



EGYPT OIL AND GAS
TECHNICAL COMMITTEE

IMPROVING BROWNFIELD PERFORMANCE

WHITE PAPER

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White Paper Recommendations

The Brownfield Subcommittee convened and began its work in February 2019 according to its identified and approved charter. The Subcommittee identified 11 Strategic Solutions with 28 initiatives and recommends that the Ministry of Petroleum consider their implementation for improving Brownfield Performance including production, cost and operating efficiency. These solutions can also be used to enhance the Egyptian Upstream industry and fit perfectly into the Modernization Project.

While the solutions are unique, they align into four broad categories: 1) Enhancing Focus on Brownfield Technology, 2) Optimizing Human Capacity Focus, 3) Improving Planning, Decision Making, and Auditing, and 4) Enhancing Sector Competitiveness.

Specifically, the recommended solutions are:

Enhancing Focus on Brownfield Technology

Strategic Solution 1 – Enhance Technological Competency and Know-How

Strategic Solution 2 – Establish Centers of Excellence

Optimizing Human Capacity

Strategic Solution 3 – Establish Performance Management

Strategic Solution 4 – Improve Human Capital Capabilities

Strategic Solution 5 – Improve Mindset, Decision Making, Risk Taking

Improving Planning, Decision Making, and Auditing

Strategic Solution 6 – Improve Decision Making and Risk Management Related to Tenders

Strategic Solution 7 – Improve Planning and Strategic Capability

Strategic Solution 8 – Streamline Auditing and Control Practices

Enhancing Sector Competitiveness

Strategic Solution 9 – Improve Production and Cost Efficiency

Strategic Solution 10 – Optimize Infrastructure Synergies and Industry Collaboration

Strategic Solution 11 – Enhance Competitiveness and Business Models

Furthermore, recognizing that the implementation of all eleven strategic solutions will take considerable time and effort, the Committee believes that the needed resources be dedicated to the following six solutions. They should be advanced due to their importance and ability for impactful quick-wins.

1. Enhance Technological Competency and Know-How
2. Establish Centers of Excellence
3. Establish Performance Management
4. Improve Human Capital Capabilities
5. Improve Mindset, Decision Making, Risk Taking
6. Optimize Infrastructure Synergies and Industry Collaboration

The implementation of the remaining five solutions is also important but it can follow the others.

7. Improve Decision Making and Risk Management Related to Tenders
8. Improve Planning and Strategic Capability
9. Streamline Auditing and Control Practices
10. Improve Production and Cost Efficiency
11. Enhance Competitiveness and Business Models

The EOG Technical Committee looks forward to collaborating further and assisting with their implementation. On behalf of the Egypt Oil and Gas Technical Committee, we are pleased to submit this white paper from our Brownfield Subcommittee for your consideration.

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Disclaimer

This document proposes solutions by the Brownfield Subcommittee of the Egypt Oil & Gas (EOG) Technical Committee. Although we are aware that as industry representatives we cannot immediately solve every challenge, the aim is to shed light on these challenges and propose initiatives to encourage appropriate actions and decisions. This is not a research paper, but rather an expert opinion of knowledgeable members of Egypt's oil and gas industry. This White Paper is not intended for publishing or widespread distribution and is classified only for the designated members, whereas the audience of the paper is His Excellency Tarek El Molla, the Ministry of Petroleum, and its related entities. The Brownfield Subcommittee is available to discuss the details with the Ministry at its convenience.

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Executive Summary

As conventional oil and gas fields in Egypt reach maturity, industry leaders call for maximizing existing mature fields’ commercial viability. There is a need to tap into more conventional, tight and unconventional hydrocarbon resources and follow up with the ever-growing new discoveries on land as well as territorial waters.

This creates an opportunity for an investment-centric climate that encourages international oil companies (IOCs) and service suppliers to share their expertise in the Egyptian conventional and unconventional developments, many of which may be present in existing brownfield acreage. In order to extract oil and natural gas from deep strata, JVs need to follow new strategies, using highly efficient advanced techniques and adopting new technologies throughout all phases of any unconventional and conventional project to realize profitability in brownfield development.

In February 2019, the Brownfield Subcommittee was created to prepare a White Paper for the Ministry of Petroleum and its associated entities. The Subcommittee went through a SWOT analysis to identify a brownfield JV’s strengths, weaknesses, opportunities and threats which impact Brownfield performance, all of which can be found on the next page.

With global examples, the Subcommittee proposes strategic solutions to the Ministry of Petroleum (MoP) for enhancing brownfields’ performance in production, cost and operating efficiency. These solutions will capitalize on identified strengths and opportunities, while seeking to reduce or eliminate weaknesses and threats.

<p><u>Strengths</u></p> <ul style="list-style-type: none">• Technology and Know-how in IOCs• Tapping into Rich Hydrocarbon Resources• Robust Human Resource Base• Available Capacities in Existing Infrastructure	<p><u>Weaknesses</u></p> <ul style="list-style-type: none">• JV Risk Averse Culture• Marginal Brownfield Economics• Complex Organization within Small JVs• Outdated Governance, Strategic and Operational Development Planning
<p><u>Opportunities</u></p> <ul style="list-style-type: none">• Leveraging Leadership Support within the MoP Modernization Project• Improving Collaboration and Integration between JVs and Leveraging Synergies• Utilizing Industry Technology and Know-How• The Potential for Unconventional and Tight Resources in Brownfields• Different Agreements and Investment Frameworks to Attract New Investments	<p><u>Threats</u></p> <ul style="list-style-type: none">• Lower Margins to Service Provider Compared to Other Markets Prevents Use of Modern Technology• Complexities in External Governance of the Brownfield JV• Lack of a Collaborative Framework Between JVs• Crowded Talent Pipeline and Brain Drain Threats

After completing a TOWS analysis, the Subcommittee identified eleven strategic solutions and recommends their implementation in a phased manner. Recognizing that the implementation of all eleven strategic solutions will take considerable time and effort, the Committee believes that the needed resources be initially dedicated to the following six solutions. They should be advanced due to their importance and ability for impactful quick-wins.

- Enhance Technological Competency and Know-How
- Establish Centers of Excellence
- Establish Performance Management
- Improve Human Capital Capabilities
- Improve Mindset, Decision Making, Risk Taking
- Optimize Infrastructure Synergies and Industry Collaboration

The remaining five solutions are also important, but their implementation can be staggered as resources become available.

- Decision Making and Risk Management Related to Tenders
- Improve Planning and Strategic Capability
- Streamline Auditing and Control Practices
- Improve Production and Cost Efficiency
- Enhance Competitiveness and Business Models

The EOG Technical Committee stands ready to assist where needed.

Introduction

The objective of this White Paper is to explore new approaches to improve brownfield performance within the Egyptian petroleum sector. The Brownfield Subcommittee was formed following the YE-2018 meeting between Mohamed Fouad and the Minister of Petroleum (MoP), aimed to support the industry in increasing crude oil production. Accordingly, the Brownfield Subcommittee has identified eleven Strategic Solutions and interweaved them into this document for the Ministry to review and consider.

Comprising seven team members, the Brownfield Subcommittee jointly established ground rules. With seventeen subcommittee meetings and hundreds of man-hours of work, the subcommittee endeavored to strictly follow a timeline to present the White Paper to the Ministry in a timely manner.

In the following document, the Subcommittee showcases in the first section a SWOT analysis for a hypothetical brownfield joint venture (JV) to identify points of strengths, points of weaknesses, opportunities, and threats.

The Subcommittee brings forth 11 strategic solutions in the second section, on which all the Subcommittee members have voted according to the prioritization of importance and implementation of each solution. Broader focus areas have been used to combine some of the solutions together; namely Enhancing Focus on Brownfield Technology, Optimizing Human Capacity Focus, Improving Planning, Decision Making, and Auditing, and Enhancing Sector Competitiveness. All foci address state-of-the-art procedures and models that can be newly introduced to Egypt to optimize its brownfields.

The fourth and last section provides a set of conclusions and recommendations from the Subcommittee, with a special focus on the concept of “quick-wins”. This was available after the Subcommittee listed their rankings on the strategic priorities and implementation priorities.

The Brownfield Subcommittee began its work in February 2019, according to its approved charter.¹ It completed the SWOT analysis as planned on March 7, 2019. With the guidance and approval of the EOG Technical Committee, the Subcommittee continued its deliberations and completed the TOWS analysis on April 14, 2019.

The TOWS was reviewed with the full EOG Technical Committee, which provided its agreement to move forward with the preparation of this White Paper.

¹ Refer to Appendix 1 for more information on Team Charter

SWOT Analysis

While developing a SWOT analysis for the hypothetical JV, the team identified the JVs “internal” capabilities as Strengths and Weakness. The Opportunities and Threats are external factors that could impact the JV but are out-of-the JV’s control. For instance, an increase in global oil and gas prices would be an external factor to the JV and out of its control, thus it could be viewed as an Opportunity. Conversely, a decrease in oil and gas prices would be seen as a Threat.

Figure 1 represents the outcome of the Team’s analysis. A detailed discussion of the SWOT follows.

	Support Factors (to achieving the objective)	Challenges (to achieving the objective)
Internal Origin (Organization)	<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Technology and Know-how in IOCs • Tapping into Rich Hydrocarbon Resources • Robust Human Resource Base • Available Capacities in Existing Infrastructure 	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> • JV Risk Averse Culture • Marginal Brownfield Economics • Complex Organization within Small JVs • Outdated Governance, Strategic and Operational Development Planning
External Origin (Environment)	<p><u>Opportunities</u></p> <ul style="list-style-type: none"> • Leveraging Leadership Support within the MoP Modernization Project • Improving Collaboration and Integration between JVs and Leveraging Synergies • Utilizing Industry Technology and Know-How • The Potential for Unconventional and Tight Resources in Brownfields • Different Agreements and Investment Frameworks to Attract New Investments 	<p><u>Threats</u></p> <ul style="list-style-type: none"> • Lower Margins to Service Provider Compared to Other Markets Prevents Use of Modern Technology • Complexities in External Governance of the Brownfield JV • Lack of a Collaborative Framework Between JVs • Crowded Talent Pipeline and Brain Drain Threats

Figure 1 – Brownfield SWOT Analysis

Strengths

A brownfield JV has different areas of strengths that can be categorized into four groups: Technology and Know-How in IOCs; Tapping into Rich Hydrocarbon Resources; Robust Human Resource Base; and Available Capacities in Existing Infrastructure.

- **Technology and Know-How in IOCs**

In Egypt, many companies work on implementing new technologies that have been successful in other countries where service companies and international oil companies (IOCs) operate. Applying these technologies enable JVs to reap the benefits of finding or producing additional hydrocarbons from brownfield concessions.

For instance, some companies use broadband 3D seismic acquisition, digital oil field technologies, ESP monitoring systems, horizontal drilling, and multi-stage fracture stimulation, among other technologies. As a relevant local example, one IOC in Egypt has successfully implemented the Fishbone Technology in a Western Desert pilot project to enhance production and reduce cost. The Bed 9-G well was successfully drilled and completed with state-of-the-art Fishbone completion and tested on 1 December, yielding significantly higher rates than previously expected.²

The use of enhanced oil recovery (EOR) techniques at mature fields is another prominent method that boosts production. The Western Desert fields and offshore areas, as well as other relatively small fields in the Gulf of Suez, Eastern Desert, Sinai, Mediterranean Sea, Nile Delta, and Upper Egypt could implement EOR technology. However, further oil investments in that area are needed, given the rising demand from the Egyptian market.

These could further strengthen the role of technological solutions in Egypt. Non-traditional technologies should be streamlined into the market after being validated technically and commercially. This enables JVs to fully-leverage the country's expertise for the benefit of the Egyptian oil and gas industry, consistent with the MoP Modernization Project.

- **Tapping into Rich Hydrocarbon Resources**

Egypt is rich in hydrocarbon resources with numerous mature fields being developed by over 40 JVs. This potentially allows more development and near-field exploration discoveries to take place on existing concession acreage as well as enabling shareholders to achieve an economic return. For example, many fields with stacked pays exist in the Western Desert

In addition, small discoveries could be made economical if low cost development options could be developed with available brownfield infrastructure. Unconventional and tight gas and oil resources are possible future opportunities.

Bringing more technologies that are available outside Egypt (identified in the point above) to exploit resources is one way to enhance Egypt's hydrocarbon development. This automatically increases production and offers multiple solutions with more attractive terms for shareholders.

² For additional details see: www.fishbone.as

- **A Robust Human Resource Base with Strong IOC Partnerships in Larger JVs.**

Large JVs have many capable professionals and a mix of talented staff. Having a strong and qualified technical team in large JVs can help in adding more reserves and increasing production at a reasonable cost. Technical and managerial talents and leadership are needed to drive forward the Modernization Project. Human resources empower technical teams in JVs, implement reward policies that recognize production increase and innovation, and apply processes for opportunity identification and maturation. All of these points strengthen the sector's human resource base.

- **Available Capacities in Existing Infrastructure**

Any available ullage in the existing infrastructure and production networks can bring production online quickly and efficiently. Infrastructure exists in various locations across the country, allowing JVs and third parties to access pipelines, processing facilities, roads, ports, etc. without the need for significant investments to build new capacities. The existing infrastructure in processing facilities (including those in the downstream industry such as refineries and petrochemical plants) lowers the operating expenses (OPEX) and capital expenditures (CAPEX), which facilitates greater production as well as reduces initial investment costs for marginally economic opportunities. However, these may need rehabilitation and/or debottlenecking as well as a streamlined commercial set-up.

Weaknesses

Despite having many strong points in a hypothetical brownfield JV, weaknesses also exist and have been classified here into four categories; JV Risk Averse Culture, Marginal Brownfield Economics, Complex Organization within Small JVs, and Outdated Governance and Lack of Strategic and Operational Development Planning.

- **JV Risk Averse Culture**

The different JV mindsets and cultural backgrounds pose a lack of risk taking and shift risks to the shareholders. A clear example is the phenomenon of “no cure-no pay” mentality, where suppliers try to introduce new technologies to improve performance or reduce cost of operation and the operator is reluctant to take any risks. This leaves the supplier under severe pressure to either take all risks or refrain from proposing new technologies. Operators should always accept to take calculated risks with service providers, leaving enough space for new technologies to be leveraged. A great example of this was Zohr project, which turned into a global success story in a very short time due to quick implementation of new technologies and processes.

- **Marginal Brownfield Economics**

The complicated economics of brownfields and volatile oil prices make investments less attractive, especially with areas of high CAPEX and OPEX requirements.

Fiscal terms that are used to rejuvenate old oil fields or legacy infrastructure can be challenging, particularly when they are based on the original concession agreements. The lack of defined incentives for IOCs to invest in the brownfield activity for secondary and tertiary recovery and the lack of an economic view to opportunities tend to turn shareholders away from mature fields. Hence, the JV overhead burdens, which generally grow with time, create financial difficulties during the mature stages of an oil fields lifecycle.

Limited brownfield resources and aging infrastructure create additional financial burdens on the shareholder. This increases CAPEX and OPEX as production declines, preventing new entry of third parties due to fear of inheriting a large overhead burden and large capital expenditures to rebuild or modernize infrastructure. Any potential for future EOR will also be challenging. Moreover, there is no flexibility in existing production sharing agreements (PSA) to leverage secondary recovery. As a result, capital spending and win-win opportunities for shareholders can be limited.

Cost recovery mechanisms tend to distort economic and strategic assessment and shareholder alignment, which result in lost economic opportunities and cost efficiency. In addition, low return of investments (ROI) discourages interested parties to enter the market. Historically speaking, high Accounts Receivables reduce shareholders' interest and confidence and drive loss in profitability.

Finally, lack of a full lifecycle economic view to assess regions and maximize recovery causes a low economic and production value. Moreover, constraints imposed by tendering process can delay projects.

- **Complex JV Organization**

The high fixed overhead costs in JVs result in a less agile organization with complex heritage processes. This prevents new entry of late-life operators due to fear of inheriting a large overhead burden. This is reflected primarily in HR processes, whereby performance rewarding processes is not implemented with sub-optimal appraisal and compensation setup. Also, Competence Frameworks do not capture leadership competencies. Finally, an unclear selection mechanism in the hiring process creates limited transparency and unequal shareholder involvement. The above is exacerbated by the overstaffing challenge associated with technical staff under-resourcing

Furthermore, small JVs may not have sufficient qualified professionals in every discipline to make the optimal business decisions and drive the business forward. Weak technical teams can lead to missed opportunities, high execution cost of projects, etc.

- **Outdated Governance and Lack of Strategic and Operational Development Planning**

A complex JV governance setup with multiple shareholders makes the JV itself not working as a fully empowered operator. Moreover, shareholders have direct detailed involvement into day-to-day operations of the JV. One reason is due to dual management. Finally, the JV board has limited independent representation with apparent overlap between management and board.

The lack of strategic and operational planning can lead to production disruptions, unoptimized operations issues, which might eventually lead to unexpected incidents. This reduces opportunities to increase or even maintain production, as well as the inability to economically justify huge expenditures for refurbishment without hope of economic return. These operational issues make increasing maintenance costs, as well as oil treating issues come up, which create further infrastructure integrity issues. In addition, this can lead to lack of alignment with the shareholders.

Opportunities

There are many opportunities that can be developed into strengths to enhance performance in brown-field JV, such as Leveraging Leadership Support within the MoP Modernization Project, Improving Collaboration and Integration between JVs and Leveraging Synergies, Utilizing Industry Technology and Know-How, the Potential for Unconventional and Tight Resources in Brownfields, and Different Agreements and Investment Frameworks to Attract New Investments.

• Leveraging Leadership Support within the MoP Modernization Project

In light of the Modernization Project, the Minister of Petroleum has sponsored an essential pillar for decision support and data flow. On different occasions, the Minister expressed his interest in developing brownfields in addition to increasing oil production by +20% as part of the sector development plans.

The Head of State mandates the government increases oil production and fill the gap between production and demand, for instance, Zohr field development plan took 28 months from its discovery in August 2015 until its first production in December 2017. This success story is the result of enabling the regulatory framework to be decentralized, with various bodies involved in the decision-making process.

As per the HR Management Pillar of the Modernization Project, human resources must be leveraged, with a special focus on young professionals. Capitalizing on young professionals in brownfield JVs could also drive future successes in the industry through initiatives such as the EOG Convention, held in December 2018, with the involvement of MoP, SPE and EOG, along with advanced efforts from industry professionals.

• Improving Collaboration and Integration between JVs and Leveraging Synergies

Infrastructure sharing can help reduce costs, increasing operational and capital efficiency. This has been done at Obayied between Bapetco and Khalda. Shell and Apache collaborated on the development of NEAG and Apollonia gas development. Other opportunities may exist with sourcing or manufacturing of materials; e.g. frac proppant, OCTG.

Integration or merging of small or large JV into larger ones can further increase operational and cost efficiency. This will leverage the capabilities of the JVs and provide additional economies of scale.

• Utilizing Industry Technology and Know-How

To leverage the current technological strengths of IOCs and service companies in Egypt, (See Strength 1 above) current technologies and frameworks exist (Opportunity 1 on Leadership and Modernization). New technologies if properly applied can increase production, lower costs, and improve efficiency; e.g. Broad-band 3D seismic, digitalization; which refers to converting paper documents and workflows to electronic format (e.g. electronic invoicing); digitalization; which refers to advanced data acquisition, automation, and control; and data analytics, and tertiary recovery.³

To empower technology as an opportunity, this will also make service and equipment suppliers more willing to bring in new equipment, technology or services.⁴

³ See Reference 1 – Digitalization in Brownfields from Petroleum Economist

⁴ Refer to Appendix 2

- **The Potential for Unconventional and Tight Resources in Brownfields**

Unconventional and tight resources in existing concession areas are a future opportunity to increase production of brownfield areas. By decreasing development costs and increasing project scale and optimizing fiscal terms, these resources can become economically attractive; e.g. Apollonia oil and gas in the Western Desert, Heavy oil in GOS, etc.

- **Different Agreements and Investment Frameworks to Attract New Investments**

Agreements and investment attraction are a development opportunity for diverse shareholders. A low-cost profile with a satisfactory low level of production will still allow for more investments with different fiscal terms; e.g. Kuwait Energy Egypt in the Eastern Desert Area A and Mediterra in Sinai's Sudr-Matarma-Asl fields. This could be a marketing opportunity to advertise the success of those projects, and to show the change in contract terms and flexibilities through a "New Models". EOG highlighted such opportunity at the Upstream Convention in December 2018. Concession extensions are also an opportunity to increase production, but may require modification of existing contractual terms.

Threats

Brownfield JVs can often pose some threats that are categorized into; Lower Margins to Service Provider Compared to Other Markets Prevents Use of Modern Technology, Complexities in External Governance of the Brownfield JV, Lack of a Collaborative Framework Between JVs, and Crowded Talent Pipeline and Brain Drain Threats.

- **Lower Margins to Service Provider Compared to Other Markets Prevents Use of Modern Technology**

The Egyptian market is not a priority business market for some service suppliers, especially with the drive to reduce prices while not considering the value element. Sometimes equipment is old and out-of-date. Delays in project executions occur because service suppliers are unwilling to deliver equipment to Egypt because they are not being paid in a timely fashion.

- **Complexities in External Governance of the Brownfield JV**

Multiple auditing organizations create concerns where staff are afraid of being blamed for making the wrong decision and then being penalized.

A slow decision-making process leads to long approval cycles and erosion of economic value. Some of these delays come during the tendering process. Revisiting tendering rules would help mitigate these delays in decision making.

Another threat is the lack of an integrated, strategic approach by the regulator to asset stewardship, asset integrity and process safety. Higher lifecycle costs of production and more acute long-term risks could result from this threat not being addressed.

- **Lack of a Collaborative Framework Between JVs**

The lack of regulations, inter-company collaboration in subsurface, supply chain, and value-adding practices results in a lack of systematic synergies/collaboration between JVs. This further cause the loss of economic value.

Furthermore, the lack of a comprehensive understanding of the existing infrastructure of the JV and its condition and capacities also occur.

In addition, the lack of benchmarks between JVs does not allow optimal business performance and sharing of best practices. This can be easily eliminated by seeking inputs from area JVs (e.g. Western Desert) on specific matriceWWs and practices. This will generate anonymous benchmark reports followed by more detailed discussions, analyses, and improvements.

- **Crowded Talent Pipeline and Brain Drain Threats**

Egypt has historically placed great emphasis on petro-technical education and degrees (e.g. petroleum engineers, geophysicists, geologists, etc.) from universities. Many top-notch students attend and matriculate from these institutions. The potential exists for a growing number of university graduates, seeking employment in the oil and gas industry.

Higher compensation and advancement outside of Egypt creates “brain drain” of talent for employment in the Egyptian oil and gas industry.

TOWS Analysis

A TOWS Analysis is a tool for identifying solutions which combine an organization's internal strengths and weaknesses to its external opportunities and threats.⁵

Strategic Solutions

As a result of its TOWS analysis, the Subcommittee identified 11 strategic solutions (Figure 2), which resulted from its deliberations on the SWOT analysis. Although the following strategic solutions focus specifically on brownfields, some of these concepts may be applicable elsewhere.

The eleven identified strategic solutions are:

1. Strategic Solution – Enhance Technological Competency and Know-How
2. Strategic Solution – Establish Centers of Excellence
3. Strategic Solution – Establish Performance Management
4. Strategic Solution – Improve Human Capital Capabilities
5. Strategic Solution – Improve Mindset, Decision Making, Risk Taking
6. Strategic Solution – Improve Decision Making and Risk Management Related to Tenders
7. Strategic Solution – Improve Planning and Strategic Capability
8. Strategic Solution – Streamline Auditing and Control Practices
9. Strategic Solution – Improve Production and Cost Efficiency
10. Strategic Solution – Optimize Infrastructure Synergies and Industry Collaboration
11. Strategic Solution – Enhance Competitiveness and Business Models

While the solutions are unique, they are combined into four broad categories, which are addressed in the following sections. These are Enhancing Focus on Brownfield Technology, Optimizing Human Capacity Focus, Improving Planning, Decision Making, and Auditing, and Enhancing Sector Competitiveness.

⁵ Additional details on TOWS processes are found in Appendix 3

<div>TOWS Strategic Solution Matrix</div>			<div><u>External Opportunities (O)</u></div> <ul style="list-style-type: none">Leveraging Leadership Support within the MoP Modernization ProjectImproving Collaboration and Integration between JVs and Leveraging SynergiesUtilizing Industry Technology and Know-HowThe Potential for Unconventional and Tight Resources in BrownfieldsDifferent Agreements and Investment Frameworks to Attract New Investments	<div><u>External Threats (T)</u></div> <ul style="list-style-type: none">Lower Margins to Service Provider Compared to Other Markets Prevents Use of Modern TechnologyComplexities in External Governance of the Brownfield JVLack of a Collaborative Framework Between JVsCrowded Talent Pipeline and Brain Drain Threats
<div><u>Internal Strengths (S)</u></div> <ul style="list-style-type: none">Technology and Know-how in IOCsTapping into Rich Hydrocarbon ResourcesRobust Human Resource BaseAvailable Capacities in Existing Infrastructure			<div><u>Enhancing Focus on Brownfield Technology</u></div> <p>Strategic Solution 1 – Enhance Technological Competency and Know-How</p> <p>Strategic Solution 2 – Establish Centers of Excellence</p> <div><u>Optimizing Human Capacity</u></div> <p>Strategic Solution 3 – Establish Performance Management</p> <p>Strategic Solution 4 – Improve Human Capital Capabilities</p> <p>Strategic Solution 5 – Improve Mindset, Decision Making, Risk Taking</p> <div><u>Improving Planning, Decision Making, and Auditing</u></div> <p>Strategic Solution 6 – Improve Decision Making and Risk Management Related to Tenders</p> <p>Strategic Solution 7 – Improve Planning and Strategic Capability</p> <p>Strategic Solution 8 – Streamline Auditing and Control Practices</p> <div><u>Enhancing Sector Competitiveness</u></div> <p>Strategic Solution 9 – Improve Production and Cost Efficiency</p> <p>Strategic Solution 10 – Optimize Infrastructure Synergies and Industry Collaboration</p> <p>Strategic Solution 11 – Enhance Competitiveness and Business Models</p>	
<div><u>Internal Weaknesses (W)</u></div> <ul style="list-style-type: none">JV Risk Averse CultureMarginal Brownfield EconomicsComplex Organization within Small JVsOutdated Governance, Strategic and Operational Development Planning				

Figure 2 – Strategic Solutions

Enhancing Focus on Brownfield Technology

The first and second Strategic Solutions offer technological know-how that can enhance brownfields.

Strategic Solution 1 – Enhance Technological Competency and Know-How

Under the technological focus, this solution addresses potential weaknesses by incorporating IOC and service providers' technical know-how. This is done through developing a Technology Leadership Module (of around a week) for company leadership (technical and managerial) to distinguish between technical tools and technical approaches which can be successfully used in a Brownfield Environment, including EOR technologies which will be leveraged and upgraded. For instance, ARAMCO in Saudi Arabia and PDO in Oman are implementing new cutting-edge EOR technologies, and EGPC can do the same. This module shall be supported by the Ministry of Petroleum and will address new technologies, implementation and tailoring them according to JV processes.⁶

In addition, momentum can be sustained by implementing a Leadership Forum in cooperation with the EOG and future EGYPS Conventions with a focus on brownfields.

Strategic Solution 2 – Establish Brownfield Center of Excellence

Building a center of excellence for brownfields can help establish common brownfield practices, share data and allow access to third party networking for consolidated group recommendations. This can further improve economics for co-development of reservoirs. EGPC can build this Brownfield Center with the support of IOCs and service providers. It must be in an advisory role to prevent another bureaucracy. Creating a Brownfield Center of Excellence (CoE)⁷ guarantees the application of best practices with the highest standards. EOG Technical Committee can facilitate the creation of a Brownfield CoE.

This solution can be further strengthened with a brownfield piloting a group and assigning one field for a speedy program to achieve the aimed production increase, share opportunity logs in regular basis among companies, and increase technical workshops across companies.

Meanwhile, other CoEs should continue expanding with technologies such as Artificial Lift, Fracture Stimulation, Production Chemicals, etc. in addition, to proceeding with forums and events to share best practices of brownfields. An Unconventional Resource CoE should also be considered. These will require a high-profile chair or co-chairs from the Egyptian oil and gas industry (NOC and IOC).

New entry of equipment and service suppliers should be encouraged for local manufacturers in addition to creating regional activity hubs for service and material suppliers. This would help reduce costs through additional business competition while increasing employment.

It may also require some additional enabling initiatives such as building an online platform where JVs share their case studies, failures and success stories. This will push for a digital transformation to take place in the oil and gas industry. Universities can also play a role as evidenced by the nanotechnology efforts at the British University of Egypt.⁸

⁶ See Appendix 4 for an example

⁷ Refer to Appendix 5

⁸ Additional information is found in Appendices 4 and 5

Optimizing Human Capacity Focus

As human capital is imperative to any company, three solutions were dedicated to human resources for the Brownfield JV. The development of human capacity is one of the seven pillars of the MoP Modernization Project. The Subcommittee supports this and offers additional details below.

Strategic Solution 3 – Establish Performance Management

This solution addresses the lack of optimal performance management that deviates from global best practices. This can be mitigated by incorporating simplified metrics limited to a small number of SMART goals for JVs to ensure alignment with shareholders. Companies should communicate a job description for each Chairman and other managerial positions with a list of expectations and goals. Part of the job description should be generic to every Chairman and leader, and part of it with expectations that are specific to each JV. For instance, EGPC, EGAS and IOCs normally issue a formal letter to the JV Chairmen and IOC Managing Director with the guidelines, which, in some cases, is already included in JV by laws and concession agreements.

Shareholders in JVs add value to this by creating a phased Performance Management process that focuses on the JV Leadership Team that sets realistic but challenging goals under prevailing budget circumstances and is accountable for achieving those goals with appropriate incentivization.

The above has to be complemented by an evidence-based appraisal system and optimal feedback mechanism utilizing the use of technology and analytics. Finally, this system needs to incorporate a strong consequence management system, whereby performance to pay linkage must be established. This will help differentiate between performers and incentivize high performers and drive an optimal promotion scheme.

Strategic Solution 4 – Improve Human Capital Capabilities

Yet another solution that focuses on human capacity by capturing the strengths of the Egyptian workforce to improve HR practices, retention, redeployment, career path development and talent management in the brownfield JVs. Working closely with admissions departments at universities would help prevent an oversupply of petro-technical graduates entering the Egyptian labor market. Effective retention policies would help alleviate the brain-drain in the industry. Through new policies and procedures, professional HR management capabilities will be built in JVs. An effective workforce plan will be established to identify the true manpower requirements of JVs and manage those requirements (relative to production levels).

PSC training allocated bonuses should be provided in-kind as per the concession agreements (not as a cash payment) and IOCs should submit an annual training plan to be provided for EGPC and their affiliated JVs. Training will include world-class technical and managerial assessment-based modules and be directed to the JV operating concessions for capability building and competency development.

Moreover, effective hiring processes and practices will be established to optimize selection based on business requirements.⁹

A Modernization Advisory Committee should be formed with cross-JV sector and IOCs to prioritize, give direction and facilitate replication across the sector. By setting up data necessary to define fit-for-purpose redeployment solutions both in and out of the sector, excess of manpower in JVs will be identified and quantified.

⁹ Refer to the proposed technical training module from solution 1

Also, by creating new meaningful positions in Centers of Excellence (CoEs), any organization should potentially expand through redeploying and relocating employees that are not working with full performance at their current positions. This will also improve the use of the existing workforce and capture those with required and critical skills and competencies.

Moreover, in order to boost professional experience and capacities within JVs, JVs should utilize the right skills and move young professionals such as geologists and engineers from the EGPC to JVs for appropriate training and exposure. In addition, serving in EGPC should be on rotational basis before being promoted to a General Manager. This way, senior engineers in EGPC committees will be given the exposure to many fields and decisions.

Strategic Solution 5 – Improve Business Mindset, Decision Making and Risk Taking

To address potential weakness in cultural and management mindset, decision making and risk taking, the tenets of the Modernization Project must be incorporated to JVs and their staffs.

Senior management and leadership to participate in customized programs according to their positions. All JV CEOs need to demonstrate that they are modeling the risk taking in their decisions. Identified leaders from the Brownfield JVs and relevant leadership from holding companies can both be sent to the American Chamber of Commerce in Egypt to enroll in a tailor-made Senior Management Leadership Program. HSE would be a key element in this leadership, training.¹⁰ Finally, Psychometric tests should also be utilized to enhance their capabilities.

Improving Planning, Decision Making, and Auditing

The following three unique solutions address areas for improving decision making and risk management surrounding tenders and auditing processes; and improving business planning and the strategic capabilities in the Joint Ventures.

Strategic Solution 6 – Improve Decision Making and Risk Management Related to Tenders

To improve decision making on tenders and reduce fear of risk taking, this solution aims to improve JVs understanding with respect to tendering rules and laws with flexibility, accepting a sole bidder or assigning a company to a job in certain cases without tendering. Although this is already possible by law, it is not readily practiced. The Strategic Solution in essence will provide a better understanding of tendering laws. EGPC with the help of the EOG Technical Committee will design a mandatory workshop for JV bid committees and the auditing organizations to explain the requirements of government's tender regulations.

A percentage of the JV budget will be assigned to meaningful direct award for new technologies while being cost recoverable. To ensure optimal spending and capture lessons learnt, such endeavor should be governed optimally and liaised with the Brownfield CoE.

Strategic Solution 7 – Improve Planning and Strategic Capability

Strategic Solution 7 focuses on planning, execution and measuring results to reduce weaknesses and improve competitiveness and production. It also encourages enhanced governance models, empowers JV Boards, evaluates and updates JV Delegation of Authority as allowed under PSC and By-Laws, and implements budgeting and accounting ERP tools and consider standardizing a tool across the industry.

¹⁰ Additional details on this program are found in Appendix 6

Strategic Solution 8 – Streamline Auditing and Control Practices

This Strategic Solution addresses auditing concerns of various auditing organizations by improving the practices in the JVs, reducing the fear of risk-taking, reducing silos, and driving value in a cost-efficient manner.

The existing Foreign Trade and Control team in EGPC/EGAS and other Auditing Organizations should be augmented with technical experts (such as engineers, chemists, etc.). This will improve awareness and ensure better communication within the various departments and organizations.

Enhancing Sector Competitiveness

This final solution area, with its three unique solutions, focuses on improving business delivery and cost efficiency in the Joint Ventures; gaining access to infrastructure and avoiding unnecessary investments, and considering new business models for enhancing competitiveness.

Strategic Solution 9 – Improve Production and Cost Efficiency

To improve production, cost efficiency and rationalization, a review for the large number of small JVs should be undertaken with the possibility of their integration. This will create a larger JV. Combining small companies into larger organizations with a shared governance can also help mitigate this point. This implies that staffing in the newly formed JV will also be under experienced professionals.

In addition, a detailed JV benchmark and scorecard may be prepared by the regulator to determine cost competitiveness and productivity. This will accept the natural daily production fluctuations and allow the organization to focus on the annual plan execution.

Strategic Solution 10 – Optimize Infrastructure Synergies and Industry Collaboration

A regional infrastructure study will be conducted to identify threats (bottlenecks, integrity issues, encroachments, etc.) and collaboration opportunities.¹¹ A database for facilities, water disposal, source wells, etc. will be an outcome of this study. The Brownfield CoE can evaluate infrastructure as part of its terms of reference. The above may allow a Midstream business within the upstream ring-fence to develop via the needed investment incentives and returns. PSC terms should be considered in that endeavor.

This Strategic Solution aims to increase the use of existing infrastructure and available resources, facility ullage, etc. and improve collaborations between JVs. This solution may consider applying the UK Model¹² to facilitate third party access and dispute resolution mechanisms as per the below references.

Strategic Solution 11 – Enhance Competitiveness and Business Models

To increase brownfield investments and production and improve cost competitiveness of JVs, other types of complimentary models should be considered to improve economic benefits in the late life of the brownfield and encourage ongoing investments. New business models complementing Production Sharing Contracts (PSC), such as Bundled Service Contracts, Risk-Reward Service Agreements, Gross-Split model, etc.

¹¹ This type of study is outlined in Appendix 7

¹² <https://oilandgasuk.co.uk/wp-content/uploads/2017/08/Infrastructure-code-of-practice-2017.pdf>.

https://www.ogaauthority.co.uk/media/2712/oga_guidance_disputes-over-third-party-access-to-upstream-infrastructure.pdf

A generic PSC model agreement should be considered to allow flexibility and adjust fiscal terms under negotiated agreement per concession without mandated parliamentary approval. That way, the overall economic returns can be improved by greater than 10-year PSC extension.

In addition, changes in existing PSCs should be considered to allow extra economic benefits such as accelerated capital amortization, longer extension durations, higher shareholder profit split and/or cost recovery percentage. This will encourage shareholders to invest in EOR/IOR, including co-development or field integration (unitization) as the case in the US.

List of Abbreviations

AmCham	American Chamber of Commerce
bbbl/d	Barrels Per Day
CAPEX	Capital Expenditures
CEO	Chief Executive Officer
CO₂	Carbon Dioxide
CoE	Center of Excellence
CSR	Corporate Social Responsibility
E&P	Exploration & Production
EGAS	Egyptian Natural Gas Holding Company
EGPC	Egyptian General Petroleum Corporation
EOG	Egypt Oil & Gas
EOR	Enhanced Oil Recovery
ERP	Enterprise Resource Planning
FFP	Fit For Purpose
GIS	Geographical Information System
HIPPS	High Integrity Pipeline Protection System
HR	Human Resources
HSE	Health, Safety, and Environment
IAM	Integrated Asset Modeler
IOCs	International Oil Companies
IoT	Internet of Things
JV	Joint Venture
LPG	Liquefied Petroleum Gas
MMcf/d	Million Cubic Feet
MoP	Ministry of Petroleum
N₂	Dinitrogen
NOCs	National Oil Companies
OCTG	Oil country tubular goods
OEM	Original Equipment Manufacturer
OPEX	Operating Expenses
Pci	Pounds per Square Inch
PIMCOE	Pipeline Integrity Management Center of Excellence

PSA	Production Sharing Agreements
PSC	Production Sharing Contracts
ROI	Return of Investments
SPE	Society of Petroleum Engineers
ST	Strengths and Threats
SWOT	Strengths, Weaknesses, Opportunities, Threats
TOWS	Threats, Opportunities, Weaknesses, Strengths
UCS	Unconfined Compressive Strength
UK	United Kingdom
USD	United States Dollar
WO	Weaknesses and Opportunities
WT	Weaknesses and Threats

Appendix 1

Brownfield Oil Production Improvement Team Charter

Brownfield Oil Production Improvement Team Charter

Background

A team of Egypt oil and gas industry experts has been assembled to perform a SWOT Analysis on behalf of the EOG Technical Committee for ultimate submittal to the Ministry of Petroleum (MoP) to Build on Strengths, Mitigate Weaknesses, Capitalize on Opportunities and Minimize Threats with the goal of improving oil production from existing mature oil fields and further unlocking the potential of the oil and gas industry in the Arab Republic of Egypt.

Deliverables

Once the Team identifies the items above, it will weave them into a traditional white paper which will include an Executive Summary, Introduction, Discussion, Conclusions and Recommendations.

Method

The Team will use a typical SWOT analysis and address:

Strengths – What are “internal” strengths and why? Can they be made stronger and how?

Weaknesses – What are “internal” weaknesses and why? What can be done to eliminate or mitigate severity?

Opportunities – What are “external environment” opportunities and why? e.g. EGPC working groups, Young Professionals, etc. Identifying these will also provide credit where credit is due to EGPC, EOG, etc. What can be done to make opportunities strengths?

Threats – What are “external environment” threats and why? What can be done to eliminate threats or mitigate severity?

The Team addressed the question of “Internal” and “External” for purposes of identifying Strengths/Weaknesses and Opportunities/Threats. The “Internal” assessment is that of a JV operating in the Egypt’s oil and gas industry. Anything outside of the JV will be considered as External. Depending on the outcome of the SWOT, the Team may decide to complete an additional SWOT analysis by using Egypt’s oil and gas industry at the highest level for identifying Internal Strengths/Weakness and everything else as Opportunities/Threats.

Appendix 2

Examples of Technology Solutions Used Internationally

1.1 General

Mature brownfields contribute significantly to global and Egypt's oil production. Declining oil and gas production can be revived through several means, such as improving well integrity and judicious well interventions to restart production from idle wells and/or previously considered unattractive low-resistivity formations. In addition, the improved reservoir characterization, optimizing ongoing waterfloods is an area where focused efforts are yielding rich dividends. These involve locating the bypassed oil and addressing un-swept areas through reservoir surveillance and modeling. Some operators also have focused on innovative enhanced-oil-recovery techniques in mature brownfields to revive production.

1.2 Applications

Several companies in Egypt have variety of technologies to address challenges in brownfields. Integration of these technologies by creating collaborative teams are an important step for the success of brownfield development in Egypt. The following applications are a few examples;

1. Because many plants were built decades ago, the information is captured on paper and stored in filing cabinets. Capturing this information electronically and, more importantly, organizing this information to support the critical operations processes is essential to make decisions. Some software platforms enable to digitally model hydrocarbon behavior based on physical measurements and associated data. Critical components along this path are an efficient collaboration environment and solid data management.
2. In an effort to enhance declining production and maximize resource recovery, brownfield operators are tasked with extending platform life while ensuring well integrity and meeting stringent HSE standards. These redevelopment operators are often looking to refurbish older facilities in mature reservoirs and are considering all aspects of upgrades, including interfacing older technology with new product developments and installing new systems. Technological solutions enable operators to seamlessly incorporate upgrades within existing facilities with minimum disruption to ongoing operations.
3. A fully integrated set of services are available to define the reservoir structure and properties and build the most accurate models of the subsurface to identify previously unattractive and/or skipped reservoir layers.
4. Transmitter and receiver tools are available to locate bypassed oil and address un-swept areas through reservoir surveillance and modeling while enhancing current waterflooding and steam injection projects.
5. CO₂ or N₂ assisted foam stimulation techniques, foam diversion from depleted layers, and water and gas shut-off chemicals are also important technologies for brownfields.

1.3 Case Studies

Case Study: PEMEX E&P Optimizes Economic Value of Large Brownfield

Challenge: Increase utilization of 25-year-old process facilities and rescue steeply declining production system plagued by irregular topography, pipeline condensate slugging, and asset bottlenecks resulting in part from counter-pressure; reduce cost of maintenance and gas line pigging.

Solution: Develop fieldwide system and methodologies; provide consulting services, training, and technology, including

- Integrated Asset Modeler (IAM) software
- Production system design and analysis software
- Downstream process simulation software.

Result: Improved process simulation and analysis with new asset model to fully integrate 69 wells, 6 process facilities, and 13 network models; optimized facilities utilization with strategic intervention that minimized bottlenecks, slugging, and other problems common to brownfields; reduced operating costs by USD 600,000/year and increased production by 1,500 bbl/d and 5 MMcf/d.

Case Study—Sand Management Evolution in a Brownfield

A brownfield has been in production for over 30 years. A redevelopment plan started in 2004 to revamp oil production under an alliance partnership between an oil and gas company in Malaysia and an oilfield service company. The mentioned brownfield is a multilayered reservoir where the Unconfined Compressive Strength (UCS) can vary from 1,500 psi in the consolidated sand until less than 800 psi in the shallow zones.

Based on a geomechanics study and existing production history of the field, unconsolidated producer sands were identified, and sand control methods were evaluated according to the degree of achieving the goals, and reducing risk, the result indicates that the Cased Hole Gravel Pack with Alternate Path System was preferential. Additional information was obtained in the latest campaign during the retrieval of gravel-pack screens in 2 sand-producing wells, which gave a better understanding of the failure mechanism in the previous gravel-pack operations.

The main changes in the design of sand control systems during 8 years includes adopting a perforating solution of performing a mechanical back surge, increasing shot density and charges with low debris, use of a 3-way sub tailpipe system to avoid problems associated with breaking flapper valves and debris accumulation, number of cup packers, size of screens, slurry concentration and back pressure applied during the treatment. Furthermore, the evolution in the sand control management have showed benefits such as increasing the number of gravel-pack zones per well, performing longer gravel packs, installing permanent downhole gauges and using bigger tubing.

Case Study: Chemical Service Helps Operator Increase Production 440% in Depleted Russian Wells

Challenge: Improve productivity of a depleted brownfield development.

Solution: Apply foam-based diversion service to enhance effectiveness of acidizing stimulation treatments.

Result: Increased production 440%—nearly double the production achieved with conventional matrix acidizing and acid fracturing techniques.

Case Study: Maintenance Strategy Reduces Intervention Time by 83% and Increases Recovery, Congo

Challenge: Improve operational performance and reduce risk after a survey revealed that about 65% of a Congo operator's wells had integrity issues.

Solution: Implement a proactive original equipment manufacturer (OEM) maintenance program to maximize equipment performance and optimize operations.

Result:

- Reduced intervention time by 83%.
- Recovered more than 186,854 bbl in lost oil production per intervention.
- Reduced inventory requirements.
- Streamlined ordering process.
- Increased the operator's competitive advantage.

Case Study: Flow Profiling on Down-hole Tractor Gains 1,300-bbl/d Oil

Challenge: Identify water entry for setting a plug in a North Sea horizontal well with a high water cut.

Solution: Effective flow profiling in horizontal and deviated well production logging system efficiently and quickly identified the water entry point through real-time data review and interpretation.

Result: Increased oil production by 1,300 bbl/d after setting a plug based on the flow profile.

Case Study: Crosswell Seismic Imaging Enhances Subsurface Understanding in Mature Oil Field

Challenge: Target new infill drilling areas in a structurally complex field with challenging surface seismic data.

Solution: Introduce cross-well seismic imaging service to conduct tomographic surveying by deploying the source and receivers downhole to avoid the attenuative overburden, resulting in enhanced-resolution images.

Result: Developed new structural and stratigraphic interpretations to support infill development based on a greatly improved understanding of the subsurface from the enhanced resolution of the cross-well seismic images.

Case Study: Hydraulic fracturing optimizes production in low-permeability offshore wells

Challenge: Stimulate wells in offshore West Africa sandstones to revive low-performance reservoirs and develop previously abandoned low-deliverability reservoirs.

Solution: Use multistage fracturing and completion service for accurate fracture placement with only one vessel mobilization and hook-up per rig and minimal time between treatments.

Result: Increased stabilized production from re-completed cased hole wells to 1,905 bbl/d from 590 bbl/d. Stabilized production from wells that had been considered uneconomical to 2,000 bbl/d.

Appendix 3

TOWS Strategic Solutions Matrix

TOWS Strategic Solutions Matrix	<u>External Opportunities (O)</u>	<u>External Threats (T)</u>
	1. 2. 3. 4.	1. 2. 3. 4.
<u>Internal Strengths (S)</u>	<u>SO</u> “Maxi-Maxi” Strategy Solutions that use strengths to maximize opportunities .	<u>ST</u> “Maxi-Mini” Strategy Solutions that use strengths to minimize threats .
<u>Internal Weaknesses (W)</u>	<u>WO</u> “Mini-Maxi” Strategy Solutions that minimize weaknesses by taking ad- vantage of opportunities .	<u>WT</u> “Mini-Mini” Strategy Solutions that minimize weak- nesses and avoid threats .

Strengths and Opportunities (SO) – How can you use your organization’s strengths to take advantage of the opportunities? This is the position any company would like to be in, being able to utilize its strengths to take advantage of opportunities in the market. For example, Volvo, with the technical know-how and its quality and safety image can take advantage of the external demand for environmentally safe cars by an increasingly environmentally aware public. Successful organizations will attempt to get into this situation where they can work from their strengths to take advantage of their opportunities.

Strengths and Threats (ST) – How can you take advantage of your organization’s strengths to avoid real and potential threats? This solution aims to maximize your organizations strengths while minimizing the latter. As with the example of BMW below, they can use their internal strength of strong R&D and engineering to address the threat of fuel-economy targets.

Weaknesses and Opportunities (WO) – How can you use your organization’s opportunities to overcome the weaknesses you are experiencing? Your company may identify market opportunities in the external environment but have organizational weaknesses which prevent you from taking advantage of market demands. A good example of this might be an organization that have identified opportunities in the

market place in relation to 'ethical' consumer, however, its own internal operations are not yet up to Corporate Social Responsibility standards and lack the policies and processes required to make its manufacturing processes more ethical. One possible marketing solution would be to acquire this know-how through cooperation with another organization having competency in this field. Of course, your organization has the choice of doing nothing, leaving the opportunity to competitors.

Weaknesses and Threats (WT) – The aim is here to consider how can you minimize your organization's weaknesses and avoid threats. An organization faced with external threats and internal weaknesses may be in a difficult situation, and may have to fight for its survival to stay in business. In order to overcome the weaknesses, or allow the threat to diminish over time, the organization might have to consider merging/partnering with another organization, exit certain markets, discontinue certain product lines etc. The WT quadrant represents a more defensive marketing solution. As a marketing manager you would put this in place to protect your organization from loss, however don't rely on it to create growth and market success.

Appendix 4

EXAMPLE IMPLEMENTATION PLAN FOR STRATEGIC SOLUTION 1 Technological Competency and Know-How

A Brownfield Center of Excellence (CoE) would initiate greater returns to Egypt. Workshops to discuss the vision of this CoE, initiate the teams to identify Egypt brownfield challenges and set the going forward actions will be beneficial in near future.

After initiating the teams, a two-weeks training program will be beneficial due to the lack of experience in brownfield projects in Egypt. The training program includes:

Course Title: Managing and Engineering Re-Development of Brownfields

Duration: Two weeks

Target: Asset Managers, Facility Engineers, Petroleum Technologist, Well Services Engineers, Reservoir Engineers

Course Content:

A cross discipline program that teaches the participants the essential workflows used in field re-development planning of brownfield assets. Brownfields today, although with more technical uncertainties and having more economic risks, can be successfully redeveloped. This 2-weeks course starts with dissemination of various redevelopment strategy options depending on the reserve volume and distribution, water production, integrity of the current wellbores and the depletion drive status and change. It then covers the complete assessment of the additional oil and gas recovery potential from reservoir performance evaluation, advanced remaining oil and gas reserve mapping, practical IOR and EOR approaches, and to the construction of the integrated production systems for cost effective further development of the brown fields.

Additionally, current logging and seismic technologies for finding and identifying previously complex layers and bypassed oil will be covered. Well interventions and workover techniques as well as water and gas shut off fluids will be discussed. Foam stimulation technologies and candidate selection for these technologies are also important for re-developing these assets. CO₂ and N₂ fracturing and re-fracturing will be studied.

Appendix 5

EXAMPLES FOR THE IMPLEMENTATION PLAN FOR STRATEGIC SOLUTION 2

Technology and Centers of Excellence

1.1 General

As part of the Brownfield White Paper, Strategic Solution 2WWW identified several actions. This Solution aims to help establish common brownfields practices, share data and allow access to third parties for consolidated group recommendations, which can further improve economics for co-development of reservoirs. The EGPC can build the CoEs with the support of IOCs and service providers.

A CoE is a team of skilled and knowledgeable workers who are responsible for promulgating knowledge about the center's areas of interest and help implementing recommended best practices. It is worth mentioning that efficient CoE should include representatives from management, a line of business and information technology.

New entry of equipment and service suppliers should be encouraged to local manufacturers, in addition to creating regional activity hubs. This would help bring costs down through additional business competition while increasing employment. It may also require some type of incentives, such as building an online platform where JVs share their case studies, failures and success stories. This will push for a digital transformation to take place in the oil and gas industry.

1.2 Applications

Pipeline Integrity Management Center of Excellence (PIMCOE) is the first of its kind in the Middle East and the fruit of a co-operation between GASCO and a service provider. The combined technical strength of the provider and operational excellence of GASCO are intended to ensure that customers receive the best in inspection, pigging proficiency and rehabilitation services. PIMCOE started its activities in mid-2006 focusing on providing proactive, protective cost-effective services and solutions enabling the center to share in national and international bids. Services provided depend on using the latest technologies and programs such as; GIS (Geographical Information System) and FFP (Fit For Purpose).

A service provider is also working with Burullus Gas Company, a JV between the Egyptian Gas Holding Company and Shell Egypt, to conduct a changeover of subsea control systems by installing new software and hardware for both Brownfields and Greenfields. The upgrade utilizes latest subsea High Integrity Pipeline Protection System (HIPPS) that enables high pressure wells to be connected to the existing pipeline infrastructure.

A global IT company opened a new center of excellence for the oil and gas industry in Dubai. The Middle East and Africa center has been launched to assist organizations in the sector to drive digital transformation, cut costs and optimize processes in their organizations.

The center, which is the largest facility of such for this company, will focus on emerging technologies including Internet of Things (IoT), advanced analytics, modern productivity, cloud computing and IT solutions. The center also brings together leading industry players.

The use of digital technologies in the upstream sector could result in cumulative savings in capital expenditures and operating expenditures of \$100 billion to \$1 trillion by 2025. Accordingly, an oil company has launched a centralized and integrated digital improvement program and is setting up a digital center of excellence with a holistic road map for digitization stretching out to 2020. The company has committed an investment of \$128 million to \$257 million in digital and emerging technologies, to be executed through the center of excellence.¹³

¹³ As cited in Drilling for data: Digitizing upstream oil and gas, PricewaterhouseCoopers (PwC) in 2018

Appendix 6

IMPLEMENTATION PLAN FOR STRATEGIC SOLUTION 5

Mindset, Decision Making and Risk Taking

As part of the Brownfield White Paper, Strategic Solution 5 identified several actions. This Solution aims to address potential weakness in cultural and management mindset, decision making and risk taking. To be successful, the tenets of the Modernization Project must be incorporated in the JVs and their staffs. Accordingly, all Brownfield JV CEOs and others need to demonstrate that they are exhibiting thoughtful risk taking in decision-making and leading personal and organizational behavioral changes. These identified leaders from the Brownfield JVs can be sent to the American Chamber of Commerce in Egypt and enroll in Middle Management Leadership Program, which has already been developed. The 6-module session which is designed over a 9-week period plus a group project, addresses the following skill areas:

- Business Models and innovation
- Influencing Skills
- Coaching for optimal performance
- Leading change
- Strategy formulation and implementation
- Team Empowerment

Another key element for this training is in the area of HSE, which is a key focus for the Ministry. The EOG Technical Committee could assist with this. With additional direction and guidance, other modules could also be added either to AmCham, EOG or other providers.

Appendix 7

IMPLEMENTATION PLAN FOR STRATEGIC SOLUTION 8 INFRASTRUCTURE AND COLLABORATION

1.1 General

As part of the Brownfield White Paper, Strategic Solution 8 identified several actions. This Solution aims to increase the use of existing infrastructure and available resources, facility ullage, etc. and improve collaboration between JVs. This solution will apply the UK Model to facilitate third party access. A regional infrastructure study will be conducted to identify threats, synergies and opportunities. A database for facilities, water disposal, source wells, etc. will be an outcome of this study.

Specifically, for the Infrastructure Study, EGPC should commission a company, such as ENPPI, to prepare of high-level study of available oil-, gas- and produced water-handling infrastructure in the Western Desert, Eastern Desert, Gulf of Suez, Mediterranean and the Sinai. This will allow the identification of processing and evacuation options for gas and hydrocarbon liquids and water from these producing regions in Egypt.

1.2 Objectives

The scope of this report is to assess the Western Desert, Eastern Desert, Gulf of Suez, Mediterranean and the Sinai hydrocarbon processing and export infrastructure for gas and liquids considering planned infrastructure expansion and forecasted production rates from all producers in the regions.

The objectives of this report, therefore, are:

Objective 1 - Analyze the Western Desert, Eastern Desert, Gulf of Suez, Mediterranean and the Sinai gas network to identify ullage in pipelines and processing plants based on today's production rates.

Objective 2 - Identify gas evacuation strategies to:

- a. Utilize ullage in downstream LPG Plants;
- b. Utilize ullage in existing infrastructure;
- c. Evacuate proven reserves.

Objective 4 - Analyze the Western Desert, Eastern Desert, Gulf of Suez, Mediterranean and the Sinai liquid network to identify ullage in liquid pipelines and processing plants based on today's production rates.

Objective 5 - Identify liquid evacuation strategies to utilize ullage in existing infrastructure to evacuate proven reserves.

Objective 6 - Perform a high-level system analysis to:

- a. Assess the capability of the existing gas and liquids evacuation infrastructure to export projected production flowrates for the next 5 years;
- b. Identify gas liquid evacuation strategies to evacuate proven and future reserves.



