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October 2019

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Shale Oil

Heavy Oil

SURGING SHALE OIL PRODUCTION IN US IS UNLIKELY TO DERAIL INVESTMENT IN HEAVY OIL DEVELOPMENT AROUND THE WORLD, INCLUDING OMAN WHERE 15% – 30% OF THE COUNTRY'S TOTAL CRUDE OUTPUT COMES FROM HEAVY OILFIELDS

MARKET

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Impressum



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» Mr. Fathy Al Mendhry,
Interim Opal CEO

Dear readers,

These are interesting times for Oman's energy sector, notwithstanding the protracted downturn that has impacted not only our industry, but other economic sectors as well – locally and internationally. Over the past year, we have seen our industry evolve and expand, at least in scope, to include the power sector – which now falls fully under the remit of the Ministry of Oil and Gas – as well as renewable energies and alternative fuels. The latter elements have been featured extensively in these pages, offering our members, among other readers, insights into the exciting opportunities and possibilities that they hold for our local industry, and indeed the wider economy.

The nation's renewable energy programme, spearheaded by Oman Power and Water Procurement Company (OPWP), is stellar in its scope and delivery timeframe. Although we may have made a belated entry into this sector – relative to other players in the Gulf region – we are well and truly on track as a nation committed to making the transition to greener, sustainable sources for our energy requirements. Solar PV and wind-based projects, and potentially grid-connected Concentrated Solar Plants (CSPs), will account for a third of Oman's electricity supply by 2030 – an ambitious, yet admirable, goal.

Of late, Oman has also taken tentative steps towards driving the growth of a 'Green Hydrogen Economy', which can be a game-changer for the country. The Ministry of Oil and Gas has proposed the establishment of a 'working group' composed of representatives from stakeholder organisations – Oil & Gas operators, academic and R&D institutions, and government regulatory agencies – to lay the initial groundwork for a future Green Hydrogen Economy in the Sultanate. Read on for a peek into this tantalizing possibility.

Finally, and as the year draws down to a close, we hope you will make the most of the trifecta of events that OPAL is busy organizing for the benefit of our industry. The first is the OPAL Oil & Gas Conference, set for 21-22 October, which will be followed by the OPAL Best Practice Awards, and finally the popular OPAL Sports Week – three events that offer opportunities for networking and engagement, as well as personal and professional development. My colleagues and I look forward to connecting with me at these events, and will welcome your thoughts and feedback on how OPAL can continue to play its role as the Voice of the industry.

Fathy Al Mendhry
Interim CEO

A handwritten signature in blue ink that reads "Fathy". The signature is written in a cursive style and is positioned below the printed name and title.



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HSE APPRENTICESHIP PROGRAM

What is special about the program?!

1. Reflect the National Occupational Standard;
2. Developed by the Sector;
3. Fully funded Program;
4. Help companies to get the competent Omani candidates for HSE positions;
5. Nationally and Internationally accredited program.

The program targets the following:

1. New opportunities for Job seekers are the main target: employers are encouraged to pledge for HSE vacancies for HSE Advisor. OPAL will support in getting the right candidates and to fund the full program cost including training cost and a stipend of 150 per candidates per month. The employer may add on the stipend to encourage their candidates retain during the program and towards their full employments.
2. New employees who join HSE departments or those who shift their jobs to HSE. However, the cost should be covered by employer.

There are two level of targets

1. Diploma holder/degree will have to study for 18 months both off-job and on job training (total of 6 months off job + 12 months on job).
2. Secondary school leaver they have to study 24 months (6 months foundation, 6 months off-job – 12 months on-job).

For more details on HSE
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Market highlights

A brief snapshot of recent events and developments of significance to Oman's Oil & Gas, Electricity and Renewables sectors:

Oman Oil and Orpic Group funds research into presence of black powder in gas pipelines



Oman Oil and Orpic Group, the nation's integrated energy powerhouse, signed a partnership agreement under the auspices of Ejaad -- a collaborative platform that connects industry with academia in the pursuit of scientific research and innovation -- to study the root causes behind the build-up of a black powdery substance in the Sultanate's extensive network of natural gas pipelines. Under the one-year-long agreement, Oman Oil and Orpic Group will work with researchers at Sultan Qaboos University (SQU), as well as the Higher College of Technology, to investigate the causative factors behind this unexplained phenomenon. The agreement was signed by Eng. Mansoor bin Ali al Abdali, Operations Director – Oman Oil and Orpic Group, and Dr. Hamood bin Khalfan al Hadhrami, the

Principal Researcher of the study, from Sultan Qaboos University. Also present on the occasion were representatives of SQU, Ejaad (part of The Research Council) and other partner organisations.

The study will focus on two gas pipelines of 24-inch and 32-inch diameters extending a combined distance of 340 kilometres. As part of their investigations, the research team will delve into the factors that contribute to the formation of the black powder, and recommend options for its disposal in an environmentally safe manner. [28 Sept 2019]

Dear readers,

Your feedback is very important to us. In this section of OPAL Magazine we would like to add a dedicated page where we can hear your thoughts on topics covered in this issue, as well as issues of relevance to the Oil & Gas business. Please feel free to send in your suggestions on how we can improve the overall content.

Contact us by email or Twitter.

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READERS' WORD



PDO SIGNS ICV DEALS WORTH RO 23.5M WITH OMANI FIRMS



Petroleum Development Oman

(PDO) has signed eight new contracts worth around RO 23.5 (\$61 million) with Omani companies to provide important manufacture, maintenance, manpower and transport services.

The deals were signed yesterday by PDO Managing Director Raoul Restucci and senior executives of the community-owned firms at an official ceremony at the Company's Knowledge World building.

Three of the companies are Omani manufacturing start-ups and were established in line with PDO's drive to implement the In-Country Value (ICV) Blueprint Strategy for the oil and gas industry announced in 2013 to create more job, training, commercial and investment opportunities for national businesses.

Mr. Restucci said: "These contracts are further testament to our strong and abiding commitment to ICV to spread the wealth of our industry throughout the wider community. The investment will support and create jobs for Omanis and help to strengthen local supply chains in terms of the provision of vital services for our operations. Each of the signatory companies has demonstrated their capa-

bility and capacity to deliver work safely, professionally and efficiently."

Three five-year contracts were signed with Oman Flanges Production, Solid Earth and Gulf Fasteners, which are newly established small and medium enterprises (SMEs) located in Nizwa, Barka and Rusayl respectively.

The agreements will be for the production of flanges, which connect pipes, valves, pumps and other equipment to form a piping system, and fasteners, such as nuts and bolts, and should create more than 50 job opportunities. Such moves to localise manufacturing are fundamental to the implementation of the ICV Blueprint document unveiled by the Ministry of Oil and Gas for operators almost six years ago.

Another contract – which will run to the end of May 2023 – is with Local Community Contractor (LCC) Sahwat Haima for the provision of personnel commuting services to and from accommodation camps, local villages and Marmul Airport in South Oman.

It represents a continuation of PDO's commuter bus scheme which was launched in the summer of 2013 to reduce the rate of road accidents by

cutting the number of staff and contractors using private vehicles to get to and from work.

The service has expanded steadily and now covers 28 hubs and 65 villages. Since it started, it has carried 536,702 passengers, including 175,095 PDO staff, and an average of 12,574 passengers a month now use it.

PDO also signed two contracts – which will run to the end of November 2020 – with LCCs Sana'a Desert Trading and Murtafaat Shaleem Trading & Contracting to provide manpower. These deals will create more than 200 jobs for Omanis in the North and South of PDO's concession area to work as carpenters, dispatchers, warehouse staff and general helpers.

Two other deals were sealed with Super Local Community Contractor (SLCC) Al Shawamikh Oil Services and LCC Al Ghalbi International Engineering and Contracting to carry out maintenance work on the Main Oil Line in Central and North Oman respectively. The agreements – which will run until November 2022 – will cover protective coating work on key pipeline sections to prevent corrosion. [24 Sept 2019]

DUQM REFINERY WINS 'DOWNSTREAM PROJECT OF THE YEAR' AWARD



Duqm Refinery was conferred the coveted Downstream Project of the Year Award at this year's Middle East Energy Awards held in Dubai. The Middle East Energy Annual Awards since 2010 have been celebrating the best projects and initiatives across different categories within the Oil and Gas sector.

On behalf of Duqm Refinery, the award was received by Nasha Al Fallahi, GM Corporate Affairs. "We are happy to receive this prestigious award from an esteemed publication such as Refining & Petrochemicals Middle East. This accolade recognizes our efforts to build a world-class refinery based on international standards and will contribute to the social and economic growth of the country. The project is making good progress and we are proud to be regionally recognized through this award at this stage.

Also, Majid Al Bahri, General Manager for Strategic Financing, commented: "We are glad to be bestowed with this award which is a sign of continued confidence that the industry has in our project." [21 Sept 2019]

MAJIS SIGNS DEAL FOR SOLAR PV PLANT AT SOHAR PORT

Majis Industrial Services, Oman's leading water solutions provider, has signed an agreement with Unicorn International to supply and install a photovoltaic (PV) solar power plant for Majis' facilities at Sohar Port, with an investment of RO 500,000.

The signing ceremony was held at Majis' head office and was attended by Ahmed al Mazrouy, CEO of Majis Industrial Services, and Ali Abdullah Saif al Maskery, Managing Director of Unicorn International.

Unicorn will install a 1.30MWp PV plant, expected to be operational by the end of 2020, introducing best-in-class solar energy technology to Sohar Port. Unicorn will deploy 3,600 solar modules and 15 solar inverters to generate 2,350 million kwhr of energy per year. The project will save 681,000 cubic metres of gas per year and will result in a reduction of 1,462 tonnes of CO2 emissions annually. The savings will thereby materially reduce the energy consumption of Majis' operations. [17 Sept. 19]



Seminar explores methanol's potential as an energy source



Salalah Methanol Company (SMC), with the support of the Methanol Institute (MI), hosted delegates from Oman and the region for the "Methanol Applications for Sustainability" seminar.

The seminar explored how methanol can be applied as a solution to recycle waste into higher valued products or lower emissions when used as a source of energy, bolstering sustainability for businesses and the government of the Sultanate of Oman. Methanol's clean burning properties and ability to be produced renewably from renewable electricity and carbon capture, as well as different kinds of wastes, is increasingly touted as an attractive solution for lowering emissions and creating a circular economy.

The seminar drew in speakers from around the world to share their experience with methanol in a variety of applications such as fuel for road and marine transport, power generation, and fuel cell technologies.

Some of the seminar's distinguished speakers includes: Saleem Alavi, President, Sea Commerce Consultants; Amer al Hinai, Associate Professor and Director, Sultan Qaboos University; Dr Gaetano Iaquaniello, Vice President for Innovation Strategy, KT Kinetics Technology Spa; Chairman, Nextchem

Srl, Maire Tecnimont for Energy Transition; and Tim Chan, Manager Government Relations and Business Development, Methanol Institute. As the discourse surrounding sustainability and measures to mitigate climate change becomes more robust, governments and businesses around the world have taken a serious approach towards methanol as a strategy to achieve those goals. Oman has an abundance of conventional and renewable feedstocks that it can employ to expand the production of methanol, which will allow the Sultanate to bolster sustainability in its continued development.

Supporting the seminar is the Methanol Institute (MI) which, as the trade association for the global methanol industry, represents world's leading methanol producers, distributors and technology companies from its offices in Singapore, Washington, Brussels and Beijing.

[17 Sept 2019]

OMAN GAS TO EXPAND CAPACITY TO SUHAR, DUQM AND SALALAH

Oman Gas Company (OGC), a subsidiary of Oman Oil and Orpic Group, says it is adding new capacity to the nation's critical gas transportation infrastructure to support demand growth at industrial hubs in Suhar, Duqm and Salalah.

OGC, which is also the operator of the gas transportation network, said it is expanding the 932-kilometre gas pipeline system newly acquired from previous operator Petroleum Development Oman (PDO), to support demand in the Salalah. The wholly government-owned utility is "expanding the pipeline, which is connecting Nimr with Salalah and the central gas network from Saih Rawl to Sur to increase the transmission capacity from 64 million standard cubic metres of gas per day (MSCM) to 80 million standard cubic metres of gas per day," it said in a post on its LinkedIn site.

In the north, OGC said it is targeting completion, by the end of this year, of a 301 km pipeline from Fahud to Suhar, which is being constructed to cater to support

natural gas demand by new industrial and manufacturing investments in Sohar Port and Freezone, and Suhar Industrial City-Work is also ongoing on a 236 km gas pipeline that will serve as an energy lifeline to the Special Economic Zone (SEZ) in Duqm, it said.

Additionally, the process of transferring government-owned gas pipeline assets operated by BP Oman in central Oman "is in the final stage", said OGC. The developments stem from the landmark Restated Concession Agreement (RCA) signed by OGC with the Omani government earlier this year, granted the utility the concession to own and operate Oman's gas transmission system of pipelines, metering, compressor and gas supply stations under a new revenue framework for the next 50 years.

The new framework reshapes the gas transmission sector by implementing a cost-reflective tariff to transport gas across the system and new (market) processes that guide the interaction between OGC,



the Ministry of Oil & Gas (as the shipper), gas producers and final gas consumers.

The framework is based on a Regulatory Asset Base (RAB) method consistent with international best practices and will be regulated by the Authority for Electricity Regulation.

OGC is currently in the process of being transformed into Oman's sole, leading and independent gas transmission system owner and operator (commonly referred to as the "gas TSO"). [14 Sept 19]

OOMCO inks pact for bunker services at Mina Sultan Qaboos



Expanding its services across the Sultanate, **Oman Oil Marketing Company (OOMCO)** has signed a long-term agreement with Marafi, port management arm of ASYAD Group, to provide bunker fuel

services at the port berths and anchorage areas of Port Sultan Qaboos. Mainly serving navy vessels and cruise ships, the license is the first-of-its-kind to get awarded at the port. A key player in the Sultanate's fuel supply chain, OOMCO has been steadily growing its marine business (fuel and lubricants) and building its reputation for providing high-quality fuel services.

"The agreement will see us provide our fuel services at Port Sultan Qaboos, which is a critical milestone in our journey leading the energy and fuel industry in Oman. We're pleased to be working with Marafi and supporting them as they develop the port into an international hub," said David Kalife, Chief Executive Officer, Oman Oil Marketing Company. "With our efficient, secure and reliable services, we have a lot to offer all commercial customers and we look forward to continue developing our marine business."

"We aim to accomplish the government's vision to increase overall port performance and functionality in order to accommodate a more demanding maritime market," said Dr Ahmed al Abri, Marafi Chief Executive Officer. "Marafi plays an important role in expanding the logistics sector in a sustainable manner and carrying out plans to enhance the expansion of ports across the Sultanate, and this agreement is a step in the right direction to provide world-class services." [11 Sept 19]

PDO COMMITS FUNDING FOR FIVE SOCIAL INVESTMENT PROJECTS

Petroleum Development Oman (PDO) unveiled its commitment to support a raft of new community initiatives as part of its Social Investment programme. The latest five agreements include commitments in the key areas of health, agriculture and infrastructure. The Company is partially funding the construction of Al Wafa Rehabilitation Centre in Samail. The 822-square-metre facility, which is also being supported by a local donor, will provide a safe and modern environment for disabled children and reduce commuting exposure. On the health and safety front, the Company is increasing its support for the construction of Thumrait Hospital, which is the largest medical facility in the area. It will serve a large portion of the community and potentially PDO staff and contractors due to its proximity to Harweel. In addition, 10 electronic beds have been funded for the Renal Dialysis unit in Nizwa Hospital to enhance the quality of this crucial service and ease the suffering of patients.

PDO is also funding the repair and maintenance of the Falaj Al Asgharyn in Manah, which is watering more than 10,000 palm trees in the area, and installing shades for selling livestock and animal food in the Hamra Al Duru slaughterhouse, also funded by PDO. Both projects will enhance the value chain in the agriculture and farming industries.

The five funding agreements confirming these commitments were signed at an official ceremony held under the auspices of His Excel-

lency Dr Darwish bin Saif Al Maharbi, Undersecretary of the Ministry of Health for Administrative and Financial Affairs, at PDO's Knowledge World venue in Muscat. [11 Sept 2019]



Oman Oil and Orpic Group to explore underground oil storage options



Oman Oil and Orpic Group, the Sultanate's newly established integrated energy conglomerate, has signed an agreement with South Korean engineering contracting SK Engineering & Construction (SKEC) to support the development of oil storage and terminaling business opportunities at the Special Economic Zone (SEZ) in Duqm. A Memorandum of Understanding (MoU) to this effect was signed by Talal al Awfi, Chief Commercial Officer – Oman Oil and Orpic Group. "Both parties will work closely to establish an anchor customer base and explore interest from strategic partners for the project. This project will focus more specifically in utilising natural caverns as a means of storing oil, leveraging on Oman's geological formations and geographical location," said Oman Oil and Orpic Group in a tweet.

Oman Tank Terminal Company (OTTCO), a wholly owned subsidiary of the Omani energy powerhouse, is developing one of the world's largest crude oil storage parks at Ras Markaz,

about 80 km north of the Duqm SEZ. Though its location is not contiguous with the SEZ, the terminal is still a key component of the SEZ initiative – its development being overseen in close coordination with the SEZ Authority of Duqm (SEZAD).

Covering an area of 1,253ha, the Ras Markaz terminal will boast a total capacity of 200 million barrels of crude oil upon completion. Development is planned in a series of five phases, with total investment estimated at around \$5 billion.

“ THE MOU WITH SKEC WILL ALLOW FOR OMAN OIL AND ORPIC GROUP TO LOOK AT OPTIONS FOR UNDERGROUND CRUDE STORAGE THAT TAKES ADVANTAGE OF THE ROCKY LIMESTONE HEADLANDS CHARACTERISTIC OF THE SULTANATE'S COASTLINE ALONG DUQM

The MoU with SKEC will allow for Oman Oil and Orpic Group to look at options for underground crude storage that takes advantage of the rocky limestone headlands characteristic of the Sultanate's coastline along Duqm. Caverns occurring naturally in these parts can be economically transformed into storage sites for crude and other petroleum

products, market analysts point out. According to experts, underground crude storage is gaining popularity around the world, as countries see the strategic and economic benefits of converting existing salt caverns or constructing underground storage bunkers to develop emergency stockpiles. Underground storage of hydrocarbons is billed as not only more safe, secure and economical than above-ground storage infrastructure, but it also comes with a number of environmental and operational benefits.

Furthermore, naturally occurring caverns can be rapidly brought into operation than conventional tank-based storage superstructure, it is noted. In the Gulf region, the world's biggest underground crude storage facility is currently being built in the UAE emirate of Fujairah with an investment of around \$1.2 billion. Featuring three caverns, each offering a capacity of 14 million barrels, the project is slated for completion by 2022. Significantly, SK Engineering & Construction (SKEC) is the main contractor for this project.

[10 Sept 2019]

OMAN SHELL WELCOMES NEW COUNTRY CHAIRMAN



Shell Development Oman (SDO) has announced the appointment of Walid Hadi as the new Oman Shell Country Chairman.

“Building on the strong foundation of our leading joint ventures Petroleum Development Oman (PDO), Oman LNG, and Shell Oman Marketing Company; and our deep and strategic partnership with the Omani government, Hadi aspires to grow this partnership with exploration, integrated gas and renewables opportunities,” said Oman Shell in a statement.

On his appointment, Hadi expressed, “We hold deep respect and admiration for His Majesty and the Omani government’s achievements in developing this great nation and the clear vision for the country’s future. Having been in the Sultanate since the 1930s, Shell is honoured to continue to be a part of this journey.

“With the current energy outlook, we strive to become an integral leader in the country’s energy transition, to support the diversification of its energy portfolio and to maintain a strong contribution to In-Country Value with an emphasis on Omanisation. This ambition is the inspiration for changing our name to ‘Oman Shell’, which reflects how we always strived to put Oman first. That sentiment certainly rings true into the future.” He added, “As Oman Shell’s Country Chairman, I look forward to working with my team and all of our partners to bring about further benefits to the Sultanate through the energy sector.”

[10 September 2019]

PDO INKS WASTE MANAGEMENT PACT WITH BE’AH

Petroleum Development Oman (PDO) has signed a waste management contract with Oman Environmental Services Holding Company (be’ah) with a value of around RO 17 million and incorporating a number of green initiatives.

The seven-year contract will see be’ah managing non-hazardous waste and waste yards in PDO’s concession area. It will provide service containers with different capacities to separate organic, plastic, paper and other waste at source, in addition to providing regular maintenance and cleaning of the containers. The agreement will also reduce the amount of waste transferred to the engineered landfill sites for final disposal.

Quantities of organic waste will be converted into fertiliser while other types, such as construction waste, will be used to clean up and close landfill sites in the concession area. be’ah will also operate and maintain waste collection sites in designated areas, and clean them of all types of accumulated waste.

The contract was signed by PDO Managing Director Raoul Restucci and be’ah Chief Executive Officer, Engineer Tariq bin Ali Al



Amri at a special ceremony held in PDO’s Knowledge World venue in Muscat. Mr. Restucci said: “We have made a determined effort to reduce our environmental footprint while boosting In-Country Value and this contract is another step in the

right direction. Last year, we recycled more than 1,600 tonnes of non-hazardous waste including wood, plastic, metal and cartons and we look forward to further expanding this programme as indeed our partnership with Be’ah.” [5 Sept 2019]

Shale Oil

vs

Heavy Oil



Surging shale oil production in the United States is unlikely to derail investment in heavy oil development around the world, including Oman where 15 - 30 per cent of the country's total crude output comes from heavy oilfields

For the second successive year, Oman played host to the World Heavy Oil Congress & Exhibition (WHOC) – an annual forum that attracted around 500 industry professionals for three days of deliberations on the importance of sustaining a more resilient global heavy oil industry. The event, held at the Oman Convention & Exhibition Centre in Muscat, also underscored the Sultanate’s role as a regional trailblazer in tertiary recovery methods as part of an escalating quest to unlock its heavy oil resources.

According to HE Salim bin Nasser Al Aufi, Under-Secretary of the Ministry of Oil & Gas, Enhanced Oil Recovery (EOR) methods targeting heavy oil resources account for between 15 – 30 per cent of Oman’s crude production. In all, Oman’s upstream sector is home to presently five EOR-driven heavy oil developments. They include Occidental’s Mukhaizna project in Block 53, while the remaining four are part of Petroleum Development Oman’s (PDO) portfolio, comprising the Amal Steam, Marmul Polymer, Harweel 2AB miscible gas injection, and Qarn Alam thermal gas-oil-gravity-drainage (T-GOGD) projects.

However, a sixth heavy oil formation could potentially be added to this list, according to HE Al Aufi. In a ‘fireside chat’ with Dan Murthy, Correspondent – CNBC International, at the opening session, the Under-Secretary said the six new hydrocarbons blocks offered for investment as part of the 2019 Oman Licensing Round earlier this year potentially includes a promising heavy oil accumulation in one of the blocks.

“The last bid round launched by the Ministry has at least one block that is heavy oil based, and we are quite surprised to see that interest is very healthy,” HE Al Aufi said, adding, “We are currently discussing with what we think is a potentially attractive development plan.”

The acreage in question is Block 70, a relatively small concession covering a 639 sq km area in central Oman. According to details published by the Ministry as part of the 2019 Bid Round documentation, the Block contains the Mafrag field, a Shuaiba formation heavy oil accumulation.

Significantly, headway is also being made in grappling with one of Oman’s most daunting upstream challenges – the development of the Habhab ultra heavy oil field in the south. Originally discovered in 1984, the field has long defied multiple attempts by Petroleum Development Oman (PDO), among other contenders, to unlock its promising hydrocarbon potential, estimated in the order of one billion barrels of oil in place.

In remarks to journalists on the sidelines of the forum, the Under-Secretary said a mix of international and local players were expected to submit proposals for the development of Habhab. With its hydrocarbon content officially classified as bitumen, Habhab’s development has posed formidable technical challenges that have tested the boundaries of Enhanced Oil Recovery (EOR) technologies currently deployed in the Sultanate.

In his ‘fireside chat’ with CNBC Correspondent Dan Murphy, HE Salim shared his perspectives on a range of issues and developments of topical interest. Here are the highlights of his Q&A session:

CNBC: (Given the steep rise in shale oil production in the US, do you think the heavy oil industry should fear this?)

HE: There will be a lot of demand for oil. Shale will, of course, contribute. But the fact is that heavy oil in terms of volume, and recovery percentages, is still dominating. I think heavy oil will continue to exist and production from heavy oil will continue to rise.

However, pricing is a different story altogether. The continuous reduction in shale oil production prices and operating costs will definitely cast



HE Salim bin Nasser Al Aufi, Under-Secretary of the Ministry of Oil & Gas with CNBC Correspondent Mr. Dan Murphy during Q&A session.

a shadow on the continuous development of heavy oil. The trick is to really understand the journey that shale oil has taken to bring the prices down, and apply much of that learning as possible to heavy oil development. There are few tricks that can be applied to heavy oil. We cannot take conventional development and apply it to heavy oil development, because it just won't work. But I think heavy oil will continue to play a role whether locally in the Sultanate or internationally.

CNBC: With the possibility of a global economic recession globally on the horizon, where will demand for crude in general come from, and should we be concerned about slowing demand?

“ THE CONTINUOUS REDUCTION IN SHALE OIL PRODUCTION PRICES AND OPERATING COSTS WILL DEFINITELY CAST A SHADOW ON THE CONTINUOUS DEVELOPMENT OF HEAVY OIL

HE: There will probably be a period of slowing demand. It is happening as we speak! But it is driven by political situations that we all understand. I think the trick, when you look at Oil & Gas developments – particularly heavy oil and also shale -- you do not take the very short term view into consideration; you may look at them – but your plans are very long term – spanning 10, 15 or 20 years -- and in the case of

heavy oil -- probably even longer. Therefore, allowing a short term view to influence the decision-making is very risky. We have seen it two years back when the demand was also going down, and there was a lot of slackness in investment. The fear was that we would come to a point where the demand will start to pick up, but the investment would not catch up.

I think the market was smart enough to continue investing. In Oman, in particular, we insisted that our development programme should not be affected at all by what is happening around us, and that we should always be ready to demonstrate that we can pick up production when the market recovers. That strategy has not changed, and I think globally it's following pretty much the same level of thinking.

For heavy oil particularly, the view is very long term in Oman. Despite the growth in gas and renewables, oil will continue to have a place. I've not seen a single forecast that shows oil really getting out of the equation. There are some forecasts that in 10 years' time, demand may start to slow down, but these are very long-term forecasts.

CNBC: (Do you see oil prices slumping to \$40 per barrel?)

HE: We don't get into the oil pricing discussion. Period! Our strategy has always been – and we've communicated this many times before – that we always need to be

ready for whatever the oil price is: whether \$40, \$30, \$60 or \$80 per barrel. Our development projects need to withstand whatever oil price the market throws at us. At this stage, we are in a strong position to manage even if it comes to the \$40 per barrel scenario.

Nationally of course, we need a much higher oil price (balance the budget). But if you talk to the operators in the oil industry in isolation – we have no problem with this price level. I hope we don't we go down to \$40, but if we do, we will continue to operate.

CNBC: (How do you compete with shale oil at low oil prices?)

HE: Whether it is heavy oil, shale oil or low oil prices, the trick lies in localising the industry. We have seen this happening in the US. The industry's ability to respond to (contingencies) – whether it's the local supplier, contractor, or local expertise, and get a solution ready to be deployed very quickly – is the differentiator. It's your ability to take equipment out of service, service it and put it back again very quickly.

That's why we are driving the ICV programme with the support of all the operators. Let's localise the industry as much as possible, to make response times much faster, and thus ultimately lowering the costs while speeding up operations.

Localisation is also one the tricks behind shale oil's success – the development of fracking techniques, the ability to respond speedily, and so on. I understand there are around 6,000 operators in the US shale oil business, supported by an equal number of service providers. We are nowhere near that figure, but we need numbers here as well.

CNBC: (How do you make sure the sector remains competitive for investors and stakeholders when you drive ICV?)

HE: ICV is designed to be fair for everybody. We are not doing ICV for the sake of it. We have a number of elements designed by the industry to measure the ICV components and we are extremely flexible where ICV doesn't make sense. We don't unnecessarily push for it, but we sincerely believe ICV is the way to go.

Currently, our ICV stands at 35 – 40 per cent, meaning this volume of contract costs are kept in the country. We think

it's a healthy position to be in, although we need to be a little more focused on the types of services and equipment that need to be brought into the country. But ICV is not a showstopper for any of the operators. I don't think anyone has come forward and said they are unable to operate in Oman and provide services because of the ICV programme. On the contrary, everyone embraces ICV and understand it's fair and can contribute fairly with ICV. It gives them a level playing ground with local operators.

ICV is also developing the economy and transforming the business. We are localising a lot of the materials, equipment and services we need for our business. We started with a low number of around 15 – 20 per cent a few years in terms of the



total spend retained in the country. Today, our monitoring programme indicates that it has climbed to around 40 per cent.

If we look at the industry, we see growth in terms of the equipment produced locally, the quality of the machinery available locally, the services offered by local companies – not necessarily Omani companies also but also international companies localising their services, and so on. That's the spirit with which we would like to work with international companies in terms of transferring technology, sharing it with us, and so on. I think it's been going quite well so far.

By Conrad Prabhu

WHOC 2019: Maximizing value from heavy oil



The World Heavy Oil Congress & Exhibition (WHOC), a global platform for the entire heavy oil value chain, featured leading lights from a number of countries at the heart of a worldwide effort to maximize value from heavy oil resources.

The 3-day forum, held under the auspices of the Ministry of Oil and Gas, was organized with the support of dmG events, headquartered in the UK. The event was co-hosted by Petroleum Development Oman (PDO), with JP Global Digital and Occidental Oman as Gold Sponsors, and Maha Energy as the Silver Sponsor. A number of regional and international NOCs, IOCs, service and technology providers also showcased the latest best technologies, products and services for the heavy oil sector.

Welcoming delegates, Jean-Philippe Cossé, Senior Vice President - Energy, Middle East of dmG

events, said, “Over the next three days, with the tireless support over the last 12 months of our Strategic and Technical Committee’s, we have put together new content from across the globe covering all areas of heavy oil production and upgrading, from technical case studies to forward thinking panel discussions.”

Running in parallel with the Strategic Conference was the Technical Conference featuring 18 stimulating sessions on topics including Advances in Chemical Flooding, Well Completion, Heavy Oil Field Development, Technology Advancement in Heavy Oil Processing, and Operational Excellence in Heavy Oil.

Day 2 of the forum featured a pair of lively roundtable discussions focusing on the following themes: (1) ‘In-Country Value Programme: Harnessing Omani Potential in the Oil & Gas Industry’ by Aqla Al

Maskri, Director of Local Resources Development, ICV Project Management Office, PMO Manager at the Ministry of Oil and Gas; (2) ‘Embracing Digitalisation Through Incremental Innovation & Top-down Approach’, moderated by Boun Sananikone, Global Sales Director of JP Global Digital; (3) ‘Upstream Heavy Oil’ moderated by Dr Rifaat Al Mjeni, EOR Portfolio Leader at Petroleum Development Oman; and (4) ‘Downstream Heavy Oil’ moderated by Dr. Abdulazim Marafie, Senior Research Scientist at Kuwait Institute of Scientific Research.

The Technical Conference addressed a number of engaging topics including Heavy Oil Production Case Studies, Health & Safety in Oilfield Operations, Enhanced Steam Flooding, and Counter Measure Challenges in Heavy Oil Refineries.

Unlocking heavy oil resources will require investment

Heavy oil and enhanced oil recovery form an important part of Oman's oil mix

The world is awash with heavy and extra heavy oil deposits, in excess of 1 trillion barrels. It currently accounts for 12-15% of total global production. There is significant recoverable potential to be unlocked. Technology and collaboration will be the key.

According to the US Energy Information Administration (EIA), global energy demand is projected to reach 736 quadrillion Btu by 2040 (a 28% increase from 2015 levels). This is mostly driven by Non-OECD Asia which includes China and India. Within the same period, while renewables is the fastest growing energy source (70% total increase), oil still dominates with a 20% increase coming mainly from the Middle East.

Needless to say, materializing this increase will take significant investments and effort. Declining old and mature light / oil fields could be offset by untapped medium heavy and extra heavy deposits with ONE PROVISO – energy and cost efficient EOR technologies and techniques.

Closer home, diverse geology, innovative strategies and novel technologies define Oman's oil and gas industry. With over five heavy oil operating fields – 4 operated by PDO and one by Occidental of Oman – heavy oil contributes about 15% of Oman's oil output.

Heavy oil and enhanced oil recovery form an important part of Oman's oil mix. It is anticipated that in the coming decade about 25% of PDO's production will come from EOR projects. We've partnered with Omani universities and academic institutions to develop and further advance our research and development pro-



Junaid Ghulam, Petroleum Engineering Manager – Oil South, PDO and WHOC Chairman, speaking at the opening of 10th World Heavy Oil Congress & Exhibition.

grammes to not just keep up with the technological innovations but also to pioneer and lead this disruption.

It is with this idea of being change-makers and creators – for the second year running, we host the 10th World Heavy Oil Congress & Exhibition here in the Sultanate of Oman under the theme: Transforming the heavy oil value chain. The 3-day Congress showcases the best of technical presentations, strategic panel discussions and networking sessions.

PDO continues to exploit all its hydrocarbon resources in its portfolio from the light to the heavy end of the spectrum. As you will hear in this congress, the three pillars that underpin the development are: maximizing recovery, cost efficiency and speed, and energy efficiency. This is enabled by people and technology. The need to continuously innovate across the entire value stream will be discussed and presented in the

various sessions. At PDO we are quick to adopt technologies/techniques/strategies and share our learnings and experiences.

Event highlights:

- **Technical Conference:** We received 250 papers from 31 countries of which we put together 18 technical sessions with over 67 presentations and 19 E-poster presentations
- **Strategic Conference:** 6 panel discussions and 4 round table discussions over two days
- **International Exhibition:** Over 18 regional and international NOCs, IOCs, service and technology providers show casing the best of technologies, products and services for the heavy oil sector.

We have aimed to create a platform where the heavy industry can come back every year to collaborate and advance the industry together.

Bright future for heavy oil

Shale oil technology is extremely complex and expensive, but the US has mastered this technology while other countries are now trying to build that capability



Dr. SM Farouq Ali
Professor of Petroleum
Engineering –
University of Houston

Hheavy oil is a subject of great interest – and great concern at the same time – for professionals like me who are in this business. I've been in heavy oil recovery for more than 60 years now, starting in 1958, and over the years, I've seen many changes. Indeed, we are now going through a very – I would say – tumultuous time!

So what is the effect of shale oil development in the US, and to some extent in Canada, among other countries, on the development of heavy oil in the years to come?

Firstly, if you consider the entire resources of heavy oil and tar sands, it's about 5 - 8 trillion barrels. In the US alone, shale oil is 500 billion barrels, perhaps much more. Just one reservoir – the Eagle Ford Shale Play – is hundreds of miles long and 400-

and expensive, but the US has mastered this technology while other countries are now trying to build that capability. In one well alone, we inject several million barrels of water, blended with some chemicals, as well as 5 - 6 million pounds of frac sand. A typical wells may cost anywhere between 2 - 5 million dollars, and despite this cost, half of the wells are highly profitable.

So what do we know about shale? We have known about shale oil for about 100 years. Shale is the source rock where oil is formed. This oil then then migrates to some reservoir rocks like sandstone. We know that the shale pore space is about one hundredth the widths of a human hair, and thus extremely fine pores. The technique for recovering shale oil was discovered in Eagle Ford in 1951, but actual development began only in 2006 - 7, when we came up with a really clever way of fracturing the rock.

Ubiquitous presence

Aside from the US, there are huge heavy oil deposits in Venezuela, Canada, and in other countries as well. Shale oil is also found in abundance everywhere. One of the biggest deposits of shale oil is in Australia, but none of these are well developed. China, for example, is trying very hard to develop its shale oil resources because it imports huge amounts of oil at the moment. Given this situation, shale oil development will drive great changes over the next 10 years.

The US experience in shale oil development is astounding. We have developed around 6 million barrels a day of additional oil in only eight years – which is incredible. The primarily reason for this growth is the fiscal system of ownership of resources in the United States. It's only in that US that you can own the oil that you discover! At the moment, we have around 6,000 small producers in the shale oil business, with a further 6,000 companies providing support services. That is very

“ SO WHAT'S THE DIFFERENCE BETWEEN HEAVY OIL AND SHALE OIL? THE PRODUCT OF HEAVY OIL IS LOW QUALITY BITUMEN OR VISCOUS OIL; THE PRODUCT OF SHALE OIL IS A HIGH QUALITY LIGHT OIL

foot thick, and runs across Texas. In fact, we don't even know how much oil we have there.

So what's the difference between heavy oil and shale oil? The product of heavy oil is low quality bitumen or viscous oil; the product of shale oil is a high quality light oil.

The big difference is in the recovery factor: In the case of heavy oil, recovery is between 30 - 60%, but in the case of shale oil, it's only 5% - 8%. Besides, shale oil is still under development, but heavy oil on the other hand, is a well-developed industry. So shale oil development has still a long way to go because the low recovery factor. Even with this recovery rate, shale oil reserves in the US are estimated at close to 50 billion barrels, up from only 19 billion barrels a decade ago – so the change is incredible!

Shale oil technology is extremely complex

In Numbers

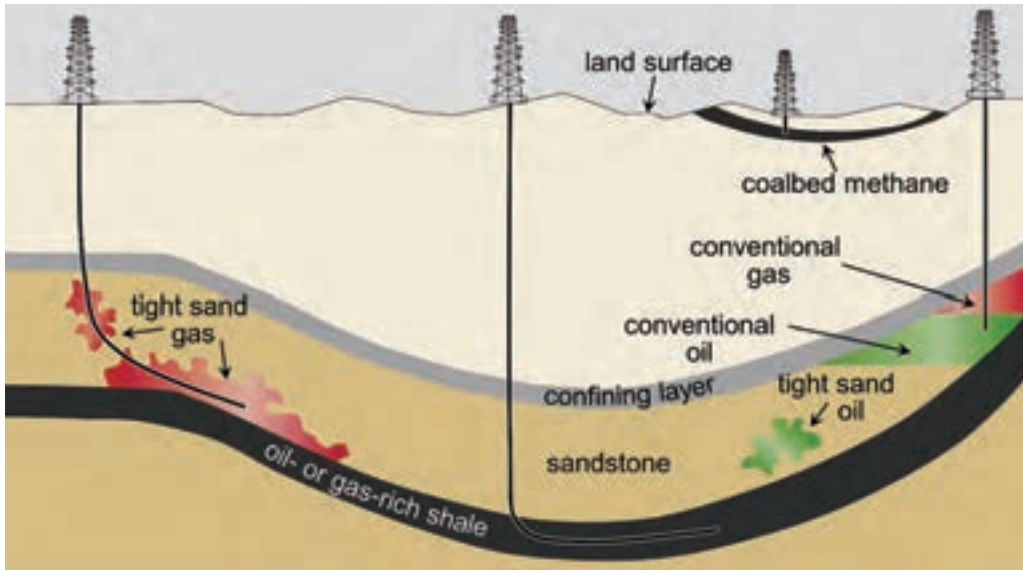
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Schematic cross-section of general types of oil and gas resources and the orientations of production wells used in hydraulic fracturing.

hard to replicate in any other country. US production is currently about 14 million barrels a day, up from 4.5 million barrels a couple of years earlier. Of this volume, 7 million barrels comes from different shale oil reservoirs.

But can the growth in shale oil be sustained for the next 10 years? Are there enough reservoirs to sustain production growth and maintain current production? The answer is 'YES'!

Firstly, we are producing very large amounts of gas and light oil from shale oil in the US, and partly in Canada as well. We are doing massive hydraulic fracturing and refracturing. Secondly, the gas price in the US is \$3 per 1,000 m³ of gas. Not long ago, it was \$8 – 11.

Furthermore, the current cost of producing shale oil has gone down to less than \$40 dollar per barrel, down from \$70 eight years ago. So the changes are astounding. So what's the impact on heavy oil? Firstly, shale oil production costs are low enough to match heavy oil production costs. Shale oil is also partly displacing upgraded heavy oil. Moreover, we have problems with environmental regulations, especially in Canada, which has a limit on heavy oil production.

Colossal deposits

In Venezuela, because of political developments there, heavy oil production has almost ground to a halt. The Orinoco oil belt has colossal deposits but is sitting idle. Secondly, many of the prolific heavy oil reservoirs in California and Indonesia are now mature, and production is going down.

“ SHALE OIL TECHNOLOGY IS EXTREMELY COMPLEX AND EXPENSIVE, BUT THE US HAS MASTERED THIS TECHNOLOGY WHILE OTHER COUNTRIES ARE NOW TRYING TO BUILD THAT CAPABILITY

Finally, current support for heavy oil is very low (in the US). Compare this with President Jimmy Carter's government who allocated \$19 billion for research in Enhanced Oil Recovery (OR) and heavy oil.

If you look at the total production cost, the California heavy oil is about \$20 per barrel all told. In Alberta (Canada), it's about \$35. In contrast, shale oil production costs averaged \$70 per barrel about 10 years ago. Today, it's below \$40! This reflects the power of private ownership, entrepreneurship and also the great incentives we have right now.

Going forward, heavy oil and tar sands will continue to be developed at an increasing pace. We have been working on heavy oil for around 100 years in Canada, California and other countries as well.

Also, the technologies for producing heavy oil or tar sands, using steam injection, have been fantastically successfully. We can achieve recovery factors of 60 per cent or higher. Steam can be adapted to any conditions. No matter what kind of reservoir you have, even light oil reservoir, you can adapt steam injection and make a profit on it.

Huge reservoirs remain to be exploited in many countries – notably China and Russia. Oil producing countries in the Arabian region also have large volumes of heavy oil. ●

Green Hydrogen:

A game-changer for Oman

Oman is witnessing the genesis of an ambitious bid to kindle the growth of a Green Hydrogen based economy in the Sultanate - an immensely promising initiative with transformational implications for the country's energy landscape



The initial stirrings of what is potentially a game-changer for Oman's future energy industry were in evidence at the Hal-ban campus of the German University of Technology in Oman (GUtech) when it hosted the 1st Oman Hydrogen Symposium on 9th October. What began as a scholarly showcase of the potential for a multi-billion-dollar Green Hydrogen Economy in Oman culminated in concrete steps being initiated to pave the way for the realisation of this future vision for the Sultanate.

The 1st Oman Hydrogen Symposium was history in the making! The half-day forum, featuring a series of presentations by local and international experts, as well as a tantalising overview of the potential for a hydrogen-based industry in Oman, had a galvanizing effect on the audience. The presentations looked at the prospects for green hydrogen (production of hydrogen based on the use of renewable energy) as a new energy carrier for Oman, as well as for export once global demand for the fuel grows exponentially.

HE Dr. Ahmed bin Mohammed Al Futaisi, Minister of Transport and Communications, was the Guest of Honour at the event. Also in attendance were a distinguished line-up of government officials, and top executives of energy utilities, Oil & Gas operators, higher learning institutions, research organisations, and various public sector enterprises.

The symposium was organised as part of the Oman Hydrogen Initiative – a joint project of GUtech and Hydrogen Rise AG, a German company specializing in integrated solutions for the hydrogen economy. The Initiative, first unveiled last year, seeks to serve as a platform for engagement between government and other stakeholders on the potential for igniting the growth of a future economy based on the production, storage, distribution and usage of green hydrogen in the Sultanate. Transformative industry

Adding prestige to the forum was the presence of HE Salim bin Nasser Al Aufi, Under-Secretary of the Ministry of Oil and Gas. In concluding remarks, HE Al Aufi exhorted the distinguished gathering, representing prospective stakeholders in the success of a future Green Hydrogen Economy, to join hands in kick-starting the development of a transformative energy industry for Oman.

The Ministry of Oil and Gas, he said, would take the lead in assembling a working group with representatives from all of the stakeholders – government, academic institutions, R&D organisations, Oil & Gas operators, industries and petrochemical companies – to help undertake the initial groundwork on this landmark initiative. The working group would pave the way for the creation of a Hydrogen Centre or hub to spearhead the development of a hydrogen economy for the Sultanate, he noted.

Green hydrogen, the Under-Secretary said, has the potential to be a game-chang-



er for the Sultanate with beneficial ramifications similar to hydrocarbons, albeit without the attendant environmental impacts.

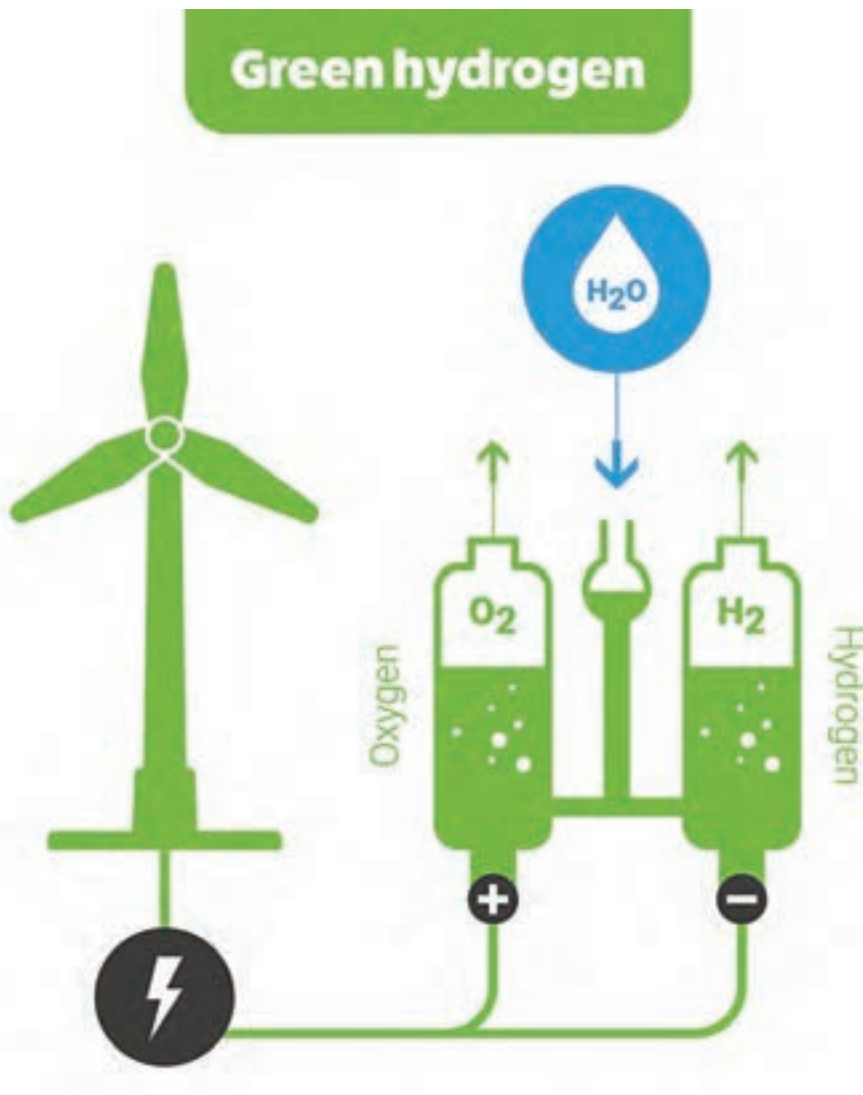
“If we go by how solar and wind energy have progressed over the last few years, I think (the adoption of hydrogen) will be much faster. There is huge demand, based on the realization globally that the only way we can meet the Paris Agreement on climate change is that we must decarbonize on an industrial scale. And to do that, hydrogen is probably at the centre of these efforts,” HE Al Aufi stated.

The opportunity to create a new ecosystem in Oman around hydrogen was very exciting, the official noted. He challenged the key players, including R&D institutions, Oil & Gas operators and industries to study the feasibility of using hydrogen as an alternative to natural gas as energy and feedstock.

Environmentally friendly hydrogen is billed as the ideal alternative to fossil fuels currently singled out at the principal contributor to greenhouse gas emissions driving global warming and climate change. By harnessing renewable energy resources, chiefly solar and wind, on a large scale, hydrogen can be produced for local supply, use, storage, distribution or export, the gas serve as an energy carrier in its own right in transportation and e-mobility applications, or used as feedstock in Oil & Gas, industrial and chemical processes.

Earlier, Hydrogen Rise CEO Dr Bernd

HE Salim bin Nasser Al Aufi, Under-Secretary of the Ministry of Oil & Gas at the Halban campus of the German University of Technology in Oman (GUtech) during the 1st Oman Hydrogen Symposium held on 9th October.



“ A FUTURE HYDROGEN ECONOMY IN OMAN HAS THE POTENTIAL TO ATTRACT ENERGY INTENSIVE INVESTMENTS IN DECARBONISED INDUSTRIES, WHICH WOULD HELP BUILD THE COUNTRY’S CARBON-FREE CREDENTIALS. EXAMPLES OF SUCH INDUSTRIES INCLUDE GREEN HYDROGEN PRODUCTION AS A FUEL, HYDROGEN BASED AMMONIA AND METHANOL, AND CARBON-FREE SYNTHETIC FUEL

Wiemann underscored the potential for a new economic sector based on ‘green hydrogen’ in the Sultanate. Factors boding well for Oman in this regard are as follows: Very competitive renewable energy costs, Energy Competence, Geographic Location, Land availability, and International Reputation.

Decarbonisation goals

Dr. Wiemann said a future hydrogen economy in Oman has the potential to attract energy intensive investments in decarbonised industries, which would help build the country’s carbon-free credentials. Examples of such industries include green hydrogen production as a fuel, hydrogen based ammonia and methanol, and carbon-free synthetic fuel.

In addition, the hydrogen economy will support the growth of ecosystem encompassing, among other opportunities, storage of hydrogen in deep caverns, pipeline systems, grid injection, and water management. Exports of hydrogen are estimated at \$20 billion annually, he added.

There were also presentations by Ms. Clara Orthofer from the Technical University Munich (TUM) in Germany spoke about the prospects of hydrogen for the local economy; Dr. Abdullah Al Abri, Executive Director of EJAAD in Oman; Mr. Emanuele Taibi, Analyst for Power Sector Transformation Strategies at the International Renewable Energy Agency (IRENA); Dr. Uwe Albrecht, Chief Executive Officer, Ludwig Bölkow Systemtechnik – LBST; Mr. Toshiyuki Shirai, Director of Advanced Energy Systems and Structure Division – Agency for National Resources and Energy, Ministry of Economy, Trade and Industry in Japan; Mr. Holger Lösch, Deputy Director General of the Federation of German Industries (BDI), Germany; and Dr. Karoline Steinbacher, Managing Consultant, Navigant, Federal Ministry of Economic Affairs and Energy, Germany.

Outlining next steps in the Oman Hydrogen Initiative, Prof. Dr. Michael Modigell, Rector of GUTech and Dr. Bernd Wiemann, CEO of Hydrogen Rise AG, shared plans for collaboration between GUTech and various other stakeholders in the establishment of a Hydrogen Competence Center. The R&D facility will support the development of a first-ever green hydrogen pilot plant at the Halban campus.

Also in attendance at the symposium were high-level officials representing Oman Oil and Orpic Group (the Sultanate’s integrated energy flagship), leading Oil & Gas operators, the Authority for Electricity Regulation Oman, Oman Power and Water Procurement Company (OPWP), Sultan Qaboos University (SQU), The Research Council, EJAAD, and a host of organisations from the academic, industrial and energy domains.

The goal of the Oman Hydrogen Initiative is to support the creation of the Sultanate's hydrogen future

Oman is excellently positioned to produce the required renewable solar- and wind-power at the lowest possible cost and in large quantities, according to Prof. Dr. Ing. Michael Modigell, Rector of GUTech; Dr. Bernd Wiemann, CEO of Hydrogen Rise; and Olav Carlsen / Hydrogen Rise, in this joint Q&A:

1. What is the potential use of hydrogen as a fuel resource in Oman?

Prof. Dr. Ing. Michael Modigell / GUTech: Hydrogen as such is not new for Oman: For a long time, hydrogen generated from Natural Gas is used for refining crude oil or for producing ammonia. However, the production of hydrogen from natural gas generates large amounts of CO₂ – besides using up the natural gas resources.

The global interest is however in "Green" Hydrogen. This is hydrogen generated from renewable power (solar, wind) and water. Being produced CO₂ emission free, this green hydrogen can be used as an energy carrier or fuel as well as a chemical feedstock without any climate CO₂ impact.

As a fuel, Green Hydrogen is as versatile as natural gas and can be used for powering almost anything from mobility (cars, trucks, buses, trains), various machinery up to stationary power generation for grid supply and stabilization. And the by-product is only pure water.

As chemical feedstock, Green Hydrogen can be used in many ways:

- As a substitute for natural gas generated hydrogen in refineries or in the ammonia production (decarbonisation)
- For the production of synfuel or other hydrocarbon chemicals.
- For innovative applications such as

1st OMAN Hydrogen Symposium

"THE DIVERSIFICATION OF ENERGY AND INDUSTRY BY INTRODUCING THE HYDROGEN ECONOMY"



OMAN Hydrogen Symposium - Prof. Modigell and Dr Bernd Wiemann

the direct reduction of iron ore for CO₂ free steel production.

This gives just a short impression of the potential use of Hydrogen in Oman.

2. How safe and stable is hydrogen as a fuel resource?

Dr. Bernd Wiemann / Hydrogen Rise: Hydrogen has similar safety requirements as other flammable fuels, including gasoline and natural gas. In fact, some of hydrogen's differences actually provide safety benefits compared to gasoline or other fuels. However, all flammable fuels must be handled responsibly. Like gasoline and natural gas, hydrogen is flammable and has similar risks under specific conditions. It is important to note that hydrogen as gas has been used safely across many industries since decades. The industry and regulators around the world have developed standards and infrastructure to produce, store, transport and utilize hydrogen safely. There has already been established an International Association for Hydrogen Safety.

3. What is known about the use of hydrogen (a) around the world (b) in the Gulf and Middle East region?

Olav Carlsen / Hydrogen Rise: All around the world, countries and industries are exploring the potential of Green Hydrogen as a game changer for a new CO₂-emission-free-world. There is already a long list of Green Hydrogen applications.

A few examples, all of these being operational already:

- **Transport:** Hydrogen powered cars, buses and heavy trucks, specifically in Asia (Japan, Korea, China) and US and Chile; Hydrogen powered regional train in Germany where electrification is cost intensive.

- **Power grid:** Excess wind power converted to hydrogen to be fed into the gas network in Germany

- **Hydrogen as Feedstock:** Green Ammonia: Ammonia production on the base of green, CO₂ free hydrogen in UK, Japan, and Australia; Iron-reduction-plant in Austria

Prof. Dr. Ing. Michael Modigell / GUTech: Earlier this year, construction for MENA's first solar-powered Green Hydrogen project started in

Dubai. The facility will be showcased at EXPO 2020 in Dubai and will pave the way for larger green hydrogen projects in Dubai.

Saudi Arabia as well as other UAE countries are also starting first activities with green hydrogen.

Besides that, many countries are working on an infrastructure for large scale transport of hydrogen and storage in caverns, notably Japan and Germany. These experiences are very useful for implementations in Oman.

4. What feedstock is typically used in the production of hydrogen?

Dr. Bernd Wiemann: The feedstock for Green Hydrogen is only purified water and electric power from renewable sources.

The generation of Green Hydrogen is done in a process called 'electrolysis'. Electrolysis uses electricity to break water into hydrogen and oxygen. It is an electrochemical reaction that does not require external components or moving parts. It is very reliable and can produce ultra-pure hydrogen (> 99.999%). Actually, the water will be desalinated sea water.

5. What are the costs involved in hydrogen production?

Olav Carlsen / Hydrogen Rise: The large-scale cost of a Green Hydrogen production is currently focus of many projects and initiatives, funded by industry, governments and supranational organizations around the globe. As these projects mature, cost projections will be more precise. The most important drivers in the future cost degression are (a) the cost of the generation of renewable power and (b) the hydrogen production costs itself and (c) similar to the development in the solar and wind technology the future significant cost advantages from global mass applications of hydrogen.

Some of the ambitious solar projects in the Gulf region aim at providing solar electricity at 3 \$ct/kWh, with even lower targets in the fu-

ture. With that, the overall midterm production cost of green hydrogen could be below 2\$/kg (Cars needed today about 0.8 Kg/100Km). The long-term target will be even lower than that.

6. What are the prospects for developing a hydrogen-based export industry in Oman?

Dr. Bernd Wiemann: Oman is excellently positioned to produce the required renewable solar- and wind-power at the lowest possible cost and in large quantities. Furthermore, there are good possibilities for large scale storage of hydrogen, e.g. in caverns, which is necessary if the hydrogen production predominantly also targets volume export.

The development of a hydrogen export industry has many opportunities:

- Production and export of green hydrogen as a fuel
- Production and export of alternative fuels, e.g. synfuel
- Production and export of decarbonized (green) ammonia, methanol and related products
- Direct reduction of iron ore and export of direct reduced iron is thinkable. Hydrogen as an energy carrier is very important when attracting high energy intensive export oriented industries to Oman that in the future will need to increasingly rely on CO2 emission free production processes.

Prof. Michael Modigell / GUTech: For all these products, there are developing export markets: Japan has already established a national hydrogen strategy that also includes the import and related infrastructure investments for hydrogen based fuels. Studies of European governments, the European Commission and supranational energy agencies also show very clearly, that the successful realization of the global energy transitions towards renewable energies must consider the international trade of hydrogen to cover significant portions of the future renewable energy demand by highly industrialized markets.

All in all, there will be many opportunities in growing new markets for Oman.

7. PDO, Oxy etc. are looking at hydrogen as an alternative fuel source in a major way? Is the GUTech – Hydrogen Rise partnership looking at roping in such players in the initiative?

Prof. Dr. Michael Modigell / GUTech: There are already close contacts between these players, and we target a very close cooperation with industry and research.

8. Is the Oman Hydrogen Initiative primarily educational / academic at this stage? Are practical applications being explored as well?

Prof. Dr. Michael Modigell / GUTech: The goal of the Oman Hydrogen Initiative is to support the creation of Oman's Hydrogen Future. Educational and academic work is an important prerequisite to enable this for the future. As part of the Hydrogen Initiative actions, GUTech is planning to establish a Hydrogen 'Economic Competence Centre' that enables and supports activities for an Oman wide 'Hydrogen Economic Competence Cluster'.

Equally important are practical implementations of the envisioned applications. In fact, the plans for setting up and operate a green hydrogen demonstration pilot plant on campus while at the same time raising public awareness of the potential of hydrogen as a green energy carrier and industrial feedstock for many new industrial business opportunities in Oman.

9. What will be the role of Hydrogen Rise in this initiative?

Dr. Bernd Wiemann / Hydrogen Rise: To develop a new energy and economic development of this scale, expertise and engagement from all possible stakeholders are needed. Hydrogen Rise will contribute the Oman specific commercial and industrial feasibility view as well as its international research and development partnerships to the initiative.

Oman and Germany share a common interest in a sustainable energy future



HE Thomas Friedrich Schneider,
Ambassador of the Federal Republic of Germany to the Sultanate of Oman

Germany is undergoing a complete restructuring of its energy sector, having decided to abandon nuclear energy and reduce its dependency on fossil-based energies to a minimum. But the transition to renewable resources poses huge challenges – not only for Germany, but for any country, for that matter!

Currently around 44% of Germany's energy production is generated from renewable energy resources. Germany also aims to reduce greenhouse gas emissions by 2050 by a rate of 80 – 95%. The factors driving this process are, of course, the protection of the environment, protection of the global climate, and the creation of new business opportunities. In order to achieve our energy and climate policy targets, we need to make progress in the buildings, transport and industry sectors. And only hydrogen can play an important role in all these sectors.

The Germany Federal Ministry of Economic Affairs and Energy is currently preparing a national strategy for hydrogen, which will be published before the end of this year. Germany is also proposing the creation of a global market for hydrogen, and more precisely, for green hydrogen based on renewable energy. Accordingly, a regulatory framework based on standards and sus-

tainability criteria is necessary to achieve this goal.

Germany may also need green hydrogen imports to reach the targets set by the Paris Agreement. At the same time, Germany is also a frontrunner in hydrogen technologies. German companies like Siemens and ThyssenKrupp are already using green hydrogen in their operations.

I commend Hydrogen Rise and GUTech on their farsightedness in setting up the Oman Hydrogen Initiative. I am also grateful and happy for the positive response from our friends in Japan, and the substantial support extended by the Government of Oman.

(The decarbonisation) of the economy is not something that can be achieved by one country alone. This is not an exclusive exercise. We need an international effort where more countries participate. We need international cooperation in R&D, implementation of pilot projects and industrial-scale projects, and defining common standards.

Oman and Germany share common interests in a sustainable energy future. I'm optimistic about the prospects for cooperation between our two countries in the field of hydrogen as a pillar of energy supply for tomorrow.

Oman's renewable energy potential can supply an industrial-scale hydrogen economy



Ms. Clara Orthofer
- The Technical
University of Munich
(TUM)

The Sultanate of Oman has the potential to become a key player in the international green hydrogen economy," says Ms. Clara Orthofer, a researcher at the world-renowned Technical University of Munich (TUM) in Germany.

TUM, along with Hydrogen Rise AG, had undertaken a preliminary study on the broad opportunity for stimulating the growth of a Green Hydrogen economy in the Sultanate. Presenting the findings of the study, Ms. Orthofer said the Sultanate has the potential to evolve into a world-scale producer of green hydrogen fuel with an export capacity that can outstrip current oil exports by a factor of ten.

The researcher cited in this regard the immense potential of Sultanate's renewable energy resources, which can be developed to generate competitively priced electricity necessary to produce green hydrogen fuel on an industrial scale.

In technical terms, Oman has the potential to generate around 7,200 terawatt-hours/year of electricity from solar and wind resources, which is roughly equivalent to 220 times the current power demand in the country.

According to the German researcher, a hydrogen-based economy that roughly corresponds to Oman's current oil export industry equates to around 1,900 trillion BTU per annum in calorific value, which is roughly equivalent to 17 million tons of hydrogen.

But with Oman's green hydrogen fuel potential projected at close to ten times the current oil exports (equivalent to 20,000 trillion BTU per year), the hydrogen economy will be correspondingly larger.

To achieve this scale of hydrogen production, the Sultanate will require around 200 gigawatts of renewable energy capacity (producing around 700 TWh/year of electricity) in addition to 150 - 300 million cubic metres of desalinated water (equivalent to 8 - 15 per cent of water consumption at 2016 levels) for the electrolysis process. The land area required for solar PV and Concentrated Solar Power (CSP) based infrastructure would cover an estimated 3,000 sq kilometres.

These resources, chiefly solar PV and CSP, can be harnessed to guarantee high full load hours (FLH) at highly competitive generation costs, to enable continuous H₂ generation, said Ms. Orthofer, noting the Sultanate can produce green hydrogen at costs averaging \$3 per kilo of hydrogen, which is below the global average.

Ms. Orthofer stressed however that the findings would need to be further validated and fine-tuned through, among other initiatives, GIS modelling for detailed RE infrastructure demand assessment, and sensitivity analysis for dynamic price development and investment risks. "Oman's renewable energy potential is well suited to supply an industrial-scale hydrogen economy," she added.

Hydrogen is the missing link in the global energy transformation: IRENA

Hydrogen from renewable power is technically viable today and is quickly approaching economic competitiveness, according to the International Renewable Energy Agency (IRENA)

Clean hydrogen is enjoying unprecedented political and business momentum, with the number of policies and projects around the world expanding rapidly. Further acceleration of efforts is critical to ensuring a significant share of hydrogen

in the energy system in the coming decades.

Two key developments have contributed to the growth of hydrogen in recent years: the cost of hydrogen supply from renewables has come down and continues to fall,

while the urgency of greenhouse gas emission mitigation has increased, and many countries have begun to take action to decarbonise their economies, notably energy supply and demand. The hydrogen debate has evolved over the past two de-

acades, with a shift in attention from applications for the auto industry to hard-to-decarbonise sectors such as energy-intensive industries, trucks, aviation, shipping and heating applications.

Ensuring a low-carbon, clean hydrogen supply is essential. Current and future sourcing options include: fossil fuel-based hydrogen production (grey hydrogen); fossil fuel-based hydrogen production combined with carbon capture, utilisation and storage (CCUS; blue hydrogen); and hydrogen from renewables (green hydrogen).

Green hydrogen, produced with renewable electricity, is projected to grow rapidly in the coming years. Many ongoing and planned projects point in this direction. Hydrogen from renewable power is technically viable today and is quickly approaching economic competitiveness. The rising interest in this supply option is driven by the falling costs of renewable power and by systems integration challenges due to rising shares of variable renewable power supply. The focus is on deployment and learning-by-doing to reduce electrolyser costs and supply chain logistics. This will require funding. Policy makers should also consider how to create legislative frameworks that facilitate hydrogen-based sector coupling.

Important synergies exist between hydrogen and renewable energy. Hydrogen can increase renewable electricity market growth potentials substantially and broaden the reach of renewable solutions, for example in industry. Electrolysers can add demand-side flexibility. For example, European countries such as the Netherlands and Germany are facing future electrification limits in end-use sectors that can be overcome with hydrogen. Hydrogen can also be used for seasonal energy storage. Low-cost hydrogen is the precondition for putting these synergies into practice.

Electrolysers are scaling up quickly, from megawatt (MW)- to gigawatt (GW)-scale, as technology continues to evolve. Progress is gradual, with no radical breakthroughs expected.

Electrolyser costs are projected to halve by 2040 to 2050, from USD 840 per kilowatt (kW) today, while renewable electricity costs will continue to fall as well. Renewable hydrogen will soon become the cheapest clean hydrogen supply option for many greenfield applications.

Blue hydrogen has some attractive features, but it is not inherently carbon free. Fossil fuels with CCUS require carbon dioxide (CO₂) monitoring and verification and certifi-

tries with ambitious climate objectives.

Per unit of energy, hydrogen supply costs are 1.5 to 5 times those of natural gas. Low-cost and highly efficient hydrogen applications warrant such a price difference. Also, decarbonisation of a significant share of global emissions will require clean hydrogen or hydrogen-derived fuels. Currently, significant energy losses occur in hydrogen production, transport and conversion. Reducing

“ IMPORTANT SYNERGIES EXIST BETWEEN HYDROGEN AND RENEWABLE ENERGY. HYDROGEN CAN INCREASE RENEWABLE ELECTRICITY MARKET GROWTH POTENTIALS SUBSTANTIALLY AND BROADEN THE REACH OF RENEWABLE SOLUTIONS, FOR EXAMPLE IN INDUSTRY

cation to account for non-captured emissions and retention of stored CO₂. Such transparency is essential for global hydrogen commodity trade.

Development of blue hydrogen as a transition solution also faces challenges in terms of production up-scaling and supply logistics. Development and deployment of CCUS has lagged compared to the objectives set in the last decade. Additional costs pose a challenge, as well as the economies of scale that favour large projects. Public acceptance can be an issue as well. Synergies may exist between green and blue hydrogen deployment, for example economies of scale in hydrogen use or hydrogen logistics.

A hydrogen-based energy transition will not happen overnight. Hydrogen will likely trail other strategies such as electrification of end-use sectors, and its use will target specific applications. The need for a dedicated new supply infrastructure may limit hydrogen use to certain countries that decide to follow this strategy. Therefore, hydrogen efforts should not be considered a panacea. Instead, hydrogen represents a complementary solution that is especially relevant for coun-

tries with ambitious climate objectives.

these losses is critical for the reduction of the hydrogen supply cost. Dedicated hydrogen pipelines have been in operation for decades. Transport of hydrogen via existing and refurbished gas pipelines is being explored. This may reduce new infrastructure investment needs and help to accelerate a transition. However, equipment standards need to be adjusted, which may take time. Whether the way ahead involves radical natural gas replacement or gradually changing mixtures of natural gas and hydrogen mixtures is still unclear. A better understanding is needed.

While international hydrogen commodity shipping is being developed, another opportunity that deserves more attention is trade of energy-intensive commodities produced with hydrogen. Ammonia production, iron and steel making, and liquids for aviation, marine bunkers or feedstock for synthetic organic materials production (so-called electrofuels or e-fuels that are part of a power-to-X strategy) seem to be prime markets, but cost and efficiency barriers need to be overcome. This may offer an opportunity to accelerate global renewables deployment with economic benefits. ●



More for Less

Post 2021, upon the introduction of solar, wind, waste-to-energy, and possibly clean coal or solar CSP plants, as well as improved despatch control technology, Oman Power and Water Procurement Company (OPWP) expects that the gas requirements for electricity generation will fall to around 144 Sm³/MWh, or 61% less than that required in 2005

The dominant role of natural gas as the longstanding fuel of choice for electricity generation in the Sultanate is slated to dramatically decline going forward, particularly as planned investments in solar and wind power projects materialize around the Sultanate.

The downtrend however began more than a decade ago when Oman Power and Water Procurement Company (OPWP) – the sole procurer of new electricity generation and related water desalination capacity – began taking measures to ramp up efficiency in power production and despatch. In the upshot, gas consumption per unit of electricity produced has dropped significantly, and is projected to plummet even further once solar, wind and other renewable and alternative based generation capacity is brought into operation.

Driving the transition from a predominantly gas-based system of power generation is a new Fuel Diversification Policy, which OPWP began to implement starting from 2018. The strategy, initiated by the government, sets out four key objectives for Oman's electricity sector:

- At least 10% of electricity generation to be sourced from renewable resources by 2025.
- Coal can be utilized to fuel up to 3,000 MW of generation capacity by 2030.
- Gas efficiency will continue to be a priority of the electricity sector.
- Study of alternate sources for electricity generation.

According to its latest Outlook Statement for the 2019 – 2024 timeframe, OPWP plans to develop 2,400 to 3,000 MW of installed capacity of renewable energy (RE) projects by 2025, aiming to exceed the 10% generation share target. By 2025, 16% of generation will be provided from fuels other than gas, primarily solar energy.

Efficiency - Fuel Utilization

Since 2005, through the introduction of progressively more efficient generation plants, OPWP has achieved a 39% reduction in the gas required per unit of electricity production, from 374 Sm³/MWh in 2005 to 227 Sm³/MWh in 2018. In 2018 alone, improvements in gas utilization (when compared against gas utilization rates in 2005), suggests savings in excess of OMR 220 million. OPWP's procurement of

new state-of-the-art CCGT plants in 2019, and new water desalination plants that shift water production from energy intensive MSF technology to efficient RO technology, will enable further improvements in gas utilization. By 2020, OPWP expects a further 21% improvement in gas utilization against 2018.

After 2021, with the introduction of solar, wind, waste-to-energy, and possibly clean coal or solar CSP plants, as well as improved dispatch control technology, OPWP expects that the gas requirements for electricity generation will fall to around 144 Sm³/MWh, or 61% less than that required in 2005.

Fuel consumption in MIS

Total gas consumption at the main power and desalination plants around the Main Interconnected System (MIS) in 2018 was about 7.44 billion Sm³, equivalent to 20.25 million Sm³/d, about 3% more than in 2017. Transmission grid upgrades has enabled better access to the most efficient generation plants.

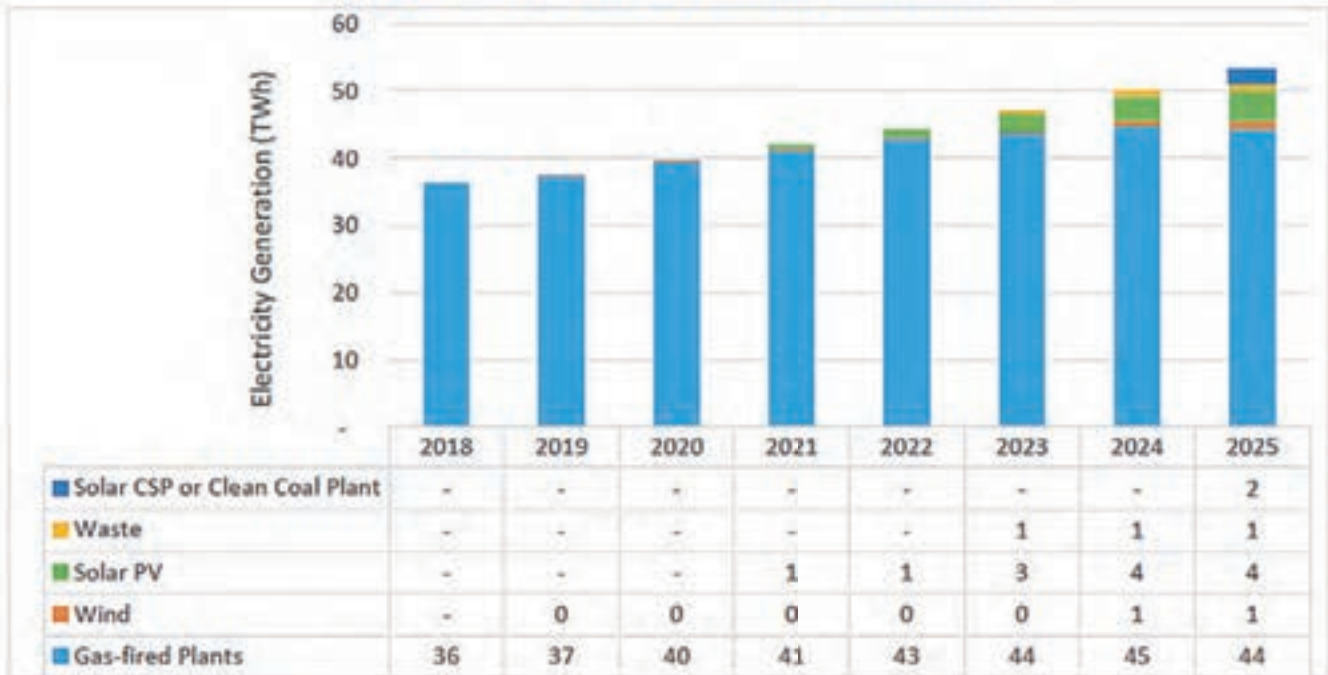
OPWP projects annual gas requirements to decline by around 1% per year from 2018 to 2025 under the Expected Case. The previous 7-Year Statement projected that MIS gas consumption would grow at an average annual rate of 0.5%, and the change is due mainly to demand reductions.

There is a drop in gas consumption in 2019 compared to 2018. This is due to several important developments: completion of the new Ibri and Sohar IPPs in 2019, retirement of Al Ghubrah IWPP and Wadi Al Jizzi IPP during 2018, and completion of the new Barka IV IWP and Sohar IV IWP which allow fuel-intensive MSF water production to be curtailed. From 2021 to 2025, the introduction of renewable energy projects will restrain the growth in gas requirements even as electricity demand continues to increase.

Dhofar Power System

Gas consumption in 2018 was 743 million Sm³ (equivalent to 2 million Sm³/d), about 13% lower than in 2017, whereas electricity production decreased by 3%. [AA1] Gas utilization improved due to transmission grid improvements and resolution of gas supply issues that enabled higher dispatch of Salalah II IPP. It is also worth noting that Cyclone Mekunu altered normal consump-

Fuel Shares in Electricity Generation



tion patterns from the end of May into June 2018. Gas consumption during May-June 2018 was on average 8% lower than similar months in 2017. With respect to the peak, peak daily natural gas consumption was 3.1 million Sm³ in 2018 compared to 3.0 million Sm³ in 2017.

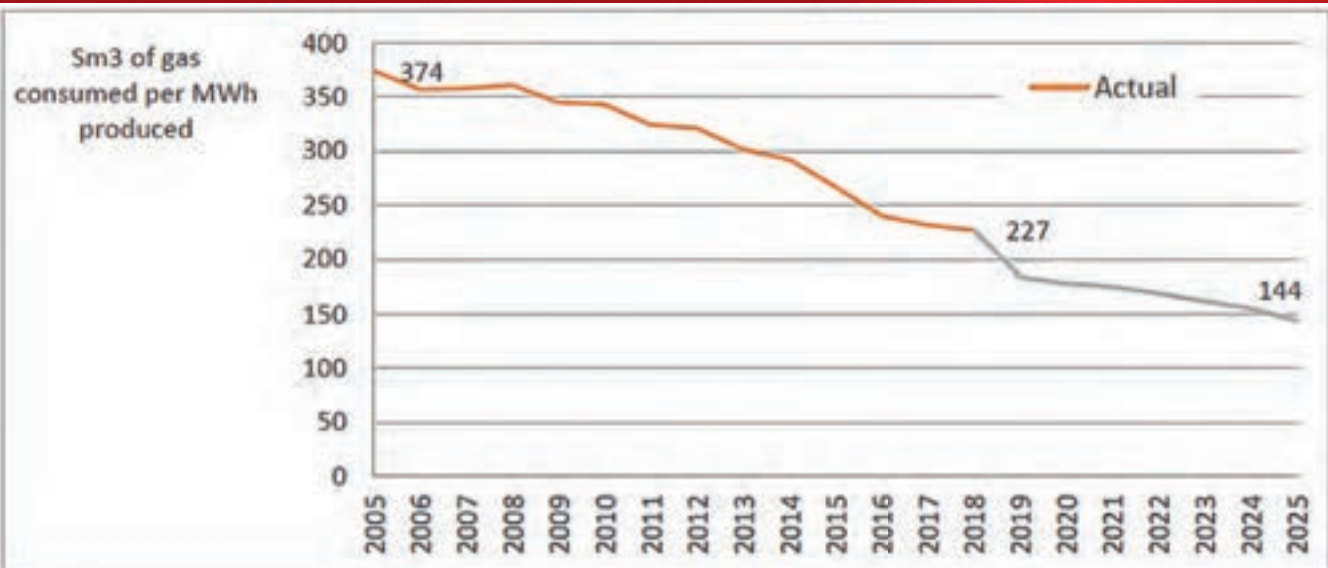
The projections include the impact of the Dhofar I Wind IPP (50 MW) at Harweel in Q4 2019.

Total fuel consumption is expected to increase at an annual average of around 6%

under the Expected Demand scenario, 4% under the Low Case scenario, and 8% in the High Case. These growth rates in fuel consumption compare to energy demand growth of 7%, 5%, and 10%, respectively.

A reduction in peak day gas consumption is anticipated in 2019. OPWP carried out an assessment of this, and found that LDC had utilized Salalah IWPP more than Salalah II during the peak period in 2018, but expects to utilize Salalah II more in 2019 and subsequent years. ●

Gas Required per Unit of Electricity Generation - MIS



[Source: OPWP's 7-Year Statement: 2019 - 2024]



Solar CSP or Clean Coal Project

A first-ever Thermal Solar plant could be developed at Duqm – the site of one of the Middle East largest Special Economic Zones (SEZ) – if a proposed Clean Coal Independent Power Project (IPP) proposed at Duqm does not get the government’s thumbs-up before the end of this year, says OPWP. Last year, OPWP had issued an RFQ as the first step towards the procurement of a 1,200 MW clean coal IPP located at Duqm. The RFP is currently on hold pending final approval of the project and site, according to the Nama Group member.

“If provided final approval enabling RFP release by Q2 2019, OPWP would expect to award the project in Q2 2020, and that the first 600 MW block would begin commercial operation in Q2 2025, followed by full power in 2026. If the clean coal IPP is not approved, OPWP plans to begin procurement of a Solar CSP IPP with thermal storage for COD in a similar time period, subject to approvals,” the procurer stated in its latest 7-Year Outlook Statement.

CSP plants use thousands of parabol-

ic trough mirrors to convert the sun’s energy into high-temperature heat which is then channelled through a conventional generator to produce electricity. The proposed venture will also include thermal storage to keep operating after sundown.

Explaining its vision for supporting the Duqm SEZ’s electricity requirements, OPWP said: “Upon direction from the Government, OPWP initiated procurement of a Clean Coal IPP in 2018, following a feasibility study. The project has not yet been approved, pending policy evaluation of alternatives. Considering the need to develop a baseload generator to serve the Duqm load center, OPWP plans to develop a Thermal Solar project with thermal storage if the procurement of the clean coal project is not approved to proceed in 2019. The Thermal Solar project is planned to provide around 600 MW by 2025, about the same capacity of the first block of the Clean Coal IPP.” Electricity demand growth is projected to grow at 23 per cent per annum over the next five years in line

with expectations of strong investment inflows into the SEZ. The SEZ and its environs are currently served by a 67 MW diesel powered plant operated by the Rural Areas Electricity Company (RAECO).

Given the SEZ’s importance as a potential dynamo of Oman’s long-term economic growth, the government is keen to ensure its energy needs are secured. To this end, Oman Electricity Transmission Company (OETC) – also part of Nama Group – is working to integrate the Duqm Power System with the Main Interconnected System (MIS) that covers much of the northern half of Oman. The North-South Interconnection Project will be substantially in place by 2023.

Significantly, OPWP also plans to develop wind-based energy plants and a baseload generation plant in the Duqm region, to be available soon after the North-South Interconnect reaches Duqm. OPWP sees the potential for around 200 MW of wind-based capacity to be added to the local grid from 2024.

Hydrocarbons: Oman's economic bulwark

The importance of the hydrocarbon sector to the Omani economy remains critical, despite an increasingly strategic focus on non-oil economic activities to promote economic diversification, says the Central Bank of Oman (CBO) in its Annual Report



The Omani economy witnessed accelerated growth during 2018 mainly due to the rapid strides made by the hydrocarbon sector. The non-hydrocarbon sector also achieved reasonable growth on the back of sustained diversification efforts.

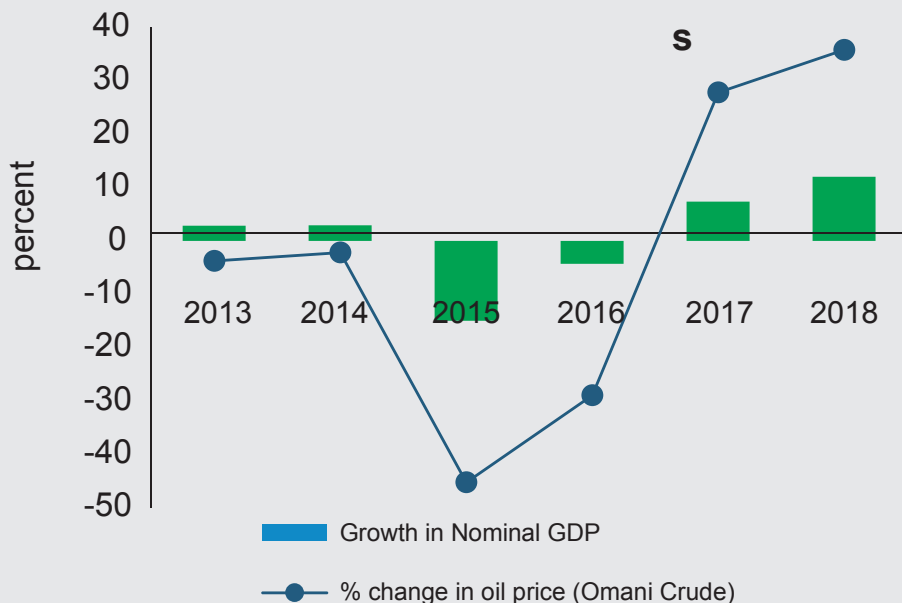
Nominal Gross Domestic Product (GDP) increased by 12.0 percent during 2018 as against 7.3 percent in the previous year. The price of Omani crude averaged US\$69.7 a barrel, representing a hefty 36 percent over the corresponding average of 2017.

Consequently, the nominal growth of the petroleum sector climbed about 19 percentage points. Also, within the domain of the petroleum sector, natural gas emerged as a significant player particularly in the wake of the commercial launch of BP Oman's Khazzan gas project in September 2018.

Non-oil growth

The non-petroleum sector, on the other hand, recorded a marginal deceleration in growth during 2018, which may be attributed to subdued

Nominal GDP Growth and Change in oil Price



domestic demand and some deceleration in external demand as well. The government's pursuit of fiscal consolidation also acted as a drag on domestic demand, although this was dictated by a need to reinstate macroeconomic balance. The growth in non-oil exports remained robust, but a significant deceleration resulted in reduced support from external demand. On the supply side, all major groups – industry, services, and agriculture – contributed to the moderation in the growth of non-petroleum sector.

To be sure, the hydrocarbon sector continues to remain of critical importance to the national economy, despite an ever increasing strategic focus on non-oil economic activities to help achieve a more diversified economy. The hydrocarbon sector accounted for about 36 percent of the nominal GDP and 78.2 percent of government revenues during 2018. The hydrocarbon sector also contributed to the growth of non-oil economic activities due to inter-linkages and spillovers. Furthermore, despite a substantial upturn in nonoil exports, hydrocarbon exports witnessed a jump of 7.1 percentage points in its share of total merchandise exports to 65.4 percent during 2018.

The price of Omani crude averaged US\$69.7 per barrel in 2018, compared to US\$51.3 per barrel a year earlier, recording an increase of 35.8 percent. The surge in oil prices, coupled with an upturn in hydrocarbon production, conditioned

the accelerated growth of the petroleum sector during the year.

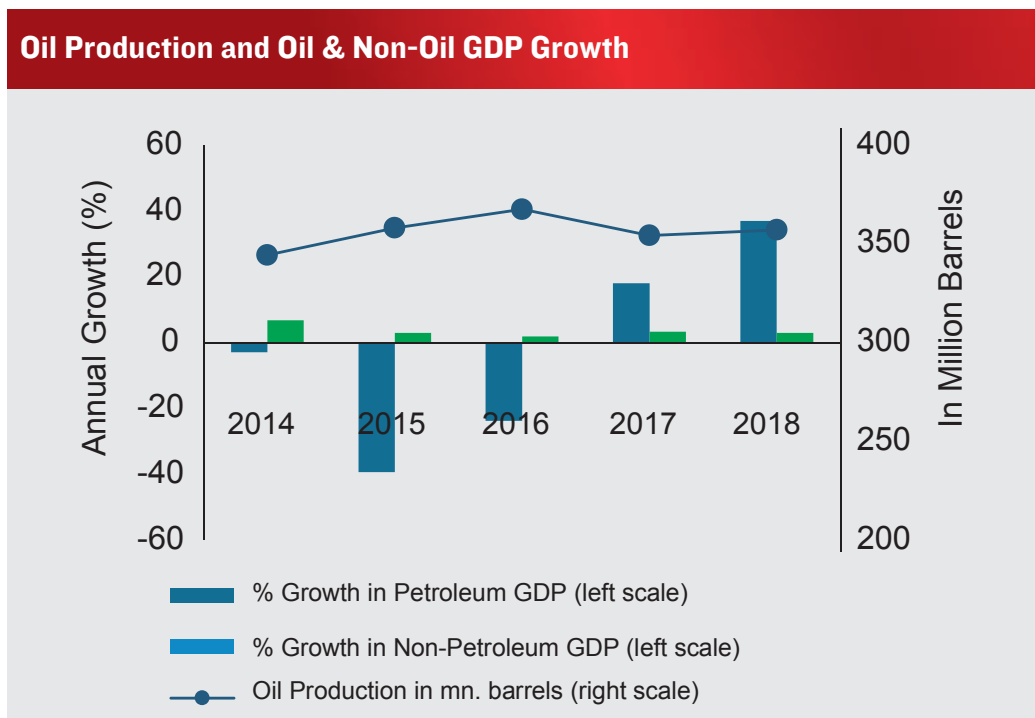
Crude Production

Oil production increased 0.8 percent to reach an average of 978.4 thousand barrels per day during 2018, while aggregate oil production rose to 357.1 million barrels.

Natural gas output climbed 12.5 percent to reach 43.750 billion cubic metres (bcm) during 2018, bolstered by the commissioning and launch of BP Oman's Khazzan development. Petroleum Development Oman (PDO) also announced the discovery of the Mabrouk North East field, one of the biggest gas finds in the world, early in 2018.

The Ministry of Oil & Gas also signed three production-sharing agreements – the first with PetroLeb LLC to develop Block 57; the second with Occidental Oman for Block 51m, and the third with a joint venture between Occidental and Oman Oil Company Exploration and Production (OOCEP) for Block 65.

Exports of Omani crude accounted for more than 80 percent of total crude oil production in 2018. Demand for Omani crude mainly emanated from Asian markets in 2018. China topped the list of importers, importing about 83 percent of total exports, followed by India with about 8 percent and Japan with around 6 percent. With China and Asia projected to grow strongly over the next several years,



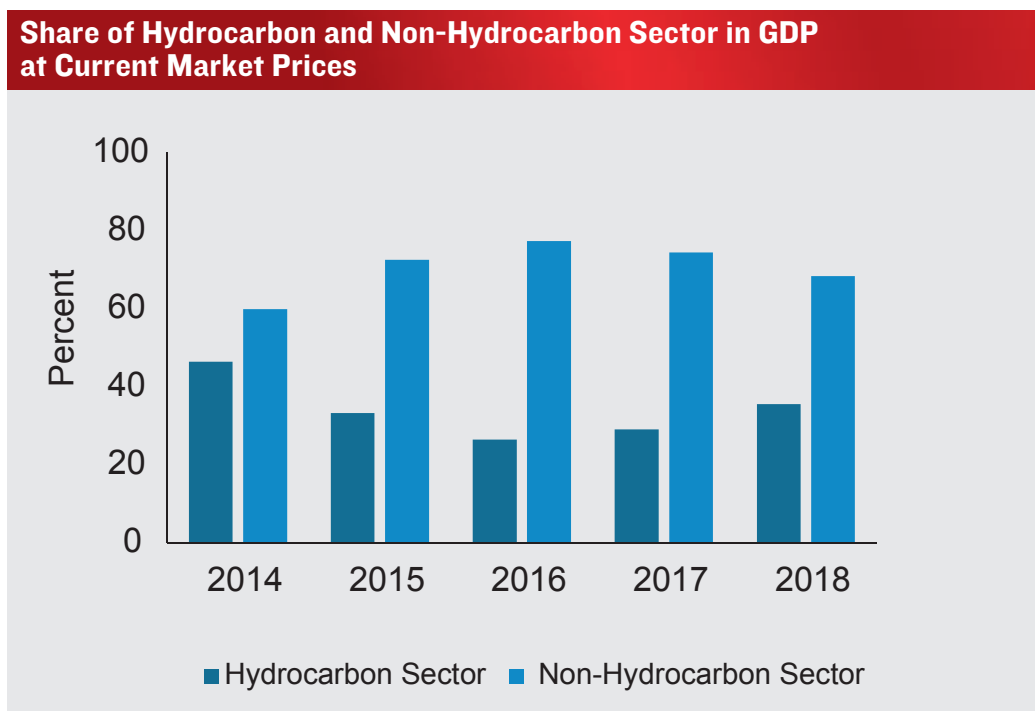
“ THE HYDROCARBON SECTOR, WITH A CONTRIBUTION OF ABOUT 78 PERCENT, REMAINED THE MAIN DRIVER OF GOVERNMENT REVENUES. HENCE, ANY SHOCK TO HYDROCARBON SECTOR REVENUES WOULD HAVE IMMENSE IMPLICATIONS FOR THE FISCAL POSITION OF THE COUNTRY

Natural gas

Associated gas accounted for 18 percent of total gas output, with non-associated gas making up the balance 82 percent of production. In addition, around 5.4 million cubic meters per day of gas was imported via the Dolphin system.

Total reserves of natural gas are estimated at 25 trillion cubic feet, with PDO holding around 54 percent of this volume, following by BP’s Khazzan and Ghazeer fields (41 percent) and the balance 5 percent

they are expected to be an important destination for Omani crude going forward.



In Numbers

The price of Omani crude averaged **US\$69.7** per barrel in 2018, compared to **US\$51.3** per barrel a year earlier, recording an increase of **35.8** percent. Exports of Omani crude accounted for more than **80** percent of total crude oil production in 2018.



shared by a number of operators and producers.

Total exports of LNG also jumped 19 percent to 10.2 million metric tons during 2018, up from 8.6 million metric tons in 2017. Oman LNG Company exported 6.9 million metric tons, while 3.3 million met-

ric tons were shipped by Qalhat LNG. Condensate exports from the LNG complex stood at 0.239 million metric tons last year.

Government Revenues

Government revenues climbed 28.6 percent during 2018, bolstered by an upsurge in oil and gas earnings. Net oil revenues grew 39.6 percent and accounted for 60 percent of total revenues. At the same time, gas revenues also witnessed a large growth of 33.2 percent on the back of a surge in prices coupled with new supply from BP's Khazzan gas field. Gas revenues accounted for about 19 percent of total revenues.

Accordingly, the hydrocarbon sector, with a contribution of about 78 percent, remained the main driver of government revenues. Hence, any shock to hydrocarbon sector revenues would have immense implications for the fiscal position of the country. However, the government is continuously working to boost economic diversification by positioning the non-hydrocarbon sector as the main driver of economic activities and government revenues.

Non-hydrocarbon revenues grew 3.2 percent in 2018 compared to a contraction of 4.6 percent in 2017, with a contribution of about 22 percent to total government revenues. Other current receipts and capital receipts shaped the accelerated growth in non-hydrocarbon revenues. ●

Oman's Oil Prices (US \$/Barrel)

Month	2014	2015	2016	2017	2018
January	105.97	78.24	42.28	44.54	60.79
February	107.88	61.01	34.59	52.72	61.60
March	104.04	46.73	27.40	53.93	66.32
April	105.04	56.21	30.23	55.12	63.01
May	104.36	55.09	36.34	51.71	63.31
June	104.99	58.68	39.40	52.82	68.31
July	105.65	63.62	44.33	50.55	74.41
August	108.08	61.84	46.60	46.52	73.61
September	106.24	56.33	43.40	47.63	73.17
October	102.23	47.88	44.02	50.39	72.64
November	97.26	45.76	43.92	54.02	78.72
December	86.96	46.03	49.18	55.59	80.20
Average (Jan-Dec)	103.23	56.45	40.14	51.30	69.67

Source: Ministry of Oil and Gas and National Center for Statistics and Information.



Duqm Salt: Epitomising In-Country Value



Oman's first salt refinery has come into operation at Bentoot on the Sultanate's Al Wusta coast - the result of novel In-Country Value (ICV) initiative that seeks to supplant pricier industrial salt imports with a competitive, high-grade local product for the nation's Oil & Gas industry



While Oman's energetic In-Country Value (ICV) programme has spawned a multitude of success stories in localisation of goods and services for the Oil & Gas sector, few are as demonstrative of ICV in action as Duqm Salt.

Localisation is at the core of Duqm Salt, says Khalid Ali Suleym Al Junaihi, Vice CEO - Global Integrated Engineering LLC, which has set up this one-of-a-kind project on a waterfront stretch overlooking the Arabian Sea in Al Wusta Governorate.

"The objective of our investment is to manufacture high-grade industrial salt from seawater as an import-substitute for Oman's Oil & Gas sector. Thus, we are not only localising industrial salt production for national consumption, but in line with our ICV commitments, we are localising – in incremental stages – all aspects of our supply chain and support activities. In effect, we aspire to become a full-fledged ICV project and serve as a model for others to emulate."

Covering a seafront area of 1.7 million sq metres, Duqm Salt's refining complex is located at Bentoot on the Al Wusta coast, some 80 km north of Duqm. Its waterfront location allows for seawater to be channelled to an array of large evaporation ponds. The concentrated solution is then transferred to an adjoining set of ponds, known as Crystallisers. Here, raw salt (NaCl) is crystallized in the form of crust that is transported to the plant for refining to achieve 99.80 per cent purity, says Mr. Al Junaibi.

At full capacity, Duqm Salt Plant can produce 240,000 metric tons of industrial salt per annum, which accounts for roughly half of Oman's annual domestic demand of around 500,000 tons. Much of this demand comes from Oil & Gas companies that require industrial salt as a water softener



in the Enhanced Oil Recovery (EOR) operations, as well as in drilling activities. Occidental of Oman (Oxy), which operates the Mukhaizna heavy oilfield in Block 53, sources part of its industrial salt requirements from Duqm Salt. Petroleum Development Oman (PDO), which is also engaged in EOR operations at its Amal heavy oilfield, is a customer as well. Offtake volumes are expected to rise once supply arrangements are concluded with other potential oilfield customers, according to Mr. Al Junaibi.

The Vice CEO is optimistic that the demand for his product will rise once customers see the benefits of switching to a locally manufactured substitute. “Our industrial salt is manufactured to the quality specs stipulated for EOR and drilling activities, so it’s a cost-competitive alternative to imported salt. Moreover, we can supply customers in one to two weeks of receiving an order, as opposed to the 3 – 4 months that it would take for an overseas supplier to ship their products into Oman. Importers also incur costs in terms of transportation and bulk storage when they source their requirements from abroad.”

Duqm Salt also sees potential to grow its customer base beyond the Oil & Gas industry. “Oman is home to a thriving water treatment sector, which requires high grade salt for water softeners purposes.

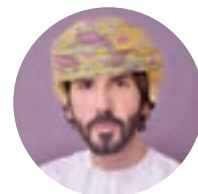
“ THE OBJECTIVE OF OUR INVESTMENT IS TO MANUFACTURE HIGH-GRADE INDUSTRIAL SALT FROM SEAWATER AS AN IMPORT-SUBSTITUTE FOR OMAN'S OIL & GAS SECTOR

Also prospective is the detergent manufacturing industry, and a host of chlor-alkali plants that are either in operation or in the early stages of development in Duqm and elsewhere. They have the choice of opting for a locally produced commodity in place of imports.”

Additionally, the company plans to break into the cooking salt market, currently dominated by leading brands from Europe and India. Edible salt consumption is estimated at around 10,000 metric tons per annum, according to Mr. Al Junaibi, adding that Duqm Salt will launch its own high quality brand once the requisite approvals come through from various government ministries.

For now, Duqm Salt is focused on meeting the needs of the Oil & Gas sector before it ponders opportunities to explore overseas markets. “We launched the project as an ICV initiative and will stay committed to the local market before we think of exporting overseas,” the Vice CEO added in conclusion.

By Conrad Prabhu



Khalid Ali Suleym Al Junaibi,
Vice CEO - Global
Integrated
Engineering LLC



Agri-nutrients critical to sustaining global food security

GCC agri-nutrients industry needs to innovate to overcome challenges, say speakers at the 10th GPCA Fertilizer Convention held in Muscat

The agri-nutrients industry in the Arabian Gulf and globally is entering a new phase characterized by lower market growth, economic slowdown and increased consolidation, and in order to enhance its competitive advantage the industry must work towards creating value through innovation and developing improved and sustainable agri-nutrient products, agreed speakers at the 10th Fertilizer Convention held by the Gulf Petrochemicals and Chemicals Association (GPCA) in Muscat on 25 September 2019.

Fertilizer demand is projected to grow at CAGR 1.4% between now and 2023, falling behind global GDP and other industries' growth. Industry consolidation is at an all-time high led by a rise in mega-mergers and acquisitions in the last 10 years, with the top ten fertilizer producers now controlling 45% of the market share.

Speakers at the convention stressed that this highly competitive and consolidated industry environment presents new challenges and opportunities for agri-nutrient producers in the GCC who must pursue value creation through innovation and strategic integration if they are to remain successful in these increasingly uncertain times.

HE Dr. Hamed Said Al Oufi, Minister of Agriculture and Fisheries Wealth, Oman inaugurated the exhibition and attended the convention, which was held under his patronage, while the opening remarks by Dr. Abdulrahman Jawahery, President, GPIC and Vice Chairman, GPCA followed by a welcome address by Eng. Isam bin Saud Al Zadjali, CEO, Oman Oil Company, and Chairman, Oman India Fertiliser Company (OMIFCO).

The keynote address on day one was presented by Samir Al-Abdrabbuh, EVP – Agri-Nutrients, SABIC, and Vice Chairman, Fertilizers Committee, GPCA, while John Baffes, Senior Economist, World Bank (Development Prospects Group), will deliver the keynote address on the following day 26 September.

In his welcome address, Eng. Al Zadjali highlighted the need for strategic partnership as well as the exchange of experiences among producers in the GCC in order to overcome the challenges facing the agri-nutrients industry, which is so central to ensuring global food security. As the global population is expected to reach 9.6 billion by 2050, the role of agri-nutrients producers in addressing higher demand for food will be particularly important, as will improving crops and water management through balanced and effective fertilizer use, he added.

HE Dr. Hamed Said Al Oufi, Minister of Agriculture and Fisheries Wealth, Oman with Dr. Abdulrahman Jawahery, President, GPIC and Vice Chairman, GPCA followed by Eng. Isam bin Saud Al Zadjali, CEO, Oman Oil Company, and Chairman, Oman India Fertiliser Company (OMIFCO)



Dr. Abdulwahab Al-Sadoun, Secretary General, GPCA, commented: “The agri-nutrients industry in the GCC must continue to enhance its competitive position and remain resilient in the face of future challenges and disruptions, which can only be achieved through building home-grown innovation capabilities, investing in strategic integration, utilizing cutting-edge technologies, and training and developing young indigenous talent – our region’s greatest asset.”

“For over a decade, the GPCA Fertilizer Convention has served as an essential platform for the exchange of knowledge, best practice and networking among global and regional leaders from government, industry and academia to address some of the most pressing issues facing the industry and provide long lasting solutions to the challenges that continue to emerge in this ever more dynamic and complex industry environment,” he added.

The two-day 10th GPCA Fertilizer Convention covered a wide variety of topics including food security in the Arabian Gulf, technology trends and disruptions, strategies for growth, market trends and producing enhanced quality agri-nutrients. In line with GPCA’s commitment to building local human capital in the region, the convention has hosted an exclusive student seminar facilitated by senior industry experts as well as a virtual visit

to OMIFCO’s facilities in Oman as part of the 12th edition of GPCA’s Leaders of Tomorrow program, powered by SABIC. The Gulf Petrochemicals and Chemicals Association (GPCA) was established in 2006 to represent the downstream hydrocarbon industry in the Arabian Gulf. Today, the association voices the common interests of more than 250 member companies from the chemical and allied industries, accounting for over 95 percent of chemical output in the GCC. The industry makes up the second largest manufacturing sector in the region, producing over USD 108 billion worth of products every year.

GPCA supports the petrochemical and chemical industry in the Arabian Gulf through advocacy, networking and thought leadership initiatives aimed at helping member companies to connect, share and advance knowledge, contribute to international dialogue, and become prime influencers in shaping the future of the global petrochemicals industry.

Committed to providing a regional platform for stakeholders from around the world, GPCA manages six working committees – Plastics, Supply Chain, Fertilizers, International Trade, Research and Innovation, and Responsible Care – and organizes six world-class events each year. ●

In Numbers

Fertilizer demand is projected to grow at CAGR **1.4%** between now and 2023, falling behind global GDP and other industries’ growth. Industry consolidation is at an all-time high led by a rise in mega-mergers and acquisitions in the last 10 years, with the top ten fertilizer producers

now controlling **45%** of the market share.

New era for the agri-nutrients industry



Dr Abdulwahab al Sadoun
Secretary General, Gulf Petrochemicals and
Chemicals Association (GPCA)

The agri-nutrients industry operates in a changing and ever more complex environment. Against the backdrop of a growing world population, rising sustainability challenges and higher demand for food, agri-nutrients producers are facing immense pressure to rise up to the needs of a changing world and ensure an uninterrupted supply of vital nutrients to nations across the globe. A new report by the United Nations estimates that the world's population will increase by 2 billion people in the next 30 years, from 7.7 billion currently to 9.7 billion in 2050, and reach its peak around the end of the current century, at a level of nearly 11 billion.

The population of sub-Saharan Africa alone is projected to double by 2050, witnessing a 99% increase, and adding further pressure to existing resources. The African continent presents a tremendous opportunity for agri-nutrients producers as the lack of food security, poor land cultivation practices and rampant soil degradation continue to dominate the current agricultural landscape.

Food security remains one of the gravest challenges facing the world today, as demand for food is expected to more than double over the next 30 years. The efficient use of fertilizers will be central to ensuring healthy crops and maintain a sustainable and efficient production. Inorganic fertilizers are currently used to produce more than half of the world's food, helping to ensure sustainable supply even in

places with the most challenging conditions. This is creating immense pressure on global regulatory authorities and shaping a new paradigm for fertilizer producers.

Advancing a new vision

Much like global players, the Arabian Gulf is entering a new era for agri-nutrient production shaped by rapid industry consolidation, technological disruption, the need for higher value-added products and increased collaboration. Building on its availability of feedstock and geographical location, the GCC has cemented its position as a leading producer of fertilizers, shipping its products to over 80 countries worldwide. Today governments in the region are fulfilling a new vision – to transform the GCC into one of the world's leading production hubs and attract some of the largest food producers to invest in the region. Governments and industry are putting a special focus on initiatives such as vertical farming to boost local food production.

Need for collaboration

Advancing this ambition will require forging new and strategic partnerships with international players, fostering innovation and setting up state-of-the-art manufacturing facilities. The agri-nutrients industry is well placed to acquire a more competitive position by focusing on strategic consolidation and acquisitions to enhance its capabilities and access to key markets.

Now more than ever before the industry needs to collaborate and enhance its capabilities if it wants to attain future growth. However, collaboration alone will not suffice in meeting rising demand for food in a world with rapidly depleting natural resources. To cater to the needs of an ever more fragmented agricultural sector, companies will need to transform into end-to-end solution providers through stra-

tegic integration with value chain partners. Vertical farming, precision farming and nitrogen fixing will revolutionize traditional agriculture and have a dramatic impact on the industry's profitability.

Focus on specialty fertilizers

To capture new business opportunities and create further value for the regional economy, the industry must diversify its product portfolio by developing more specialty products. As food demand worldwide continues to increase in both sophistication and volume, higher crop production would also need to rise in line. Particularly in regions where water resources are relatively scarce, the need for specialty fertilizers is even greater. The specialty business will require a different skill set, greater emphasis on innovation and niche markets. Collaboration across the value chain, but also between government, industry and academia will act as a steppingstone to enable the future development and success of the fertilizer industry in the GCC.

Innovation will be key

Ultimately, this will require a stronger focus on R&D and innovation. It will mean working closely with farmers and technology providers to invent and develop future proof solutions. The industry would also need to play a growing role in building better knowhow for the farming industry and introducing new technologies in order to help maximize the use of fertilizers in agricultural production. Technology development and innovation are reaching unprecedented levels is enabling better soil analysis and access to information. This in turn is providing key opportunities to address agricultural challenges and provide solutions to maximize yields, reduce risk and improve agricultural output.

In-country value retention:

40 per cent and rising!

Oman's Oil & Gas industry succeeded in retaining on average 40 per cent of its supply chain expenditure in-country as of end-2018, maintaining a target increase in the overall In-Country Value (ICV) delivery of two per cent year-on-year



Despite the fall in oil prices, the Sultanate's Oil & Gas industry continued showing an increase in the value retained in-country, thanks to the collaborative approach and the continuous engagements between the Ministry of Oil and Gas, the operators and the contractors, says Aqla N. Al Maskari, Director of Local Resources Development, (ICV Project Management Office – PMO Manager), Ministry of Oil and Gas.

In this interview, Ms. Al Maskari traces the growth of the ICV strategy from a fledgling initiative of the industry to a full-blown, high-impact value-generating programme:

1. How has the ICV strategy evolved over the past 4-5 years since it was first introduced?

At the inception of the ICV programme, the ICV Committee commissioned a gap analysis study to diagnose the local market's capacity and capability in goods, services and manpower. The study indicated that only 18% of the total spend of the Oil & Gas sector was retained in the economy. A five-phase roadmap was adopted for the implementation of the ICV Strategy:

2013–2014: Focused on establishing the foundation required to support

and execute the ICV Strategy by defining the execution model, standardizing the ICV terms and implementing ICV key performance indicators (KPIs).

2014–2015: Boosting the ICV Strategy through identifying and executing high-impact opportunities and implementing mid- and long-term initiatives.

2015–2016: Refining the ICV Strategy based on lessons learnt and running deeper analysis in addition to launching new opportunities.

2016–2018: Capitalizing and sustaining the ICV Strategy through systematization of tools and processes such as the monitoring and reporting system, contract management and the E-tendering. 2018 onwards: Continuing the efforts towards organic ICV development.

2. Percentage-wise, how has ICV progressed?

The ICV Blueprint Roadmap envisaged the doubling of ICV from 18% in 2013 to 36% by end of 2020. However, the industry managed to reach the target of 36% in 2016. Furthermore, the industry managed to retain on average 40% of its Supply Chain spent by the end of 2018, while maintaining a target increase in the overall ICV delivery of 2% year on year.

3. Why does ICV continue to make economic sense for the Oil & Gas industry and the wider economy regardless of the current fiscal challenges?

Despite the fall in oil prices, the Oil & Gas industry continued showing an increase in the value retained thanks to the collaborative approach and the continuous engagements between the Ministry of Oil & Gas, the operators and the contractors. In addition, the introduction of the seven ICV elements in the contracting and procurement process has been an instrumental tool in facilitating and encouraging operators and contractors to identify and address opportunities required to increase ICV throughout the supply chain. Moreover, the implementation of seven ICV elements in the contracting and procurement process ensures that ICV opportunities are being implemented at a competitive market price and therefore, mitigates the fiscal challenges.

4. Please shed light on strategic manufacturing initiatives that have been spawned by the ICT programme.

In line with the goal of securing high impact opportunities, the industry supported the establishment of several manufacturing opportunities which are considered essen-

tial to the oil & gas operations. Examples of these opportunities are the establishment of chemical blending plants, manufacturing of EOR polymers, manufacturing of drill bits, manufacturing of salt, facility for repairing and assembly of Electrical Submersible Pumps, in addition to several other initiatives.

“ THE ICV STRATEGY HAS PLACED AN IMPORTANT EMPHASIS ON TECHNOLOGY TRANSFER BY INTRODUCING THE DEVELOPMENT OF RESEARCH & DEVELOPMENT INSTITUTIONS AS PART OF THE SEVEN ICV ELEMENTS IN CONTRACTING AND PROCUREMENT PROCESSES

5. How is tech transfer being viewed as a potential ICV objective?

The ICV strategy has placed an important emphasis on technology transfer by introducing the development of Research & Development institutions as part of the seven ICV elements in contracting and procurement processes. In addition, the Ministry is currently in collaboration with the Ejaad committee (a platform to bridge industry's R&D requirements with academia) to establish a process for sponsoring R&D projects.

6. Plans, if any, for taking the ICV programme to the next level.

As you know, the ICV programme is in its sixth year of implementation. The Ministry of Oil and Gas recognized a need to reflect on the performance of the ICV programme and ensure it is aligned with the country's 2040 vision. Therefore, the Ministry in collaboration with key stakeholders has initiated a performance review exercise to assess the effectiveness of the current ICV strategies. It is expected that this review would lead to the identification of more initiatives.

7. How is the Oil & Gas ICV programme being replicated across other economic sectors in Oman?

The ICV programme of the Oil & Gas industry has been taken as a role model by several sectors. The ICV PMO at the Ministry has engaged and presented to various government and private entities such as, the Ministry of Tourism, Ministry of Transport and Communication, Diwan of Royal Court, The Public Authority of Privatization & Partnership, in addition to the Ministry of Commerce and Industries. ●





Plugging into solar

Occidental builds on its efforts to source solar energy for its Permian Basin operations in the United States, mirroring a similar strategy that it announced last November for its Mukhaizna operations in Oman

On 3rd October 2019, Occidental announced the start-up of the company's first solar facility to directly power an enhanced oil recovery field operation in the Permian Basin in the United States – a landmark event that also bodes well for the equally ambitious plans of its wholly owned Oman subsidiary – Occidental of Oman – for the speedy implementation of a mega solar thermal energy plant to support its heavy oil operations in the Mukhaizna oilfield in the Sultanate.

The parent company, through its Oxy Low Carbon Ventures (OLCV) subsidiary, also announced that it has signed a long-term power purchase agreement for 109 MW of solar energy, beginning in 2021, for use in its Permian operations.

“Occidental is taking an important step toward realizing our aspiration to become carbon neutral through the use of emissions-free solar electricity,” President and CEO Vicki Hollub said. “Using solar energy in our operations is another way Oxy Low Carbon Ventures is enhancing the profitability and sustainability of our business while meeting the challenge of reducing atmospheric greenhouse gases.”

The Goldsmith field solar facility, built by Occidental in Ector County near Odessa, Texas, expands on the company's commitment to economically lower its carbon footprint by using emissions-free power sources in operations. The 120-acre field is the first large-scale solar facility of its kind to directly power oil and gas operations in Texas and features 174,000 photovoltaic panels with a total capacity of 16 MW – enough to power the operations at the Goldsmith field. First Solar manufactured the photovoltaic panels and is under contract with OLCV to operate the facility.

OLCV also recently signed a 12-year solar power purchase agreement with

“ THE PROPOSED SOLAR PROJECT COULD SAVE MORE THAN 800,000 TONS OF CARBON DIOXIDE (CO₂) EMISSIONS EACH YEAR

a joint venture between Macquarie's Green Investment Group (GIG) and Core Solar LLC, whose solar project in West Texas will be oper-

ational in 2021. GIG is a specialist in green infrastructure principal investment, project delivery and the management of portfolio assets and related services and Core Solar is a developer of utility scale solar plants.

“As the top producer in the Permian, we are focusing many of our low-carbon investments and projects in the region with the goal of becoming the leader in producing lower-carbon energy,” OLCV President Richard Jackson said. “The solar facility and long-term solar power agreement further enable us to realize cost efficiencies and reduce the carbon intensity of our operations through the use of lower-carbon electricity, which together are ultimately expected to eliminate more than 160,000 tons of CO₂ emissions each year.”

Mukhaizna solar thermal farm

Last November, Occidental of Oman announced the signing of a Memorandum of Understanding (MoU) with GlassPoint Solar, the leading supplier of solar energy to the oil and gas industry, for the development of a large solar thermal energy plant, exceeding two gigawatts, at the Mukhaizna oilfield in central Oman.

As the lead developer of the proposed project, GlassPoint will deploy its proven solar technology to produce up to 100,000 barrels of solar steam per day. The solar steam would be purchased by Occidental and used to

facilitate production of heavy oil. With preliminary studies complete, engineering work has now commenced to define the project scope and field integration plans.

GlassPoint's solar steam generators use large mirrors to concentrate sunlight and boil oilfield water into steam. Occidental of Oman would purchase the steam under a long-term off-take agreement, providing a cost-effective, zero-emissions alternative to steam generated using natural gas. The proposed solar project could save more than 800,000 tons of carbon dioxide (CO₂) emissions each year.

Occidental Petroleum's global strategy includes active investment in CO₂ EOR and carbon capture, utilization and storage (CCUS), as well as other emissions-reducing technologies. This low emissions energy utilization project and approach is one aspect being explored and commercialized by Occidental's Low Carbon Ventures business unit in partnership with asset teams across their global operations. This project will enable technical learning and commercialization success to promote similar projects in other areas to help reduce Occidental's global carbon footprint.

The partnership between Occidental of Oman and GlassPoint Solar is expected to deliver significant benefits for the Sultanate's economy, as well as the environment, said Dr. Mohammed bin Hamad Al Rumhy, Minister of Oil and Gas, in a statement on the occasion.

"As we continue to diversify Oman's economy and develop the renewable energy sector, we are also identifying ways to save our natural gas resources. Oman's vast heavy oilfields present one of the largest opportunities to deploy solar energy and conserve gas, which can instead be used to fuel industries and generate power. We're pleased to see this progress between Occidental of Oman and GlassPoint, which can deliver substantial economic and environmental benefits to the Sultanate," he said.

Operating in Oman for more than 30 years, Occidental of Oman is the largest independent oil producer in the country. At the Mukhaizna field, Occidental of Oman has implemented one of the world's largest steam flood projects for enhanced oil recovery (EOR).



“ THE GLOBAL OIL AND GAS INDUSTRY CONSUMES AN AMOUNT OF ENERGY EQUAL TO 10% OF ITS OWN PRODUCTION, MAKING IT ONE OF THE BIGGEST MARKETS FOR RENEWABLE ENERGY

US-based GlassPoint Solar is a leading player in the global solar industry credited primarily with pioneering technology to help upstream producers harness the sun's limitless energy to generate steam for hydrocarbon production. The global oil and gas industry consumes an amount of energy equal to 10% of its own production, making it one of the biggest markets for renewable energy. Operating worldwide from the Middle East to the Americas, GlassPoint's enclosed trough technology delivers the lowest cost energy to power oilfield operations. By harnessing sunshine, instead of burning natural gas or other fuels, GlassPoint technology helps oil producers reduce operating expenses while significantly cutting greenhouse gas emissions. ●

Are hydrocarbon investments riding on a high wave with buoyant oil prices?

Muscat-based Oil & Gas expert **Mohammed Al Riyami** reviews the performance of the world's top five IOCs and discusses their strategies to overcome challenges such as oil price volatility, capital expenditure, climate change targets, and so on, in order to be sustainable



The oil and gas industry has had its fair share of oscillations in terms of price fluctuations, investments acquisitions and some oil majors offloading non-performing assets during the last few years. Oil majors, whether government or independent, were under so much pressure to reduce operating costs on the back of depleted oil and gas prices. As we moved into 2019, we have recorded an upward swing and oil prices in Q1 2019, the highest since 2009. There is a strong consensus that oil prices are going to average around \$60 - \$75 per barrel in 2019. However, with geopolitics at play, anything could happen with supply, demand and prices. At this juncture it would be prudent to reflect on the performance of some of the top International Oil Companies (IOCs) in 2018 and try to ascertain how they move forward in meeting some of the challenges like volatility, reducing global warming, eroding talent pool, and so on.

Performance of 5 top IOCs in 2018

In 2018 we saw prices rise up to \$85 per barrel and the levels of optimism increase. As mentioned earlier, oil prices have oscillated up and down. This is evident with price for the average Brent in 2016 at \$43.69 and rising to \$71 in 2018. In general, the IOCs had good financial performances compared to previous years. This is on the back of 2017 world GDP of 3.8% and an estimated GDP of 3.7% for 2018 as indicated in Internation-

al Monetary Fund (IMF), World Economic Outlook (WEO) in January 2019.

During 2017 to 2018, we have seen a lot of activity from OPEC and OPEC+ in reducing production of around 1.5 million barrel per day and prices have propped up. There have been job cuts and maybe some valuable experience has been lost in the lean time. Albeit, the main aim of the IOCs was to remove duplication, and create synergies in order to get more value addition. A simplified 2018 performance snapshot for BP, ENI, ExxonMobil, Shell and Total is given below.

The table below clearly demonstrates that IOCs had positive increased income in relation to 2017. On the investment side, acreage and other assets on the portfolio was added like Maersk Oil for Total in UAE. BP had six upstream projects that came upstream in 2018. Albeit, BP also had some divestments of \$3.5 billion in 2018.

Optimism in 2019 has been quite high and this is reflected with Brent oil price hitting \$71 per barrel in March to April 2019. According to the Dubai Mercantile Exchange (DME), Oman Crude Futures June 2019 delivery price is \$70.75. In relation to Oman 2019 budget, oil is estimated at \$58 per barrel, further fueling economy growth as hydrocarbons account around 70% to 74% of revenues.

Overall the world GDP is expected to grow, with a slight expansion of 3.5% in 2019 and 3.6% in 2020. At this point, we go back to



Mr. Mohammed Al Riyami,
Senior Manager,
Oman Society for
Petroleum Services

Table 1: 2018 Performance of 5 top IOCs (BOE denotes barrels' oil equivalent)

IOC	Net Income \$ in billion (2018)	Increase from previous year	Return on Capital Employed	Investment \$ in billion	Prod. /day Proved Reserves in BOE
BP	\$12.7	>50%	11.2%	\$15 - \$17 for couple yrs	3.7 million/d 19.9 billion
Exxon	\$20.8	>38%	9.2%	0%	3.83 million/d 24 billion
ENI	\$11.1	+25%	8.5%	\$8.6	1.85 million/d 7.2 billion
Shell	\$23.35	+80%	7.6%	\$25 billion	3.66 million/d 11.6 billion
Total	\$13.6	+28%	11.8%	\$15.6	2.8 million/d

All table figures are taken from company websites and P&L statements (unaudited).

the world's top 5 IOCs and examine their strategies and a few key deliverables that aim to overcome the challenges like volatility, climate change targets and to be sustainable.

Many of the IOCs have reviewed their portfolio and are changing their working model and invariability moving to a more integrated model across the value chain. Additionally, there is a distinct trend to increase gas and LNG footprint with acquisitions. As an example, Total in April 2019 signed a Heads of Agreement with Oman's Ministry of Oil & Gas for exploring gas in Block 12. This is demonstrating the ethos of cleaner fuels and most IOCs are also tapping into renewables like solar and wind. This supports the Paris Climate Agreement in reducing greenhouse gas emissions.

On the capital discipline side, many IOCs are concentrating to reduce their debt, buy back shares and reduce operating cost to paint a better profit and loss account financial position. The trend of good cost cutting and lean operations will most likely continue to meet key deliverables. Albeit capital expenditure is likely to go up.

The information presented clearly shows that IOCs have benefitted from improved oil prices. This has affected how operations are conducted with due regard to internal and external factors like volatility, trade

tensions and climate targets. As we move forward, negative tariff in USA and China will affect IOCs, coupled with supply and demand dynamics. Crude oil prices from January to August 2019 have hovered to \$65.05 for ICE Brent and \$64.64 for DME Oman. However, we can expect to see oil prices within \$60 - \$75 range in 2019 and early 2020, though this not a done deal.

On the cost side, global oil and gas capital expenditure should go up. According to PwC, Barclays and Rystad Energy, capital expenditure in 2018 is \$415 - \$418 billion and this will rise to \$530 billion by 2020.

IOCs will have to continue to take prudent steps in the years to come and this was highlighted in Petroleum Review February 2019:

- Capital discipline to remain a key deliverable
- Innovation through investment to improve productivity
- Portfolios need to be reviewed and realigned
- IOCs to continue to attract talent to deliver growth
- IOCs strategies to be agile

Therefore, we can say the buoyant oil prices have spurred on investments in the hydro-carbon sectors in a challenging landscape. ●

Table 2: IOC strategies for 2019 and beyond

	Value chain Energy Integration	Energy transition Increase Gas	Capital Discipline	Key Deliverable (As per strategy statements)
BP				<ul style="list-style-type: none"> • Growing Gas • Market Growth in Downstream • Modernize Group
Exxon				<ul style="list-style-type: none"> • Tapping Technology • Scale & Integration • Portfolio improvement
ENI				<ul style="list-style-type: none"> • Value Expansion to 2021 • Decarbonization & Sustain. Financial Plan • Dual Exploration
Shell				<ul style="list-style-type: none"> • Add Value • Thrive in Energy Transition • Strong License to Operate
Total				<ul style="list-style-type: none"> • Move 50% to 60% gas production • Integrated gas & low carbon electricity • LNG Acquisition

Mid – High High

Data from company website and own analysis

[Reproduced & modified from Al-Markazi, magazine of the Central Bank of Oman]



Can Oman turn its plastic waste into fuel?

A joint research project by the German University of Technology in Oman and Oman Oil and Orpic Group - the Sultanate's integrated energy powerhouse - seeks to study the commercial feasibility of converting plastic waste into fuel - an initiative that has beneficial implications for the growth of a vibrant Circular Economy in Oman

While international experts have longed championed recycling as a panacea to the increasingly nightmarish problem of plastic waste polluting our environment, Oman has adopted a more practical, and potentially profitable, option to address this challenge. In plastic waste, it sees the opportunity to convert it into a 'green fuel' and thus commercialize a commodity that has ended up, thus far, in landfills across the Sultanate.

Now a joint project by the German University of Technology in Oman (GUTech) and Oman Oil and Orpic Group aims to change the dynamic around plastic waste.

In August, the two sides signed a Memorandum of Understanding to collaborate on research projects, internship opportunities for engineering students, professional seminars and any other activities that may support enriching the knowledge of the students. The MoU was signed by Prof Dr Michael Modigell, Rector – GUTech, with Mr. Gilles Rochas, GM - Polymer Marketing – Orpic.

Mr. Rochas commented: “Orpic’s production of polyethylene (PE) and polypropylene (PP) is about to increase to 1.4 million tons by next year; this collaboration with GUTech is so timely and instrumental in accelerating the execution of the circular economy agenda in the country.”

“Our aim is to develop a novel and innovative process that provides a technical solution to one of the most persisting environmental problem in Oman and in the world. The new process will offer a sustainable solution for recycling million tons of plastic waste in Oman,” said Prof Dr Najah al Mhanna, Head of the Engineering Department at GUTech. He added that one the first joint projects will be a research project focusing on the conversion of plastic waste to fuel.

OPAL Oil & Gas spoke to Dr Al Mhanna on opportunities for ‘Plastic Waste to Fuel’ conversion:

1. In your view, why is plastic waste conversion into fuel a good route for addressing the plastic pollution challenge?

Dr. Al Mhanna: In addition to the economy factor in selecting the technology of plastic waste management, reducing the emission of CO₂ and other chemical pollutants must be one of the plastic recycling goals. Today’s recycling infrastructure and technologies (e.g., mechanical recycling and chemical transformation to chemical products) still cannot address the challenge of processing diverse types of plastic waste. For instance, mechanical recycling requires the plastic waste to be sorted and size reduction before it uses in production of lower value products (e.g., carpet fibres, bags, clothes, etc). Such process doesn’t offer an actual recycling solution. It is just adding one more production step that has no recycling benefit after use. Another example, if polyvinyl chloride (PVC) contaminates (less than 0.01%) the PET recycling stream, the resin product becomes yellowish, brittle and eventually degradable.

Moreover, the chemical transformation to chemical products (converting plastic to feedstock and then produce valuable chemicals) is still in lab scale phase, where technical and economy studies have to be developed. The produced feedstock product cannot compete with original raw material used in plastic production.

However, pyrolysis plastic waste to fuel process can handle and manage a complex stream of mixed plastic wastes. Thus, the technology doesn’t require sorting the plastic waste, which will decrease significantly the production cost and show the feasibility of the process.



Dr. Al Mhanna: Diverse types of plastic wastes (e.g., Polyethylene terephthalate (PET), High-density polyethylene (HDPE), Low-density polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS)) can be converted into fuel. The concern in Polyvinyl chloride (PVC) pyrolysis is the Hydrogen chloride (HCl) production and the presence of chlorobenzene, which needs a further step of de-chlorination of PVC to reduce the chlorine contents.

The composition of each plastic determines its final product after pyrolysis



Dr. Najah Al Mhanna,
Head of the Engineering
Department at GUtech

2. Please shed light on the technological options for converting plastic waste into fuel.

Dr. Al Mhanna: Pyrolysis plastic to fuel reactor operates at relatively moderate temperature 400-550 °C in the absence of oxygen. Therefore, this thermal decomposition reaction has very low emission rate since no oxidation reaction happens. The pyrolysis reaction depolymerizes the polymer long chains into small molecules. Three main products (gas, liquid, and solid) are produced during the process. The gas and liquid products (which represent approx. 90% of the plastic waste mass) are petroleum fuels that can be collected and used in other applications (e.g., as a source of energy or as a feedstock for chemicals production). For instance, the produced gas stream (propane, ethane and methane) can be recycled back to produce heat for the process, while the liquid fuel needs to be further processed to meet the transport fuel quality. The solid (which is called char) is a pure carbon waste. However, its quantity is very small.

3. What is your assessment of plastic waste generation in Oman?

Dr. Al Mhanna: Plastic waste contributes in 20+% of approximate 2 million tons municipal solid waste (MSW) that is generated in Oman annually. There isn't any recycling infrastructure available in Oman to process plastic waste. Therefore, most of the plastic waste ends up in landfills or in incineration. Consequently, management of this waste urge the need to develop an approach to recover the value of such resource.

4. Will all kinds of plastic waste be suitable for conversion into fuel?

“ PLASTIC WASTE CONTRIBUTES IN 20+% OF APPROXIMATE 2 MILLION TONS MUNICIPAL SOLID WASTE (MSW) THAT IS GENERATED IN OMAN ANNUALLY. THERE ISN'T ANY RECYCLING INFRASTRUCTURE AVAILABLE IN OMAN TO PROCESS PLASTIC WASTE

process. Therefore, the percentage of gas, liquid and solid in the product will vary according the plastic waste feedstock chemical properties.

5. What is the commercial potential for fuel production form plastic waste in Oman in the future?

Dr. Al Mhanna: Oman is one of the main oil producers. Leading the petrochemical and plastic manufacturing is the goal of many oil producer countries. Therefore, finding a circular solution for the plastic waste will make Oman setting an example in waste management as a key factor in mitigating adverse effects of landfilling and the emission from incineration. Furthermore, converting plastic waste to fuel will provide an opportunity for plastic management in Oman by exploring fuel technology by examining the potential uses and applications of the produced fuel. Consequently, our work focuses on developing a novel and innovative process that provides a technical solution by integrating processes and energy. It will address one of the most persisting environmental problem in Oman and in the world. The process will open the opportunity to recycling million tons of generated plastic waste in Oman. Thus, the technique has a great potential to be commercialized. ●

Bustling post-summer schedule at OPAL

The past four months have been frenetic for OPAL's Interim CEO Fathy Al Mendhry and his executive team as they pulled out all the stops to deliver on an array of commitments, not least the 3rd OPAL Oil & Gas Conference 2019 (OOGC) - the signature fixture of the Society's annual calendar of high-profile events



Having already delivered two hugely successful editions, this year's OPAL Oil & Gas Conference (OOGC) should have been a metaphorical 'walk in the park' for OPAL and its partner agency, Oman Expo, tasked with putting together yet another installment of the Society's distinctive annual forum.

But when the bar is set high from the outset, and coupled with the fact that the post-summer season has seen a sharp spike in industry conferences and expos, the self-imposed challenge to lay on a standout forum can be daunting indeed for the organizing team.

Albeit as any well-established event organizer will vouch, piecing together – and nailing down – all of the elements of a conference, not least the guests of honour, keynote speakers, presenters, moderators and panelists, can be overwhelming, to say the least. Particularly so, when the conference features an unprecedented seven sessions each dedicated to a topic of immense relevance to our industry's rapidly evolving landscape.

"It has been a taxing time for our core team," said Mr. Fathy Al Mendhry, Interim CEO – OPAL. "But we were determined to lay on an event that not only surpasses in scope and content the previous two editions, but set new benchmarks in the process. In the end, we were satisfied that this year's forum, entitled 'Shaping the Future of Oman's Energy Sector', brings together rich content, thought leadership, and networking opportunities."

Scheduled to be held during 21 – 22 October 2019 at the Oman Convention and Exhibition Centre in Muscat, the two-day OOGC 2019 forum is an opportunity for OPAL members and industry professionals alike to hear winning strategies and solutions

to challenges besetting the sector, said Mr. Al Mendhry.

The diverse and comprehensive scope of the conference, organized into seven different sessions, is noteworthy. These sessions focus on the following sub-themes: (a) Offshore Development (b) Renewable and Future Energy Spotlight (c) ICV Human Resource and Training (d) Future Commercial Outlook (e) HSE in Oil & Gas (f) IoT in Oil and Gas, and (g) Advanced Technology in Oil & Gas. This ensures that just about every industry professional, regardless of their professional background, has something to look forward to during the two-day forum.

Best Practice Awards

As is usually the case, activity levels peak at OPAL even as the year draws to a close. The next big event being lined up is the eagerly awaited and exceptionally popular Best Practice Awards.

Introduced for the first time in 2016, the Best Practice Awards recognize and applaud excellence in a number of key areas of business service and innovation. Organised as standalone events since inception, they were clubbed with the OPAL Oil & Gas Conference last year. However, in response to requests from members seeking adequate time to plan their participation in this prestigious show, it was decided to present it as a standalone event this year, according to the Interim CEO.



Mr. Fathy Al Mendhry,
Interim CEO – OPAL

“ INTRODUCED FOR THE FIRST TIME IN 2016, THE BEST PRACTICE AWARDS RECOGNIZE AND APPLAUD EXCELLENCE IN A NUMBER OF KEY AREAS OF BUSINESS SERVICE AND INNOVATION. ORGANISED AS STAND-ALONE EVENTS SINCE INCEPTION, THEY WERE CLUBBED WITH THE OPAL OIL & GAS CONFERENCE LAST YEAR



The OPAL Best Practice 2018 Awards proved to be as popular as the standalone version of the event.

“The event is an opportunity for our members to celebrate best practices and disseminate company achievements in the industry. Our desire is to encourage business improvement, HSSE standardizations, and highlight the importance of our own ‘OPAL Best Practices,’” said Mr. Al Mendhry.

Proposed categories in this year’s Best Practice Awards are as follow:

- (a) Omanisation:** Most innovative policies and procedures implemented towards recruiting, developing and retaining Omani workforce.
- (b) Health & safety:** To have successful HSE practice that has minimized risk to fatal injuries, damage to assets, reputation. Also, to change people behavior and improve safety culture.
- (c) Environment:** Practices that have significant positive impact in reducing emissions, saving water, electricity and reduction of waste.
- (d) Energy transition:** Evidence of companies committed to Paris Agreement. Adopters of energy efficiency initiatives like use of renewables and better management of energy, thereby minimizing carbon footprint.
- (e) Operational Excellence:** Technically

recognized as best practice in industry, using innovative approaches or techniques that improved the operational efficiency and effectiveness in terms of reduced resources, time, and or scale of economy, improve profitability so as benefitting the company and industry.

(f) Omani Products & Services: Companies who maximize the use of locally manufactured products and or services that retain and improve local business partnership and supply chain.

(g) Research & Development: Sustained research and development activities that are developed or promoted or implemented for the benefit of the oil and gas operations that enhance production without impacting the safety and environment.

OPAL Sports Week

On the heels of the Best Practice Awards is planned the equally popular OPAL Sports Week. As with previous editions, this year’s Sports Week is spread over several weeks across November and December, says Fathy. “The underlying goal is to enable our esteemed members to connect together outside the office environment. Conceived as a fun-filled, family-oriented extravaganza,



the Sports Week features a range of activities designed to promote a healthy work-life balance, interest in sports, and positive attitudes. OPAL has lined up interesting sport events, such as mountain biking, football, cricket and bowling. We are also thinking of having a family day for parents and their children.”

Over the past six months, OPAL has made considerable progress in advancing a number of important initiatives linked to its HSE objectives. These achievements can be summed up as follows:

- a) Approval of vehicle inspection workshops to ensure vehicles safety through the Roadworthiness Assurance Standard (RAS)
- b) Unification of Defensive Driving Training standards across the Oil & Gas sector and the introduction OPAL Driver Permit that would be recognised by all Operating companies
- c) The approval process of suppliers of IVMS systems through a process of rigorous evaluation to ensure their reliability and quality carried out by a group of technical expertise.

Furthermore, a number of initiatives were implemented in support of OPAL’s Human Capital Development objectives. Notable is

an ICV workshop organized by OPAL for over 35 candidates from member companies. The Society also supported Outward Bound Oman in the delivery of three sets of upskilling courses for OPAL TFE Trainees. Additionally, OPAL awarded and launched four sets of Training for Employment (TFE) programmes benefiting over 200 Omanis.

OPAL continues to build on its portfolio of HSE standards for the Oil & Gas industry. This year, two new HSE standards will be launched: (i) ‘Fitness-To-Work’ that defines requirements of employees to be assessed for their physical and mental fitness during pre-employment stages, while in employment and rejoining the work after chronic illness and post-injury conditions, and (ii) ‘Lifting Inspection and Operations’ standard specifying the requirements that must be in place while planning and execution of lifting operations.

Several initiatives have also been completed in support of its Quality mark objective. These initiatives pertain to (i) OPAL STAR Learning hub enhancement (i) OPAL STAR Recognition audits (iii) OPAL STAR Course approval audits (iv) Issue of Compliance Verification certificates, and (v) Standardization of training programmes, the Interim CEO added. ●

Driven by success from previous editions, this year’s Sports Week is spread over several weeks across November and December.

Addressing the diversity challenge in energy sector recruitment

by Bipasha Baruah, IEA Analyst

One of the enduring legacies of women's traditional exclusion from the energy sector is the continued disadvantage women and girls face in comparison to their male counterparts in accessing information about employment and industry trends. In a volatile industry, such information and access to networks and training can make a significant difference in recruitment or advancement. A lack of information also means that the barriers faced by women in conventional sectors, such as oil and gas, can persist in their emerging counterparts, such as clean energy.

Employment in the energy sector can be volatile. Fluctuations in world energy prices; growth of the sector in emerging economies and developing countries; the politics of climate change and energy transitions; conflicts over land and water resources with Indigenous populations; new resource discoveries; and technological change all have the potential to shake up the industry. Being aware of the implications of these changes is key to building a successful career.

Men working in the fossil-fuel industry tend to be relatively well informed about such changes. Based on this knowledge, some are seeking out opportunities in the clean energy sector in higher numbers, and earlier than people employed in other sectors. For example, 25 percent of students studying to be wind turbine technicians at the Lethbridge College Wind Turbine Technician program in Alberta, Canada were once oil and gas workers. Recent media reports in Canada also note that oil and gas workers in Alberta are increasingly seeking and finding employment in the clean energy sector.

Another aspect of the information imbalance is a lack of awareness about the range of occupations, specializations and fields within the energy sector. The energy sector is more than just engineers, research scientists or equipment installers – the sector draws upon expertise and skills from diverse backgrounds in environmental science, ecology, conservation, engineering, business management, law, public policy and finance, to name just a few.

There are ways to account for these various imbalances, such as direct access to industry insiders or building connections through mentoring, outreach presentations and visits, site tours, student networks, temporary work placements and so on. The industry can play a role here, supported by gender equality advocacy organizations in the energy sector such as Women in Oil and Gas (WIOG), Women in Renewable Energy (WiRE),



Women of Renewable Industries and Sustainable Energy (WRISE) and Women in Clean Energy (WICE).

Making training and education in the energy sector more versatile to enable intra-sectoral and inter-sectoral transferability is also a promising strategy and there is already some movement in this direction. For example, post-secondary institutions in US and Canada are looking for ways to deliver graduates with skills that are transferable across broader energy industry sectors rather than delivering petroleum-specific or renewable energy specific programs.

Such changes may enable the energy sector to employ and retain more women and young workers. A survey conducted by Ernst & Young in 2017 of 1200 Americans below the age of 20 revealed a significant gender gap: a much greater percentage of young men found oil and gas appealing compared to young women – 54% versus 24% respectively. In the same survey, 62% of respondents said a career in oil and gas was unappealing or very unappealing. In contrast, two-thirds of those polled, with no significant gender difference, said that a job working in renewable energy was appealing.

Reports from around the world warn of a looming skills gap as both industrial-

“ THE ENERGY SECTOR IS MORE THAN JUST ENGINEERS, RESEARCH SCIENTISTS OR EQUIPMENT INSTALLERS – THE SECTOR DRAWS UPON EXPERTISE AND SKILLS FROM DIVERSE BACKGROUNDS IN ENVIRONMENTAL SCIENCE, ECOLOGY, CONSERVATION, ENGINEERING, BUSINESS MANAGEMENT, LAW, PUBLIC POLICY AND FINANCE, TO NAME JUST A FEW

ized and emerging economies retool their existing industries and seek out new opportunities for creating employment. In virtually all areas of the energy sector, there are skills shortages and calls for additional training. These shortages cover a wide range of different occupations, from engineers and architects to skilled trades, equipment operators, technicians and construction labourers. Skills shortages also vary by country, by region, and by technologies.

Although these skill shortages present challenges for labour supply, they also represent an opportunity to train and recruit women, visible minorities, Indigenous peoples, new immigrants and other groups that have historically been marginalized in the energy sector. ●

District cooling can save US\$1 trillion in energy costs worldwide

The penetration rates of district cooling and stand-alone air or water chillers are 15 to 25 percent in GCC countries, compared to 2 percent in the rest of the world

Global demand for air-conditioning is projected to triple over the next 30 years, with most of this demand emanating from developing countries, according to international forecasts. Meeting this demand will be expensive, says the “Cooling our World” study released by Strategy& Middle East, part of the PwC network. To keep costs under control, the study recommends deploying district cooling where appropriate in developing countries as this could lead to over US\$1 trillion in energy savings worldwide through 2035.

Among the factors for this rise in demand are higher population growth, greater household disposable income, higher living standards and rapid urbanization. The growth of urban areas, in particular, leads to “heat islands” that are much warmer than surrounding rural areas because appliances and machinery generate heat when used and increase the local temperature. Although international forecasts anticipate that improvements in the energy efficiency of traditional cooling technologies can prevent unsustainable electricity demand, the volume of additional demand may simply be too great, which is why developing countries should consider district cooling.

According to the Strategy& Middle East report, district cooling is an efficient means of providing cooling in appropriate areas. District cooling aggregates demand and uses the most energy efficient technology to cool high-density developments, whilst using less energy than even the most efficient stand-alone systems.

Speaking about the benefits of district cooling, George Sarraf, Partner and Managing Director of Strategy& Middle East, said: “Gulf Cooperation Council (GCC) countries have been early adopters of district cooling, and can be the benchmark for other countries. We estimate that worldwide, increased adoption of district cooling could reduce energy consumption by up to 5,000 terawatt-hours over the next 16 years, representing \$1 trillion in cost savings by 2035, assuming that energy prices are \$0.20 per kilowatt-hour. This is a significant reduction and builds the case for using district cooling because it is energy efficient method and cost effective.”

District cooling systems consume 20 to 30 percent less power than the most efficient conventional cooling solution, and 60 to 80 percent less power than the average conventional cooling system. Additionally, district cooling can reduce peak power capacity by up to 30 percent on average (with an additional 20 percent reduction that can be unlocked through

thermal energy storage).

“A key advantage of district cooling comes from aggregating demand, ideally among multiple buildings that combine residential and commercial spaces. The result is a higher cooling density – a measure of the maximum amount of energy required to cool a specific area, directly related to the population density and the type of occupied space in the area to be cooled. As cooling density grows, the unit cost of district cooling decreases, while the cost of conventional technologies remains relatively flat,” said Christopher Decker, Senior Executive Advisor, Strategy& Middle East.

Interestingly, the penetration rates of both district cooling and stand-alone air or water chillers are higher in GCC countries than in the rest of the world, representing 15 percent to 25 percent of the total installed cooling capacity in the region. This high adoption rate stems from two factors: recent real estate development, and the need to minimize the cooling load during the hot summer days, when cooling load could represent up to 70 percent of peak electricity demand in some countries. Furthermore, Strategy& Middle East forecasts of urban plans show that district cooling is feasible in about 40 percent of new-build communities. The percentage is even higher for the mega-developments in GCC countries, which are ideal candidates for district cooling.

Strategy& Middle East outlines the environmental and real estate benefits of district cooling, which include:

- **Reduced emissions;** Less energy consumption because district cooling is efficient, consequently reducing CO2 emissions from existing fossil-fuel-burning power plants.
- **Increased real estate values;** By removing the air-cooled chillers that occupy large areas on building rooftops, district cooling frees up space for sale or lease.
- **Improved user experience;** The availability and reliability of cooling improves, leading to a better experience for users, because district cooling systems are monitored more closely.
- **Alignment with other technologies;** Using district cooling can help with the introduction of other technologies. District cooling requires large, up-front investments, centralized man-



agement, and considerable regulation, largely the same as what is required for the adoption of other sustainability and efficiency measures, such as solar power or geothermal cooling.

Building a regulatory framework for District Cooling

“Governments play a critical role in the adoption of district cooling, because it requires significant planning to aggregate demand, protect customers, and ensure that the economic benefits are equally distributed along the value chain. Governments need to develop a holistic regulatory framework, similar to those for electricity and water utilities, as this will address the commercial, legal and technical aspects of district cooling”, said Dr. Raed Kombargi, Partner, Strategy& Middle East.

“The six part regulatory framework is vital because the necessary aggregation of demand, protection of customers, securing of the significant capital required, management of financial and demand

risks, and surmounting of other challenges will not happen through an unregulated market,” he added.

Based on the experience of GCC countries, Strategy& Middle East has developed a six-part regulatory framework, will all six elements to be implemented simultaneously:

1. **Mandate the use of district cooling where appropriate:** Make district cooling mandatory in areas or developments that meet predefined criteria. Developers opt for conventional cooling systems, or build district cooling systems that are underutilized, if they perceive insufficient demand. For this reason, governments should mandate district cooling where it is appropriate. Regulators should work closely with urban planners and identify promising areas based on an analysis of master plans and respective cooling load densities.
2. **License operators, providers, and retailers:** The regulator should license operators, providers, and retailers to ensure they have sufficient capabilities and know-how to operate in the sector. Licensing would allow regulators to control the number and quality of service providers, and take other necessary steps to ensure that customers enjoy high-quality service and effective competition and pricing.
3. **Set technical and service standards:** Regulators should introduce technical standards and specifications, design codes, and minimum performance indicators. Technical standards would cover topics such as planning, system design, distribution, metering, and operations. Service standards would establish baselines for the availability of cooling services to customers.
4. **Develop contractual frameworks:** There should be a process to stan-
5. **Establish competitive tendering process:** Introduce regulations to ensure competitive bidding and fair competition during the tendering of district cooling systems. This is necessary to eliminate monopolistic or oligopolistic behaviors and ensure a baseline of healthy competition in the market. The benefits include increased transparency, lower barriers to entry for new companies, more competitive prices, and higher-quality service to customers.
6. **Regulate prices:** Stabilize the market and protect consumer rights through regulations for price control, revenue recovery, and payment allocation. Price control would ensure healthy competition and fair pricing for district cooling services in the market; revenue recovery would ensure that prices paid by customers reflect the true underlying cost of the service; and payment allocation would ensure that charges are equitably distributed among paying entities.

“As developing countries worldwide face growing demand for comfort cooling, merely improving the energy efficiency of the existing solution will probably not suffice. Developing countries need to increase the adoption of district cooling at a national level. To ensure that this occurs to the maximum possible extent, these countries should emulate GCC countries by drafting and implementing district cooling policies,” concluded Jad Moussalli, Principal with Strategy& Middle East. ●



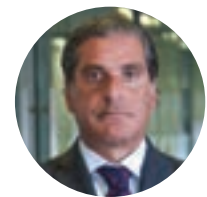
Christopher Decker
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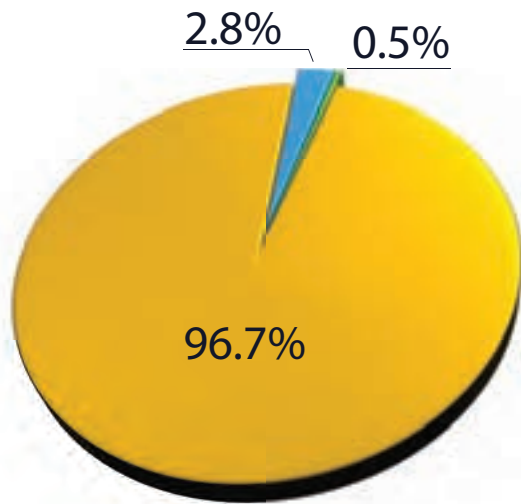
Challenges to maximizing renewables in Oman's energy mix

For the Gulf Arab states, renewables could contribute to reducing greenhouse gas emissions while also supporting economic goals of meeting increasing domestic energy demand and creating jobs

by Aisha Al Sarihi and Hafiz Bello

Climate change and increasing energy demand have prompted a global search for ways of producing less pollution-generating energy. The oil and gas rich Gulf Arab states are highly impacted by climate change and are also challenged by increasing domestic energy demand. The surge in energy demand of 5% per year on average for the Gulf Arab states has been mainly met by fossil fuel resources, namely oil and gas, which comprise nearly 99% of the total energy mix; this has been associated with regional growth in greenhouse gas emissions. Increasing energy demand has already triggered some of the Gulf Arab states, such as Oman, the United Arab Emirates, and Kuwait, to import natural gas to meet domestic energy needs. This growing demand has also affected the ability of these hydrocarbon-dependent states' economies to maintain oil and gas exports, the major sources of income. Furthermore, deficits in states' budgets due to the 2014 drop in oil prices have prompted Gulf Arab governments to seek alternative sources of income to hydrocarbon revenue. However, the Gulf states have pursued economic diversification largely through the expansion of oil downstream industries and petrochemicals, which necessitate reallocation of oil and gas feedstocks for their operation. Reallocation of oil and gas feedstocks to petrochemical industries, however, is challenging because oil and gas supplies are also needed to meet increasing demands for electricity, water desalination, and, in some cases, enhanced oil recovery. The Gulf Arab states are therefore searching for alternative energy resources, such as renewable energy. Renewables could contribute to reducing greenhouse gas emissions while also supporting the Gulf states in their economic goals of meeting increasing domestic energy demand and creating jobs. However, renewable energy remains extremely underutilized in the Gulf Arab states: By the end of 2018 renewables accounted for a mere 0.6 percent of total electricity capacity. In Oman, for instance, the share of renewables in total electricity capacity was around 0.5 percent in 2018 despite ambitious plans of sourcing 10 percent of electricity from renewable energy sources by 2025. Natural gas is the main fuel used for electricity generation, constituting nearly 96.7 percent of the country's energy mix.

Types and share of fuel used for electricity generation in Oman



■ Natural gas (Urban areas) ■ Diesel (Rural areas) ■ Renewable energy

Source: Authors' calculations

Aware of the economic, social, and environmental challenges associated with 100% reliance on hydrocarbons, the Omani government has started focusing on developing alternative energy resources, such as renewables. In 2008, Oman's Authority for Electricity Regulation launched a study to assess the potential renewable energy resources in the country. It found significant available resources, especially wind and solar. The study indicated that 50% of houses in Oman, with 20 square meters of available roof area, are suitable for solar photovoltaic installation; utilizing the total available area would provide space for an installation capacity at around 420 megawatts. Also, the study indicated that around 100

square miles of desert area (0.1% of the country's land area) could be utilized to build concentrated solar power plants, providing around 2,800 megawatts of solar energy capacity.

Additionally, the installation of 375 wind turbines, each with 2 megawatts of capacity, would have the generation potential of at least 750 megawatts; this would require a wind farm land area of nearly 40 square miles. If all available solar and wind resources are harnessed, a total 3,970 megawatts of electricity could be generated from renewables – around 48.2% of total installed electricity capacity in 2018.

The release of the 2008 study sparked interest among investors, researchers, and other governmental entities in Oman in renewable energy research and development. In 2017, Oman launched two policy initiatives and the Oman Power and Procurement Company signed a power purchase agreement for the first utility-scale 50 megawatt wind-based renewable project in southern Oman. The first policy initiative, Sahim, allows entities such as homeowners and commercial buildings to install rooftop solar photovoltaic systems to produce solar electricity for their own use and to sell surplus energy to electricity distribution companies.

Secondly, Oman announced a national renewable energy target, which aims to source 10% of total electricity generation capacity from renewables by 2025. Oman's installed renewable energy capacity increased from 1 megawatt in 2014 to 8 megawatts by the end of 2018. Oman's progress toward incorporating renewables is in line with its commitments to the Paris Agreement, which it signed in April 2019, and its target of reducing greenhouse gas emissions by 2% set in its

Proposed renewable energy integration scenarios through 2040

Scenario	Scenario assumptions				
	Solar Photovoltaic	Concentrated Solar	Wind	Total Renewables	Fossil Fuels
Business as Usual	0%	0%	0%	0%	100%
Moderate	2%	3%	5%	10%	90%
Advanced	10%	10%	10%	10%	70%
Ambitious	10%	20%	20%	50%	50%

nationally determined contribution.

In considering increasing renewable energy adoption in hydrocarbon-rich states, it is important to explore the interactions between renewable energy and economic, social, and environmental domains. This can help to measure the role of renewables in addressing the challenges of energy security, job creation, and reducing carbon emissions.

In the case of Oman, considering four scenarios with different degrees of integration of renewable energy sources in the sultanate's energy mix (including solar photovoltaic, concentrated solar, and wind power) shows varying impacts on levels of hydrocarbon consumption, carbon dioxide emissions, and job creation. These scenarios include a business-as-usual situation in which there is no additional incorporation of renewables as well as moderate, advanced, and ambitious scenarios, with 10%, 30%, and 50%, respectively, of electricity generation sourced from renewables through 2040. The ambitious scenario is estimated at 50% renewable energy integration in line with the 2008 Authority for Electricity Regulation's findings projecting that, if harnessed fully, renewables could meet 48.2% of Oman's total electricity installed capacity. Also, solar photovoltaic remains at 10% in the advanced and ambitious scenarios due to its potential to meet only 10% of Oman's total electricity installed capacity.

By 2040, in the business-as-usual scenario, the use of natural gas for electricity generation could increase by 28% compared with 2010. In comparison to the business-as-usual scenario, in the moderate, advanced, and ambitious scenarios, there could be 27%, 46%, and more than 64% less natural gas consumption, respectively. Furthermore, if no renewables are included in the future energy mix, carbon dioxide emissions are expected to significantly rise. Under the current growth rate of natural gas consumption for power generation, in the business-as-usual scenario, total carbon dioxide emissions are expected to rise by 400% from 2010 to 2040.

The integration of renewables, however, could reduce carbon dioxide emissions in comparison to the business-as-usual scenario by more than 20%, 40%, and 58% in the moderate, advanced, and ambitious scenarios, respectively. In terms

of job creation, given the increase in the renewable energy share in Oman's energy mix in the moderate, advanced, and ambitious scenarios, the employment in installation, operation, and maintenance of renewable energy technology would increase correspondingly. Concentrated solar power provides the largest number of jobs over time compared with other renewable technologies, such as solar photovoltaic and wind power.

Yet, a number of barriers continue to constrain large-scale adoption of renewable energy in Oman. These include a fragmented energy policy, the lack of a comprehensive renewable energy regulatory framework, and a highly controlled energy market. To better integrate renewables into the country's energy mix, Oman needs to make institutional chang-



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“RENEWABLES COULD CONTRIBUTE TO REDUCING GREENHOUSE GAS EMISSIONS WHILE ALSO SUPPORTING THE GULF STATES IN THEIR ECONOMIC GOALS OF MEETING INCREASING DOMESTIC ENERGY DEMAND AND CREATING JOBS

es to harmonize the efforts of different energy sector entities and define accurate roles and responsibilities; develop a comprehensive renewable energy regulatory framework to promote the integration of renewables in different energy sectors, such as electricity, transportation, and industry; and gradually liberalize the energy market, which could improve decision-making processes and attract renewable energy investors.

Overcoming barriers that hinder the integration of renewables would unlock many socioeconomic and environmental advantages. However, solar and wind energy alone cannot meet all of Oman's energy needs, especially given their nature of intermittency and low technical efficiency due to high temperatures, humidity, and dust in the country. Therefore, the enhancement of a mixed clean energy profile, including off-shore wind, waste-to-energy, hydrogen, thermal, and hydropower energy sources, as well as developing smart grids and enhancing regional cooperation on renewables are promising options that need further investigation. ●



Hafiz Bello

is a doctoral researcher at Imperial College London.

New BP Chief Executive is no stranger to Oman



BP Chief Executive Bob Dudley is set to retire next March and will be succeeded by Bernard Looney, an industry veteran with an intimate understanding of the supermajor's operations in Oman, notably its signature investment, the Khazzan tight gas development in Block 61

The Board of BP announced on 4 October that, after a 40-year career with BP and over nine years as group Chief Executive, Bob Dudley, 64, has decided to step down as group chief executive and from the BP Board following delivery of the company's 2019 full year results on 4 February 2020 and will retire on 31 March 2020.

The Board also revealed that Bernard Looney, 49, currently Chief Executive, Upstream, will succeed Dudley as group chief executive and join the BP Board on 5 February 2020. Looney will continue in his current role until this date.

Commenting on the announcement, BP Chairman Helge Lund said: "Bob has dedicated his whole career to the service of this industry. He was appointed chief executive at probably the most challenging time in BP's history. During his tenure he has led the recovery from the Deepwater Horizon accident, rebuilt BP as a stronger, safer company and helped it re-earn its position as one of the leaders of the energy sector. This company – and indeed the whole industry – owes him a debt of gratitude."

On Mr. Looney's appointment, Lund added: "As the company charts its course through the energy transition this is a logical time for a change. Bernard has all the right qualities to lead us through this transformational era. He has deep experience in the energy sector, has risen through the ranks of BP, and has consistently delivered strong safety, operational and financial performance. He is an authentic, progressive leader, with a passion for purpose and people and a clear sense of what BP must do to thrive through the energy transition."

Bob Dudley commented: “It has been the privilege of a lifetime to serve this company and work in this industry for the past four decades. I have worked with so many committed people from all over the world – both inside and outside BP – and I am enormously proud of all the things we have achieved together to provide energy for the world. Bernard is a terrific choice to lead the company next. He knows BP and our industry as well as anyone but is creative and not bound by traditional ways of working. I have no doubt that he will thoughtfully lead BP through the transition to a low carbon future.”

Bernard Looney said: “It has been a great pleasure to work with Bob and it is an honour to succeed him as chief executive. I am humbled by the responsibility that is being entrusted to me by the Board and am truly excited about both the role and BP’s future. Our company has amazing people, tremendous assets, and a set of core values that guide our actions, but most of all we have a desire to be better. I look forward to tapping into that desire and building on the strong foundation that Bob has built as we meet society’s demand for cleaner, better energy.”

Incoming Chief Executive Bernard Looney has run BP’s Upstream business since April 2016 and has been a member of the company’s executive management team since November 2010.

As Chief Executive, Upstream, Bernard is responsible for all BP’s oil and gas exploration, development and production activities worldwide. The Upstream segment includes some 17,000 people operating across almost 30 countries and produces around 2.6 million barrels equivalent of oil and gas a day.

The Khazzan development

Late last year, Mr. Looney led a group of top-flight upstream investors on a first-of-its-kind visit to the Sultanate that underscored the importance of its signature investment, the Khazzan tight gas development, in its global operations.

BP is the operator of the block with a 60 per cent equity interest. Oman Oil Company Exploration & Production (OOCEP), the upstream arm of Oman Oil Company, is a shareholder (30 per cent). Malaysian state-owned energy firm Petronas has also acquired a 10 per cent stake from OOCEP.

Khazzan, representing Phase 1 of an estimated \$16 billion investment that BP and its shareholders are making in Block 61, currently delivers 1 billion cubic feet (bcf) per day of gas into the Sultanate’s gas grid. Ghazeer, representing Phase 2 of this landmark project, will boost output to 1.5 bcf per day when it is brought into operation in 2021.

Mr. Looney described the visit was a testament to the “extraordinary” partnership that BP has forged with the Omani government in unlocking Khazzan’s tight gas resources in Block 61 in central Oman.



Bernard Looney,
currently Chief
Executive, Upstream,
BP

“ AS CHIEF EXECUTIVE, UPSTREAM, BERNARD IS RESPONSIBLE FOR ALL BP’S OIL AND GAS EXPLORATION, DEVELOPMENT AND PRODUCTION ACTIVITIES WORLDWIDE

“This visit exemplifies BP’s strategy in Oman,” said Mr. Looney. “It’s about early access, which occurred back in the 2007. It’s about very strong execution as reflected in the transfer of technology and learning from across BP, particularly in this example from North America, and it’s about growth in the future. Indeed, our business here in Oman, in collaboration with the Ministry of Oil & Gas and the Omani government, exemplifies what can happen when we work in partnership.”

The roughly 30-member team, comprising a mix of shareholders and analysts, spent two days in the Sultanate. Deliberations on the first day encompassed BP’s upstream operations around the globe. On the following day, the group flew into central Oman by charter flight for a ring-side tour of the two-train gas processing plant in Khazzan – the centerpiece of BP Oman’s multibillion dollar tight gas development.

BP is also keen to explore new opportunities for business growth, said Mr. Looney, citing the “positive environment” that has enabled international Oil & Gas firms to thrive in the Sultanate. “Our experience in Oman for our company, and I hope for Oman as well, has been very positive. The environment we find ourselves working in here has been a positive experience for us. So we would like to do more, if possible!” ◆

Middle East solar dream in danger of early burn out

by Claudia Carpenter

With abundant sunshine, the Middle East and North Africa should be global leaders in solar power. But slowing electricity demand growth and an uncertain economic outlook across the region may hold back investment, experts warn.

Arab Petroleum Investments Corporation lowered by 20% its estimate of spending on power generation over the next five years in the region, in a report last month, citing reduced economic and population growth forecasts and higher electricity prices. Egypt – the region’s most populous Arab country – five years ago suffered blackouts due to electricity shortages. It is now facing overbuilding new capacity, Apicorp said.

Annual Middle East power demand will grow by an average 2.3% over the next five years, down from 3.4% for 2013 to 2018, according to S&P Global Platts Analytics. Saudi Electricity Co., which accounts for about 70% of the country’s total installed generating capacity, reported a 2.2% drop in electricity demand for last year as electricity prices to end users rose as a result of a reform.

“Declining costs represent an opportunity for renewables in the region [but] it would be less pressing to invest in renewables when you have domestic gas and also policies that are being so successful in curbing power demand growth,” said Bruno Brunetti, S&P Global Platts Analytics’ head of global power planning.

Hydrocarbons hard to shift

Weakening appetite for solar could shatter plans for the region’s oil producers to divert more fossil fuels from power generation into exports. Saudi Arabia – the world’s largest exporter of crude – plans to use renewables such as solar to reduce the almost 500,000 b/d of crude used for power generation and industry. Natural gas is the dominant fuel used to produce electricity in the region, accounting for more than three quarters of all projects underway in Saudi Arabia, Egypt and Iraq, according to Apicorp. Experts are now closely watching Dubai Electricity & Water Authority (DEWA) ahead of its imminent tender results for the 900 MW fifth-phase expansion of the Mohammed bin Rashid al-Maktoum solar park, with bids due by August 22. Depending on the bids, solar tariffs could go below 2 cents per kilowatt hour for the DEWA project, compared with 2.4 cents/kWh for natural gas, according to Vahid Fotuhi, managing director at Access Power, a Dubai-based power project developer.

“A more moderate power demand growth outlook could limit the appetite for renewables development, especially as the pipeline of the projects is only now starting to more clearly shape up,” Brunetti said. “Our global power plant database shows the amount of gas-fired projects in development across the region is very large and quite stable.”

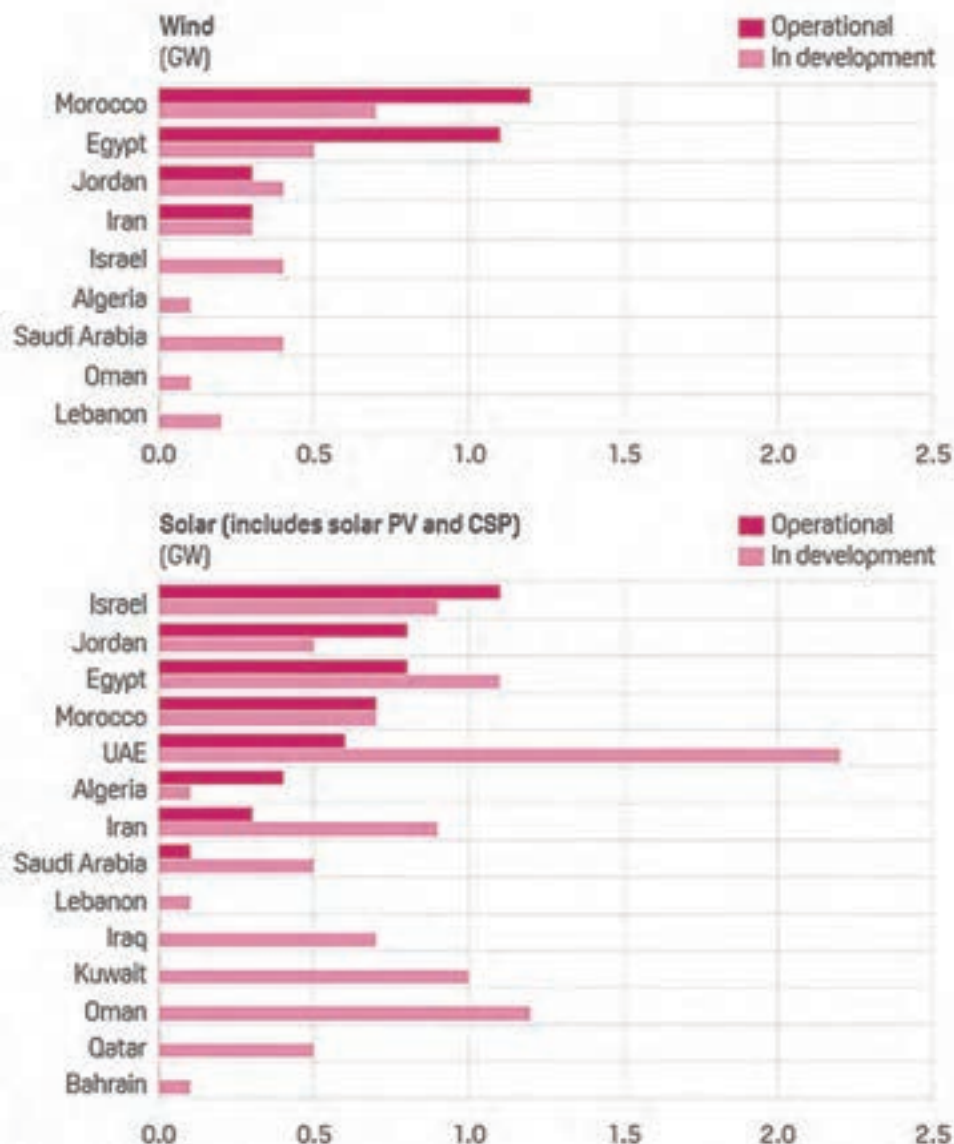
UAE breaking records

Despite the potential for solar in the region, the industry remains small. The share of renewables in Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE was equal to 0.6% of total electricity ca-

capacity at the end of last year, or 867 MW, according to the International Renewable Energy Agency. Led by the UAE, Oman and Kuwait, almost 7 GW of renewable power generation capacity is planned to come online by the early 2020s, IRENA estimates.

Meanwhile, renewable energy accounts for 34% of total planned and committed power investments in the Middle East and North Africa, compared with 31% in 2018 and 22% in 2017, according to Apicorp. The region is expected to add 74 GW of total electricity generation capacity within the next five years, it estimated. ●

Current Renewables Capacity and Major Known Projects in MENA



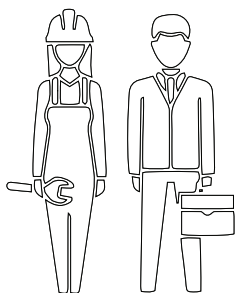


RENEWABLES: A global employment generating dynamo

The renewable energy sector employed at least 11 million people, directly and indirectly, in 2018. The total includes, for the first time, a fuller estimate of off-grid solar in parts of the developing world. Renewable energy employment has continued to grow worldwide since the first annual assessment by the International Renewable Energy Agency (IRENA) in 2012. The solar photovoltaics (PV), bioenergy, hydro, and wind power industries were the biggest employers



FACTORS SHAPING RENEWABLE ENERGY EMPLOYMENT



Several factors shape how and where employment is generated along the renewable energy supply chain. These include governmental policies; the diversification of supply chains; trade patterns; and industry reorganisation and consolidation trends.

Aside from these factors, which are discussed below, labour productivity grows in importance over time. As renewable energy industries become more mature, gain economies of scale, navigate learning curves and turn more to automated processes, fewer people will be needed for a given task.

Governmental Policies

Governmental measures, such as auctions, feed-in tariffs, subsidies, and industrial, labour and trade policies, are indispensable as the renewable energy sector expands and matures. They thus retain strong influence on employment prospects.

Feed-in tariffs were essential to the creation of many of today's markets, but if their rates are too generous they can become a budgetary burden. The growing embrace of auctions in recent years has translated into lower project costs, greater competitiveness with fossil fuels, and thus more deployment. But the competitive pressure of tenders also entails risks. Winning bids may not always come to fruition. Cost pressure may lead some firms to use inexpensive but low-quality equipment, or to skimp on staffing levels, wages or skills-training. Above all, policymaking needs to minimise swings from strong supportive measures to aggressive curbs.

Likewise, prolonged periods of policy uncertainty can trigger job loss if they lead equipment manufacturers, project developers, and other industry actors to mothball or shutter facilities.

Industrial policies leverage capabilities within an economy and strengthen domestic supply chains. Well-designed incentives are needed to nurture nascent industries, along with preferential access to credit, economic incubators and supplier development programmes, as well as appropriate education, training and labour market policies to build a capable workforce.

The proper policy mix – between enabling measures and mandates, and between inviting foreign investment and building domestic capabilities—needs to be tailored to country- or region-specific circumstances. A key example of a successful industrial policy is the well-developed domestic sup-

ply chains and economies of scale in China's solar PV industry. Manufacturing clusters in the Yangtze River Delta play a key role. The area's extensive industrial infrastructure, low power prices, and presence of suppliers from sectors such as the glass industry enables solar firms to purchase primary and intermediate inputs inexpensively. Strong support from central, provincial

and municipal governments has been critical. Many other countries could, in principle, imitate such policies in order to build viable domestic supply chains.

Trade, Supply-Chain Dynamics and Industry Consolidation

Domestic installation markets are important for employment generation in the downstream segments of the value chain. Deeper domestic supply chains translate into a lower degree of reliance on imports of equipment and components. On the other side of the equation, however, export sales hold great significance for job creation in countries that serve as regional or global manufacturing hubs. This is particularly true for China and a number of European countries.

Countries' trade profiles vary considerably from one renewable energy technology to another.

For example, while China is the largest exporter in the field of solar PV, its wind power firms mostly serve their domestic market. By contrast, Europe is a net importer of solar PV equipment, but the continent's wind sector (especially in Denmark, Germany, and Spain)

is heavily export-oriented, and European wind firms also have an extensive international manufacturing footprint. The United States is a minor exporter of wind equipment and runs a very small negative trade balance in the sector, but is a large net solar importer along with India and Turkey.

In biofuels, the United States accounted for close to 30% of exports in 2016, ahead of European countries (principally the Netherlands, France, Belgium, Hungary, Germany and the United Kingdom). In hydropower, China represented a quarter of global exports, while European firms (primarily based in Germany, Austria, and Italy) commanded a 46% share. The United States and India contributed just under 5% each.

Changes along renewable energy supply chains alter the industry's geographic footprint and its trade patterns, with consequences for where jobs are created and lost. Corporate strategies are a key driver, although some countries have sought to take an active role through local content requirements.

The footprint of the solar PV industry, for instance, has changed significantly since 2012. The bulk of manufacturing capacity has shifted to Asia, which now accounts for 92% and 85% of global cell and module capacities, respectively. While China remains dominant, a number of Southeast Asian countries have emerged as significant exporters. By contrast, the United States, India and Europe rely heavily on imports. In an effort to build or retain a domestic

manufacturing base, some importing countries have adopted a variety of import tariffs and levies, but the effectiveness of such policies can vary.

Quality and Inclusion

As important as it is to shed light on the quantity of jobs created in renewable energy, job quality must be examined as well. Although detailed information remains quite limited, job quality is a critical aspect.

A well-paying job that requires well-honed skills and is performed in a safe, rewarding workplace is a greater multiplier of socio-economic benefits than one that pays little, carries few benefits, or is temporary.

Employment also needs to be inclusive, providing opportunities for people with different talents and skills, and ensuring that no population group, such as women, is systematically excluded. IRENA has emphasised the importance of gender equity in particular.

What makes for good jobs? The International Labour Organization (ILO) defines "decent work" as work that is "productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal devel-

Annual Review 2019: Key facts

- The global renewable energy sector employed 11 million people in 2018. This compares with 10.3 million in 2017, based on available information.

- Employment remains concentrated in a handful of countries, with China, Brazil, the United States, India and members of the European Union in the lead. Asian countries' share remained at 60% of the global total.

- Several factors — including national deployment and industrial policies, changes in the geographic footprint of supply chains and in trade patterns, and industry consolidation trends — shape how and where jobs are created.

- Nonetheless, the increasingly diverse geographic footprint of energy-generation capacities and, to a lesser degree, assembly and manufacturing plants, has created jobs in a rising number of countries.

- The solar PV industry retains the top spot, with a third of the total renewable energy workforce. In 2018, PV employment expanded in India, Southeast Asia and Brazil, while China, the United States, Japan and the European Union lost jobs.

- Rising off-grid solar sales are translating into growing numbers of jobs in the context of expanding energy access and spurring economic activities in previously isolated communities.

- Rising output pushed biofuel jobs up 6% to 2.1 million. Brazil, Colombia, and Southeast Asia have labour-intensive supply chains, whereas operations in the United States and the European Union are far more mechanised.

- Employment in wind power supports 1.2 million jobs. Onshore projects predominate, but the offshore segment is gaining traction and could build on expertise and infrastructure in the offshore oil and gas sector.

- Hydropower has the largest installed capacity of all renewables but is now expanding slowly. The sector employs 2.1 million people directly, three quarters of whom are in operations and maintenance.

- While the analysis suggests job growth in 2018, some of the increase reflects the continued improvement and refinement of methodologies that allows a rising share of employment to be captured in statistics.



opment and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men”.

As is true for the economy at large, job quality in renewable energy varies widely across the industries and companies that make up the sector and its diverse supply chain. Variations in required skills and occupational patterns explain some of this. The significant role of the agricultural supply chain gives bioenergy a very different profile from the solar, wind, hydropower, and geothermal industries.

With respect to issues like wage levels and workplace protections, national regulations can make a big difference, as can corporate management culture and the presence of labour representatives. A friendly workplace tends to minimise staff turnover rates and is more likely to yield high-quality performance in equipment manufacturing, construction and installation, and operations and maintenance.

Solar photovoltaics

Globally, the solar PV industry installed 94 gigawatts (GW) of capacity during 2018, the same amount as in 2017. China, India, the United States and Japan were the most important installation markets, followed by Australia, Germany, the Republic of Korea, and Turkey.

A recent listing reveals that 50 leading solar PV panel manufacturers maintain factories in 23 countries. China remains dominant, accounting in 2018 for 69% and 64% of global cell and module capacities, respec-

tively. All Asian countries as a group (excluding India) held shares of 92% and 85%, respectively. Japan, the Republic of Korea, and Chinese Taipei are important producers. Driven by Chinese and other foreign investment, Malaysia, Thailand and Viet Nam are playing significant roles as producers and exporters⁴. Viet Nam hosts facilities owned by 11 different manufacturers; Malaysia, 9; and Thailand, 6.

IRENA estimates that global solar PV employment stood at 3.6 million jobs in 2018⁵. Of the leading ten countries, eight are Asian, while Turkey is counted as part of Asia in this report. Overall, Asia is home to almost 3 million solar PV jobs (85% of the global total), followed by North America's 6.4% share, Africa's 3.9% and Europe's 3.2%. This year's global total is not directly comparable to the figure reported in last year's edition. It includes an off-grid jobs estimate of 372 000 jobs for South Asia and parts of Africa.

China, the leading producer of PV equipment and the world's largest installation market, accounted for about two-thirds of PV employment worldwide, or some 2.2 million jobs. A strong pace of capacity additions in India (9.2 GW in 2018) led IRENA to raise its on-grid solar employment estimate from 92 400 jobs to 115 000 jobs, a number that could double if off-grid deployments were included.

Solar PV employment in the European Union declined by about 5% to 90 800 jobs in 2017, reflecting a drop of more than 10% in installations. Policy uncertainties caused US employment to fall for a second year in 2018, to an estimated 225 000 jobs. Japan's

Prioritising renewables



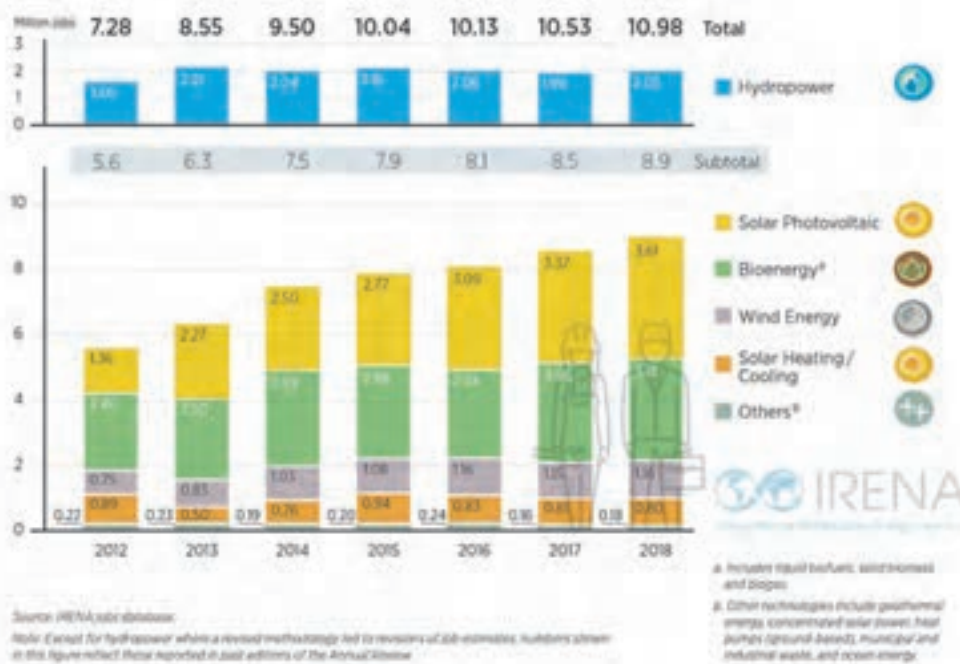
Francesco La Camera
Director-General
International
Renewable Energy
Agency (IRENA)

Renewable energy delivers on all main pillars of sustainable development: environmental, economic and even social. Alongside declining costs and steadily improving technologies, the transition to renewables is also creating numerous employment opportunities.

Beyond pursuing climate goals, many governments have prioritized renewables as a driver of low-carbon economic growth. Diversification of the supply chain has broadened the sector's geographic footprint beyond a few leading markets, as more countries link sustainable technology choices to broader socio-economic benefits. Increasingly, countries envisage a domestic renewable energy industry taking the place of unsustainable fossil-based industries.

The sector now employs at least 11 million people worldwide, with more countries manufacturing, trading and installing renewable energy technologies every year. As the global energy transformation continues to gain momentum, this employment dimension ensures socio-economic sustainability and provides yet another reason for countries to commit to renewables.

Global Renewable Energy Employment by Technology, 2012-2018



solar PV industry continues to face difficulties, including shortages of available land for deployment. Although the country's installation market is still one of the world's largest, additions in 2018 were below those of 2017. IRENA estimates that employment fell to 250 000 jobs in 2018.

Wind

Most of the wind industry's activity still occurs on land. The 540 GW of cumulative onshore capacity compares with about 23 GW in offshore projects. But offshore is gaining traction, receiving USD 25.7 billion of investments in 2018, or 20% of the wind total.

For the first time, China led the way with offshore projects worth USD 11.4 billion. European projects attracted spending of USD 3.3 billion. Offshore wind farms tend to require more labour inputs than onshore projects. In addition to the construction, assembly, and deployment of new equipment such as platforms, they can leverage existing technical capacities and skills (IRENA, 2018) and use converted and upgraded existing infrastructure from the offshore oil and gas and shipping industries.

Offshore wind development in northern Europe, for example, utilises the expertise of workboats that provide surveying, lifting

and other services, and draws on the know-how of companies that build foundations for production platforms.

Together, onshore and offshore wind employ 1.16 million people worldwide, up 1% from 2017. Most wind jobs are found in a small number of countries, although the concentration is less than in the solar PV sector. China accounts for 44% of the global total; the top five countries represent 75%. The regional picture is also more balanced than in the solar PV industry.

Asia's 620 000 wind jobs make up about half the total, while Europe accounts for 28% and North America for 10%. China remained the leader in new installations during 2018, adding 20 GW, of which 1.8 GW offshore. The country's total wind employment was estimated to hold steady at 510 000 jobs, followed by Germany (140 800 jobs) and the United States, where wind employment grew 8% to a new peak of 114 000 jobs.

IRENA estimates European employment at 314 200 jobs in 2017, the year with the latest available data. The continent's cumulative capacity reached 189 GW in 2018. Europe is not only a leader in domestic installations but also holds a strong position in exports of turbines and foundations. In Denmark, export sales support the majority of wind manufacturing jobs. ●

Investments worth \$209 bn needed in MENA Power Sector



Over the next five years, the MENA region will need to invest USD209 billion in the power sector according to the latest MENA Power Investment Outlook 2019-2023 report issued by The Arab Petroleum Investments Corporation (APICORP), a multilateral development financial institution.

Between 2019 and 2023, APICORP estimates that investment in the MENA energy sector could reach USD1 trillion, with the power sector accounting for the largest share at 36%, spurred by growing electricity demand and greater momentum for renewable energy, noted the report.

Dr Leila Benali, Chief Economist at APICORP, said: “We have observed that a large share of the funding requirements in MENA’s energy sector will go to the power sector, of which renewables account for a substantial share of around 34%.”

“We also estimate that MENA power capacity will need to expand by an average of 4% each year between 2019 and 2023, which corresponds to 88GW by 2023, to meet rising consumption and pent-up demand. Highly leveraged power projects in the region continue to be largely financed based on non-recourse or limited recourse structure, with debt-equity ratios in the 60:40 to 80:20 range, even 85:15 for lower risk profile projects backed by strong government payment guarantee,” further commented Benali.

New generation capacity

According to APICORP, the power sector continues to evolve throughout the MENA region, driven by the need for countries to meet demand growth, diversify their economies and create efficiencies. The MENA region will require the addition of 88GW by the end of 2023 to meet demand growth. Governments have been accelerating their investment plans and APICORP estimates that 87GW of capacity additions are already at execution stage. This is expected to translate into USD 142 billion for power generation, and approximately USD 68 billion for transmission and distribution.

Private sector financing

While the government remains involved at different phases of power projects, even in PPPs, the private sector is critical for risk management due to its track record in performance, technology and cost efficiency that it provides for financing.

Speaking about the private sector’s involvement, Mustafa Ansari, Senior Economist at APICORP, said: “Greater participation and financing from the private sector is imperative to the energy sectors growth; as more evenly shared responsibility in financing will ensure a reliable supply of competitively priced power. The energy sector represents significant opportunities for private sector financing in the long term.”

APICORP anticipates governments and central authorities to continue to remain involved particularly in central generation and transmission, and it has noticed some forays of private sector into distributed power through aggregating sites or clusters and leasing.

Electricity demand growth

During the period between 2007 and 2017, electricity consumption in the MENA region increased by 5.6% compound annual growth rate (CAGR) driven by rapid economic growth, industrialisation, rising income levels, high population growth rates and urbanisation, all coupled with low electricity prices.

Outside the GCC, countries have been struggling to keep up with growing demand. In both cases, the trajectory of demand growth meant that the model was unsustainable for governments, and - in a few cases - created suboptimal electricity systems.

- **MENA region** will need to install 88GW of power generation capacity over the period 2019-23
- **Electricity demand growth** to slow over the medium term leading to some overbuilding
- **Renewable Energy** to account for 34% of power investments in the MENA region
- Close to 87GW of **generation capacity** is currently under execution, driven by the UAE (19%), followed by Saudi Arabia (17%) and Egypt (16%)
- **Private sector financing** dependent on sector reforms and government guarantees
- **Highly leveraged power projects** in the region continue to be financed based on non-recourse or limited recourse structure

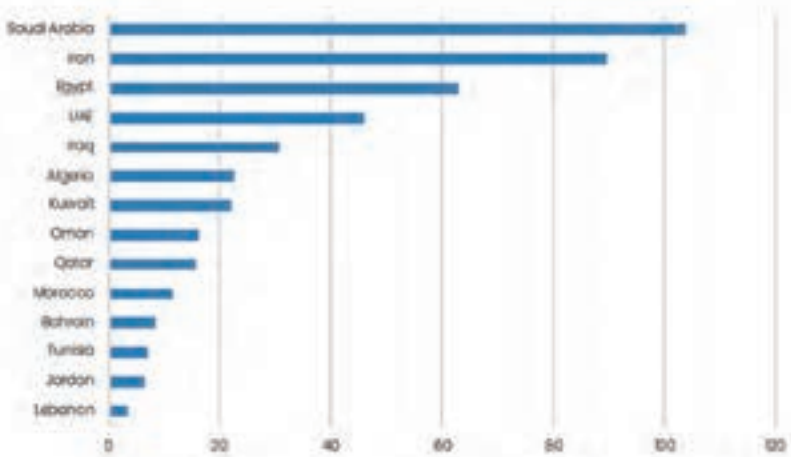


MENA

Capacity still needed to meet healthy consumption and peak-up demand

Required Capacity 2023 (GW)

Source: APICORP



Efforts to promote energy efficiency and support the public with smarter and more responsible consumption, whilst tackling infrastructural and regulatory hurdles are equally important. Consequently, APICORP forecasts that over the next five years, electricity demand growth will slow to around 3.8% CAGR.

Renewable Energy

APICORP predicts that close to USD 350 billion could be invested in MENA’s power sector in the next five years, with renew-

able energy accounting for 34% of power investment, or 12% of total energy investment. Renewable energy developments in the Arab world have gained tremendous momentum in recent years, driven primarily by governments that recognise the urgency of tackling rising demand for energy coupled with the declining costs of solar PV.

“From a business model perspective, Jordan and Morocco have so far led the region with their renewable initiatives. Morocco’s target for renewable energy as a share of total generation is ambitious, standing at 42% by 2020. However, across the region, the policy signals, change in business models and investment/credit support required in grids and storage to accompany the introduction of renewables are yet to be seen,” added Benali.

The report indicates that Saudi Arabia has ambitious plans to diversify its electricity generation mix with considerable renewable and nuclear capacities. Demand slow down and the ensuing overbuilding are anticipated to continue in the Kingdom, even as it embarks on transforming its power sector. The report noted that the most influential factors slowing domestic demand in Saudi Arabia have arguably been policy driven.

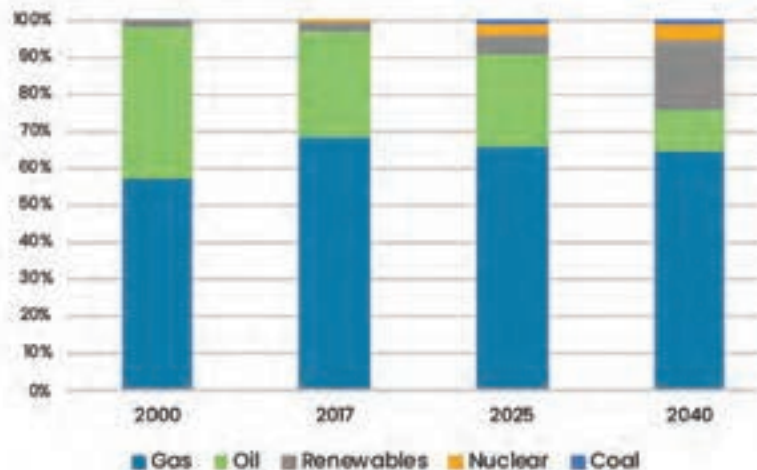
Elsewhere, the UAE needs to invest at least USD 16.2 billion to meet the expected additional 8GW capacity requirement over the medium term. The country is pushing strongly to diversify its energy sources in the power mix; and APICORP estimates that nearly 14GW of capacity additions are already in execution.

In Egypt, demand for electricity grew at a rate of 4.6% CAGR in the period between 2015 and 2017 and is expected to rise to 5.1% by 2023. APICORP projects that Egypt will need to invest USD 20 billion in power generation and a further USD 10 billion in transmission and distribution (T&D). This would help increase capacity in MENA’s most populous country to 63GW by 2023.

Meanwhile in Iraq, there continues to be a gap between demand growth and available generating capacity. The country still faces power outages, and hence providing reliable electricity is at the heart of the government’s plans. APICORP forecasts that Iraq will need to invest USD 21 billion in generation over the next five years to take capacity up to 30GW. ●

Electricity Generation in MENA (TWh)

Source: IEA, WEO 2018



Key Points



- The MENA region will need to install 88GW of generation capacity over the period 2019-23. This is expected to translate into USD 142 billion for generation, and approximately USD 68 billion for transmission & distribution (T&D).
- Close to 87GW of generation capacity is currently under execution, of which 74GW are due for commissioning within the next five years. This is driven by the UAE (19%), followed by Saudi Arabia (17%) and Egypt (16%) respectively. Gas-fired capacity accounts for more than three quarters of all projects under execution in Saudi Arabia, Egypt and Iraq.
- Investments in renewable energy continue to grow throughout MENA (34% of total power investments), benefitting from tailored, flexible funding mechanisms. However, many countries are likely to fall below expected targets for technical and regulatory reasons.
- Highly leveraged power projects in the region continue to be largely financed based on non-recourse or limited recourse structure, with debt-equity ratios 85:15 for lower risk profile projects backed by strong government payment guarantees.
- The private sector, critical for risk management (performance, technology, cost efficiency) and for financing, is still largely dependent on sector reforms, as the share of government investments remain high at 78%. Demand slowdown and the ensuing overbuilding are anticipated to continue in countries such as Saudi Arabia, even as the Kingdom embarks on transforming its power sector.
- More restructuring is clearly needed, but rather than full deregulation, we see more of adapting traditional business models to allow for private sector involvement in distributed or fully owned generation and a continuation of the Single-Buyer Model for conventional centralised generation where it already exists.
- The capital intensity of the electricity sector, even for renewables given the large scale of the projects in the region and the relatively large upfront capex, calls for the maintaining of mechanisms to increase investors' confidence with the government as the backbone.

Digitalization: Optional or necessary?

By Amjad A Musallam

WThere is an ongoing debate about the speed in which the oil and gas industry has adopted technological innovations. Has it been a slow or a timely adoption? Some argue that the industry has been a pioneer, leading the development of supercomputing techniques for reservoir modeling, seismic processing and 3-D imaging for drilling and other upstream businesses. Others refute that there is a palpable apprehension from the industry towards technologies that involve information shared across cyberspace.

Most people will agree however, that the oil and gas industry requires a continuous evolution of increased safety, reliability and efficiency. The natural course seems to be one that will eventually involve many digital solutions, working together in a holistic manner.

For this to occur, increased connectivity will be a requirement. The wave of IoT has only just begun and organizations are evaluating many ways in which they can harness the benefits. The use of shared information located in a secure 'cloud' environment should not be seen as a threat but as the standard for better internal communication, integration across departments and quicker decision making. As companies become more comfortable with the idea of being connected, more digital solutions will appear and collaboration will rapidly escalate, occurring as a part of the natural workflow between parties.

Regional Perspective

In my 27 years living and working in the United Arab Emirates, I have seen this region grow like no other, surpassing even its own expectations on many fronts. And the oil and gas industry is no exception. As the world moves toward the digital age, many emerging technologies have been on the rise such as Blockchain, IoT Platform, knowledge graphs, and digital twins to name a few. These and others are having a major impact on digitizing the ecosystem. As mentioned above, the Upstream sector has been investing in computing power and models for decades, using 3D models to understand reservoirs and implement this data into overall field management. Hardly any operator drills a well now without knowing their targets in 3D space and how it will impact the reservoir. Producers are implementing 'smart fields,' and 'intelligent completions.' And unconventional operators are using microseismic and other measurements to model the frac results in 3D. How this data is shared and incorporated is, of course, unique to each operator, but the investment is significant.

The Midstream and Downstream sectors are by no means exceptions. The power of digitalization is strong and getting stronger as they capitalize on the benefits of digital twins to design, maintain and extend the life of their valuable capital assets.

Smart Digital Twin

While there are many definitions for Smart Digital Twin, I like to define it as a complete and accurate 3D digital representation of the physical asset. All the details are captured and rolled into the model with millimetric accuracy. It

ENABLING THE JOURNEY TO INDUSTRY 4.0



offers benefits for just about all work being done in onshore plants, offshore platforms and floating facilities. And the fact that it can be tailored results in a digital twin that will look and perform differently from operator to operator, but will always address common challenges across all industries including oil and gas.

One of the most noticeable differences between existing products in the market is the level of quality. Using a team of qualified professionals, experienced in both operations and development of the models is key. These experts understand how to gather the highest quality data in the most efficient manner from the field which is then utilized to build up the Digital Twin. Their experience in producing complex models brings the perspective of what is needed during the data gathering process, ensuring a complete set of data has been collected to build the best 3D digital model in the shortest amount of time. As digital transformation continues to evolve, having a partner that delivers the highest quality and provides an end to end solution is key.

Digital Twin Applications

Digital Twin applications are expanding rapidly, enabling the capability to accomplish many tasks much faster than they had been done previously. A good example would be plants or facilities which are performing manual inspection of pipelines, valves, pressure vessels, hydraulic connections, etc. The time and cost of the labor to accomplish this can be extraordinary. And

there is the corresponding HSE exposure from the required driving distance and man hours in the field. Digital Twins accomplish this labor intensive process in a fraction of the time. Further, as the field crews walk the lines they often discover discrepancies between the actual, physical status and that which is recorded in their records.

The Smart Digital Twin creation process captures these and provides a complete, up-to-date, 3D model of the existing facility. A model which is fully immersible, able to generate accurate BIM's, ISO's and P&ID's of the actual equipment in each of the lines within minutes. The applications and benefits are enormous from this simple concept as this extremely accurate model can now become the platform tied into real life challenges and requirements such as leak detection, corrosion monitoring, work permit systems, plant security, shut-down or other operational procedures.

Empowering the Middle East Region

Across the Middle East, Digital Twins are rapidly being embraced and JP Global Digital is working to lead the way. Recently, we expressed how pleased we were with the outcome of the World Heavy Oil Congress 2019 and the interest in digital transformation in Oman's heavy oil industry. To continue this momentum towards Industry 4.0, we will be attending the Abu Dhabi International Exhibition & Conference 2019 (ADIPEC). Find us at the Digitalisation Zone, booth 14342, Hall 14. ♦



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Al Baraka Oilfield Services SAOC

When localization triumphs

Al Baraka Oilfield Services SAOC exemplifies the resilience of Super Local Community Contractors (SLCCs) that have successfully bucked the protracted downturn in the Oil & Gas sector to deliver unparalleled growth



An aggressive localization strategy going back two decades and more has spawned, among other initiatives, a plethora of Local Community Contractors (LCCs) and six Super Local Community Contractors. While it is true they initially leaned on Oman's oil and gas operators for sustenance early on in their development, these homegrown oilfield service providers have since learnt to build their own capabilities in order to survive and succeed in what is increasingly, a fiercely competitive marketplace. The case of Al Baraka Oilfield Services SAOC is particularly edifying as an example of a local Omani contractor that witnessed strong growth notwith-

standing a bruising slump in the domestic hydrocarbon sector, as indeed across the global Oil & Gas industry, stemming from the oil price crash of 2014.

“We have grown by more than 100 per cent in totality over the past three years, encompassing growth not only in the value of contracts garnered over this period, but also in our turnover, operational capabilities, and the size of our workforce,” said Mr. Musallam Said Salim Al Maashani, CEO. “This expansion, amidst the ongoing downturn, is a reflection of our growth ambitions.”

Registered in 2011, Al Baraka Oilfield Services is a Super Local Community Contractor (SLCC) representing around 1,340 Omani shareholders in the Wilayat of Shaleem and Al Halaniyat Islands in Dhofar Governorate.

Commencing operations with just two hoists, this SLCC has grown exponentially over the past decade. “Al Baraka has projects – completed and ongoing – across our two divisions, Hoist Operations and Off-Plot Delivery Contract (ODC) services,” said Mr. Al Maashani. “Starting with Petroleum Development Oman (PDO) as our principal client, we have since grown our customer base to include other Operators.” In South Oman, Al Baraka operates multiple hoists in the provision of well services, notably with regard to workovers. The company has completed over 1,000 well workovers as of 30th June 2019, while maintaining a superior degree of operational safety as evident from its 5-year LTI free record. The Hoists Division has seen its workforce burgeon to around 242 staff with Omanisation at a remarkable 90 per cent. They include significant numbers of Omani candidates from the concession area who have been trained to become roustabouts and floormen.

Equally commendable is the performance of Al Baraka’s ODC division, says the CEO. “We have constructed wellhead locations and flowlines, while also executing EPC projects in South Oman, primarily in Bahja. This division has undertaken more than 600 km of flowline welding and over 250 well hook-ups, completed dismantling of 250 km of bare CS flowlines/hookups, and the design, construction and pre-commissioning of more than 151 wells,” said Mr. Al Maashani.

The CEO credits the company’s performance to its early response to the unfold-

ing slump when the oil price shock hit the global hydrocarbon industry in 2014/2015. “We began a constant dialogue with our suppliers and subcontractors to work collaboratively in the delivery of projects, keeping in mind our strengths and resources. We also moved to minimize waste, eliminate redundant practices and optimize logistics in the hope of riding out the current downturn.”

Previous depressions have provided important learnings for the company, according to the CEO. “Oil price fluctuations, as we all know, are cyclical. Following the



**Mr. Musallam
Said Salim Al
Maashani,**
*Al Baraka Oilfield
Services Saoc, CEO*

“AL BARAKA IS EXPLORING OPPORTUNITIES TO DIVERSIFY ITS BUSINESS BOTH OPERATIONALLY AND GEOGRAPHICALLY

slump in 2008 and more recently in 2014, we have learnt to weather turbulent market conditions by improving efficiency, running lean operations, building synergies on the supply chain side of our business, and working hand in hand with the operators. “God willing, we will continue to run the business profitably, guided by a philosophy to consolidate during downturn and to grow in good times.”

Mr. Al Maashani is grateful to the Oil & Gas Operators – PDO in particular – for their steadfast support. “We are in continuous dialogue with PDO, trying to understand their pain points, and offering help where possible. We are also actively engaging with other Operators to offer them optimal solutions to oilfield challenges.”

As a reputable oilfield services contractor, Al Baraka is also ramping up its contribution to In-Country Value (ICV) development. “Our suppliers are predominantly from Oman, and we are engaging with our subcontractors to ensure they are patronizing local suppliers well. We are 90 per cent Omanised in our Hoists business, and boosting Omanisation in our ODC services as well.”

Going forward, Al Baraka is exploring opportunities to diversify its business both operationally and geographically. It is studying options to add transportation and logistics to its portfolio, among other areas, that are in sync with its core competencies. Longer term, the company also sees potential to build a presence elsewhere around the Gulf region, Mr. Al Maashani added. ●

IMO 2020:

Demand for low sulfur fuel benefits Gulf oil and gas producers



Countries that export larger quantities of low-sulfur crude oil will be the foremost beneficiaries of the demand brought on by IMO 2020, but the new regulations will not be a boon for everyone in the region

By Colby Connelly

IMO 2020” is a term that global commodities and energy analysts are now very familiar with, if they are not completely exhausted at its very mention. The new set of regulations established by the International Maritime Organization, an arm of the United Nations, will impact oil and gas markets around the world, and the hydrocarbon-exporting countries of the Gulf region will be no exception. The regulations are aimed at drastically reducing sulfur emissions that are heavily produced by popular variations of marine fuel, also known as bunker fuel. The IMO intends to accomplish this by banning the use of fuels with a sulfur content greater than 0.5% under almost all circumstances. Heavy fuel oil, or HFO, the most commonly used marine fuel in the world, has a sulfur content of 3.5% and this year HFO demand was approximately 3.13 million barrels per day. As a result, Gulf states that can fill the demand for lower-sulfur fuel oils and substitute marine fuels, such as diesel and liquefied natural gas, will stand to benefit once IMO 2020 goes into effect.

Countries like Saudi Arabia, the United Arab Emirates, and Kuwait, which all export larger quantities of lower-sulfur (or sweet) crude oil and whose refineries have undergone years of upgrades, will be the foremost beneficiaries of the demand for low-sulfur alternatives to HFO. Refiners around the world will require higher volumes of sweeter crude to produce IMO-compliant low-sulfur fuel oil, as well more valuable products like marine gas oil and diesel, which are also likely to see an increase in demand in 2020. While the projected impact of IMO 2020 remains a topic of considerable debate, these effects are the most immediately clear. What remains less certain is how the behavior of shipping firms that decide to seek alternatives to HFO will affect the Gulf’s energy industry. Fujairah, which is now the world’s second largest bunker fuel port, has already taken extensive measures to ensure the availability of low-sulfur, IMO-compliant fuel oil at its facilities. Fujairah has mounted serious competition against Singapore as a global bunker hub, and increased attention to the bunker fuel market may spur greater international interest in the UAE’s bunker fuel market.

This is yet another area where IMO 2020 may create volatility. Should there be a substantial increase in demand for LNG as a bunker fuel, other ports in the Gulf may rise to compete with Fujairah. Qatar, the largest LNG exporter of the Gulf Arab states, has already begun investing in LNG bunker fuel infrastructure. Oman has followed suit, with a surge in gas production that may propel it toward a competitive status in the LNG bunker market once its project at Sohar is operational. However, there is still skepticism surrounding assertions that demand for LNG bunker fuel will drastically increase beyond 2020. In May 2018, only 121 LNG powered vessels were in service. Though LNG represents a cheaper fuel source than oil-based products, construction of these vessels is very expensive, as is retrofitting older vessels with LNG engines.

Perhaps more importantly, the infrastructure for LNG bunkering has been slow to develop around the world, providing little incentive for shippers to invest in it. Another deterrent to investment is that while the emissions from LNG-powered vessels are a low-sulfur solution, they are not a low-carbon solution and may be vulnerable to future regulatory measures target-

ing carbon output. However, if IMO 2020 motivates a serious adoption of LNG bunker fuel technologies, Gulf states that have taken the risk of financing LNG bunker fuel infrastructure will enjoy significant returns on their investments.

While Supplies Last

IMO 2020 will not be a boon for everyone in the region. Uncertainty from the effects of new IMO regulations looms large over efforts to rehabilitate Iraq's long-suffering energy industry. Iraq's crude reserves are known for their high sulfur content, which reduces the appeal of its exports to refiners. Demand for high-sulfur (sour) crude will be impacted by IMO 2020, as the average barrel of sour produces almost 50% fuel oil. Demand for Iraqi crude is currently buoyed while production by the world's largest

projected to retain this status into 2030. Its largest refinery at Baiji has been offline since 2014, when it was severely damaged by militants from the Islamic State in Iraq and the Levant. While Iraq's refining capacity grew nearly 11% in 2018, much of this capacity remains underutilized, and its operational facilities are not complex enough to produce higher-value products for which IMO 2020 will generate increased levels of demand. The IEA reports that Iraqi refineries continually produce more HFO than any other products at a level that is astronomically higher than the global average and even much higher than average refineries in the rest of the Middle East. Without upgrades to its downstream infrastructure that are only likely to come from foreign investment, Iraq is set to continue generating a product that is neither desirable for exportation nor in great demand domestically. Since retooling and construction of downstream assets is a time- and capital-intensive process even in the most stable parts of the world, offering sweeter crude may be Iraq's best way to avoid completely forgoing any potential benefit of IMO 2020.

Fuel Surplus, Power Shortage

While IMO 2020 was initially conceived with the intention of reducing global sulfur emissions, its implementation may do little to stem carbon emissions from the largest polluters in the Middle East and in fact may have a completely adverse effect. The regulations that are meant to curb global usage of HFO will create a surplus of cheap fuel in a region that produces much of the world's supply and is more dependent on it as a means of power generation than any other. With almost all of the carbon content of fuel oil converted to carbon dioxide when burned, IMO 2020 may unintentionally contribute to an explosion in carbon emissions from the Gulf.

Saudi Arabia, the United Arab Emirates, and Iraq are the top three carbon dioxide emitters of the Gulf region. In 2018, Saudi Arabia emitted 571 million tons of carbon dioxide: approximately 1.7% of global carbon emissions. To its credit, this number is actually a 3.4% decrease from 2017. At 151.4 million tons, Iraqi carbon dioxide emissions grew 13.3% in 2018. Despite the slow pace of Iraq's economic recovery, carbon emissions are rising at a breakneck speed and are being pushed higher by domestic

“ QATAR, THE LARGEST LNG EXPORTER OF THE GULF ARAB STATES, HAS ALREADY BEGUN INVESTING IN LNG BUNKER FUEL INFRASTRUCTURE. OMAN HAS FOLLOWED SUIT, WITH A SURGE IN GAS PRODUCTION THAT MAY PROPEL IT TOWARD A COMPETITIVE STATUS IN THE LNG BUNKER MARKET ONCE ITS PROJECT AT SOHAR IS OPERATIONAL

heavy crude producers Iran and Venezuela remains effectively offline. Yet a re-entry into the market by either country would surely damage the amount of limited revenue Iraq is able to collect from its exports. One of the most effective steps toward re-orienting Iraqi energy exports to evolving demand induced by the IMO would be the diversification of its crude grades, which Iraq has stated its intentions to do for some time. The introduction of its Basrah Medium grade product, with a lower sulfur content than Basrah Heavy or Basrah Light, would have a greater appeal to refiners and trade at a competitive price. Unfortunately, Iraq's launch of Basrah Medium has been stalled for more than five years by delays in completing an oil storage project.

Yet the largest complication that IMO 2020 creates for Iraq is that worldwide demand for HFO is expected to plummet by over 50% in 2020. According to the International Energy Agency, Iraq is the world's third-largest producer of fuel oil and is

In Numbers

Heavy fuel oil, or HFO, the most commonly used marine fuel in the world, has a sulfur content of **3.5%** and this year HFO demand was approximately **3.13** million barrels per day.

oil consumption, which rose 6.1% in 2018. Assuming the country remains on the road to recovery, it is likely emissions will rise in the coming years.

Power generation and water desalination are the primary drivers of these figures; Saudi Arabia is more reliant on oil-based fuels for these processes than any other country in the world. Anticipation of lower demand for fuel oil in 2020 is likely what is leading Saudi Aramco to pursue a goal of zero fuel-oil production by 2024. Nonetheless, as recently as June, the kingdom produced 519,000 b/d of fuel oil and imported another 223,000 b/d. Figures like this will be important to observe as the effects of IMO 2020 take hold in order to determine whether the impending surplus of HFO will prove too attractive for the kingdom's authorities to pass up as a source of cheap fuel for power generation. With dim global growth forecasts and volatile crude prices increasingly shaping up to be the order of the day, policymakers in Riyadh may decide that initiatives to reduce carbon emissions will take a backseat to measures that offset the need to cut fuel subsidies enjoyed by power and water desalination plants for so long. More important is the fact that crude oil makes up 24.2% of the fuel used for power generation in Saudi Arabia – a much greater share than HFO at 16.5%. With a surplus of HFO at home, Saudi policymakers may be keen to substitute HFO to generate power, thereby enabling a greater share of crude oil to be exported whenever the kingdom decides to increase its oil production.

In Iraq, an abundance of HFO caused by IMO 2020 creates as many issues for power generation as it does exports. Iraqi power plants have gradually been transitioning to gas-fueled electricity generation, and 55% of Iraq's power generation capacity is now served by facilities that can burn either oil or gas. The limited ability to burn fuel oil for power will not alleviate issues Iraq has faced in importing all of the gas it needs, nor will it completely resolve the question of what refineries should do with all the excess fuel oil they will be producing. Ironically, the Iraqi oil and gas industry is the largest consumer of electricity in the country, and Iraq's inability to generate enough power for this sector will harm its ability to maintain a badly needed revenue stream.

Iraqis are accustomed to the fact that Baghdad is not able to meet their demand for electricity and have long taken matters into their own hands. The IEA estimates that approximately 20% of Iraqi power demand relies on diesel generators to provide businesses or residential homes with electricity, especially during the increasingly hot summer months. The diesel fuel that is used in private generators is typically purchased from government-regulated distributors, but rationing has led diesel to be sold at a significant markup by black marketers, placing yet further strain on Iraqi consumers. However, as many of these generators can be reconfigured to burn HFO, a large supply of cheap fuel may provide temporary relief for Iraqis who are badly in need of additional power



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“ GULF STATES THAT HAVE TAKEN THE RISK OF FINANCING LNG BUNKER FUEL INFRASTRUCTURE WILL ENJOY SIGNIFICANT RETURNS ON THEIR INVESTMENTS

generation capacity. Such a measure will only make a small-bore impact on excess HFO supplies, and it will not help Iraq's billowing carbon dioxide emissions, but as in Saudi Arabia this matter is arguably less of a concern weighed against more immediate needs. Substituting HFO for diesel also remains a stopgap solution. Iraqi refineries still produce fuel oil at a rate that far exceeds demand while producing diesel and other, more valuable refined products at an inverse rate. Iraqi dependence on generators for electricity needs is compounded by additional dependence on imports of diesel fuel, the price of which may increase once IMO 2020 goes into effect.

After a year of decreasing oil prices and bearish global growth forecasts, IMO 2020 may finally bring some positive developments for the oil and gas industries of the Gulf. The full effects of the new regulations will remain unclear until they have been in effect for some time, but the larger questions surrounding market reactions to the regulatory change will soon give way to the policy reactions of individual states that experience some of the unintended consequences of such a massive change. ●

OPES 2020 set to be a stellar show

The Oil & Gas West Asia (OGWA) show, unquestionably the definitive exposition on Oman's hydrocarbon industry, will be held next March in its new and invigorated avatar - the Oman Petroleum & Energy Show (OPES)

The Oman Petroleum & Energy Show (OPES 2020) - combining a conference component and mega exhibition - will be held at the Oman Convention and Exhibition Centre from March 9 to 11, 2020. As the largest B2B event of its kind in the Sultanate, OPES 2020 will occupy the entire convention centre at Madinat Al Irfan, underscoring the scope and magnitude of this flagship event.

We speak to Mr. Ashley Roberts, Events Director at Oman Expo, organisers of this prestigious forum:

1. Please shed light on the rationale behind the switch from OGWA to OPES.

Mr. Roberts: Over the years Oil & Gas West Asia (OGWA) has evolved with the market's needs. As the national oil and gas event of the Sultanate of Oman it is hugely important that it meets the ever-evolving needs of our exhibitors, sponsors and visitors. We

consulted the Ministry of Oil and Gas who are an instrumental partner of the event. Collectively it was agreed to rename the event to Oman Petroleum & Energy Show (OPES) which would much better align itself with the needs of the industry and to be clearing what the event offered.

2. Is there a significant change in the profile and scope of next year's launch event under the new brand?

Mr. Roberts: New elements such as Gas & LNG, Digital Oil & Gas, Offshore & Marine, and Stainless Steel, have all been added

to the overall focus of the event as well as the more traditional areas of the upstream market. As the event profile continues to broaden the event shall also be expanded to included areas such as downstream. From 2020, OPES shall be taking place every year, again this is following close consultation with the Ministry of Oil and Gas and acting upon the industry's needs.

3. What is the key theme of OPES 2020??

Mr. Roberts: The Society of Petroleum Engineers (SPE) Conference at OPES which is an integral part of OPES shall be focusing on areas such as EOR/ IOR, Gas & LNG, Offshore & Marine and Low Carbon, among other areas.

4. How does this theme resonate with the current outlook for Oman's hydrocarbon and broader energy sector?

Mr. Roberts: The Petroleum and Gas market in Oman is diversifying and is in a strong position. Growth in areas such as gas has a direct correlation with the exhibitors at OPES and the programme for the SPE Conference at OPES.

5. What is the role of the Ministry of Oil & Gas in this forum?

Mr. Roberts: The Ministry of oil and gas are a fundamental partner in OPES, the national oil and gas event of Oman. Salman Mohammed al Shidi Director General of Management of Petroleum Investments Ministry of Oil and Gas, Sultanate of Oman, is the chairperson for OPES 2020.

6. How different will next year's expo be in comparison with the 2018 event?

Mr. Roberts: The event will occupy the entire Oman Convention & Exhibition Centre making it the largest B2B exhibition to take place in the Sultanate of Oman. It will be over 20% bigger than OGWA 2018 which was the biggest event in its 20-year history. ●



Mr. Ashley Roberts,
Events Director
at Oman Expo

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