

UPSTREAM TECHNICAL CONVENTION

Paving the Way for a Modernized Industry

With upstream activities as a core pillar on Egypt's ambitious growth plans, petroleum leaders gathered at Cairo's Sky Executive Resort on January 21st and 22nd to examine recent achievements and discuss ways of enhancing oil and gas production levels, reducing operational costs, and providing new opportunities for young industry professionals.

Under the patronage of H.E. Minister of Petroleum and Mineral Resources, Tarek El Molla, the two-day Upstream Technical Convention was launched in line with the ministry's "Modernization Program," offering important updates on the program's activities and fruitful insights to meet the ministry's expectations.

During his speech El Molla thanked the organizers for their efforts and commitment; he further praised the event's importance in giving "an excellent opportunity to exchange ideas and insights on the challenges and opportunities of the recent developments in the oil and gas sector." The minister expressed his expectation that the mindset-rich environment would promote "production increase and decrease costs," as well as bring "significant recommendations on how to enhance opportunity and productivity of young professionals."

The inaugural speech was presented by Egypt Oil & Gas Managing Director, Eng. Mohamed Fouad, who noted the industry's responsibility to "continuously reinvent itself in order to keep up with the high competitive petroleum market."



"This event gives an excellent opportunity to exchange ideas and insights on the challenges and opportunities of the recent developments in the oil and gas sector."

ENG. TAREK EL MOLLA

H.E Minister of Petroleum and Mineral Resource



As the industry starts a new era, embarking on a new journey of overcoming challenges and contributing to new successes at the Egyptian petroleum sector, Egypt Oil & Gas Technical Committee presented **H.E. Minister ENG. TAREK EL MOLLA** with an Award of Achievement for his guidance through Egypt's accomplishments and his vision behind the modernization of the sector.

Achievements and Plans under the Modernization Program

The Upstream Technical Convention opened with the “Modernization Program Update” panel, providing valuable updates on the Egyptian oil and gas sector’s trajectory, as well as insights to ongoing projects within the Ministry’s Modernization. Due to a global crash in oil barrel prices and previous political turmoil that shook Egypt’s business environment, the country has gone through bold reforms to overcome the market challenges, which have resulted in solid accomplishments in the upstream sector.

“By early 2016, the petroleum sector had already achieved several successful stories. We had signed several concession agreements, with investment commitments of over \$15 billion, started accelerating some of the gas development projects, discovered and signed development agreements for Zohr, put back on track North Alexandria, and started several downstream projects,” said Eng. Osama Mobarez, Undersecretary for Technical Office at the Ministry of Petroleum.

Despite the previous achievements, Mobarez noted the ministry’s ambition to be proactive and do more. “We wanted to set a vision for the sector that is contributing to the sustainability of the country and sector by being efficient and transparent.” To that purpose, a diagnostic phase with detailed analysis designed the sector’s vision to unlock the industry’s full potential as a growth and sustainable engine for Egypt, achieve financial sustainability, as well as become a regional oil and gas hub and role model for the future of modernized Egypt by 2022.

Production Increase

The Ministry’s First Undersecretary for Gas Affairs, Upstream Program Sponsor, Eng. Mohamed Mounes, noted that seven pillars sustain the Modernization Project. “Upstream is one of these pillars. The aim of Upstream is to boost oil and gas production, secure the local market with petroleum products and achieve sustainability.”

Mounes added that the ministry expects to increase production from existing wells, achieve new activities, build new facilities, improve efficiency, and adopt new technologies. To achieve this vision, production and exploration activity has been increased through signing around 83 agreements. Plateau production and sharing agreements are

expected to drive, “an ambitious plan of around eight billion cubic feet of gas per day in 2021, which will be the double of 2015’s production.” He went on to add that, with an extensive exploration scheme, the ministry hopes to, “start the exploration of around 230 wells, starting from April until the end of 2018,” with around \$2 billion in investments.

Eng. Hafez El Shamy, Assistant General Manager, Production Department at the Egyptian General Petroleum Corporation (EGPC), who made a valuable presentation within the panel, noted that for increasing production both short and long term, Egypt must enhance existing well productivity by identifying new initiatives to increase petroleum production from existing wells, improve surface facilities and pipeline integrity and study secondary recovery projects and unconventional resources. El Shamy further suggested the country should, “drill new wells from existing fields, promote new bid rounds, propose solutions for payment of arrears and internal debt, and drag investment from outside Egypt.”

For Mounes, a strong indicator that the program is being effective in enhancing output is the program’s quick wins, which correspond to aspects that increase production from three to six months. “One example is the last discovery of Badr Petroleum Company (Bapetco). It was supposed to be put into production by February or March. We succeeded to put it into production around ten days ago [early January].”

Economic Factors

In line with the government’s efforts to attract capital influx and boost the industry’s performance, the floatation of the Egyptian pound (EGP) was mentioned as a key factor to enable economic recovery. According to Economist Allen Sandeep, Director of Research at Naeem Holding, the currency devaluation represents a third revolution in Egypt’s recent history. “It was the best decision taken by the Egyptian government when it comes to macroeconomic stability and setting the books proper.”

Sandeep highlighted that although the currency floatation increased local prices and reduced levels of consumption and production in certain sectors – the sales of cars dropped by 60%, as he exemplified – the full economic picture has improved. Since the government took this daring step, it has eliminated the black market for currency, helped recover tourism and increased the country’s exports. “We are now in an ‘economic flu,’ and the floating of the EGP in 2016 was the first antibiotic. It is a long course that must be followed so we do not resort back to the flu.”

In addition, currency devaluation works as a main attractive for foreign direct investment (FDI) into the petroleum sector. “As long as the EGP remains weak, you will continue to see foreign investment coming into the market,” Sandeep said.

According to Mobarez, “One of the main objectives from the modernization is to have more investments, as well as to increase efficiency and decrease costs.” In an economic perspective, “Attracting more investments would definitely support the reserves of foreign currency in the country and at the same time, as production increases, it would limit imports, thus reducing spending of foreign currency,” he disclosed, further adding that the optimization of processes equally decreases costs, supporting the state budget and reducing the deficit.

Furthermore, Sandeep remarked that two factors



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Undersecretary for Gas Affairs, Upstream Program Sponsor at the Ministry of Petroleum

would boost the oil and gas sector: lowering the price of natural gas and, as the petroleum industry contributes more than 30% of the country’s exports, channeling some of these exports to the downstream refineries.

Technology Transfer and Digitalization

Digging deeper on the technology’s fundamental part in the modernization of the sector, Eng. Moataz Darwish, Deputy Chairman of Shell Egypt, remarked that, as IOCs quickly advance in technology development, the challenge relies on how to transfer this technology to Egypt. “It has to be through a very efficient operating model of technology transfer to our joint ventures (JVs), and it will certainly enhance the collaboration through all the supply chain in the country.”

“What I would add as one of the key pillars of the program is digitalization,” Eng. Rami Qasem, BHGE’s President, CEO for MENA, Turkey and India, pointed out. He further questioned, “How can we make sure that upstream and downstream data are available in a very efficient manner that provides data in the right time, making sure we drive transparency and costs out?”

Based on BHGE’s experience and partnership with



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Deputy Chairman at Shell Egypt

Apple, Microsoft, BP, Shell and others, Qasem believes digitalization, “is something we need to bring in to Egypt, leveraging everything we have in a way to fulfill the key pillars of the whole modernization program in the next three years.”

Private Sector Participation

With the remarkable presence of the private sector in the Egyptian petroleum industry and its fundamental role in the country’s economic sustainability, Qasem stressed the importance of the private companies’ contribution to three fundamental pillars within the Modernization Program: People, technology, and building the capability to serve the region.

“We believe the private sector today needs to use Egypt as hub for technology, partnering with different sectors within the ministry to create innovation, and work in collaboration with international oil companies (IOCs) and other services when it comes to building talents for the future,” Qasem noted.

Collaboration for Success

In order to meet the discussed expectations, the panelists unanimously indicated collaboration



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GEO. FABIO CAVANNA

General Manager at IEOC

as an essential part of the process. “Even if it is an oil and gas hub, a hub has to go through all sectors of the economy. It has to be backed up by the banking sector, port facilities and by all the agencies in the government and the private sector. It is a collaborative work,” Qasem disclosed.

Mounes noted that there is a good agreement between the government and IOCs, to which Darwish, as a representative of the private sector, agreed by stating, “We believe we are truly one party [government and IOCs]. The relationship with the government is very strong and there is no doubt that this is a true partnership.”

“The interaction of the government with IOCs is a two-way exchange,” Mobarez pointed out. “For two to three years, the discussions with IOCs have been extensive. The investment attraction and the upstream program have a lot of interaction with the IOCs.”

Qasem added to the discussion the commitment to address some of the internal economical requirements to increase Egypt’s competitiveness in the market. “The question here is the timing. Today, with the prices going up, we will see more and more the need to build new talents and invest in resources, so the sooner we can have everyone supporting the Ministry of Oil, the easiest it is going to be to turn into a hub.”

Mobarez further stated that the main factors in making the Modernization Program successful is the support from the leadership of the country and the leadership of the sector. “During the first phase of the Modernization Program, we studied several experiences from other countries and companies. We noticed that a practical factor is the leadership support. If you do not have this, you cannot succeed in this transformation. I believe we already have this support.”

Positioning Egypt for Growth

The second day of the convention began with an in-depth look into Egypt’s current perspective on upstream oil and gas during the “Positioning Egypt for Growth” panel. The presentations and ensuing discussions focused on the domestic gas situation and the prospects of liquefied natural gas (LNG) exports, but also on the requirements for future growth of the sector in general. During the various exchanges, panelists addressed the need to reshape government policies and enhance investment opportunities, thus creating a more sustainable climate for investors.

Egypt’s Capex

Mr. Martijn Murphy, Research Manager Upstream at Wood Mackenzie, the event’s official research partner, pointed out that since 2012, Egypt’s discoveries have been tending more towards gas. According to him, “2015 was a pretty good year with the discovery of Zohr,” and “The outlook for natural gas production now is pretty bright as a record gas output is expected by 2019.”

“Within 2017 and 2018, there is record level suspending the capex across North Africa, reaching about \$15 billion, from which around 70% is on gas projects in the region,” he continued. “By country, you can see that Egypt accounts for about 60% of spending across North Africa last year and this year, and of course a lot of that is concentrated in West Nile Delta and Zohr.”

Additionally, Wood Mackenzie’s data suggested that the global capex had decreased by 20% each



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Director of Research at Naem Holding

year since the oil price downturn in 2014, before stabilizing in 2017. “In contrast, you can see that Egyptian capex is pretty much doubled in that period,” as low breakeven makes Egypt attractive despite low oil prices.

Challenges vs. Opportunities

Murphy further stressed that, with these numbers, Egypt competes globally despite high government share. Low cost recovery ceiling and the high starting government profit share create a highly effective royalty rate and a quite long payback period. “I believe the upstream sector is in a good place and in line with the reforms of the modernization program. I think the future is pretty bright.”

However, although Egypt is likely to be self-sufficient in natural gas until possibly the middle of next decade, beyond that, the gap between demand and supply begins to widen again. “We [Wood Mackenzie] think that in 2019 or sooner, Egypt will have a gas surplus. However, we think that Egypt will manage to be self-sufficient until 2023 or 2024, based on current reserves and our production forecast. Beyond that, it is going to be relying on yet-to-find potential,” Murphy added. In this line, he indicated, “Discovering new gas offshore and monetizing some of the existing discoveries, which



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Vice President and General Manager at Schlumberger



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ENG. ABED EZZ EL REGAL

CEO at EGPC

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From a service provider perspective, Eng. Hussein Fouad El Ghazzawy, Vice President and General Manager at Schlumberger, stated that, “One of the main challenges is the business model. I think new business models with service providers – looking at the total cost other than the individual service cost and more integrated deals – will help attract more business.”

Geologist Fabio Cavanna, General Manager at the Italian Egyptian Oil Company (IEOC), spoke from the perspective of Egypt having more opportunities than challenges. “First, because of the location of Egypt, which is very well positioned, geographically speaking. Second, because we have a very stable country and third, because we have very knowledgeable third parties and a very strong and robust industry. All this together is consolidating a very good situation for Egypt, which is boosting the future.”

One of the opportunities mentioned in the discussion was the continuous potential for offshore exploration and production. “We believe that the potential is still there for offshore, and Zohr unlocked this potential,” Eng. Osama El-Bakly, Chairman of EGAS, stated.



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MR. MARTIJN MURPHY

Research Manager Upstream at Wood Mackenzie

In addition, speeding up processes was brought up as a main target to sustain Egypt's growth. “Among the 83 concession agreements signed since 2013, around 20 are just amending terms and conditions, and gas pricing. This will save a lot of time and a lot of effort,” Eng. Abed Ezz El Regal, CEO at EGPC, commented, subsequently noting that, “There is a lot of liquid hydrocarbon waiting just for just a small investment and a timeframe to be brought on stream, especially in the Gulf of Suez.”

In terms of technology, Ghazzawy believes it is “... definitely a challenge and opportunity at the same time,” disclosing that Schlumberger has made big investments on its central of efficiency, reaching almost \$60 million of investments.

Opening the Way for Gas Exports

Since Egypt began importing LNG in 2015, the country has incorporated floating storage regasification unites (FSRUs) to its infrastructure. As imports gradually decrease due to the hike in domestic natural gas output, the petroleum sector rethinks FSRUs' usage in order to incorporate the existing facilities to Egypt's future market position.

“When we say we are putting effort in turning Egypt into a gas hub, it means we have to maintain our infrastructure,” El-Bakly defended. “Our infrastructure is the entire asset we have to cover whatever [options arise], concerning exporting [in the near future].”

The ambitious plan of gaining back the country's position as a gas supplier has brought international partnership into the equation. When it comes to the construction of strategic pipelines between Egypt and Turkey, Greece, Cyprus, or Israel, El-Bakly and El Regal affirmed all options remain open. “We have the project itself coming first and the methodology coming after. We are talking about being a hub, so it is a major project. Methodology could be decided during initiation and all the options are open,” El Regal added.

He further reminded that, in order to achieve this plan, the country must keep an eye on the generation of power. “The main consumer of gas in the country is power generation. There is a plan for utilizing renewable energy, which will have a considerable impact in the country, but we cannot drop maximizing the efficiency of power plants.”

Growing Oil Production

As oil fields mature and production falls behind the boom in natural gas, IOCs' representatives discussed ways of enhancing oil activities. “We [IEOC] are trying to maximize our oil recovery and, in the Western Desert, we never stop investing,” Cavanna stated. “We are also interested in expanding our activities in new areas. We know there will be bid rounds in the Red Sea in the near future. We hope that it will open new frontiers.”

As for Schlumberger, El Ghazzawy disclosed the company will be more selective and focus is specific areas. “We are very pleased that we signed, in July, the multiple agreement in the Red Sea. The Red Sea will bring a lot of potential to Egypt.”

Speaking on this potential, Murphy believes the Red Sea is an interesting area. However, “It is still a very early case, probably too early to comment on production levels.”

According to El-Bakly, the country does not lack facilities to boost offshore output. “We are facing a downturn of oil production and some activities in the industry have slowed down, so some facilities



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are more available.”

Commenting on further exploration drilling in Shorouk concession, Cavanna explained it is still an early call. “We are looking at the exploration data and I cannot confirm now.”

Young Professionals

Human capabilities and human development stand as top priorities in the Modernization Program. In this line, the Upstream Technical Convention's third and last panel “Young Professionals” provided successful stories and insights on tailored training sessions to narrow skill gap, programs in building human capital, equal opportunity policies in the petroleum sector, as well as strategies to keep young professionals motivated and the oil and gas sector attractive.

Skill Gap: Academics vs. Practice

In order to prepare undergrad petroleum engineers, technicians, and geologists to face the open market, oil and gas leaders pointed out the need of closing the gap between academic studies and actual practice. “Petroleum engineering education has to show that they give students skills to work in the working environment,” noted Dr. Ahmed



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ENG. OSAMA A. HALIM

Egypt & Libya Area Manager at Halliburton



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ENG. OSAMA ELSAADAWI

Marketing Manager at OGS

ElBanbi, Professor and Chair of the Department of Petroleum and Energy Engineering at the American University in Cairo. “Before they graduate and join the industry, they must have the skills to educate themselves.”

Eng. Osama A. Halim, Egypt & Libya Area Manager at Halliburton, believes Egyptian young professionals can deliver when placed in the right working environment, and that universities have a major role in building skills and encouragement. “Our education system is a highly technical system. We are missing the practical training and soft skills,” he added.

This gap could be closed through true partnerships between universities and the industry, David Chi, Vice President & General Manager at Apache, stated. “The industry is the one who has a better idea of what it needs in terms of human resources.” Thus, universities can benefit from the industry’s insights to improve its educational system.

Chi further noted that students should learn how to make decisions, emphasizing project management and problem solving skills. With internships consisting of a one-month formation, Chi proclaimed that this timeframe is not long enough to develop the students’ abilities, suggesting lengthier internships for bigger impacts.



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ElBanbi agreed that internships should be extensive, noting that students are highly pressured to finish university fast to join the work force. “I think we could discuss a one-year off to acquire experience.”

Joint programs between the private and the public sector were highly suggested by the industry’s representatives as a means of enhancing human development. “A few months ago, we [OGS] announced a very promising program as a capacity building program for middle management and young professionals. We are aiming to invite more IOCs in order to join the implementation. More than 3,000 applicants already submitted their applications in this program,” Osama ElSaadawi, Research & Development –Marketing General Manager at Oil & Gas Skills (OGS) stated.

Equal Opportunity

In an industry dominated by men, the discussion progressed toward equality. “We need to give male and females equal opportunities when we talk about hiring processes,” Halim stressed.

“As our industry continues to evolve, we need to be more inclusive,” Chi continued. “A lot of female employees are mothers, but that does not mean they cannot make a significant contribution to our industry. As an industry, we have to be supportive and identify the strength of our female employees.”

Keeping the Sector Attractive and Motivated

With a downturn in petroleum engineering enrollment, ElBanbi pointed out that volatility affects both the industry and the universities. “The last three years have been really tough on geoscientists and petroleum engineer undergrads. What I suggest is that companies should continue hiring, in bad and good times, especially in these two majors,” he added.

“The oil and gas industry plays, in many countries, a very critical role. We are a global industry for people with a spirit and taste for adventure. We have to communicate the importance of the industry, its financial reward, and the opportunity of applying technology and making an impact on the society. When we do a better job at that, I believe we will be able to introduce our industry to a lot of talent that young people want to bring in,” said Chi.

Halim further stressed the role of senior management in fostering young talent. “People in different levels are the key for the success of every company.” According to Halim, people quit their jobs when they do not see a career progression for themselves. In order to keep people attracted, there must be a clear succession plan, as well as a fruitful working environment. “If you have an unfair environment, you will leave. We, in Halliburton, sit with our people from day one and tell them, ‘This is where you are now and this is where you are going.’ This transparency leads people to continue in the company.”

Recommendations within the Modernization Program

In a people development perspective, Chi suggested the Modernization Program should focus on empowering young talents. “We need to empower young people, so that they are able to make decisions and come up with new ideas that will make us move forward.”

Geol. Samir Ab. Moaty, Rockhopper Country Manager and Founder of Al-Amal Program, insisted the Modernization Program should direct its efforts toward universities. “What I am looking for is a collaboration between IOCs, JVs, and NOCs and to help with internships and summer training. Those



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DR. AHMED ELBANBI

Professor and Chair of the Department of Petroleum and Energy Engineering at AUC

young professionals will be the future leaders. We do not have to wait for them to come to us. We need to go to them and prepare them to be ready upon graduation.”

Halim agreed with Moaty and stressed the need of a national training program that covers a good proportion of fresh graduated employees, with “... technical training and soft skill trainings to educate the students on what they are expected when they come out of university.”

ElSaadawi pointed out the industry needs to understand that it is working in complexity. In that line, ElBanbi commented, “Educating the young generation is something we do not do for the young generation, but to ourselves. A very important thing to do is leading by example.”

The Upstream Technical Convention was concluded with a series of presentations showcasing initiatives to enhance young professionals’ formation, including Al Amal, Shell’s NXplorer, Schlumberger’s Technician Development Training Program, as well as the Ministry’s Subsea Development Program and Zohr Training Project. The convention marked the beginning of important discussions within the ministry’s Modernization Program for 2018.



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GEOL. SAMIR AB. MOATY

Country Manager at Rockhopper and Founder of Al-Amal Program



Drivers of Greater Production: Efficiency in Operations

The Upstream Technical Convention offered its attendees a series of specialized workshops, tailored towards method of enhancing the yields of upstream operations. The first workshop addressed matters of "Efficiency in Operations," beginning with a session focused on the effective use of upgrades, and two more centered on increased production and the optimization of specific operations, respectively.

Osama Halim, Halliburton's Area Manager for Egypt and Libya, and Mahmoud Shawkat, Director of Sales and Marketing NAF at Baker Hughes, a GE company, chaired the first technical workshop, which aimed to bring insights on ways of optimizing activities in oil and gas fields and, hence, increasing production. "Efficiency is the keyword now in the oil industry world, and we all need to focus on how to bring efficiencies to our business," said Halim in his opening remarks, subsequently introducing Ahmed Adel Fahmy, Senior Reservoir Simulation Engineer at Khalda, for the workshop's first presentation. Berenice Field Simulation Study

Representing Khalda Petroleum Company, Fahmy's presentation revolved around the implementation impacts of Berenice Field Simulation Study.

Fahmy opened his presentation with an explanation of the particularities of Berenice reservoir, which lies under a partial water drive and contains black oil. Fahmy divided Berenice wells into two groups. The first group consists of three high structure wells with high productivity index (PI) ranging from 50 up to 100 barrel per pounds per square inch (BBL/PSI), no water production and no oil water contact (OWC). Meanwhile, "the second group is [four] low structure wells. They have relatively low PI ranging from three up to 40 BBL/PSI, as well as water production and clear OWC," Fahmy explained.

The presentation compared the actual and forecasted economic aspects of upgrading efforts, including proposed rates, candidate wells, timing factor, acceleration period and achieved plateaus, as well as drilling new wells.

Khalda's goal is to "... to maximize the value from the field," Fathy pointed out, adding, "The only ways to accelerate production are by either upgrading or by drilling new wells – or both." Crucially, the evaluation showed that in order "... to maximize the field's production in presence of [the evaluation concerns – including acceleration impact on the oil recovery in light of the field's excessive water movement, pressure impact on acceleration and the best field

development plans –] would have been highly critical for the management without the use of reservoir simulation."

The Berenice stimulation proved that, "Increasing the production from the crestal locations does not have negative impact on the ultimate recovery and it achieved even water table movement, which resulted in good water/oil displacement." Fahmy concluded his presentation adding that, "Drilling new wells adds marginal value. Therefore, acceleration from the current wells is sufficient as long as there is no change in the geological structure." The study's result collaborates with a valuable angle on how to boost well performance while decreasing costs.

TransGlobe Increases Production at West Bakr Field

PetroDara Company's Reservoir Engineer Manager, Mahmoud Tolba, subsequently conducted a presentation focused on production optimization of West Bakr field. The presentation introduced Artificial Lift Systems and activities completing it, through which TransGlobe Energy Corporation has been able to decrease costs and reach sustainable production at West Bakr.

"The normal decline rate for West Bakr is 24% per year, so we have succeeded in maintaining the production. We added 22% more to the production, so we actually achieved around 46% more production this year," Tolba said. Therefore, part of the field's development success was "depending on the strategy how to subject the artificial lift that fits the purpose," he added.

The company started developing the field during the period from 2012 to 2014 through drilling operations, which were followed by optimization work in 2016, Tolba presented. TransGlobe was using sucker rod pumps (SRPs) in placing more than 90% of the wells in the field's re-development phase to production. However, the company "...concluded that the SRPs aren't able to produce from those wells in an efficient way so we have started to make a change from SRPs to PCP [progressive cavity pumps], the percentage of PCP in 2017 reached up to 44% compared to just 10 % in 2011," Tolba explained.

During the development work, the operating companies "...had only two wells that exceeded the budget by 10% but the seven rest wells saved a lot of money. Specifically in K29 we just spent 42% actual cash and we used the material in-house. We spent 58% from the budget on the materials so we saved more than \$300,000 in comparison with the

planned budget," Tolba stated.

KPC Pigging Optimization

The workshop further included a presentation by Mohamed Gad Allah Mahmoud, Surface Engineering AGM at Khalda Petroleum Company, and Mohamed Negm, Senior Production Engineer at Schlumberger, on determining optimum pigging frequency and controlling pig speed to avoid deferred production and reduce operational costs.

In order to both reduce and save annual costs, pig optimization was performed on the Qasr-Salam 24" pipeline and PTAH-UMB pipeline.

Qasr-Salam 24" pipeline has a major problem as there is "...a slug catcher at the end of line. The drainage rate of this slug catcher is around 35,000 barrels per day (b/d)," Mahmoud said. "Typically, [a company] decrease[s] the load on production rate during any pigging period to avoid any process offset on the downstream facility," he added. However, with pigging optimization the pipeline was able to decrease downtime by over 50%, reduce production decline by 50%, decrease the risk of sudden offset occurring due to liquid level constraint violation and reduce pig stuck risk.

Meanwhile, PTAH-UMB field pipeline 8" was affected by wax, which in-turn affected production. Hence, it was proposed to determine the pigging frequency and velocity in order to solve the issue, or to install two new rented heating stations with a cost of approximately \$1 million. Pigging optimization at the pipeline prevented pipeline plugging and decreased mitigation cost to a point where it was lower than prevention cost. "PTAH-UMB optimization eliminated the need for the heating station and saved cost of around \$1 million per year," Mohamed Negm concluded.

At the end of the three presentations the convention welcomed all other attendees to join individual round table discussions, where questions and open exchanges were welcome and where the presenters could elaborate on specifics.

"So far the convention has been amazing, especially the efficiency workshop and its case studies. It helps in transferring experience between companies. Everything presented by a company might relate to a hidden problem in another firm in which the new technologies in the presentation can be used," said Mostafa El Aswany, General Manager of Regions Evaluation at Qarun Petroleum Company when asked for his comments on the workshops.

APPLICATION OF NEW TECHNOLOGY

A key Factor to Increase Hydrocarbon Production

Industry experts have been developing and implementing new techniques in order to boost oil and gas productivity. These innovative applications and new technologies that are designed to meet a growing demand for energy are of particular value to Egypt's expanding oil and gas sector.

The third technical workshop of the Upstream Technical Convention was dedicated to the "Application of New Technology." It included three presentations by International Oil Companies (IOCs) and national oil companies (NOCs) representatives alike, who focused on new ideas, newly implemented technologies, and relevant success stories.



Seismic Stimulation

The first presentation was by Bill Wooden, Vice President of the Applied Seismic Research (ASR) Corporation. Wooden presented his and business partner Sergey Kostrov's trademarked "Seismic Stimulation" Tool, along with relevant case studies that prove its simple, yet effective approach to increase oil production through revitalizing mature fields.

Wooden focused on the importance of Enhanced Oil Recovery (EOR) techniques as an effective way to boost oil production and clarified that, "The way [ASR] enhance[s] oil recovery does not follow the traditional flow path." As Wooden explained, Seismic Stimulation's approach has thusly proven increases in oil production of greater than 20% in numerous fields. Discussing Seismic Stimulation across boundaries, he also explained that its application contributed to a production increase of 30% in the seven wells drilled in Belayim accounts, or approximately 1,200 billion barrels per day (b/d).

Regarding shale recovery technologies and tools, Wooden elaborated on how a single ASR Tool was one of the most productive methods. "I do not know how many shale reservoirs there are in Egypt but this is a very good technology for that – and believe it or not, our tool is very simple," he highlighted. Wooden concluded his presentation by showing how ASR uses Dynocard to track and monitor the performance of the Seismic Stimulation Tools.

During his breakout session, Wooden received numerous questions from the audience concerning EOR and ASR, one of which enquired about the limitation of applying the presented techniques.

Wooden's answer explained how only high gas oil ratio (GOR) wells above [2,000] are unsuitable but that the depth limitation has no effect at all.

Enhanced Characterization of Productive Intervals

The second presentation focused on a paper entitled, "Zohr Field: Enhanced Characterization of Productive Intervals by Means of an Innovative Temperature Monitoring Application During Well Testing," that was introduced by co-author and Zohr Task Force Petrobel Reservoir Expert Iskander Abdeddaiem. He explained how understanding fluid movement from the reservoir through the perforated

intervals is crucial for well management and that it is strategic during well test operation. This knowledge is also required for reservoir characterization as it provides reliable input for pressure test analysis.

"Historically, reservoir information is collected after the well test operation with PLT acquisition, leading to cost increase and risks increase, especially in deep water wells," Abdeddaiem said. The main temperature concepts include, "...temperature surveys, which are the backbone of logging for downhole fluid movement detection," he added. Usually the temperatures in wells increase with depth and the actual rate of increase will depend upon the geographic area, formation mineralogy, rocks petrophysical properties and rocks' thermal features.

Representing a new technique, Abdeddaiem explained that the "Multiple Discrete Temperature Sensor System" is a wireless temperature monitoring system that allows continuous high-resolution temperature profiles to be gathered from any section of the well.

Regarding Zohr's well-test description, "Two well tests have been successfully performed in wells Zohr-2 (North-east Culmination) and Zohr-5 (South Western culmination)," said Abdeddaiem, noting that the results show that both wells are characterized by a great production capacity. Deliverability is estimated up to 250 million standard cubic feet per day (mscf/d), per well in the final production configuration.

Abdeddaiem concluded that the multiple discrete temperature sensors deployed with TCP guns has been successfully applied during well test operation

in Zohr-5. No sensor damage was noted during the perforating operation. In addition, a reliable understanding of the reservoir behavior and well deliverability has been achieved safely, thus providing a downhole flow allocation during well test time.

Finally, Abdeddaiem explained how integration of the concurrent data from a single well test and a MDTs tool permits savings in the range of 15% when compared to a single well test with PLT, or 40% if compared to a dual well test strategy.

In the open discussion that followed his presentation, Abdeddaiem received a question concerning the role of temperature profiles in improving well analysis. He supported their application and explained that, "Understanding the temperature profile is a key point to understanding the contribution of each part of your reservoir. Since the technology is already available, you should take advantage of it and use it."

Powered Dump Flood

The third session was dedicated to "Enhanced Oil Production Using Powered Dump Flood," as presented by BHGE's Artificial Lift Regional Sales Manager, Walid Abdelrahman, who focused on how Powered Dump Flood adds value, through its minimal environmental impact, higher production, enhanced reliability and economic gains. Conventional water flood was ruled out on account of limited productivity and negative agricultural impact. "Installing a Dump Flood ESP with in a dual injection completion has saved [an unspecified] client over \$70,000 per month," Abdelrahman said. Moreover, he explained that reservoir characteristics change from time to time. He stressed the importance of knowing the root cause of the failure – and to design the pump to fit its purpose.

In addition to powered injection, the six Powered Dump Flood systems running so far have demonstrated their capability to increase oil recovery. "The cost savings are plus or minus \$ 2 million per year, per field," he noted.

Following his presentation, Abdelrahman received a question during the breakout session querying how Powered Dump Flood could help Egypt meet the targets of its Modernization Program. "Boost the production, enhance the well life, and minimize the cost per barrel – those are the aspects we are looking for," he explained. "At the end of the day, the discussions we had will bring us insights on two things: The possibility of the cost per barrel being down, which will encourage new investments, and the life-increase of the equipment." Abdelrahman projected that, "...if [the companies] put those actions into a timeline, I believe by the middle of the year, or the third quarter, we would be able to make a change."

Recovering oil and increasing production is becoming more difficult at a time when oil fields are declining. Effective techniques used to extract more oil from mature fields are hence crucial. Commenting on the three presentations, multiple attendees mentioned that cost-effective reservoir monitoring is essential to make well-informed field-development decisions, mitigate project risks and meet production targets.

"[These were] very interesting and strong presentations. All three were novel applications [representing] new concepts brought together with valued cases to rise. I think there is a lot of interest from the attendees and a lot of feedback to be received. Excellent session," Ismail El Kholy, Strategic Projects Director at Schlumberger and one of EOG's Technical Committee members summarized

Designing Impactful Exploration and Development

With well optimization being specified as a major step in the country's path toward production increase and cost reduction, representatives from key industry players shared their successful stories in a workshop dedicated to "Impactful Exploration and Development."

21st Century Egypt E&P

In her presentation, Rand Al-Obaidy, Senior Petroleum Engineer and North Africa BD Manager at Gaffney Cline & Associates (GCA), suggested several solutions for increased oil production in Egypt. Her approach was to first review already existing wells and then apply various methods and techniques to increase their productivity. Al-Obaidy discussed several successful cases in-depth, including reviving the Amal field in the Gulf of Suez (GOS).

Oil asset managers were encouraged by Al-Obaidy to "listen" to existing wells, emphasizing that reviewing and reinterpreting them is the first step to increased productivity. "If we do nothing, we will continue with the natural declining of the field and it will dry up. However, if we invest, we could actually increase our enhanced oil recovery (EOR)," she stated.

Al-Obaidy stressed the importance of initiating this process now, so as to benefit both from the recent increase in oil production and the current low production cost in Egypt. "I will be confidently saying from all the projects I have worked on that Egypt definitely sets in the lower [ranking] of the cost per barrel," she said, adding that GCA benefits significantly from this.

Sour gas reserves, especially the ones at GOS, represent another potential to increase production in Egypt, Al-Obaidy stated. As a senior petroleum engineer, she described the existing facilities at GOS as world class "I am not just saying that myself, but

I went with facilities engineers and they were really impressed," she explained.

Regarding the challenges in well optimization, Al-Obaidy disclosed that the country faces imaging-related challenges, especially in the GOS. Yet, overcoming this problem is both rewarding and doable. "Recently, one of the clients we worked with reprocessed, reimaged and then reinterpreted the size that they have in GOS assets and, as a direct result from that, they are currently reviewing nine prospects – and of course this will be translated into more production," Al-Obaidy explained.

Production from Yakout Shale

In a similar vein, the following presentation highlighted another aspect of the importance of re-exploring and re-studying already existing wells. Ahmed Essa, Geographical Operation Section Head of Agiba Petroleum Company, showed that reviving mature wells lead to uncovering new production opportunities.

Essa introduced the case of Agiba's increased production in the Meleiha area through revisiting the Yakout Shale. He announced that, due to this recent study, the production of Agiba's reservoir at Rosa North 4 in the Yakout Shale in Katatba will be stabilized at 3300 b/d.

The discovery of the Yakout shale formations in the Meleiha area and the increased production from the formation were another valuable example of exploration and production (E&P) improvement. When it was first tested, Agiba's team overcame numerous challenges before initiating production from the shale, including the area's porosity and seismic resolution, said Essa. "Measuring the seismic resolution to exactly detect the extension of the reservoir was the main risk for us, because its seismic survey

is very low."

Essa summarized his presentation by emphasizing how the production from the Yakout Shale has been a turning point for Agiba and added that this specific case shows how even fields that are considered non-promising can increase production if restudied.

Unlocking Bypassed Oil

The third presentation was lead by Mostafa Mamdouh, Senior Reservoir Engineer at the Gulf of Suez Petroleum Company (GUPCO), who highlighted the importance of bypassed oil in mature fields. He also spoke highly of the productive value of combining engineering and geological data and discussed, cost reduction through rigless work. GUPCO's development process carried out in the Belayim area was a perfect example of following these previously mentioned approaches.

"In such a high recovery factor of Belayim and such high performance reaching the red line of high water cap, it is not that easy to deliver new opportunities in that field," Mamdouh said. He added that water injection in Belayim has been conducted for around 40 years, which reduced the field's potential. Yet, positive results from GUPCO's work at this field prove it is indeed possible to increase the productivity of mature reservoirs.

GUPCO's team started operations at the southern part (B1) of Belayim, with lesser quality of sand, since it would be less affected by water injection. The team further tested three wells and managed to get 700 b/d from the first tested well, 500 b/d from the second, and 300 b/d from the third.

Mamdouh concluded his presentation stating that there is always a way to maximize oil productivity by following a robust integrated approach.



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The Propelling Impact of Natural Gas Growth

On the second day of the Upstream Technical Convention, Deputy Reservoir General Manager and Board Member of Petrobel, and Santo Giannone, Deputy Exploration Manager at Petrosilah, James Pendergrass, chaired the final technical workshop dedicated to natural gas growth. The workshop commenced with Wood Mackenzie's trace of Egypt's natural gas history and was then followed by three more success stories from natural gas fields and unconventional fields that were presented by SDX and Shell, respectively.

Natural Gas Growth Story

Research Associate at Wood Mackenzie, Stephen Fullerton, has tracked Egypt's natural gas path and forecasted the upcoming years for the natural gas industry. "The Egyptian gas market really has gone through transformations in the past few years," Fullerton highlighted in his presentation, as he examined the challenges faced by the gas market and previewed endeavors to address said obstacles.

"Over the studied period of 2008 through 2016, Egypt only discovered that more natural gas resources were produced in two of the years [2008 and 2015]," Fullerton explained during his presentation; stressing the significance of this fact he further added "these gas discoveries helped keep up production rates and drive Egypt forward."

The session moved on to highlight how the natural gas resources landscape has evolved over the years. Fullerton cited Wood Mackenzie's data for discoveries and production specifically between 2009 and 2012, pointing out that during this period, "Egypt only discovered a third of the resource that it produces, which was a real concern and has been addressed going forward. The reason this happened was because easy gas had been discovered. So, companies were having to focus on higher cost exploration, and this, at the time, was not as attractive as the gas prices that they were receiving, for their gas [volume discovered] was reasonably low. There is a buildup of arrears [that the Egyptian government owed IOCs] and a general idea that Egypt wasn't viewed as an attractive place to invest capital," he said. However, new laws issued to help protect contractors – for example the new gas market regulating law – and new discoveries that have recently surfaced in areas including West Nile Delta, Nooros and Zohr, have "transformed the Egyptian gas market" and Egypt has thus grown to become an increasingly attractive market.

In recent time, Egypt has grappled with increasing arrears for oil and gas companies. Yet, simultaneously, Egypt has also been developing natural gas, especially as the sector has seen significant payments issued from the Egyptian oil sector to IOCs in the past months alone. "Wood Mackenzie anticipates arrears continuing to fall and [that they] would be paid off by mid-2019, in line with the IMF agreements," Fullerton pointed out.

With its location among numerous prominent natural gas fields and LNG facilities, Fullerton viewed Egypt as a potential natural gas regional trading hub. "Egypt would appear the most logical destination for gas from fields like Aphrodite, Calypso, Leviathan and Tamar, either into the domestic market or into the LNG facilities to be exported," he said.

SDX Route to Natural Gas from South Disouq

The first presentation of the workshop focused on SDX strategy and activities towards achieving the natural gas discovery and early production in South Disouq concession, leading to a further exploration



of its potential. The session was presented by Stephan Jackson, Senior Staff Geophysicist at SDX Energy.

In April 2017, SDX Energy announced natural gas finds at the concession, where it both operates and holds a 55% equity interest. Jackson, highlighted that the South Disouq concession was already producing; however, by adopting innovative forces in drilling new wells, the company was able to strike natural gas in the Abu Madi field.

Throughout the presentation, Jackson stressed that by means of "...successful exploration programs, [the] agility of small, well-funded operators and a pioneering attitude to exploration, the company can unlock significant natural gas resources."

"Our experience in South Disouq shows that a company can take an area where people have drilled wells before and, just by applying a tiny bit of innovative force, [the company] can come up with a new exploration concept in that area," Jackson told Egypt Oil & Gas on the sideline of the workshop, adding that SDX' stands as an, "...example of how thinking slightly differently can bring success."

Shell's Unconventional Natural Gas Appraisal in Egypt

Despite the increasing natural gas discoveries and the widely held belief that Egypt can be reach self-sufficiency before the end of 2018, Shell has been exploring unconventional natural gas resources within the country's borders.

Reservoir Engineer at Shell Egypt, Amr Zaher, presented during the workshop a session on the unconventional natural gas appraisals in Shell Egypt's portfolio, highlighting the Apollonia reservoir as an example of an unconventional opportunity.

The main drive for Shell to address unconventional resources is that "the natural gas market has opened up and the new gas law is out, so if a company has the right opportunity and a cost-effective strategy, then it definitely has a chance to succeed," Zaher explained.

Part of Zaher's presentation revolved around showcasing the Apollonia unconventional reservoir, which is characterized as a carbonate reservoir, and consists mainly of low permeability limestone and high-porosity soft chalky.

"The reservoir is already producing. It is close to infrastructure and facilities and there are large amounts of gas in place," Zaher said commenting on what he considers to be the key drivers of the reservoir. Meanwhile, the challenges faced by Shell in operating Apollonia included the "...chalky [nature of the] reservoir." Zaher also pointed out that, "It is very thin and poor in terms of vertical connectivity. It has a thick transition zone and the water produced is very high."

At first, the operating companies tried vertical fracs for the Apollonia reservoir, but it was proved that, "Vertical well performance does not justify economic full field development even with stimulation." Thus, firms resorted to, "...horizontal wells with multi-stage hydraulic frac, which resulted into much better sustainable relatively higher gas rates compared to the stimulated vertical wells," Zaher stated.

Addressing Reservoir Uncertainties

Shell Egypt has adopted an integrated methodology in recognizing and handling the uncertainties in its fields' operations. Reservoir Engineer at Shell Egypt, Mostafa Abdelkhalek, gave the concluding presentation of the "Natural Gas Growth Story" workshop, presenting the company's approach in addressing the BTE natural gas discovery.

Shell's approach included "...Statistical Risk Analysis (SRA), which can be used to analyze and quantify the risk associated to any kind of problem or business," Abdelkhalek pointed out. "In BTE study, SRA was used with Monte Carlo simulation to pinpoint all the possible outcomes of gas recovery." The approach further encompassed, "...Material Balance Equation [MBE], which has been recognized as one of the basic tools for interpreting and predicting reservoir performance," according to Abdelkhalek.

In order to transfer data from SRA into MBE, the company required the use of a programming language. "The experimental design model is created to assess all the possible scenarios of different uncertainties," Abdelkhalek concluded, explaining that it is a "...fast and easy model to use."

The propelling potential of the natural gas industry, highlighted through these sessions, has shown that the industry is well on its way to further enhance production and surpass a state of self-sufficiency.



PEOPLE ORIENTED PROGRAMS

In line with the fruitful discussions on ways of enhancing young professionals' skills and integrating them to the market, the Upstream Technical Convention was concluded with the "People Oriented" workshop, which brought a series of presentations displaying people development initiatives in Egypt.

Shell's NXplorer

In the first presentation, Nashwa Saleh, Social Investment Manager at Shell, introduced Shell's NXplorer, a unique program to help prepare future leaders for a complex and interconnected world. The program equips participants with tools and skills to embrace complexity, empowers participants to create a positive change in themselves, locally and globally, and unlocks the STEM Habits of Mind.

"What we have identified at Shell is that globally, young professionals are lacking what we call STEAM Habits of Mind," Saleh explained. According to her, the concept consists of creative problem solving, improvising, adapting, systems thinking, problem finding and visualizing.

During three- to five-day workshops, trained facilitators work with participants in finding solutions to real world challenges that are relevant to themselves and their communities. Through the program, participants select the issue, learn and apply "NXThinking" to help create ideas and "NXTools" to create future scenarios. Participants continue to develop the project over four to 12 months.

"What we learn with pleasure, we never forget. It was a joyful, interesting experience. It made me be creative and think out of the box, changing the ways I think when facing a problem," Fatma Sherif, an NXplorer former participant, commented.

Schlumberger's Technician Development Training Program

As Schlumberger identified the need to

increasingly integrate blue-collar labor, the second presentation, presented by Heba Abaza, Training Program Manager at Schlumberger, gave attendees the chance to have a closer look at the company's Technician Development Training Program, which was designed to bridge the gap between formal university education and the demands of the current labor market.

The program looks at empowering participants to discover their capabilities, strengths and weaknesses to better establish and work toward their career goals, helping reduce unemployment rates. Additionally, Schlumberger aims to build a strong database of qualified technicians to help serve the oil and gas industry, extending its support to multiple industries around Egypt and supporting the country's vision of growth. "We usually make group interviews with around 30 participants in each group. Once they are selected, they start their training program," Abaza, stated.

Applicants of up to 25 years of age are considered, and the program is divided in six phases. "They start with a six-week soft skills training. After they finish the six weeks, they move on to phase two, consisting of safety trainings that all of us Schlumberger employees go through when joining the company," Abaza added. Phase three consists of a five-week job training at the company's bases, and phase four concludes the program with a debrief and recap. "They also attend something called 'Train the Trainer' to pass the knowledge they gained."

Subsea Development Program

Under the umbrella of the Modernization Program, the third presentation, conducted by Randi Banna, Subsea Engineer at Oil & Gas Skills (OGS), introduced the Ministry of Petroleum's Subsea Development Program. In its class component, "...the program will cover all the main aspects of the Subsea engineering delivery scope of work, as well as the operational requirements for the life field," Banna disclosed.

In its practical component, it will offer a rotational program to work in local fabrication shops for three to four weeks per group. Overseas, participants will visit supplier-manufacturing facilities over the course of two weeks, in addition to trips to ongoing projects in collaboration with Subsea installation companies operating on Egyptian projects.

Potential partners consist of international universities, as well as international and local companies. Banna explained that since many international universities developed master programs in petroleum engineering, this creates numerous partnership opportunities between international and local companies and international universities.

Zohr Training Project

Another initiative within the Modernization Program is the Zohr Training Project (ZTP), which was presented by Ahmed Yousry El-Sharkawy, ZTP's Technical Manager, on the fourth presentation within the "People Oriented" workshop. The project represents an opportunity to provide a role model in the development of human resources, El-Sharkawy stated. "It was sanctioned in October 2016 by Petrobel to ensure the availability of skilled and competent staff for the safest operations of Zohr gas plant."

The program is designed and operated by OGS in cooperation with Eni Corporate University (ECU), under the supervision of Petrobel. It consists in health, security, and environment (HSE) mandatory training, tailored training path for skilled Petrobel staff, and competence based training path for Zohr qualified trainees.

For example, the tailored training path for skilled Petrobel staff consists of a specific training addressed to 125 selected participants to enhance their existing competencies in order to operate Zohr new process units and technology. El-Sharkawy's presentation on Zohr Training Project closed the "People Oriented" workshop.