EGYPT
OIL&GAS
NEWSPAPER

EXCLUSIVE INTERVIEW

"2019 PROMISES A NEW FOCUS ON INCREASING DEVELOPMENT OF EGYPT'S CRUDE OIL SECTOR ALONG WITH FURTHER DEVELOPMENT OF OUR THRIVING NATURAL GAS SECTOR."

HIS EXCELLENCY TAREK EL MOLLA
Minister of Petroleum and Mineral Resources,
Arab Republic of Egypt

PETROLEUM EXPERTS DISCUSS SECTOR'S FUTURE AT

EOG 2ND UPSTREAM OPERATIONAL EXCELLENCE CONVENTION

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EDITOR'S **LETTER**

The Egyptian oil and gas sector said good-bye to 2018 with many achievements in hand. The country made outstanding progress in major natural gas projects and closed the year self-sufficient in natural gas. That alone would already be a great reason to celebrate, but – fortunately! – last year's successes did not stop there.

No one better than the Minister of Petroleum and Mineral Resources himself to go through the details of all the achievements of 2018. In our Interview section, we are happy to bring you an exclusive interview with petroleum minister Tarek El Molla, who gave us complete information about all the developments in the oil and gas, and mining industries during last year.

In December, the sector has witnessed many important events. You can find in our pages an extensive coverage of the EOG 2nd Upstream Operational Excellence Convention, which was organized by the EOG Technical Committee under the Egyptian oil and gas sector Modernization Project.

As the ministry's partner during the Ministry of Petroleum Annual Safety Day 2018, we are also happy to provide you with a detailed coverage of the event, which brought together many industry leaders to discuss ways of enhancing safety in the sector's operations.

EOG also attended the celebration of Schlumberger's 80th anniversary in Egypt, during which the company inaugurated the Egyptian Center of Efficiency (ECE) facility. In addition to the highlights of Schlumberger's event, you can also find in this issue everything about Apache's Fun Day at KidZania, which was provided to over 600 orphans from different orphanages as part of Apache's CSR activities.

In our Industry Insights section, you can find an article on the inclusion of humanities studies to the petroleum engineering curriculum. The EOG Research & Analysis Department also contributed to this issue with a report on gas pricing.

We would like to wish all our readers a very happy and special new year! As always, thank you for your support and readership.

Editor in Chief

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HELD UNDER THE PATRONAGE OF HIS EXCELLENCY ABDEL FATTAH EL SISI PRESIDENT OF THE ARAB REPUBLIC OF EGYPT تحت رعاية فخامة الرئيس عبد الفتاح السيسي رئيس جمهورية مصر العربية

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QALAA HOLDINGS SHOWCASE ERC AT AFRICAN FORUM

Qalaa Holdings Company presented its $4.3 billion Egyptian Refining Company (ERC) at the African Investment Forum as a case study for boosting the attractiveness of private investment using policy reform. Ahmed Heikal, Chairman and Founder of Qalaa Holdings, announced the lessons learned from Qalaa's 12-year journey to develop ERC at the forum, which was held in Johannesburg earlier in November. The refinery is going through the final stages of technical testing, paving the way to start full-scale commercial production in 2019.

ASORC NEGOTIATES $500 M LOAN

The Assiut Oil Refining Company (ASORC) has completed talks with local and Gulf banks for a $500 million loan as part of the $1.9 billion financing package for the mazut hydrocracking complex. The loan will be directed to Assiut National Oil Processing Company (ANOPC), which was recently established for the complex. The complex will receive 2.5 million tons of mazut from ASORC to produce 1.6 million tons of diesel, 402,000 tons of naphtha, 101,000 tons of butane, and 330 tons of sulfur.

EGYPT 5.5% GDP PROJECTED IN 2019

Egypt's annual gross domestic product (GDP) is expected to reach 5.5% in 2019, according to the International Monetary Fund's (IMF) latest Regional Economic Outlook. Egyptian GDP has been increasing over the past few years, recording 5.3% in 2018 up from 4.2% in 2017. The latest projections come amid improving macroeconomic indicators. Egypt's average consumer price inflation reached 29.5% in 2016 and then fell to 13.9% in 2018. The average consumer price inflation is expected to keep decreasing to reach 12.6% in 2019. The country's current account balance reached -2.6% of GDP in 2018, and it is expected to reach -2.4% of GDP in 2019.

EGYPT M&A VALUE SOARS TO $1.5 B IN 2018: MERGERMARKET

Egypt's mergers and acquisitions (M&A) value increased by 285.6%, reaching $1.5 billion in 2018 with a total of 14 deals, compared to $389 million in 2017, which had only 10 deals. The M&A deals value grew due to several deals in the energy, mining, and utilities sectors. These included Mubadala's acquisition of 10% in the Zohr oil field from Eni, and Soco International's acquisition of Merlon Petroleum El Fayoum Company. Egypt's share in the MENA M&A deals has increased to 6.3% in 2018, compared to 2.5% in 2017.

MISR PETROLEUM, COOP TO LAUNCH NEW, REFORMULATED 95-OCTANE BENZENE

Misr Petroleum Company and Egypt's Co-operation Petroleum Company (COOP) will launch a new reformulated 95-octane benzene, which will be sold at the same price of 95-octane benzene, said Hamdy Abdel Aziz, Oil Ministry Spokesman. The new benzene will be sold through gas stations that have regular 95-octane benzene starting from December 2018. However, the new product will not replace the 92-octane benzene, Abdel Aziz pointed out. The new product was reformulated to have a higher quality benzene which will be able to meet the needs of new vehicles in the Egyptian market.

EGYPT, US TO BOOST OIL AND GAS COOPERATION

Egyptian Minister of Petroleum Tarek El Molla met with Francis Fannon, Assistant Secretary for the Bureau of Energy Resources (ENR) at the US Department of State, to discuss cooperation in the oil and natural gas sector. During the meeting, El Molla and his guest reviewed aspects of cooperation between Egypt and the US in the oil and natural gas field, as well as efforts exerted to enhance the investment climate through the Ministry of Petroleum's Modernization Program. The ministry is looking forward to attracting exploration and production investments from major US companies, including ExxonMobil and Chevron.

GANOPE HOLDS RED SEA E&P WORKSHOP

Minister of Petroleum Tarek El Molla inaugurated a workshop on November 19 organized by Ganoub El Wadi Petroleum Company (Ganope) on the oil and gas exploration and production (E&P) in the Red Sea. The workshop was held by Ganope, in cooperation with Schlumberger and the Exploration Geophysics Society. Ganope's workshop included 10 sessions, 35 pieces of research on sedimentary ponds and petroleum reservoirs in the Red Sea, and 130 Egyptian and international experts representing 10 countries, said Mohamed Abdel Azzim, head of Ganope. The workshop was aimed at promoting E&P investment opportunities in the Red Sea, through discussing the geological and rock formations, as well as the petroleum reservoirs, Abdel Azzim pointed out.

EGYPT'S BUDGET DEFICIT DECREASES TO 1.9% IN Q1 2018/19

Egypt's budget deficit decreased to 1.9% during Q1 of fiscal year (FY) 2018/19, compared to 2% in the previous fiscal year, stated Minister of Finance Mohamed Maait. Egypt is working to bring its public finances under control as part of the economic reform program agreed with the International Monetary Fund (IMF) in November 2016. The Egyptian budget deficit for FY 2017/18 was 9.8% of gross domestic product (GDP), a decrease from 10.9% in the previous fiscal year. This was the first time the country had generated a primary fiscal surplus in 15 years, deputy finance minister Ahmed Kouchouk stated on July 26.

EGYPT AGREES $1.75 B SETTLEMENT IN ARBITRATION CASE WITH ISRAEL

Egypt agreed to pay Israel a $1.75 billion settlement in the arbitration case filed by the Israel Electric Company (IEC) against the Egyptian Natural Gas Holding Company (EGAS) and the Egyptian General Petroleum Corporation (EGPC). The IEC filed the case against the Egyptian companies after they halted natural gas exports to Israel in 2012. The countries signed a 20-year export agreement in 2005 but the Egyptian government was forced to stop shipments following attacks on the pipeline in Sinai province. Under the terms of the agreement, Egypt will pay a reduced fine in stages when the natural gas pipeline linking the two countries begins operating.

BANKING CONSORTIUM OFFERS EGP 10 B LOAN TO EGPC

A banking consortium offered to loan the Egyptian General Petroleum Corporation (EGPC) EGP 10 billion to import oil and to settle part of its debts to the Ministry of Electricity. The consortium includes the National Bank of Egypt (NBE), Banque Misr, Commercial International Bank (CIB), Arab African International Bank, Qatar National Bank (QNB), and Crédit Agricole. EGPC was in the middle of negotiating the loan agreement earlier this year, but put talks on hold after it obtained several loans amounting to $1.5 billion. It began receiving offers for a new loan in October 2018.

ELECTRICITY SECTOR TO PAY DOWN DEBTS TO PETROLEUM MINISTRY OVER FIVE YEARS

The Egyptian Ministry of Electricity is set to pay down the total debts to the Ministry of Petroleum within five years, Minister of Electricity Mohamed Shaker said. The Ministry of Electricity has accumulated EGP 127 billion in debt, money which has been spent on providing fuel to electricity plants. The sector will repay its debts in full in order to lift subsidies on electricity prices by fiscal year (FY) 2021/22, Shaker pointed out, adding that the Ministry of Finance will help the electricity sector to pay off the debt. The ministry plans to completely remove electricity subsidies by FY 2021/22.

NATURAL GAS PRODUCTION INCREASES BY 29.28% YOY

Egypt's natural gas output jumped by 29.28% year-on-year (YOY) to 4.159 million tons in September 2018, up from 3.217 million tons in September 2017. The monthly bulletin published by the Central Agency for Public Mobilization and Statistics (CAPMAS) reveals that Egypt's consumption of natural gas increased by 10.24% YOY to reach 4.155 million tons in September 2018, up from the 3.769 million tons consumed in the same month a year earlier. Monthly figures show that Egypt's natural gas production grew by 0.89% in September 2018, up from the 4.023 million tons produced in August 2018.

PETROLEUM PRODUCTS CONSUMPTION FELL BY 18% YOY

Egypt's consumption of petroleum products dropped by around 18% year-on-year (YOY) in September 2018 to 2.585 million tons, compared to 3.156 million tons in September 2017. Statistics published by CAPMAS show that petroleum product's output slightly increased by 0.073% from 2.751 million tons in September 2017, to 2.753 million tons in the same month of 2018. Egypt's consumption of petroleum products decreased by around 2.5% month-on-month, down from the 2.652 million tons produced in August 2018.

EGYPTIAN BUTANE IMPORTS PLUNGE BY 25% IN SEPTEMBER

Egypt's butane imports plunged by almost a quarter (23.49%) in September. Statistics published by CAPMAS show that the country imported 113,000 tons of butane in September, 35,000 less than the 148,000 imported in August. The figures also show that imports sharply decreased by 26.53% year-on-year (YOY) in September from 153,800 tons in September 2017. Egypt's butane consumption dropped by 6.8% YOY, falling to 292,800 tons in September 2018 from 314,200 tons in September 2017. Meanwhile, the country's butane output decreased by 4.39%, producing 148,000 in September 2018 compared to 154,800 in the same month a year earlier.

PETROLEUM SECTOR TO REPAY $1 B TO IOCS EACH YEAR

The Egyptian oil and gas sector plans to repay $1 billion each year to international oil companies (IOCs) that work in Egyptian concession areas, said an official source at the Egyptian General Petroleum Corporation (EGPC). The Egyptian government has repaid $5.1 billion to IOCs over the past four years, which has decreased its arrears to $1.2 billion. The government hopes that, by demonstrating commitment to paying the arrears, IOCs' confidence will improve and investment in exploration and production projects will increase. The source revealed the plans on the sidelines of the 15th International Arab Mineral Resources Conference, an event designed to increase investment in the country's mining sector and discuss future prospects.

EL MOLLA: NATURAL GAS ACCOUNTS FOR 15% OF EGYPT GDP

Natural gas accounts for 15% of the Egypt's gross domestic product (GDP), Minister of Petroleum Tarek El Molla has said. El Molla, speaking on the sidelines of the 15th International Arab Mineral Resources Conference, added that Egypt has succeeded in increasing natural gas output by 60% over the past two years. The minister said that the sector is focused on enhancing the added value of different oil, gas, and mineral resources to achieve the highest economic returns. The International Arab Mineral Resources Conference took place November 26-28 in Cairo for the first time since 1999.

CAPMAS: EGYPT DIESEL PRODUCTION FALLS 16% IN SEPTEMBER

Egypt's diesel output fell by 15.77% in September 2018, decreasing to 552,000 tons from 650,000 tons produced in August. Statistics published by CAPMAS also show that production fell 2.8% year-on-year (YOY) in September, down from 568,000 tons in September 2017. Egypt's diesel consumption slightly increased by 0.55%, recording 1.088 million tons in September 2018 compared to 1.082 million tons in the same month a year earlier. Monthly figures show that consumption increased 7.3% in September, down from 1.014 million tons in August.

EGYPT REVIEWS FINANCIAL OFFERS FOR E&P TENDER

Egypt reviewed financial offers for the exploration and production (E&P) tender launched for Egyptian concessions, said Abed Ezz El Regal, head of the Egyptian General Petroleum Corporation (EGPC). The oil and gas sector is currently conducting the operational review of the bidders, which will be completed soon and followed by evaluating the tender's results and announcing the winner, he added. EGPC launched two E&P tenders in 2018 for five concessions in the Western Desert, two concessions in Nile Delta, three in the Gulf of Suez, and one in the Eastern Desert. Egypt currently produces 660,000 barrels of crude per day (b/d) amid efforts to increase production levels further, Ezz El Regal said.

INDUSTRY LEADERS DISCUSS EGYPTIAN INVESTMENT CLIMATE AT EOG UPSTREAM CONVENTION

Industry leaders discussed Egypt's upstream investment climate during the first strategic panel of the Egypt Oil & Gas (EOG) 2nd Upstream Operational Excellence Convention, on December 2. Participants on the panel included First Undersecretary for Gas Affairs at the Ministry of Petroleum, Mohammed Moanes; Fabio Cavanna, general manager of IEOC; Gasser Hanter, vice president and managing director of Shell Egypt; Stuart Shaw, vice president of operations at BP Egypt; Karim Bedawi, managing director for Egypt and the Mediterranean at Schlumberger; and Martijn Murphy, Wood Mackenzie's upstream research manager. The panel was moderated by Thomas Maher, president and COO of Apex Energy and chairman of the EOG Technical Committee.

EDC HOSTS MINISTRY OF PETROLEUM'S ANNUAL SAFETY DAY

The Ministry of Petroleum's Annual Safety Day 2018, held on December 6 at the Egyptian Drilling Company's (EDC) headquarters in Cairo, brought together oil and gas leaders to discuss safety culture, leadership, and best practices. The event, organized in cooperation with EDC and Apache, started with an opening speech by Eng. Mohamed Saafan, First Undersecretary for Oil Affairs at the Ministry of Petroleum, on behalf of minister Eng. Tarek El Molla. Representatives from EDC, Apache, BP, IEOC, and Shell also gave their opening remarks.

EGYPTIAN NATURAL GAS OUTPUT TO REACH 8 BCF/D IN 2021: MINISTRY OFFICIAL

Egypt's natural gas production will increase to 8 billion cubic feet per day (bcf/d) by 2021, up 29% from 6.2 bcf/d currently. The ministry is working with companies to introduce a program to preserve current oil and condensates production rates until 2021, while compensating for the natural decline of some of the country's oil fields. Crude oil production has increased by 4.3% to reach 657,000 barrels per day (b/d) compared to 630,000 b/d a year ago, the source said, adding however that the country's crude reserves have shrunk by 25% to 3 billion barrels, compared to 4 billion barrels in 2015.

EL MOLLA MEETS WITH COMPANY HEADS TO DISCUSS NAPHTHA TANK FIRE

Minister of Petroleum Tarek El Molla met with the head of the Egyptian General Petroleum Corporation (EGPC), Abed Ezz El Regal, and the head of the Alexandria Petroleum Company (APC), Medhat Bahgat, to discuss a recent fire in one of Alexandria's naphtha tanks. El Molla issues urgent decrees to form an operational committee to follow up and prepare a final report on the fire. The fire broke out in one of APC's naphtha tanks on December 6 due to bad weather, Bahgat said. The company's existing emergency plans and security protocols enabled the company to contain the fire without any injuries.

EGYPT CANCELS FUEL HEDGING CONTRACTS

The Ministry of Finance has canceled plans to purchase fuel hedging contracts from international financial institutions. The ministry was close to finalizing contracts with two banks, before crude oil prices dipped below the $67 benchmark price used to calculate the country's 2018/19 budget. The government first announced it was looking to obtain a hedging mechanism in July, as Brent prices rose above the government's projections. However, prices have rapidly declined since the beginning of October, plummeting almost $30 to lows of $58 per barrel at the end of November. Brent is now trading below $67, eliminating the need for the government to purchase hedging products, the source said.

EGYPT GAS SEEKS 8% PROFIT GROWTH IN 2019

Egypt Gas Company is seeking an 8% profit increase to EGP 26.57 million by the end of 2019, up from EGP 24.57 million currently. The company hopes to boost its annual revenues to EGP 3.1 billion, up from EGP 2.6 billion. Egypt Gas has improved its financial position in 2018, despite making a pre-tax loss of EGP 12 million in Q1. The company made a loss of EGP 17.6 million in the first nine months of 2018, compared to EGP 58.9 million losses during the same period of 2017. Egypt Gas's revenue recorded EGP 397.3 million in Q1 2018, compared to EGP 318.6 million in the preceding year.

SHELL TO INCREASE BURULLUS, RASHID GAS PRODUCTION

Shell is looking to increase natural gas production from its Burullus and Rashid fields to 450 million standard cubic feet per day (mmscf/d) by the end of fiscal year (FY) 2018/19, up from the current 400 mmscf/d. The source explained that the increase will be due to adding new output from the 9B phase wells to the production map. Egypt completed drilling the Simian DT natural gas well in October – the first well of the 9B phase in the West Delta Deep Marine (WDDM) project – and added the new well to production at a capacity of 20 mmscf/d.

TRANSGLOBE TESTS THREE INTERVALS IN BAHARIYA FORMATION

TransGlobe Energy Corporation started testing three intervals in its Bahariya formation, which showed 3,840 barrels per day (b/d) of light oil from both the Bahariya and Lower Bahariya. The company announced drilling the SGZ 6X exploration well with a total 5,195 feet-depth and defined it as a light oil discovery at Bahariya. The lower Bahariya had a natural flow at an average of 2,437 b/d of light oil, 1.4 million standard cubic feet per day (mmscf/d) of natural gas and 21 b/d of water. Meanwhile, the middle Bahariya formation produces a small amount of formation water.

ENI COMPLETES DRILLING OF NINTH WELL AT ZOHR

Italian oil giant Eni has completed drilling the ninth well at the Zohr natural gas field at a cost of $300 million. The well has an initial production capacity of 150 million standard cubic feet per day (mmscf/d) which will be gradually increased to reach 250 mmscf/d. The new well will boost Zohr's total output to 2.25 billion cubic feet per day (bcf/d) when fully operational. Eni is closing the new well until the field's sixth processing facility has been completed. The facility will have a capacity of 400 mmscf/d, and is expected to be operational by the end of the 2018/19 fiscal year.

SHELL PROMOTES CSR DURING THE ARAB SUSTAINABLE DEVELOPMENT WEEK

Shell is working within its corporate social responsibility (CSR) framework to create jobs and develop local businesses, said Moataz Darwish, Vice Chairman of Shell Egypt. The company has been working in Egypt in several petroleum fields including the exploration and production (E&P) field, Darwish stated during the third day of the Arab Sustainable Development Week (ASD Week). Shell is keen on developing the areas surrounding its operations through paving roads and establishing technical schools as well as community schools. Darwish noted that the energy demands, especially natural gas demands, will increase in the coming period due to global population growth.

CHEVRON, AXENS SHOW INTEREST IN AMOC PROJECT

Chevron and France's Axens have shown interest in a project for the Alexandria Mineral Oils Company (AMOC) and will submit financial and technical offers by the end of December 2018, said Amr Mostafa, head of AMOC. AMOC is planning to merge the mazut refining and the wax distillation projects into a single $1.5 billion project following lower-than-expected profits in Q1 of fiscal year 2018/19. The company plans to complete the project before 2023, Mostafa stated, adding that the project might be operated by a new company that would be a subsidiary of AMOC. Around 70% of the project's cost will be secured through loans, while 30% will be self-financed.

SDX ENERGY BOOSTS PRODUCTION IN EGYPT, MOROCCO

SDX Energy Corporation increased its actual production from Egypt and Morocco to reach 11,109 barrels of oil equivalent per day (boe/d) as of November 23. The increases were driven by the ongoing development drilling and work-over program at Egypt's North West Gemsa and Meseda fields. Gross production from North West Gemsa reached 4,992 boe/d, while it recorded 5,234 boe/d in the country's Meseda field. SDX's Morocco asset has a comparatively low gross production of 883 boe/d. The company completed three new infill wells – AASE-25, AASE-27 and Al Ola-4 – and undertook a seven well work-over program at the North West Gemsa field.

ENI TO DRILL TENTH ZOHR WELL IN JANUARY 2019: SOURCE

Eni plans to start drilling the tenth well at the Zohr natural gas field during January 2019 at a cost of $300 million. The new well is expected to produce 200 million standard cubic feet per day (mmscf/d) of natural gas. Drilling the well will take around two months, the source noted, adding that preparations are currently under way. Production from the ninth and tenth wells will be linked to the sixth gas processing plant, which is currently under construction. The ninth well was completed in November 2018 and is currently closed pending the completion of the processing plant.

BP, MUBADALA PURCHASE 45% STAKE IN ENI'S NOOR CONCESSION

Egypt approved the sale of a 25% stake in Eni's offshore exploratory Noor concession to BP, Eni announced. The agreement, signed by Minister of Petroleum Tarek El Molla, also approved the entry of Emirati investment company Mubadala to the concession, which reached an agreement with Eni in November to purchase a 20% stake. The sale leaves Eni holding a 40% stake in the concession, while its Egyptian partner company Tharwa Petroleum holds the remaining 15%. Eni and Tharwa have invested $105 million to drill two exploratory wells. The first well is currently being drilled 50 km away from the shore at a depth ranging between 50 and 400 meters, covering a total 735 km2 area.

SCHLUMBERGER SIGNS THREE MOUS DURING ECE INAUGURATION

Schlumberger has officially inaugurated the Egypt Center of Efficiency (ECE) facility at the Polaris Industrial City in 6th of October. The inauguration took place on December 12 during the company's event to celebrate 80 years of operations in Egypt. The event, held under the patronage of H.E. Eng. Tarek El Molla, Minister of Petroleum and Mineral Resources, also witnessed the signing of three memoranda of understanding (MoUs) covering health, safety, and environment (HSE); capacity building; and cooperation in processing and separation systems. The new agreements were signed by Eng. Karim Badawi, Schlumberger Egypt & East Mediterranean Managing Director; Eng. Abed Ezz El Regal, Head of EGPC; and Eng. Waleed Lotfy Mostafa, Petrojet's Chairman and Managing Director.

DANA GAS ADDS 5,000 BOE/D TO PRODUCTION

Dana Gas Company announced the completion of the Balsam-8 well drilling in Q4 of 2018, which added over 5,000 barrels of oil equivalent per day (boe/d) to production. The firm's operations in both Egypt and the Kurdistan Region of Iraq (KRI) led to a significant increase in production reaching 70,000 boe/d, compared to average production of 62,250 boe/d during the first three quarters of 2018. "Production in excess of 70,000 boe/d is a great achievement for Dana Gas. At the start of the year, we planned a drilling program in Egypt and a debottlenecking project in the KRI that would significantly increase production. We have successfully delivered both projects," company CEO Patrick Allman-Ward said.

SAUDI ARABIA

A new Saudi mining project is expected to increase the country's gross domestic product (GDP) by $6.4 billion and its non-oil GDP by 3%. The kingdom plans to invest around $22.7 billion in the project, a 440-square km city for mining industries. The project will raise annual phosphate fertilizer production to 9 billion tons, making the country the second largest producer in the world.

Saudi Aramco will sign 30 deals with local and foreign companies worth about $25 billion during the in-Kingdom Total Value Add (iktva) event. The slew of agreements come as the kingdom tries to develop its industrial base and increase its manufacturing sector. The iktva program was launched by Aramco to increase the amount of goods produced inside the kingdom to 70% by 2021.

Saudi Crown Mohammed bin Salman and Bahraini King Hamad bin Isa Al Khalifa opened a new oil pipeline connecting facilities in the two countries on November 26. The oil pipeline is set to connect the Abqaiq oil processing facilities in Saudi Arabia with the Bahraini Bapco refinery. It currently has a flow of 220,000 barrels per day (b/d) and a transport capacity of 350,000 b/d.

Saudi Aramco is looking to attract investments worth $150 billion over the next 10 years in order to become a natural gas exporter. Aramco plans to increase gas production to reach 23 billion standard cubic feet. The company's plan comes in line with its targets to satisfy the local market needs and become a net gas exporter as well.

KUWAIT

The Kuwait Oil Company (KOC) has signed contracts worth $1.3 billion to buy over 86 drilling rigs. 30 rigs have so far been delivered from Chinese, American and Italian companies. The company decided to buy the rigs due to their high rental price of between $12,000 and $14,000 per day.

The Kuwait National Petroleum Company (KNPC) plans to increase the country's refining capacity to 2 million barrels per day (b/d) by 2035. The plan comes as part of the company's 2035 strategy, which will cost around $25 billion to implement. The company hopes to boost the refining capacity by 300,000 b/d to 1.7 million b/d by 2025 after the first phase of the new Al-Zour refinery is completed. The project's second phase will raise capacity to 2 million b/d and is scheduled for completion in 2035.

IRAQ

Iraq has restarted exporting oil from Kirkuk after being interrupted for a year due to conflicts between the central government in Baghdad and the Kurdistan Regional Government. The flows resumed on November 16 at a low level of around 50,000 to 60,000 barrels per day (b/d), comparing to the peak level reached 300,000 b/d at the same period in 2017.

Dana Gas and its partner Crescent Petroleum have announced a 30% increase of the production capacity of the Khor Mor natural gas field in Iraqi Kurdistan. The field's production capacity has increased to 400 million standard cubic feet per day (mmscf/d), up from 305 mmscf/d, with over 15,000 barrels per day (b/d) of condensate. The field supplies natural gas to power plants in Chemchemal and Erbil and will soon supply a new plant in Bazian.

Oil production from Halfaya oilfield in Iraq has increased by 100,000 barrels per day (b/d) to reach 370,000 b/d. The boost to Halfaya's output will increase Missan Oil Company's total production to around 510,000 b/d. The new crude facility, which has a capacity to process 200,000 b/d of crude oil, will help to further boost output from Halfaya to reach 470,000 b/d in Q1 2019. The oil production increase from Halfaya oilfield comes in line with Iraq's strategy to boost its oil capacity to reach 5 million b/d.

OMAN

Crude oil and condensates production in Oman exceeded more than 30 million barrels in November, with a daily average of more than 1 million barrels. A report published by the Ministry of Oil and Gas revealed that Oman exported 22.75 million barrels in November, averaging 758,219 barrels per day. China remained Oman's largest crude export market in November, despite falling 1.68% from October, accounting for 91.64% of the country's total exports to the Asian market. Exports to Japan also fell 3.79% in November while demand from India rose 2.64%.

The Omani Ministry of Oil and Gas has signed two new exploration and production sharing agreements (ESPA) worth $65 billion to explore and develop the onshore concession blocks 51 and 65. The agreements will enable 14 wells to be drilled across both blocks: nine wells in block 65 and five wells in block 51 during the two phases

Petrofac has been awarded a $115 million engineering, procurement and construction (EPC) contract by Petroleum Development Oman (PDO) for developing and supporting oil extraction from the Qarn Alam generator project in Oman. The 36-month contract includes installation and commissioning support for a gas turbine generator package with one heat recovery steam generator at the power plant, which was built to support oil extraction in Oman's central region. Under the terms of the agreement, all engineering, procurement, and project activities will be operated from Petrofac's Muscat office.

2018: A CORNERSTONE FOR THE EGYPTIAN OIL AND GAS SECTOR

AN INTERVIEW WITH PETROLEUM MINISTER, H.E. ENG. TAREK EL MOLLA

The Ministry of Petroleum and Mineral Resources achieved outstanding results in oil and gas activities throughout 2018. These are the fruits of intensive work and new successful projects developed in Egypt's fields, refineries, and infrastructure under the umbrella of the ministry's Modernization Project. Petroleum minister Eng. Tarek El Molla shared with Egypt Oil & Gas the sector's achievements and their impacts to the economy and the Egyptian society.

LAST YEAR WAS AN IMPORTANT YEAR FOR THE NATURAL GAS MARKET. COULD YOU TELL US ABOUT THE COUNTRY'S JOURNEY TOWARDS NATURAL GAS SELF-SUFFICIENCY?

In 2018, we have witnessed continuous growth in natural gas production. This increase was the result of the Ministry of Petroleum's vision to speed up the development of discovered natural gas fields in order to add them to the production map across the year. As a result, the current total natural gas production exceedsed 6.6 billion cubic feet per day (bcf/d), which enabled us to achieve self-sufficiency of locally produced natural gas at the end of September. This allowed us to halt liquefied natural gas (LNG) imports for the first time in more than three years, which eventually led to rationalizing the usage of foreign currency allocated for imports and decreasing imports bills.

Many projects contributed to this achievement. We finalized new phases of four mega-projects in the Mediterranean Sea - Zohr, North Alexandria, Nooros and Atoll fields - in which the total investments exceeded $27 billion, and maximum production rates will reach 6.5 bcf/d by the completion of all the fields' phases.

The Zohr field, which had its first phase of early production inaugurated by president Abdel Fattah El Sisi in January after its first real production in December 2017, developed new phases to maximize its production more than six times since the inauguration, to reach more than 2 bcf/d.

We are continuing the development of the coming phases of Zohr with an overall investment of $12 billion, with production expected to reach over 3 bcf/d by the end of 2019.

In December, we have started the early production from the second phase of the development and production project of North Alexandria and West Delta Deep Marine (WDDM) at the rate of 400 million standard cubic feet per day (mmscf/d) from Giza and Fayoum fields, which gradually increased to 700 mmscf/d. Ravin field will be added to the production map in 2019, completing all phases of the project, with more than $10 billion investments and 1.6 bcf/d total production.

Meanwhile, the Nooros field in the Nile Delta has reached 1.2 bcf/d of natural gas due to drilling new successful wells, which led to continuity in achieving the highest natural gas production in the history of the Nile Delta region.

As for Atoll, efforts are being conducted to develop the fourth well to increase its production to reach 400 mmscf/d by October 2019. Atoll started operations in 2017 at a production rate of 350 mmscf/d of natural gas and 9,000 barrels per day (b/d) of condensates.

I would also like to add the linking of the 9B phase natural gas project, in the WDDM in the Mediterranean, to the production map through an initial production from the first well reaching 20 mmscf/d of the 400 mmscf/d maximum production capacity, in addition to 3,000 b/d of condensates through drilling eight development wells and two exploratory wells with total investment cost exceeding $870 million.

In light of the increase in the natural gas production rates, after linking a number of big fields to production and reaching self-sufficiency, re-exporting natural gas to Jordan has started with trial quantities in October, and will gradually reach the contracted quantities by 2019.

The year of 2019 promises a new focus on increasing development of Egypt's crude oil sector along with further development of our thriving natural gas sector.

HOW HAS EGYPT'S CRUDE OIL PRODUCTION MAP CHANGED THROUGHOUT 2018?

We made 61 new oil and gas discoveries in 2018, of which were 43 crude oil discoveries and 18 were natural gas discoveries. In the Western Desert, we had three important oil discoveries in the Faghour basin, operated by Eni. Two of them were oil discoveries, which reflects promising probabilities in the Western Desert basins and opens new scopes to attract more investments from international oil companies (IOCs) to intensify activities in this area.

Egypt's current production average of crude oil and condensates reached around 660,000 b/d due to the efforts exerted last year in exploration and production (E&P) and development, adding 36 new exploratory crude oil wells to the production map with initial production average of 27,000 b/d of crude oil, and 175 development wells with initial average of 113,000 b/d.

In addition to that, we have also succeeded in compensating natural decline of production from brownfields due to the decrease in reservoirs' pressure, through the performance enhancing program, which is a part of the Modernization Project. This contributed to compensating the decline of almost 100,000 b/d of crude oil.

WHAT ARE EGYPT'S NEW MECHANISMS TO ATTRACT FOREIGN INVESTMENT INTO THE OIL AND GAS SECTOR?

We have decreased arrears of IOCs to reach an unprecedented value of $1.2 billion by the end of the fiscal year in June 2018, which is the lowest debt level since 2010. This assures the credibility and commitment of the government with its international partners, and sends a message from Egypt to the world, to encourage new investments. This further has direct positive effect on the petroleum sector through the increasing turnout of IOCs in E&P tenders and increasing investments in the field of E&P activities, and field development, which is positively reflected in the production of Egypt's natural hydrocarbon resources.

Through the Modernization Project, we have also applied new untraditional mechanisms to encourage and increase E&P investments. We have enhanced E&P agreement models to explore and produce oil and gas in new areas, which contributes in attracting investors, and encouraging IOCs to work and invest in these areas with big exploration challenges that will also require huge capital with the use of advanced technologies.

We have also taken new steps in establishing the Egyptian Online Gateway for promoting E&P areas in cooperation with specialized global firms, which not only attracts foreign investments but also enables business to be made with a modern and advanced concept. In 2018, the ministry signed cooperation agreements regarding this project with both Schlumberger and Baker Hughes GE (BHGE) global firms.

In addition to that, two international bid rounds were launched for the Egyptian General Petroleum Corporation (EGPC) and the Egyptian Natural Gas Holding Company (EGAS) for the exploration and production of oil and gas from 27 areas including the Gulf of Suez, Western Desert, Eastern Desert, Nile Delta and Mediterranean. Participating companies bids are now being evaluated to announce the winning companies.

We are also ready to launch the first E&P international bid round in the Red Sea, based on the results of 10,000-kilometer seismic survey and data collection that was conducted in 2018 with the cooperation of Schlumberger with a total investment $750 million. This represents one of the fruits of the demarcation agreement between Egypt and Saudi Arabia, which enabled us to explore the area's untapped potential.

Recognizing the results of the initiatives made through the past couple of years, last year we signed 12 new agreement with IOCs for oil and gas exploration for several concessions in the Mediterranean, Gulf of Suez, Nile Delta, Western Desert and Sinai, with total investments reaching at least $1.3 billion and around $95 million signing bonuses to drill 41 wells. In the past four years, the total number of agreements reached 63 since June 2014.

Additionally, we signed a number of new partnership agreements for the development of Zohr field, according to which Russia's Rosneft became a partner with 30% shares, and UAE's Mubadala with 10% shares, with Itlay's Eni, the main operator, and British BP, which owns 10% shares. I am personally glad to see these new agreements coming through as it represents new partners entering the project and supporting the oil and gas sector with major expertise and new technologies.

Another important indicator to highlight is that, as steps are being taken to attract investments, fiscal year (FY) 2017/18 has witnessed investments of around $10 billion that were injected in

INVESTMENT INDICATORS

In FY 2017/18, the upstream investments reached around **$10 billion**

61
Discoveries during 2018

43
Crude Oil

18
Natural Gas

Average crude oil and condensates production reached 660,000 (b/d), as a result of

36 new exploratory crude oil wells, with initial average crude oil production of **27,000 (b/d)**

175 development wells with initial average production of **113,000(b/d)**

ARREARS TO IOCS

Arrears to IOCs decreased to record **$1.2 billion** in June 2018

NATURAL GAS SELF SUFFICIENCY

Egypt reached natural gas self-sufficiency in the end of **September 2018**

RESUMING NATURAL GAS EXPORTS

Resuming natural gas **exports** to Jordan with trial quantities in **October 2018** to reach the contracted quantities by **2019**

DEVELOPING FOUR GAS FIELDS

4 natural gas **fields** were developed in the **Mediterranean Sea** with total investments exceeded **$27 billion** and expected production of about **6.5 (bcf/d)**

oil and gas E&P and fields' development. FY 2018/19 is planned to witness the same value of investments.

IN ADDITION TO THE INITIATIVES YOU HAVE MENTIONED, WHAT OTHER STEPS WERE TAKEN IN ORDER TO TURN EGYPT INTO A REGIONAL ENERGY HUB?

During 2018, the ministry took positive concrete steps towards achieving the national project of turning Egypt into a regional energy hub. In February 2018, we prepared the legislative environment to achieve this vision through issuing executive regulations for the natural gas law aiming at regulating the natural gas market's activities. With this, we have established an independent authority to regulate the market's activities. The authority is one of the most important steps and main factors that support achieving Egypt's goal to become a regional hub for trading oil and gas as it encourages international firms and private sector's companies to contribute and invest in the natural gas trading market in Egypt.

The authority organizes the process of receiving and supplying gas from and to the Egyptian market, which leads to boosting investment opportunities in logistics and supporting private sector's contribution in all the activities related to the gas market, whether it is importing, shipping, transporting, distributing, or storing.

In the framework of boosting cooperation with major international and regional partners, April 2018 witnessed the signing of a memorandum of understanding (MoU) for the strategic partnership in the energy field between Egypt and the European Union (EU). The EU countries represent the final markets for east Mediterranean gas, which will be re-exported by Egypt as a part of its role as a pivotal country and a regional hub for trading oil and gas

At the end of September, we signed a joint governmental agreement between Egypt and Cyprus in Necosia, capital of Cyprus, which stated establishing a direct subsea pipeline between the two countries to transport natural gas from the Cypriot Aphrodite field to Egypt's gas liquefaction plants on the Mediterranean coast to liquefy gas and re-export it through Egypt to different markets.

In October, Egyptian, Cypriot and Greece leaders also met in the Crete Summit to establish the gas forum for the east Mediterranean countries, with headquarter in Cairo.

We are very satisfied with those partnerships and we look forward to increasing even more Egypt's role in the international market. For this, during 2018 Egypt has participated in many international events and conferences related to the natural gas and petroleum industries in a way that reflects Egypt's growing value internationally and regionally. Most importantly in June, Egypt participated in the meeting of the Organization of the Petroleum Exporting Countries (OPEC) as an observer. In addition, Egypt participated as the main speaker in the International Petroleum Week in London and the World Gas Conference in Washington, both in February. We were also present at the Arab European Summit in Athens that I had the pleasure to attend on behalf of the President Abdel Fattah El Sisi.

The list of Egypt's participation in events continues. We attended the conference of the Organization of the Arab Petroleum Exporting Countries (OAPEC) in Morocco in October, the Mediterranean Dialogues in Rome, and the Abu Dhabi International Exhibition and Conference (ADIPEC 2018) in November. In addition, Egypt hosted many international and regional events including the second Egypt Petroleum Show (EGYPS 2018); the 15th Arab International Mineral Resources Conference in November, which had a presidential inauguration by president El Sisi; and the 9th Mediterranean Offshore Conference for Petroleum (MOC 2018) at Alexandria in April.

"LAST YEAR, WE SIGNED 12 NEW AGREEMENT WITH IOCS FOR OIL AND GAS EXPLORATION IN SEVERAL CONCESSIONS IN THE MEDITERRANEAN, GULF OF SUEZ, NILE DELTA, WESTERN DESERT AND SINAI, WITH TOTAL INVESTMENTS REACHING AT LEAST $1.3 BILLION."

THE COUNTRY HAS ALSO WITNESSED THE ADVANCEMENT OF KEY INFRASTRUCTURE PROJECTS. HOW DO THEY IMPACT THE CURRENT ENERGY SUPPLY?

Last year, we did a great job connecting homes at different governorates to the natural gas grid, especially in Upper Egypt governorates and areas with high population density. This was done under the national project of connecting households to the natural gas grid which aims to replace butane with natural gas to ease the government burdens of foreign currency spent on importing part of the local consumption needs of butane. Natural gas was delivered to more than one million households, which is the biggest number achieved since starting the project of delivering natural gas to households in 1981. The total number of households connected stands at 9.3 million units.

At the end of July, we extended the installment initiative by offering households the opportunity to get connected to the gas grid without paying any contracting deposit, with installment fee of EGP 30 over six years without any interests, to be collected with the gas consumption bill. With this initiative, we look at easing the citizens' economic burden and enhancing their quality of life.

Under this framework, the year saw us delivering natural gas to 72 high population cities and villages at different Egyptian governorates to benefit for the first time from the natural gas services that were never delivered to them before. The new connected areas include El Ayat, Awsim, Tanash at Giza, Hadaek Helwan, Siklam, Askot in Alexandria, Abu Kebir in El-Sharqia, and Maghagha in Minya.

In parallel to that, we operated the first phases of the platforms and facilities of Egypt's Arab Petroleum Pipelines Company's (SUMED) offshore for receiving and trading liquefied natural gas (LNG) and butane, as the first phase of the project for establishing offshore platforms with SUMED's facilities. Moreover, 2018 witnessed moving forward in conducting the second phase of storage and trade facilities for imported petroleum products at SUMED, aiming to establish three mazut storage tanks with 105,000-cubic-meter total storage capacity at Ain Sokhna, and is expected to be complete by March 2019 with investment cost for the two phases at around $415 million.

We also went ahead in conducting the bulk-liquids terminal in Ain Sokhna for Sonker, aiming to establish six diesel and butane storage tanks with 250,000-cubic-meter total storage capacity, with the aim to boost storage capacity of strategic products, in addition to establishing two lines to transport butane and diesel. The project is expected to be completed by June 2019 with an investment of $220 million.

In addition, we have the new butane storage facilities in Alexandria with seven butane storage tanks established operating with total storage capacity of 8,400 tons to secure strategic reserves of butane. The project's total investment cost reached EGP 150 million.

SPEAKING OF PETROCHEMICALS, COULD YOU TELL US MORE ABOUT THE PETROCHEMICAL PROJECTS DEVELOPED IN 2018?

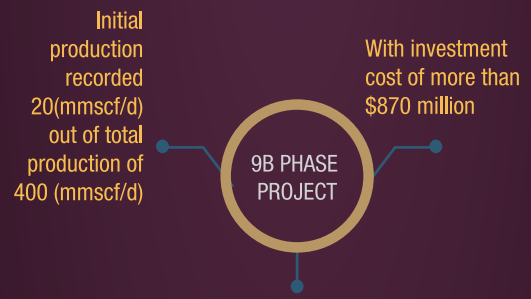
The petrochemical projects have superior economic benefits, providing the local market with basic needed materials, and have the ability to greatly increase job opportunities. This is why developing this industry is a key target for us. In 2018, Egypt witnessed the beginning of the implementation of four new industrial petrochemical projects with investments around $1.5 billion. This includes a project for producing methanol derivatives in Damietta port for the Suez of Petroleum Services Company (SOPSC), with investments around $60 million.

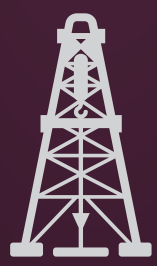
ZOHR FIELD

- **Mid of Dec. 2017** — Initial production of the field
- **Since Jan. 2018** — Production has been doubled to **6** times and early production of the field has reached **2** (bcf/d)
- **End of 2019** — Production will reach its peak to be more than 3(bcf/d)

  With total investments of about $12 billion

9B PHASE PROJECT





Modernization program contributed to compensate decline of production of old wells of almost **100,000 barrel** of crude oil

"FY 2017/18 HAS WITNESSED INVESTMENTS OF AROUND $10 BILLION THAT WERE INJECTED IN OIL AND GAS E&P AND FIELDS' DEVELOPMENT. FY 2018/19 IS PLANNED TO WITNESS THE SAME VALUE OF INVESTMENTS."

BID ROUNDS

2 Bid rounds were launched through **EGAS** and **EGPC** for **E&P** of Oil and Gas in **27** areas at the Gulf of Suez, the Western Desert, the Eastern Desert, the Nile Delta and the Mediterranean

PETROLEUM AGREEMENTS

The government and IOCs signed **12** petroleum agreements in **2018**

Total investments of **$1.3 billion** and around **$95 million** signature bonuses to drill **41** wells

Additionally, Egypt started to implement a project for the production of industrial rubber (Poly Butadiene) at the Egyptian Ethylene and Derivatives Company (ETHYDCO)'s complex in Alexandria, with investments around $105 million. The project's final product will be used in 13 industries, including car tires, conveyer belts for cars and factories, and building and construction industries.

Egypt also started implementing the expansion project of Sidi Kerir Petrochemicals Company (Sidpec), containing two new factories to produce propylene and polypropylene with investments reaching $1.2 billion, as well as a project to produce medium-density fibreboard (MDF) at Kafr El-Sheikh. Last year, we also laid the cornerstone to construct the new offshore exporting platform of Misr Fertilizers Production Company (MOPCO) at Damietta port with investments reaching $180 million to serve the exporting operations of urea fertilizer and liquid ammonia to the world.

In addition, we have executed and operated a project for producing high-octane benzene 92 and 95 at the Alexandria National Refining and Petrochemicals Company (ANRPC). The project is part of the ministry's plans to develop the refining industry and increase the local production from the high economic value petroleum products, such as benzene, diesel, and butane, as well to provide high-quality petroleum products according to global standards. The economic and strategic importance of the $219 million project is represented in adding new production capacities of high-octane benzene, up to 700,000 tons, to boost production to 1.5 million tons per year directed to the local market, in addition to the production of butane and hydrogen.

I would also like to mention that we moved forward with the implementation of the Egyptian refining project at Mostorod, which is considered the biggest development for the Egyptian refining project; in addition to the implementation of the biggest project for petroleum refining at Upper Egypt to establish a production complex of benzene and diesel through transforming mazut to high-valued petroleum products. This is one of the projects developing the Assiut Refinery with $1.9 billion investments.

Last year additionally witnessed the signing of contracts to implement and finance the expansion projects of the Middle East Oil Refinery (MIDOR) in Alexandria, with investments reaching $2.3 billion to increase the refining capacity by around 60%. MIDOR is one of the largest refineries in Egypt and the Middle East, reaching 7.5 million tons annually.

YOU HAVE PREVIOUSLY MENTIONED THE CONNECTION OF HOUSEHOLDS TO THE NATIONAL NATURAL GAS GRID. WHAT ABOUT ELECTRICITY STATIONS?

In 2018, many projects were successfully implemented to provide the giant electricity stations established in the New Administrative Capital, Beni Suef and Burullus with their natural gas needs through a number of gas transporting lines with 322 kilometers length and an investment cost of around EGP 2.2 billion and $93.5 million - the gas providing project for the electricity station in the New Administrative Capital has a cost of EGP 399 million and $21.2 million; the project for the electricity station in Beni Suef has a cost of EGP 991.6 million and $47.2 million; and the electricity station in Burullus feeding project has a cost of EGP 839 million and $25 million. With this, the number of electricity stations operating with natural gas reached 58 stations across the country.

WHAT IMPROVEMENTS HAS EGYPT WITNESSED AT ITS FUEL STATIONS?

Under the framework of improving the services introduced to the citizens and launching petroleum products with global quality standards, in February we introduced the new version branded 95-octane benzene to the stations of Mobil and Total, aiming to help improve engine performance and save fuel consumption, which will secure surplus for consumers. The new product is suitable for a big tranche of benzene consumers.

At the beginning of December 2018, the new 95-octane benzene was also launched at the stations of Misr Petroleum Company and Co-operation Petroleum Company (COOP) under their own brands, which contributed to increasing its distribution centers over the country to cope with the continuous increase in the product's sales.

The year saw a leap in the 95-benzene sales and consumption, in the light of launching the new 95-octane benzene in the local market, boosting sales from 2 million liters to 33 million liters that have been distributed through 316 car stations instead of 179 stations at the end of 2017.

Additionally, 18,784 cars were converted to operate with natural gas from January to November 2018, reaching, since starting the activity, around 255,600 cars at the end of November 2018.

On top of that, we have increased the number of services and car maintenance stations operating in the Egyptian market by 100 new stations, which has greatly increased the outlets and stations to 3,651. It is worth noting that the distribution centers of butane cylinders over the country have also been increased by 75 new distribution centers, boosting the total number centers to 3,028.

HOW HAS THE MINISTRY'S MODERNIZATION PROJECT SUPPORTED LAST YEAR'S ACHIEVEMENTS?

There were actual steps in 2018 implemented in the seven pillars included in the oil and gas Modernization Project, which includes the different activities of oil and gas industrial fields aiming to increase the performance efficiency, improve the economics of existing petroleum projects and activities, and develop the human resources.

I would like to add that, alongside the ministry's Modernization Project, the national economic reform also played a major role in the development of the oil and gas sector in 2018. We took new steps in the government's program, started in 2014, to rationalize and reform energy subsidies over five years, in which the cabinet has decided to increase the prices of different petroleum products and natural gas. The money spent on subsidies can now be used to promote social welfare programs and develop services of education, health and public transportation.

THE ACHIEVEMENTS OF OIL THE GAS SECTOR ARE VERY IMPRESSIVE. HAS THE MINING SECTOR WITNESSED SIMILAR ACHIEVEMENTS?

In 2018, a group of real reforms were implemented to develop the mining sector. During the year, the legislative proceeded to amend the mineral wealth law, issued in 2014, with the participation of specialists, investors and the concerned authorities in the country aiming to create the suitable climate in the mining sector to inject more investments. This has been done according to international models and helps the country achieve sustainable growth through establishing economic projects that reach the added-value of the mineral wealth.

We are expected to discuss the amendments in the parliament, and the executive regulation will be issued within six months from its issuing date in cooperation with many concerned authorities from ministries and industrial rooms working on the mining sector.

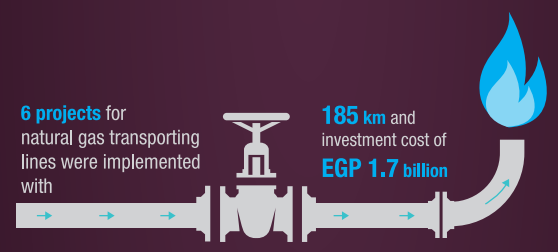
We have also established a roadmap to develop the mining sector in cooperation with a global specialist consultant. The roadmap considers the balance between achieving economic returns for the country from its mineral resources and opening wider horizons to attract new investments and encourage the investors. The sector is planned to be one of the most important sources of national income and public revenues for the country. While putting the roadmap, successful models applied in many countries were studied, especially those in Latin America and Africa. Additionally, experts have been working on benefiting from these models in a way that is suitable for the Egyptian experience in that field.

Las year also saw many steps taken to implement the project of the phosphoric acid production complex at Abu Tartor in the New Valley area with a capacity of one million tons per year and with a cost of $750 million that contributes to increasing the phosphate value-added.

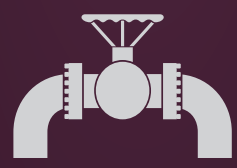
Moreover, we proudly established the first Egyptian company specialized in marketing the Egyptian phosphate, under the name of the Egyptian Company for Marketing Phosphate and Fertilizers. This represents a new step in the Ministry of Petroleum and Mineral Resources' strategy to reach the best economic use of raw-phosphate, increase its added-value and boost its returns to the country.

"18,784 CARS WERE CONVERTED TO OPERATE WITH NATURAL GAS FROM JANUARY TO NOVEMBER 2018."

NATURAL GAS TRANSPORTING NETWORK



EXPANDING OF NATURAL GAS CONNECTIONS



The total number of households connected to the national gas grid reached more than **a million** in **2018**

Under the High Patronage of **HE. Eng. Tarek El Molla**
Minister of Petroleum & Mineral Resources - Arab Republic of Egypt

PART OF THE EGYPTIAN OIL AND GAS SECTOR MODERNIZATION PROGRAM

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GAS PRICING IN EGYPT: OBJECTIVES AND MILESTONES

BY **REHAM GAMAL, AMINA HUSSEIN**

The natural gas market in Egypt has functioned under the authority of the Egyptian Natural Gas Holding Company (EGAS) - a wholly-owned subsidiary of the Egyptian General Petroleum Company (EGPC) - since 2001. EGAS was established to manage and control natural gas development and is currently in charge of active exploration concessions in Egypt in collaboration with international oil companies (IOCs).

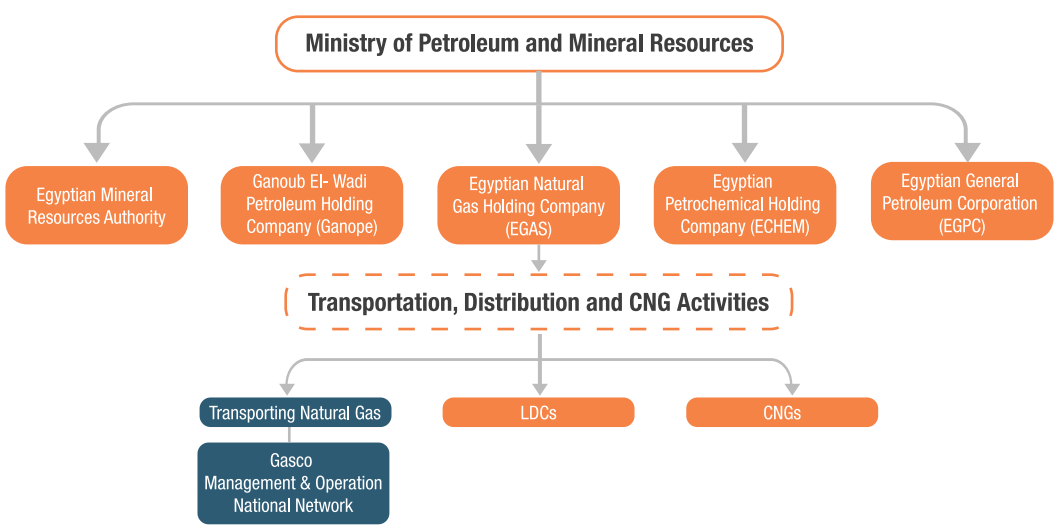
In August 2017, a new gas law on midstream and downstream gas market activities was announced. It aims to fully liberalize the market by 2022. Six months later, the executive regulations were issued, enabling private sector companies to procure their gas supplies as well as shipping, transportation, storing and trading natural gas using the national grid. All of these activities are done under the supervision of the Gas Market Regulatory Authority (GMRA).

Gas market liberalization is an important step towards increasing gas supply to the domestic market, in addition to relieving the financial burden on state-owned companies. It means that EGAS will no longer be the only national gas supplier.

GAS PRICING

Most gas markets around the world sit between two extremes regarding gas pricing. The chart below classifies gas-market systems in the world into four groups.

GAS SECTOR ORGANIZATION



GAS MARKET SYSTEMS

The natural gas pricing in petroleum agreements started in **1993**

Gas pricing represents around **12.3%** of the total annual agreements

Egypt is considered one of the regulated markets where the gas pricing equations are nationally set; these equations differ according to the economic situation. According to a paper published by the Egyptian Center for Economic Studies in 1998, a gas-pricing policy for Egypt should correspond with a number of objectives. First, it should encourage exploration and development (E&P) activities by foreign companies that provide the upstream sector with many investment opportunities. Secondly, it should provide stable prices domestically both for households and businesses. Thirdly, the gas price differences - taking into consideration the opportunity for exports and domestic - must yield a rent for the government as well.

Petroleum agreements in Egypt have undergone many changes, including amendments to the gas pricing method. Prior to 1993, gas prices were based on the international prices of normal sulfur mazut, in addition to a 15% discount rate for EGPC. Natural gas pricing in petroleum agreements started in 1993. Since then, gas pricing represented around 12.3% of the total annual exploration agreements.

FROM MAZUT TO GULF OF SUEZ CRUDE

To develop the natural gas sector and increase its output, the state moved toward applying a different pricing method. After screening the alternatives, EGPC decided to link gas prices to Gulf of Suez crude prices instead of mazut. This amendment encouraged IOCs to invest in natural gas E&P activities, which led to large discoveries in the Nile Delta and the Mediterranean Sea during the 1990s.

Shell was the first company to sign a gas pricing agreement, as it signed an agreement over El Obayed concession. Between 1993 and 2000, 18 gas pricing agreements were signed, 28% of were signed with the Italian Egyptian Oil Company (IEOC). It is worth noting that 83% of the gas pricing agreements during this phase were signed in 1994.

Shell was the first company to sign a gas pricing agreement

18 gas pricing agreements were signed from 1993-2000

83% of total gas pricing agreements were signed in 1994

IEOC signed **28%** of the gas pricing amendments

GAS PRICING AMENDMENTS: JULY 2000

In July 2000, the government agreed with IOCs to amend gas prices within agreements retroactively. This included raising the price of gas for foreign companies to reach a maximum of $2.65 per million British thermal units (mBtu) at a Brent price of $22 per barrel or more, and a minimum of $1.50/mBtu at a Brent price of $10 per barrel.

Between 2000 and 2010, gas prices were changed 29 times according to the fluctuating price of oil. Prices changed 10 times in 2001 alone. Five IOCs complied with the amendments during this period: IEOC, BP, Shell, BG, Amoco and RWE. The below chart shows the percentages of amendments agreed upon by each company. IEOC witnessed the highest number of price changes, representing 38% of amendments over the period.

Gas pricing amendments reached **29**

By setting a ceiling and a floor for gas prices, these amendments were a cornerstone in enabling the export of natural gas. Prior to 2000, it was not possible to sign any contract for gas exports without an accurate estimation for the cost of buying the gas from the foreign partner during the twenty years that follow signing the contract. These amendments included a ceiling price in line with prices agreed upon for exporting gas. The opportunity of gas exporting contributed positively to the rapid development of gas fields and doubling the production as well.

2001 witnessed the highest number with **10** gas pricing amendments

According to a 2008 study conducted by Al-Ahram Center for Petroleum and Energy Studies on the Egyptian natural gas exports, Egypt has strongly entered the field of exporting natural gas. The export of gas began in July 2003 to Jordan, the first phase of the Arab gas pipeline which extends to Lebanon via Syria, Turkey and Spain. In 2005, liquefied natural gas (LNG) was first exported from the liquefaction plants established on the Mediterranean Sea.

Gas production increased to **37 mt** in **2006**

The decision to export gas increased the foreign investments in the field of research and exploration inside Egypt. Gas production increased to 37 million tons in 2006. The amendment also resulted in overcoming the shortage in crude oil production in 2002. Moreover, it helped in substituting the petroleum products and reduced butane imports.

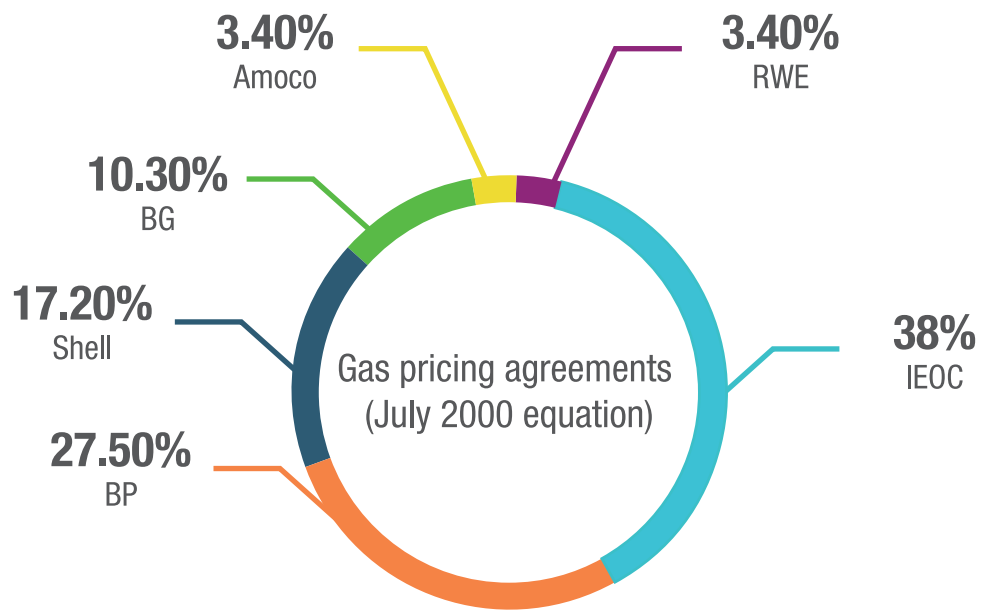
NORTH ALEXANDRIA AND WEST MEDITERRANEAN AMENDMENTS

The richest natural gas fields are commonly found in deep waters, which are considered an excellent opportunity for the country to maintain the desired natural gas levels. However, due to the characteristics of such concessions, including high pressure level and high temperature, they are considered unattractive to IOCs as they need intensive investments to apply the needed advanced technologies.

These concessions include the large concessions such as the North Alexandria and the West Mediterranean. To encourage the IOCs to invest in such areas, the ministry changed the agreement model for those two concessions in 2010. The investments needed to develop the two concessions were approximately $9 million, in addition to the investments needed to develop the discovered reserves in order to meet local demand and achieve suitable revenues.

According to the amendments made to the agreements, IOCs cover all the needed investments and take on the cost recovery risk, before delivering all production to EGPC for a specific price. The price is determined according to the price equation for the average price of Brent crude, the Henry Hub natural gas prices, and UK natural gas NBP prices with a minimum of $3 per mBtu and a maximum of $4.1 per mBtu.

Since the 1990s, key changes have taken place in the natural gas sector. Egyptian petroleum agreements have gone through several gas pricing amendments in favor of opening up the country's gas resources to the foreign market, as well as satisfying domestic demand. It is worth mentioning that the ministry's main objective has been to achieve a balanced gas market. However, meeting the need of the domestic gas market is also one of the government's main priorities.



INTRODUCING HUMANITIES INTO THE PETROLEUM ENGINEERING CURRICULUM AT UNIVERSITIES

BY **CORY DE VRIES**

The National Academy of Engineers and the Accreditation Board for Engineering and Technology (ABET) recently stated that todays' engineers need to have a more holistic understanding of their work than just "math and science". The petroleum engineering curriculum is predicated on STEM (science, technology, engineering and mathematics) with little to no focus on the humanities. One idea is to include humanities and liberal arts studies into the engineering curriculum to produce more well-rounded engineers into the next generation.

Egypt is one country that boasts numerous higher education programs in petroleum engineering at the bachelor (BSc), masters (MSc), and doctoral levels (PhD) to support students studying in this field, as the country is a major player in the oil and gas industry in the Middle East. Egypt Oil and Gas spoke to a range of students, academics, and practitioners in order to know their views on the application of humanities to engineering.

WHY INTEGRATE HUMANITIES AND LIBERAL ARTS INTO ENGINEERING?

Liberal arts and humanities education is said to impart important soft skills for students and also teach topics concerning common human objectives; engineering teaches technology, science, and math. Merged, it may bring more holistic solutions at the communal, national, and global level and open a novel discussion about the impact and future vision of petroleum engineering.

Dr. Ahmed Sultan is the manager of the Petrophysics Department at Tharwa Petroleum Company and spoke to Egypt Oil & Gas on this topic. He is a practitioner and an academic, having received his BSc, MSc and PhD in various streams of petroleum engineering from Suez University, where he currently holds a teaching position. He stated that training in liberal arts may develop a student's critical thinking, social and emotional intelligence, and ability to innovate, and "generate new ideas", all which are said to complement hard skills. He further stated that with the inclusion of this education, the graduates would become "diverse, well rounded, socially conscious individuals." That may lead to the acquisition of "knowledge of international affairs that will help students decide what is best, not just for their community but also for the entire humanity."

Several students interviewed by Egypt Oil & Gas are in agreement with Dr. Sultan's sentiments. Ola Hussein is a fresh graduate with a BSc in petroleum engineering from the American University in Cairo (AUC) and currently works in the field. In an email interview, she stated the importance for engineering students to have a certain soft-skill toolset. Specifically, she said that liberal arts training would be useful to teach engineers "how to work with people from different nationalities and backgrounds". From a broader perspective, she stressed that the oil industry is "affecting our economies, politics, welfare, health, safety, environment and societies… and also the world's economy and politics". She concluded by expressing through learning liberal arts, engineers could comprehend the bigger picture of how critical and influential this industry is.

In another student's perspective, common themes were resounded. Abdullahi Bare studied petroleum engineering at the University of Regina, Saskatchewan, Canada and graduated in 2016. In an email interview, he said that engineering students would benefit from not only the hard skills taught in engineering curriculums, but also be taught in a way that allowed students to think from more "rational and emotional standpoints."

However, as it stands, humanities and liberal education appear to be absent in engineering curriculums. Micheal Alfy is a senior geo-scientist at CGG, a French-American Geophysical services company operating in Egypt. Alfy studied geophysics at Cairo University (CU) and maintains ongoing relations with the university by providing updated training material on the industry. When asked about the connection between engineering and humanities studies, Alfy told Egypt Oil & Gas that 'humanities' "has nothing to do with my work". He said his work is "purely technical, related to the mechanics of engineering" and does not address any aspect related to humanities studies. He noted that during his visits to CU, he observes that the education provided to students is "not including humanities or liberal arts" and that it is "purely technical at the moment". However, when asked about the utility of this inter-disciplinary bridge, he said that humanities "is a hidden part from engineering" but he believes that "the link between engineering and humanities is important".

Academics, students, and practitioners appear to see the utility of bridging these two disciplines, but it may time for this initiative to be realized in the educational system. In the meantime, looking at the 'big-picture' of petroleum engineering seems to be taken care of by companies. Alfy stated that his interaction with topics concerning ethics and the environment come top-down, through his company's protocols.

> "INTEGRATION OF DIFFERENT STREAMS OF KNOWLEDGE, ESPECIALLY LIBERAL ARTS, HUMANITIES AND SOCIAL SCIENCES IN THE ENGINEERING CURRICULUM WOULD ADD TO THE OIL INDUSTRY IN EGYPT BECAUSE IT WOULD BOOST EGYPT'S OIL SECTOR MODERNIZATION AND DEVELOPMENT."
>
> **DR. AHMED SULTAN**
> Petrophysics Department Manager
> at Tharwa Petroleum Company

HOW CAN EGYPT BENEFIT FROM TRAINING THEIR ENGINEERS IN HUMANITIES AND LIBERAL ARTS?

There appears to be a growing opinion for engineers to be able to make responsible cultural, political and social decisions that will shape the future of the country. Wrong decisions in the oil and gas sector may risk resource exploitation, damage the environment, and stir political conflicts if not carried out properly.

Dr. Sultan neatly summarizes the issue and possible solution by stating "integration of different streams of knowledge, especially liberal arts, humanities and social sciences in the engineering curriculum would add to the oil industry in Egypt because it would boost Egypt's oil sector modernization and development".

PETROLEUM EXPERTS DISCUSS SECTOR'S FUTURE AT EOG 2ND UPSTREAM OPERATIONAL EXCELLENCE CONVENTION

Egypt Oil & Gas (EOG) and the EOG Technical Committee held the 2nd Upstream Operational Excellence Convention from December 2-4 at the Sky Executive Resort in Cairo. The event was held under the High Patronage of H.E. Eng. Tarek El Molla, Egypt's Minister of Petroleum and Mineral Resources.

The annual convention comes in line with the ministry's Modernization Project and paves the way for professionals from public and private entities to meet together and share best practices for optimizing operations and increasing oil and gas production.

In his opening speech, El Molla thanked EOG for promoting such event and bringing together a diverse group of oil and gas experts. "I would like to assure [attendees] that during this three-day convention you will gain more insights and be exposed to discussions around a number of important strategic issues that hold key priorities in our sector," said the minister.

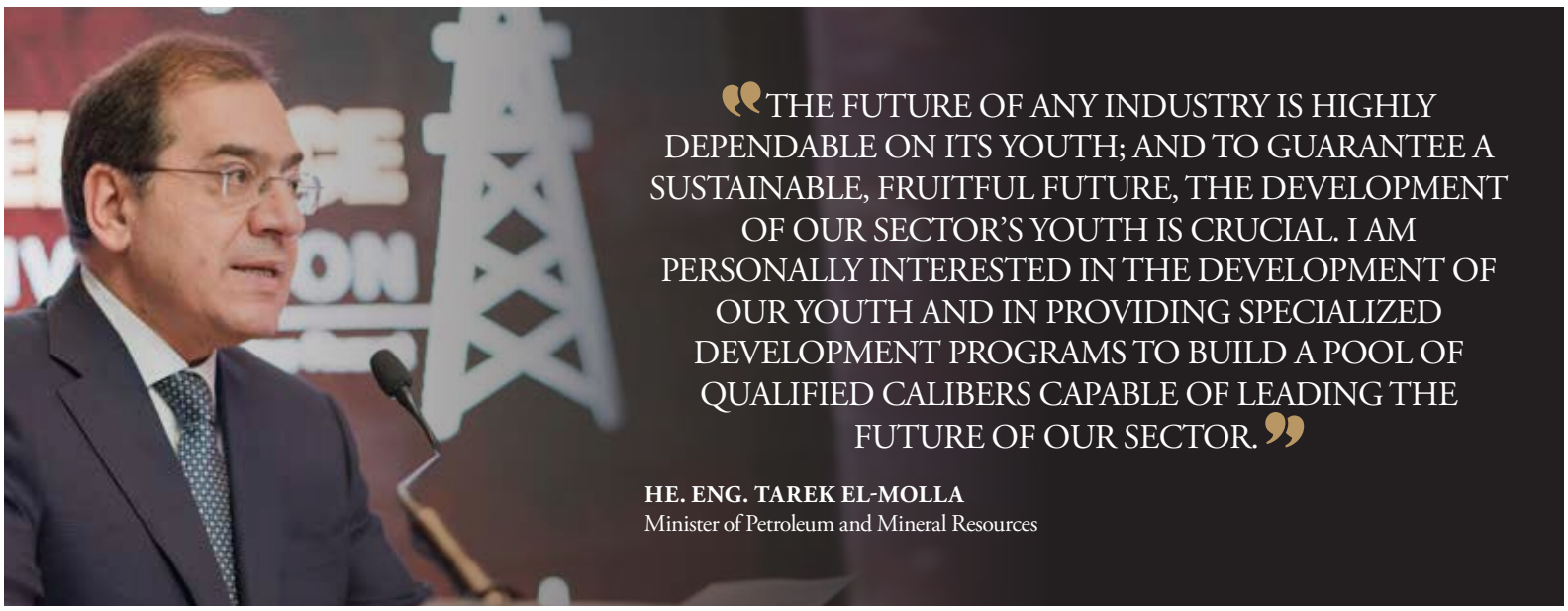
El Molla expressed his excitement for the inaugural Young Professionals Day – a full day dedicated to discussing the development of young professionals in the sector, which took place in the last day of the convention – and stressed that building highly-skilled human capital remains a cornerstone for the sector's success.

"The future of any industry is highly dependable on its youth; and to guarantee a sustainable, fruitful future, the development of our sector's youth is crucial. I am personally interested in the development of our youth and in providing specialized development programs to build a pool of qualified calibers capable of leading the future of our sector," he added.

Mohamed Fouad, EOG CEO and Technical Committee Co-chairman, also noted that, although the industry has witnessed many achievements throughout 2018, there are many other challenges in the process of making a change.

"That is why EOG takes the responsibility of promoting this yearly event, aiming to provide national and international partners with the opportunity to discuss relevant topics and enhance the efficiency of the sector," he said.

On behalf of the EOG Technical Committee, Thomas Maher, the committee's Chairman, and President and COO of Apex Egypt, welcomed attendees and congratulated the committee members for their great effort in organizing the event.



"THE FUTURE OF ANY INDUSTRY IS HIGHLY DEPENDABLE ON ITS YOUTH; AND TO GUARANTEE A SUSTAINABLE, FRUITFUL FUTURE, THE DEVELOPMENT OF OUR SECTOR'S YOUTH IS CRUCIAL. I AM PERSONALLY INTERESTED IN THE DEVELOPMENT OF OUR YOUTH AND IN PROVIDING SPECIALIZED DEVELOPMENT PROGRAMS TO BUILD A POOL OF QUALIFIED CALIBERS CAPABLE OF LEADING THE FUTURE OF OUR SECTOR."

HE. ENG. TAREK EL-MOLLA
Minister of Petroleum and Mineral Resources

"Our committee's objective in designing this convention, in cooperation with the technical office of the Ministry of Petroleum, is to advance the realization and how important the Modernization Program, and particularly the upstream and people development pillars, is to our industry," said Maher.

The convention's panels were designed in a way that allowed industry leaders to review topics that shape the oil and gas sector and to answer crucial questions in the process. Topics discussed included the upstream investment climate, the modernization of joint ventures (JVs), and service agreements for mature fields.

The technical workshops were run by respected players in the industry and brought important updates on unconventional production enhancement; field best practices; new technologies; asset integrity; and health, safety, security, environmental and social awareness (HSSES).

The third day was dedicated to empowering young professionals and fostering the talent needed to secure the industry's future. The Young Professionals Day, as it was named, held a live coaching session and a panel discussion about retaining talent.

Platinum sponsors included Apache, Apex, Cheiron, Shell, and Transglobe Energy. DEA was the Gold sponsor, while Maridive, Shawcor, and Subsea 7 were Silver sponsors. Bronze sponsors included Sapesco and Schulumberger. The Technical Workshops sponsor was Kuwait Energy; and the Delegate Bag & Name Tag sponsor was Baker Hughes, a GE company (BHGE). Wood Mackenzie was also present at the event as EOG official research partner.

Before initiating the event's agenda, Fouad and Maher presented minister Tarek El Molla with an appreciation award for his efforts in the Modernization Project and in encouraging and guiding the youth in the sector.

EOG has also offered the Operational Excellence Awards for nominees of very insightful projects developed by joint venture companies in the Egyptian fields. The awards had one winner in the Individual category, and two winners in the Project category.

Ahmed Sultan, Petrophysics Department Manager at Tharwa Petroleum Company, received the Operation Excellence Award on the Individual Category. On the Projects category, winners were Petrodara and Petrobel.

BUILDING A SUSTAINABLE UPSTREAM INVESTMENT CLIMATE

The opening panel discussion of the convention saw six industry experts engage in an insightful discussion about one of the most important issues facing the Egyptian oil and gas sector today: attracting sustainable levels of outside investment.

The panel featured some of the most prominent figures in the industry giving their views on the topic. Representatives from four of the largest international oil companies (IOCs) operating in Egypt were in attendance to give their views: Fabio Cavanna, General Manager of Eni subsidiary IEOC; Gasser Hanter, Country Manager and Managing Director of Shell Egypt; Stuart Shaw, Vice President of Operations at BP Egypt; and Karim Badawi, Managing Director for Egypt and the Mediterranean at Schlumberger.

Representing the ministry was Mohammed Moanes, First Undersecretary for Production at the Ministry of Petroleum, while independent expertise was provided by Martijn Murphy, Upstream Research Manager at Wood Mackenzie. Moderating the discussion was Thomas Maher, President and COO of Apex Energy and Chairman of the EOG Technical Committee.

CURRENT CAPITAL INVESTMENT

Before the discussion began, Murphy delivered a presentation focusing on the levels of private and public capital investment in Egypt over the past five years. Noting that the government had put around $9 billion of public investment into the sector, he praised the high levels of private sector involvement.

"This is something that puts Egypt in pretty good stead with investors. It is an open market, it is not dominated by national oil companies (NOCs), and there is a real diverse corporate landscape," he said. "The barriers to entry, compared to elsewhere in Africa and the Middle East, are fairly low."

However, despite the promising levels of private investment, Murphy insisted that the government must go further if it is to maximize returns from brownfield sites – in the Gulf of Suez in particular. Using a Gulf of Suez Petroleum Company (GUPCO) contract as a case study, he estimated that an additional $425 million could be gained if the Egyptian General Petroleum Company (EGPC) reduced its stake, resulting in increased takes for the government in absolute terms.

Murphy then highlighted the government's "great progress" in paying down arrears to IOCs, and predicted that all arrears will be paid by the end of 2019. "I think that this has really given confidence to smaller IOCs," he said. He finished the presentation by discussing Egypt's high rate of mergers and acquisitions (M&A), describing the country as "one of the most active M&A markets" in the Middle East and North Africa (MENA) region.

INVESTMENT CLIMATE

Following the presentation, Maher opened the discussion by asking each of the panelists for their opinion on Egypt's current upstream investment climate. Cavanna announced that Eni would continue to make further investments in Egypt. "We will continue investing in Egypt; we strongly believe in the resources of the nation," he said. "This is because we have an appropriate and stable climate for contracts."

Hanter identified Egypt's wealth of human capital and developed infrastructure as key foundations for nurturing the country's investment climate. He told the audience that, going forward, Shell will be looking to increase its involvement in Egypt. "We believe that collaborating with the government and actually investing is the best way forward for making the industry more attractive," he said. "We are here to stay, we are here to grow, and we look forward to working very closely with the government to turn our growth aspirations into reality.

> "[INITIATIVES LIKE SCHLUMBERGER'S UPSTREAM GATEWAY PROJECT ARE IMPORTANT] IN ORDER TO IMPROVE THE DATA THAT IS AVAILABLE IN OUR HAND, AND TO BRING MORE COMPANIES TO WORK IN EGYPT."

MOHAMMED MOANES
First Undersecretary for Production at the Ministry of Petroleum

> "WE BELIEVE THAT COLLABORATING WITH THE GOVERNMENT AND ACTUALLY INVESTING IS THE BEST WAY FORWARD FOR MAKING THE INDUSTRY MORE ATTRACTIVE."

GASSER HANTER
VP and Managing Director of Shell Egypt

> "[SCHLUMBERGER] IS VERY PROUD OF THE COLLABORATION IN THE KEY ACTIVITIES BRINGING IN MORE INVESTMENTS INTO EGYPT, SUCH AS THE MULTICLIENT FOR THE RED SEA. THIS IS GOING TO BE A KEY ENABLER TO ATTRACT INVESTMENT IN EGYPT."

KARIM BADAWI
Managing Director for Egypt and the Mediterranean at Schlumberger

> "[ENI] WILL CONTINUE INVESTING IN EGYPT; WE STRONGLY BELIEVE IN THE RESOURCES OF THE NATION. THIS IS BECAUSE WE HAVE AN APPROPRIATE AND STABLE CLIMATE FOR CONTRACTS."

FABIO CAVANNA
General Manager of IEOC

> "COUNTRIES NEED A STABLE FRAMEWORK THAT ENABLES COMPANIES TO INVEST AND FORM PARTNERSHIPS."

STUART SHAW
Vice President of Operations at BP Egypt

> "IT IS IMPERATIVE THAT EGYPT CONTINUES TO HOST ANNUAL BID ROUNDS. THIS IS GOING TO BE IMPORTANT IN ENSURING THAT THERE IS AN INVENTORY OF PROSPECTS AVAILABLE TO IOCS."

MARTIJN MURPHY
Upstream Research Manager at Wood Mackenzie

Asked about Schlumberger's approach to investing in Egypt, Badawi described the company's role as becoming a "key enabler" for the ministry's Modernization Program. "We are very proud of the collaboration in the key activities bringing in more investments into Egypt, such as the multiclient for the Red Sea," he said. "This is going to be a key enabler to attract investment in Egypt."

GOVERNMENTAL INITIATIVES

Moanes turned the conversation towards what the government is hoping to do to transform Egypt into a more attractive investment destination. He told the audience that the government will continue to move forward with the digitalization of the sector, and increasing the data available to potential investors. Initiatives like Schlumberger's Upstream Gateway Project are important "in order to improve the data that is available in our hand, and to bring more companies to work in Egypt," Moanes said.

Maher then asked Shaw about how the private sector views the role of the state in generating a sustainable investment climate. "If there was one word I would use, it would be stability," he said. "Countries need a stable framework that enables companies to invest and form partnerships," he continued. Shaw then praised the government's perseverance with its economic reforms; a program that is hoped to stimulate investment in the country's energy sector. "They show courage and vision, and they are creating the right momentum for energy investment in the future," he said.

Closing out the discussion, Murphy sounded a note of optimism by predicting Egypt's natural gas production to exceed 8 billion cubic feet per day by the start of the next decade. However, he cautioned that the country's high domestic demand for hydrocarbons will necessitate new discoveries by the middle of the decade if the Egypt is going to build on current successes.

"It is imperative that Egypt continues to host annual bid rounds," Murphy said. "This is going to be important in ensuring that there is an inventory of prospects available to IOCs."

THE MODERNIZATION OF JVs

The second day of the convention took off on December 3 with a strategic discussion on the implementation of the Ministry of Petroleum's Modernization Program in all Egypt's joint venture (JV) companies.

The panel, entitled "JV Company Modernization", was moderated by Layla El-Hares, GM Development Egypt and East Mediterranean at Shell.

Panelists included Abed Ezz El Regal, Head of EGPC; Osama Mobarez, Undersecretary for Technical Office at the Ministry of Petroleum; Mark Konecki, Region Operations Director at Apache; Alaa ElBatal, Vice Chairman for Exploration at EGPC; and Dina Fouda, Transformation and Value Capture GM at Shell.

Ezz El Regal opened the section, remarking that developing JVs is the first step to achieving modernization across the entire sector. " The first target to achieve such modernization is focusing on people, so we will build the capacity required for such revolution in all aspects of the value chain, starting from the upstream. Second, the excellence of performance and operation," he said.

"Bapetco is a good model to start with, as it took the lead on this issue," Eng. Ezz El Regal added.

BAPETCO AS A ROLE MODEL

Bapetco, a JV between EGPC and Shell, was chosen by the government to be the pilot for the modernization of JVs in Egypt. According to the head of EGPC, this choice was made considering a number of factors.

"Number one, it is a mature company with a huge number of employees, and the capability of the staff in Bapetco and the willingness to accept such change makes it an easier process. This in addition to Shell's willingness to collaborate even apart from the Modernization Program," he said.

Mobarez explained that the idea of having Bapetco as a role model for the modernization of JVs came from the necessity to implement the Modernization Program simultaneously in holding companies and their affiliates.

"In the overall Modernization Program, we are trying to improve the organizational structure of the sector, including EGPC and holding companies, and also improve the governance of the sector in the upper tier; but we do not have the luxury to wait until we have improved the upper tier and then move down to the affiliates," he explained.

"That is why we are planning, and have already started, to move in parallel to improve EGPC and the holding companies as well as create a role model, starting with Bapetco," he added.

This process, according to Mobarez, is done by a committee composed by CEOs of holding companies and first undersecretaries of the ministry, whose main role is to build a map of the challenges, and support and inspire the teams working on different tasks within the modernization process.

HOW TO REACH MODERNIZATION?

According to Mobarez, the Modernization Program was created from the willingness to make pre-2016 achievements sustainable.

In order to achieve this goal, Konecki stated that JVs should heavily invest in their human resources. "The industry here must develop leaders for the future," he said.

> "THE FIRST TARGET TO ACHIEVE SUCH MODERNIZATION IS FOCUSING ON PEOPLE, SO WE WILL BUILD THE CAPACITY REQUIRED FOR SUCH REVOLUTION IN ALL ASPECTS OF THE VALUE CHAIN, STARTING FROM THE UPSTREAM."

ABED EZZ EL REGAL
CEO of EGPC

> "IN THE OVERALL MODERNIZATION PROGRAM, WE ARE TRYING TO IMPROVE THE ORGANIZATIONAL STRUCTURE OF THE SECTOR, INCLUDING EGPC AND HOLDING COMPANIES, AND ALSO IMPROVE THE GOVERNANCE OF THE SECTOR IN THE UPPER TIER"

OSAMA MOBAREZ
Undersecretary for Technical Office at the Ministry of Petroleum

Commenting on Bapetco's experience, ElBatal said the company has already implemented many of the steps recommended by the ministry's program. According to him, the pillars for the modernization of JVs are three: governance; human capital development; and key processes like procurement and tendering. "If we are going to improve our working environment, we have to stress on these points," he said.

"I advise all JVs to follow this model, as it is very important for the future," ElBatal added.

"When [Apache] advances people through our organization, we advance them because of their competencies and because of their performance, and not just because of how long they have been in a particular job," he mentioned.

Konecki also stressed that Egypt must work on retaining its skilled employees, who often go to other countries in order to have better opportunities. "We have many talented individuals here in Egypt and we need to nurture those talented people," he added.

"WE HAVE MANY TALENTED INDIVIDUALS HERE IN EGYPT AND WE NEED TO NURTURE THOSE TALENTED PEOPLE."

MARK KONECKI
Region Operations Director at Apache

"I WANT TO ENSURE THAT BAPETCO IS GIVING A LOT OF ATTENTION TO HSE, AND WE ARE WILLING TO STOP ANY BUSINESS IF WE ARE NOT ACHIEVING OUR HSE REQUIREMENTS. WE ARE NOT CELEBRATING ANY SUCCESS WITHOUT HSE."

ALAA ELBATAL
Vice Chairman for Exploration at EGPC

"WE HAVE A TEAM OF OVER 30 PEOPLE FROM BAPETCO WHO ARE WORKING ON IMPLEMENTING THIS CHANGE WITHIN THE COMPANY AND WE ARE GETTING GREAT VALUE FROM THE PASSION AND THE WILLINGNESS OF THE TEAM WORKING ON THE PROGRAM."

DINA FOUDA
Transformation and Value Capture GM at Shell

Building on this, Mobarez emphasized that personnel are at the core of any reforms made to the sector. "We are talking about a transformation that is going to have a long journey, so we need the collaboration of all stakeholders," he added.

In order to exemplify the importance of investing in human resources, Fouda mentioned how the motivation of employees has impacted the Modernization Program itself.

"We have a team of over 30 people from Bapetco who are working on implementing this change within the company and we are getting great value from the passion and the willingness of the team working on the program," she said.

For Fouda, "the ministry's vision is all about unlocking the sector's value."

This value, however, cannot be unlocked without serious health, safety, and environmental (HSE) management, ElBatal argued. "I want to ensure that Bapetco is giving a lot of attention to HSE, and we are willing to stop any business if we are not achieving our HSE requirements. We are not celebrating any success without HSE," he said.

Konecki also disclosed that he expects the modernization of JVs to open the way for other positive changes. "Once these pilots are finished, I hope it will be feasible to perhaps have some different business models, because one size does not fit all. The way JVs were organized 30 to 40 years ago does not fit the model of business here in Egypt today," he said.

Ezz El Regal closed the discussion, stressing his positive expectations for the future of JVs in Egypt; having companies fully digitalized, with everyone in the company having a clear vision both for the modernization process and their individual career paths.

SERVICE AGREEMENTS FOR MATURE FIELDS

The third strategic panel witnessed five industry experts discuss the pros and cons of service agreements for mature fields in Egypt.

Panelists included Kamel El Sawi, President of Kuwait Energy Egypt; Memet Kont, President and CEO of Mediterra; Hussam Abuseif, Director and General Manager of Egypt, Sudan and South Sudan at BHGE; Thomas Maher, President and COO of Apex Energy, and EOG Technical Committee Chairman; and Colby Fuser, Vice President Egypt and Libya at Halliburton.

The session was moderated by Mohamed Fouad, Managing Director of Egypt Oil & Gas and Technical Committee Co-Chairman.

MEDITERRA'S EXPERIENCE

Kont introduced the session with a presentation explaining Mediterra's experience working under a service contract in Egypt. The company entered into a service agreement in 2017 covering the Sudr Matarma and Asl mature fields in the Gulf of Suez. Under the terms of the contract, Mediterra was required to pay a signing bonus and made a work commitment for the first three years. The company managed to achieve this within just 9-10 months after signing the contract.

Kont then explained that the EGPC agreed to pay the company a small fee after the fields reach baseline production. Any amount above the baseline is then shared between EGPC and the company according to the terms agreed to in the contract.

Since it took over the fields, the company has drilled 11 appraisal and development wells, one exploration well and completed 38 workover, recompletion and testing projects. Production has increased rapidly from around 1,750 barrels of oil per day (b/d) in August 2018 to more than 4,500 b/d at the end of November.

"It's a great model, it works for us," Kont said, before cautioning that service contracts still require work to make them truly effective. This is to be expected, he said, because the model is still relatively new.

BENEFITS AND CHALLENGES

Tom Maher kicked off the discussion stating that, although the production sharing agreement (PSA) model has been beneficial for the country, it is not best suited to brownfield sites. For him, service contracts provide a way of getting around the problem of high recovery costs associated with mature fields. This is especially important, he said, because of the growing number of mature fields that have drifted back into government ownership only to be kept in stasis.

"It is no secret that the next big challenge is stabilizing oil production, and I feel very strongly that service agreements are one avenue to do that," he said, emphasizing their potential to introduce new technology to restore production from late-stage fields

El Sawi emphasized the necessity of maximizing production from mature fields, highlighting the fact that two-thirds of global oil and gas production come from such assets. "One of the issues with the PSA is to recover the cost at the last period for the concession agreement, which will place a burden on the contractor and even the government to inject more cash," he said, agreeing with Maher.

Kuwait Energy Egypt has operated in Egypt under a service agreement with considerable success. Over the past 10 years, the company has produced 27 million barrels of oil from its concession in the Gulf of Suez, and drilled 15 wells – five of which were producible.

"With the application of practical and focused engineering, tied with geology and enabling technologies, you can do something," he said. "It became very important to introduce this model to the market. It gives the contractors the freedom to do it their own way to control the overheads, to introduce whatever technology the company needs."

Following on from this, Fuser suggested that service contracts may provide the sort of incentives necessary to persuade companies to operate late-stage sites. "In a lot of cases there are no incentives for companies to go back [to bypassed wells]," he said. "If a company

"IT IS NO SECRET THAT THE NEXT BIG CHALLENGE IS STABILIZING OIL PRODUCTION, AND I FEEL VERY STRONGLY THAT SERVICE AGREEMENTS ARE ONE AVENUE TO DO THAT."

THOMAS MAHER
President and COO of Apex Energy, and EOG Technical Committee Chairman

"IT BECAME VERY IMPORTANT TO INTRODUCE [THE SERVICE AGREEMENT] MODEL TO THE MARKET. IT GIVES THE CONTRACTORS THE FREEDOM TO DO IT THEIR OWN WAY TO CONTROL THE OVERHEADS, TO INTRODUCE WHATEVER TECHNOLOGY THE COMPANY NEEDS."

KAMEL EL SAWI
President of Kuwait Energy Egypt

"YOU NEED TO ELIMINATE THE UNCERTAINTY IN THE CONTRACT. THE LANGUAGE OF THE CONTRACT IS OFTEN VERY VAGUE… IT DEFEATS THE PURPOSE OF THE CONTRACT ITSELF."

MEMET KONT
President and CEO of Mediterra

"THE MINISTRY IS VERY OPEN TO NEW IDEAS ABOUT HOW YOU CAN DO CONTRACTING… BUT YOU NEED TO HAVE THE MANEUVERABILITY IN THE CONTRACT LANGUAGE"

COLBY FUSER
Vice President Egypt and Libya at Halliburton

"SERVICE CONTRACTS ARE A GOOD TOOL TO APPLY TECHNOLOGY."

HUSSAM ABUSEIF
Director and General Manager of Egypt, Sudan and South Sudan at BHGE

wants to re-look at bypassed production zones, there should be some incentive from the government to provide the benefits to do that. That only gives more barrels back to the country."

Kont, however, highlighted the ambiguity of some service contracts, and said there was still work to be done to make their implementation easier. "You need to eliminate the uncertainty in the contract," he said. "The language of the contract is often very vague… it defeats the purpose of the contract itself."

Abuseif then emphasized the success of service contracts in bringing new technologies into the sector. "Service contracts are a good tool to apply technology," he said, adding that he would like to see their usage increased in Egypt but acknowledging an important barrier to achieving this. "I think we need to make a lot of effort to change the mindset of approaching mature fields," he concluded.

The panel concluded with a short question and answer session that allowed audience members to put their thoughts to the panelists. Ashraf Menawi, from Apex International Energy, asked about the prospects for service agreements in Egypt, and whether the sector can expect to see them become more widespread in the future. Maher pointed out that the upcoming Red Sea bid round will have attached a new form of contract – the details of which are still to be announced by the ministry – and that new "fit-for-purpose" agreements are on the horizon with regard to mineral wealth.

Another audience member asked how the sector can enable service agreements to become commonplace with mature fields. "The ministry is very open to new ideas about how you can do contracting… but you need to have the maneuverability in the contract language," Fuser said. "If the government adds the ability to have a contract change, you are still guaranteeing the ability to produce more barrels. You need to go in together in order to achieve that."

YOUNG PROFESSIONALS DEVELOPMENT: THE KEY FOR FUTURE LEADERS

The EOG Upstream Operational Excellence Convention reached its third and final day on December 4. Dedicated to the youth in the oil and gas sector, the Young Professionals' Day started with an open panel discussion on the importance of career visioning to sustain business and retain talent.

Panelists included Maha Fouad Attia, Vice Head of the Technical Office at the Ministry of Petroleum; Ahmed Osama, Enppi's Project Manager; Tarek Sami, Enppi's Senior IT External Projects Coordinator; Layla El-Hares, GM Development Egypt and East Mediterranean at Shell; Mirna Arif, Regional Sales Director O&G Digital Egypt, Turkey and Tunisia at BHGE; and Sameh Sabry, Country Manager at DEA Egypt.

The panel was moderated by Kelly Bone, Co-founder of Wolfpack Holdings.

YOUTH IN MODERNIZATION

Attia opened the discussion commenting on the approaches of the Ministry of Petroleum's Modernization Program to human resources (HR) and youth empowerment. "Modernization is a transformation that goes through all the value chain. It aims to unlock the full potential of the sector and increase its contribution to the Egyptian economy," said the ministry's representative, who is also the leader of the Modernization Program's Realization Office. "One of the major and most important pillars in the modernization is the HR pillar, as we believe our HR are the most valuable asset we have," she continued.

The Modernization Program tackles HR in three different ways: first, through the institutionalization of human capital; second, through HR development; and third, through improving HR systems. For the HR institutionalization, the program has started developing a data bank that includes all employees in the sector. "This will allow us to have a better view of our resources and will enable us to have the right people in the right place," she said.

Attia also explained that in order to build a sustainable growth for the sector, HR development must focus on youth. "The Modernization Program itself is already an example of this; about 60% of the teams in modernization are youth," she disclosed.

The second approach includes the Middle-Management Program, which looks at identifying, developing, and retaining talents, further preparing them for taking higher responsibilities in the future. "This program offers big chances for young professionals who have passion and commitment to the sector, and capability to lead the sector in the coming years," said Attia, adding that this program will continue to be implemented after its first round.

As for improving the HR systems, the modernization of joint ventures serves as example. According to Attia, this modernization includes both HR and governance components. "These components aim to have an effective system that enables effective performance management and early identification of talents," she explained.

Sami, who is a member of the ERP and the Middle-Management projects within the Modernization Program, stated that the ministry's objectives are strategically aligned with the Egypt's Vision 2030 strategy. Commenting on his participation in the Middle-Management Program as a young professional, he praised the organization and transparency of the selection process. "I am confident that within the nominated candidates there will be the future leaders of our sector," he said.

Osama, who has been a member of the Process Management unit of the Realization Office since 2016, shared Sami's sentiments and added that his participation in the ministry's program "was a chance to learn more about the activities across the whole value chain".

DEVELOPING AND RETAINING TALENTS

Panelists subsequently discussed new strategies to develop young professionals' skills and career paths, as well as ways of retaining talent. On this matter, Sabry pointed out that in order to achieve a successful career path in the sector, young professionals should have more than just technical skills. One of the most important soft skills in his opinion is communication. "You need to make sure that you are expressing yourself in a structured and convincing way," he said.

Being himself a young professional in a management position, Sabry's personal advice to the new generation of petroleum employees was to go out of the comfort zone. "You have always to challenge and believe in yourselves. I have witnessed many colleagues who were capable of doing much more than what they are doing now, but the main limitation that restricted them was actually themselves," he added.

"DO NOT BE AFRAID OF BEING CREATIVE, BECAUSE THIS IS HOW CHANGE COMES ALONG. TRY TO BE EXPERIENCED AND KNOWLEDGEABLE IN YOUR WORK. YOU HAVE TO LEAVE YOUR OWN PRINT."

MAHA FOUAD ATTIA
Vice Head of the Technical Office at the Ministry of Petroleum

"I AM CONFIDENT THAT WITHIN THE NOMINATED CANDIDATES [OF THE MINISTRY'S MIDDLE-MANAGEMENT PROJECT] THERE WILL BE THE FUTURE LEADERS OF OUR SECTOR."

TAREK SAMI
Enppi's Senior IT External Projects Coordinator

"DIGITALIZATION IS A GAME-CHANGING ELEMENT FOR THE INDUSTRY, IT IS THE KEY FOR OIL AND GAS PLAYERS TO ATTRACT TALENT. THE YOUNGER GENERATIONS WANT MORE AGILITY, THEY WANT MORE FLEXIBILITY. DIGITALIZATION GIVES THEM ALL OF THAT."

MIRNA ARIF
Regional Sales Director O&G Digital Egypt, Turkey and Tunisia at BHGE

A number of panelists emphasized the need for the sector to adapt and become more flexible in its approach to young professionals.

"We need to think about the young talent; they are motivated by different things," El-Hares said, suggesting that companies should move to a more flexible working model that accommodates modern lifestyles and working schedules.

"We talk about changing working hours, but we neither believe in it nor promote it, and we are actually very critical when someone adopts it. We need to start looking at it differently. Someone who is really into snowboarding, for example, and is working long hours during winter. What is wrong with having him working these hours during summer instead? We really need to promote that more," she explained.

Building on her comments, Sabry spoke of the importance of developing careers on an individual basis in order to increase employee retention. "The key thing to retain talent is to provide them with opportunities to continuously learn and grow," he said.

For El-Hares, promoting the culture of safety and care within oil and gas companies is a key step to retain young professionals and encourage them to improve. "If people feel they are cared for, they will not think of quitting. What we really need to do is being close to our people and lead by example," she added.

Arif, an expert on digitalization, told the audience that new technologies are key to attracting and retaining talent within the industry. "Digitalization is a game-changing element for the industry, it is the key for oil and gas players to attract talent," she said. "The younger generations want more agility, they want more flexibility. Digitalization gives them all of that," she said.

"We are perceived as an old industry, but surprisingly we are the first industry that was actually digital. It is all about data. The first step in the oil and gas exploration phase is acquiring huge tons of terabytes of seismic data. All the data that the industry has, now it is time to look at that from a bigger perspective," Arif continued.

Attia closed the discussion with advice for the new generation of professionals: "Do not be afraid of being creative, because this is how change comes along. Try to be experienced and knowledgeable in your work. You have to leave your own print."

On the sidelines of the convention, Moataz Darwish, External and Government Relations Manager and Deputy Chairman at Shell Egypt, told Egypt Oil & Gas that, in addition to all the points mentioned during the panel discussion, the industry should also teach the young professionals to understand themselves. "They must be self-aware, set their own goals, and understand their own mindset. That can help them a lot in paving their own way through their career," said Darwish, who is also member of the EOG Technical Committee.

"[PARTICIPATING IN THE MODERNIZATION PROGRAM] WAS A CHANCE TO LEARN MORE ABOUT THE ACTIVITIES ACROSS THE WHOLE VALUE CHAIN."

AHMED OSAMA
Enppi's Project Manager

"WE ARE ALL MOTIVATED BY DIFFERENT THINGS. WHAT WE REALLY NEED TO DO IS TO BE CLOSE TO OUR PEOPLE, AND UNDERSTAND WHAT MOTIVATES THEM"

LAYLA EL-HARES
GM Development Egypt and East Mediterranean at Shell

"THE KEY THING TO RETAIN TALENT IS TO PROVIDE THEM WITH OPPORTUNITIES TO CONTINUOUSLY LEARN AND GROW."

SAMEH SABRY
Country Manager at DEA Egypt

YOUNG PROFESSIONALS RECEIVE LIVE COACHING SESSION

The Young Professionals Day was concluded with a live coaching session delivered by Kelly Bone, Co-founder of Wolfpack Holdings. The dynamic session featured a mix of coaching, audience participation, motivational videos, and interviews, looking at empowering attendees to seize the energy in their days and change mindsets.

"There are three things people control in their lives: the thoughts they think, the images they visualize and the actions they take," she said.

During the session, Bone encouraged attendees to take responsibility of their own lives and actions. "Remember, responsibility is not given, it is taken. Do not wait for responsibility to be given to you; take control of your life," she added.

The coach took the audience through the daily habits needed to get the most out of each day and fast-track their professional and personal development. These include: win your morning to win your day; time-blocking; delivering more than expected; self-reflection; and making time for 60 minutes of learning each day.

According to Bone, people's first actions and thoughts in the morning affect their energy during the rest of the day. Instead of checking mobile phones, for instance, it would be more positive to take a moment to put thoughts together and visualize the day's task. When discussing time-blocking, she invited the audience to schedule their daily priorities by selecting the things they want to get done.

Another key for success is delivering more than expected, according to Bone. In order to become a leader, she encouraged young professionals to over-deliver, "go the extra mile", and become indispensable. When over-delivering, however, youth should "focus on what matters more," she noted.

Speaking of the 60 daily minutes of learning, Bone advised attendees to be self-reflective, having a quiet time in which they can reflect on their week, what they are doing and whether it has an impact. "First thing in the morning is the best time to do self-reflection, because it is the peak of creativity," she noted.

The coach subsequently explained the six perspectives that need to be adopted to become a high achiever. The personal perspectives included: focusing on 20% purposeful aims to achieve 80% of the desired results; committing to self-mastery; moving from an engineering style to a purposeful style; being learning based; removing limiting believes; and being accountable.

"When you have a purpose, it does not feel like work, but like love and passion," she said.

According to Bone, leaders should be learning-based and remove any limiting belief they have, holding themselves accountable instead of victimizing themselves.

LETTERS TO THE MINISTRY

After the session, young professionals in the audience were divided into seven teams. Each team, coached by a different industry leader, discussed certain challenges and needs within the oil and gas sector. After the discussion, each team wrote a letter to be sent to petroleum minister Eng. Tarek El Molla addressing the young professionals' commitments and needs to become future leaders.

"The challenges that may be faced by companies include the resistance of change, fear of mistakes, defying rules and regulations, and lack of communications," said the yellow team in their letter.

The red team focused on self-mastery, accountability, and creating more jobs in future. "We are committed to work hard and be effective through self-learning and keeping high performance," the letter read.

The green team focused on opportunities, promotions, digitalization, and human capital investment. "Our current challenges are mainly economics, regulation, skills-matching gap that align with our companies' needs, and the social impact we might have because of the digitalization of the oil and gas sector," the letter read, suggesting psychometric testing to face these challenges.

The pink team addressed the leadership relation with employees, giving promotion based on who deserves it, and hiring employees; while the grey team suggested empowering middle leaders and university students.

The blue team focused on developments and proposed creating a suggestion box at each company to receive employees' suggestions. The last group to read their letter was the orange team, which discussed what support young professionals need, as well as their commitment and dedications.

SHELL NXPLORER PROGRAM

Representing Shell, Nashwa Saleh, the company's Investment Manager in Egypt, made a presentation about the company's NXplorer program, which aims to unlock future leaders' potential through introducing youth to the complex and creative thinking they will need in their future.

According to Saleh, Shell has an extensive portfolio of social investment programs that focus on youth, development, and capacity. "We have our programs on different themes. NXplorer is more focused on complexity," she said.

In her presentation, Saleh discussed general issues that need solving, which include food, water, and energy nexus. "[Shell] wants to empower students to go beyond all the barriers, and wants to equip them with the tools to be able to face challenges," she noted. The company aims to globally reach 1 million youth through NXplorer.

The program is developed in three phases. The first phase is Explore, which is based on system thinking methodologies. The second phase is Create, in which students start creating the solutions for the problems discussed. Following that, comes the third phase, Change, which is related to what can lead to a fruitful future.

The NXplorer program currently takes place in 16 countries, and the company is adopting a vision "to have Egypt as the hub for delivering NXplorer to the region," Saleh pointed out.

In addition to NXplorer, Shell has also become a sponsor of Al Amal program in 2017. After Salah's presentation, students at Al Amal Program, led by Dr. Samir Abdel Moaty, Chairman of EGS and Al Amal Founder, talked about their contributions at the program. "Our aim is to get [students] ready to compete for a job in a multinational company," Dr. Abdel Moaty said.

UNCONVENTIONAL THINKING FOR PRODUCTION ENHANCEMENT

In addition to the panels, the convention showcased several technical workshops during its first and second days. The workshops were presented by representatives of national, international, service, and joint venture companies. The first technical session introduced case studies from Egyptian fields and insights on unconventional production workflow.

ACID GAS TREATMENT

Irene Frino, Zohr Process Engineering Specialist at the Belayim Petroleum Company (Petrobel), made a presentation on the usage of Thiopaq and claus technologies in gas treatment, as well as their application in the Zohr natural gas deep-water field.

The field operator, Eni, used both technologies to treat Zohr's sour gas, which contains 450 parts per million (ppm) of hydrogen sulfide (H2S). Frino explained that the gas is processed through early production facilities (EPF) consisting of three main parts: an acid gas removal unit; a sour liquid processing unit; and a sulfur treatment unit, which includes the Claus and Thiopaq technologies.

The Thiopaq technology is used to treat sulfur from gas. According to Frino, the difference between Thiopaq units and sulfur recovery units (SRUs), which are based on applying the Claus process, is that the Thiopaq is smaller than the Claus and does not have any reactors.

Frino also disclosed that the Thiopaq technology is available in 60 units and can perform 3,800 analyses per year. Meanwhile, SRUs, which work in high temperatures and pressures, are available in 200 units and perform 8,500 analyses per year.

"SRU is more unavailable considering the steam operations that are required to run the facility," Frino concluded.

Thiopaq is not just used in gas treatment, but also in oil. After the presentation, Dr. Ahmed Ali, Operation General Manager at Alexandria Mineral Oils Company (AMOC), told Egypt Oil & Gas that Egypt already has Thiopaq units in AMOC, adding that AMOC's Thiopaq unit "was established in 2004".

INTEGRATED MODELING APPROACH

Following Frino's presentation, Mostafa Mamdouh, Senior Reservoir Engineer at the Gulf of Suez Petroleum Company (GUPCO), presented a case study showcasing the Saqqara field, in the Southern Gulf of Suez, and the methods used to unlock potential in the multilayered heterogeneous reservoirs in the field – which were found in poor seismic regions via applying an integrated modeling approach.

The presentation discussed the risks and uncertainties the operators faced during unlocking the multilayered heterogeneous reservoirs, which include facies distribution, STOIIP calculations and aquifer strength, lateral and vertical communication, rock quality and permeability distribution, as well as the impact on offset producers.

"The rock quality was a big issue in all of Nezzazat [area in the Gulf of Suez], because Nezzazat, in some areas, has a very good sand quality and permeability, and in other areas has low permeability," Mamdouh said.

He further explained that the key risk faced in the new well deliverables was net sand thickness, which can be mitigated through the well penetrations control model.

As Mamdouh highlighted, the vitality of collecting periodic surveillance data for a better understanding of the multilayered heterogeneous reservoir enables better development decisions. According to him, a company can maximize oil recovery through using integrated approaches to overcome data uncertainty and subsurface risks even in mature fields.

INTEGRATED WORKFLOW

Mohamed Salah, Senior Production Engineer at Khalda Petroleum Company, made a presentation on the importance of having an integrated workflow for unconventional reservoir evaluation in order to improve characterizations and reduce uncertainties.

"We need to address these challenges [faced in unconventional reservoirs] to better understand the reservoir characterization and performance, reduce uncertainties, and identify key technologies to reduce the risk and the operation's cost," Salah explained.

According to Salah, boosting unconventional production is possible through introducing a series of tax, financial, and knowledge transfer; technology support; pipeline network; resource management; and international cooperation policies.

He also explained that unconventional resources are important due to the decline in global conventional resources. "Developing the unconventional resources [goes through] four major phases. Each phase has its own objective, scope and target," he added.

The first two phases are exploration and appraising phases, which are related to finding the sweet spot in the natural gas play, and the last two are the pilot production and project development phases, which are based on drilling and completing the sustainable-rates-wells.

According to Salah, companies could create an experimental zone through testing several wells and understanding suitable strategies to develop a play. He explained that even the immature expertise could help through bringing international cooperation to the unconventional field.

NOVEL FRACTURING TECHNIQUE

The last person to make a presentation on unconventional production was Taner Batmaz, Stimulation Domain Manager at Schlumberger, who discussed new fracturing techniques to triple gas production through addressing possible water blockage and halving the amount of proppant in Egypt's Western Desert.

Batmaz discussed the reservoir stimulation and production challenges at the Obaiyed field and the

Lower Safa formation, highlighting two water-based wells and two methanol-based wells.

The challenges faced in the reservoir included rapid pressure decline caused by reservoir compartmentalization, varying condensate gas ratios, unpredictable relative permeability, and varying thickness and reservoir properties. Challenges also included tight reservoir properties that require high-pressure hydraulic fracturing, in addition to water and fluid blockage caused by the poor petrophysical properties, and the multiple contact rather than single gas water contact (GWC).

Water blockage is one of the main challenges faced when operating in this formation. "Water blockage plays a very important role in gas reservoirs, especially in tight gas reservoirs," Batmaz said.

Having water close to the wellbore or the fracture face could lead to a lower relative permeability of oil and gas. Excess water in the formation could be affected by the fluid used in drilling and fracturing treatments.

To face these challenges, Batmaz suggested methanol fracturing as the best option for water sensitive formations. Methanol could decrease the surface tension, maximize the fracturing fluids recovery, accelerate the clean-up period, and improve gel stability.

EGYPT'S FIELD BEST PRACTICES

Continuing the first day's presentations, attendees were provided with a second technical workshop on field best practices.

SCALE INHIBITION SQUEEZE

Mohamed Askar, Petroleum Engineer at GUPCO, introduced the scale management system adopted by GUPCO. He defined scale as a hard deposit of inorganic mineral compounds deposited from aqueous solutions. It has different causes such as pressure drop, temperature change, mixing of incompatible waters, PH increase, and agitation operations.

"All of these causes will form microcrystals and make these crystals grow in size until having an out-of-solution issue," Askar commented. Because of this, he argues scale in wells and facilities "needs to be faced and solved before happening".

Askar stated that in order to evaluate the problem of scale and build an equipment responsible for scale inhibition, GUPCO's team firstly looked closely to the effects to scale to production. The main tools adopted by the team included a prediction step through complete water analysis and commercial software.

After the prediction step, Askar stressed the team's conclusion. "Prediction is not enough, we need actual scale samples from the wells." This led to the detection phase, which was subsequently followed by the squeeze inhibition phase to properly prevent scale.

According to him, the following well modelling phase was carried by "using commercial software to build a well and optimize the well design". Askar argues that for companies that do not have software or cannot collect samples from wells, there are some other indicators for detecting scale in the wells, including a decrease in the well productivity, water chemistry change, and injection water breakthrough.

DOWNHOLE INJECTION AND BACKWASH PROGRAM WITH BIOCIDE

Ibrahim Hassan, Chemical Treatment Department Head at Qarun Petroleum Company (QPC), made a presentation on the usage of biocide to protect QPC's assets from souring, and improve the well's run life and cost-saving for work over.

QPC's production wells are running by two main types of pumps, which are the electrical submersible pump (ESP) and the sucker rod pump (SRP). High water percentage can cause corrosion and scale on these wells.

"QPC and most of the sister companies in the Western Desert are facing problems due to sulfate reducing bacteria (SRB) that may cause corrosion (MIC), producing sour gas (H2S), high cost due to failure of the wells, and hence production loss," Hassan said.

Due to ESP's constant failures, which led to high operating cost and lower production rates, QPC began a Dismantle, Inspections and Failure Analysis (DIFA) for the ESP equipment. The company found out that iron sulfide built up downhole causes many problems, including partial plugging for ESP/SRP, emulsion problem, effect on the running time of the wells, decrease on production rate, and increase on the cost impact by work over.

QPC arranged a survey about the downhole problem to get the most prominent way to solve the iron sulfide issue. The company found that the biocide] THPS was compatible with their target. Because of that, "QPC took the decision to use THPS for the downhole problem," Hassan stated.

THPS has many advantages such as killing bacteria and dissolving agent for iron sulfide. It is also water-soluble, non-foaming, reservoir compatible, and has a good system throughput. "[QPC] applied the THPS method at a field called YOMNA and it enhanced the running time to 520 days," he said.

"Now, we are using another technique for downhole treatment which is used in emergencies, the chemical backwash." The most important procedure in applying the backwash program is the recycling step, "because we must keep downhole for some hours then begin applying it."

"THPS showed good dissolving results for iron sulfide scale by using continuous injection and chemical backwash treatment. Chemical backwash succeed as a proactive action for improving the production and increasing the run life for the wells that suffer from scale problems leading to plugging and semi-plugging of artificial lifting pumps, work over cost saving, and decrease in the well down time," he concluded.

GEMPETCO OPERATIONAL EXCELLENCE PROGRAM

Emad Hamdy, Gemsa Petroleum Company's (Gempetco) Surface Facilities Department Head, led a presentation that focused on the company's operational excellence program.

"Operational excellence is a professional path to put any company in the track to be best in clause performance. Therefore, Gempetco decided to take this approach to be a pioneer in the oil and gas sector," he said.

The operational excellence program consists of five pillars, which are: reserves and recovery, production, deliver new asset integrity, add or modify asset integrity, and deliver component and effective people. The program's methodology starts with identifying gaps, opportunities, and priorities; determining resources; developing an implementation plan; delivering projects; and finally monitoring and controlling.

According to Hamdy, Gempetco has defined a four-year timeline to reach a sustainable result. It passes through three phases. First, the creation phase, which lasted from April 2018 to May 2018. Second, the planning phase, which lasted from May 2018 to September 2018. Third, the implementation phase, which is planned to be developed from September 2018 until August 2022.

Nowadays, the company is working on the implementation of platform inspection, maintenance

and repair (IMR); firefighting upgrade; SCADA update and upgrade; hazardous material management; new pipeline installation; waste water effluent; materials management upgrade project; competency assurance; contractor management; and welfare improvement.

For Hamdy, the company's leaders play a major role in implementing the program, and the whole company must be involved. "We have integrated the organization to ensure that operational excellence is a daily agenda item at all levels."

DRILLING PERFORMANCE OPTIMIZATION

Ahmed Abdelaziz, Drilling Engineer at Khalda Petroleum Company, made a presentation about drilling challenges and ways of optimizing drilling performance.

Abdelaziz stated that Khalda's initiative towards drilling optimization comes in line with the visions of the ministry's Modernization Project. "From this point, Khalda Petroleum Company has announced a new strategy to use new technologies to reduce drilling cost through optimization of planning and well design, operational practices, logistic operations, and application of new or fit-for-purpose technology," he said.

The engineer compared the company's drilling performance in 2009 and 2018. "In 2009, it took more than 48 days to reach 12,000 feet, and more than 95 days to reach 14,000 feet. [While] in 2018, it took less than 8 days to reach 10,000 feet, and less than 16 days to reach 14,000 feet."

Abdelaziz pointed out that "Khalda managed to drill the longest and fastest 12.25' hole in Western Desert reaching 10,000 feet in 10 days only."

Drilling performance can be optimized in different ways. One of them is casing design optimization to minimize well phases to two instead of three; reducing the number of casing strings will decrease the well cost and drilling days.

Drilling fluid optimization is another option. "We have collected samples from different concessions to select which has better share inhibition and well poor stability. Instead of using expensive, complex and high-performance water base mud, the cost reduction of using this soft or simple drilling fluid reached more than 60% from the previous design," he said. "Another point is the re-use of water base mud in some wells, which leads to significant decrease in the cost of drilling fluid."

The presentation continued with many other ways for drilling optimization, including bit selection, improve BHA's design, cement design optimization, SoftSpeed application, real-time well data, and directional drilling optimization.

"It is not necessary to depend only on the new technology for achieving lower drilling cost per foot, but it is important to adapt the drilling techniques to desired requirements: cost reduction and better performance," he concluded.

NEW TECHNOLOGIES FOR OPERATIONAL ENHANCEMENT

The upstream convention's first day provided the attendees with one more workshop about new technologies.

GAS EARLY PRODUCTION FACILITY: J-T PLANT

Mohamed Kamal Gaber, Piping & Pipeline Design Engineer at Petrojet, discussed natural gas and early gas production facilities using the JT-Plant technology.

"Capital Economics estimated that the increase in gas production in Egypt will translate into a 2.8% increase in the real gross domestic product (GDP) over the next three years" Gaber said. "The increase in gas production could reach up to 9 billion cubic feet of gas per day by 2020, up from an average of 5.1 billion cubic feet of gas per day [in 2017]."

Gaber explained to the audience that natural gas processing is a complex industrial process that consists of many steps, but it can also be simple, as it simply consists of cleaning raw natural gas by separating impurities and various non-methane hydrocarbons and fluids. "Gas is processed to produce what is known as pipeline-quality dry natural gas, the sales gas," he added.

Petrojet's case study showed that, for this process, the company's main challenge was to keep the methane with its high rate taking into consideration all other surrounding conditions. Using JT-Plant, the company could "remove the heavy components, water and hydration formation to produce the sales gas."

SUCCESSFUL LANDING AND GEOSTEERING

Aly Morad, Petrophysics and Well Placement Team Lead, Sis at Schlumberger, made a presentation about new technologies in geosteering.

Geosteering consists of a "planned interactive positioning of the well-bore using geological criteria and real-time measurements," according to Morad. He introduced a case study about Petrobel drilling project at the Belayim Land Field, Sidri Formation, which was drilled in June 2018.

The company's main objective was to a drill land well in the S3 zone, with geosteering well at 3 meters from top to maximize reservoir exposure. The main challenges faced were varying reservoir thickness, possible dip change, and the complex geology.

"We need to have offset data to form the right idea about what we are drilling," Morad said.

"Mapping-while-drilling and multi-layer bed boundary detection services allowed us to successfully drill the land well after crossing several challenging faults with varying formation dip and throw," he added. "Formation mapping allowed for better reservoir understanding and modelling for future wells drilled in the region and we were able to map fine laminations and features inside the reservoir for better delineation of formation dip."

IMPLEMENTATION OF REINFORCED THERMOPLASTIC PIPE (RTP)

Otto Comin, Senior Applications Engineer at Shawcor, introduced the company's reinforced thermoplastic pipe (RTP) during his presentation.

RTP is a plastic inner liner for corrosion resistance with a reinforcement layer made of high-strength materials such as fiberglass and aramid fiber. It has also an external jacket made of similar material to the inner liner to protect and contain the reinforcement layer. The RTP is a corrosion-resistant and cost-effective alternative to steel and it can be supplied on reels, in coils or stick lengths.

The RTP started in North America but it is now spread all over the world. The pipe has some standards to be based on including API 15S for product testing and design standard, and ASME B31 for complies with requirements. International regulations include local codes. Moreover, "national oil companies (NOCs) have

developed internal standards, including Saudi Aramco, KOC, and YPF Argentina," Comin said.

The RTP has many applications, including crude oil and emulsion, enhanced oil recovery (EOR) injection line, gas distribution, fuel and lift gas lines, zero flaring, H2S and CO2 applications, source water, disposal lines, rehabilitation liner pulls, and temporary surface lines.

Using the RTP has many benefits as it is a corrosion free pipe with simple and rapid installation, infrequent joints, and reduced installation costs.

Subsea Wireless Communication Technology Control System

Mohamed Abdou, I&C GM Assistant, and Mohamed ElWakil, Systems and Controls Lead at Enppi, made a presentation discussing the subsea wireless technology that led to increasing the focus on the subsea umbilical cables, which become crucial for all subsea system delivery.

The subsea wireless technology is available on three domains, which are: radio-frequency (RF) communication, which has high data throughput, short range, and suffers from mild doppler effect; optical transmission, which is preferably in blue-green wavelength and requires line-of-sight positioning; acoustic communication, which is the longest range of communication, with low throughput.

Recently, the technology has been used to transfer data and control remote subsea assets. Users employ the technology for different purposes, ranging from long-term measurement of oceanographic phenomena to the real-time monitoring of positions and movement of subsea structures.

The technology has many applications, including positioning systems, mobile unit tracking, pipe-lay support, spool metrology, structure installation, BOP controls, cathodic protection monitoring, and Subsea X-tree control.

ADDRESSING ASSET INTEGRITY

The second day of the convention included a workshop with four presentations on asset integrity.

SIM FOR OFFSHORE ASSETS

Structural Integrity Management (SIM) is defined as "a continuous process used for demonstrating the fit-for-purpose of an offshore structure from installation to decommissioning," Mohamed ElHabbal, Principal Offshore Engineer at Enppi, introduced.

According to him, SIM is one of the Asset Integrity Management (AIM) system's main pillars and is divided into four main phases. The first one, named data phase, is where "[we need to] gather characteristic and condition data of the operating assets and build a data management system, which is a very crucial activity in order to have a successful structural integrity," he said.

The second phase, named the evaluation phase, identifies, evaluates, and characterizes the risks and the structural assessment according to these risks. After that, the third phase, named strategic, "uses planning for repairs, inspections, and maintenance, and sets the roles and responsibilities in each part that the operator signed," ElHabbal stated. The last phase is the program phase, "where we do activities after planning them," he added.

ElHabbal pointed out that offshore assets in the Egyptian waters are aged and their operational expenditure is getting higher, which has been leading some operators to consider selling their assets.

He illustrated the application of SIM in those assets mentioning a case study carried out by Enppi. "In our case, our client has about 120 platforms in the Egyptian waters [from which] 13 are out of service. These assets have been installed between 1966 and 1987," he said.

According to him, most of these platforms were subjected to modifications where the impact of these modifications was underestimated, in addition to the environmental changes in the areas surrounding the platforms. All of these activities needed to be assessed to ensure that the life of the asset could be extended successfully.

"Our scope was to bring fleet data," he said. After that, the "engineering team's main responsibility was to transform the data gathered into knowledge in order to have deep understanding of the fleet," he continued. Once this diagnosis phase was concluded, "the platform with highest risk score in each group was selected for structural assessment." As ElHabbal explained, the company then moved to a non-linear structural analyses to calculate the Reserve Strength Ratio (RSR), which indicates the ultimate load carrying capacity of a platform.

The engineer clarified that setting a SIM system is an efficient way to optimize OPEX. He continued setting some recommendations to upgrade SIM processes, which included two other phases: philosophy at the beginning of the process, and monitoring at the end.

During the roundtable discussion after his presentation, ElHabbal was asked about why Enppi only focusing on the qualitative approach instead of the quantitative, to what he answered that the approach actually depends on the number of platforms: if they are 10 or 12, it will be better to use the qualitative approach.

When asked about decommissioning, ElHabbal stated that, unfortunately, this is not part of the regulations in Egypt. He finally suggested that the country goes through its legalization and includes this process in the ministry's Modernization Program.

ASSET PERFORMANCE MANAGEMENT (APM)

Daniel Costa Rodas, Solution Architect Director at Baker Hughes, a GE company (BHGE), made a presentation about reliability and how it affects the business health. Rodas also mentioned what the best in class companies do, and the effects of Asset Performance Management (APM) when addressing reliability.

For Rodas, reliability engineering and APM represent the base for successful function. "Reliability, in many ways, is compared to safety. Some failures came by safety incidents and, in some cases, some safety incidents in the history took place by equipment failure," he said.

He continued explaining that maintenance and reliability are in continuous improvement. "The best in class companies have been continuously assessing the multiple potential opportunities from a perspective of cost, mismanagement, and time availability," he stated. "These things are directly and indirectly related to the health of the assets and the equipment that operates these assets."

In fact, reliability can affect everything done in the industry, generally and inside the company. “There is a relation between injury rate and equipment effectiveness; when equipment effectiveness increases, the injury rate decreases,” Rodas pointed out.

He also explained that, sometimes, there is not enough time to do things right, which requires some procedures to be redone. Often, they are not redone in time to prevent failures. “In some occasions, we fail to identify the issues before they transform into function failure,” he added.

The ideal case would be having the ability to dedicate the needed time and resources to implement the job right, as well as to enhance it. According to Rodas, this happens when “we understand deeply not only how the equipment works, but also how they fail and how we can predict that failure.”

In order to reach this level of understanding, Rodas argues companies should utilize risk assessments, digital technologies, and workforce in an ideal way to collect data and analyze them. “The best in class companies spend annually over 1% of their investments in maintenance,” he added.

Commenting on work process, Rodas stated that having proper work process starts not from technologies, but from assessing the risks that are in place. Accordingly, he suggests companies anticipate risks before starting operations.

“Reliability is strategic to any asset intensive business. APM and reliability are sustained by a solid culture like safety,” he said, concluding his presentation.

PRODUCTION FACILITIES INTEGRITY AND CORROSION MANAGEMENT

Mohammad Mahrous, Inspection Section Head at the Oil & Gas Skills (OGS) company, discussed the effects of corrosion in asset integrity. In order to properly manage corrosion, he mentioned three elements of the asset integrity management system (AIMS): facility and process integrity; failure analysis and incident investigation; and corrosion management system (CMS).

“The role of facility integrity is to maximize the availability of the facility and provide integrity assurance for the facility,” he said. As he explained, availability is a measure of how often facility equipment and systems are alive and function as they were designed to.

“[There is a] road which the management should follow to have a free-of-failure environment: if you have a reactive approach to facility integrity, you are in a bad position. You need to show commitment towards facility integrity by providing enough resources and training employees,” he noted, explaining the importance of caring for asset integrity as a precaution instead of a remedy to problems when they have already happened.

Mahrous introduced the example of a re-boiler whose function was to evaporate the light elements and water from condensates. According to him, this re-boiler lost its availability. Although the structure was still there, the availability loss also consisted of a failure. “Losing integrity, from my point of view, does not necessarily means losing the equipment physically. Losing its function is a failure too,” he said.

“My conclusion here is that we should consider a reasonable budget for asset integrity and consider corrosion as a hazard not only for the equipment physically, but also for its function,” he concluded.

TUBING-CASING INTEGRITY (TCI)

The asset integrity workshop was closed with a presentation about tubing-casing integrity (TCI) delivered by Ashraf Said Mohamed, Production Department Head at Qarun Petroleum Company (QPC).

QPC had many problems related to injection well tubing-casing communication caused by advanced tubing corrosion, which led to increased risk of casing leaks, work over costs, and the possibility of complete loss of several wells.

“Initially, QPC staff instituted a company-wide TCI program,” Mohamed said. Under the program, the company conducted a survey that was based on a regular schedule according to the TCI classification of the previous survey. After entering the data in the database, the data is automatically classified into good integrity, unconfirmed communication, probable communication, or confirmed communication.

Commenting on the TCI survey techniques, Mohamed mentioned casing valve risers were installed on all injector wells to facilitate the surveillance procedure. A portable testing manifold was connected to the casing riser during the survey process. If the result was, for instance, unconfirmed TCI, “[that would mean] a small leak that does not lead to increase in tubing flow but pressure builds back up in the annulus slowly over time,” he said.

On database management, Mohamed stressed the importance of collecting data to be entered as historical database, which can determine the well TCI classification and schedule future surveys. Besides, this database can be used to identify corrosions by area and to determine the most suitable chemical treatment to decrease the corrosion rate. The database also extends tubing life, reduces work over frequency, and avoids high operating costs.

According to Mohamed, TCI survey has many advantages. It has no costs, can be applied to all injection wells, and the process is easy to be performed with only one engineer in a short time. TCI database also allows reviewing historical surveys to identify high corrosion areas that need chemical corrosion program.

HSSES AS A CORE VALUE

The second day closed with another technical workshop focusing on health, safety, security, and environment (HSSES) guidelines, which play a crucial role in the oil and gas industry.

RISK-BASED INSPECTION: HOW MATURE FIELDS CAN BENEFIT

Mohamed Elsebay, Projects Section Head at Gempetco, made a presentation focusing on how the company integrated in-service inspection, risk-based inspection (RBI) and asset integrity management (AIM) procedures.

In-service inspection strategies and techniques are deployed “for the inspection and monitoring of the deterioration that affects different pieces of equipment", Elsebay said. He explained that companies could plan inspection intervals based on time period, the condition of the asset or the level of risk associated with its failure.

RBI is used to identify and assess the risks posed to processes and equipment. According to Elsebay, there are four main phases companies must undertake to establish a working RBI system. The first stage includes hazard identification and risk assessment using the company’s standard risk matrix. In the second stage, the company plans for and implements the inspection regime, while in the third stage its carries out mitigation actions and updates its risk assessment protocol. The fourth and final stage includes establishing an integrated RBI program, and an RBI study re-assessment plan.

Gempetco faced different challenges, Elsebay explained. “We have to enhance the understanding of such important topics on a managerial level to get the desired results," he said, suggesting that there was not adequate awareness of the program at the higher echelons of the company. He also reported that the inspection program was not comprehensive enough, and that the company had faced challenges extending the lives of assets beyond their design lives.

After conducting a risk assessment, Elsebay said that uncertainty gave the majority of Gempetco's equipment a high risk rating, while all equipment assessed had a high impact rating. After completing the RBI program, the company was successful in reducing the risk of a number of assets. Although several still lingered in the high-risk range, the RBI program was able to markedly improve the majority of assets subjected to inspection.

SUSTAINABILITY: "A CORE VALUE, NOT JUST A TARGET"

James Garvie, Managing Director at Amal Petroleum Company (Amapetco), and HSE Advisor at Cheiron. The made a presentation focused on sustainable asset management techniques and how they can provide organizational benefits.

Garvie opened his presentation defining sustainable development as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. He argued that sustainability shares the same goals as asset integrity and operational excellence. All three aspect involve members of the organization working together to achieve a common objective which delivers long-term value. "We very much see sustainability as a core part of operational excellence program," Garvie said.

Sustainable practice applies to every aspect of the business: from infrastructure and transportation, to public relations and contractor management. “We have achieved a number of major advances in a way that we could manage health, safety, environment, and social aspects,” Garvie said. Operations at Zaafarana, for instance, saw sustainable development projects that helped “overcoming waste management and enhancing the way of managing public contractors”.

Another crucial aspect is engagement; not only among staff but also “engaging the workers to their families and people surrounding them", he said. This enables the company to better communicate the benefits of sustainability to a larger audience.

Garvie concluded the presentation by clearly articulating the guiding principles of sustainable corporate development: a clearly-defined roadmap, efficient team collaboration and effective communication of the project's goals and benefits.

START-UPS: A POSITIVE HSE CULTURE FROM THE OUTSET

Continuing the workshop, Emad Elewa, HSE Manager at Apex International Energy, delivered a presentation about how to foster a positive HSE culture specifically within E&P start-up companies.

The newly-established E&P companies in Egypt need to focus on the dynamic practices for building up HSE culture and a good management system, Elewa told the audience. The dynamic system is maintained through team collaboration, resulting in an environment in which “everyone will achieve more and efficiency will be more with team work”.

The presentation focused on four projects undertaken by Apex to improve HSE culture, guided by a set of 12 principles put into practice across the company. Elewa started by explain how the company developed its HSE policies. Rather than taking the traditional routes of handing all the responsibility to managers, the company was keen to involve all employees in the process and encourage their participation.

Elewa then described how Apex designed HSE observation card, explaining that it was created to "encourage a positive attitude".

"We made a draft card and asked an employee to fill it to report the safe and the unsafe behaviors," he said, adding that employees are able to stop working if they feel unsafe.

He then moved to key performance indicators (KPIs), and explained how the company approached their development. Apex monitors KPIs each month, which ensures that they are regularly assessed and continuously updated. It allows the company to meaningfully engage with feedback provided by employees and act on it quickly.

Finally, Elewa explained Apex's approach to managing HSE practices of their contractors. Contractors are in many ways the foundations of the E&P industry, accounting for 85% of all working hours. It is important then to ensure contracting companies work to the same HSE standards as the operator. To achieve this, Apex implements a four-phase process: inserting HSE clauses into the contract; establishing that the contractors understand their HSE obligations; monitoring their activities during the project's implementation; and collecting feedback for future improvements after the project has been completed.

IMPROVING PERFORMANCE: SAFETY CULTURE AND HSE MANAGEMENT SYSTEMS

Martin Wheeler, HSE and Asset Integrity Director at Atticus Energy made a presentation about safety culture, its importance, and how it should be implemented.

"Safety culture is based on a common goal," Wheeler said, highlighting the importance of company-wide participation. Everybody inside the organization needs to accept the culture if it is to be reinforced. In order to make this happen, each and every employee must feel appreciated. "People must feel that they are respected in the organization…everyone in the organization must benefit from the system,” he pointed out.

Normalizing an effective safety culture can be – to some extent – self-sustaining. "When someone joins an organization, they are affected by the performance of people around. So, if you join a high performing team you up your game to match them," Wheeler explained. The opposite is also true however. Employees entering a workplace indifferent to poor safety practices may also reproduce the same low standards.

Effective leadership was a focal point of the presentation, as Wheeler emphasized the importance of having leaders across all parts of the organization. "People cannot work without knowing where they are going," he said, highlighting the fact that some individuals must be able to set a good example for other employees to follow.

Wheeler closed the workshop with a positive assessment of Egypt's HSE development: "Egypt is currently improving especially with the important role of the senior members in the industry."

INDUSTRY PLAYERS DISCUSS SAFETY CULTURE AND LEADERSHIP AT MINISTRY'S

ANNUAL SAFETY DAY

BY **MATTHEW HOARE, DINA EL-BAHIRY**

The Ministry of Petroleum's Annual Safety Day 2018, held on December 6 at the Egyptian Drilling Company's (EDC) headquarters in Cairo, brought together oil and gas leaders to discuss safety culture, leadership, and best practices.

The event, organized by EDC and sponsored by Apache, started with an opening speech by Eng. Mohamed Saafan, First Undersecretary for Oil Affairs at the Ministry of Petroleum, on behalf of minister Eng. Tarek El Molla.

"This event is very important. I see it growing every year, and it gives insights on the ministry's keenness on safety, which continuously improves year after year," he said.

Saafan also disclosed that "minister El Molla assigned the Egyptian General Petroleum Corporation (EGPC), headed by Abed Ezz El Regal, and holding companies to prepare a full review for health, safety and environment (HSE) systems, including all related subjects, such as equipment, employees, and training, consulting experts in this field."

Representatives from EDC, Apache, BP, IEOC, and Shell also gave their opening remarks.

"EDC is honored to host the safety day sponsored by Apache. This event aims to assure the safety of ourselves and our children," said Salah Abdelkareem, former EDC Chairman and Managing Director, currently Chairman at Bapetcow.

For Gasser Hanter, Shell Egypt Country Chairman, discussing safety does not mean looking at simply decreasing accidents, but rather completely eliminating them. "Our aim is zero harm for people and the environment," he said.

In order to achieve this goal, Kareem Alaa, BP Egypt General Manager, highlighted on his speech that sharing failures is necessary to improve safety. "I would like to encourage all of us to exchange different experiences, especially after accidents, to ensure they do not happen again."

"We must show purposeful leadership on the safety front," said Ken Neupert, HSSE VP at Apache.

Fabio Cavanna, General Manager of Eni subsidiary IEOC, also emphasized the role of leadership. "We are all here to demonstrate that safety leadership is fundamental and our commitment towards safety is mandatory."

IOGP LIFE-SAVING RULES

The opening speeches were followed by two informative presentations. The first one, presented by Chris Hawkes, Health, Safety and Security Director at the International Association of Oil & Gas Procedures (IOGP), introduced the IOGP life-saving rules.

IOGP has produced its life-saving rules based on the recent performance analysis of the employees. According to Hawkes, the rules were developed in order to provide workers in the industry with applicable and relevant actions to protect themselves and their colleagues.

"MINISTER EL MOLLA ASSIGNED EGPC, HEADED BY ABED EZZ EL REGAL, AND HOLDING COMPANIES TO PREPARE A FULL REVIEW FOR HSE SYSTEMS, INCLUDING ALL RELATED SUBJECTS, SUCH AS EQUIPMENT, EMPLOYEES, AND TRAINING, CONSULTING EXPERTS IN THIS FIELD."

ENG. MOHAMED SAAFAN
First Undersecretary for Oil Affairs at the Ministry of Petroleum

"THIS EVENT AIMS TO ASSURE THE SAFETY OF OURSELVES AND OUR CHILDREN."

SALAH ABDELKAREEM
Chairman of Bapetco
Former EDC Chairman and Managing Director

He also explained that IOGP previously had a total of 20 rules, which were subsequently simplified and reduced to nine in order to make them easy to understand and memorize, avoiding confusion.

"In order to keep our workforce alive, we need to work together, side by side, in the industry," said Hawkes, stressing the importance of collaboration to assure safety rules are well implemented. "Any one operator on their own can make very little impact. Working together as an industry, the impact we can make is much greater."

> "OUR AIM IS ZERO HARM FOR PEOPLE AND THE ENVIRONMENT."
>
> **GASSER HANTER**
> Shell Egypt Country Chairman

> "WE ARE ALL HERE TO DEMONSTRATE THAT SAFETY LEADERSHIP IS FUNDAMENTAL AND OUR COMMITMENT TOWARDS SAFETY IS MANDATORY."
>
> **FABIO CAVANNA**
> General Manager of Eni subsidiary IEOC

If an employee does not follow the rules, Hawkes argues it is important to first understand the reasons for not following them to avoid repetition and ensure safety reveals in the workplace.

"We hope to see the IOGP life-saving rules become universally accepted and applied," he added.

SAFETY BEST PRACTICES

The second presentation, made by the President of the American Society of Safety Professionals (ASSP), Rixio E. Medina, tackled safety leadership and culture change. Throughout the presentation, Medina discussed what leaders should adopt to ensure safety procedures are applied.

"I like to define safety leadership as what we, as leaders, think, say, do and measure to prevent undesirable events that can harm workers and affect operational success," he said.

There are seven best practices in safety leadership: vision; credibility; action-oriented; collaboration; communication; recognition and feedback; and responsibility and accountability.

In order to establish the vision, Medina suggested companies "describe a compelling picture of what the company's future could be," which in return should inspire the employees about the safety values and vision they should implement.

For achieving credibility, companies must "treat others with respect and dignity," he said. The action-oriented practice consists of taking advantage of safety improvement opportunities as soon as they are detected. The recognition and feedback practice creates opportunities to recognize people and celebrate work done safely, while responsibility and accountability means clearly establishing responsibilities for the employees and make them accountable for meeting their commitments.

For Medina, safety has to be established as a culture. Safety culture refers to a "combination of group values and behaviors" that determine how safety is implemented in the organization to protect its people,

he explained. In simple terms, it refers to how activities are performed and "how the employees and the contractors behave when no one is watching."

Medina guaranteed that, if best practices are achieved, safety culture is established as consequence. "Safety leadership is the wheel in creating successful safety culture," he concluded.

CHANGING HSE CULTURE

Following the safety presentations, a series of three back-to-back panel discussions took place. The session featured health, safety and environmental (HSE) professionals from the largest international oil companies (IOCs) operating in Egypt, alongside representatives from Egypt's national oil companies (NOCs). Topics included how to change HSE culture; empowerment of future leaders; and the relationship between operator and contractor in improving safety standards.

The first panel discussion of the day focused on HSE culture within oil and gas companies: how to promote a positive safety environment across companies, and – most importantly – how to make it sustainable. Participants included Hesham Elamroussy, Chairman and Managing Director at ExxonMobil Egypt; Cees de Regt, Business Development Manager Downstream at DNV; Eng. Salah Abdelkareem, Chairman and Managing Director at the Egyptian Drilling Company (EDC); and Johan van der Westhuyzen, Regional Director of Turkey, Middle East & Sub-Saharan Africa at DuPont. The panel was moderated by Egypt Oil & Gas Managing Director Mohamed Fouad.

Eng. Salah kicked off the discussion by highlighting the importance of digitalization and modern technology as a means to uphold and improve current safety regimes. By capturing and analyzing data, companies will obtain predictive power, enabling them to better anticipate future problems and put plans in place accordingly.

However, de Regt said that managerial improvements can only go so far in improving a company's HSE standards. Unless they take root in the company and employees act upon them, it will be hard to effect meaningful change, he argued. "It is not enough to just have safety management systems," de Regt said. "It needs to be implemented, we need a safety culture which is embedded in the management system."

Echoing de Regt's comments, Elamroussy emphasized the importance of developing a system in which employees hold each other to account and everyone is encouraged to actively participate in maintaining health and safety codes. "The culture of safety is improved by leaders who set expectations, they put in the structure, they lead by example," he said. "In ExxonMobil, we have safety embedded in our organization…An environment where everybody is encouraged to intervene."

Van der Westhuyzen noted a particularly problematic area for DuPont – shift handovers. Handovers are particularly important in ensuring information is communicated to employees beginning their shift and maintaining continuity in the workplace. "We found that when we focused on shift handovers we really helped building those leading metrics," he said. "We started seeing the safety culture come alive across the whole organization."

Ending the discussion, Van der Westhuyzen raised the important issue of how HSE training is delivered, noting that training courses should be adapted to the needs of millennials. "We need to think about doing capacity-building in a way that reaches the target audience," van der Westhuyzen said. "The youngsters today want everything on their phone. We have tried to make training appealing to the target audience", adding that the means used to deliver the training play a big role in determining its impact on the workplace.

HSE LEADERSHIP

The second panel of the day tackled HSE leadership, and how the oil and gas sector can collaborate to produce the next generation's leaders. Panelists included IOGP's Chris Hawkes; Stuart Shaw, Vice President of Operations at BP Egypt; Luciano Scataglini, Upstream Safety Manager at Eni; and Sameh Sayed Abdelrazek, Assistant Chairman for Occupational Health at the EGAS. On hand to moderate was Mark Konecki, Region Operations Director at Apache.

Abdelrazek opened the discussion by talking about EGAS's experience working with Eni on the Zohr megaproject. "Zohr requires proactive leadership and management practices. Both EGAS and Eni HSE leaders have considered the possibilities of shared leadership practices," Abdelrazek said. "The plan focused on compliance with the project's HSE requirements, encouraging increased HSE supervision. This means one HSE officer for each 40 workers in compliance with international requirements."

"I WOULD LIKE TO ENCOURAGE ALL OF US TO EXCHANGE DIFFERENT EXPERIENCES, ESPECIALLY AFTER ACCIDENTS, TO ENSURE THEY DO NOT HAPPEN AGAIN."

KAREEM ALAA
BP Egypt General Manager

"I LIKE TO DEFINE SAFETY LEADERSHIP AS WHAT WE, AS LEADERS, THINK, SAY, DO AND MEASURE TO PREVENT UNDESIRABLE EVENTS THAT CAN HARM WORKERS AND AFFECT OPERATIONAL SUCCESS."

RIXIO E. MEDINA
ASSP President

Konecki then asked Hawkes about the role of a good leaders during the implementation of new HSE rules. "The key piece of advice is practice what you preach," Hawkes said. "Leaders clearly need to be engaged with the life-saving rules, and they need to understand the circumstances in which they work."

However, ensuring high HSE performance is not just down to competent leadership, Hawkes said. It is critical that the company makes it as easy as possible for workers to comply with the rules. "The next important aspect of leadership is to make sure the circumstances allow them to follow the life-saving rules," he added. "If the safety equipment is substandard or has not been inspected properly, the worker cannot follow the life-saving rules."

> "WE MUST SHOW PURPOSEFUL LEADERSHIP ON THE SAFETY FRONT."
>
> **KEN NEUPERT**
> HSSE VP at Apache

> "LEADERS CLEARLY NEED TO BE ENGAGED WITH THE LIFE-SAVING RULES, AND THEY NEED TO UNDERSTAND THE CIRCUMSTANCES IN WHICH THEY WORK."
>
> **CHRIS HAWKES**
> IOGP HSS Director

Eni's Scataglini suggested that leaders should place more emphasis on working with frontline workers if companies are to experience a transformative HSE performance. "We need to focus on the frontline workers," Scataglini said.

"One of the main aspects is to implement coaching. A taskforce that works with people on site and identify hazards, discuss with them the solutions and make them promote safety culture awareness." Hawkes agreed with Scataglini's comment. "It's about getting to the frontline, showing that I understand their issues and their challenges, trying to make their lives a little bit easier, showing that I care about their wellbeing, and make their workplace as safe as I can," he said.

Shaw argued that it is important for leaders to make an "emotional connection" to HSE guidelines, suggesting that this could help HSE standards permeate through the workplace. "Can we talk about [safety] with emotion and conviction? If we can talk about safety with emotion and we can demonstrate how we care, that really has a profound impact," he said.

OPERATOR/CONTRACTOR PARTNERING TO IMPROVE SAFETY CULTURE

The final session of the day saw panelists dissect the relationship that oil and gas companies have with their contractors, and discuss the ways that they can work together to improve HSE standards across the contractor chain.

On the panel was Ken Neufert, Operations Director at Apache; Khalid Aljahwari, General Manager of Operations at Badr Petroleum Company (Bapetco); ASSP's Rixio E. Medina; and Tarek Adly, HSE consultant at Petrojet. Ehab Erfan, Business Support Chief Officer at EDC, moderated the discussion.

Neupert said that he favors a more distant relationship with contractors regarding safety standards, suggesting that contractors should work to their own HSE standards without collaboration with the

operating company. "I don't believe it is incumbent on us to set their safety expectation," he said. "Our best practice is to have offsite meeting before the project starts…We listen to them and see what they have as safety expectations."

However, Aljahwari disagreed with this, and advocated building close partnerships between the operating and contractor companies. "Most the IOCs, you look down at your contractors, but we need to start looking at contractors as real partners," Aljahwari said. "You can listen to them and you can learn from them. They understand the culture, they understand the people, and they understand the rules." By developing a close working relationship, both parties can benefit from the transfer of knowledge and best practice skills that goes in both directions.

The event was closed with positive feedback from attendees, who praised EDC for the hospitality and for successfully organizing the event.

WHAT ARE 2019'S KEY RISKS AND UNCERTAINTIES?

BY **SIMON FLOWERS,** CHIEF ANALYST, WOOD MACKENZIE

Wood Mackenzie
A Verisk Business

Brent over $80 a barrel always seemed too good to last, defying the fundamentals. The sharp retreat in price may turn out to be a good thing, injecting a healthy dose of reality to the industry at just the right time.

We expect Brent to average $66 a barrel in 2019. That is a tad down on 2018 though still a price that allows companies to generate free cash flow and continue to strengthen finances.

It may sound benign, but numerous identifiable risks and uncertainties lurk in the shadows. I picked out ones Wood Mackenzie's analysts worry could threaten our base case.

ECONOMIC SLOWDOWN AND OIL DEMAND

Alarm bells are starting to ring. Demand growth has been a pillar of strength for the oil market since prices fell and demand growth has exceeded 1 million barrels per day (b/d) every year since 2012.

We forecast demand growth of 1.1 million b/d in 2019, but the trend is at risk. China-US trade conflict and political tensions are dragging the global economy down.

An inversion of the US yield curve, where short-term borrowing costs exceed long-term, is imminent. Inversion has proved a reliable indicator of recession in previous cycles.

A modest slowdown in the global economy would push oil demand growth down by 0.8 million b/d in 2020 compared with our base case. A severe recession could wipe out oil demand growth altogether by 2020.

TIGHT OIL UPSIDE

Can US Lower 48 production outperform again? Tight oil stunned the oil market in 2018, not for the first time. Volumes increased by 1.5 million b/d, delivering 0.5 million b/d more by the end of the year than we had forecast at the start, mostly from the Permian. Operators completed more wells and were able to get the oil to market despite pipeline constraints.

We forecast 1.1 million b/d of growth in 2019, and again there could be upside risk. Big M&A deals in 2018 – such as Concho Resources/RSP Permian and Diamond/Energen – are all about creating value from scale. Operators that doubled down on the Permian will want to justify their acquisitions with guidance-beating production growth in 2019.

OPEC AND IRAN

Iran's exports plunged from 2.8 million b/d in April to 1.1 million b/d by year-end as buyers withdrew to comply with US sanctions imposed in November.

Exports could increase by 0.3 million b/d under the terms of the 120-day waivers granted to China, India, Italy, Greece, Japan, South Korea, Taiwan and Turkey.

When the waivers end in May, the outcome is potentially binary. Renewal may force OPEC, at its June meeting, to cut production again in the second half of 2019. No renewal takes more Iranian crude off the market, opening the door for OPEC to lift its self-imposed production constraints.

COMPOUNDING EFFECT OF UNDERSPEND

Oil supply may be the least of the market's problems at present. But are we in danger of sleepwalking towards a supply squeeze?

A fifth year of low global conventional spend and cherry picking the best projects leaves hoppers increasingly depleted. The retreat in oil price likely nips in the bud any urge to relax capital discipline. Good for near-term returns, but not for the sustainability of the business in the longer term.

A return to organic growth must come at some stage to deliver the new volumes to meet a looming supply gap beyond the mid-2020s. Full-cycle exploration returns, back in double digits, are attractive again. Given lead times from discovery to production, the industry may come to rue its present lack of investment in exploration.

DOWNSTREAM AND THE IMO

The entire refining value chain needs to adjust in the next 12 months for the 2020 regulation on marine fuels. Sulphur content must be cut from 3.5% (high Sulphur fuel oil, or HSFO) to 0.5% (very low Sulphur fuel oil, VSLFO).

This is a big deal for refiners, affecting 3.5 million b/d of HSFO volumes. It will affect crude prices, differentials, product prices and refining margins. There are huge uncertainties. What will be the level of global compliance? How many ships will install scrubbers to allow them to burn HSFO? How much VLSFO can refiners produce and what will be its price?

KAMOSE DEVELOPMENT IN NORTH WESTERN SINAI

After developing the Offshore North Sinai (ONS) leases – moving on from the TAO platform - NOSPCO decided to next develop the Kamose gas field, as it had proven reserves. This offshore field is located 50 km north of Rommana, North Western Sinai, in 30 meters of water depth. Due to the small field size, the predicted field life is only four years, with four gas wells producing at a peak rate of 120 million standard cubic feet per day (mscf/d). Because of this, the selected concept for this project, which was initiated in May 2017 and was completed in November 2018, had to be cost effective with a rapid return on investment.

ODE was selected by NOSPCO to perform the concept selection for this development. Four concepts were reviewed, these being: an existing monopod; a partially completed tripod design; an existing conventional jacket; and a Mobile Offshore Production Unit (MOPU) supported by wellhead structure. The MOPU option was further split into assessing the use of either a jack-up barge or a drill rig. In addition to the topside facilities, a 10-inch subsea pipeline, utilizing a hot-tap tie-in to the existing subsea 22-inch TAO to Romanna gas export pipeline, was also required for all options.

Using group workshop techniques, the concept selection evaluated and compared the technical, schedule, safety, operational, risk and commercial (both CAPEX and OPEX) aspects of each option, with a cost accuracy of ±15%. The final output from the study was a detailed concept selection report which identified the jack-up barge MOPU option with an adjacent conductor/wellhead platform as the most cost-effective solution, due to the following numerous benefits.

The jack-up barge, which would be retrofitted to function as a MOPU, has a large deck space area and a suitably sized crane capable of installing the wellhead structure onsite, making this solution self-installing. This would save considerable installation costs typically associated with hiring third party lift vessels.

Equally important, once the Kamose reservoir has been depleted, the wellhead platform shall be made gas safe and have renewably powered navigation beacons installed. The MOPU would then be free to relocate and develop a second field from NOSPCO's portfolio using an identical wellhead platform structure. Once the second field was depleted, a third could be developed, and so on.

By delaying the full decommissioning of the abandoned platforms until several are ready to be removed, the hire costs of the removal vessel would be consolidated into a single multiple-asset decommissioning project. It is not anticipated that the MOPU will be capable of fully decommissioning the platforms by itself.

The MOPU production and utility facilities, including 230V, 50 Hz power generation, as well as its 45-man accommodation block, navigational aids, fire detection, firefighting systems, lifeboat and helideck, would be reused, significantly reducing the CAPEX of this and future developments. Additionally, as the wellhead platforms used in future developments would be essentially identical to the first, future engineering design costs would be minimal.

Following completion of the concept selection study, ODE was again selected to perform the detailed design for the selected option. This was a highly schedule driven detailed design project to match a fast-track construction and offshore implementation phase. ODE kicked off the detailed design phase by outlining the jack-up vessel selection scope of requirements. After reviewing several vessels, NOSPCO selected the MOSCO-1 barge.

Both the wellhead platform and the MOPU production facilities are fully rated for the maximum gas pressure. Therefore, instead of a blowdown system, only a maintenance vent was necessary. The wellhead platform only contains the wellheads, high-pressure flowlines, the export riser and riser export shutdown valve. All production facilities, including the choke valves, metering and pipeline HIPPS, are located on the MOPU. A maintenance control panel is included on the barge; however, process control will be performed from the main control room at the central processing facility in Romanna.

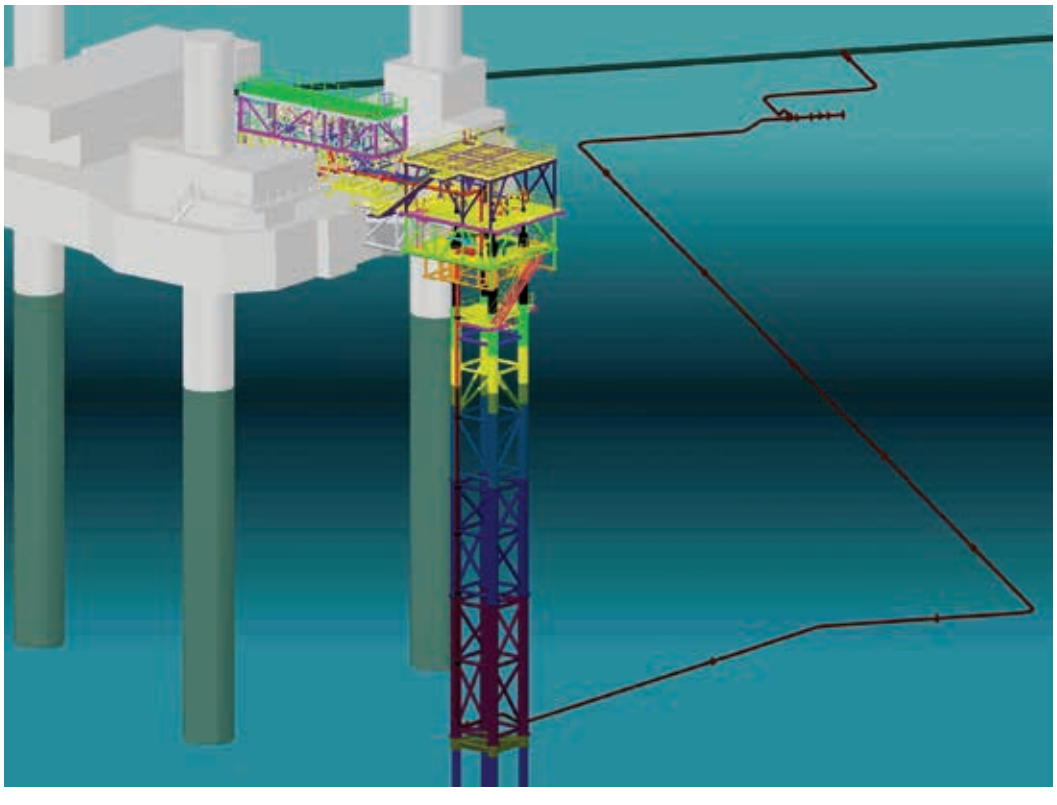
When first installed, the platform is only supported by connections to the strengthened MOPU hull; however, by the end of the installation process it is fully self-supporting. The installation sequence was designed to minimize offshore construction activities, whilst only requiring the barge facilities, such as its crane.

Following the MOPU's arrival at the construction location and elevation to the correct height, an extension frame is attached to the front of the barge. This is then extended further by the addition of an installation frame. The mudmat and the first of three jacket substructures are then lowered through the installation frame and temporarily fastened in place.

A central temporary conductor is then lowered down through the installation frame and substructure and attached to the mudmat. Once attached, the mudmat and conductor are lowered together to the sea floor. Two permanent conductors are then lowered through the installation frame and substructure all the way down to the mudmat. They are guided by divers and, following correctly threading through the mudmat, guides are hammered approximately 10 meters into the seabed. Once securely hammered in place, the first substructure is lowered using the crane to the mudmat and bolted in place. The temporary conductor is then removed.

The second substructure is then lowered to the first and bolted. The third conductor is then lowered through the substructures and mudmat before also being hammered into the seabed to a depth of 20 meters. This is followed by the third and final substructure section, and the fourth and final conductor being installed in the same manner, but to a depth of 70 meters. Then, the remaining three conductors are hammered to a depth of 70 meters.

Once hammering is complete, the crown welds are made and the topsides are installed level by level. The four wellheads are installed at the top of the conductors and the riser is also attached and connected to the 10-inch subsea pipeline.



In support of this project, ODE completed all required structural, piping, electrical, instrumentation, process and technical safety deliverables to the 'approved for construction' status for the wellhead platform and barge modifications. ODE also provided the engineering required to select a suitable location for a 10" to 22" hot tap tee and the associated subsea pipeline routing between the Kamose asset and the tee's location within the export pipeline.

All equipment and material specifications were provided together with development of scope of supply for the major contractors, including provision of jack-up barge, mechanical (structural and piping), electrical and pipeline fabricator/installation contractors.

As part of the engineering support scope, ODE undertook technical reviews of vendor submitted materials and equipment tenders, to ensure compliance with specifications and data sheets, making recommendations to the client for technical compliant proposals. ODE is currently supporting NOSPCO by providing assistance during the fabrication and offshore installation.

This project demonstrates ODE's ability to overcome challenging project and client requirements with inventive, safe and professionally developed solutions. These challenges included creative design modifications to minimize long leads, and to enable the use of materials already held in stock by the client, such as 30-inch conductors with a wall thickness of one inch. The delivered design provides NOSPCO with a valuable solution for developing small fields due to the reusability of both the MOPU and the wellhead platform design.

Schlumberger Inaugurates Egypt Center of Efficiency and Celebrates 80 Years in Egypt

BY **SARAH SAMIR**

Schlumberger has spent many successful years supporting the Egyptian oil and gas industry. In celebration of its 80th anniversary in Egypt, the company inaugurated the Egypt Center of Efficiency (ECE) facility, located at the Polaris Industrial City in 6th of October. The celebration was held on December 12, at the ECE location.

The event was organized under the patronage of Minister of Petroleum and Mineral Resources, Eng. Tarek El Molla, and Paal Kibsgaard, Schlumberger Chairman and CEO. The celebration was attended by prominent figures that included the Minister; EGPC CEO Abed Ezz El Regal; EGAS Chairman, Ossama El Bakli , Ganoupe Chairman, Mohamed AbdelAzim, First Undersecretary for Agreements and Exploration, Ashraf Farag, Undersecretary for Minister's Technical Office, Osama Mobarez and Petrojet's Chairman and Managing Director, Waleed Lotfy Mostafa, along with sector leaders and as well as IOCs & JVs Chairmen and MDs.

80 YEARS IN EGYPT

During its 80 years in Egypt, Schlumberger has been instrumental in contributing to Egypt oil and gas industry through leading technologies, local content and expanded partnerships. "80 years in Egypt is something that we are very proud of," said Karim Badawi, Managing Director of Schlumberger Egypt and East Mediterranean.

"The sense of cooperation and partnership that we all share together is essential. This is how we are able as an industry to reach key milestones and make key records in Egypt," he added.

During the event, attendees were shown a documentary on Schlumberger's 80 years in Egypt. The video included interviews with employees who have worked in Schlumberger during different times and who described their memories, what they learned, and what training the company has provided them.

The success achieved by Schlumberger was supported by the Ministry of Petroleum. The ministry's "long standing endeavor has been to build and support partnerships and strategic alliances within all international operations that enhance the sector's activities and help ensure a secure, affordable and sustainable energy supply," El Molla stated.

"Egypt is keen on enhancing co-operation with Schlumberger as one of our key partners, and we are looking forward to another 80 years of success," he added.

ECE FACILITY

Enhancing its presence in Egypt, Schlumberger inaugurated the ECE facility. “The ECE is one of our largest facilities in the world bringing the latest in oil field technologies and providing a platform for teams to deliver the highest safety and quality for our customers in the region,” said Kibsgaard

"The inauguration of such a major integrated facility in Egypt signals the company's commitment to invest in Egypt," El Molla highlighted during his speech.

MOUS FOR FUTURE COOPERATION

Cooperation between Schlumberger and the ministry is yet to be seen on different levels. However, during the event Schlumberger signed three memorandum of understanding (MoUs) that signal future cooperation.

The first MoU, signed by Schlumberger's Badawi and EGPC's Ezz El Regal, is related to health, safety, and environment (HSE). The second MoU, also signed by Badawi and Ezz El Regal, covers capacity building.

Badawi signed a third MoU with Petrojet's Mostafa which will further cooperation in processing and separation systems.

Kibsgaard expressed excitement about the MoUs, "that will further reinforce collaboration, particularly in the areas of HSE, creating new partnerships and new technical solutions in the country."

TECHNOLOGY EXHIBITION & BASE TOUR

Following the inauguration, attendees visited an exhibition at the ECE location, where Schlumberger showcased a number of its products, including virtual reality (VR) technology.

The exhibited VR technology was a pair of glasses that trainees could put on to give them the feeling that they are in the field, so that they could identify the hazards.

The products exhibited also included the Saturn 3D Radial Probe, which supports the borehole and enables formation testing, and SenTURIAN E&A, which enables operators to control well testing operations and to protect their assets.

El Molla and industry leaders then toured the facility where they could appreciate the size, organization and equipment of the ECE.

Schlumberger has been growing and going through a successful journey in Egypt. The company is still looking forward to a flourishing future through collaboration with the Egyptian oil and gas sector. Schlumberger will add to developing the industry and the country's youth through future MoUs and agreement with the Egyptian ministry.

APACHE BRINGS ORPHANS

FOR CAREER ORIENTED FUN DAY IN KIDZANIA

BY: **DINA EL-BEHIRY**

In a supportive movement for corporate social responsibility (CSR) programs, Apache organized an orphan day at the KidZania area in New Cairo on December 13. The company invited more than 600 children from different orphanages to attend the event, along with Apache's employees and their families.

This is the second year Apache promotes an orphan day in KidZania. "Our aim is to let the kids have an unforgettable and fun day, while providing them with inspirations to pursue a successful career via job simulation games." David Chi, Vice President and General Manager at Apache Egypt, told Egypt Oil & Gas.

"We started to support the orphanages with volunteers from Apache's employees. And today we support more than 70 orphanages with their main needs," he added.

KidZania bills itself as an 'edutainment' experience which aims to teach children about different jobs and career paths. Children can learn about more than 80 different professions – from acting all the way through to working in a supermarket - by participating in fun activities.

Apache hired the facility for the entire evening, and provided the transportation for the children. After volunteers distributed gifts, the children received checks to be spent from the banks located inside the city to have the money to play.

"A lot of kids are inspired as they have the opportunity to go through different professions, which provides them with a vision on what career they can potentially pursue as they grow up. I think that inspiration is really important for them," Chi pointed out.

Mohamed El-Kady, Project Engineer at Apache Egypt, told us that he hopes the event will be positive experience for the disadvantaged children. "It will make them feel like ordinary children, not orphans," he said.

> WE STARTED TO SUPPORT THE ORPHANAGES WITH VOLUNTEERS FROM APACHE'S EMPLOYEES. WE SUPPORT MORE THAN 70 ORPHANAGES WITH THEIR MAIN NEEDS.

DAVID CHI
Vice President and General Manager at Apache Egypt

"KidZania will provide them with the incentives to decide on the job they want to be prepared for, and such a day will support the children's ambitions through being in such an experience," El-Kady added.

The event is part of Apache's broader program aimed at supporting disadvantaged children. Earlier this year, the company funded a carpentry workshop for older orphans that equipped them with the woodworking skills necessary for them to earn an independent income.

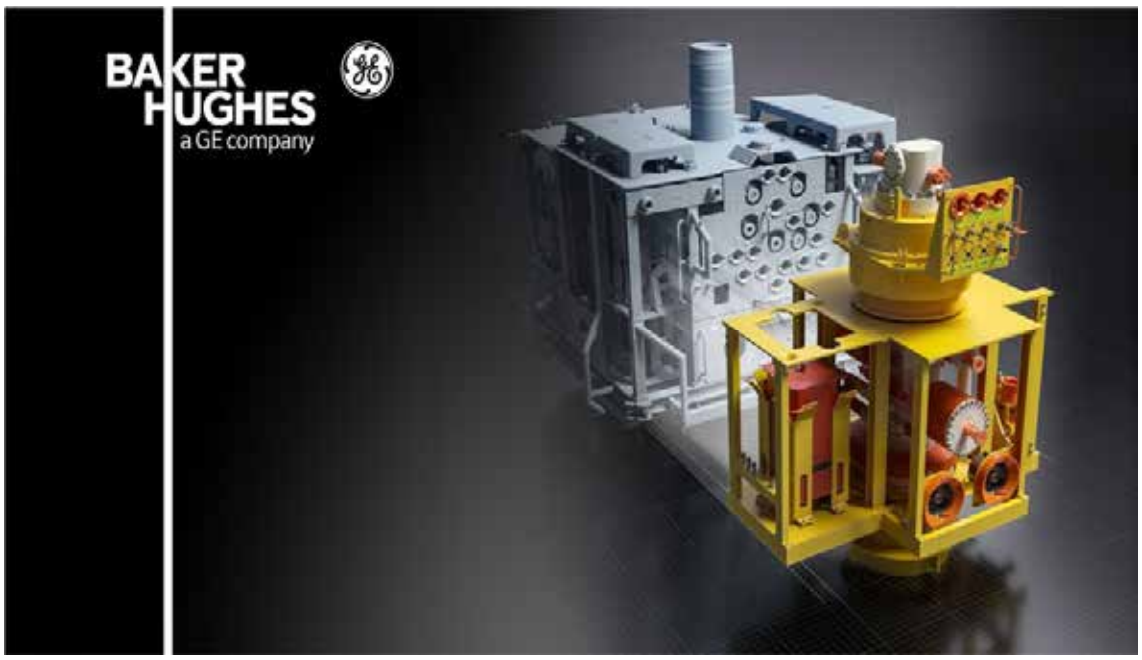
To achieve this, Apache renovated the workshop at the Al Madina Al Monawara orphanage, provided equipment and materials, and assigned a professional carpenter to lead the lessons. These kind of projects will ensure the children "to obtain sustainable skills to move forward," Chi told us.

In addition to helping orphanages, Apache has set up other educational initiatives. Under the Springboard program, the company has established 201 schools in rural parts of the country in an effort to improve the education of more than 10,000 girls.

"All of this comes from our belief that we give where we live," Chi said.

"We believe in generating strong returns, not only financially but also socially. That is how we can have a sustainable future and make an impact on the community where we live."

Shaping the future at Baker Hughes, a GE Company (BHGE), with a new lightweight compact subsea tree, designed to reduce overall system costs across the total life of the field



The industry is emerging from a significant downturn with global offshore capital investment projected to significantly in the next few years. Despite the improved outlook, the right economics are key. Subsea projects must be made more competitive in the wider energy supply market, by developing smarter solutions that drive cost out, as well as efficiency and productivity up.

BHGE revolutionary Aptara™ lightweight compact tree reduces not just initial CAPEX but also OPEX over the entire life-of-field. This TOTEX-lite approach uses a unique industry-first tree cap design that allows it to be adapted on the seabed to address the changing requirements over the life-of-field.

These simpler, lower-cost vertical subsea systems incorporate 4-inch, 5-inch and 7-inch production bores, 10,000 / 15,000 / 20,000 psi pressure ratings and can be run with or without a tubing head spool. The tree can be deployed in up to 3,000 m of water.

While BHGE Aptara™ lightweight compact tree is built on mature field-proven technology, its design is driven by BHGE life-of-field approach. It uses an innovative flow path that reduces size and complexity, which supports faster field development, lower field total expenditure (TOTEX) and increases value from the reservoir. The configuration has also been simplified, with a lower valve count requirement that still provides all the functionality needed and compliant with industry standards.

The Aptara™ lightweight compact tree has been designed with the entire lifecycle in mind and BHGE Make to Order variant can be delivered in 10 months. By reducing the number of components, the footprint and weight of the tree is reduced by around 50% compared to a traditional deepwater tree. With this reduction in size and complexity, comes a reduction in costs across the entire manufacturing cycle of the tree. Its size and weight offer flexibility during installation and enable vessel optimization. To flow the well, a Subsea Test Tree (SSTT) system can be used, either before or after tree installation, as well as a traditional Open Water Completion Workover Riser (CWOR).

The Aptara™ lightweight compact tree includes integrated flow metering, comprising BHGE's Virtual Flow Meter (VFM), downhole flow meter (SureFLO™) and water cut measurements at the tree, providing accurate oil, gas and water flow rate measurements at the wellhead. It also supports enhanced real-time condition monitoring and diagnostics enabling active control and monitoring of subsea equipment integrity.

Winer of the World Oil Award 2018 for "Best Deepwater Technology", Aptara™ lightweight compact tree is part of BHGE's APTARA family of lightweight, modular technology solutions, designed to be more responsive to changing conditions across the life-of-field and cut total cost of ownership by up to 50%.

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HOW TO AVOID OIL WELL BLOW-OUT DURING DRILLING OPERATIONS IN THE FUTURE?

The oil well drilling industry is considered one of the most dangerous industries in the world. Due its high risk, it is classified as the second most dangerous after the mining industry. Risks in oil well drilling operations consist of well kick problems, which may lead to uncontrollable well blow-out and cause huge negative impact on health, safety and environment (HSE).

The main objectives of oil well drilling are: keep HSE during all drilling operations; implement the well drilling program in minimum time, hence minimizing well cost; and create a hole in the earth crust that is usable for extracting the subsurface hydrocarbons. To achieve all of the previous targets, the oil well must be kept under control all time while different drilling operations are carried out, so well control safety is considered the cornerstone of the drilling industry.

Over 20 years ago, the world used to witness problems on well control and blow-out accidents very frequently. Because of this, international drilling associations such as IADC, well control organizations such as IWCF, and major international oil drilling companies worked together to create and develop a new advanced international well control system to avoid the huge losses resulted from blow-out accidents.

The International well control system depends on two basic elements. The first is a human element, which is the presence of good, experienced and well-trained drilling crews. The second is well control equipment, namely blow-out preventers (BOP), which have been continuously updated and enhanced to be able to control high subsurface pressures in few seconds. In addition to these two basic elements, the major international exploration and production (E&P) oil companies developed new policies and created very strict rules and procedures for reducing the risk of well control accident.

From the technical side, all technical and economic aspects of oil well drilling are related to well control. This means that the success of the drilling industry is dependent on well control and safety or risk level during all of drilling operations.

In my opinion, the Egyptian General Petroleum Corporation (EGPC) has to develop strict rules, procedures and policies to be included in a valuable well control manual. This manual should be used as a basic reference for all oil operating companies and drilling contractors in Egypt. It should also cover all aspects of well control basics, practices, calculations, testing procedures, rules, personnel roles and BOP equipment maintenance based on the API and IADC international manuals.

I also believe that high-quality technical and practical well control training is very beneficial for all drilling industry teamwork members. This technical training should be updated continuously to be compatible with the new drilling technologies and harsh conditions.

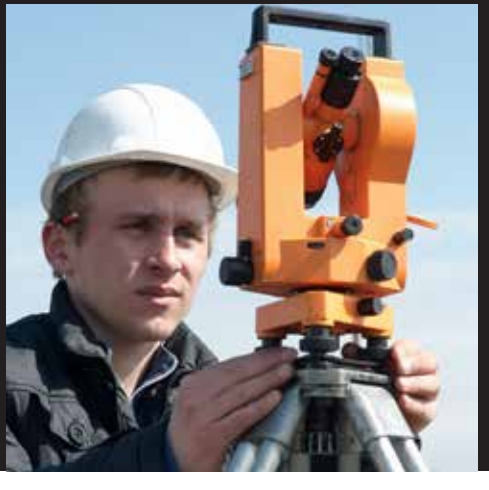
BY ENG. MOHSEN AHMED FARHAN
Drilling Department Head
General Petroleum Company (GPC)

TRENDS IN PETROLEUM ENGINEERING EDUCATION

The petroleum industry is characterized by significance, risk, and globalization. Significance means that the petroleum engineer can be required to take decisions that are worth several millions (and sometimes billions) of dollars. Examples include field development and decisions for drilling and completing high cost wells. Risk signifies the high cost for many operations that may result in undesirable outcomes. The petroleum industry is a global industry in the sense that petroleum and oil services companies operate with the same standards in every country regardless of whether the country is developed or developing.

The petroleum industry has been going through cycles of growth and decline (downturns). These downturns are characterized by suppressed oil prices and lower activity levels. After every downturn, the petroleum industry comes out leaner and looking for higher efficiency to drive the costs of development and operations down. The efficiency comes from expansion in applying advanced technology, utilization of more rigorous, efficient work processes, and more skillful workforces. In addition, petroleum companies also expect their petroleum engineers to reach autonomy in decision-making much faster than before. In the past, petroleum engineers used to reach this level of decision-making after seven to 10 years of graduation. In some statistics, reaching that level of autonomy is different and is a function of the company type (governmental, major, independent, or small producer). In recent years, it has been noticed that petroleum engineers reach that level of independence in less than five years and sometimes in less than three years. That required level of autonomy is attained through structured training programs, rapid exposure to increased levels of responsibility, and working through integrated teams. The level of undergraduate education is believed to significantly affect graduates in reaching the required level of maturity and experience to make multimillion-dollar decisions.

Petroleum engineering education has had to cope with these dynamics and with the emphasis on advanced technology and higher efficiency. Every few years, we witness the emergence of new contents that find their way into petroleum engineering curricula. In the past, petroleum engineering education branched from the fundamentals and conventional reservoir, production and drilling engineering education to more specialized topics such as reservoir simulation, well testing, artificial lift, stimulation, and advanced drilling that covers horizontal wells and deep-water applications. More recently, we also saw the advent of recent topics that cover more specialized technologies such as unconventional reservoirs and reservoir characterization. These advanced topics were integrated into petroleum engineering programs to cope with market demands and drive more efficient petroleum production. Very recently, there have been talks about adding data analytics and the applications of artificial intelligence and data mining in the petroleum industry into the core curriculum of petroleum engineering.



Petroleum engineering is very practical profession and its education cannot be completed without a strong emphasis on graduation projects and industrial training. The integration between academia and industry is very important to bridge the gap between classroom education

BY DR. AHMED EL BANBY
Professor and Chair of the Department of Petroleum and Energy Engineering
American University in Cairo

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EGYPT OIL&GAS RESEARCH & ANALYSIS

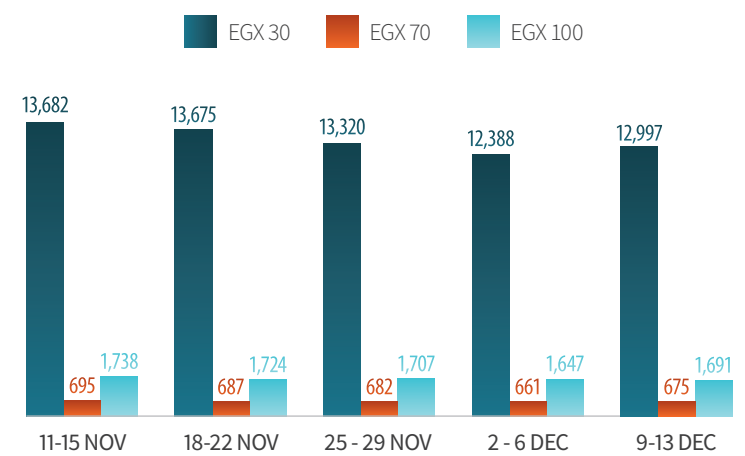
Annual Inflation Headline CPI

OCT 2018	NOV 2018
17.5%	15.6%

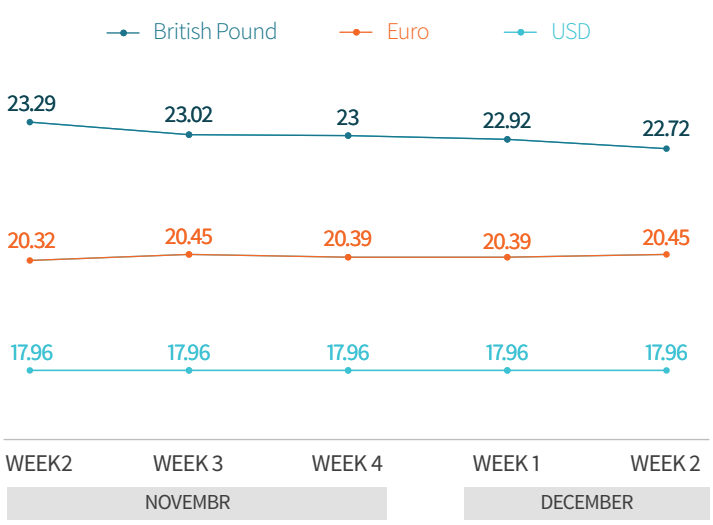
Net International Reserves ($ billion)

OCT 2018	NOV 2018
44.50	44.51

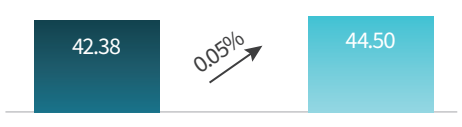
Capital Market Indicators



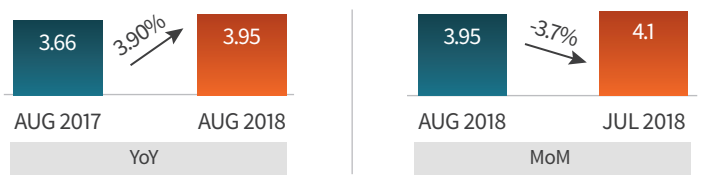
Exchange Rates



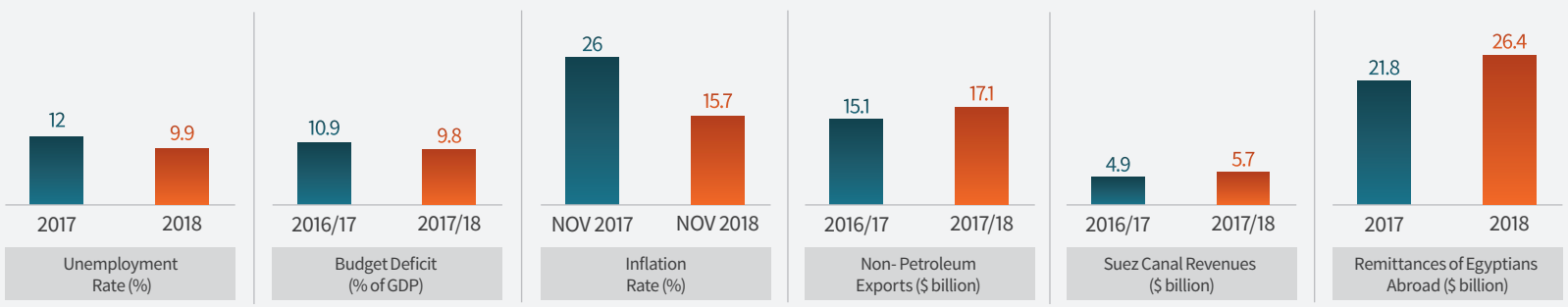
Average International Reserves ($ billion) (YoY)



Trade Deficit ($ billion)

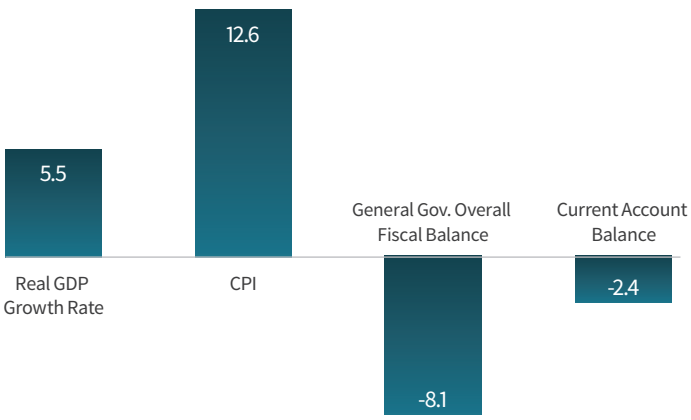


Egyptian Economic Indicators (YoY)

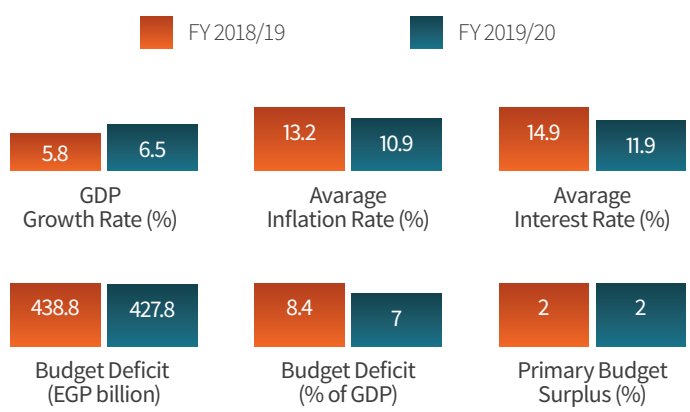


Sources of Raw Data: Central Bank of Egypt, Egyptian Exchange, Egyptian Cabinet

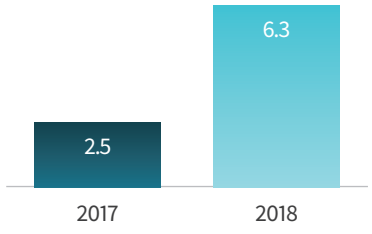
IMF Projections of Egypt's Economic Indicators in 2019 (%)



Ministry of Finance Projections of Economic Indicators



Share in MENA Mergers and Acquisitions Deal Value (%) (YoY)

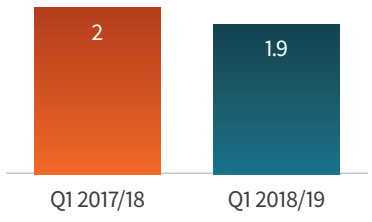


Egypt's Mergers and Acquisitions (YoY)

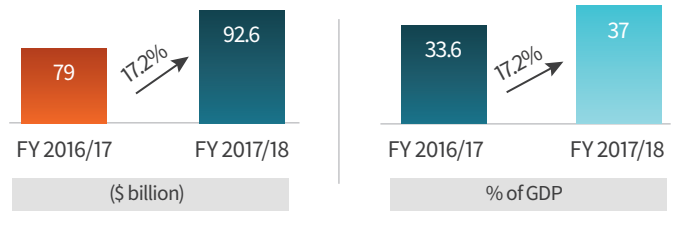
$389 MILLION
10 DEALS
2017

$1.5 BILLION
14 DEALS
2018

Budget Deficit (% of GDP) (YoY)



External Debt (YoY)



Egypt's Rank in Global Competitiveness Index

2017/18 (Out of 137)
2018/19 (Out of 140)

Global Competitiveness Index
100 ▲ 94

Labor Market Efficiency
134 ▲ 130

Market Size
25 ▲ 24

Quality of Overall infrastructure
71 ▲ 56

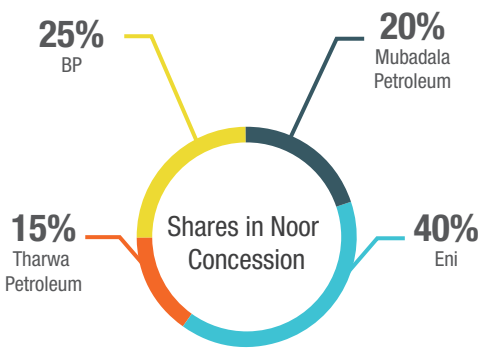
Innovation
109 ▲ 64

Sources: IMF, MoF, CBE, World Economic Forum, Mergermarket

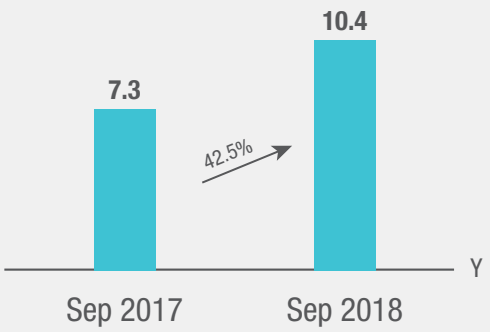
Dana Gas Company completed the Balsam-8 well drilling in **Q4 2017/18**, which added over **5000 boe/d** to production

From 2014-2018 Egypt has

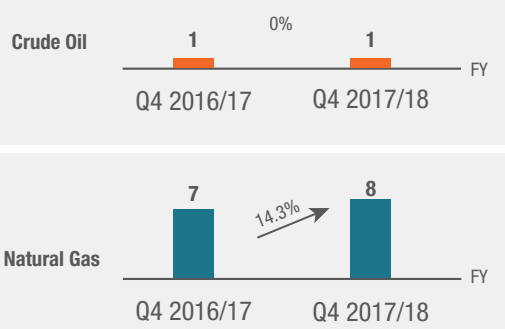
- Signed **63** petroleum agreements with around **$14** billion investments
- Conducted the biggest geophysical data collection projects in **the Red Sea** and **Upper Egypt**
- Decreased its arrears to the IOCs to less than **a third** reaching **$1.2 billion** by the end of June 2018
- Conducted **24** projects to develop natural gas fields, including Zohr, Atol, Nooros and North Alexandria

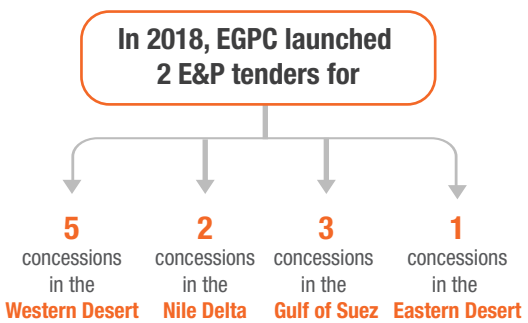


Crude Oil Average Price (EGP thousand/t) (YoY)



Petroleum Investments (% of Egypt's Total Investments) (YoY)

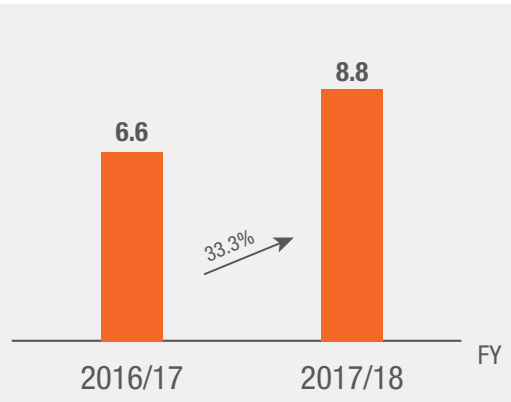




The total arrears paid by the Egyptian government to Dana Gas has reached

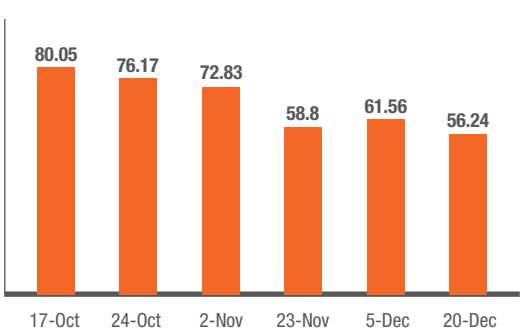
$199 million in 2018

Petroleum Exports ($ billion) (YoY)

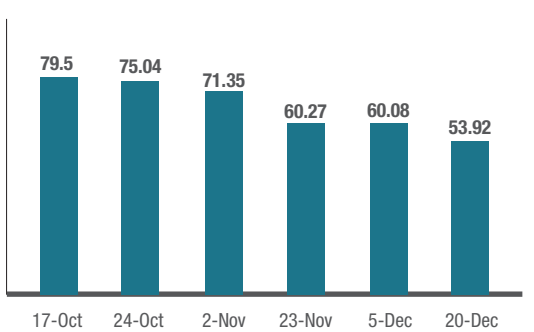


Sources of Raw Data: Ministry of Petroleum, Ministry of Planning, Eni and Central Agency for Public Mobilization and Statistics.

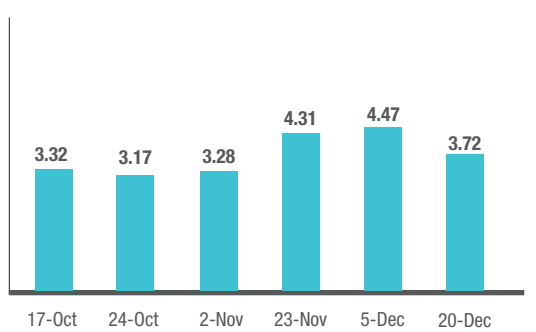
BRENT PRICES



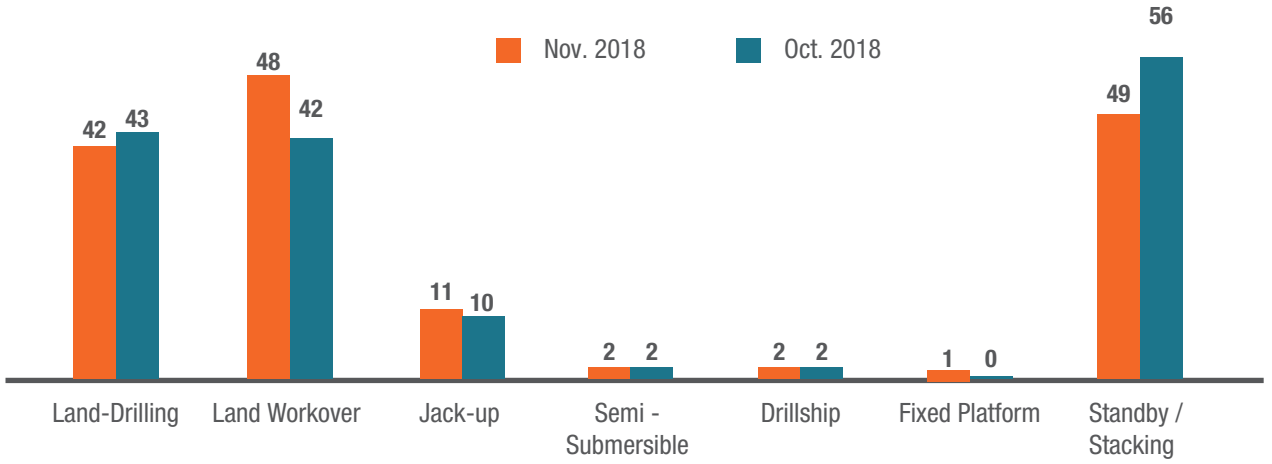
OPEC BASKET PRICES



NATURAL GAS PRICES



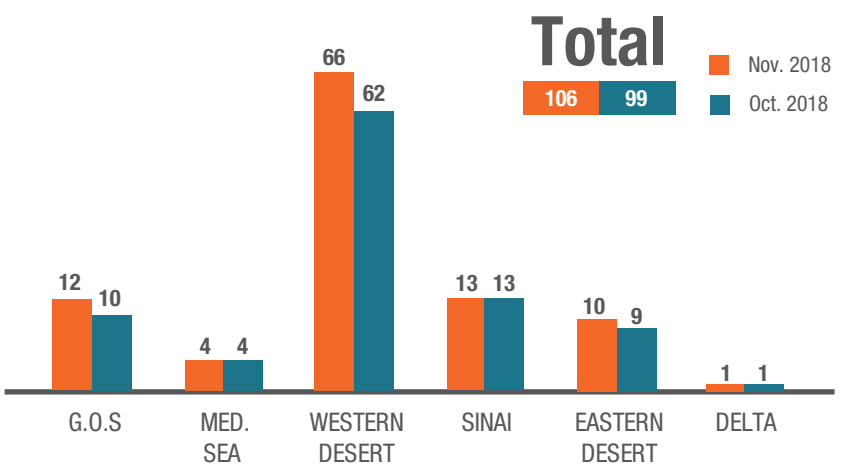
EGYPT RIG COUNT PER TYPE Nov. 2018



Total

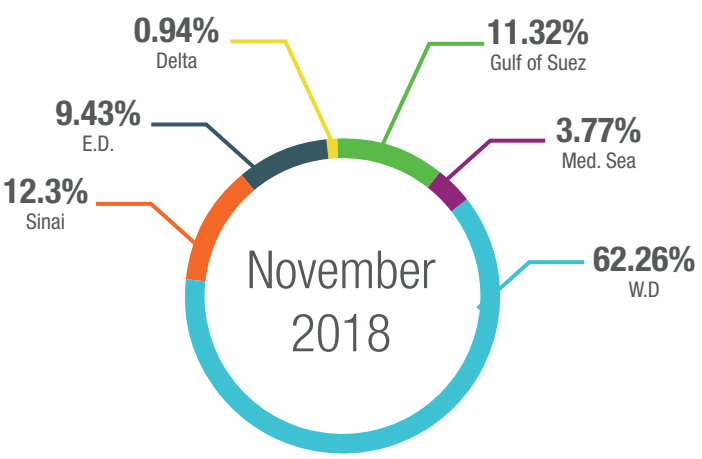
155	155

EGYPT RIG COUNT PER AREA Nov. 2018



The difference between the total of Rigs per Area and per type is due to the Stand By / Stacking number.

Distribution of Rigs



Egypt Production Nov. 2018

Total

545,793	B/D
6.5175	BCF/D
6343	MCF/D
92,074	B/D

Numbers are calculated per day on average.

	CRUDE OIL	GAS	SOLD GAS	CONDENSATES
MEDITERRANEAN SEA	600	3.7550	3655	31,169
EASTERN DESERT	66,267	0.0069	7	-
WESTERN DESERT	315,633	1.3084	1273	44,581
GULF OF SUEZ	115,667	0.1016	99	2,396
DELTA	233	1.3454	1310	13,465
SINAI	47,200	0.0001	0	463
UPPER EGYPT	193	0	0	0

Egypt Drilling Updates

REGION	COMPANY	WELL	WELL TYPE	RIG	DEPTH	WELL INVESTMENTS
EASTERN DESERT	GPC	HNW-2	Development	ST-9	5,289	828,466 $
	GPC	NAO 3/5 C	Appraisal	ADMARINE-6	6,637	3.686 M$
WESTERN DESERT	NORPETCO	GANNA-16	Development	ECDC-2	7,995	1.200 M$
	GPC	SWS AEB-1X	EXP	EDC-16	13,124	3.136 M$
	BAPETCO	NEAG 2-H	Development	EDC-72	9,499	2.400 M$
	KHALDA	MESK-1X	EXP	EDC-57	15,900	2.301 M$
		MENES-7	Development	EDC-54	12,103	1.701 M$
		M RZK-188	Development	EDC-62	7,200	1.800 M$
		SIWA 2 L-5	Development	EDC-11	15,471	2.300 M$
		HERUNFER W-11	Development	EDC-57	12,270	1.900 M$

*DRILLING are for Novmber 2018.

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