughout the project
- Improved overall transparency in anticipating downtime, productivity loss, delays, overruns
- Technology deployment times are much faster on the cloud - from months down to as little as a week.
- Fuels operational efficiency programmes such as Asset Performance Management and Machine Learning.

Incorporating project and asset data into your Digital Twin strategy creates transparency through digital tools and real-time data sharing to inform and expedite decision making, drive project efficiency and reduce risk while enhancing future operations.

Gainful benefits through disruption

In the past, project decisions were based on data generated from a mix of physical and digital documents and reports leading to errors, inconsistencies, and conflicts,

ultimately impacting the success of the project, while lending little value to operational decisions. On operational plants, a scaled-back Digital Twin strategy may have been developed from a point in time with limited or missing data on its design or construction, or more commonly, prioritised for future greenfield projects only.

Putting data at the centre of your asset strategy disrupts the way all project and operations stakeholders work and collaborate. When data is continuously shared to the core of the Digital Twin, as it is generated and all documents and reports are created from the latest version of that data, the insights you extract can be trusted to make and implement decisions quickly and with complete confidence. The efficiency gains from this approach translate to 10 or even 15 per cent savings on the Total Installed Cost of a typical capital project.

Don't downgrade your digital transformation aspirations for your existing and legacy operational assets. With access to powerful technology and the right partners, your Digital Twin is well within reach no matter the age of your plant, and the potential future benefits are unimaginable. ■

Technology for a clear Future

Individual Solutions for Oilfield Pump Systems

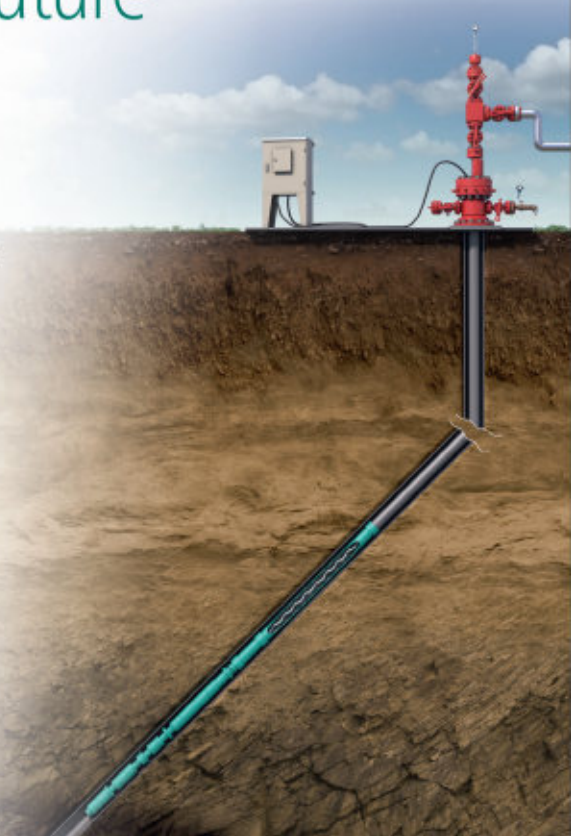
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Addressing data challenges in the midstream sector

Saul Zambrano, global industry director, energy and utilities digital transformation leader at Software AG, discusses how midstream operators can make the best use of their data to optimise their processes.

How would you describe the current state of oil and gas midstream technology challenges today?

On my last trip to Abu Dhabi, I came across one of the best descriptions that describes the technology challenges facing the overall oil and gas sector, including those that specialise in the midstream value chain: “The digital transformation of oil and gas companies has been largely piecemeal and focused on improving efficiencies for very specific applications.” While there are certainly value-creation opportunities in this type of approach, it is hard (or impossible) to scale it.

For example, one of the most important exercises in the oil and gas sector is the characterisation of production reservoirs. For this activity, some of the most advanced analytics and visual characterisation technologies are employed to define and contextualise them. For the midstream value chain, this approach is often replicated in a variety of very specific applications – schedulers, blend management and custody transfers to name a few – that are purpose built for managing the storage and transportation of petrochemicals. On the other end of the spectrum, a large degree of field assets in the midstream storage, transport and financial settlement process are managed through manual processes.

And herein lie the two principle challenges facing oil and gas midstream operators. One, while the purpose-built applications work, these solutions often function as stand-alone applications generating data that is specific and isolated to one application. And two, for the field assets that are not enabled to log



Midstream operators face a number of data-related challenges.

and record data, there is no data generation. Without access to quality data, it is very difficult to optimise production decisions through advanced analytical capabilities, such as artificial intelligence (AI) and machine learning (ML).

For the first challenge associated with purpose-built solutions, what are the important considerations on accessing the data that they generate and capture?

While purpose-built solutions will always have a key role in supporting midstream operations, there is one key technology capability that all leading oil and gas operators need to develop to support their digital transformation plans. They need a world-class application integration capability that allows them to not only access any data pool but, just as importantly, provide them with the ability to move the data where it can best be used in a timely fashion by production engineers, data

scientists and plant managers.

A significant use case is from one of the state-owned oil companies of the region which is also one of the few that are ahead of the digitalisation curve. The outcome of the deployment benefited the company through data synchronisation by connecting dots between applications across all partners and operating companies via a unified layer of common framework and standards. As a key business objective of the firm is to integrate for internal and external purposes, this implementation increased the effectiveness and efficiency of services delivered by the company and its subsidiaries, giving it a distinctive competitive advantage. They further have the option to scale it up horizontally and vertically. With this truly cloud enabled platform, the organisation is able to adapt cloud technologies and move gradually to cloud without jeopardising the security or quality of services.

“The digital transformation of oil and gas companies has been largely piecemeal.”

Can you give an example as to how leveraging data from different applications can be used to optimise operations?

My favourite example of the importance of this capability is the field of self-service industrial analytics. Anyone who has worked or supported storage and pipeline operations understands that it is an incredibly complicated process environment. Within this environment, there are a multitude of assets from different vendors generating millions of data tags. These tags are captured in either historian or data lake environments.

For production and reliability engineers to make full use of this data, self-service industrial analytics technology platforms that can perform Advance Pattern Recognition analytics are critical for two reasons. One, to find and record root cause anomalies that are negatively impacting reliability across the end-to-end production process. Two, once an anomaly is recorded and diagnosed, it can be catalogued and utilised as a predictive tool to inform engineers that the potential for a production disruption is high when that pattern repeats itself. In the case of the regional oil firm highlighted above, integration across siloed applications, assets and

services enabled the firm to combine existing functions and its underlying data to increase agility and improve efficiency.

One of the challenges that you mentioned was the manual management of field assets. Can you provide an example of a manual process for a particular asset type, and compare this with a ‘digitally transformed’ process?

For the midstream sector, one of the better examples is the storage and blending of petroleum stocks. For a number of storage operators, tank levels are often measured via a manual process of work crews going out to individual tanks to perform the measurements. While this process works, it is often associated with recording inaccuracies and delayed decision making associated with the time it takes crews to visit, record and post their findings.


Compare this against a storage environment where all tank levels are monitored with IoT tank-level sensors and technology across terminal and blended storage tanks. At any given time, plant managers can make real-time decisions to support storage requests based on a real-



Image Credit: Software AG

Saul Zambrano, global industry director, energy and utilities digital transformation leader, Software AG.


time view of storage capacity. Additionally, they can run advanced analytics on transferred volumes in relation to tank storage levels, also in real time, to identify asset integrity (leakage) events. And lastly, by using a self-service industrial analytics platform, they would be able to run advance pattern analytics to enable predictive maintenance capabilities across the field assets (pumps, compressors, etc.) supporting the storage and transport transfer process. ■



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The evolving role of well integrity

At the Offshore Well Intervention Conference, Middle East and North Africa 2021, an expert panel discussed the pressures shaping the well integrity market, and the factors that will drive change for the discipline in the future. Robert Daniels reports.



Image Credit : Adobe Stock

OWI MENA 2021 was held virtually due to the pandemic.

HOST TURAL YUSOBOV, senior engineer, Well Integrity at ADNOC, was joined by Fayez Issa, group well integrity advisor for ADNOC, who commented, “Well integrity has gone through different stages. If you go back 30-40 years it did not exist, there was minimum knowledge. But then after many incidents and major catastrophes, the knowledge of well integrity has become a vital aspect of oil and gas. It changed a lot 10 years ago after the events on the Macondo field in the Gulf of Mexico. Before, people could happily ask things like, do we really need to log cement? Is it important to see variations? Do we need special requirements for a gas lift? Additionally, a lot of things were done at minimum cost. Now if a well is planned to last for 30 years it has to be designed to last that long, a change partially due to the environmental challenges and more stringent regulations.”

Nowadays well integrity is a much larger concern for the industry, emphasised Neil Ferguson, business and sales development manager of well intervention and integrity at Expro Group, who noted that Expro now has 50% of its portfolio dedicated to this discipline, whereas 20 years ago it was just 20%.

Exemplifying why well integrity and surveillance is such an important topic in today's world, Mustafa Adel Amer, well

integrity focal point at BAPETCO, said, “Ten years ago BAPETCO started doing well integrity management systems which accelerated the building up of knowledge. But unfortunately after the crash in 2014, the company took the decision to save costs and stop things such as corrosion logs etc. Now after six years the company is going to pay more to fix the unknown causes of corrosion and will have to probe the wells.”

While the discipline has grown significantly over the last few decades, the panellists noted that there was still room for improvement. Ferguson suggested that there was perhaps a bit of a disconnect from integrity as it was so often bound up as part of drilling and production. The participants suggested that if well integrity is kept within these departments it might not perform its role as effectively, but having well integrity as a separate entity within companies would empower it to do so.

“ After many incidents and catastrophes the knowledge of well integrity has become a vital aspect of oil and gas.”

Abandonment

Switching the conversation slightly, Ferguson turned the focus on well integrity related to abandonment. He said, “One of my concerns is how do we help customers safely abandon their wells when they need to stay abandoned. There is now an expectation that once abandoned, these wells stay that way forever. The next challenge is figuring out how to do the best possible job to ensure integrity not just in a well’s operating life, but once it is abandoned also. I don’t think we will be able to just forget these wells once they are abandoned, and there will be elements of risk that will continue to challenge the industry. We have a huge responsibility as we move forward as to what we categorise as well integrity.”

Abandonment remains a difficult topic for the industry as, at the bottom line, it does not return any profit. As the panellists noted, drilling wells is exciting as you then get the reward, but this is not the case with abandonment, and so often it can be neglected. This is exemplified by Bloomberg projecting that more than 32 millions wells worldwide are no longer producing and are awaiting proper abandonment.

To ensure these operations are carried out and, importantly, are done so in a proper way to ensure the integrity is not compromised, the panellists suggested that cost must be projected forward, so that operators can plan for these financial hits in advance rather than bear the brunt unexpectedly at the end of a well’s life. Additionally, more stringent regulations would ensure that abandonment would be a requirement, but of course the implementation of regulations varies from region to region. Ultimately, the panellists agreed, if there is an event relating to an abandoned well’s integrity, it could easily be a catastrophic event that will affect everybody, not just the local region. Therefore it is also the responsibility of the oil and gas industry, not just the regulators, to ensure the integrity and abandonment of wells is taken seriously and performed in an environmentally responsible manner.

The role of technology

The participants noted that technology has played, and will continue to play, a huge role in the well integrity sector and, in recent years, perhaps the most significant advancements have been made with AI and big data.

Ferguson commented, “Artificial Intelligence (AI) is used in just about everything else we do in day to day life, so why shouldn’t we use it to our advantage in our industry to give us a predictive view on well integrity issues. We are in the era of big data and digitalisation, and there is so much data to look at that is very easy to miss some key information. The capacity for AI to interpret data and predict well integrity issues



Image Credit : Adobe Stock

The panellists discussed how technology plays a key role in the well integrity sector.

in the future is a huge cause for optimism, and I think it is going to be hugely important moving forward.”

Adel Amer added, “One of the challenges of performing corrective actions was the unavailability of material. We had one well, for example, that had three failures, and we couldn’t acquire the material to replace the faults for one and a half years. But just replying on a simple data model, we can plan ahead for such instances by seeing how many faults occurred in previous years to predict what material we will need in the future. I think more solutions like this are going to come up if we make data available to these smart minds.”

Although enormous strides have been made with digitalisation and AI, the panellists noted that there were still many areas for improvement which have the potential to greatly enhance well integrity capacity. For instance, Issa noted that while there is a lot of data being collected from various sources such as corrosion logs, cement logs etc, there is still not enough surveillance data being conducted. Improving this would only enhance the ability to predict issues and rapidly remediate them.

Another area of improvement is centred around data sharing. As noted, the more data available, the easier it is to predict potential issues in the future and, while perhaps there is scope for acquiring more, collectively oil and gas operators hold a plethora of data from locations across the world. If companies were more visible with their data, it would enhance opportunities to rapidly remediate wells and ultimately capture value for operators.

“But this is something the industry is not keen on, sharing products and data. This

hinders a lot of the opportunities that could be unlocked without really spending any money,” noted Adel Amer. “If we want to move forward in the digital era we need to exchange data and make data sets available.”

The impact of COVID-19

The panellists also reflected on how the well integrity discipline had been affected by COVID-19, noting that perhaps the most significant change, which will most likely last into the future, is the reduced reliance on external sources. For instance, Adel Amer noted that in Egypt, the company typically orders a lot of materials from abroad but this was, for obvious reasons, dramatically hindered by travel restrictions and so, instead, local companies began manufacturing more advanced equipment.

There is also an emphasis on training to ensure that the expertise is available within companies rather than seeking it from external sources. Issa noted that in ADNOC the company had recently issued a well integrity e-learning which was mandatory not only for those related to the discipline but also drilling and operations etc to ensure all employees know what irregularities and potential issues they should be looking for.

It was clear from the discussion that while the discipline of well integrity has made great strides over the last few decades, factors such as lack of surveillance and a reluctance to share data are holding it back. Addressing these obstacles would only enhance the field, which would ultimately lead to healthier wells with extended production lives capable of providing more value to operators and the industry. ■

Partnering with Aramco to build local capacity

Alfanar, one of the largest conglomerates in Saudi Arabia with a long history of involvement in the oil and gas sector, has signed a memorandum of understanding (MoU) with Aramco to co-operate on various initiatives. Mr. Amer Al Ajmi, VP – Sales & Marketing at Alfanar Construction, told Oil Review Middle East more.

What role does Alfanar Industrial City play in capacity building and localising industry, and why did you make the decision to partner with Saudi Aramco?

Localisation is at the heart of our operations at Alfanar. Alfanar Industrial City (AIC) has been the largest private industrial complex in the Middle East since 2008. Today, equipped with fully localised medium voltage switchgear, it stands as a prime example of our ongoing mission to localise the industries we operate in and build national capacity. To further this mission, we have been forging strategic partnerships with both local and international market leaders to secure a future defined by prosperity and sustainable development. We also hope that our wide-ranging achievements will encourage other organisations to pursue ongoing expansion.

As certified IKTVA participants, we are especially proud to be collaborating with Saudi Aramco to meet the Kingdom's Vision 2030 ambitious plans and targets. Our cooperation spans over a decade, and this groundbreaking new agreement is a new way for us to capitalise on our shared goals of building and transforming Saudi Arabia. Some of our initiatives aim to enhance localisation as well as sustainability, while others aim to instigate digitalisation and innovation in the Kingdom.

Together, Saudi Aramco and Alfanar's powerful commitment to both social and environmental responsibility will contribute to development in the Kingdom and create a lasting positive impact.

What role can digitalisation play in improving project outcomes, and what is its importance within the MoU?

Digitalisation is the golden thread running throughout the entire MoU, because it is both a requirement of the future as well as an instrument through which we can provide better quality to our clients and the community. This is why we prioritised



The MoU was signed by Mr. Ahmad Al Saadi, senior vice president of Technical Services, Aramco and Mr. Abdul Salam Al Mutlaq, chairman, Alfanar.

digitalisation years ahead of the curve, and consistently implement it across all our local and international projects.

To take the Smart Meter Project as an example: in 2019, Alfanar became the key driving force behind the largest digital transformation endeavour outside of China. Aside from being a critical first step towards a smart future, the project benefits range from reducing technical and non-technical losses to predicting demand. To accommodate the immense scope of the project, we built on our strong background in R&D to develop customised technology such as the Project Quality Management Information System (PQMIS), which we have adapted into a highly competitive quality control system. It also holds us accountable both internally and externally – project stakeholders can monitor quality across all project stages, starting from

the initial construction phases to O&M.

This blend of quality control and transparency is why having a strong digital foundation is particularly highlighted across all of the MoU's initiatives. Beyond the scope of the agreement, we are certain that the continual advancement of leaders such as Saudi Aramco and Alfanar will serve to encourage local innovation and promote digital transformation throughout Saudi Arabia.

How important is sustainability to Alfanar?

For Alfanar, quality and sustainability are two sides of the same coin: our commitment to quality awarded us our heritage of excellence, but our commitment to sustainability is what assures our future – the future of the planet as well as the company.

In terms of environmental sustainability, the

MoU is a channel through which Saudi Aramco and Alfanar aim to minimise the nation's carbon footprint, as even simple energy-efficient measures such as waste heat recovery can reduce fuel consumption and CO₂ emissions.

For the company as a whole, our focus is on business innovation and adaptability, localisation and diversification. By owning and developing our own technologies, training local professionals, and engaging in prudent capital investment, we can secure our long-term standing and stay ahead of the competition. Our aim is to predict what the world will look like in ten years and take actionable steps today that will help us assert a prominent place in it.

How deeply involved is Alfanar in research and technology innovation? Are there any sectors the company is focusing on in particular?

R&D is a central part of Alfanar, considering the strong and well-established reputation of our Industrial City and our position as leaders in the energy sector. However, it is Alfanar's commitment to exceeding expectations that led to its emergence as local pioneers in R&D. What sets us apart from our competitors is our ability to study client's construction project requirements and provide customised manufacturing solutions. We have produced all these innovative solutions internally to succeed in major projects such as supplying electricity to the Haramain High-Speed Railway and Wa'ad Al-Shamal Industrial City, while also contributing to localisation and



Image Credit : Alfanar

Mr. Amer Al Ajmi, VP – Sales & Marketing at Alfanar Construction.

sustainability.

For more than 20 years, we have carefully monitored international market trends and the latest energy techniques to successfully introduce them to the Saudi market. As of today, Alfanar has acquired various IPs for EV charging and smart metering. EV charging, specifically, will soon become a global standard, and we broke ground when we collaborated with DEWA to introduce EV charging to Dubai. For smart metering, we

took the initiative of adding Spain's ZIV to our prestigious list of international acquisitions across Europe and Asia.

We are open to expanding our list of techniques and acquisitions to stay in tune with market trends and continue to impress our influential clients. At both our headquarters and international offices, we have hired subject matter experts in comparatively infant markets such as waste-to-value and energy efficiency because we foresee that they will play a much stronger role in Saudi Arabia in the decades to come.

How is Alfanar helping to promote the advancement of women in the workforce?

Alfanar was one of the first companies to capitalise on the untapped potential of female professionals. Alfanar began promoting gender diversity in the workplace as far back as two decades. Since then, Saudi Arabia has witnessed immense cultural developments that were further catalysed by Vision 2030. Now, Alfanar actively employs more than 700 female staff across the organisation with a dedicated technical training programme for each employee, and this number is increasing regularly. In terms of career advancement, we take great measures at Alfanar to offer multiple professional development programmes to all our staff members that train them for future leadership roles in the company, such as the "incubator" programme we offer for fresh graduates, which provides on-the-job and off-the-job training. It is our vision to soon witness talented female engineers joining Alfanar's Construction division and spearheading projects across diverse sectors. ■



Image Credit : Alfanar

The MoU was signed during a visit by Aramco's senior management to Alfanar Industrial City

Progressing in the digital transformation

A new report from Axora, the digital solutions marketplace for industrial innovators, predicts digital trends and key growth drivers in the global oil and gas industry in the ongoing energy transition.

FREED FROM RESTRICTIONS imposed by supply surpluses, price wars and the COVID-19 pandemic – and anticipating an imminent hydrocarbon boom – companies are ready to devote more capital to harnessing the power of digital technology, according to the *Axora 2021 Innovation Forecast: Oil and Gas*, which is based on a survey of 150 senior decision makers worldwide, as well as interviews with small and large operators alike. However the findings reveal that while some digital progress has been made, more still needs to be done to prepare for the energy transition.

Key findings include:

It is no longer about formulating digital transformation strategies, it is about executing them

99% of survey respondents said technology and innovation were critical to their organisation's survival and most respondents (55%) said they were at an advanced stage of implementation. Decision makers in Brazil were most likely to see themselves as advanced, followed by those in North America. Respondents in the Middle East and Europe saw their companies as lagging.

89% of respondents say they invested more in digital transformation over the past year. However companies have yet to invest significantly in it; on average, respondents dedicated 8% of their annual revenue to digital technology. Over the next five years, respondents expect to double their investment in digital transformation.

Cybersecurity is seen as the biggest individual barrier to investing in digital technology (by 45% of respondents), with the recent ransomware attack on the Colonial Pipeline in the southern United States standing as a frightening example of the industry's current limitations. This is followed by lack of IT infrastructure to handle data generated by digital solutions (41%). However, 61% of respondents reported facing issues due to either a lack of in-house skills or a company culture resistant to technical innovation.

A digital foundation must be established so it can deliver value as the energy transition gathers momentum

Business sustainability is seen as the most important concern over the next three years, with 39% of respondents ranking it as a top-three priority. 38% of respondents cited digital technology investment as top-three priority for their organisation over the next three years, a close

second to business sustainability. In three to five years, investing in digital technology is forecast to become the most popular priority, overtaking business sustainability. This shows the perceived increase in technology's importance as the energy transition approaches. Over the next three to five years, creating digital oilfields, boosting acquisition and use of renewable energy, and reducing greenhouse gas emissions become increasingly important priorities for oil and gas companies.

There is a favourable view of digital deployments to date

76% of respondents said they have deployed cloud-based platforms to some extent. The most popular application was monitoring upstream oil production, with 81% of respondents saying they were at some stage of deployment. Inspecting installations remotely came in second place (78%).

Mid-size companies are excelling at digital transformation, but small players have time to catch up

On average, mid-sized companies with 250 to 999 employees are seeing the most widespread benefits from technology. But small operators (50 to 249 employees) are gaining ground, especially when it comes to technology that monitors gas leaks and reserve volumes.

AI is viewed as the greatest growth opportunity for oil and gas companies

55% of key decision makers see AI as the biggest growth driver over the next five years. Companies with 250 to 499 employees are most likely to see strong potential from AI over the coming year, with 70% of respondents from businesses of that size predicting it would offer the greatest growth opportunities. Companies that have deployed AI are quickly pushing it throughout the organisation – it is penetrating faster than other technologies.

You can't go it alone to achieve digital transformation success

73% of respondents said a partner – either generic or industry-specific – had the biggest influence on their organisation's digital technology adoption, with 99% of respondents saying they would benefit from a digital transformation community.

Ritz Steytler, CEO, Axora said, "It's good to see that many oil and gas firms have taken the first steps to digitally transform their businesses. However, it's clear from our research that partnership and information sharing will be vital for de-risking digital transformation so that companies are positioned for the future." ■

You can access a copy of the report at <https://www.axora.com/knowledge/innovation-forecast-oil-gas-2021/>

“Cybersecurity is seen as the biggest barrier to investing in digital technology.”

A dynamic and diversified technology leader

Diversified Lines for Petroleum Services Co. (DLPS) is making a positive contribution to Saudi Arabia's economic growth, with a focus on technological development and long-term partnerships.

Image Credit : Shutterstock

The company provides solutions and services in various areas including oil, gas and petrochemicals.

AN ISO 9001:2015 certified company with headquarters in Al Khobar, Saudi Arabia since 2001, Diversified Lines for Petroleum Services Co. (DLPS) is today known as a highly diversified company in the Kingdom, with activities in various segments of the industry.

Its core business activities include engineering, advanced supply chain, construction, manufacturing, and providing professional solutions, products and services in the areas of oil and gas, petrochemicals, power generation, and water industry.

"DLPS is a dynamic and diverse business group involved in the growth of the national economy by taking a lead role in providing high quality and innovative products and construction services," says Rajeh Salem Alfahidi, CEO, DLPS.

The company's reputation has grown through the creation of long-term partnerships, joint ventures and subsidiary companies. These include globally renowned manufacturers, OEMs and technology providers that have partnered with DLPS to offer world-class solutions to customers in the region. The company, along with its principals, has started

the transfer of technological knowhow.

Mr. Alfahidi supports the participation of women in the workforce, a key objective of the Kingdom's Vision 2030, which envisages the creation of one million jobs for women. "No country can ever truly flourish if it stifles the potential of its women and deprives itself of the contributions of half of its citizens," he remarks.

“Our focus is on growth through technological development.”

Leading in the coating segment

In the coating segment, DLPS is a leading provider of quality products. Its Coating Services offers a wide range of coating solutions from around the world. "Our focus is on growth through technological development. We provide end-to-end solutions to bring substantial value to our customers in the field of industrial protective coating," says Alfahidi.

And whatever the requirement, DLPS can

offer a complete range of liquid and fusion bonded epoxy (FBE) coatings for external, internal, and custom coating solutions along with its field girth weld coating services.

Its state-of-the-art coating facility in Abqaiq is one of the largest in the GCC, providing multiple coating and repair solutions at a single location, with capabilities to handle large and heavy vessels for heat cured coatings.

As the Covid-19 pandemic continues to have a significant impact on economies around the world, many companies in Saudi Arabia have been confronted by numerous challenges.

"Our company's resilience during these unprecedented times is a direct consequence of continued commitment. As such, I want to thank our employees for their dedication and customers for their cooperation as we not only strive to deliver positive results, but also contribute to an even greater tomorrow," says Alfahidi.

"With Covid-19 still a concern, it's the responsibility of everyone to remain vigilant when it comes to our health and safety. This includes continuing to wear face masks while practicing good hygiene and safe distancing," he adds. ■

Oil companies venture into quantum computing

THE PREVAILING INDUSTRY downturn from COVID-19 has heightened the need for oil and gas companies to reduce operational costs by improving efficiency. Although classical computers are capable enough in delivering efficiency gains, quantum computers and their optimisation algorithms could deliver these gains in a much shorter time, says GlobalData, a leading data and analytics company.

According to GlobalData's latest report, *Quantum Computing in Oil & Gas*, full-fledged commercial computers are not expected to be ready for approximately another 20 years. However, intermediate versions would be available within the next five to seven years, offering a quantum advantage over classical computers in optimisation applications across several sectors.

Ravindra Puranik, oil & gas analyst at GlobalData, commented, "Oil majors ExxonMobil, Total, Shell, and BP, are among the few industry participants to venture into quantum computing. Although these companies intend to use the technology to solve diverse business problems, quantum chemistry is emerging as the common focus area of research in the initial phase. These majors are seeking to develop advanced materials for carbon capture technologies. This could potentially lower the operational costs of carbon capture and storage (CCS) projects, enabling companies to deploy them on a wider scale to curb operational emissions."

Quantum computing is a very specialised field requiring niche expertise, which is not readily available with oil and gas companies. Hence, they are opting for collaborations with technology players and research institutions who have expertise in this subject.

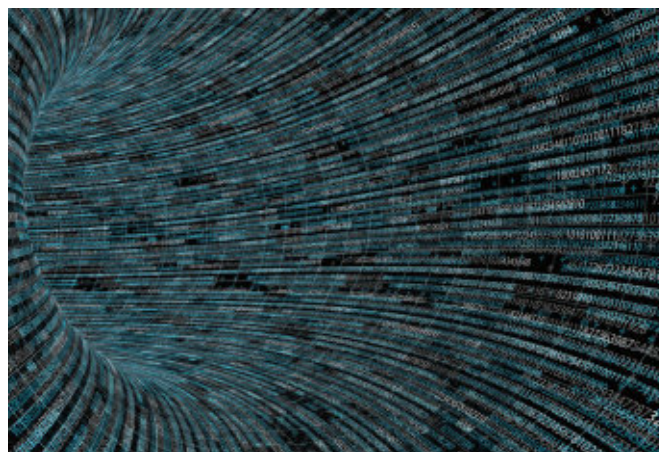


Image credit: Adobe Stock

Quantum computers could deliver faster efficiency gains.

Ravindra added, "IBM is at the forefront in providing quantum computing tools to a host of industries, including oil and gas. It has brought on board leading oil and gas and chemical companies, such as ExxonMobil, BP, Woodside, Mitsubishi Chemical and JSR, to facilitate the advancement of quantum computing via cross-domain research. Oil and gas companies have also collaborated with other quantum computing experts, including D-Wave, Microsoft and Atos."

Frigmaires Engineers launches mobile plants for lubricant production

FRIGMAIRES ENGINEERS' NEWLY developed ABB (Automatic Batch Blending) skid mounted and containerised plants are designed for firms wishing to enter the lubricant business. They are recommended for installations in remote and logistically challenged areas. These units can be installed indoors, as well as outdoors. A provision for connecting a generator to operate the entire system can be provided as an option to make it

independent of the local power supply.

The units are assembled and fully tested at the company's facility before being delivered in 20 or 40 FT containers with no need for on-site assembly, pipework, electrical wiring or mounting of components. These are simple plug-and-play units. The base oils are charged directly from flexitanks to be connected to the feed manifold.

The main components of the plant are the feed

manifold, feed and discharge pumps, load cell mounted blenders, additive dosing unit, heating unit, online filters, piping, valves, instrumentation and filling station, which are connected and operated through a semiautomatic PLC system with HMI controls.

The end user has to simply connect the base oils from flexitanks to the feed manifold. Each package is provided with basic laboratory testing equipment, a set of spares, maintenance tool kit, a booklet for starting formulations and basic laboratory quality tests. A quick change-over flushing system is also provided for product turn arounds.

This plant is used for production of automotive, industrial, bio and marine lubricants.

Advantages include:

- Short delivery and installation time
- Quick and homogeneous blends
- Connects directly to flexitanks
- Low investment costs
- Reduced on-site erection and hook-up time
- Factory tested and manufactured
- Single source responsibility, ensuring fewer interfaces for our client to handle
- Self-contained operations
- Manufactured to CE specifications

Frigmaires also offers turnkey solutions for the production of lube oil blending and grease plants that cater to the requirements of small or large scale lubricant and grease manufacturers. Constant innovation remains their top priority, ensuring delivery of high-quality solutions to customers in the industry.



Image credit: Frigmaires Engineers

The plant can be used for the production of automotive, industrial, bio and marine lubricants.

William Hackett unveils hoist for onshore operations

WILLIAM HACKETT, SPECIALISTS in offshore lifting hoists and chains, has launched the WH C4 QP hoist for onshore operators, incorporating the company's patented quad pawl (QP) mechanism – considered as one of the safest and most efficient in the world.

“Innovation based on a detailed understanding of lifting applications is at the heart of what we do, and this latest addition of the QP in the WH C4 range of hoists increases the level of operational safety and performance levels provided by chain blocks,” said Ben Burgess, director at William Hackett.

“The QP offset load bearing mechanism is the best in the market, and it offers enhanced operating performance compared to first-generation twin-pawl products. With double the number of offset pawls in a chain hoist, from two to four, the load is spread securely against the ratchet gear to provide increased redundancy and resilience for the user.”

Safe and continual performance of lifting equipment crucially depends on minimising risk through improved resilience to failure. Lift operations are often fast-moving, challenging and hazardous environments. Improvements in efficiency, ease of use and safety can yield large returns for operators across any industry – from construction, engineering and shipping, through to energy and transport.

The QP works by allowing all four pawls to engage with the ratchet gear in an offset configuration that allows for finer adjustment, and tensioning capability, while maintaining pawl and ratchet gear engagement. The pawl springs are enclosed in the product's brake chamber to minimise contamination, and the patented pawl design ensures that in the unlikely event of both pawl springs failing, the quad pawls maintain full function with the ratchet gear, making the hoist operation much safer to use. The patented QP mechanism synchronises to minimise the time and distance travelled to the next point of engagement further improving hoist times and providing smooth lift operations.

“It overcomes jamming and unintended malfunctions that can be experienced when using other simpler first-generation products,” said Burgess. “This helps to minimise project downtime or costly delays to work scopes, providing reassurance and peace of mind for operators and contractors.”

William Hackett is preparing to launch a subsea version of the WH C4 QP that comes with high corrosion protection for offshore operations.

CGG introduces GeoSoftware 11.0

CGG GEOSOFTWARE HAS launched version 11.0 of its extensive portfolio of reservoir characterisation and petrophysical interpretation software solutions.

GeoSoftware 11.0 integrates all of GeoSoftware's industry-trusted solutions, including Jason, HampsonRussell, PowerLog, RockSI, InsightEarth and VelPro, so that they can work together on a single platform. This advanced integration features flexible cross-product workflows to improve E&P project performance and provide a better understanding of reservoir properties.

Kamal al-Yahya, senior vice-president, GeoSoftware and Smart Data Solutions, said, “GeoSoftware 11.0 is the culmination of five years of intense software development to deliver an integrated GeoSoftware platform linking geophysics, geology and petrophysics for optimum workflows that drive greater reservoir understanding. With our continued investment in technology, we are delivering more benefits from our digitalisation roadmap that help elevate subsurface knowledge and increase the E&P success of our clients.”

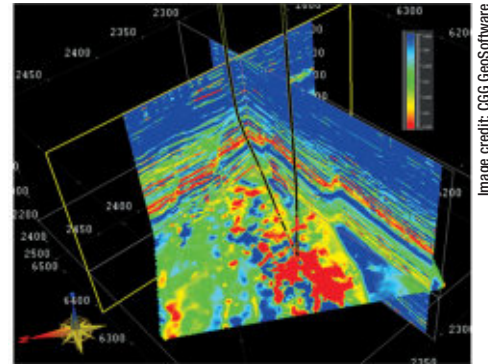


Image credit: CGG GeoSoftware

Jason RockTrace reveals sandstones with low V_p/V_s (ratio of seismic compressional and shear-wave velocities) to highlight pay zone.

De Nora launches biofouling prevention solution

DE NORA HAS launched the SANILEC TRP low-maintenance seawater electrochlorination (SWEC) system for marine biofouling prevention in offshore oil and gas and coastal applications, powered by a new self-cleaning cell technology.

The damaging impacts of marine biofouling, including environmental and economic consequences, are of particular concern for offshore production facilities. Marine growth can reduce a firewater or cooling system's efficiency, leading to equipment damage, compromised safety, and unexpected maintenance costs.

The new patented self-cleaning cell technology in the SANILEC TRP unit eliminates the need to purchase, store, and handle hazardous chemicals for system maintenance.

TJ Westerhaus, business development director of De Nora Water Technologies, said, “The new self-cleaning cell technology, which requires no acid washing, is driving towards a goal of health, safety, and OPEX advantages. The SANILEC TRP unit offers clear, practical advantages, including no use of cleaning chemicals, no disposal of neutralised acid, and ultimately fewer maintenance hours.”

Hempel launches passive fire protection coating

COATINGS MANUFACTURER HEMPEL has launched Hempafire Pro 400, a new passive fire protection coating that maintains the stability of steel structures in the event of a fire for up to 120 minutes and has been optimised for maximum efficiency in the loadings for a 90-minute duration.

Hempel launched Hempafire Pro 315 in 2018, which provides 60 minutes cellululosic fire protection and market-leading dry film thicknesses. Now, with the launch of Hempafire Pro 400 under BS 476 20/21,

Hempel has extended the range to include fire protection for 90 and 120 minutes.

Hempel's group product manager, Cellulosic PFP, Roger Soler, said, “Our Hempafire Pro range of products has proven to be very attractive for applicators and specifiers. The exceptionally low loadings help to reduce both the total paint consumption and the number of coats required. This in turn means our intumescent coatings dry faster than similar coatings, which helps to speed up project completion times. Since we launched Hempafire Pro 315, our customers have asked for a coating with similar properties certified for a 90-minute fire duration. We developed Hempafire Pro 400 to meet this need.”

Hempel's Hempafire Pro coatings can be used in exterior conditions and corrosion environments up to C4 according to ISO 12944.



Image credit: Hempel

The new coating maintains the stability of steel structures for up to 120 minutes in the event of a fire.

GD introduces valve for improved performance

GARDNER DENVER HIGH Pressure Solutions (GD) has proven in field trials that its new V3 valve significantly increases performance hours in high pressure hydraulic fracturing operations.

GD Redline valves and seats are designed for maximum performance and reliability, with the full-open, bonded design providing optimal flow efficiency and maximum sealing. The V3 valve has undergone a complete redesign to improve metallurgy and heat treatment, resulting in enhanced wear resistance and strength.

During field trials in the Eagle Ford, Permian and Marcellus shale plays, increased performance of up to 46% over the leading competitor was observed.

Neal Spence, product line leader, GD, said, "The dramatic increase in performance hours for the V3 compared to its competitors underlines Gardner Denver's ongoing commitment to applying innovation and improvements to all of our American-made products."

The V3 valve is suitable for use with any standard fluid end utilising P-4 and P-5 valve configuration.



The GD V3 valve.

Image credit: Gardner Denver High Pressure Solutions

Neles launches new valve range

NELES IS INTRODUCING a new versatile butterfly valve product range that enables easy valve configuration for an extensive range of applications in all process industries. With its proven technology and state-of-the-art functionality, the product range offers superior process efficiency with a minimised environmental footprint, according to the company.

"We wanted to make valve selection as easy as possible for our customers. With this range, customers can easily pick the features, functionalities, and materials they need to create a robust and reliable butterfly valve that meets their exact requirements," said Tajja Hämäläinen, vice president of Butterfly Valves at Neles.



Image credit: Neles

The modular butterfly valve range enables a vast number of configurations.

The product platform offers reliable solutions for a wide range of applications, including a high-cycling valve to handle high-purity gases and valves for abrasive service or corrosive media. The cross-compatible components and standardised parts make it easy to upgrade valve performance without the need to replace the entire valve.

The versatile butterfly valve range offers longer lasting tightness, lower torque need, less wear and high flow rate – in other words, superior process efficiency and energy savings.

"Instead of focusing only on one maintenance interval, we wanted to think about the entire life cycle of the product. Along with high performance, the valves are also designed for maintenance, which means they are easy to put together and take apart. Serviceability increases the lifetime and safety of the valve and also minimises waste," Hämäläinen noted.

The versatile butterfly valve range enables a large number of configurations. For more information, see Neles' website at <https://www.neles.com/products/valves/butterfly-valves/next-generation>.

New flow meter to detect methane seal leaks

THE CONTINUOUS MONITORING of gas compressor equipment for seal leaks of methane is essential for safety, predictive maintenance, operational efficiency and to meet environmental regulations.

Fluid Components International (FCI) has unveiled the ST75 Series Thermal Mass Flow Meter that is set to provide precision measurement in small lines for the detection of hazardous, non-compliant and costly gas leaks. The flow meter is well suited for small line, low flow measurements in various applications throughout the oil and gas industry's production, processing, transportation and storage industry segments. It measures air or gases from 0.01 to 559 SCFM (0.01 to 950 NCMH) depending on line size and actual process conditions. The ST75 is factory calibrated and can provide a flow turndown range up to 100:1, surpassing the capabilities of other flow meter technologies. With built-in temperature compensation, the ST75 flow meter offers highly repeatable performance in harsh industrial process environments. It features accuracy to $\pm 2\%$ of reading with $\pm 0.5\%$ repeatability over varying process temperatures and pressures in line sizes from 0.25 inches to two inches (six mm to 51mm).

Sercel launches new nodal seismic acquisition solution

SERCEL HAS LAUNCHED the GPR300, a new nodal seismic acquisition solution specially designed for deployment in shallow waters down to depths of 300 metres. Developed in partnership with BGP, the new solution expands Sercel's existing GPR range which includes GPR1500 for high-end deepwater subsurface imaging.

Compact and lightweight, GPR300 features Sercel's unique QuietSeis broadband digital sensor technology for ultra-quiet performance and unmatched digital fidelity. Its ability to record high-fidelity low-frequency signal also makes it the ideal choice for high-end seismic imaging with full-waveform inversion (FWI). In addition, its omni-tilt sensor package corrects for node inclination on the seabed, ensuring the most accurate 3C recording.

Emmanuelle Dubu, Sercel CEO, said, "We are delighted to launch a seabed nodal solution dedicated to the shallow water seismic acquisition market. With its innovative and flexible design, our game-changing GPR300 meets growing industry demand for high-quality seismic data for reservoir optimisation. Furthermore, with the addition of this new nodal solution, Sercel is unique in being able to offer to the market a complete portfolio of products – from sources to receivers – that enables any operator to acquire the best-in-class low-frequency data for the latest seismic imaging technologies."



The new GPR300 shallow water seabed solution

Image credit: Sercel

FutureOn introduces updated field planning software

FUTUREON, THE GLOBAL software company specialising in the energy sector, has launched FieldTwin Design 6.0, previously FieldAP, which offers a powerful new 3D engine, feature-rich user interface and industry-leading data/metadata integration. The result is a cutting-edge – yet proven – design and digital twin package that is easier, cleaner and more responsive to use, across field design, well planning, pipeline engineering and beyond.

Benefits include improved efficiencies when planning new assets, maintenance and modifications; reduced costs compared with traditional design approaches; and visibility at the earliest project stages, minimising the need for late-phase revision, redrafting and/or correction.

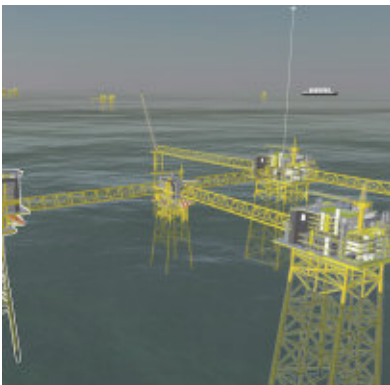


Image credit: FutureOn

The latest software provides a new dimension to digital field planning.

Also key is increased flexibility around environmental drivers – pushing down emissions or avoiding a sensitive area, for instance – while enabling increased collaboration across project teams, operators and contractors.

Further value is provided by seamless transfer from the design stage into ground-breaking digital twin capabilities.

FutureOn's technology has been proven on client projects to reduce planning and design time by up to 80%, whilst reducing FEED and EPC (Engineering, Procurement, and Construction) time, which has led to savings of between one and two years from discovery to first oil.

Jostein Lien, senior vice president of Products at FutureOn, said, "From initial concept through to operations and decommissioning, our design and digital twin package will help to speed savings and minimise time to first oil while providing increased control and encouraging maximum collaboration from the earliest stage."

Salunda launches wireless sensor network

SALUNDA HAS INTRODUCED the Hawk wireless sensor network, which provides reliable and secure connectivity of critical production, operational and safety systems in the oil and gas industry, such as Red Zone management and real-time location applications.

Offering the latest in robust standalone technology, the patent protected Hawk network can accommodate more than 5,000 ultra-low power sensors as part of a fully integrated and functioning wide area network, providing real time location and monitoring of people and equipment operating in hazardous environments.

Hawk is specifically designed to operate with optimum functionality in harsh and cluttered environments where there are regular changes to propagation paths – for example, equipment movements and relocation blocking transmission paths. Sensors attached to people or equipment do not require line-of-sight connectivity to communicate effectively with the network, ensuring there is no drop off in signal strength or loss of message status, contributing further to improved safety levels.

Comprising robust concentrators to send and receive messages, gateway beacons to relay messages and passive sensors that listen for transmissions, Hawk can support a range of position tracking performance technologies that help to avert incidents and trigger personalised warnings to reduce the risk of workplace injuries and accidents.

IECEx and DNV-certified for use in flammable environments, Hawk can also be extended with connectivity to additional technologies and devices such as digital ranging (e.g. Time of Flight or LIDAR) cameras and machine vision to provide expanded levels of real time coverage, zone management and control of critical work area access, safety and security. Configuration flexibility sees the network capable of accommodating all sizes of multi-levelled offshore structures as well as installation in areas requiring large scale safety and automation such as drilling rigs, derricks, decks, machine rooms and mud plants.

Alan Finlay, CEO at Salunda, said, "The Hawk network has been specifically optimised to meet the requirements of industrial environments. In particular, its excellent in-service reliability, flexibility and capacity to accommodate large numbers of battery-powered sensors for very long periods is already making a significant contribution to keeping people safe and secure in hazardous environments."

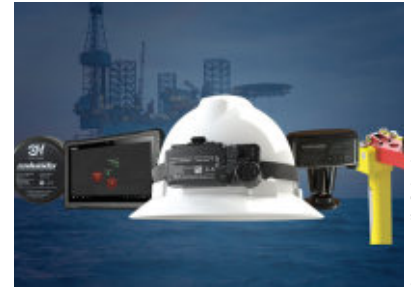


Image credit: Salunda

The Hawk network can accommodate more than 5,000 ultra-low power sensors.

Enhanced security certification for Yokogawa

YOKOGAWA ELECTRIC CORPORATION has obtained ISASecure CSA Level 1 certification from the ISA Security Compliance Institute (ISCI) for its ProSafe-RS safety instrumented system, which helps to prevent accidents by detecting abnormal conditions in plant operations and initiating emergency actions such as a plant shutdown. This is the first time a safety instrumented system has obtained this certification. Yokogawa has long emphasised the importance of cyber security with its safety instrumented systems, and this certification is expected to give customers even greater confidence in the use of this product.

Yokogawa's ProSafe-RS safety instrumented system is certified for use in safety integrity level 3 (SIL3) applications. ISASecure CSA certifies compliance with the IEC62443-4-2 and IEC62443-4-1 international standards pertaining to control device security. Yokogawa also plans to obtain ISASecure CSA certification for the ProSafe-RS Lite SIL2 safety instrumented system, which was released in January of this year.

Yokogawa will leverage this certification to accelerate its efforts to enhance the cyber security of its customers' plant operations.

Since 2017, Yokogawa has provided a comprehensive set of services, systems, and software packages under the Sustainable Safety Instrumented System concept that helps to ensure continued safety in plant operations.



Image credit: Adobe Stock

The ProSafe-RS safety instrumented system helps to prevent accidents in plants.

Project Databank

Compiled by Data Media Systems

OIL, GAS AND PETROCHEMICAL PROJECTS, OMAN

Project Name	City	Facility	Budget (US\$)	Status
ARA Petroleum - Garat Al Milih Production Station	Al Wusta	Oil Production	200,000,000	EPC ITB
BP - Block 61 - Khazzan and Ghazeer Gas Fields Development - Overview	Al Dahirah	Gas Field Development	24,000,000,000	Commissioning
Canada Business Holdings - Low Sulphur Fuel Oil Refinery	Duqm	Petroleum Oil Refinery	1,500,000,000	FEED
Duqm Petroleum Terminal Company - Duqm Liquid Jetty (IP7)	Duqm	Oil Storage Terminal	600,000,000	Construction
Enerflex - Sadad North Early Development Facility	Al Wusta	Oil Field Development	200,000,000	Construction
ENI - Block 47 Onshore Exploration and Production	Northern Oman	Exploration	40,000,000	Engineering & Procurement
Hydrocarbon Finder - Block 7 Onshore Exploration and Production	Al Wusta	Exploration	160,000,000	Construction
Marsa LNG - Sohar LNG Bunkering Terminal (SLNGB)	Sohar	Liquefied Natural Gas (LNG)	200,000,000	EPC ITB
Masirah Oil Ltd - Block 50 (Masirah Bay Offshore) - Exploration	Masirah Basin	Exploration	250,000,000	Construction
Ministry of Energy and Minerals - Iran to Oman Subsea Natural Gas Pipeline	Sohar	Welded, Gas Pipeline	600,000,000	EPC ITB
Oman LNG - LNG Plant Upgrade	Qalhat	Liquefied Natural Gas (LNG)	100,000,000	Construction
Oman Wanfang - Crude Oil Refinery	Duqm	Petroleum Oil Refinery	5,000,000,000	Project Announced
OQ - Block 60 Concession - Bisat Oilfield Development - Early Production Facility - Station C	Central Oman	Oil Field Development	400,000,000	Engineering & Procurement
OQ - Block 60 Concession - Bisat Oilfield Development - Full Field Development	Central Oman	Oil Field Development	150,000,000	EPC ITB
OQ - Block 60 Concession Development - Overview	Central Oman	Oil & Gas Field	1,100,000,000	Construction
OQ - Oil Storage and Terminal	Duqm	Oil Storage Terminal	200,000,000	Project Announced
OQ Gas Networks - Al-Kamil (BVS 9) to Sur GSS Gas Pipeline	Sur	Welded, Gas, Gas Pipeline	300,000,000	EPC ITB
OQ Gas Networks - South Grid Debottlenecking - Phase 2	Various	Welded, Gas Pipeline	150,000,000	Engineering & Procurement
OQ LPG - Salalah LPG Extraction	Salalah	Liquefied Petroleum Gas (LPG)	650,000,000	Commissioning
OQ8 - Duqm Refinery & Petrochemical Complex - Duqm Refinery - Main Process Units	Duqm	Petroleum Oil Refinery	4,000,000,000	Construction
OQ8 - Duqm Refinery & Petrochemical Complex - Duqm Refinery - Offsite Facilities	Duqm	Petroleum Oil Refinery	800,000,000	Construction
OQ8 - Duqm Refinery & Petrochemical Complex - Duqm Refinery - Offsites and Utilities	Duqm	Petroleum Oil Refinery	2,000,000,000	Construction
OQ8 - Duqm Refinery & Petrochemical Complex - Duqm Refinery - Overview	Duqm	Petroleum Oil Refinery	7,700,000,000	Construction
OTTCO - Main Line Oil - Ras Markaz Crude Oil Terminal Pipeline	Duqm	Welded, Oil Pipeline	300,000,000	FEED
OTTCO - Ras Markaz Crude Oil Park - Overview	Ras Markaz	Oil Storage Terminal	400,000,000	Construction
OTTCO - Ras Markaz Crude Oil Park - Phase 1 (Tanks, Marine, and Infrastructure Facilities)	Ras Markaz	Oil Storage Terminal	400,000,000	Construction
OTTCO - Ras Markaz Crude Oil Park - Phase 2 (Crude Oil Tanks and Associated Infrastructure)	Ras Markaz	Oil Storage Terminal	925,000,000	Project Announced
OTTCO - Ras Markaz Crude Oil Park - Phases 3, 4, and 5 (Crude Oil Tanks and Associated Infrastructure)	Ras Markaz	Oil Storage Terminal	210,000,003	Project Announced
PDO - Mabrouk North East Deep Gas Field Development	Saih Rawl	Gas Field Development	5,000,000,000	Engineering & Procurement
PDO - Mabrouk North East Line Pipe	Northern Oman	Welded, Gas Pipeline	170,000,000	Construction
PDO - Marmul Main Production Station (MMPS) - Gas Compression	Marmul	Gas Compression	150,000,000	Engineering & Procurement
PDO - Marmul Main Production Station (MMPS) - Tanks and Heaters	Marmul	Storage Tanks	70,000,000	Engineering & Procurement
PDO - Marmul Polymer Phase 3 (MPP3) - Off-Plot and On-Plot Production Facilities	Marmul	Oil Field Development	270,000,000	Construction
PDO - Yibal Khuff Sudair Field Development	Northern Oman	Oil Field Development	3,000,000,000	Commissioning
PDO - Yibal Rejuvenation	Yibal	Oil Field Development	500,000,000	Construction
Petroleb SAL - Block 57 Onshore Exploration and Production	Dhofar	Exploration	40,000,000	Engineering & Procurement
Salalah Refinery (SFZ) - Salalah Refinery Project	Salalah Free Zone (SFZ)	Refinery	2,500,000,000	FEED
Shumookh Investment and Services - Sur Refinery and Petrochemical Complex	Sur	Refinery	10,000,000,000	Pre-FEED
Tethys Oil Company Qetpet Limited - Block 58 Onshore Exploration and Production	Dhofar	Exploration	80,000,000	Engineering & Procurement
Tethys Oil Oman Onshore - Block 56 Onshore Exploration and Production	Al Wusta	Exploration	50,000,000	Construction
Total - PTTEP - Block 12 Onshore Exploration and Production	Central Oman	Gas Exploration	100,000,000	Feasibility Study

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REGIONS COVERED

- Asia Pacific
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- Latin America
- North America
- Central America
- Russia & CIS
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- North Africa
- West Africa
- India
- China
- Europe

SECTORS COVERED



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Project Databank

Compiled by Data Media Systems

Project Focus

Compiled by Data Media Systems

Project name: PDO - Yibal Khuff Sudair Field Development

Name of Client	PDO - Petroleum Development Oman
Revised Budget (US\$)	2,900,000,000
Facility Type	Oilfield Development
Status	Commissioning
Location	Northern Oman
Project Start	Q1-2012
End Date	Q3-2021
FEED	PDO - WorleyParsons FEED Office
PMC	Petrofac
Main Contractor	Petrofac Galfar Engineering & Contracting SAOG
Contract Value (US\$)	1,200,000,000
Award Date	Q2-2015

Background

PDO plans to develop Yibal Khuff and Sudair reservoirs at the Yibal field in the north of the country, which are located at depths of around 3,000 metres. Yibal Khuff (YK) is an onshore project consisting of 47 wells and a Central Processing Facility (CPF) to produce the sour gas from YK Sudair Reservoir. Peak average production is targeted at 20,000 bpd of oil and six million cubic metres per day of gas.

Project Status

Date	Status
02 Jun 2021	Petrofac has announced that hydrocarbons have begun flowing into the central processing facilities as part of the commissioning activities.
25 Mar 2021	99% of the project is complete. PDO has announced that the trial operation is expected to start in Q2 2021 with the full commercial production of 20,000 bpd and six million cubic metres per day of gas to follow in August 2021.
05 Jan 2020	PDO has awarded a contract for additional scope of work to Petrofac for the Yibal Khuff project. The 20-month contract includes detailed engineering, procurement, and support for construction and commissioning of nine additional wells to improve overall plant production, and laying of gas pipeline from Yibal A to the main processing facility.

Project Scope

The gathering system scope entails:

- Each of the 52 wells will be hooked up to dedicated six-inch flowlines, with tie in to remote manifold stations (RMS)
- A single 14-inch 15km pipeline from the West RMS, a single 16-inch 5km pipeline from the South RMS, and dual 12-inch 12km pipelines from East RMS
- A well test manifold and multiphase flow-meter located at each RMS, and connected to a 'backup' test line.

Central processing facility scope:

- A facility with average annual raw gas processing capacity of six million cubic metres per day and oil and water handling capacity each of 4,000 cubic metres per day
- CPF inlet facilities to receive and separate oil, water, and gas
- A gas treating unit, low pressure acid gas enrichment unit and sulphur recovery unit, sour water treatment unit
- An oil handling train, gas dehydration and nitrogen removal unit
- A 45MW power plant, HRSG and standby boiler

Middle East & North Africa

The Baker Hughes Rig Count tracks industry-wide rigs engaged in drilling and related operations, which include drilling, logging, cementing, coring, well testing, waiting on weather, running casing and blowout preventer (BOP) testing.

Country	MAY 2021			VARIANCE		APRIL 2021		
	Land	Offshore	Total	From May 2020	From April 2021	Land	Offshore	Total
Middle East								
ABU DHABI	30	13	43	-11	0	30	13	43
DUBAI	0	0	0	0	0	0	2	2
IRAQ	35	0	35	-16	0	35	0	35
KUWAIT	23	0	23	-29	-2	25	0	25
OMAN	43	0	43	-10	+2	41	0	41
PAKISTAN	14	0	14	-3	+1	13	0	13
QATAR	2	9	11	+5	+3	2	6	8
SAUDI ARABIA	56	10	66	-43	+6	52	8	60
YEMEN	2	0	2	+1	+1	1	0	1
TOTAL	205	32	237	-106	+11	199	27	226

North Africa

ALGERIA	28	0	28	+1	+1	27	0	27
EGYPT	21	5	26	-2	+3	19	4	23
LIBYA	12	0	12	+1	0	12	0	12
TUNISIA	0	0	0	-1	0	0	0	0
TOTAL	61	5	66	-1	+4	58	4	62

Source: Baker Hughes

من البيانات التي تتولد. ويمكن للتوائم الرقمية تسخير البيانات الأولية وإنشاء منظومة من النظم يُعتمد عليها. إذ أنها يمكنها صنع الاتصال بين البيانات والعمليات، وتحديد جميع مصادر البيانات ذات الصلة وتوجيهها وتحليلها حتى تجعل صحة الأصول أكثر قابلية للرؤية وتكون سندا لصنع قرارات مُستنيرة وللتوصل إلى نتائج أعمال يمكن قياسها.

ونظرا لأن الأصول مُصممة، مُكلفه، مُشغلة وبعد ذلك سيعاد تصميمها أو تعديلها أو إضافتها، يحتاج التوأم الرقمي ونموذج المعلومات عن الأصول إلى أن يظل مُتجددا تلقائيا. ويغذي التقارب بين تكنولوجيا المعلومات وتكنولوجيا العمليات والتكنولوجيا الهندسية (أو IT-OT-ET) التوأم الرقمي. ويمكن للتوأم الرقمي، بالإضافة إلى قيامه بالإبلاغ عن الحالة الراهنة للأصل، أن يؤدي عمليات المحاكاة التشغيلية والهندسية لنمذجة أداء أصل ما، مع مرور الوقت وتقييم الخيارات لتحسين أدائه. وبصورة جوهرية، يقوم التوأم الرقمي بصنع الاتصال بين البيانات المُتولدة من تكنولوجيا المعلومات وتكنولوجيا العمليات والتكنولوجيا الهندسية في طريقة عرض مُفردة، مما يسمح للفريق بالتحقق من صحة جميع بيانات المصنع وتصورها وتحليلها بأي صيغة وفي أي مكان لتخزين البيانات. وتمكّن بيئة التوأم الرقمي المفتوحة والقابلة للتشغيل التفاعلي والمُتصلة والمُحددة السياق، من التعاون الحقيقي بين الهندسة والعمليات والصيانة.

كما أن التوائم الرقمية تعمل على تحويل المصانع لإبقتها في صدارة المنافسة. حيث يحتاج كل شخص، بدءاً من طابق المصنع وصولاً إلى قاعة اجتماعات مجلس الإدارة، إلى النظرات المُتعمقة من أجل اتخاذ قرارات تستند إلى البيانات تتسم بمزيد من الاستنارة. وتوفر التوائم الرقمية فكرة مُوحدة ضرورية عن جميع البيانات والنظم اللازمة، مما يمنح المستخدمين، على جميع المستويات، الرؤية المُتعمقة اللازمة لتحقيق النجاح الشامل.

وتكامل النظم وإمكانية التشغيل التفاعلي والبيانات المُنعزلة. وتُعتبر التوائم الرقمية بيئات للبيانات مفتوحة ومُتصلة، وربما تصبح ميزة تنافسية مُستدامة في عصر إنترنت الأشياء الصناعي.

اكتساب نظرات متعمقة لصنع قرارات فعالة

القواعد المُؤتمتة والحسابات والذكاء الاصطناعي والتعلم الآلي جميعها أساليب قيمة للتمكن من صنع قرارات أسرع وأكثر فعالية. ومع ذلك، يجب أن تكون المعلومات الهندسية، عن كل منها، كاملة ودقيقة ومُتاحة حتى تضمن بأنك تتخذ القرار الصائب في الوقت المناسب، وإلا سيكون من الصعب عليك الحد من التكاليف ووقت التوقف في حالة فشل الأصل. فباختصار، يعتمد صنع القرار الفعال على المعرفة الدائمة بالحالة الراهنة والوضع الراهن للأصل، وأن يتم إبلاغك على الفور عند تغير تلك الحالة أو الوضع. وينبغي أن تشمل هذه المعرفة المعلومات الهندسية الجوهرية، وكذلك كيفية إعادة الأصل إلى الحالة التي تم بناؤه أو تشغيله أو تصميمه عليها عند الضرورة.

إن إدارة المعلومات عن دورة حياة الأصول هي أساس التوأم الرقمي. إذ تتغير جميع المكونات والبيانات والنظم وحالات التشغيل مع مرور الوقت نتيجة للبلى والتلف وقرارات عامل التشغيل والظروف العامة للمصنع. ويمكن أن يكون للتغيرات، في أي أصل وحيد، تأثير سلبي على النظم والعمليات الأوسع نطاقا. وتمكّن البيانات الهندسية، الجديرة بالثقة، مهندسي المصنع من تحديد السبب وراء حدوث تغيير ما، ومن الذي تسبب في حدوثه.

نحن نعلم بأن البيانات الأولية، التي تتولد من أجهزة الاستشعار وحدها، ربما لا تكون مفيدة حيث يزيد تعقيد معدات شبكة الأنابيب والمعالجة، والنظم، والأدوات، وأجهزة التحكم والوصلات بينها. وتعتمد تكنولوجيا العمليات على قابلية رؤية التحليلات وكذلك على الخبراء المُتخصصين الذين يمكنهم التصرف بناءً على المقدار الضخم

مع مرور الوقت ببيانات هندسية مرئية ويمكن الوصول إليها وموثوق بها.

فعندما تكون البيانات الصحيحة في موضعها بعد جمعها وإدارتها وتحليلها ومشاركتها، فإنها توفر معلومات هامة لصانعي القرار، مما يعطيهم معلومات في الوقت الفعلي عن أداء الأصول. هذا فضلا عن نظرة مُتعمقة في التنبؤات والتوقعات المُستقبلية. ومن الممكن صنع قرارات تستند إلى البيانات مع معرفة ما يحدث وكيفية الاستعداد له، بما في ذلك فهم ما ينجح وما لا ينجح، والكيفية التي تؤدي بها الأصول، وقابلية الاعتمادية المُحتملة للمعدات. فمع التوائم الرقمية، يمكنك أن ترى آثار القرارات التي يتم صنعها في الماضي وفي الحاضر على حد سواء، ويمكنك كذلك محاكاة المستقبل والتنبؤ به.

فالتوائم الرقمية تساعد على صنع قرارات تستند إلى البيانات يُعتمد عليها بكل ثقة. فمع التوائم الرقمية، يمكنك القيام بما يلي:

- التقاط جميع مصادر المعلومات عن الأصول.
- تحسين جودة البيانات من النفقات الرأسمالية إلى نفقات التشغيل.
- ضمانجاهزية التشغيلية والأداء المتفوق للأصول.
- خفض تكاليف التشغيل.
- تسهيل العثور على المعلومات.
- ضمان أن المعلومات مُحدثة.
- تفسير وإدارة وتحليل البيانات من مصدر مركزي واحد.

• تحسين الطريقة التي تُعرض بها المعلومات.

• اكتساب نظرات متعمقة ذكية لصنع قرارات سريعة ودقيقة.

فالتوائم الرقمية تعمل داخل المصنع على تمكين الهندسة والعمليات والصيانة من التعاون والاستفادة من فرصة وجود الثورة الصناعية الرابعة. إذ تساعد التوائم الرقمية على تجاوز المخاطر الشائعة؛ مثل التحميل الزائد للبيانات

← مفكرة الفعاليات 2021

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المعلومات الهندسية المولدة يمكن المهندسين من معرفة أي تغير وما الذي تسبب فيه

اتخاذ قرارات تستند إلى بيانات لإنتاج يمكن التنبؤ به

في هذا المقال، تناقش ساندرا دي ماتيو، مديرة التسويق العالمية لحلول التوائم الرقمية وأداء الأصول والشبكات بشركة بنتلي سيستمز، كيفية اكتساب نظرات مُتعمقة في البيانات لتحسين أداء الأصول وإمكانية الاعتماد عليها. فالقرارات التي تستند إلى البيانات هي تلك القرارات المدعومة بالأدلة القاطعة، وهي البيانات التي يمكن الاعتماد عليها والجديرة بالثقة بدلاً من الحدس أو الفراسة أو التخمين.

في المصنع بنظيراتها الرقمية لتحسين أتمتة عمليات المصانع وصيانتها. فلقد تبنى مديرو المصانع إنترنت الأشياء الصناعي رغبة منهم في محو الحواس البشرية من عمليات الفحص؛ مثل رؤية تسريب ما أو سماع صوت محرك مُعطل. وحتى مع الانتشار المدوي لأجهزة الاستشعار التي يمكنها اكتشاف التغيرات في ظروف التشغيل، تكمن الحقيقة في أن المصانع ما زالت تعتمد بشكل كبير على الأشخاص في عمليات الفحص. ومن أجل تحسين الأتمتة، تكون المصانع في حاجة إلى برنامج يتسم بالكفاءة والفعالية والشمولية يحدد - بشكل كامل - عمليات تسيير الأعمال والأمور التنظيمية، وممارسات إدارة الأصول الاستباقية والتنبؤية، والتكنولوجيا المناسبة التي تمكّن من تنفيذ وتطبيق أداء الأصول في الوقت الفعلي. ومن أجل الإشراف الكامل على منشأة ما، فإنك في حاجة إلى نهج نظامي ومُستدام لتتبع أداء الأصول

النمو. ففي حين أن البيانات الضخمة كان من المتوقع أن تجعل صنع القرار أسهل، واجهت المؤسسات صعوبة في الاستفادة من الإمكانيات الكاملة للبيانات الضخمة لعدم معرفتها بكيفية تسخير وزيادة مقدار بياناتها بطريقة تثبت بأنها جديرة بالثقة. وبالإضافة إلى ذلك، لا تقوم المؤسسات بتحليل البيانات في الوقت المحدد من أجل اكتساب نظرات مُتعمقة.

وبالنسبة لمعظم مديري المصانع، لا تزال رؤية المصنع المُستقل تماماً حلماً بعيد المنال. إذ ينتج كل جهاز استشعار مضاف الآلاف من نقاط البيانات الإضافية. ونتيجة لذلك، يمكن أن يكون فهم المُراد من البيانات لاكتساب نظرات مُتعمقة ذات معنى والوصول إلى القرارات الصائبة، مُضيقاً للوقت وصعباً إذا لم تكن متأكداً من أهميته أو دقته. يمكن للثورة الصناعية الرابعة أن تربط الأصول المادية

ومع ذلك، تُصعب وفرة البيانات، التي تتولد من أجهزة إنترنت الأشياء الصناعي (IIOT) ومصادر مُتعددة مُنعزلة، من عملية التحليل. إذ إن أسوأ شيء يمكن أن يحدث هو أن تكون البيانات الهامة مفقودة أو أن تظل مخفية أو أن تكون غير صحيحة، فكيف يمكن - إذن - أن تعرف بأن لديك المعلومات الصحيحة من أجل أن تصنع القرار الصائب في الوقت المناسب؟

إنترنت الأشياء الصناعي عند النقطة التي أصبح عندها يعتبر مهماً بما يكفي لإحداث تغيير أكبر وأكثر أهمية. حيث أصبحت تكلفة أجهزة الاستشعار واتصال البيانات وتخزين البيانات في الوقت الحالي جزءاً صغيراً مقارنة بما كانت عليه في السابق. ونتيجة لذلك، ينمو حجم البيانات الأولية التي تتولد في المصانع من مصادر إنترنت الأشياء الصناعي بشكل مطرد، ولا يمكن للعديد من المؤسسات مواكبة هذا

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تحليلات

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تقارير خاصة: شركة تنمية نفط عُمان.

استطلاعات: إدارة تسرب النفط، الأعمال الهندسية والمشتريات والبناء، تقنية سلامة الأصول،

الرفع الاصطناعي، قياس التدفق والتحكم فيه، إدارة البيانات.

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