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IPTC DAILY

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IPTC Welcomes A New Energy Era

John Donnelly, IPTC Daily Editor

The 12th International Petroleum Technology Conference (IPTC) opened Monday with a distinguished panel offering its outlook for oil and gas markets in the next year and the next decade.

IPTC, which is sponsored by four leading oil and gas associations, is being held in Saudi Arabia for the first time. "This is the first interdisciplinary oil and gas conference to be held in Saudi Arabia," said Mahmoud M. Abdulbaqi, Chairman of the Board of ARGAS and Chairman of the IPTC Board of Directors. The conference is being hosted exclusively by Saudi Aramco.

The opening panel included Abdulbaqi; Mohammed Y. Al-Qahtani, Senior Vice President, Upstream, Saudi Aramco; HE Yasir Al-Rumayyan, Chairman of the Board, Saudi Aramco; and HRH Prince Abdulaziz bin Salman Al-Saud, Minister of Energy, Kingdom of Saudi Arabia.



Saudi Energy Minister Al-Saud noted the key contribution his country has made to global oil supply stability.

Industry Faces A Range of Challenges in New Year

John Donnelly, IPTC Daily Editor

Geopolitical and oil supply uncertainty shadow the oil and gas industry as it enters a new decade, but its mission must continue to be to provide the world with a steady flow of energy, industry chief executives and energy ministers said Monday.

The opening panel session of IPTC included HRH Prince Abdulaziz bin Salman Al-Saud, Minister of Energy, Kingdom of Saudi Arabia; HE Shaikh Mohammed Bin Khalifa Al Khalifa, Minister of Oil, Kingdom of Bahrain;

Darren Woods, Chairman and CEO of ExxonMobil; Patrick Pouyanné, Chairman and CEO of Total; and Jason Bordoff, Professor at Columbia University and founder of the Center on Global Energy Policy. They discussed a range of issues, including US-Iran tensions, the US election, shale supply and OPEC's response, and the biggest challenges currently confronting the industry.

Assessing what he wanted to see in the new year, al-Saud said the world

needs a stable oil market, sustainable supply and demand growth, predictability, and production that has little impact on the environment. Market volatility doesn't allow companies to prepare properly, he said, because they don't know if price swings are temporary or not. "Generally, we don't like volatility," he said. That is the goal of OPEC, to promote the stability of prices, supply, and demand, he added.

Picking up on that theme, al Khalifa

defended the actions of the OPEC-plus group against critics who said it undermined free market economics. He said that after the global financial crisis of 2008, cheap credit funded the shale revolution in the US. That "induced stimulus" led to an oil glut, which caused the price collapse that began in 2014, he said.

Producers had to respond with a counter-balance, which led to the curtailment of supply by OPEC members and other large producers

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Al-Qahtani, who is serving as Executive Committee Chairman of this year's conference, announced that the conference would return to Saudi Arabia in 2 years, with the 2021 conference to be held in Malaysia. "These are exciting times for the Kingdom," said al-Qahtani, as both Saudi Aramco and the oil and gas industry at large face a new decade of growing demand but with a need to lighten the industry's carbon footprint. Aramco is in the midst of an initial public offering (IPO), which has raised a record USD 29 billion.

Al-Rumayyan said the oil and gas industry thinks in terms of decades, which runs up against the notion that the "energy transition" will occur "from a definitive point A to a definitive point B" and will take place at the same time in the same way everywhere. Instead, he offered what he called the "pragmatic narrative" of a transition happening over decades and that there "will be many energy transitions" at different speeds.

The more narrow narrative is having negative consequences for the industry, he added, because it is

influencing some banks to back away from funding oil and gas projects. This lack of investment eventually will lead to a supply shortage that could cause oil price spikes in the near future, he said.

He acknowledged the need of the industry to "lighten the carbon footprint" through technology and innovation, but it must continue to meet the world's energy needs. The industry must never forget its role to responsibly supply energy required to power the world and sustain economies, he said. If the industry

"offers real solutions with real energy to meet real needs" it will last well into the future, he added.

Saudi Energy Minister Al-Saud noted the historically important role that Saudi Arabia has played since the discovery of oil there about 80 years ago. The global economic growth of the past half century, which paved the way for transformative development and lifted many out of poverty, would not have taken place without the stability of oil supply from Saudi Arabia. ■



Pouyanné, center, speaks about his outlook for the industry while Woods, left, and Bordoff look on.

such as Russia. "Going forward, all eyes are on US production," he said, adding that another 1 million B/D increase in shale output would weigh heavily on prices this year. But he said that all indications are that the growth in US shale supply is waning. He said that he even worries that there might be an oil scarcity soon because of the lack of investment in the industry in the past few years.

Woods said his mantra is to focus on the fundamentals despite volatile price swings or political events. The oil industry will continue to operate in a time cycle that lasts beyond one year, and that hydrocarbon demand will grow in the decades to come because of its importance to prosperity. The challenge on the supply side is to produce as efficiently as possible and at low cost and "let the markets take you wherever the markets want to take you."

Asked about US President Donald Trump's decision to launch a drone strike against Iran's top military leader last week and the impact it could

have on markets, al-Saud said, "The president can do whatever he wishes. The US is a strategic partner and has a big role to play in security."

The subject of US politics came up again in a question about the Democratic candidates for president who oppose hydraulic fracturing. Woods said the growth in US shale supply has provided tremendous economic benefits for the country, including adding thousands of jobs. Politicians tend to speak narrowly about issues in a campaign but eventually will look "at the bigger picture" if elected and try to strike a balance among competing interests. The disruption to the economy and to individuals that banning hydraulic fracturing would cause is a "natural hedge" against such dramatic change, he added. As for his company, "Our plan is to continue to talk about the fundamentals, what is good for the industry and for the economy," he said.

Another positive from the increase in US shale supply, said Bordoff, is that

recent geopolitical events, which would have caused prices to soar in the past, have only caused small blips. That is because shale is short-cycle production and can act as a swing supplier when needed, which dampens price volatility.

Total CEO Pouyanné said his company is moving toward becoming an energy company rather than just an oil and gas company. By 2030 and 2040, oil will still be important to consumers but renewable energy is no doubt growing. He said discussion about climate change too often focuses just on producers but it is not "a black and white debate." Companies are providing hydrocarbons because there is demand for them, and politicians need to emphasise the complexities of the energy transition as well as the associated costs.

Assessing the biggest challenges facing the industry going forward, panelists spoke of the daunting climate change goals of the Paris agreement, uncertainty of US

production, and lack of investment. But al-Saud said, "My focus isn't on 2020, it's on 2030," emphasizing that the industry must take the longer view and adding that he is confident that OPEC will remain the world's key producer in the future. ■

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Nasser Satisfied With Aramco IPO, Advocates Climate Strategy

John Donnelly, IPTC Daily Editor

IPTC Daily interviewed Saudi Aramco President and Chief Executive Officer Amin Nasser about the company and the current state of the oil and gas industry.

Saudi Aramco has recently faced a very low price oil environment, competition from US shale, and a drone and missile attack yet has continued to move forward in spite of this. How has Saudi Aramco remained so resilient?

Saudi Aramco is used to dealing with oil market volatility and effectively responding to unforeseen events. Our production costs are among the lowest in the industry and we remain quite profitable even during market down cycles. We also have a very strong balance sheet, and maintain high financial flexibility.

Similarly, our infrastructure and plants have built-in, yet optimum, flexibility by design. These factors, among others, show our deliberate and proactive focus on resilience.

What is the status of unconventional development in Saudi Arabia? Is this a key emphasis at present?

Saudi Aramco has significant unconventional gas resources, and the key goals of the current efforts in this area are to delineate and commercially prove this large resource base. Of course, profitability and environmental sustainability are always on top of our agenda.

The major focus of the current efforts is on unconventional gas deposits in the Jafurah Basin in eastern Saudi Arabia. Jafurah has a special economic attraction because its gas is also rich in liquids. The purpose of our unconventional gas programme is to prepare these resources to complement supplies from our large conventional gas reserves.

How do you assess the global supply/demand balance in 2020?

The oil demand last year was impacted by global economic headwinds. But most analysts expect the situation to significantly improve this year. The International Energy Agency (IEA), for example, is forecasting 1.2 million B/D growth for 2020, which is fairly healthy.



Amin Nasser, President and CEO
Saudi Aramco

On the supply side, a key contributor to supply growth over recent years has been the production of US shale oil, which appears to be slowing. And the very recent events add complexity to the supply picture. The assessment of the supply-demand balance by various institutions and consultancies varies, while variations also occur during the year owing to seasonal demand factors. So, we will have to watch the situation as the year progresses.

Saudi Aramco has completed its IPO. Were you satisfied with the process and how the situation has progressed?

The company successfully completed its IPO and our shares began trading on the Saudi Stock Exchange on 11 December 2019. The offering was diversified and balanced, and included individuals, banks, pension funds, sovereign wealth funds, mutual funds, endowments, and foundations. And it included both Saudi and foreign institutions. The offering was over-subscribed by more than 4.6 times. All in all, we are quite satisfied with how the stock is performing.

You are a participant in one of the major panel discussions at IPTC about how CEOs view the “new energy era.” What is your key message?

Our industry has played a key role in creating the economic prosperity the world enjoys today. And we will continue to play our part by providing affordable and reliable supplies of energy.

Global energy is undergoing a transformation but I believe that oil and gas will remain a core element of this transition for a long time to come.

Technology is a key instrument that helps us address the future

challenges our industry faces, and we rely on IPTC and its constituent societies to continue playing a major role in promoting advanced technology and sharing best practices and experiences, as they have in the past.

What is your assessment of the current political and public discussion on climate change?

Helping to manage climate change while providing affordable energy are our industry's top priorities. So, our industry and the climate proponents agree as far as lightening the carbon footprint of energy is concerned.

In other words, we are part of the solution, and our goals in protecting the planet and society's well being are aligned. But to effectively address complex challenges in the way of concurrently meeting society's climate, energy, and economic goals, we need to adopt well thought out and realistic solutions, as opposed to opting for hasty and emotional responses.

We hope the industry's sincere efforts to lower the greenhouse-gas footprint of oil and gas will receive broader support also from outside the industry.

As far as we are concerned, I am glad to report that we have among the greenest oil barrels, with the upstream carbon intensity of Saudi Arabia's oil among the lowest in the world. Similarly, our methane intensity is also among the lowest in the industry, which is significant considering the high potency of methane as a greenhouse gas.

You recently stated that current carbon management strategies “are too narrowly focused.” Can you elaborate on this?

There is a concern that carbon management efforts being pursued across the world are not producing adequate and rapid results. My view is that an important reason for this situation is that the global efforts to reduce greenhouse gas emissions are too narrowly focused.

What I mean is that currently there are two primary areas in which attention is being centered. One is electrification of light-duty passenger vehicles and the other is replacement of fossil fuels in electricity generation. But these efforts together account for only about one-third of the total

global greenhouse gas emissions; the remaining two-thirds receive very little attention. In other words, the efforts are very narrowly focused.

In my view, three additional strategies can help significantly. Firstly, the world needs to broaden its focus and pay attention to all economic sectors with large greenhouse emissions. Secondly, most R&D and technology spend currently focuses on renewables and electric vehicles. The research funding should be extended to reducing the carbon footprint of fossil fuels, which dominate global energy and are likely to continue playing an important role in the world energy mix for a long time to come. Reducing their greenhouse-gas footprint would make a much bigger difference. And thirdly, taking advantage of the pioneering circular economy concept would help in leveraging synergies across a wide range of economic sectors emitting greenhouse gases. ■

Nasser Wins Executive of the Year Award

Amin Nasser, President and Chief Executive Officer of Saudi Aramco, on Monday was named Energy Intelligence's "Energy Executive of the Year" for 2020. He was chosen by a selection committee made up of top global energy industry executives, and is the 24th winner of this peer-selected honor. The award will be presented to Nasser at a gala dinner on 13 October at the close of the first day of the inaugural Energy Intelligence Forum in London.

Nasser distinguished himself by stewarding Aramco through the unprecedented attacks on the Abqaiq processing plant and Khurais oil field last September. Through his leadership, Aramco was able to swiftly restore output with minimal disruption to customers, helping the company get through the industry-defining incident with flying colors.

"Amin Nasser's leadership was put to the test in 2019 with a series of major challenges—launching the world's largest IPO, acquiring one of the world's largest petrochemical companies, SABIC, and responding to the attack on Saudi oil facilities," said Alex Schindelar, President of Energy Intelligence. "His steady hand and focus on execution helped steer Saudi Aramco through these often choppy waters, delivering results that many predicted were impossible."

Gazprom Neft Takes Home IPTC's Top Award

On the edge of the Arabian Desert, a megaproject located above the Arctic Circle was given the IPTC Excellence in Project Integration Award on Monday in Dhahran. Taking home the top honor was Moscow-based Gazprom Neft, which is the current operator of the Novoportovskoye oil and gas condensate field that was discovered in 1964 but left undeveloped for decades due to its remote location on the Yamal Peninsula in Siberia.

For the past 5 years, Gazprom Neft has maintained year-round delivery of oil via an offshore loading terminal known as the "Arctic Gate." The project has also required the Russian oil and gas sector to build a new fleet of super-spec icebreakers and ice-class oil tankers designed for the harsh environments of the Arctic.

The remoteness of the Novoportovskoye field has demanded that Gazprom Neft invest in remote surveillance and production technologies. Among them is a newly launched digital twin of the field.



The "Arctic Gate" offloading terminal offshore the Yamal Peninsula where Gazprom Neft operates the Novoportovskoye oil and gas condensate field. Source: Gazprom Neft

The operator was also challenged with overcoming extreme winter temperatures of -60° C, at least 86 days of snowstorms each year, and an average of 245 snow-covered days.

Two new icebreakers were needed for the project because the offshore area only sees an average of 85 days of ice-free navigation each year. To move the oil, seven ice-class tankers travel between the Yamal Peninsula

to ports in Murmansk and Rotterdam. Oil shipments by road began in 2013 and tanker trucks must make a 200 km journey to deliver each load.

The field covers more than 250 sq mi. and holds proven oil reserves of 1.9 billion bbl. At least 90% of the recoverable reserves are located in five distinct formation horizons, which makes the exploratory efforts more complex.

There were 17 nominations for the award this year from 10 companies, representing nine nations.

The other two finalist this year were Total and Petronas. Total's nomination involved the Kaombo FPSO, which saw first oil in 2018 and aims to produce a peak of 230,000 B/D offshore Angola. Petronas' nomination was the FLNG SATU project, which was the world's first FLNG unit to come on stream. The project took Petronas' more than 2,000 miles from Malaysia to develop marginal gas fields. First gas was delivered in 2016 from the initial host field and in March 2019 the FLNG SATU was relocated to another marginal gas field where it operates today.

The Project Integration Award is given only to projects that exceed \$500 million and represent one that pushes the industry's envelope on what is possible. Last year's winner was Saudi Aramco, which was recognised for its own unique offshore project at the Manifa field, discovered in 1954 and only delivered first oil last decade. ■

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Spelling Out Critical Components of Modern Cybersecurity Strategies

The fourth industrial revolution is upon us. It is bringing new opportunities and changing the way most businesses around the world operate.

But there are new challenges too that threaten to weaken the effectiveness and prosperity that all the new automation and analytics technologies promise to deliver. In a technical paper session to be presented on Wednesday on “Industrial Cybersecurity” several nuances of this broad topic will be explored by industry experts.

A paper to be presented by Saudi Aramco outlines the design requirements for a modern day cybersecurity policy framework that helps enterprise business units navigate through the cyber-threat landscape without impacting the larger goals of the company. “How Cybersecurity Policies Enable IR 4.0 Emerging Technologies” highlights that one of the biggest concerns of every industrial firm today is how to ensure secure access to critical data to

its personnel while also making sure those data owners do their own part in protecting organizational networks against unauthorized access.

Today, all employees must understand this is their ultimate responsibility. The authors argue that the right design and enforcement of cybersecurity policies must be tailored to the threat environment each individual company faces. The proposed framework unfolds the multiple layers of successful cybersecurity policy, which include data encryption, continuous data logging, periodic compliance and risk assessments, user training and awareness programs, and non-disclosure agreements.

Petrolink will deliver a paper that describes the challenges of securing real-time data, which is increasingly becoming a prerequisite for high-level analytics efforts within the upstream sector. The paper notes that from creation to storage, each step in the life of a bit has unique challenges. Cyber protectors may employ a

variety of strategies to secure real-time data.

The Petrolink authors have chosen to focus their research paper on two of them: encryption and access control. Vulnerabilities of both methods are identified, along with proposed measures that can be used as a guide to validate the security of data transfer and analytics systems. The paper follows the flow of data from the wellhead to its typical final destination, the central data hub, while offering considerations and recommendations along each step in the journey.

The session’s third paper will focus on the critical role of the industrial control system (ICS) and the security tactic known as “Moving Target Defense” (MTD). Presented by Saudi Aramco, “How Feasible Moving Target Defense is Within the ICS Environment,” evaluates MTD as an alternative to more traditional IT network protection strategies and its effectiveness within the ICS environment. MTD mechanisms

include IP randomization and using software defined networks, or SDNs. MTD is regarded as a promising security option provided that implementers avoid the processing delays that come with using the tactic. ■

Industrial Cybersecurity

Paper 20114—How Cybersecurity Policies Enable IR 4.0 Emerging Technologies

Paper 19723—End-To-End Data Security Challenges in Real-Time Drilling Data Environment-From Data Transfer to Analytics

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MIT Initiative Examines Energy Needs in Low-Carbon World

The mission of the Massachusetts Institute of Technology (MIT) Energy Initiative is to develop low and no-carbon solutions that will meet global energy needs in an efficient, sustainable manner with minimal environmental impact, while reducing greenhouse gas emissions and mitigating the effects of climate change. The initiative acts as MIT's hub for energy research, education, and outreach—connecting students, faculty, and staff to develop the technologies and solutions that will deliver clean, plentiful, and affordable energy resources.

The anticipated rise in global energy demand due to population growth and increased standard of living in the developed world—and the need to reduce the effects of climate change—will require simultaneous action on multiple policy and technology fronts. This action will require broad collaboration among academia, industry, government, and philanthropic and non-profit organisations. To meet this challenge,

MIT established in October 2015 the Low-Carbon Energy Centers, a key element of MIT's Plan for Action on Climate Change. These centers allow companies and governments to jointly advance research in eight key technology areas to address climate change, including carbon capture, utilisation, and storage.

The initiative's research efforts have also focused on shale oil well productivity. While technology has been credited for the growth of the shale oil industry, MIT reported in 2017 that location, not technology, was the key to shale oil production success and that the impact of technology on well productivity improvements was overestimated by about 50%. The MIT initiative reached this conclusion after using five different regression models to analyse Williston Basin well productivity data over a 42-month period starting in 2012.

A key takeaway from the study is that the oil and gas industry cannot assume that low-cost wells and

high-productivity levels will continue, and that the most productive acreage will dry up regardless of the technology. To ensure the accurate forecast of shale oil production, the MIT initiative proposed that spatial error model and regression kriging, a type of prediction technique, be used in well-productivity modelling. These methods significantly improve prediction accuracy because they account for the variance in location at a much higher resolution, according to MIT researchers.

Researchers there also created a systematic method to understand the costs of oil production and how they change with time and circumstances. This method was developed in response to the oil price crash of 2014. At that time, US tight oil production was expected to decline due to reduced investment in high-cost tight oil wells. When this decrease failed to materialize, researchers investigated the factors that determine the break-even points of tight oil production projects.

To develop the method, the research team first defined three primary categories of costs that are commonly referenced in break-even analyses: lifting, half-cycle, and full-cycle. Lifting costs are expenditures required to produce oil from existing wells. Half-cycle costs include those related to drilling activity. Full-cycle costs include all expenses related to developing a new project, including exploration, resource estimation, and lease acquisition.

Researchers next showed how internal factors, such as technological improvements in the efficiency of oil extraction, and external factors, such as the market-determined price of oil, impact these costs. As oil prices decline, the main driver of break-even economics shifts from full-cycle to half-cycle to lifting costs, researchers found. As oil prices rise, they found that the reverse sequence applies. ■



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CEOs: Oil and Gas Looms Large in Future Energy Mix

Stephen Whitfield, Staff Writer

The road to a low-carbon future will add enormous complexity to oil and gas operations, but the industry still figures to play a significant role in the energy mix. That was the theme from one of the chief executive officer (CEO) plenary sessions (“Vision to Prosperity: A New Energy Era Emerges”) from the first day of this year’s IPTC, in which five CEOs from various parts of the supply chain spoke about how their companies factor into a rapidly changing world.

In his first public speaking engagement since Saudi Aramco’s \$29.4-billion IPO, CEO Amin Nasser said there is a practical, economic framework for transition worth discussion, one in which oil and gas plays a significant role.

“We look at this transition in a pragmatic light, because surely its foremost driver is a desire to move to a lower carbon energy mix or, more precisely, an energy mix with lower greenhouse gas emissions. But, when it comes to transitioning, oil and gas is not yet halfway there, and there is a lot more low-hanging fruit,” Nasser said.

Nasser also spoke on a more granular level about the potential vulnerability of the company’s assets in the wake of drone attacks on its oil processing facilities at Abqaiq and Kurais in the Eastern Province last September. The attacks forced the shutdown of the facilities, but Aramco recovered fairly quickly, as it restored production to pre-attack levels within two weeks.

Nasser said Aramco has a track record of “being a very reliable supplier” to its customers, and the attacks were a testament to its reliability. That reliability, he said, stemmed from three areas: its infrastructure, its workforce, and the way the company manages its resources.

“Our ability to restore a facility is unmatched in the industry,” Nasser said. “It’s a testament to our training, the involvement in emergency response, and the drills we run. Unless you take these drills seriously, you will end up with a disaster. Our emergency response, our highly trained workforce, made it possible for us to restore the facility quickly, and our business continued. Our contractors were ready to execute. Everybody knew what they were supposed to do.”

Petronas President and Group CEO Wan Zulkiflee bin Wan Ariffin said the security risk in operations will remain the same as the industry moves forward. Volatility, he said, is something companies must contend with and accept. The impact of the



Nasser said his company's quick recovery from drone attack was a testament to its reliability.

energy transition may add significantly to that element of volatility, and companies need to be ready for that as well. However, Wan Ariffin said it is too early to know exactly what that impact will be.

“Different governments will adopt different policies, and only time will tell if these policies are successful or not. Technology will be a key differentiator for all the organizations in this industry. I think there will be more nontraditional partnerships moving forward, many unconventional partnerships between technology companies and oil and gas,” he said.

Wan Ariffin also said that growing the appetite of financial institutions to back oil and gas projects, particularly in the wake of public pressure and economic pressure stemming from such issues as delays on final investment decisions, is another challenge the industry must attack. Jeff Miller, Halliburton’s Chairman and CEO, said the part of that challenge is focused more on returns than anything else.

“When I think about the path to prosperity in the long term, the future may look different, particularly as it requires collaboration in our industry to drive things like better technology adoption, better operational efficiency, and, most importantly, better

capital efficiency. I think that some of the things that have traditionally challenged our industry will also become opportunities for us, because I think there is a path to do what we do today more efficiently and attract investors back into the energy industry. How effectively do we focus on the collaboration it takes, for example, to get rid of the duplicative assets and processes that get in that way of that efficiency?”

Along a similar track, Woodside CEO and Managing Director Peter Coleman said attracting high-quality young talent into the industry will require bold thinking and versatility.

Coleman said top-notch young talent only wants to work for an industry that has a bright future. While harnessing advanced technologies are good way to demonstrate that oil and gas is a dynamic and future-focused industry, the best way that it will attract new blood into the industry is to show that it is serious about taking on climate change.

“We are part of the solution. We support a transition to a lower-carbon future, and we intend to play a role in it. As the world deals with the consequences of climate change, the pressure to reduce emissions will only increase, and as an industry we

must be ready to develop the most climate-friendly product we can possibly produce. This figures into the design and operation of our facilities, and our other efforts to offset our emissions. We must develop resources in the most carbon-efficient way possible, and it’s up to us as industry leaders to make sure that’s prioritised,” Coleman said.

Baker Hughes President and CEO Lorenzo Simonelli said the industry faces a “fundamental challenge” around the narrative of oil and gas that it must address if wants to maintain a social license to operate. He pointed to Baker Hughes’ “Road to Net Zero,” in which the company pledged to achieve net zero carbon emissions by 2050, as a way forward.

“It is important to realize that this industry sits at an inflection point,” Simonelli said. “We are an industry that is hated by many but essential to everyone. As we go through the increase in population and the energy transition, it is clear that there will be more required of energy as people move into the middle class. How do we acknowledge a carbon footprint challenge and a reduction in the carbon footprint within the energy landscape?” ■

How To Move At The Speed Of Cloud Computing

The use of a network of disparate systems to conduct mission-critical processes is allowing the oil and gas industry to revolutionise the workflows of its most time-consuming exploration tasks. A technical session on Wednesday titled, "Cloud Computing," will feature key applications of this area of technology that are relevant to operators across a broad spectrum of asset type.

Saudi Aramco will present a paper describing the use of an automation engine that the company designed and developed in-house. The central role of the advanced program is to manage the capacity of High Performance Computing (HPC) resources. Geoscientists running seismic data via HPC require uninterrupted access in order to complete their intensive processing jobs. This competes however with the processing needs of other personnel, sometimes resulting in those activities being halted. The paper, "An Automation Engine to Improve Seismic Operations in Exploration" explains how various modules—

monitoring, data gathering, job state management, and notifications—can be assembled to work in unison as a fully automated system.

Key performance metrics of the automated engine include an 80% reduction in response time. A lengthy manual process to verify and perform key actions in the HPC environment are now completely automated, leading to increased accuracy and the elimination of human errors. The effort has additionally alleviated slow response times, freed up storage space, and avoided wasted CPU hours.

King Fahd University of Petroleum & Minerals will share the results of a new study that used AI models—functional neural networks (FNN) and support vector machines (SVM)—to estimate the total organic carbon (TOC). The global unconventional shale sector relies on TOC estimates as a key factor for the characterisation of shale resources. The use of AI for this process represents a fast-moving area of digital innovation.

The two AI models described in the

paper were trained using more than 500 well log data sets (i.e. gamma ray, deep resistivity, sonic transit time, and bulk formation density) along with corresponding core samples collected from the Barnett Shale in Texas. After training, the models were tasked with estimating TOC and the results were then compared to a classical density-based correlation for TOC estimation methods. The researchers found that both models were highly accurate, and show that they outperformed the classical method.

The focus of a paper from Halliburton is on how operators are transitioning from legacy reservoir simulators to those that run natively on cloud platforms. Unlike traditional simulators, cloud-based reservoir simulators use the increasingly popular software-as-a-service model, which reduces hardware requirements for end users, associated maintenance costs, and engineers transferring gigabytes and terabytes of data over enterprise networks. Additional benefits include the integration of evolving intelligent

data analysis programme that help quantify the uncertainties of models, which is highly desired from a decision-making point of view. ■

Cloud Computing

Paper 19960—An Automation Engine to Improve Seismic Operations in Exploration

Paper 19659—Estimation of the Total Organic Carbon Using Functional Neural Networks and Support Vector Machine

Paper 20237—Transitioning of a Legacy Reservoir Simulator to Cloud Native Services

Alternate 19703—IR4 Innovative Solution for Gas Flow Measurement

Alternate 20235—Energy Query Language - An Oil and Gas Domain Query Language for Big Data Analytics in Real-time Data Streaming



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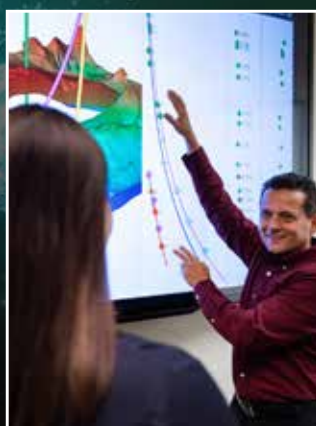
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ExxonMobil Guyana Production Shows Project Leadership

ExxonMobil recently started oil production from the Liza field offshore Guyana ahead of schedule and less than five years after the first discovery of hydrocarbons well ahead of the industry average for deepwater developments. Production from the first phase of the Liza field, located in the Stabroek Block, is expected to reach full capacity of 120,000 B/D in the coming months.

"This historic milestone to start oil production safely and on schedule demonstrates ExxonMobil's commitment to quality and leadership in project execution," said Darren Woods, Chairman and Chief Executive Officer of Exxon Mobil Corporation. "We are proud of our work with the Guyanese people and government to realise our shared long-term vision of responsible resource development that maximises benefits for all."

The concept design for the Liza Phase

1 development project features the Liza Destiny floating, production, storage and offloading (FPSO) vessel moored 190 kilometers offshore Guyana, and four subsea drill centers supporting 17 wells.

Approximately 1,700 of ExxonMobil's employees and other workers supporting its activities in Guyana are Guyanese, more than 50% of the total workforce. This number will continue to grow as additional operations progress. ExxonMobil and its direct contractors have spent approximately USD 180 million with more than 630 local suppliers since the first discovery in 2015.

"Through our continued workforce development and community investments, we are making a positive impact in Guyana," said Rod Henson, President of ExxonMobil's Guyana affiliate. "We are committed to the use of technology and continued

innovation to achieve the highest standards for safety and environmental performance."

A second FPSO, Liza Unity, with a capacity to produce up to 220,000 B/D is under construction to support the Liza Phase 2 development, and front-end engineering design is under way for a potential third FPSO, the Prosperity, to develop the Payara field upon government and regulatory approvals. ExxonMobil anticipates that by 2025, at least five FPSOs will be producing more than 750,000 B/D from the Stabroek Block. The timely development of these additional projects will ensure that the local workforce and the utilisation of local suppliers will continue to grow.

In late December, ExxonMobil announced that it had made an oil discovery offshore Guyana at the Mako-1 well southeast of the Liza field, marking the 15th discovery on

the Stabroek Block. The discovery adds to the previously announced estimated recoverable resource of more 6 billion oil-equivalent barrels on the Stabroek Block.

Esso Exploration and Production Guyana Limited is operator and holds 45% interest. Hess Guyana Exploration Ltd. holds 30% interest and CNOOC Nexen Petroleum Guyana Limited holds 25% interest.

ExxonMobil is the largest publicly traded international energy company, using technology and innovation to help meet the world's growing energy needs. ExxonMobil holds an industry-leading inventory of resources, is one of the largest refiners and marketers of petroleum products, and its chemical company is one of the largest in the world. For more information, visit www.exxonmobil.com or Hzon Twitter [www.twitter.com/exxonmobil](https://twitter.com/exxonmobil). ■



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Microsoft Revolutionizing Saudi Energy Sector with Cloud

Contributed by Microsoft

In a rapidly digitalising world, Microsoft's mission is to empower every organization and individual to achieve more. In line with this mission, the company strives to provide trusted and innovative solutions for oil and energy companies to revolutionize the sector through pioneering technologies, creative ideas, and futuristic propositions.

In terms of onsite safety, Microsoft has gone a long way with Azure IoT Edge. By using machine-learning algorithms, a security camera installed in the fields or local gas stations can pick up hazardous behaviour such as smoking, reckless driving, and theft. These systems are also able to learn more about dangerous behaviour thanks to the flexible system of uploading frames instead of large files, then use them in the process of deep learning.

Apart from security cameras, digitalising oil and gas platforms can lead to economic and efficient maintenance strategies. In offshore and remote production hubs where vital equipment is installed, the Azure intelligent cloud allows maintenance to be forecast 48 hours in advance so inventory can be swiftly sent to prevent failure. The usefulness of these security measures lies in the ability to alert owners and security employees of potential dangers, which can prevent death, structural damage, and unprofitability.

Microsoft's cybersecurity and cloud computing capabilities makes it a more reliable provider. With end-to-end security measures and a "privacy by design" model, large oil and gas companies can rest assured that all sensitive information circulating through the cloud is secure. It is proven that cloud security is more cost-efficient and reliable than spending millions of dollars securing every endpoint, WiFi connection, and physical access point.

The cloud enables control, collaboration, and engagement by empowering companies to visualize real-time data in all their branches globally. The data uploaded allows the company to monitor the performance of employees and track assets across the supply chain. It also allows employees to engage in the platforms by creating discussion forums, uploading videos, and even working on projects.

Many companies have started acquiring these technologies. A 2016 survey by Accenture and Microsoft found that over the next 3-5 years, 80% of upstream O&G companies plan to spend the same, more, or significantly more (30%, 36%, and 14%,

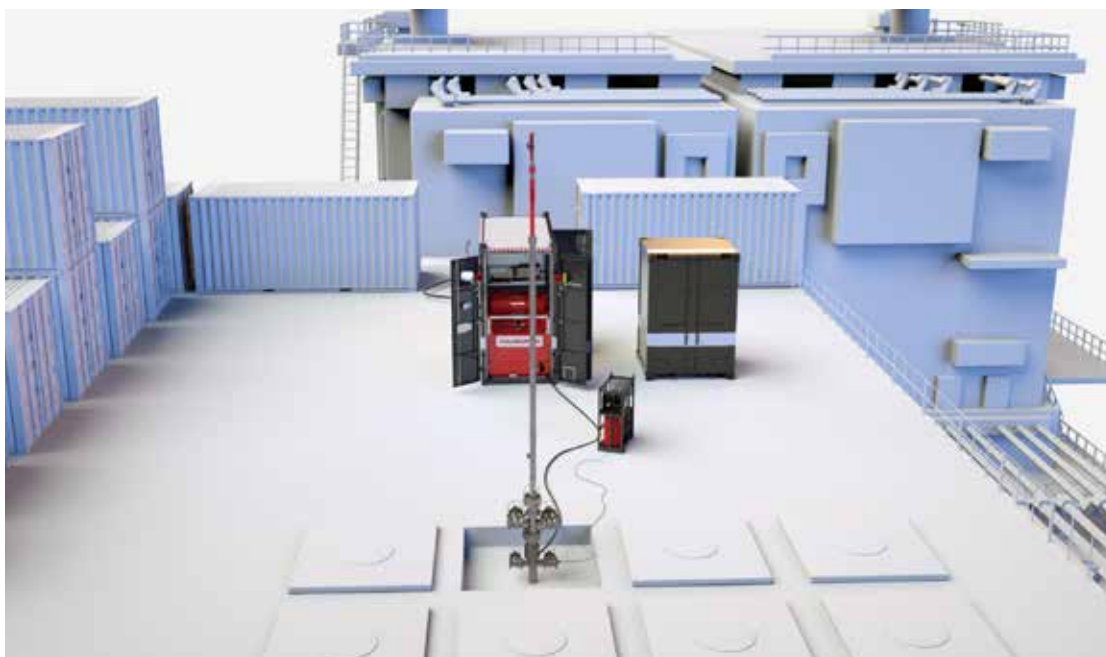
respectively) on digital technologies. The confidence expressed by these companies is part of the revolutionizing and empowering strategy of Microsoft in the energy sector, which perfectly aligns with Saudi Vision 2030's economic aspiration.

Microsoft is working toward empowering Saudi organizations to enhance skillsets in adopting these technologies by providing expertise and advanced tools, from the desktop

to the cloud. Improving the skills of individuals in technology fields has been one of the core efforts of the company as it heavily invests in programs such as "train the trainer." The oil and gas companies of Saudi Arabia can make the most of such programs to upskill and reskill their workforce while improving their security.

The cloud has transformed into a compatible, easy to use, and optimisable asset. Microsoft's efforts in

line with supporting Saudi Arabia's energy sector to unleash its full potential through these innovations lies in simplifying the platforms and providing support teams with the right technology. Becoming a trusted cybersecurity provider, a global technology innovator, and a digital transformation partner to support Saudi Arabia in Vision 2030 makes Microsoft a reliable choice and an enabler for oil and gas companies. ■



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ARO Drilling Plays Important Role in Saudi Arabia Vision 2030

IPTC Show Daily interviewed ARO Drilling Chief Executive Officer Kelly McHenry about his company and plans for 2020.

Please tell us about your company. Where is it based and what is its primary business?

In 2016, Crown Prince Mohammad bin Salman announced an ambitious program called Saudi Arabia Vision 2030 which, in short, tasks the government with transforming the country's economy by enhancing its existing industries and developing new ones. ARO is a product of Vision 2030 and, more specifically, a joint venture between Aramco, which is the world's largest oil and gas producer, and Valaris (f/k/a EnscoRowan), which is the world's largest offshore driller.

ARO launched operations in October 2017 with 10 jack-up rigs and currently operates a fleet of 16. We operate in one market, Saudi Arabia, and for one customer, Aramco.

We feel that the combination of Aramco and Valaris is one of those exceedingly rare opportunities where a customer and supplier can more effectively collaborate and that the end result will be ARO becoming a "best-in-class" performer. Just as important, ARO's launch and growth is a significant achievement toward the fulfillment of Vision 2030 and will increase its In-Kingdom Total Value Added to an amount in line with Aramco's IKTV program.

Where and what are your key markets?

Saudi Arabia is currently ARO's exclusive market. ARO has grown from 10 to 16 rigs in the course of two years and is committed to further growth. In fact, over the course of the next decade or so, we will take delivery of up to 20 newbuild jackup rigs, all of which will be designed and outfitted to meet the specific demands of Aramco and constructed in the Kingdom. We expect delivery of the first of these 20 rigs in late



ARO CEO Kelly McHenry

2021. While our primary goal is to service the needs of Aramco in Saudi Arabia, we believe that ARO will have opportunities to operate outside of Saudi Arabia for other customers in the near future.

What emergent technologies are helping transform the oil and gas industry from your perspective, and what innovations are you looking

to bring to the industry?

Several technologies are transforming the drilling industry. For example, we are using data analytics—the ability to extract meaning from raw data—to improve the way we maintain our equipment. The industry norm is to maintain equipment at specified time intervals. With data analytics, we can evaluate equipment-specific performance data and make decisions about maintenance based on the condition of the equipment. A "condition-based" maintenance program is safer, less expensive, and more efficient than a "time-based" approach and ultimately optimises our ability to deliver value to our customers. Other emergent technologies are the use of robotics and drones.

How do you view the global energy market going into 2020?

For the moment, we operate in one market, and that is our focus. ■



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