



H.E. TAREK EL MOLLA

Minister of Petroleum & Mineral Resources
Arab Republic of Egypt



EOG'S ROUNDTABLE

DELVING INTO BROWNFIELDS ATTRACTIVE CHANCES
**BRINGING MORE INVESTMENTS,
INCREASING PRODUCTION**



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SCOPE OUT EGYPT'S REFINING SECTOR OVER FYS (2014/15-2018/19)

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EDITOR'S LETTER

Reviving Egypt's Brownfields

On October 18, Egypt Oil & Gas organized a virtual roundtable focusing on increasing investments in Egypt's brownfields. The roundtable was under the patronage and with the participation of H.E. Eng. Tarek El Molla, Minister of Petroleum and Mineral Resources. It included several topics such as brownfield revival strategies, technology's role in boosting production from brownfields, as well as the economic barriers of using brownfields.

Thus, our November issue is fully dedicated to discuss different aspects of developing brownfields in Egypt. The event coverage can be found inside the issue. The coverage includes the recommendations suggested by our valuable industry experts who were speaking in the event.

Our industry insights section includes different opinions that are presented in quotes taken from industry experts. One of the features discusses Rate Transient Analysis (RTA), which unlocks wellbore flow performance through reshaping data usage. Another feature tracks the implications of fluctuating oil prices and its effect on brownfields development efforts. A third feature highlights water management optimization as one of the technical solutions to utilize brownfields production.

In the research and analysis section, we provide our readers with an analytical report about Egypt's Refining Sector over fiscal years (2014/15-2018/19).

Finally, our politics section analyzes the Nagorno-Karabakh conflict and its effects on the oil and gas industry.

Wish you an informative reading.

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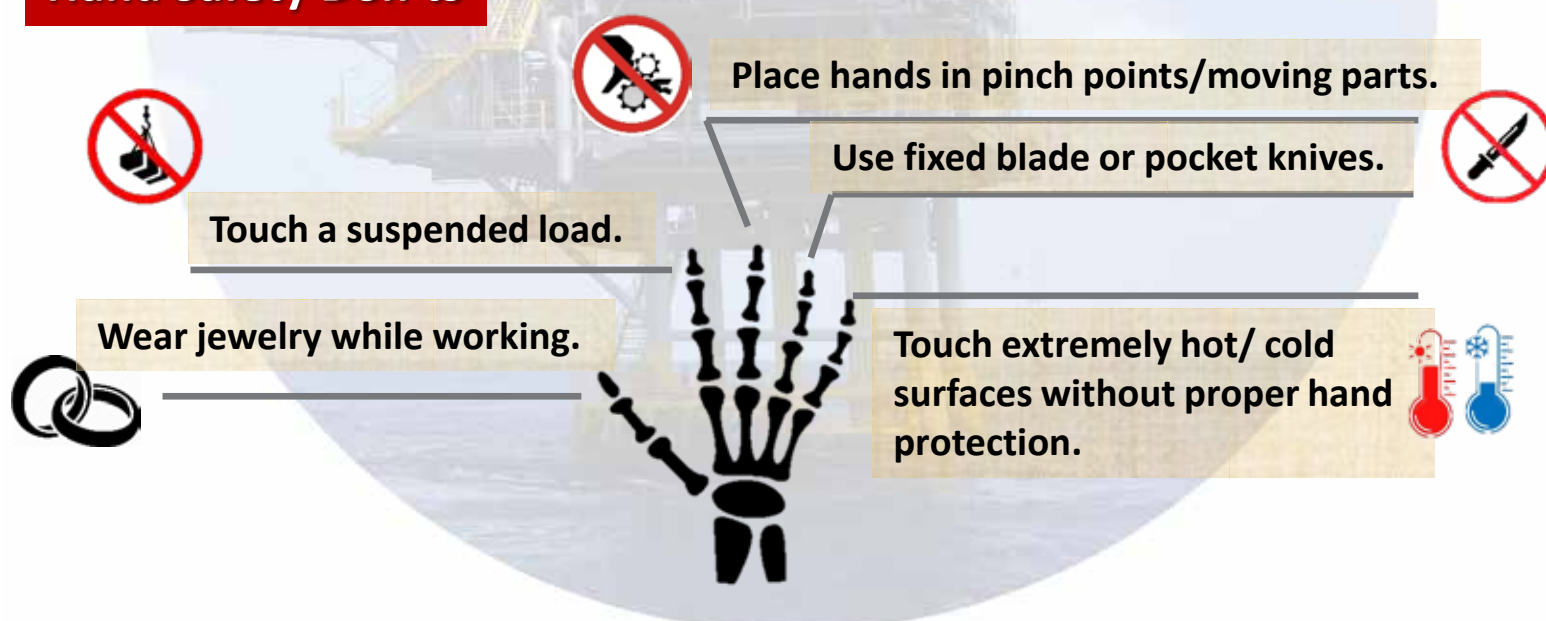
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Hand Safety Don'ts



Hatem Bashandy
HSEQ Area Manager
Halliburton–Egypt & Libya

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STOP the work for
any deviation



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INVESTMENTS



AL-SISI INAUGURATES NEW MOSTOROD PROJECT WORTH \$4.3 B

The Egyptian President Abdel Fattah Al-Sisi has inaugurated the Egyptian Refinery Company's (ERC) project in Mostorod with investments of \$4.3 billion, equivalent to EGP 70 billion, as it is one of the most important petroleum refineries in Egypt and Africa, producing 4.7 million tons of petroleum products per year.

This giant project comes in the framework of the ministry's plan to increase production and reach self-sufficiency of petroleum products through establishing more updated refineries.

HEIKAL: MOSTOROD REFINERY TO ACHIEVE SAVINGS WORTH \$1 B YEARLY

Chairman of the Board of Directors of Qalaa Holdings, Ahmed Heikal, said that Mostorod Refinery project will achieve savings for the country between \$600 million to \$1 billion per year.

Heikal said that during his speech in the inauguration of the refinery project in Mostorod in attendance of President Abdel Fattah Al-Sisi and the Minister of Petroleum and Mineral Resources, Tarek El Molla, in addition to other ministers and official leaders.

Heikal affirmed that the project was implemented despite the challenges it faced, which proves the state's and the petroleum minister's support. El Molla Urges Raising Mostorod Region's Efficiency

The Minister of Petroleum and Mineral Resources, Tarek El Molla, stressed the importance of raising the efficiency of

The Minister of Petroleum and Mineral Resources, Tarek El Molla, presented the strategy for infrastructure development in Egypt's refineries. According to El Molla, the ministry is updating the infrastructure for transporting, storing and shipping petroleum products at a cost of \$3 billion equivalent to EGP 48 billion.

El Molla added that Mostorod refining project is providing high-quality of petroleum products under international standards.

Mostorod region which comes in line with the integrated program of boosting the efficiency of all petroleum regions all over Egypt.

El Molla asserted that Mostorod is a strategic area which should be supported by health, safety and environment (HSE) operation system. This came during the meeting of the geographical committee of Mostorod petroleum region headed by El Molla in attendance of senior official leaders.

The minister gave directives to review the tasks and responsibilities related to the geographical petroleum regions to cope up with the new changes and utilization of the latest technologies. El Molla confirmed the commitment of the petroleum sector in developing the community by its projects.

FOAD: MOSTOROD REFINERY INTEGRATES ENVIRONMENT, ENERGY, INDUSTRY

The Minister of Environment, Yasmine Foad, praised the Egyptian Refinery Company's (ERC) Mostorod project as a model for integration between energy, environment and industry sectors, which is set to be one of the main elements for economic growth and a path to international markets.

Foad added that this project is implemented under environmental measures for triple treatment of industrial wastewater, noting that her ministry is continuously cooperating with the Ministry of Petroleum and Mineral Resources to fulfill the environmental safety conditions.

Foad said that the ministry is taking all precautionary measures for limiting pollution in Gulf of Suez and Nile River from exploration operations. She noted that tangible steps are being taken to merge biological diversity

to the petroleum and mining sector with guidelines for including environmental management within exploration and mining operations.

EBRD TO FUND APC'S PROJECT WITH \$250 MM

The European Bank for Reconstruction and Development (EBRD) announced its provision of a sovereign loan to fund a project by Alexandria Petroleum Company (APC) worth \$250 million for upgrading water and energy efficiency at the company's diesel refinery.

According to the bank, the project will install energy management system, cooling water tower, emissions monitoring system, pollution and emissions reduction investments, in addition to implementing an energy and

water efficiency investment program (EWEIP) and implementing a waste water treatment as well as other modernization investments.

The project aims to improve the refinery's efficiency, reduce energy consumption and emissions. It will also raise the quality of fuel according to Euro 5 standards and reduce water usage.

The total cost of the project is worth \$647 million.

KORRAENERGI LAUNCHES NEW PROJECT FOR GAS FLARING WORTH \$10 MM

Mohmaed Medhat, Energy Solutions Division Manager in KorraEnergi, said that the company will implement a new project in cooperation with Egyptian Maintenance Company (EMC) worth \$10 million.

He added that the project will be implemented using the latest Canadian-American technologies and includes establishment of a station to exploit the flaring gas instead of burning it in favor of Al Amreya Petroleum Refining Company (APRC).

The production capacity of this project is estimated at 100,000 barrels per year of butane, 3,500 barrels of condensates, and 1.4 billion cubic feet per year (bcf/y) of hydrogen to be used instead of natural gas in ovens, Medhat elaborated.

Medhat stated that the company's investments in exploiting flaring gas at the oil fields and refining companies reached \$20 million.

GPC ALLOCATES EGP150 MILLION FOR "NORTH WEST" PIPELINE PROJECT

General petroleum Company (GPC) has allocated EGP150 million for implementing 8-inches pipeline project to exploit gases produced from "North West" field in the Eastern desert.

Nabil Abdel Sadeq, the Head of GPC, said in a statement that the implementation of the project has commenced at the end of August 2020 and is expected to be finalized by the end of February 2021.

He added that the project is one of several projects that the company intends to implement to maintain the company's production rates and compensate the normal reduction in addition to increase the output in the upcoming period.

Abdel Sadeq elaborated that the company is still keeping its standard production levels at 64,500 barrels per day (b/d) which is the highest throughout its history despite the challenges of COVID-19.

CSR



MOP, EOG-CSR OFFER SECOND BATCH OF ANTI-CORONAVIRUS AID SUPPLY TO MEDICAL COMMUNITY

The Ministry of Petroleum and Mineral Resources, and Egypt Oil & Gas (EOG) Technical Committee through its Corporate Social Responsibility (CSR) subcommittee have sent the second batch of medical equipment today, Thursday 17, to

support the medical community amid the coronavirus (COVID-19) outbreak.

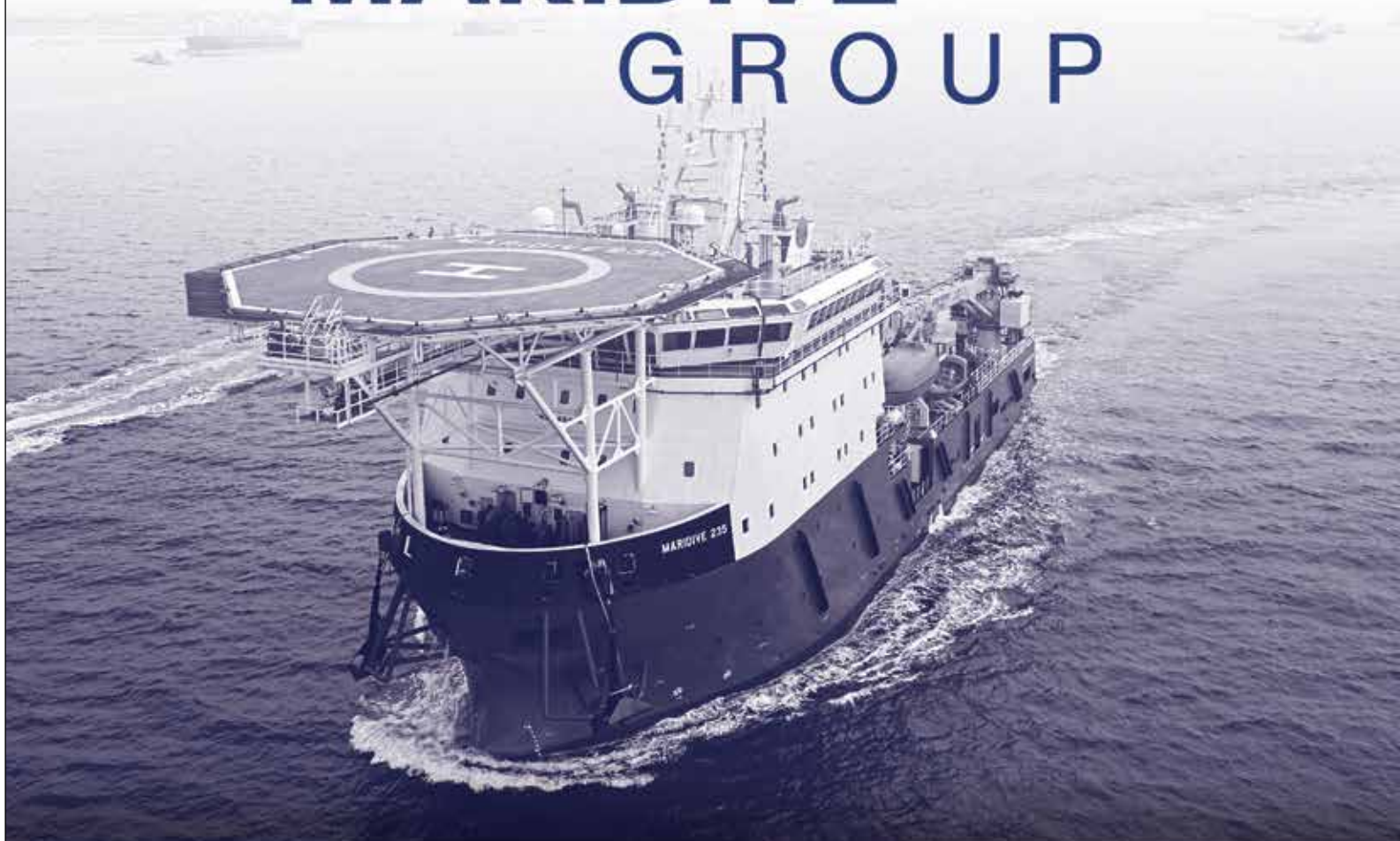
Several national oil companies (NOCs) and international oil companies (IOCs) have cooperated to donate medical gowns,

goggles, surgical masks, and other needed medical supplies to quarantine hospitals in Egypt to combat COVID-19. The donated medical supplies meet the standards to combat the virus. Misr El Kheir Foundation has also contributed to the subcommittee's efforts in delivering the equipment.

The donor IOCs include; Advanced Energy Systems (ADES), Apex International Energy, Bechtel,

Chevron Petroleum Corporation, Dana Gas, ENAP Sipetrol, Energean, ExxonMobil, IPR Group, KuwaitEnergy, Methanex, Neptune Energy, Petronas, Schlumberger, and WintershallDea.

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AL-SISI SUPPORTS EXPANSION OF ENI'S INVESTMENTS IN EGYPT

President Abdel Fattah Al-Sisi directed the Ministry of Petroleum and Mineral Resources to intensify cooperation with Eni for more exploration and production activities (E&P) in Egypt.

Al-Sisi urged facilitating Eni's operations in Egypt and overcoming any obstacles that may face the company, which comes in line with Egypt's goal to maximize its oil and gas resources and utilize them in an

optimum way in the development process to become a regional energy hub.

For his part, Eni's CEO, Claudio Descalzi, showcased the latest developments of several projects implemented in Egypt especially in the Red Sea, Mediterranean, and the Western region. He praised the fruitful partnership with the Egyptian government which is supported directly by Al-Sisi.

SDX EXCEEDS PRODUCTION GUIDANCE FOR 2020

SDX recorded 50–51 million standard cubic feet equivalent per day (mmscfe/d) from its South Disouq concession by the end of September exceeding production guidance for 2020 of 47–49 mmscfe/d.

SD-12X well located in South Disouq will be connected to the company's gas processing plant via a 5.8 kilometer (km) flow line to the Ibn Yunus-1X well location. Production is expected to begin in Q1 2021 and to produce at a stabilized rate of 10–12 million standard cubic feet per day (mmscfd) when connected. Additionally, SDX still awaits the ministerial

and parliamentary approval of the two-year extension to the South Disouq exploration area. Upon approval, the company plans to accelerate its drilling campaign to Q2/Q3 2021 from late 2021/early 2022.

As for West Gharib's concession, the company's production amounted to 3,300–3,325 barrels of oil per day (bbl/d) by September 30 exceeding the original 3,200–3,300 bbl/d. The newly added South Ramadan concession has been put on production on May 13 and produced about 390 – 400 bbl/d.

EGAS APPROVES SDX'S TWO-YEAR EXTENSION IN DISOUQ

The Ministry of Petroleum and Mineral Resources, represented by the Egyptian Natural Gas Holding Company (EGAS), approved to extend SDX Energy's agreement in South Disouq concession for two years.

SDX is still waiting to receive the final approval from the ministry and House of Representatives for the extension as it plans to start drilling two new wells in Disouq

targeting production of 165 billion cubic feet (bcf) of natural gas.

The company requested the extension after its positive results in the concession in addition to studies that confirm the richness of this area with about 223 bcf of natural gas. Additionally, the company has pumped expenditures worth \$8 million on Disouq concession during the first nine months of 2020.

ACTIS 5 EYES ABOUT \$4.5 B INVESTMENTS IN ENERGY, INFRASTRUCTURE

Actis plans to set up a new Middle East and North Africa (MENA)-focused international fund (Actis 5) of \$4–\$4.5 billion to invest in energy, infrastructure, and renewable energy projects, Sherif El Kholy, Partner and Head of MENA at Actis, stated.

The fund will concentrate its work on combined cycle power projects; wind power generation projects with build, own, operate (BOO) systems; and solar energy projects. Actis is also targeting investment in water desalination and treatment projects with its \$1.2 billion infrastructure fund. The fund will be limited so that sovereign funds,

major international pension funds, and major financial institutions will be the only organizations able to participate in the fund.

El-Kholy said that Actis is open for the Sovereign Fund of Egypt (SFE) to join their new fund, noting that both parties have previously signed a memorandum of understanding (MoU) for cooperation in multiple sectors.

The fund is expected to be up and running before the end of 2020, noting that they are currently completing the fund's subscription.

PETROFAC RESTRUCTURES MANAGEMENT, BOARD

Sami Iskander will join Petrofac and assume the role of Group CEO as of January 1, 2021, replacing Ayman Asfari after his retirement announcement. Asfari has decided to retire as CEO at the end of 2020, and Iskander will hold the role of Deputy CEO during the transition period starting on November 1. Following the transition phase, Iskander will join Petrofac's Board of Directors as its Executive Director.

Iskander has extensive knowledge in the oil and gas industry due to his 30 years of experience in the business in both oilfield services and exploration and production (E&P) companies. Previously, he was Shell's Executive Vice President of Upstream Joint Ventures overseeing business in Abu Dhabi, Brunei, Denmark, Egypt, Italy, Kazakhstan, Kuwait, and Oman.

NEPTUNE APPOINTS GIRARD AS DIRECTOR OF NEW ENERGY

Neptune Energy appointed Pierre Girard for the newly-created role of Director of New Energy. Back in August, Neptune created the new energy division to scale partnerships and investments in low carbon technologies, particularly hydrogen, carbon capture and storage (CCS), and electrification. Girard is currently Director of Commercial and Joint Ventures, United Kingdom (UK), and has held several titles throughout his career including

Interim Managing Director of Neptune's UK business.

Girard has a long and strong working experience in the oil and gas industry spanning over 30 years. He has worked with several international oil companies (IOCs) during that time including Elf, Chevron, and Engie in France, Angola, Egypt, and the UK.

CENTAMIN SUSPENDS OPERATIONS AT SUKARI PIT

Centamin has announced that it will suspend its operations in the Sukari open-pit Stage 4 West wall after detecting movement in a localized area of waste material.

The preventative measure aims to safeguard the health and safety of the workforce and the long-term potential of Sukari. Centamin has not given up on its work in the affected area and began a detailed geotechnical assessment focusing on developing a mining plan for the impacted area. The area was estimated to

contain approximately 90,000 ounces of gold in situ at grades of up to 2.0 grams per tonne of milled ore (g/t) Au. Accordingly, the company changed its 2020 guidance and stated that it will be reduced.

The mine's initial production for Q3 2020 was estimated at 120,000 ounces, bringing the total production of 2020 until September 30 to about 375,000 ounces. By suspending the operation, the company expects production for Q4 to be reduced to circa 70,000 ounces.

DANA GAS TO SELL EGYPT ONSHORE ASSETS TO IPR FOR \$236 MM

Dana Gas and IPR Wastani Petroleum Ltd have entered into a binding agreement for the sale of Dana Gas's onshore Egyptian producing oil and gas assets valued at \$236 million including contingent payments.

Per the Company's statement, Dana Gas will proceed with the sale of its 100% working interests in El Manzala, West El Manzala, West El Qantara and North El Salhiya onshore concessions and associated development leases. Dana Gas Egypt will continue to hold its interests in El Matariya (Block 3) onshore concession and North El Arish (Block 6) offshore concession and maximize their value.

The terms of the sale include cash consideration of \$153 million, and \$83 million of contingent payments depending on the average Brent prices and production performance between 2020–2023. Upon closing, the base consideration will be adjusted by the collections received and payments made by Dana Gas during the intervening period between the effective date, and the closing date.

The agreement currently awaits the approval of the Ministry of Petroleum and Mineral Resources and expected to be completed by early 2021.

CENTAMIN'S SUKARI PRODUCTION HIKES BY 31% YOY

Centamin's production from the Sukari gold mine increased by 31% year-on-year (YoY) in Q3 2020 with 128,240 ounces (oz) of gold compared to 98,045 oz in Q3 2019.

This brings the company's total production from January to September to 384,324 oz. Gold sales have also gone up by 9% YoY from 108,826 oz to 118,617 oz in Q3 2020. The amount of sold gold produced revenue of \$230 million with an average realized price of \$1,933/oz. Additionally, the total open pit ore mined was 3.8 million tons at an average grade of 1.01 grams of gold per tonne (g/t Au), a 5%

increase in tonnes and a 35% improvement in average grade YoY.

Centamin has kept its guidance for 2020 at 445,000–455,000 oz of gold produced and has rescheduled the open-pit mining sequence. This means that its Q4 production guidance will include about 60,000–70,000 oz, at an estimated cash cost of \$950–\$1,050/oz.

The company has also rescheduled its operation in Stage 4 West to H2 2021 and into 2022. Centamin halted operations in the area earlier this month after detecting movement in a localized area of waste material.

NAFTOGAZ'S INVESTMENTS SURPASS \$535 MM IN EGYPT

Naftogaz of Ukraine's investments in Egypt have amounted to over \$535 million over the course of 14 years, according to the Director of Naftogaz in Egypt, Fedir Baiuk.

Baiuk stated that the company is currently involved in several oil and gas projects in collaboration with the Egyptian General Petroleum Corporation (EGPC) and Ganoub El

Wadi Petroleum Holding Company (Ganope). Such projects include Alam El Shawish East concession in the Western Desert, as well as Wadi El Mahareeth and South Wadi El Mahareeth in the Eastern Desert.

The company aims to develop the current concession agreements and to increase its investments in Egypt.

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SAUDI ARABIA

Saudi Arabia, the world's largest oil producer, has reduced its crude oil production by only 14,000 barrels of oil per day (bbl/d) compared to August's figures, keeping output at a steady pace. The Kingdom pumped 8.974 million barrels per day (mmbbl/d) in September compared with 8.988 mmbbl/d in August. In terms of exports, the kingdom exported 6.1 mmbbl/d during September, up from 6.0 mmbbl/d in August. This can be explained by Saudi Arabia traditionally having more oil for export after the end of its scorching summer as its domestic petroleum consumption declines.

Saudi Aramco has announced new petroleum prices starting October 11. The company lowered the price of Gasoline 91 to 1.44 riyals, and Gasoline 95 to 1.59 riyals as compared with the previous prices of 1.47 and 1.63, respectively. Energy product prices are adjusted according to government procedures to amend energy and water prices, noting that domestic energy product prices are subject to change according to changes in export prices from the Kingdom to global markets. Aramco announced in February that it will now review gasoline prices on a monthly basis as opposed to the old system of each quarter.

Aramco and the Institute of Energy Economics Japan (IEEJ), in partnership with SABIC, have successfully produced and shipped the world's first batch of blue ammonia from Saudi Arabia. Forty tons of high-grade blue ammonia have already been dispatched to Japan for use in zero-carbon power generation. Ammonia, a compound consisting of three parts hydrogen and one part nitrogen, is a landmark step towards the world's transition to Hydrogen fuel. Ammonia contains approximately 18% hydrogen by weight and is already a widely traded chemical on the world stage. It releases zero carbon dioxide (CO₂) emissions when combusted in a thermal power plant. This is part of the concept Circular Carbon Economy, whereby CO₂ emissions are reduced, removed, recycled, and reused.

Saudi Industrial Investment Group and National Petrochemical Company have initiated talks to merge the two companies, resulting in an \$11 billion

petrochemical enterprise. The companies said that discussions are still at an early stage and no agreement has been reached, yet. Saudi Industrial owns 50% of National Petrochemical, and a full-blown merger was attempted nine years ago. As a result of this news, the companies' shares climbed as the National Petrochemical's shares closed at the highest level since 2014, giving it a market value of about \$4 billion. Saudi Industrial ended 5.5% higher in Riyadh. This is in direct response to the lower oil-price environment as Middle Eastern companies assess their options. Saudi Arabia, Qatar, and the United Arab Emirates (UAE) are all restructuring their operations.

Saudi Aramco and Saudi Basic Industries (SABIC) have reevaluated their \$20 billion crude-oil-to-chemicals project with a view to integrating existing facilities instead. This decision has been taken in light of the global energy crisis with the companies looking to conserve cash at a time of economic uncertainty. As a result, SABIC said the two companies were now considering the integration of Aramco's existing refineries in Yanbu with a mixed feed steam cracker and downstream olefin derivative units. Aramco and petrochemical producer SABIC signed a preliminary deal to build a \$20 billion complex to convert crude oil to chemicals back in 2017.

Rosneft and Saudi Aramco are increasingly unlikely to bid in the privatization of Bharat Petroleum Corporation (BPCL). However, low oil prices and weak demand have curbed the companies' investment plans. As a result, Rosneft is now only interested in BPCL's marketing business, which consists of fuel depots and more than 16,800 fuel stations. India's government is looking to generate funds to try and bridge a fiscal deficit that has already topped the annual target to raise \$8 billion to \$10 billion through the sale of its stake in BPCL.

Rosneft had expressed an interest in buying the federal government's 53.29% stake in Bharat Petroleum (BPCL) back in February, while India's trade minister has said that Aramco was enthusiastic about the stake sale.

LIBYA

Libya's daily oil production continues to see a meteoric rise since the resumption of operations, with oil production rising to 500,000 barrels per day (bbl/d). The country's biggest oilfield, Sharara, is at present pumping roughly 110,000 bbl/d with the southwestern deposit having a capacity of 300,000 bbl/d. In terms of oil-producing companies, Arabian Gulf Oil Corporation posted production figures of 257,000 bbl/d from its eastern fields; Sirte Oil Corporation (which operates fields supplying Brega port) is pumping 76,000 bbl/d; fields run by Mellitah Oil Corporation are producing 100,000 bbl/d. According to forecasts by JP Morgan, Libyan output could hit 1 million barrels per day (mmbbl/d) by the end of March 2021 with the likes of El Feel oilfield (70,000 bbl/d) yet to resume production.

Libya's National Oil Company (NOC) has announced that the force majeure at Sharara oilfield has been lifted with immediate effect and that production has restarted. The decision comes into effect from October 11 and

is dependent on the safety and safety of the workers. The NOC acknowledges the efforts made by both local and international parties and pledges to adhere to the professional and non-political constants. With regard to the oil profits, the company stressed that it is a matter for the executive authority in the country.

The Organization for Petroleum Exporting Countries and its allies (OPEC+) are closely watching attempts to resume oil output in Libya and are assessing the situation. A restart in Libyan exports could mean further cuts for other OPEC members as Libya is exempt from cuts under the current OPEC deal. With the resumption of Libyan oil, there will be a further influx of oil into an already saturated market. As a possible reaction to the resumption of exports, oil prices fell to \$42 a barrel on September 21. However, as of yet, OPEC sources said time was needed to assess the situation. Libya's NOC lifted force majeure on what it deemed secure ports and facilities, and restart procedures are underway at some locations following a blockade that began in January and cut production.



UNDER THE HIGH PATRONAGE OF **HE. ENG. TAREK EL MOLLA**
MINISTER OF PETROLEUM & MINERAL RESOURCES - ARAB REPUBLIC OF EGYPT



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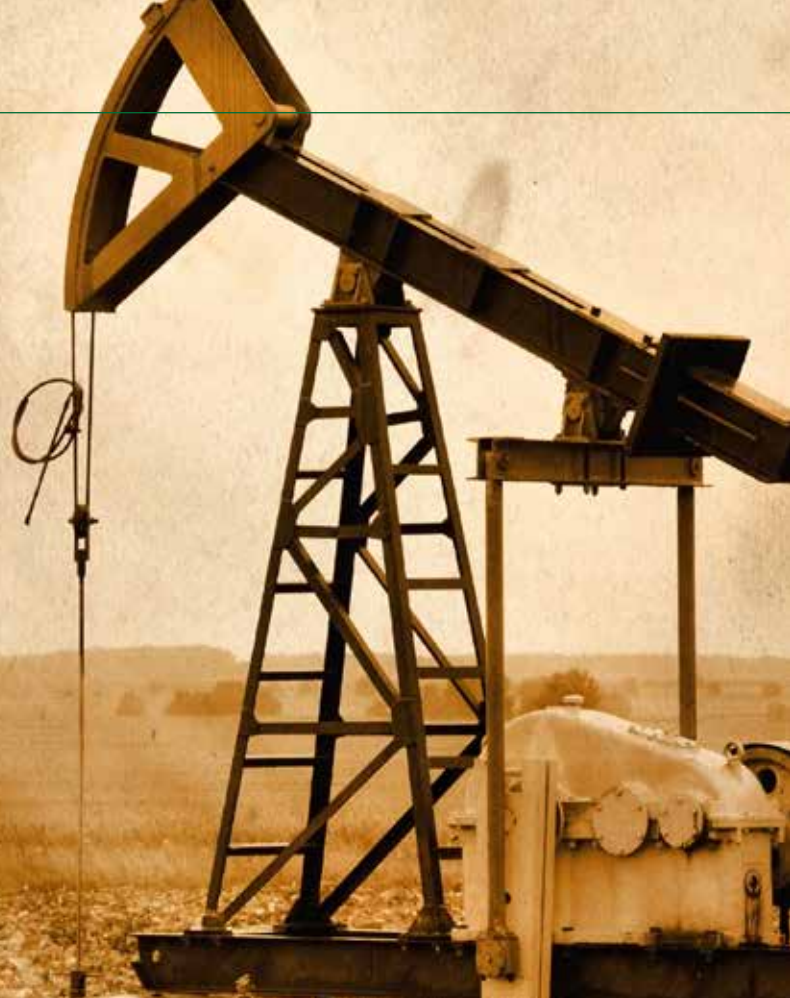
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UNTAPPED POTENTIAL: BROWNFIELDS MAKE A COMEBACK



BROWNFIELDS IN EGYPT

The Minister of the Petroleum and Mineral Resources, Tarek El Molla, said in the Upstream Technical Convention Conference in December 2019, that Egypt aims to boost crude oil production. As a consequence, the minister stressed the importance of increasing brownfields' production, adding that Egypt has several distinguished sites in the Western Desert and Gulf of Suez which are rich with conventional and non-conventional hydrocarbons. El Molla declared an agreement upon establishing a technical committee from the petroleum sector and some of the international companies' heads and some of the experts in the industry to study how to improve the brownfields performance, provided that the committee would present its recommendations by the end of Q1 2020.

WintershallDea announced that it is eyeing increased investments in Egypt's mature oil fields in July 2019. The company said it would invest more than \$500 million over three years (2018–2020), aiming to significantly boost its gas and oil production in the country. To increase production from the mature oil fields in the Gulf of Suez, WintershallDea carried out a workover of existing wells, drilling sidetracks, and replaced existing pipelines with new ones with greater capacity. Additionally, WintershallDea implemented a plan to maintain asset integrity through an active maintenance and replacement program.

The petroleum sector declared in July 2019 to raise its daily crude oil production to reach 720,000 barrels per day (bbl/d) and help reduce pressure on mature oil fields. Production rate stood at around 675,000 bbl/d, which was accomplished after introducing new explorations that led to a production increase. The petroleum sector has been maintaining Egypt's petroleum production at a minimum rate of 670,000 bbl/d while facing a shortage in mature wells, as the sector planned to intensify its exploration for new wells. Crude oil production would rely on new exploration areas like East Bahria in Qarun fields as well as facilitating the production in Southwest of Meliha and intensifying the fields' development processes in the Western Desert.

INTERNATIONAL BROWNFIELDS

Perenco has agreed in July to acquire interests in seven mature non-operated fields offshore Gabon, along with interests and operatorship in the Cap Lopez oil terminal from Total's 58%-owned affiliate Total Gabon for \$290–350 million, dependent upon future Brent prices. Estimated production divested by Total Gabon amounted to 8,000 SEC barrels per day (bbl/d) of oil in 2019. With the deal, Perenco will acquire Total's 65.275% interest each in Grondin, Gonelle, Barbier, Mandaros, Torpille, and Pageau areas, along with Total's 37.5% interest in Hylia and its 100% interest in Cap Lopez oil terminal. Total will give up any interests in the assets following the deal's close but continues in Gabon through its operated production clusters at Anguille-Mandji and Torpille-Baudroie-Mérou.

Construction completed in April for two revamps of brownfield units based on composite ionic liquid (IL) alkylation technology at Sinopec's 161,000 bbl/d refinery in Anqing, Anhui Province, and Wuhan Petrochemical Corporation's 161,000 bbl/d refinery in Wuhan City. Each unit is designed to produce 300,000 tonnes/year of high-quality alkylate with research octane numbers ranging from 96–98. Commissioning of the Anqing refinery's Ionikylation unit had been scheduled for mid-July, while the Wuhan unit would be commissioned by the end of Q3 2019. Ionikylation alkylation technology uses a

proprietary composite IL catalyst that eliminates reliance on more dangerous, corrosive, and hazardous chemicals such as hydrogen fluoride and sulfuric acid—as they seek to meet increasingly more stringent clean-fuel standards.

Brunei Shell Petroleum signed a brownfield services contract with Aker Solutions in March, in a joint venture with PTAS SdnBhd, for offshore maintenance and modification services in Brunei. The scope of the five-year contract covers maintenance and upgrades to maintain production levels for more than 200 offshore assets in the South China Sea. Work will be managed from PTAS Aker Solutions SdnBhd's office in Kuala Belait, Brunei Darussalam.

Saudi Aramco signed an EPCI contract to Saipem in March for offshore brownfield contract work encompassing the design, engineering, procurement, construction, and installation of a 36-inches carbon steel pipeline onto the existing network around the Ju'aymah area and brownfield services at the associated offshore platform. The award is part of the long-term agreement in force until 2021.

Nigeria LNG Ltd. (NLNG) partners made a final investment decision (FID) in February to expand NLNG's 6-train liquefied natural gas (LNG) plant at Finima on Bonny Island, Nigeria. The brownfield development, which is expected to start-up in 2024, will increase the annual production capacity to more than 30 million tonnes of LNG per year from the current 22.5 million tonnes per year, Nigerian National Petroleum Corp. (NNPC). The expansion adds 7.6 million tonnes per year of LNG—4.2 million tonnes per year from a new liquefaction train (Train 7), and 3.4 million tonnes per year from the debottlenecking of existing trains. NLNG is a Nigerian joint venture of NNPC 49%, Shell 25.6%, Total 15%, and ENI (NA) NV 10.4%.

Total SA, operator of Block 17 offshore Angola, along with partners Equinor, Exxon, and BP, signed an agreement in December 2019 with Angola's national oil, gas, and biofuels agency (ANPG) and state-owned Sonangol of Angola, to extend the consortium's production licenses to 2045. Within this contract extension, three short-cycle brownfield projects—Zinia Phase 2, CLOV Phase 2, and Dalia Phase 3—are under development on the block and are expected to add 150 million barrels (mmbbl) of resources. Other brownfield projects for extending the production of Pazflor, Rosa, Girassol, and Dalia are under study. Additional exploration campaigns may unlock further resources, Total said, and two wells were expected to be drilled in 2020. The offshore blocks currently produce some 440,000 barrels of oil equivalent per day (boe/d), with more than 1 billion bbl is yet to be produced.

DRILLING TECHNOLOGIES

Weatherford has launched in October ForeSite Sense, the world's most comprehensive reservoir monitoring solution that shows, in real-time, the critical downhole data that determines profit: pressure, temperature, and flow. ForeSite Sense delivers actionable, real-time intelligence across the spectrum of wells. With regards to mature wells, the technology provides cost-effective solutions to drive down the cost of well-ownership with simple and reliable ForeSite Sense pods. Also, with shale wells, it manages the multiple producing zones with ForeSite Sense quartz solutions. For deepwater wells, it optimizes reservoir drainage with ForeSite Sense optical distributed sensing solutions.

Halliburton has introduced in October SmartFleet, the first intelligent automated fracturing system. SmartFleet, unlike any current fracturing fleet, gives operators real-time fracture control while pumping by integrating subsurface fracture measurements, live 3D visualization, and real-time fracture commands. The SmartFleet system connects to the reservoir through subsurface sensing to continuously measure cluster uniformity and fracture geometry. The system applies the measurements to make intelligent adjustments that improve fracture placement. SmartFleet also provides users a direct line of sight to live, 3D fracture geometry, projected fracture growth, and cross-well interactions. With SmartFleet, operators can control fracture outcomes in ways not previously possible, through real-time fracture decision-making and commands. This includes automated actions while pumping to improve near-wellbore and far-field fracture placement, as well as directly manage frac hits.

Weatherford International has announced in August a strengthened collaboration with upstream data visualization provider INT to provide next-level, real-time well visualization in both 2D and 3D. Weatherford will embed INT's IVAAP framework into the Weatherford Centro digital well delivery software, advancing its data visualization capabilities. This will offer workflows that integrate every element of an operator's well data, allowing team members from any global location to access, share, and store all vital project information at any time. Weatherford has been at the forefront of software innovation, especially in drilling and production. Both companies have built a strong relationship by embedding advanced HTML5 domain visualizations libraries and modules from INT in several Weatherford software applications.

Halliburton and TechnipFMC have introduced Odissea, the first distributed acoustic sensing solution technology into their subsea well operations in July. The new technology platform enables operators to execute intervention-less seismic imaging and reservoir diagnostics to reduce the total cost of ownership while improving reservoir knowledge. It is an integration of hardware and digital systems to strengthen digital capabilities in subsea reservoir monitoring and production optimization. Halliburton was assigned to be in charge of providing the fiber optic sensing technology, completions, and analysis for reservoir diagnostics. Meanwhile, TechnipFMC was assigned to provide the optical connectivity from the top side to the completions. Through this merger of technical skills, operators can accelerate full-field subsea fiber optic sensing, design, and execution.

Halliburton has released a new drilling technology in May, namely, DynaTrac Real-Time Wireless Depth Correlation System. This technology reduces uncertainty and saves rig-time by enabling operators to accurately position packers, perforating guns, and the bottom-hole assembly (BHA) without running wireline or moving the work string. The DynaTrac system takes static measurements to determine the position of the BHA

before and after setting the retrievable packer. Operators can measure the depth at any time while tracking changes in position to improve operational efficiency.

ENHANCED OIL RECOVERY

Gazprom Neft and Zarubezhneft have closed a transaction establishing a joint venture (JV) to develop Salymsky license blocks in the Khanty-Mansi Autonomous Okrug last August. This JV will provide a platform for developing and testing enhanced oil recovery (EOR) technologies. The JV's asset portfolio will include the Salymsky-3 and Salymsky-5 license blocks in the Khanty-Mansi Autonomous Okrug-Yugra. As of August, 3D seismic works have been undertaken at the Salymsky-3 and Salymsky-5 license blocks, the first exploration and appraisal well drilled, and a 15-stage fracking operation completed. Geological prospecting works are expected to start at the adjacent Salymsky-5 block by the end of 2020. Preliminary prognoses suggest initial reserves in place at both blocks comprise more than 500 million tonnes of oil. Depending on the outcomes of geological prospecting works, commercial production at Salymsky-block hard-to-recover reserves could start as soon as 2025.

BASF offered in August high molecular weight polymer and polymer injection technologies for EOR to extend the life of a major oilfield in Argentina. The design, supply, installation, and commissioning of five modular polymer injection units were previously successfully completed in close collaboration with the operator. These units can minimize mechanical degradation of the polymer used in the EOR process and are part of chemical flooding projects to help increase oil recovery rates. In such a polymer flooding project, hydration and injection of the polymer solution with minimal mechanical degradation are essential.

Abu Dhabi National Oil Company (ADNOC) announced in November 2019 its plans for the United Arab Emirates (UAE) to be among the top four countries in the world in carbon capture, use, and storage (CCUS) EOR projects, by 2025. Of a forecast 55 million tonnes per year (mmt/y) global CCUS capacity, ADNOC expects to have 5 mmt/y compared with the US' 33 mmt/y and China's and Canada's 7 mmt/y each. ADNOC's Shah ultra-sour gas plant could contribute 2.3 mmt/y of carbon dioxide to this total, with another 1.9 mmt/y coming from the Habshan and Bab gas complex. By continuing to develop its EOR capabilities, ADNOC seeks to ensure sustainable oil production and 70% ultimate recovery. It also is developing polymer, chemical, low salinity, and hybrid EOR using a combination of CO₂ and chemical injection. The company envisions the creation of a CO₂ hub and network.

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SCOPE OUT EGYPT'S REFINING SECTOR

OVER FYS (2014/15-2018/19)



BY AMINA HUSSEIN, REHAM GAMAL, AND TASNEEM MADI

Egypt is the second largest oil refining country in Africa, acquiring about 23% of the total domestically-refined crude oil in Africa. There are 12 refineries in Egypt, operated by the Egyptian General Petroleum Corporation (EGPC), with a total capacity of 795,000 barrels per day (bbl/d) in 2019, according to BP's Annual Statistical Review of 2020. The Ministry of Petroleum and Mineral Resources (MoP) has been working on fulfilling self-sufficiency of petroleum products since 2016, when imports reached 10 million tons (mmt) annually at a cost of \$4.5 billion (EGP 75.9 billion), noting that these rates declined during 2020, reaching 3.5 mmt with \$1.5 billion (EGP 25.3 billion).

Within the report, all investment costs in dollars and EURs are calculated in their equivalent in EGP on the basis of 2019 average exchange rates.

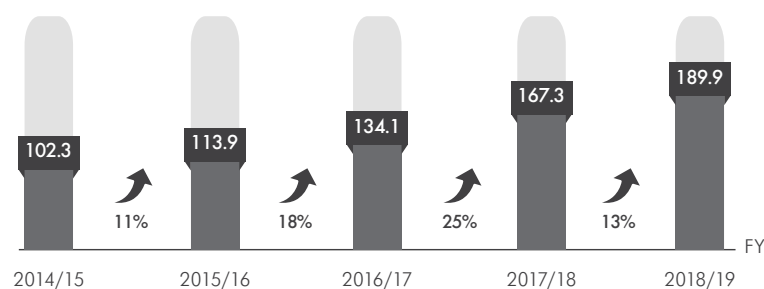
REFINING SECTOR ECONOMIC PERFORMANCE

1. SECTOR'S CONTRIBUTION TO GDP

Over the period from fiscal year (FY) 2014/15 to 2018/19, the refining industry contributed a total of EGP 707.4 billion as Gross Domestic Product (GDP). The refining activities' GDP witnessed a continuous increasing trend over the mentioned period moving consistently with the government's mega projects targeting increasing petroleum product's supply. The refining GDP remarkably increased by 85.6% from EGP 102.3 billion in FY 2014/15 to EGP 189.9 billion in FY 2018/19, according to data published by the Ministry of Planning and Economic Development (MPED).

Despite the increasing value of the refining sector GDP, the sector's share in the total GDP has declined. The share dropped from 4.1% in FY 2014/15 to 3.7% in FY 2018/19, the lowest over the whole period, according to MPED's data.

Refining GDP (EGP billion)



On an annual average, refining contributes 30% of petroleum GDP. The highest share of refining in petroleum GDP was 39% in FY 2015/16, which happened as the crude oil GDP contribution declined, according to MPED's data.

The refining sector has a remarkable weight in the transformative industries activities. Over the mentioned period, refining activities share in transformative industries' GDP ranged between 22% and 25%, according to MPED's data.



Refining Share in GDP over FYs (2014/15-2018/19) (%)



The public sector dominates refining GDP, as over the referred period, the public sector contributed a total GDP of EGP 670.84 billion, while the private sector contributed only EGP 36.54 billion, according to MPED's data.

Both sectors' GDP exhibited an increasing trend over the comparison period. On one hand, public refining GDP increased by 85.7% from EGP 96.96 billion in FY 2014/15 to EGP 180.04 billion in FY 2018/19. On the other hand, private refining GDP rose by 85.3%, from EGP 5.3 billion in FY 2014/15 to EGP 9.82 billion in FY 2018/19, according to MPED's data.



Refining GDP per Sector over FYs (2014/15-2018/19)



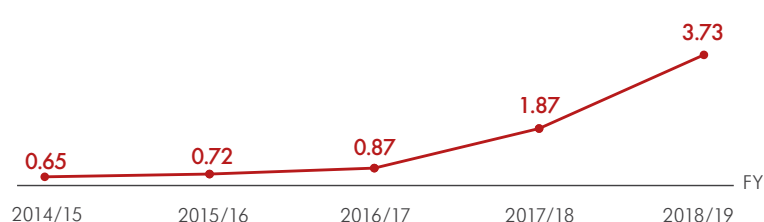
2. SECTOR'S CONTRIBUTION TO INVESTMENTS

Boosting investments in the refining sector comes as part of the MoP plan to expand and develop refineries. Hence, the sector will be able to increase the domestic production of high-value petroleum products to meet the local market's needs with the potential of exporting the surplus. With this regard, over FYs (2014/15 to 2018/19), the investments pumped into the refining sector recorded EGP 7.47 billion, representing 0.3% of the total public investments, according to MPED's data.

Yet, these investments experienced an outstandingly increasing trend, hitting the highest value in FY 2018/19 at EGP 3.73 billion. It is worth mentioning that the investments have increased five-fold in FY 2018/19 compared to FY 2014/15, which witnessed the lowest investments of only EGP 0.65 billion. Further, over FYs 2017/18 and 2018/19, the refining investments jumped by 115% and 100%, respectively, in line with the expansion projects in Midor and Mostorod two of the largest refineries in Egypt, stated by MPED's data.



Refining Investments (EGP billion)

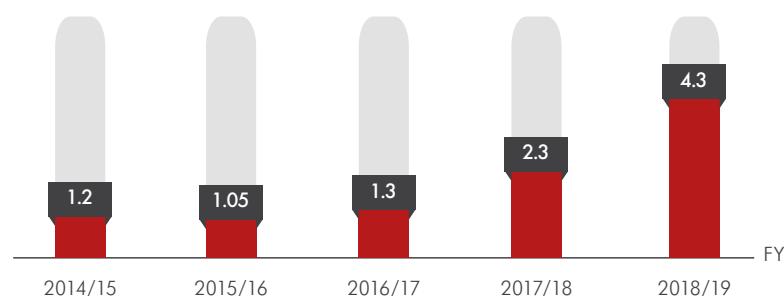


Over the referred period, the petroleum refining contribution in the petroleum sector's investments, represented only 2% while crude oil and natural gas contributions act

38% and 60% respectively. Yet, the refining contribution followed an increasing trend over the years, reaching its highest in FY 2018/19 with 4.28%, explained by MPED's data.



Refining Share in the Petroleum Sector's Investments (%)



B. EGYPT'S MAIN REFINING COMPANIES

1. MIDDLE EAST OIL REFINERY (MIDOR)

MIDOR is one of the most important refineries in Egypt. The refinery was established in 1994 to refine crude oil and to process high-quality petroleum products for the domestic market as well as the international markets. MIDOR has a design capacity of 115,000 bbl/d. The refinery's investments reached approximately \$1.4 billion (EGP 23.6 billion), according to the company's official website.

MIDOR is owned by state companies including the EGPC, Engineering for the Petroleum & Process Industries (Enppi), the Petroleum Projects and Technical Consultations Company (Petrojet), and Suez Canal Bank, according to the refinery's official website.

In FY 2018/19, MIDOR achieved the highest revenues over a period of five years with \$2.4 billion (EGP 40 billion), according to the company's press release on the general assembly results in FY 2018/19.

From FY 2014/15 to 2018/19, MIDOR was able to refine a total of 167 million barrels (mmbbl) of crude oil, and to supply the domestic market with 15.8 mmt of high-quality petroleum products, according to press releases on the general assembly results over FYs 2014/15-2018/19.



MIDOR Performance Evolution over FYs (2014/15-2018/19)

	2014/15		2018/19
Production (mmt)	4.3	18.6%	5.1
Refined Oil (mmbbl)	10.7	261.7%	38.7
Diesel Production (mmt)	1.9	31.6%	2.5
Domestic Supply (mmt)	3.7	16.2%	3.1
Exports (mmt)	0.72	177.8%	2

2. THE EGYPTIAN REFINING COMPANY (ERC)

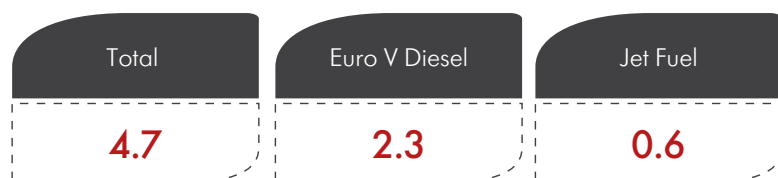
ERC is the only Egyptian refinery managed by the private sector, which makes up 76.2% of the refinery's shares. Qatar Petroleum has the majority of the shares in the ERC with approximately 30%, in addition to other international partners. EGPC has a share of around 24%. The company's investment cost is \$4.4 billion (EGP 74.2 billion) and is considered Egypt's largest Public Private Partnership (PPP) infrastructure megaproject, according to Qalaa Holding official website.

The refinery that was established in 2007, converts low value mazut into middle and light distillates to meet the domestic market needs. Cairo Oil Refining Company (CORC) provides the feedstock for ERC.

In September 2019, all the projects' units were in operation. Since then and until February 2020, the company's total production recorded 2.58 mmt, according to Qalaa Holding official website.



ERC Production Capacity (mmt)



3. ALEXANDRIA PETROLEUM COMPANY (APC) (EL MEX REFINERY)

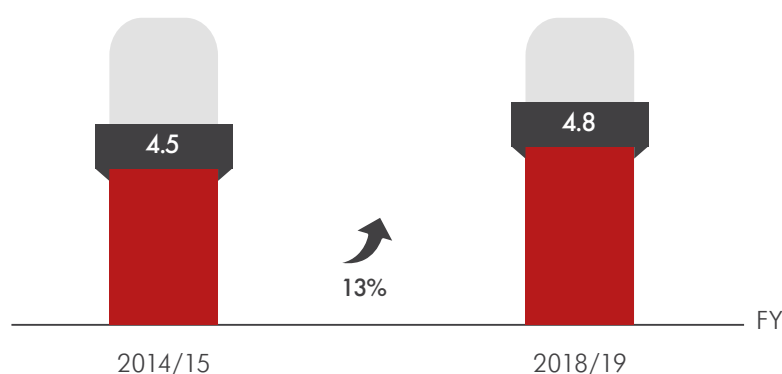
APC was built in 1962, to supply the market with its needs of Liquefied Petroleum Gas (LPG), kerosene, diesel, mazut, lube oils, and waxes. The refinery, located in El Mex in Alexandria, has an annual refining capacity of 5 mmt, according to EGPC.

The refinery has three crude distillation units, one of which is basically to produce the atmospheric residue for the lube oil complex. The refinery has a lube oil complex that was commissioned in 1983 with an annual capacity of 1.1 mmt. It mainly produces vacuum gas oil, bright stock, waxes, bitumen, and mazut to be further processed by downstream units, according to EGPC.

Over the referred five years, APC was able to refine a total of 22.9 mmt of crude oil to meet part of the domestic market needs, according to press releases on the general assembly results over FYs 2014/15-2018/19.



Crude Oil Refined by APC (mmt)



4. ALEXANDRIA NATIONAL REFINING AND PETROCHEMICALS COMPANY (ANRPC)

ANRPC is a crude oil refinery that was established in 1999 under the Egyptian investment law no. (8) of 1997. It is one of the largest refining and petrochemicals companies. In fact, the refinery's production of 92-octane and 95-octane represents around 43% across Egypt. The company is located in the Amerya region in Alexandria, according to EGPC.



ANRPC's Main Units

	Number	Capacity (mmt/y)	Date	Products
CCR & Isomerization Complex	1	0.8	-	LPG Isomerate Reformate
CCR & Platforming Unit	1	0.55	2015-2018	Reformate Stabilized LPG Hydrogen

In FY 2015/16, ANRPC produced 1.2 mmt of naphtha, of which 238,000 tons were exported. Meanwhile, octane 92 and octane 95 production exceeded 842,000 tons. Moreover, the company's revenue reached EGP 4.7 billion.

In FY 2016/17, the company's petrochemical project completed by 78.5%, adding 850,000 tons of reformate to produce high octane benzene, in addition to producing naphtha and hydrogen, worth \$233 million (EGP 3.9 billion) of investments. This came during the review of the company's report by El Molla in June 2017.

In FY 2017/18, the company finished 97% of its project, as announced during El Molla's visit for the project in June, 2018. In FY 2018/19, ANRPC completed a project for producing high-octane benzene 92 and 95 to increase the annual capacity to 1.5 mmt, according to the MoP.

5. AMERYA PETROLEUM REFINING COMPANY (ARPC)

ARPC was built in 1972 with an annual refining capacity 4 mmt. It supplies the local market with its needs of LPG, naphtha, jet fuel and others. The refinery is also located in the Amerya region in Alexandria, as explained by EGPC.



ARPC's Main Units

	Number	Capacity (mmt/y)	Date	Products
Crude Distillation Units 2 4 CHEX	2	4	-	Propane LPG Naphtha -Others
Platforming Unit	1	0.4	1985	LPG Isomerate Reformate
Isomerization Unit	1	0.15		
LAB Complex	1	-	-	LAB HAB
Lube Complex	1	0.58	1973	Special Oils Medical Oil Mazut & Others

Over FYs 2015/16, 2017/18 and 2018/19, ARPC refined over 11 mmt of crude oil with investments of almost EGP 600 million. In addition, company's revenues accounted for more than EGP 5 billion, according to the company's general assemblies for the mentioned FYs.

In FY 2015/16, ARPC refined 3.9 mmt of crude oil in order to cover its output targets of petroleum products. Meanwhile, the company's investments reached EGP 217 million. In FY 2017/18, the company refined about 3.7 mmt of crude oil, its investments amounted to EGP 194 million while its revenues recorded about EGP 2.6 billion. In FY 2018/19, the company refined 3.7 mmt of crude oil. In the meantime, the company's investments accounted for EGP 179 million, while its revenues hit EGP 3 billion. All stated during the general assemblies of the company for the mentioned FYs.

6. SUEZ OIL PROCESSING COMPANY (SOPC)

The Suez Refinery was built in 1965 and has a current annual refining capacity of 3 mmt. It supplies the market with LPG, naphtha, gasoline, kerosene, diesel, and mazut. The refinery is located in Suez region on the Red Sea, according to EGPC.



SOPC's Main Units

	Number	Capacity (mmt/y)	Date	Products
Crude Distillation Units	2	3	-	LPG Naphtha Jet Fuel & Others
Platforming Unit	1	0.8	1983	LPG Isomerate reformate
Coker Complex	1	1.5	1966	
Vacuum Distillation Unit	1	0.0012	2014-2017	Asphalt VGO

It is worth mentioning that in FY 2017/18, the company's plan included producing 48,000 tons of butane and 81,000 tons of naphtha with investments worth more

than \$44 million (EGP 741.8 million). This is also in addition to producing 396,000 tons of Asphalt and 322,000 tons of diesel with total investments amounted to \$54 million (EGP 910 million), stated by SOPC's CEO, Reda Abdel Samad during the company's general assembly in January 2017.

7. ASSIUT OIL REFINING COMPANY (ASORC)

ASORC was established in 1984 with an annual refining capacity of 2.5 mmt. It supplies the market in Upper Egypt with LPG, propane, naphtha, jet fuel, diesel, and mazut, according to EGPC.



ASORC' Main Units

	Number	Capacity (mmt/y)
Crude Distillation Units	2	2.5
Vapor Recovery Unit	1	0.4
Hydrocracker Complex	1	2.3
CCR and Isomerization Complex	1	0.88

In FY 2018/19, ASORC refined around 3.5 mmt of crude oil to produce high-quality products including gasoline 92 and 80, butane, jet fuels, and diesel. Meanwhile, the company implemented several projects with investments reaching EGP 2 billion, including establishing a plant to produce naphtha fuel with amounts reaching 660,000 tons annually, according to the company's general assembly held in September 2019.

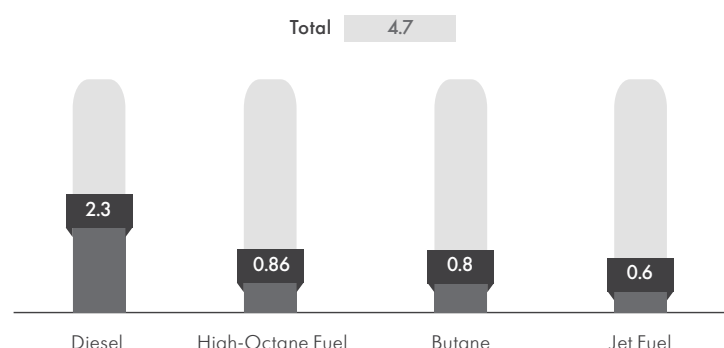
C. MAJOR CURRENT & PLANNED REFINING PROJECTS

1. MOSTOROD PETROCHEM REFINERY AT ERC

Mostorod Refinery was built in 1969 with a refining capacity 8 mmt/y to supply the local market with its needs of LPG, Jet fuel, Gas Oil and Fuel Oil. The refinery is located in the Mostorod region, north of Cairo. In September 2020, a new ERC facility in Mostorod was inaugurated. The project's total current annual capacity represents 22% of Egypt's refining capacity. The project is expected to increase Egypt's diesel production by 30% and increase octane production by 15%. Accordingly, the project is estimated to reduce Egypt's annual imports bill by \$0.6-1 billion (EGP 10.1-16.9 billion). Moreover, the refinery is expected to decrease gasoline and diesel imports by 35%. The project's investment cost is \$ 4.3 billion (EGP 72.5 billion), according to MoP's press release, in September.



Mostorod Refinery Production Capacity (mmt)



2. MIDOR'S EXPANSION

In 2017, the first phase of the refinery's expansion was operated, which increased MIDOR's total production capacity by 15%. In 2018, a new project was implemented to increase MIDOR's refining capacity by 60%, increasing crude oil from 100,000 barrels per day (bbl/d) to 160,000 bbl/d. Additionally, that same year, a new project was implemented to increase MIDOR's refining capacity by 60% to reach 160,000 bbl of crude oil. This project costs \$2.3 billion (EGP 38.78 billion). In February 2019, MIDOR reached financial closure for the \$2.2 billion (EGP 37.1 billion) expansion and upgrade program for its Alexandria refinery. The project is planned to be completed in 2022, according to a document published in January by MoP on refining projects.



MIDOR Expansion Production Capacity (mmt/y)

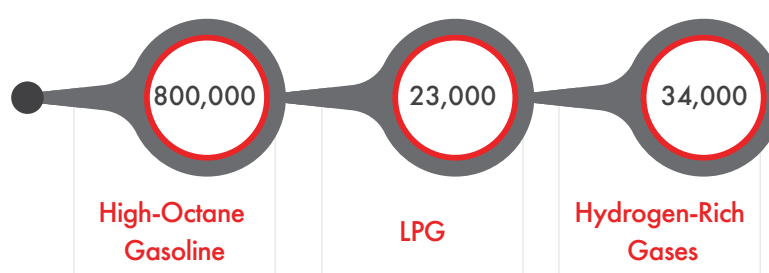
GASOLINE 95	DIESEL	LPG	JET FUEL	COAL	SULFUR
0.6	1.3	0.15	0.7	0.23	0.065

3. HIGH-OCTANE GASOLINE PRODUCTION UNIT AT ASORC

The project in ASORC has started in 2017 and is expected to be fully completed by Q4 2020. The project's annual capacity is expected to reach 660,000 tons of naphtha in addition to producing butane. The project's investment cost is \$450 million (about EGP 7.6 billion in 2019), according to the petroleum minister during the general assembly of ASORC in September.



High-Octane Gasoline Production Unit Capacity (t/y)

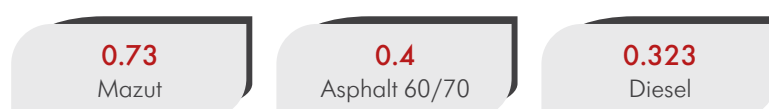


4. ASPHALT 60/70 PRODUCTION UNIT AT SOPC

A project for asphalt 60/70 production started in 2019 at SOPC. The project aims to increase asphalt production, through establishing a vacuum distillation unit, to direct asphalt production to the local market. The project is expected to be finalized in Q4 2021. The project's investments are estimated at more than \$ 68.5 million (EGP1.2 billion), according to the MoP's document published in January on refining projects.



Asphalt Production Unit Capacity (mmt/y)



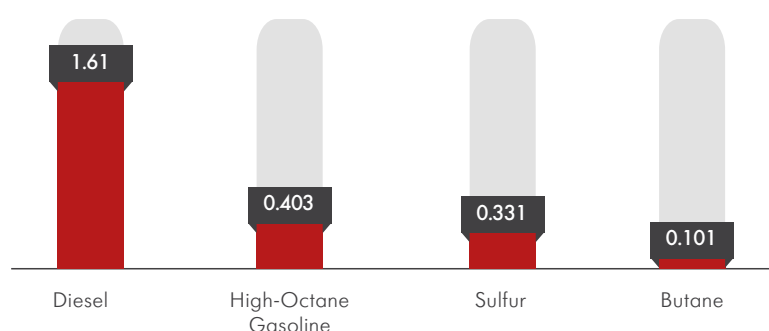
It is worth noting that the three mentioned projects, MIDOR refinery expansion project, High-Octane Gasoline project, and the Asphalt production unit received investments of \$2.8 billion (EGP 47.2 billion) in June, according to MoP's press release in June.

5. MAZUT HYDROCRACKING COMPLEX AT ANOPC

The project started its operations in 2019 at Assiut National Oil Processing Company (ANOPC), aiming at achieving self-sufficiency of petroleum products in Upper Egypt and decreasing import bills. The project has a feed capacity of 2.5 mmt of mazut to produce higher quality petroleum products. The project is scheduled to be finalized in September 2022 with investment costs of \$2.15 billion (EGP 36.25 billion), according to MoP's document on refining projects in January.



Mazut Hydrocracking Complex Production Capacity (mmt/y)



6. HYDROCRACKING COMPLEX AND PRODUCTION OF GASOLINE (RED SEA CO.)

The project started operations in 2019 to exploit untapped capacities of El Nasr refinery at SOPC. The project also aims to benefit from the produced mazut to manufacture high-quality petroleum products. The project's production capacity reaches 2.5 mmt of mazut and 1 mmt of naphtha. The project is planned to be completed by 2022, with costs of \$2.75 billion (EGP 46.37 billion), according to MoP's document on refining projects in January.

7. REHABILITATION OF COKING COMPLEX AT SOPC

In 2019, a project had started to rehabilitate the coking complex at SOPC, with the aim to increase the production capacity of mazut to 1.75 mmt annually. The project's investment cost is estimated at \$589 million (EGP 9.9 billion), according to MoP's document on refining projects in January.

8. AROMATICS EXTRACTION UNITS PROJECT AT APC

The project aims to renew the oils complex at APC and to increase oils and waxes production from 32 to 36 m³/h. The project investment cost is estimated at EUR 356.5 million (EGP 6.73 billion), according to MoP's document on refining projects in January.

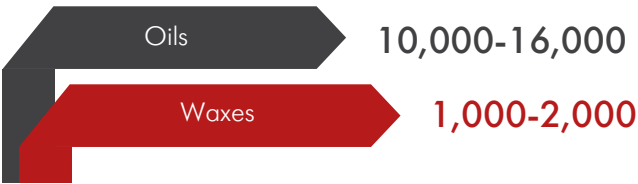
The MoP has set an integrated plan to increase refining capacity to reach more than 41 mmt of petroleum products and achieve self-sufficiency, according to the MoP's document on refining projects in 2020, published in January.

This can be achieved through developing and updating the efficiencies of refineries, implementing projects and conversion units. Moreover, the ministry considered developing refineries as an essential step in transforming Egypt into a regional hub for trading oil and gas, taking advantage of its privileged location in the middle of the world's energy-producing and consuming markets. The ambitious plan's investment cost reached EGP 48 billion.

Moreover, the sector seeks the assistance of major international consultancy offices to implement the refining sector's development strategy, and so, an attractive investment climate was created. This was in addition to applying the latest technologies in the field of digital transformation, according to the ministry's press release in September.



Aromatics Extraction Units Production Capacity (t/y)



Investments Directed to Recent Refining Projects





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EOG'S ROUNDTABLE EXPLORES EGYPT'S BROWNFIELDS DYNAMICS



BY FATMA AHMED, JASMINE SHAHEEN

Under the patronage and with the participation of H.E. Eng. Tarek El Molla, Minister of Petroleum and Mineral Resources, Egypt Oil & Gas (EOG) Committee hosted a virtual roundtable on October 18, focusing on increasing investments in Egypt's brownfields. The minister, alongside several prominent figures from international oil companies (IOCs), Abed Ezz El Regal; CEO of Egyptian General Petroleum Corporation (EGPC), and Samir Abady; EGPC's Deputy CEO for Production, delved into a topical discussion on brownfields optimization in Egypt.

The discussion probed several issues of concern regarding brownfields development. The selected topics included optimum brownfield revival strategies, technology's role in boosting production from brownfields, as well as the economic barriers of using brownfields. The roundtable created a space for discussing Egypt's untapped opportunities in brownfields as well as to present strategic and possible recommendations to improve mature fields.

Mohamed Fouad, EOG's Managing Director, began his opening remarks affirming that the current pandemic urges action to lay down a foundation for growth. He noted that "brownfields count as a fundamental element for the oil and gas sector that also reflects on its economy." This has been made evident enough that industry leaders and foreign partners in Egypt began expanding their scope of exploring brownfield opportunities. Fouad remarked that the roundtable hopes to "be another enabler to the government's efforts to increase investments in Egypt's brownfields."

The minister commenced the virtual event denoting that "Egypt has taken several bold reforms over the past few years on both the government and economic levels as well as the oil and gas sector level." The minister alluded to such steps which have raised the bar for Egypt's oil and gas sector, leading it to withstand the pandemic's aftereffect. El Molla asserted that through developing technologies and refining competent skills and human resources, Egypt can go a long way.

When it comes to brownfield enhancement, "Egypt has several opportunities in this area as well as some successes," the minister continued, requesting that EOG Committee and EGPC form an action plan to attract brownfield investments, improve performance, and increase crude production. That is exactly where the Brownfield of Excellence (BCoE) comes to play.

THE MAIN OBJECTIVES ARE TO ATTRACT INVESTMENTS IN THE BROWNFIELDS AND IMPROVE PERFORMANCE AND INCREASE CRUDE OIL PRODUCTION

H.E. TAREK EL MOLLA

MINISTER OF PETROLEUM & MINERAL RESOURCES - ARAB REPUBLIC OF EGYPT



THE BROWNFIELD CENTER OF EXCELLENCE

On that note, Sameh Sabry, Chairman of the EOG Committee, and Vice President (VP) and Managing Director at Wintershall Dea-Egypt, joined the conversation reflecting on the committee's progress during the past period. He pointed out that during the slow-down period, there has been a restructure within the committee so that they strengthen its impact and expand its scope. In light of expanding brownfields' scope of work in Egypt, Sabry mentioned that EGPC is currently exploring brownfield opportunities with each IOC separately. Then he proceeded to present the EOG Committee white paper on brownfields which focused on "identifying a number of strategic solutions and 28 initiatives to help improving brownfields in Egypt," he stated.

In addition to the white paper, he introduced the BCoE approach, governed by academia in cooperation with EGPC and the EOG Committee. The BCoE aims to "identify measures to increase production, optimize costs, and generally improve the brownfield conditions in Egypt to attract further foreign investments," he assured. Sabry emphasized EGPC's catalyst role in establishing the BCoE; connecting the BCoE with EGPC's subsidiaries and national oil companies (NOCs).

Through the new establishment, members of the EOG Committee will present new brownfield technologies that could be implemented in Egypt, suggest best practices, in addition to providing technical and commercial approaches on brownfield projects inside and outside Egypt. Sabry affirmed that the aim of BCoE's ideation sessions is to "identify ideas; measures to be implemented and to be followed up by real and tailored action plans."

OPTIMUM BROWNFIELD REVIVAL STRATEGIES

Commencing the roundtable, the first session on brownfield revival strategies included four speakers. Tameer Nasser, Director and General Manager of Baker Hughes, started the session noting that brownfield investments need to have the right investment climate. He praised the performance of the Egyptian economy in this regard especially that of the oil and gas sector during the last period.

Naseer expressed his appreciation for highlighting such a topic which may help in reducing the gap between supply and demand. He elaborated that investing in brownfields is very appealing as "recovering the remaining production in brownfields, in terms of cost, is cheaper than exploring and producing from a greenfield," adding that this is in fact "a very good investment opportunity."

Baker Hughes's director pointed out that technology is important in this regard in addition to having the right business and commercial models, accessibility to data, and feasibility. He noted that his company has started to use unique techniques that follow the same approach.

Tayeb Huwair, COO of Dragon Oil, began his speech by expressing his pleasure for his company's work in Egypt with EGPC and Gulf of Suez Petroleum Company (GUPCO). He said that the Gulf of Suez has many challenges but at the same time has huge potentials. "One of the most important elements was the reservoir data which contributed significantly in increasing the productions," Huwair said.

He added that any brownfield has its own challenges mentioning that during the company's work with GUPCO, it was proven that partnership with service providers is strategic to face these challenges. Huwair stated that "we need to have some sort of win-win contract situation with service and technological providers." He elaborated that "in Egypt and in GUPCO specifically, we need to look at improving drilling efficiency as well as artificial intelligence and enhanced oil recovery."

The COO of Dragon Oil noted that "we need to look at economical models to encourage investors" adding that "we believe business models need to be more dynamic in line with brownfields and market conditions." Huwair ended his speech calling for conducting a forum for operations companies to look at the learned lessons.

Kamel El Sawi, President of Kuwait Energy Egypt, highlighted the importance of adopting strategies for revitalizing brownfields as they are the source of more than 80% of oil production worldwide. "One of the main principles of the economic theory is that during the decisions especially at these difficult times, the businesses and the companies are focus on the efficiency improvement rather than growth," he mentioned.

El Sawi noted that it is important to control the challenges that are facing brownfields to increase production, especially as brownfields can maintain their production rates without large investments. "I think the best way to increase production and optimize expenses is to adopt a model that forestall the decline rate in the mature fields while optimizing capital expenditures (Capex) and operating expenses (Opex)," he stated. Al Sawi pointed out that this model can be achieved by adopting new technologies and analyzing all data, which is how his company increased its brownfields production.

At the end of the session, Craig Robertson, Country Manager and Director of TransGlobe Energy, said that brownfields operations are the core of his company, showcasing the company's successful experience in recovering brownfields in Canada by using the latest technologies.

Additionally, he talked about the company's achievements in the Eastern Desert especially at the West Bakr field in Egypt which according to him has great potentials. Robertson exemplified how this field managed to increase its production by using proven technologies and best practices.

“THE NEXT STEP IS TO DEFINE THE BEST OPPORTUNITIES AND THE SUITABLE NEW TECHNOLOGY TO UNLOCK ANY POTENTIAL IN THE BROWNFIELD AND TO OPTIMIZE THE COST IN THE SAME REGARD.”



ABED EZZ EL REGAL
CEO - EGPC

“WE NEED TO FOCUS ON TWO GENERAL ANGLES WHICH ARE THE OPERATIONAL EFFICIENCY AND FISCAL REGIME..”



DAVID CHI
VICE PRESIDENT AND GENERAL MANAGER - APACHE

“RECOVERING THE REMAINING PRODUCTION IN BROWNFIELDS, IN TERMS OF COST, IS CHEAPER THAN EXPLORING AND PRODUCING FROM A GREENFIELD.”



TAMEER NASSER
DIRECTOR AND GENERAL MANAGER - BAKER HUGHES

“THE PSC COST-RECOVERY SYSTEM ALLOWS FOR THE RECOVERY OF CAPITAL INVESTMENT OVER SEVERAL YEARS, BUT DUE TO THE COMPLICATED NATURE OF THE NEGOTIATIONS, WE NEED TO FIND A WAY TO EXPEDITE THESE NEGOTIATIONS TO INCREASE INVESTMENT AT THE END OF THE CONCESSION'S LIFECYCLE.”



DAVE THOMAS
CEO - CHEIRON

“IN GENERAL, THERE ARE LOTS OF OPPORTUNITIES AT BROWNFIELDS AND WE WOULD LIKE TO CASCADE DOWN THIS BROWNFIELD SO WE CAN LOOK AT THE LESSONS LEARNED.”



TAYEB HUWAIR
COO - **DRAGON OIL**

“AT HALLIBURTON, WE COLLABORATE AND ENGINEER SOLUTIONS TO MAXIMIZE THE ASSET VALUE FOR OUR CUSTOMERS, ESPECIALLY IN EGYPT'S BROWNFIELDS.”



COLBY FUSER
VP OF **HALLIBURTON** EGYPT
AND LIBYA

“WHEN MANAGERS ARE IN A POSITION TO MAKE BETTER DECISIONS BASED ON PROPOSALS COMING FROM THE TECHNICAL TEAM, ASSET VALUES CAN BE INCREASED AND FIELD LIFE EXTENDED, ESPECIALLY IN BROWNFIELDS.”



GIORDANO CREMA
ACTING GENERAL MANAGER
AND OPERATIONS MANAGER AT
THE ITALIAN EGYPTIAN OIL COMPANY (**IEOC**)

“IF WE KEPT IN MIND THAT MORE THAN 80% OF THE WORLD'S AND EGYPT'S OIL PRODUCTION IS COMING FROM BROWNFIELDS, WE WILL REALIZE HOW IT'S IMPORTANT TO PAY ATTENTION TO ADOPTING THE NECESSARY STRATEGIES FOR REVITALIZATION OF THE BROWNFIELDS.”



KAMEL AL-SAWI
PRESIDENT OF **KUWAIT**
ENERGY EGYPT

Robertson highlighted the importance of EGPC's and the Egyptian government's flexibility, saying that “there is a revolution in the Egyptian petroleum sector in terms of flexibility and willingness to discuss in order to achieve a win-win situation in terms of brownfield revival.”

For his part, Ezz El Regal commented that “we [EGPC] have an ambitious plan for old fields,” but it depends on changing the mood of consumption during the next period. He said that this depends on two factors; the first one is to define the precise expected consumption during the next two years and for the long term. The second factor is to maximize the local production and rationalize hydrocarbon products' utilization.

Abed said that this will happen by the economic reforms noting that “by using technology, we can reduce the costs and maximize production.”

TECHNOLOGY'S ROLE IN BOOSTING PRODUCTION OF BROWNFIELDS

Diving into the next session of the roundtable, the focus shifted to adopting technology in brownfield for optimum results, in addition to reducing cost per barrel and maximizing oil recovery. Colby Fuser, VP of Halliburton Egypt and Libya, kicked off the discussion with insights from one of the world's largest providers of products and services to the energy industry. He elaborated that from the perspective of a service company, technology should act as an enabler.

Fuser explained that “to collaborate with various companies in the country to develop engineered solutions, not only maximize the asset value for the customers, [but] in these cases, improve the brownfields in Egypt.” Moving on to discussing the challenges of brownfield integration with technology, Fuser elaborated on the trickiness of technologies; where one might work for a project but not another, noting that “the challenges are very varietal and they come in very different things, so we have to have the right applications.”

Fuser provided an example of such challenges recalling a customer-facing problem of cross-flow and lacking better isolation. Through utilizing Halliburton's H2Zero™ and Halliburton's Back Stop™, the affected well came back on around 2,500 barrels per day (bbl/d) increasing from 1,900 bbl/d and with minimal water; managing to reduce the cost and increasing production. Pushing the envelope further, Fuser believes that integrating technology with local content is highly beneficial; making it a win-win for all parties involved in developing brownfields.

Moving on to Giordano Crema, Acting General Manager and Operations Manager at the Italian Egyptian Oil Company (IEOC), Crema focused on adopting technology in reservoir management to get the maximum value from the fields. Crema pointed out that in this day and age, we need to boost data collection and analysis, denoting that fostering a data collection culture is essential. He highlighted Eni's latest technologies in brownfields which is an integration of production data analysis and reservoir simulation that allows getting the best value from the reservoir. This confirmed that investing in technologies is greatly advantageous.

Crema praised Eni as being the “frontrunner in advanced reservoir simulation,” noting that Eni's cutting-edge technologies have allowed the discovery of the Zohr field, and will allow further exploitation of reservoirs. He concluded by noting that “when managers are in a position to make better decisions based on proposals coming from the technical team, asset values can be increased and field life extended, especially in brownfields.”

Meanwhile, Karim Badawi, Managing Director at Schlumberger Egypt, Sudan and East Mediterranean, remarked that when it comes to technology, “Schlumberger's purpose is to create amazing technology to unlock access to energy for the benefit of all.” He then proceeded to illustrate the role of technology in Egypt's brownfields which included; a multi-client project in the Gulf of Suez, Pulsar Multifunction Spectroscopy (PNX) technology, and Egypt Production Digital Center.

Elaborating on the multi-client project in the Gulf of Suez, Badawi commended the joint efforts of the tech team, EGPC, and the ministry, noting that “Schlumberger is very proud of our joint effort to leverage the best in class seismic processing technology.” He reckoned that the results of the project “will help operators to maximize the chances of success in drilling and production activities, and potentially identify a new place to unlock the full potentials of their assets.”

Badawi then touched on Schlumberger's PNX technology which was used for the first time in Egypt by the General Petroleum Company (GPC), achieving great results at several wells that began producing crude after years of producing just water. The PNX aims to increase production efficiency from depleted oil and gas fields in addition to increasing their economic value. From adopting technology in the fields to paving the way for the full digital transformation of the sector, Schlumberger was awarded the Egypt Production Digital Center project. “The center would be a key enabler of investments in brownfields because it will help to reduce the cost per barrel,” Badawi stated pointing out that through utilizing the latest technologies, it will lead to making better operational decisions.

The final speaker in the technology session was Khaled Kacem, VP Egypt, Country Chairman and Managing Director at Shell Egypt, who acknowledged that “developing brownfield opportunities that are resilient to market fluctuation and uncertainties is now more critical than ever.” He talked about the role of technology that enabled the company to realize and sustain operating costs and production improvement in Egypt's brownfields.

Kacem gave a few examples of how the company managed to limit its expenses while also maintaining high-level activities. He explained that through implementing aggressive injectivity in water injection wells, Badr El-Din Petroleum Company (Bapetco) managed to avoid lost time and expensive spending on fracking operations; reducing its end-to-end well cost by more than 20% in 2020 compared to 2019's. Additionally, Kacem shed light on the production enhancement technology; the Fishbone Technology, which is used in long horizontal wells in tight reservoirs.

Kacem mentioned that collaboration with other parties is a key to success, saying that "there is a really great collaboration between EGPC, IOCs, and the contractors. All parties are willing to have a conversation about the right cost and scale to allow for the successful deployment of technologies in Egypt." Kacem further illustrated the adoption of technology in offshore projects such as the West Delta Deep Marine (WDDM) Project - Phase 9B; stating that the company used the six-generation rigs to drill the wells at a huge competitive cost, affirming that "new technologies can definitely improve production, reduce cost, and enhance efficiency if properly applied."

Concluding the session, Kacem stated that he "strongly believes that Egypt's brownfields can accelerate improvements," through the automation of rigs and exploration of offshore brownfields. In response to the session's speakers, Ezz El Regal lauded their insights and concurred that "the next step is to define the best opportunities and the suitable new technology to unlock any potential in the brownfield and to optimize the cost in the same regard."

THE ECONOMIC BARRIERS OF USING BROWNFIELDS

The third and last session came under the title of "The Economic Barriers of Using Brownfields" which included three key speakers. At the beginning of the session, David Chi, VP and General manager of Apache, stated "as technology continues to advance, of course our ability to recover more oil from our assets will continue to increase." He declared that in order to get more oil from the reservoir and mature fields "we need to supply more energy at reservoir level, well level and/or at service."

Additionally, Chi added that mature fields may need additional chemical and fluid injections to improve sweep efficiency and change the physical and chemical balance of fluids to allow hydrocarbons to come out. Moreover, he pointed out that increasing investment in brownfields can be achieved by making more new hydrocarbon explorations and economic recovery for the existing resources.

Chi noted that "we need to focus on two general angles which are the operational efficiency and fiscal regime" in order to overcome economic barriers and extend the life of fields.

The general manager of Apache recommended a mechanism for investors to recover the significant fields in a timing manner, feasibility studies for the fields, and redesigning the decision-making process.

Moreover, Dave Thomas, CEO of Chevron, started his speech by talking about his company's latest developments of mature fields in the Gulf of Suez and the Western Desert.

Thomas highlighted risk-sharing as an important commercial issue. "When applying new technology to mature fields or reserves, I am not sure that we have the right balance of risk-sharing between service companies, IOCs and government," he questioned.

Additionally, he evoked another issue regarding the too long-standing discussions between the government and IOCs towards brownfield investments saying, "we need to find a way to expedite these negotiations to increase investment at the end of the concession's lifecycle."

The CEO of Chevron ended his remarks asking for more discussions to be made on the production sharing regime to stimulate production in the industry.

At the end of the session, Sabry stated the importance of focusing on brownfield production during the current period as "this is, of course, the rightly focus given the pending target to achieve Egypt's self-sufficiency of liquid production." He advocated the attendee's recommendations for the need to apply sophisticated technology and production optimization measures to increase production.

He noted, "one of the main hurdles of investment in brownfields is the big accumulated cost boom." Furthermore, he pointed out that high costs are required to maintain assets integrity, do maintenance, keep the facilities and equipment up and running. Sabry added that Wintershall Dea conducted discussions with the Ministry of Petroleum and Mineral Resources and EGPC to amend concessions agreements which allow win-win arrangement between IOCs and state companies in Egypt.

For his part, Ezz El Regal highlighted that EGPC's negotiations during the last five years with IOCs' representatives for amending concession agreements. He indicated that EGPC has the readiness to start negotiations for amendments once a company has a planned program for operations. "We are ready to reach a win-win situation towards the terms and conditions," Ezz El Regal said.

CLOSING REMARKS

As the roundtable came to an end, the minister wrapped up the roundtable commending its success, noting that "[the roundtable] demonstrates and proves that we are still able to offer attractive opportunities to IOCs and our partners." Additionally, it shows that IOCs firmly believe in Egypt's capabilities and trust their investments in it.

Seeing eye to eye with the esteemed speakers from IOCs, the minister agreed that new flexible legal frameworks, commercial terms, and fiscal regimes are needed. From a strategic level, the minister remarked that as an industry, we should focus on optimizing costs, enhancing performance which will give the industry a new edge. The minister concluded that open discussions are significant and that "[the ministry and IOCs] have managed together to progress successfully," and are ready for more effective and creative discussions.

COUPLING THE BEST IN CLASS ACQUISITION TECHNOLOGIES WITH THE RIGHT SET OF DIGITAL ENABLERS TO TRANSFORM DATA INTO KNOWLEDGE IS ONE OF THE KEY SUCCESS TO DEVELOP REALLY THE LOWER COST PER BARREL IN THE BROWNFIELDS.



KARIM BADAWI
MANAGING DIRECTOR EGYPT,
SUDAN & EAST MEDITERRANEAN -
SCHLUMBERGER

NEW TECHNOLOGIES CAN DEFINITELY IMPROVE PRODUCTION, REDUCE COSTS, AND ENHANCE EFFICIENCY, BUT IF PROPERLY APPLIED.



KHALED KACEM
VP EGYPT, COUNTRY CHAIRMAN
AND MANAGING DIRECTOR -
SHELL EGYPT

THERE IS A REVOLUTION IN THE EGYPTIAN PETROLEUM SECTOR IN TERMS OF FLEXIBILITY AND WILLINGNESS TO DISCUSS IN ORDER TO ACHIEVE A WIN-WIN SITUATION IN TERMS OF BROWNFIELD REVIVAL.



CRAIG ROBERTSON
COUNTRY MANAGER AND
DIRECTOR -
TRANSGLLOBE ENERGY

BROWNFIELDS DEVELOPMENT HOLDS CHALLENGES, BUT SENSIBLE COST OPTIMIZATION, AND A FLEXIBLE APPROACH CAN LEAD TO A WIN-WIN FOR IOC AND STATE COMPANIES.



SAMEH SABRY
VP AND MANAGING DIRECTOR -
WINTERSHALL DEA-EGYPT

REGENERATION: BROWNFIELDS LIVE ANOTHER DAY

BY RANA AL KADY

To begin with, brownfield regeneration has been a very attractive topic in the oil and gas industry since the turn of the 21st century. With recent environmental regulations and frameworks pushing for land restoration and protection of contaminated sites, the oil and gas industry has faced tremendous pressure to comply with such requirements. However, before any brownfield site is redeveloped or regenerated for reuse, the brownfield must be effectively remediated from all potential hazards and toxins.

GENERAL OVERVIEW OF THE CURRENT BROWNFIELDS IN EGYPT

Brownfields in Egypt have different uses across the industries. For example, while the oil and gas industry predominantly uses brownfield sites for relevant oil and gas-related projects, there are examples of brownfields that have been regenerated for transportation, building, and even industrial uses. Of course, each type of brownfield is regenerated in its own way due to the different contaminants involved as well as the potential level of contamination that could be overcome.

In Egypt, most brownfield sites are left abandoned after project completion or desertion. However, the main concern is not that these brownfield sites are left abandoned, rather that it could lead to detrimental damage to the environment. In fact, it was suggested by an industry expert, who preferred anonymity, that "the oil and gas field has already

understood that the redevelopment of brownfields is important and there are a lot of companies that do marketing to show how their companies take care of the environment before and after a project in the field. At the same time, this topic is extremely important and we should do our best to bring it to the attention of senior level executives to action the steps to work on the whole process of brownfield redevelopment".

Over time, such brownfield sites could harm nearby habitats and inhabitants through unintentional seepage of toxic compounds. For instance, when certain oil and gas onshore projects are completed, the by-products that emerge from the processes are not properly disposed of, leading to potential poisoning of any nearby organisms.

REGENERATION OF BROWNFIELDS

However, other than the technical aspect of eliminating hazardous toxins, there are

other technical and legal obstacles that must be addressed before regeneration of a brownfield site could take place. For example, one of the most important elements to consider is the current contamination percentage (i.e. the degree to which the contaminant has spread throughout the site) and the respective level of cleaning required. There are different levels of cleaning; for instance, the highest level of cleaning means that the site could be regenerated to be as it was before the project was initiated, while the lowest level of cleaning refers to the just removing or eliminating the necessary toxins to make the site safer than it was after project completion.

Another important element to consider is that of air and soil pollution. Due to negligence, some toxic or harmful petroleum by-products are either left unsettled or not disposed of. Based on this information, nearby communities or even oil and gas workers nearby are left susceptible to all the toxic odours that come about from oil and gas-based activities. Furthermore, some projects could result in the destruction of open space either that could be used by humans or other organisms. In fact, some activities could result in the damage of a site that, later on, would become damaged beyond repair or cannot be regenerated again to its original environmental state. These activities would not only affect air quality, but would also impact noise levels, destruction of land or offshore sites, a disturbance in the natural circle of life, etc.

The sources for some of the aforementioned environmental damages include a variety of activities. For example, in the case of natural gas manufacturing, there are potential harmful products that could be dispersed into any nearby sources of surface water or aquifers. Additionally, in the case of setting-up gas stations, soil contamination is likely to occur during both the construction phases and during the operational and maintenance phase as well. Finally, during the generic cases of oil production – through oil rigs, wells, piping, storage, and even transportation of such products – the site in question is susceptible to numerous potential hazards and environmental pollutants that would not be taken care of without proper reprimands.

ADVANTAGES AND DISADVANTAGES OF BROWNFIELD REGENERATION

While some of the advantages of brownfield regeneration are quite self-explanatory, it is necessary to understand that the advantages outweigh the disadvantages by far. For

example, one crucial advantage of regenerating brownfields in the oil and gas industry is that it ensures the protection of the general public's health and surroundings as threats are eliminated. Also, it creates a job market for employees working between the environmental industry as well as the oil and gas industry. Additionally, these locations are often well-situated and would be an investment to clean up and allow another industry (such as the building and infrastructure sector) to take over and put this, now deserted but environmentally safe, brownfield site to good use. This, in turn could revitalize social or urban communities yet again.

On the other hand, there are also a few disadvantages that must be considered and could not be left ignored. For instance, there are various costs that are typically associated with the regeneration process. These costs could include the equipment, machinery and labor work involved in the process of regeneration; these values vary depending on the level of restoration that the entity in question aims to achieve. Furthermore, the process of restoration is excessively time consuming, which, given the fast pace of the oil and gas industry, is considered to be financially straining by some. Also, there are no specific regulations or a local framework which the responsible entity could use as a reference to endure a smooth and efficient process. For this reason, it is difficult to have standardized regeneration processes as every entity or organization would have to form a loose set of standards to carry out the actual regeneration processes of the brownfield sites.

To conclude there are several reasons as to why the regeneration processes of the brownfield sites are becoming normalized, yet haven't fully attracted the adequate attention it requires. It is suggested that the existence of a regulatory framework for the oil and gas industry to use as a reference for the regeneration of brownfield sites, could encourage better and more effective care for the human health and quality of living as well as relieve the environment from toxins on all mediums, both onshore and offshore. Finally, while there are multiple advantages and disadvantages, it is universally acknowledged that the need for regeneration of brownfields is essential (not only in the oil and gas field, but in all sectors) to enhance landscapes and provide a better environment for the future.



RTA: HOW TO MAKE THE MOST OUT OF YOUR DATA

BY MAI EL GHANDOUR

As we embark on the threshold of digital transformation, we are simultaneously gaining access to data more than ever before. However, are we making the most out of it to particularly understand the fluid flow in a reservoir? Here is where Rate Transient Analysis (RTA) shapes our data usage to unlock wellbore flow performance.

EVALUATING UNCONVENTIONAL RESERVOIRS WITH MORE RELIABILITY

A number of traditional reservoir engineering methods such as Decline Analysis (DCA) are increasingly becoming unreliable, especially with low permeability unconventional reservoirs. According to Matthew Bax, Engineering Sales Manager at IHS Markit, DCA usage creates a great deal of uncertainty and limitation, leading a well to become rate-restricted.

Modern production analysis, on the other hand, is used to evaluate reserves with greater reliability as the data generated is more accurate. In addition, it is used to monitor production performance and also characterize the reservoir in terms of damage areas, pressure, and rate which can be obtained with minimal cost.

"The development of unconventional reservoirs is a challenge. Knowledge about the properties and physical controlling flow parameters of formations as well as the long-term production performance is the main key element. Targeting a reliable production forecast of unconventional reserves requires using a combination of different methods," Omar Mahmoud, Assistant Professor at the Future University in Egypt (FUE), told Egypt Oil & Gas (EOG).

As a robust tool to access unconventional oil and gas reservoirs, RTA puts into account variable operating conditions that allows one to evaluate wells confidently and get accurate forecasts. The IHS Markit describes RTA as a "forensic analysis" that helps you carry out an investigation of the entire history of a well's life production cycle with the large amount of data it bears.

"After determining the reservoir properties using RTA, a reservoir model can be constructed to forecast future production performance," Mahmoud explained. Another report by the IHS Markit on reservoir and production engineering frames RTA as a solution offering different techniques to estimate original oil and gas-in-place (OOIP/OGIP) and expected ultimate recovery (EUR).

"There is an ongoing development in analytical models that can be adopted for forecasting production and estimating the EUR of unconventional reserves under the umbrella of RTA," Mahmoud further noted.

RTA BENEFITS

"RTA is the art of analyzing production data (i.e. rates and flowing pressures) and matching them with analytical models. It is an important tool to estimate reserves and predict EUR of oil and gas reservoirs," Mahmoud remarked.

The key features of an RTA lie mainly in enhancing reservoir flow-rate workflows specific to unconventional oil and gas reservoirs as well as complex hydraulic fracturing projects. RTA also generates meticulous production forecasts with robust guidelines and field examples on how to deal with data uncertainties, poor data quality, and operational upsets.

Mazher Ibrahim, Chief Reservoir Engineer at ShearFRAC Group, told EOG that "RTA can evaluate the reserve of unconventional reservoir with good accuracy which depend on data quality and engineer experience."

Other benefits of utilizing RTA include determining the reserves and being able to formulate a strategy to develop reservoirs. According to Mohamed Gallab, Reservoir Engineer and Department Head at Khalda Petroleum Company (Apache), if analytical solutions like RTA and Pressure Transient Analysis (PTA) are combined together, they can provide good characterization for the reservoir and improve the quality of results.

RTA VS. PTA

"RTA as well as PTA have been used effectively to understand reservoir performance. They estimate certain characteristics using long-term production data or transient pressure data. So that, both can be used as powerful tools to understand the behavior of brownfields. However, in tight and unconventional reservoirs, the RTA based on daily production data is more attractive because of the difficulties of well-testing," Mahmoud stated.

While PTA requires costly shut-ins, RTA does not necessitate the wells to be shut-in to be able to acquire the same results. "PTA requires shut-in well for buildup which will lead to production loss and wireline cost of the gauge," Ibrahim told EOG. Moreover, as RTA taps into a well's entire history, it digs deeper into the reservoir's analysis, which in turn leads to better, faster and cheaper data-driven decision-making.

Shedding light on PTA's benefits, Ibrahim specified that "PTA can be helpful in some cases of well damage and boundary compared with RTA." However, he concluded saying: "RTA give unique answer but PTA can give many answers so the need of experience of engineer is required to integrate all data to get good answer."

CASE STUDY: ABU QIR PETROLEUM COMPANY

To optimize its development strategy in the Abu Madi and Kafr El Sheikh formations, Abu Qir Petroleum Company started developing a model to estimate production rates back in 2015. This was an attempt to find out if the wells were producing to their maximum value as insufficient information was becoming an obstacle in the reservoirs.

Abu Qir Petroleum Company, along with Schlumberger, developed a workflow by which missing data could be estimated using RTA. As a result, RTA was able to estimate the average static reservoir pressure, skin, permeability, and productivity parameters – data that was previously inaccessible. In short, the results showed that RTA's usage of well-history matching process optimized production based on forecasts.

Likewise, in another case study, production forecasting played a major role in unlocking data in one of the unconventional gas bearing formations in Egypt's Western Desert. According to an article published in 2017 by Ibrahim along with Mohamed Salah, Stimulation Lead Engineer at Khalda Petroleum Company, integration of PTA and RTA not only evaluated the economic feasibility of the Western Desert project, but also facilitated the most optimal development strategy.

"RTA with reservoir simulation can [also] be used to optimize brownfield development [in Egypt]," Ibrahim commented to EOG. With that said, as flowing data is becoming readily available and accessible in Egypt, RTA shall unlock information previously not available and produce more accurate forecasts.

"RTA is one of the important tools to estimate reserves and predict EUR of oil and gas reservoirs, which can be used to optimize brownfield development in Egypt. RTA can always be targeted to obtain convincing estimates of reservoir parameters with available low-frequency (weekly or monthly) production data. Those highly confidence parameters can then be used in constructing efficient reservoir models to forecast future production performance from brownfields," Mahmoud concluded.



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BROWNFIELDS: POWERING THROUGH PRICES SLUMP

BY JASMINE SHAHEEN

As the year comes to an end, taking a look back to how it was for the oil and gas industry, 2020 certainly was anything but calm. The tumultuous fluctuation of the oil prices has rocked the industry quite a bit; from narrowing and sometimes halting production, to layoffs. Combined with an unforeseeable pandemic, it was the perfect storm that altered the balance of norms, but that does not mean that the oil and gas industry will not pull through. In fact, it has opened new doors for the industry to explore; whether in energy transition or taking advantage of brownfields.

BROWNFIELDS & PRICES

Brownfields are largely prevalent in Egypt's oil and gas industry. Now more than ever, the current oil price climate could set up an improvement in brownfield activities mainly because during times of recession, it is best to head towards improvements instead of growth. That is, essentially, the route to keep businesses up and running until after the 'drought period'. The Brent crude oil spot prices averaged around \$41 per barrel (bbl) in September, down by \$4/bbl from the average in August. Despite the decrease in demand worldwide that dominated the industry in H1 2020, global demand is expected to increase in Q4. The United States (US) Energy Information Administration (EIA) expects global inventory draws in Q4 to reach 3 million bbl/d. Based on EIA presumption, they forecast that Brent spot prices could average around \$42/b during Q4 2020 reaching an average of \$47/b in 2021.

Even then, the oil prices remain lower than the industry norm, but in what way could it provide an opportunity for brownfield development? Experts weigh in. Mahmoud Tayel, Brownfield Project Management Expert, told Egypt Oil & Gas that "the current low prices should be used as an opportunity for brownfield projects [in] Egypt as an owner and producer since the cost of shutting down any plant or facility is lower than any other time." However, a few things should not be swept under the rug; "in order to utilize this opportunity, we must be very precise on our brownfield plans in terms of a clear and defined scope of work on such projects and also for the value and return of the brownfield project," Tayel added.

Mahmoud El-Ghalid, a Senior Reservoir Engineer at the Gulf of Suez Petroleum Company (GUPCO), concurred that the current price climate holds an advantage as the existing infrastructure "has a positive impact on saving time and money, and consequently improving the economics of the field development." Hence, the risk of developing brownfields becomes lower "because of data availability and experience gained throughout the field's history. This experience led to the knowledge of low-cost oil winning opportunities," El-Ghalid continued.

A DIAMOND IN THE ROUGH

So it seems that during this tough time, it is better to improve what is already there - i.e. brownfields - and think of it as a long-term investment for the future. When it comes to brownfields, there are a few factors that should be considered when estimating the costs of brownfield projects. Tayel remarked that "a defined and clear scope on [what to] replace or upgrade, how it will be done, what other changes or impact [it will have] on other existing systems in the plant," is an essential factor for developing brownfields. As critical and important as that step is, Tayel noted that "we normally are not paying much attention for it here in

Egypt or maybe it is not done correctly." This sort of negligence could very much impact on brownfield projects and increase costs.

Drawing on that point, BP, for example, provides three major anchor points companies should focus on when approaching brownfields in a low oil price environment; reliability and integrity; production optimization; and reservoir management. BP recommends that investing in the infrastructure goes a long way in addition to building a detailed understanding of the reservoir and optimizing its recovery mechanisms. Of course, in order to achieve financial efficiency and maximum benefits, all of these elements should be supported by a range of technologies.

There is no doubt that technology has a key role in brownfields, adding operational efficiency to managing brownfield projects only elevate the value of brownfields. Operational efficiency helps manage cost escalation in addition to meeting environmental obligations. As the current oil price climate seems favorable towards brownfields development, El-Ghalid suggested two main axes to unlock brownfields potentials. He noted that production optimization through utilizing technologies is essential to the process as "process surveillance and predictive analytical tools provide early warnings of potential facility issues, giving us time to intervene proactively." Coupling that with production maximization through "removing bottlenecks, easing constraints through the system which might lead to a quick boost in production with minimum costs," El-Ghalid further elaborated.

CASE STUDY

Egypt has many success stories when it comes to optimizing production from brownfields. Take West Bakr Petroleum Company for example, in 2016 the company made an integrated plan for West Bakr brownfield. Not only was the company able to double its production, but it managed to reduce operational costs as well. In order to do so, the company implemented main strategies which included; unlocking oil potential, freeing water disposal constraints, freeing oil handling constraints, tracking and analyzing well failures, and selecting durable Artificial Lift Systems (ALS). Through following a predetermined scope of work, the company managed to increase production by 30% in the fiscal year (FY) 2018/19.

A STEP FURTHER

By establishing strong foundation markers for Egypt's brownfield, it is a must to think ahead on how to maximize their potential. One way to do so is through creating an efficient inventory system, as it becomes an effective tool for resource prioritization in addition to being a favorable asset for attracting private investment.

As the Ministry of Petroleum and Mineral Resources continues its digital transformation process, digital inventories should not be left out. In addition to digitizing the existing data, El-Ghalid suggested moving to the cloud stating that "allowing our technical staff to access it [data] to search for analogies and best practices, also benchmarking their assets would broaden and strengthen their [brownfield] development strategies for greater revenue." Thus, despite the current slump, there is always a chance for improvements, and investing in brownfields seems like the most reasonable way to do it.





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WATER MANAGEMENT OPTIMIZATION: BREATHING NEW LIFE INTO BROWNFIELDS

BY FATMA AHMED

In the oil and gas industry, it is hard to produce barrels of oil without water as it exists in both onshore and offshore wells naturally. Due to this, sometimes oil companies have been referred to as water companies within the oil and gas sector. The ratio of produced water to oil varies from one well to another. CNBC reported, in 2017, that for each barrel of oil an average of three to five barrels of water is produced as well.

According to a sheet published by the Water Environment Federation, the amount of water barrels may reach more than 20 barrels in some parts of the world. In a mature field, produced water may reach nine barrels for every barrel of oil. Excessive Water Influence

Excessive water control in wells is a very important issue that should be taken into consideration for new as well as mature oil fields. Excess water affects the performance of the wells' production and it may shorten the wells' lifetime. As a result, many fields could be turned into brownfields earlier, despite having the ability to produce more oil.

Amer Hassan, a Senior Reservoir Engineer at IPR Energy Group, told Egypt Oil and Gas (EOG) "Water Production has side effects on the environmental footprint due to harsh oil contaminants and on overall project economics."

Additionally, it represents an economic challenge for the operators and reduces profitability due to the high costs of water disposal process. According to an article published by the Society of Petroleum Engineers (SPE), water disposal and treatment from oil fields costs more than \$40 billion per year because the water produced is accompanied by hydrocarbons. Furthermore, water production leads to corruptions and degradation of the fields.

Noureddien Darhim, New Technology and Unconventional Resources Lead, discussed the quantity and quality of produced water control project commerciality. According to him "Water quantity can restrain project economics due to production loss, and water quality dictates the degree of complexity needed in surface facilities counting on technology advancement especially when it comes to environmental regulations in case of water disposal, for example."

WATER FORMATION ORIGINS

There are many sources for the undesired water. One of them, which is considered the most arguable issue in the sector, is water injection. During oil production, the water flooding technique is used to push the oil from the matrix rock toward the production well in addition to keep the pressure stability of the reservoir. As the stickiness of water differs from the oil, a great amount of water may permeate into the production well to stop production.

Another cause of water existence is water coning. Water coning happens when the production well is located near to aquifer with the presence of a permeable connection between them. Coning is caused when the pressure drawdown is increased to overcome the gravitational resistance of nearby water.

In addition, poor conditions of the wellbore are another source of unwanted water. It resulted from casing leaks or bad cement jobs behind the casing. These problems are the causes of connection between water sources and the wellbore.

IT CAN BE RESOLVED

The optimum method to resolve such a problem can be identified by gathering all the data related to the reservoir and production to diagnose it accurately. Accordingly, the most suitable solution can be reached. There are two main methods for water shutoff: mechanical methods and chemical methods.

According to an article titled "Comprehensive Review of Water Shutoff Methods for Horizontal Wells", written by Baojun Bai from Missouri University, these methods can be used individually or combined.

Mechanical methods are known to be the most suitable techniques, especially when reducing water from the field's wellbore or near to the wellbore to provide temporary zonal isolation. While chemical methods are used in the plugging matrix or fractures especially in the wells that are completed with perforated liners as well as completed with sand screen pipe. However, the two types are applicable in an open hole and cased hole horizontal well in case that the water entry point is at the toe.

The most popular mechanical methods packers are those of plugs and patches. A paper entitled "Overview of Water Shutoff Operations in Oil and Gas Wells" written by Abdullah Taha, from Qatar Petroleum, defined that packers and plugs are objects made of rubber with a small diameter which can expand the downhole the wellbore into larger diameters and create a seal and isolating the well from unwanted features or zones. The Patch method is suitable when the source of water is from the casing leaks. It is used after finding the location of the leak accurately. It can be applied through the rigging as well as non-rigging by using technologies.

Chemical solutions, although its results may take between two months to years to appear, it has a unique advantage over mechanical solutions, which is solving the problem rather than hiding it. One example of chemical solutions is injecting the reservoir with chemical substances to change the features of fluids and, therefore, reduce permeability. Not only that, but close off the water source entirely. In addition, chemical injections can be used to increase the viscosity of the injected fluid, which can increase the sweeping efficiency and consequently reduce the amount of water.

There are several efficient chemical solutions, but one of the most famous is gel injection. It helps in reducing the water to oil ratio by decreasing the permeability and block any open holes or fractures. This gel is always made of water, polymers, and crosslinking chemical agents. To be implemented, it should pass through three stages including modeling, designing, and executing.

Modeling the gel injection can be done by using all available information about the reservoir. Then, suitable properties of the gel are designed according to the collected information and executed to the reservoir.

Another well-known chemical solution is polymer flooding. Polymer flooding refers to a long chain of molecules composed of many repeated subunits with high molecular weight which increases the viscosity of the water and mobilizes the oil in the reservoir matrix rock. The most common types of used polymers are biopolymer and synthetic polymers. Biopolymers are suitable for high-salinity water while synthetic polymers perform better with low-salinity water.

Hassan, the Senior Reservoir Engineer, pointed out that in order to handle this issue, there is a need for understanding reservoir dynamics in order to prevent water production by reliable good intervention actions and treating water before disposal to eliminate environmental side effects.

TECHNOLOGICAL FEATURE

Of course, there is a wide range of applied technologies that are used in solving the excessive water issue. A study entitled "Controlling Water Production by Application of Smart Well Technology", explained the importance of intelligent good application in solving excessive water problem and how it can be implemented by using Integrated Production Modelling (IPM) to simulate smart wells.

Many IOCs exerted efforts to develop some of these technologies, which help in reducing the amount of unwanted water, enhance recovery efficiency and extend wells life. Baker Hughes company presented the Aquacut technique, which targets only the water phase of produced fluids with minimal impact on the oil.

Halliburton also developed a number of technologies to reduce unwanted water and enhance recovery efficiency including CrystalSeal, Waterweb Water Control, Thermatek Fluids, QuickLook Reservoir Simulation Service, MOC/One System.

Moreover, Schlumberger presented All Seal technologies water and gas conformance service starting from relative permeability modifiers (RPMs) and temporary chemical blocks to permanent cements.

Furthermore, Poweltec implemented Water Shut-Off (WSO) and Conformance Control (CC), and Sand Control. SNF provided advanced polymer technologies and cutting-edge solutions for Hydraulic Fracturing, Enhanced Oil Recovery (EOR), Oil Sands, Drilling, as well as Cementing and Well Stimulation.

For Egypt, Darhim stated that there different technology solutions are being applied in Egypt, starting from simple mechanical shut-off or deep conformance techniques to Enhanced Oil Recovery applications.

Darhim elaborated that the solutions provided by different oil service companies are using very similar physical and/or chemical mechanisms that usually are applicable for a wide range of conditions for Egyptian fields.

"By implementing a big-loop water management strategy, Egypt may be able to unlock an extra margin of recoverable commercial oil. This would be economically efficient since only 1% incremental recovery in such fields means millions of oil barrels", Darhim remarked.

In addition, Hassan said that the technologies used in Egypt to decrease the side effects of water production include drilling horizontal wells and tertiary oil recovery techniques such as Polymer flooding in the development plans.

Hassan noted that implementing water management strategies in Egypt can "prolong the life of the mature field by increasing recovery factor by adding more reserves

NAGORNO-KARABAKH CONFLICT THREATENS WIDER WAR, JEOPARDIZES ENERGY CORRIDOR

BY IHAB SHAARAWY

One of the most complicated decades-long world conflicts was revived when fights erupted again between Armenia and Azerbaijan over the mountainous enclave late in September. Hopes of ending the bloodshed in Nagorno-Karabakh looked slim last month as several brokered ceasefires failed to halt the worst fighting in the South Caucasus since the 1990s. The new wave of fighting is not only threatening to spiral into regional war, but also threatening an important energy corridor.

Although skirmishes have been common along the front lines of Nagorno-Karabakh, which is internationally recognized as a part of Azerbaijan but is home to ethnic Armenians, the recent violence wave shows signs that the local ethnic dispute could threaten to destabilize the South Caucasus region and disrupt oil and gas exports from Azerbaijan, a significant oil and gas exporter to Central Asia and Europe.

The conflict is becoming more complicated with Russia promising to defend Armenia, while Turkey pledging support to Azerbaijan. The complicated situation also left Iran, which has a large Azeri minority and good relations with Armenia, torn between supporting the fellow Shiite brothers in Azerbaijan or the important strategic and trade partners in Armenia.

DEEP ROOTED CONFLICT

The Caucasus, a strategically important mountainous region in south-east Europe, has been a venue for conflict between different powers that vied to control it over centuries. However, the Nagorno-Karabakh dispute in particular can be traced to the early 1920s when Armenia and Azerbaijan both became part of the Soviet Union. Nagorno-Karabakh was an ethnic-majority Armenian region, but the Soviets gave control over the area to Azerbaijan authorities.

For decades, the Armenians in Nagorno-Karabakh called to be transferred to Armenian authority control. But it was only when the Soviet Union began to collapse in the late 1980s that Nagorno-Karabakh's regional parliament officially voted to become part of Armenia to begin a military confrontation between the two former Soviet states.

Armenians eventually were able to gain control of Nagorno-Karabakh before a Russian-brokered ceasefire was declared in 1994. Since then, Nagorno-Karabakh remained part of Azerbaijan but has mostly been governed by separatists who declared a republic, run by ethnic Armenians and backed by the Armenian government. However, the declared republic was never recognized by any country in the world.

Clashes have continued throughout the past three decades, with one serious flare in 2016, when dozens of troops on both sides were killed. About 30,000 people were reportedly killed in a 1991-94 war, which resulted in the displacement of 750,000 Azerbaijanis and 353,000 Armenians.

Peace talks have taken place since then, mediated by the Organization for Security and Co-operation in Europe (OSCE) Minsk Group - a body set up in 1992 and chaired by France, Russia and the US.

The two countries traded accusations about who began the last bout of fighting that killed hundreds of people, including civilians, and strained ties between Turkey, a close ally of Azerbaijan and Russia, which has a defense pact with Armenia.

In spite of three ceasefire agreements signed in recent weeks, fighting has continued apace and even getting more brutal as the recent offensive marked by the deployment of drones, sensors, long-range heavy artillery and missile strikes.

According to Amnesty International, Armenian, Armenian-backed and Azerbaijani forces have all been guilty of using banned weapons including Cluster munitions that have endangered the lives of civilians caught in the middle.

Despite the international calls for calm, the prospects for a broader peace deal appear dim. A ceasefire brokered in Moscow on October 10 failed to hold, while a truce mediated by France a week later also broke down, whereas a US-brokered truce met the same destiny with each side blaming the other for violations.

ASSERTIVE TURKEY

According to analysts, the recent episode of the conflict is very different and more serious mainly due to the involvement of Turkey, which offered more direct support to Azerbaijan and elevated the scale of the fighting.

Turkey, which owns the North Atlantic Treaty Organization's (Nato) second-largest army after the US, supplies weapons and training to Azerbaijan, and there are signs that it is actively engaged in the fighting and sending Syrian mercenaries, which Ankara has denied. If Turkish involvement is confirmed, even in a supporting role, it would be just one of several fronts where it has recently deployed troops, ships, and aircraft with increasing readiness. Analysts see the Turkish role as another example that could rapidly project military forces with recent interventions in Iraq, Syria and Libya in mind.

Turkey and Azerbaijan are bound by strong ethnic, cultural and historic bonds and refer to their relationship as being one between the sons of one nation.

Over the last three decades, the two countries have forged robust economic ties. Turkey is the main channel for Azerbaijan's oil and gas exports, while the ex-Soviet republic has become a major investor in Turkey.

However, many commentators see Turkish involvement in the Armenian-Azeri conflict as part of Turkey's aspirations for global and regional leadership.

The Turkish involvement is even heating up the conflict as Armenians view the current attack as an attempt to continue the Armenian genocide of 1915, when 1.5 million Armenian are believed to be massacred by the rulers of the Ottoman Empire.

STUMBLING UPON A REAL BEAR

Turkey's direct engagement in support of Azerbaijan that lies in an area of traditional Russian influence also risks turning the local dispute into a regional one.

Russia and Turkey used to coordinate together at times in the past to tamp down tensions between Azerbaijan and Armenia.

But that uneasy cooperation between Turkey and Russia, an ally of Armenia, is starting to fade as both countries become increasingly assertive in the Middle East in the absence of US influence. Indeed the relations between Turkey and Russia were never more complicated.

Turkey has angered the US by buying anti-aircraft missiles from Russia and cutting a natural gas pipeline deal seen as undermining Ukraine. At the same time, it is fighting proxy wars against Moscow in Syria and Libya.

Armenia and Russia are members of the Collective Security Treaty Organization, a military alliance of some former Soviet republics raising the possibility that Armenia could at some point ask for military help from the alliance.

Armenia is also hosting a large Russian military base less than 10 kilometers from the Turkish border.

However, since the eruption of the recent round of violence, Moscow has sought to remain neutral in the conflict between the two former Soviet states but is cautious of the rising regional clout of Turkey.

PERPLEXED IRAN

Another relevant actor in the Armenian-Azerbaijani conflict is the Islamic regime of Iran, which shares borders with both countries and where several rockets have hit its soil.

Iran is generally cautious of the conflict expanding to its borders; however, it is also suspicious of growing Turkish influence in South Caucasus.

Tehran has so far called for mediation and for a ceasefire, remaining largely neutral, shooting down allegations that military equipment passed through its borders into Armenia.

Despite the religious ties with Azerbaijan, the Islamic regime perceives Armenia as an ally with which to create a power of balance in the region. Trade relations with Armenia are also significant for the Iranian regime because of the US sanctions. Thus, there is no wonder that some regime elements have openly taken sides in the conflict.

However, Iran is in a crucial position in the middle of the conflict and surely needs to be well prepared and not to let the situation aggravate and spill out of control.

In spite of the considerable influence that the US used to have in the region as a host to a large, wealthy and politically active Armenian diaspora and the primary backer of new Azeri oil and gas pipeline routes that compete with Russia's transit network, the US interest in the region appears to have faded. A ceasefire brokered by the State Department in late October broke down hours after coming into effect.

ENERGY CORRIDOR AT GUNPOINT

A deeper look at the Nagorno-Karabakh conflict will uncover more stakes for the world to worry about. It is not only about the danger it imposes to stability in the region, but also the threat to a corridor for major pipelines taking oil and gas to world markets. The latest clash took place in the Tavush area puts the fighting even closer to the pipelines, including the South Caucasus Pipeline (SCP).

SCP is part of the Southern Gas Corridor, which also includes the Trans-Anatolian Natural Gas Pipeline (TANAP) and the Trans Adriatic Pipeline (TAP). This combined network of pipelines is due to start carrying gas from Azerbaijan to Europe.

However, Armenian armed forces are unlikely to target Azeri pipelines because significant damage or destruction would dent international support for Armenia.

Thanks to the coronavirus outbreak, any brief interruption to output or disruption to a pipeline would easily be recovered given the vast amount of spare crude and gas production capacity elsewhere around the world.

However, a long-term disruption may lead to a commodity price spike especially once the demand rates come to normal again.

It was the destiny of the Caspian region to lie in crossroads, where the interests of many states meet to form a complex pattern.

Hence, there should be a direct link between the settlement of regional security, on the one hand, and the geopolitical, economic and strategic interests of the conflicting sides, the mediators (third parties) and the international community as a whole, on the other.

The Karabakh issue would have found its way to resolution much more easily were it not for the involvement of the strategic interests of other states that threaten not to find a solution for the complicated problem any time soon.

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OIL FIGHTS BACK: BROWNFIELD REJUVENATION IN EGYPT

BY JACK BECKFORD

Oil brownfields are the backbone of the oil industry. According to a report from IHS Cambridge Energy Research Associates, two-thirds of the world's daily oil production hails from mature fields. This figure is even greater in Egypt, and according to empirical data at Egypt Oil & Gas' (EOG) "Future of Egypt's Brownfield Development" roundtable, crude production from brownfields in Egypt makes up a resounding 77%.

Thus, there is a strong incentive to develop the best and most cost-effective technologies to enhance the output of brownfields. For ageing assets such as production platforms and related infrastructure, structural integrity assessment requires high-tech methods.

According to Hisham El Grawany, DNV GL's Regional Manager for Egypt and North Africa, brownfield integrity is a tight line to walk: "exploration and production clients need to know at what point it is more economical to squeeze production out of an existing platform or to perform an overhaul on the asset, including replacing or refurbishing equipment where necessary."

BROWNFIELD CONTRACTS

There is a myriad of brownfield contracts available in Egypt for production at brownfields. The most prevalent form of contract for mature fields in Egypt is a production-sharing contract (PSC). In this scenario, IOCs have the decision-making power over the field, in addition to handling the redevelopment operations needed.

PSCs have their shortcomings, however, and prove to be inefficient in certain cases as the Egyptian government has less jurisdiction over the oilfields whether it be supervising, regulating, or determining the IOCs operating roles. Couple this with the tax code deficiencies that potentially prevent the host governments from getting rent from IOCs, they are not ideal.

A concession agreement (CA) is a type of contract between a state or mineral rights owner and a company that provides the former with the right to operate a business with the jurisdiction of the latter based on negotiated terms and conditions. These are the most old fashioned contract type in Egypt and are also the simplest in form. The problem when it comes to brownfields, though, is that a CA lessee absorbs all financial risks, including the costs of oil exploration. For obvious reasons, this is a contractual sticking point at brownfields given their already risky nature.

Meanwhile, Service Contracts (SC) are seen as a new viable option to enhance profitability at brownfields in Egypt. They represent a key incentive for companies to invest in the late-stage sites, where IOCs agree to a predetermined return in lieu of sharing the profits. All the while, the host government remains the owner of the field and its production. According to Mahmoud Wazery, a Production Manager at WEPCO, "an SC is, in essence, a type of contract that is a simplified tool for purchasing and constructing activities. IOCs do not need to comply with the normal approval cycle to purchase materials and equipment which shall be used for production."

Despite the introduction of SCs, Panos Douglis, Managing Director at Delft Inversion, maintains that there is still more work to be done to "open up the industry doors to foreign technology vendors by simplifying the paperwork and registration processes could bring multi-fold benefits in the mid-run."

AVAILABLE BROWNFIELD TECHNOLOGIES IN EGYPT

In terms of well revival techniques, there is a whole range of techniques present in Egypt to aid Enhanced oil recovery (EOR). Among these techniques is water flooding, whereby water is injected into the oil field to increase pressure and thereby stimulate production. According to a study by the Society of Petroleum Engineers (SPE), this technique can enhance oil extraction from 30% to a recovery factor of 50%.

A more advanced technique implemented in Egypt is Steam Injection (the Cyclic Steam Stimulation (CSC) method the most popular). Steam is injected into the well to heat the oil in the surrounding reservoir to recover approximately 20% of the Original Oil in Place (OOIP). This process is repeated until the cost of injecting steam overtakes the money made from producing oil. In terms of cost efficiency, the cost of injecting steam is high thus the profit margins are reduced.



In terms of drilling technologies that enhance brownfield profitability, radial drilling (RD) is a key operation in Egypt. RD utilizes hydraulic energy to create several lateral holes in different directions and levels with several lengths. These lateral holes are made by milling the casing with a small bit then extending these holes laterally using high pressure hydraulic jetting. A successful case study in Egypt is at the Gulf of Suez: the results showed the first well gross rate increased by 37.4%, and the net oil rate was improved by more than 31.4%; the second well showed an improvement by about 73.34% increase in gross rate, and 47.3%, an increase in the net oil rate; and the third well showed an improvement by about 14.3% gross rate, and a 14.7% increase in the net oil rate for a very short period. Therefore, this technology extends the productive life of wells and the whole field at a reasonable cost.

Seismic mapping is the preferred technology over other EOR techniques due to its elastic waves – which have no vertical or horizontal plane barriers – and because other EOR methods usually are more expensive and ineffective in reservoirs that are highly heterogeneous.

Operators use seismic stimulation in mature fields, due to its effectiveness on sandstone, carbonate reservoirs, and diatomite. Seismic stimulation is a promising alternative to shale plays re-fracturing. The seismic stimulation tool works by creating elastic waves to prepare the lightest phase first. It is accompanied by less water production and produces more oil. According to Bill Wooden's article named 'Seismic Stimulation Advances EOR Technology', seismic stimulation "is best applied to fields having gas-oil ratios of less than 2,000 standard cubic feet per barrel

(cf/b). Thick oil is less inclined to move regardless of the elastic wave strength."

WHAT'S NEXT FOR EGYPT?

The immediate future of Egypt's brownfields is currently in flux. With the coronavirus crippling oil prices and profit margins, the need for cost efficiency has never been greater. When questioned on how the pandemic will shape the future of brownfields, Douglis asserted: "The pandemic has given a boost globally to the movement of digitization, which is expected to have an immediate impact on operations and efficiency. On the other hand, it has created a volatile investment environment that creates a barrier for other innovative technologies."

One technology that has been in the pipeline for a long while is 4D seismic visualization technology. 4D, or time-lapse seismic survey, is applied in monitoring three major aspects namely: the changes in a producing hydrocarbon reservoir, underground storage of carbon dioxide (CO₂), and geohazards. This technology enhances decision making and determines the best ways that could be used to capitalize on reserves in mature hydrocarbon fields. This assists in reservoir characterization, identifying the movement of fluid interfaces, and locating reserves. On top of this, the technology has gained notoriety as it provides higher accuracy and a clearer understanding of reservoirs, as well as guiding the selection of the best possible techniques that could be applied in production.



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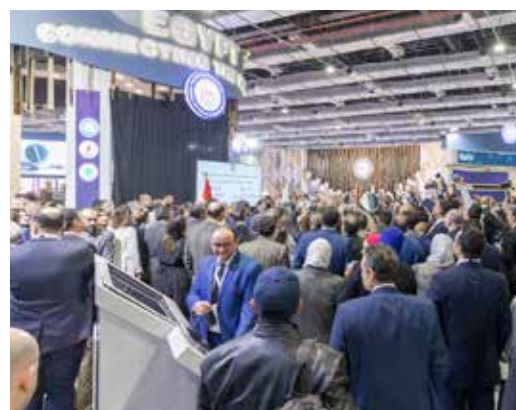
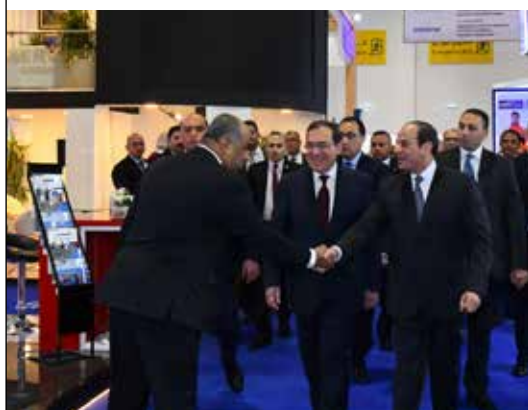
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REVITALIZING BROWNFIELDS: A CASE STUDY FROM THE WESTERN DESERT

BY JACK BECKFORD

The issue of revitalizing brownfields in Egypt is a pressing issue. With over 70% of Egypt's oilfields in a mature stage of their production lifespan, the need to prolong the oilfield's lifespan is of paramount importance. As a result, a myriad of revitalization techniques have been implemented to try and boost production at brownfields.

One of the important enhanced oil recovery (EOR) techniques is waterflooding (WF), which was the focus of a paper under the title "Key Learnings from Re-Development Activity and Waterflood EOR of Mature Brownfield: Heterogeneous Compartmentalized Reservoir Case Study, Western Desert, Egypt". It is written by Mohamed El Bagoury, Senior Reservoir Geologist at Bapetco, and, Mohamad Fatmy, Senior Reservoir Engineer at Bapetco.

The paper aims to prove that by a multi-phased development approach and extensive modeling work, it is possible to increase the field life production, improve the pattern flood, optimize EOR, and facilitate operations.

FIELD BACKGROUND

The area in question is the "Neag-1" field. Discovered in 2007 with first production occurring in June 2008, it is located within the Bahariya reservoir. The geology consists of a sequence of thin-bedded shaley sandstone that shows variable permeability ranges with vertical and lateral heterogeneity.

Following a full well-analysis report, it was recommended to perforate and frac all layers to enhance seeping and maximize production potential. WF started at this well in 2010 by way of commingling injections and commingle production.

The reservoir is known for having a complex architectural structure with a three-way dip fault closure. Two separate accumulations lie at the intersection both of which are similar in structural style and are separated by normal faults of ± 200 meters throw. The northwest-trending normal fault is, however, broken into three en-echelon faults. This enhances the risk of fault-block compartmentalization and poor connectivity on thin sands.

FIELD DEVELOPMENT AND UNDERSTANDING

The Naeg-1 field underwent a multi-phased development to maximize hydrocarbon potential, which was showing a clear decline in different reservoir blocks.

Phase one consisted of amassing subsurface data as cores, logs, BHI, pressure and well performance from a select few wells to gain a better understanding of the volumes, propose new infill wells, and extend the well-pattern instead of peripheral injection.

After obtaining this

data the next stage is pre-injection, which helps to propose infill wells and concept selection to minimize well spacing in the latter phases. At this stage, big uncertainties were encountered in the following areas: reservoir connectivity, reservoir geology, production allocation (due to lack of testing), and a lack of production logging tool (PLT) to administer the injection.

After assessing the appraisals of a further six wells, the final phase resulted in drawing up space with 14 wells. However, to fully evaluate the results, a detailed modeling scope is needed to fill any defined gaps in recovery, improve production forecasting, and manage the ongoing WF.

STATIC MODEL WORKFLOW

The model constructed to form a detailed 3D model using Petrel with the aim of performing reservoir simulation. Due to the mature nature of the field, the chances of drilling untapped wells are low. Thus obtaining high-quality zonation detail, borehole images, multi-sand maps, reservoir analogs, and attribute semblance are vitally important to build a new model of high resolution.

A detailed interpretation of additional seismic markers was completed and followed by extraction of the semblance volume to detect discontinuities and see if there is a relation between these discontinuities and the current situation of Producers/Injectors connectivity. This modeling led to the discovery of additional barriers that inhibit good sweeping from producer to injector, which affects the Well position and recovery due to the thin-bedded nature of the reservoir.

In terms of Facies Modelling Resolve, a sedimentological study was carried out on core from three wells to identify genetic units and facies associations. After the identification, the data was used to calibrate the logs and calculate electrofacies and lithofacies. The applied method was proposing to minimize the zones' resolution for the dense well control in open holes. Also, pressure and performance were used to generate sand maps for facies modeling purposes.

DATA ANALYSIS

Once the data was collated, data analysis was implemented for quality control in order to find the right balance between

input and output and also determining the property modeling. Facies proportion and attribute probability were used for data transformation and modeling of properties. Function windows were used to inspect the property distributions and the correlation between porosity and permeability. Quality was assured by using facies and property models, histograms to check for anomalies, and aided upscaling of the model outputs compared to the raw data.

FIELDWORK FINDINGS

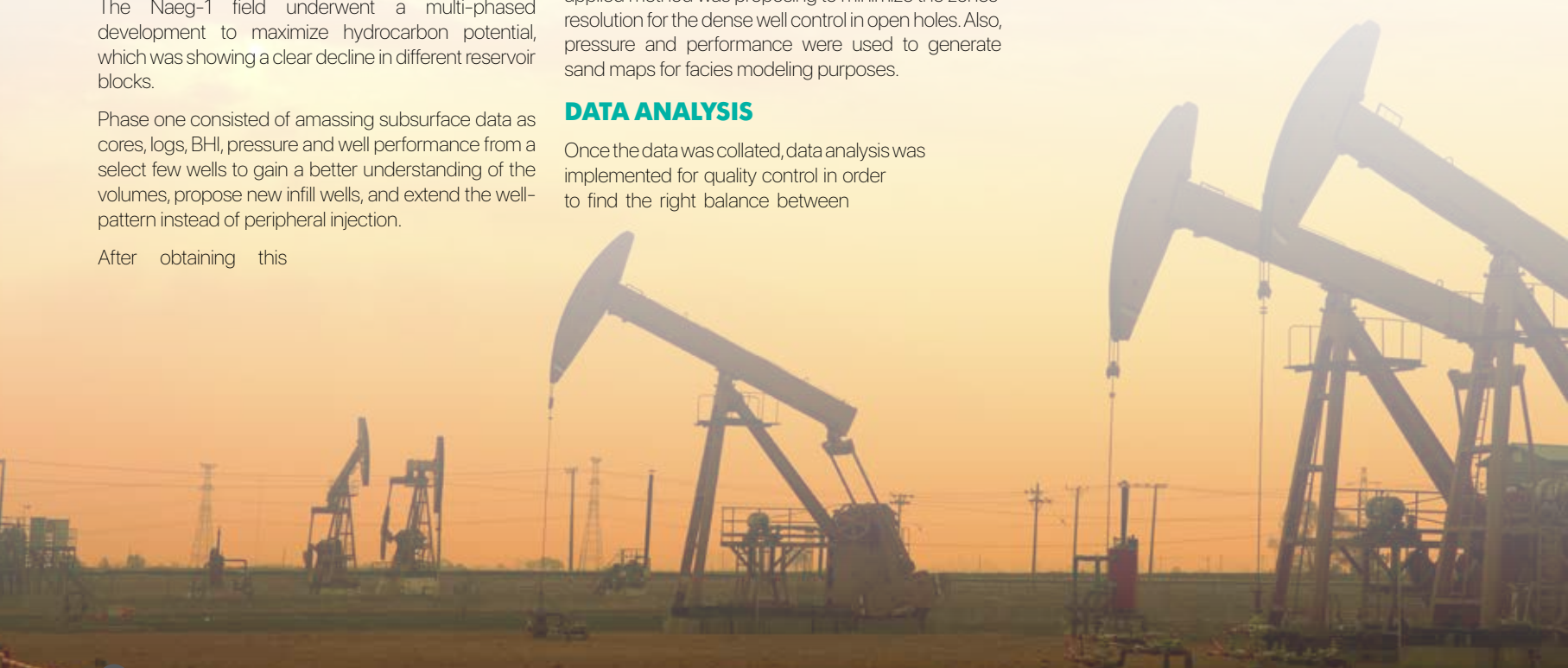
Once all the data was fully applied and analyzed through the data modeling software, the following conclusions could be drawn:

The Bahariya reservoir in the Neag-1 field showed different sand patches stacked together that were found to be oriented in different directions, which cannot be predicted in the early phases of development.

Furthermore, after evaluating the stresses influence, the data presented a clear understanding of flow patterns and exceptional recovery in naturally fractured blocks when compared to flat unbended blocks in addition to WF pattern design.

When the 3D modeling was completed for the reservoir, it added the huge additional benefit of filling in the gaps for reservoir recovery and rational testing of new development options. This, coupled with successful approaches for geometry prediction, allowed for a far superior understanding of the Bahariya heterogeneous reservoir.

The concluding findings of the study elucidated that recovery benchmarking and assessment is essential for mature fields to optimize reservoir management in the suffering reservoir portion.



A CALL TO CURB GREENHOUSE GASES

During the past decades, many international organisations; financial institutions; major oil and gas companies; and electricity producers have shown a fast-growing commitment and responsibility toward combating the global warming of our planet. The main reason behind the persistent global warming is the continuous emissions of what is called greenhouse gas (GHG).

GHG is a gas which absorbs and emits radiant energy and traps heat in the atmosphere. The main greenhouse gases in Earth's atmosphere are: water vapour (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and ozone (O₃). Sources for these gases are burning fuels, coal, trees, biological materials, industrial activities, solid waste, decay of organic waste and wastewater treatment.

The effect of these gases on climate change depends on their concentration in air. According to the World Resources Institute (WRI) in 2014, global GHG emissions increased from around 34,000 million metric tons of CO₂ in 1990 to around 46,000 million metric tons of CO₂ in 2010.

International financial institutions are approaching a framework for harmonized greenhouse gas by estimating the gross GHG emissions that a project is expected to produce on an annual basis. Once it is completed, a normal operation capacity should have a base line scenario, either "without project scenario" or an "alternative scenario". Meanwhile, designing a concept of measuring, reporting, and verification (MRV) has gained significance in the design and implementation of climate change policies in the recent years.

We also have GHG Protocol, which establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions.

Building on a 20-year partnership between WRI and the World Business Council for Sustainable Development (WBCSD), GHG Protocol works with governments, industry associations, non-governmental organizations (NGOs), businesses, and other organizations.



To help organizations prove environmental best practice, the international standard for GHG emission inventories and verification introduced ISO 14046, which consists of three parts, each with a different technical focus. The first part is the "specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals," which addresses greenhouse gas emission inventories to data collection, consolidation, and emissions quantification. The second part addresses quantification and reporting of emission reductions from project activities. The third part is the "specification with guidance for the validation and verification of greenhouse gas assertions."

Thus we can realize that GHG emission reduction and removal is a global responsibility for international and local industrial organizations, energy producers, transportations, and agricultural activities, which should comply with the regulations and protocols concerning GHG removals.

Egypt has more than 130 years in the oil industry since the first oil was discovered in Gemsa late nineteenth century, in addition to the stable fiscal and attractive investment regime with more than 50 years of mutual business collaboration and partnership with multinational major oil and gas companies, this leads Egypt to recognize the importance of cooperation and accommodation with the international regulations to take all measures for stopping the GHG emissions, which is a must for the benefit of Egypt and the Globe.

Abubakr Ibrahim Ibrahim

Former Chairman of Ganoub El Wadi Holding Petroleum Co. (GANOPE)

NEW WAVE OF CORONAVIRUS, THE EGYPTIAN PETROLEUM SECTOR

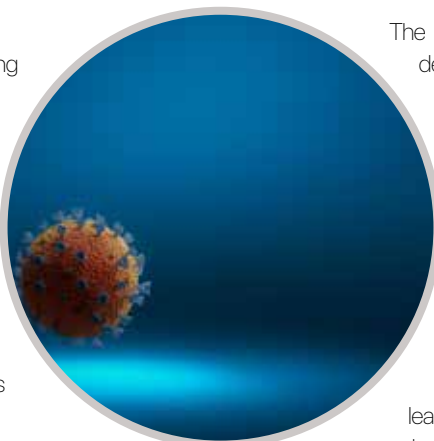
As coronavirus figures in Egypt show consistent decrease every day, the Cabinet has moved towards a continuous returning of its economy, easing off a portion of its anti-virus restrictions, including lifting curfews, reopening stores and cafes, and resuming international flights.

But fears are overflowing that this will trigger a second wave of coronavirus, requiring the world's oil recuperation to be postponed, oil prices to be lowered, and levels of supply and demand to be affected in the coming months.

Oil prices fell as the Organization of the Petroleum Exporting Countries and its allies' (OPEC+) plans to develop deftly cuts were eclipsed by the demand worries as a portion of the world's greatest oil-consuming nations fight to contain a second-wave of quarantine measures.

The production process of oil in Egypt is by all accounts influenced, some way or another, by the current difficulties of the drop in oil prices and the lockdown forced over the world. Oil companies consistently look to keep up and increment their level of output, yet this should not have occurred until oil prices recuperate to compensate companies' losses.

On the off chance that oil prices stay discouraged over the coming time frame, the import bill is probably going to decline considerably (at least by 50%), and this will have a positive impact on Egypt's subsidy budget. Low oil prices appear to be something useful for Egypt, however not for international oil companies (IOCs) investing in the Egyptian oil market whose profits on exploration and production (E&P) are affected.



This shall lead the placement of numerous upstream producers into default under their individual borrowing base facilities.

The expected new wave of coronavirus has also reduced global demand for energy, a new issue for Egypt, which has as of late become a huge exporter of natural gas. This could alter the extension of Egypt's natural gas industry for the time being, however, in the medium term, development of natural gas industry will continue to be a critical source of Egypt's economic growth and contribute to its external balance of trade.

The last effect on the Egyptian petroleum sector will show up sooner or later. The more extended oil prices stay discouraged, the larger the impact will be on E&P activities. However, this may lead to improving the Egyptian balance of trade through improving production in the long run.

Mohamed El Haythem

Mphil., DBA, MBA, PMP

General Manager, Foreign Companies' Control, EGPC

THE ENERGY TRANSITION IN THE MIDDLE EAST & NORTH AFRICA: WHAT TO EXPECT IN THE YEARS TO COME

Economically and politically, the Middle East and North Africa (MENA) region is diverse and has vast petroleum resources. More recent discoveries off the shores of Egypt have further enhanced the region's importance as an energy producing hub. Being at the core of the geopolitical system of extraction and trade in oil and gas, the Organization of the Petroleum Exporting Countries (OPEC) members in the region are trying to maintain a delicate balance of keeping oil prices and revenues high. This is due to the fact that volatilities in oil prices and conflicts have hampered economic growth in recent years.

The region faces challenges associated with socioeconomic development, youth unemployment, and the need to meet rapidly growing energy demands while considering water and food security, climate change, and local air pollution. The dominance of fossil-energy resources drives policy in many of the region's nations. Electricity, gasoline, and water subsidies are widespread, driving high consumption per capita and draining government finances.

Thus, the region is taking serious steps to realize its vast renewable-energy potential and diversify its energy sources but continues to face external criticism for ignoring the sustainable-energy agenda. "The region is making progress in streamlining its policies to progress clean-energy sectors, while working towards fully exploiting the potential of its natural gas and crude oil reserves in a safe and efficient manner," said Hisham el Grawany, Vice President and North Africa Area Manager for DNV GL, Oil & Gas.

Saudi Arabia's Vision 2030 strategy is to allocate large investments in renewables. Jordan, Morocco, and Tunisia have set targets to transform their energy mixes. Egypt, Iran, and Turkey, which are the most populous nations in the region, have streamlined their policies to progress clean-energy sectors and renewable generation, and to attract foreign investors. The region is also taking steps to implement demand-side management measures, including subsidy and tariff reforms, building retrofits, energy-management systems, and private-sector involvement.

POINTERS TO THE FUTURE

- » The geopolitical shift towards a more electrified world, the rise in unconventional sources, and the tapering off of oil demand will force this region's fossil-fuel producing countries to adopt more diversified economic models.
- » With these nations now feeling the effects of climate change, rising water scarcity, and a need to liberate fossil fuels for export, key policies will aim 'to green' supply chains and reduce per capita energy consumption. Water constraints will give a further push towards renewable energy, e.g., solar photovoltaics (PV) and wind, for which water is neither a major input nor cost component, and which could be used to replace fossil-fueled desalination.
- » The region has vast renewables potential, particularly solar PV. The renewable build starts from a very low base, but investment and uptake will mature. Egypt aims to obtain 42% of its electricity from renewables by 2035; Turkey has raised its target to 50% renewable power by 2023; Saudi Arabia targets 30% by 2030; and the United Arab Emirates (UAE) is calling for 70% decarbonization and 44% clean-energy power generation by 2050.
- » Rising power demand and increased variable renewable generation will see grid inter-connections established between the Gulf nations and the rest of the Middle East, despite political tensions. Cooperation will have to overcome a historical preference for self-sufficiency for security reasons, distortions in electricity prices due to subsidies, and state-owned monopolies not yet run on a commercial footing. Battery energy-storage will expand to support flexibility and renewables integration.
- » Systemic subsidization of energy will likely reduce slowly owing to growing budgetary pressures linked to growing population and consumption. Reduced fossil-fuel subsidies will be the first step towards a price on carbon, but we foresee slow adoption of low carbon prices for the region.

ENERGY TRANSITION

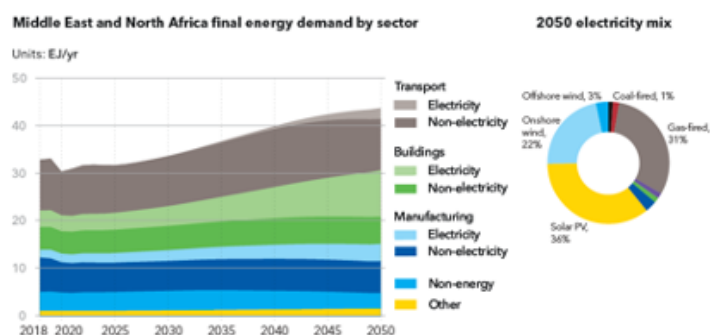


Figure 1 shows the region's final energy demand growing throughout the forecast period. The growth is distributed across all sectors, though efficiency gains in transport will see energy use peak there first. Efficiency improvements will limit growth of final energy demand in all sectors, thereby counteracting the effect of population and economic growth.

The share of electricity in final energy demand continues to increase, from 17% in 2018 to 38% in 2050. Buildings see the strongest electrification, with transport and manufacturing following later in the forecast period. The 2050 electricity mix will be dominated by solar PV, natural gas, and onshore wind. Even in this oil and gas-rich region, variable renewables will produce more than half the power in 2050.

THE REGION IS MAKING PROGRESS IN STREAMLINING ITS POLICIES TO PROGRESS CLEAN-ENERGY SECTORS, WHILE WORKING TOWARDS FULLY EXPLOITING THE POTENTIAL OF ITS NATURAL GAS AND CRUDE OIL RESERVES IN A SAFE AND EFFICIENT MANNER.



HISHAM EL GRAWANY

Vice President & Area Manager North Africa, DNV GL - Oil & Gas

Middle East and North Africa primary energy consumption by source

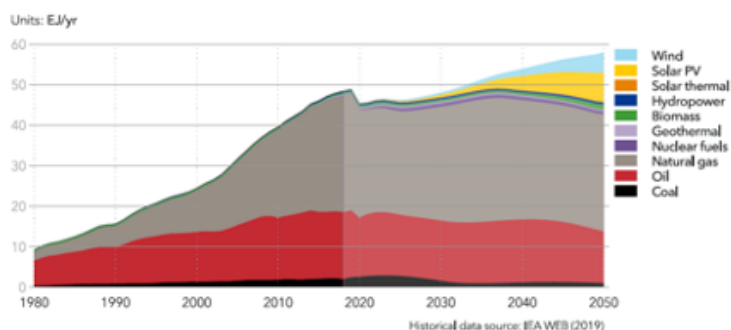


Figure 2 shows natural gas and oil dominating the primary energy mix through 2050. Whereas oil use will see a slight decrease after 2040, natural gas's contribution will stay about constant at 2018 levels, and with around 40% of the gas going to the power sector. Solar PV and wind will increase, but the uptake before 2030 is very limited. Coal, nuclear, hydropower and biomass are all minor players.

ENERGY TRANSITION INDICATORS

- » The region will see a strong increase in the share of electricity in its final energy demand mix after 2030 in an order of magnitude of 17%.
- » Energy intensity in this oil and gas-rich region will be reduced by more than 40% between 2018 and 2050.
- » The high share of fossil fuels in the energy mix will counteract further carbon-intensity reductions, reaching slightly more than 40 tCO₂/TJ in 2050 and representing highest value of all regions.

EMISSIONS

We project the region's average carbon price to be \$20/t by 2050. There will be limited explicit carbon-pricing instruments; negative carbon prices currently exist, and the likely first step towards carbon pricing will be to eliminate fossil-fuel subsidies.

Energy-related emissions from MENA follow an almost flat course over the next three decades. There will be a slight change in the contribution from the three demand sectors, with a small decline in manufacturing emissions and a small increase in transport emissions. Among the energy carriers there is also a slow movement, with only emissions from natural gas showing a small increase and coal and oil a small decline.

As the carbon price remains low, the expected uptake of carbon capture and storage (CCS) is negligible in the region; at 31 MtCO₂/year in 2050, 1% of total emissions. The Nationally Determined Contributions' (NDCs) pledges imply a regional target for emissions to increase by no more than 305% by 2030 relative to 1990. Our outlook indicates that energy-related emissions will be limited to a 175% increase by then. There are some uncertainties in the comparisons of targets and forecasts as some countries are unclear about whether the targets reported in NDCs also include non-energy related CO₂ emissions.

MENA's forecast emissions of 3.4 tCO₂/person in 2050 are two-thirds of the present level, and among the highest of all regions. This fossil rich region has a relatively slow transition, with emissions reducing less than in other regions with the same standards of living.

Download the full Energy Transition Outlook 2020 at dnvgl.com/eto

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Annual Inflation Headline CPI (%)

AUGUST 2020 **3.4** ↑ SEPTEMBER 2020 **3.7**



Net International Reserves (\$ billion)

AUGUST 2020 **38.37** ↑ SEPTEMBER 2020 **38.43**



Non-Oil Private Sector PMI (Points)

AUGUST 2020 **49.4** ↑ SEPTEMBER 2020 **50.4**

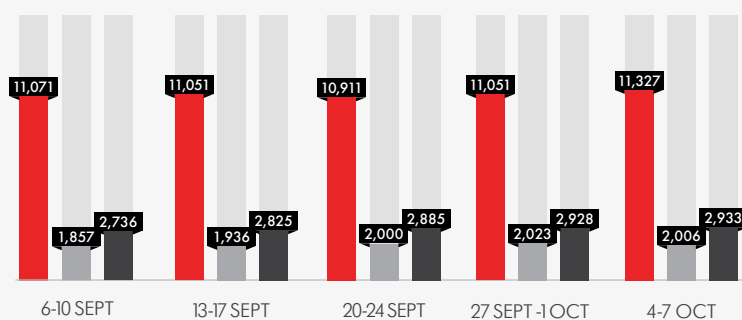


Exchange Rates

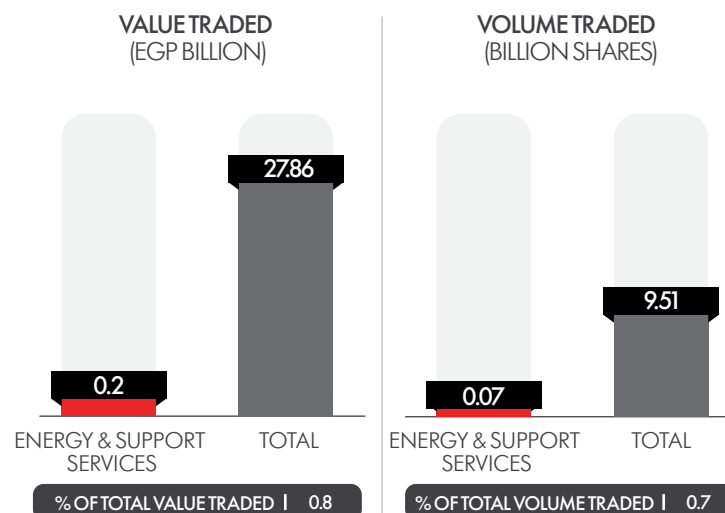


Capital Market Indicators

■ EGX 30 ■ EGX 70 EWI ■ EGX 100 EWI



Performance of Petroleum Companies in the Egyptian Exchange in September 2020



National Drilling

CURRENCY	CLOSE PRICE	YTD PRICE CHANGE (%)
USD	4.69	▼ 5.44



Alexandria Mineral Oils Co.

CURRENCY	CLOSE PRICE	YTD PRICE CHANGE (%)
EGP	2.62	▼ 26.82



Egypt Gas

CURRENCY	CLOSE PRICE	YTD PRICE CHANGE (%)
EGP	63.09	▲ 13.68



Sidi Kerir Petrochemicals

CURRENCY	CLOSE PRICE	YTD PRICE CHANGE (%)
EGP	8.57	▼ 4.57



ZAFARANA & GEMSA FIELDS' DEVELOPMENT IN OCTOBER

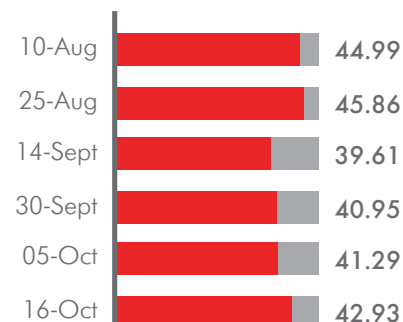
Zafarana

Completion of New Development
Well A-151,500 bbl/d
Production

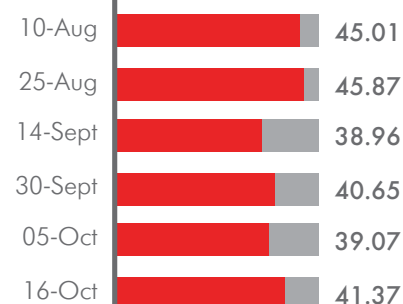
Gemsa

Repairing of SE-11
& SE-15 WellsGempetco's Production
(bbl/d)8,000
Exceeded>9,000
ExpectedINTERNATIONAL
OIL PRICES

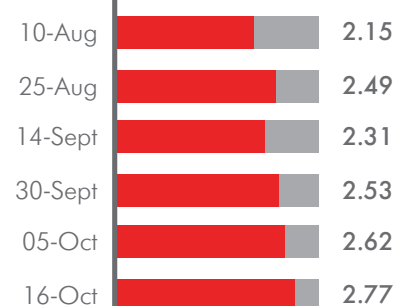
BRENT PRICES (\$/bbl)



OPEC BASKET PRICES (\$/bbl)



NATURAL GAS PRICES (\$/mmBtu)

ABU SENNAN CONCESSION
DEVELOPMENT IN H1 2020

Production (bbl/d)

12,347
Gross2,716
Net

Gross 2P Reserves

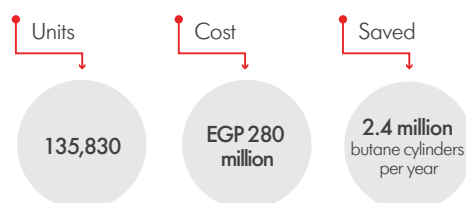
12%
Increased13.5 mmbbl
Reached

Completion of ES-5 well's Testing Program

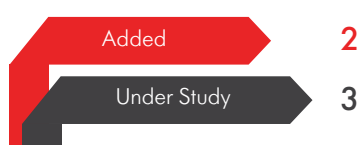
Added

2,900 bbl/d
Crude Oil9 mmscf/d
Natural GasNEW MOSTOROD REFINERY
PROJECT BY ERCSeptember
Date4.7 mmt of petroleum products
ProductionCairo Oil Refinery | Egyptian Refinery
Complexes\$4.3 billion
Investments\$0.6 - 1 billion per year
Savings

REGAS OPERATIONS IN QENA

RESIDENTIAL UNITS CONNECTED INTO
NATURAL GAS2 INDUSTRIAL AREAS CONNECTED INTO
NATURAL GAS

NATURAL GAS SUPPLY STATIONS

THE REFINING SECTOR'S
UPDATES

IMPLEMENTED PROJECTS

Expansion Projects in Alexandria and ERC



ONGOING PROJECTS

Octane and Diesel Complex

Assuit
LocationEGP 91 billion
Cost

Midor Refinery Expansion

4.9 mmt/y of petroleum products
Target



We take energy forward

We're committed to making energy safer, cleaner, and more efficient for people and the planet. By combining industry-leading technologies and services with operations in over 120 countries, we're collaborating with customers to transform the future of energy—everywhere.

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