

# Energy Outlook

FOURTH QUARTER 2017

**SPECIAL REPORT**  
*CLIMATE CHANGE  
& FOSSIL FUELS*



**YOU  
TALKIN'  
TO  
ME...?**



**The 9<sup>th</sup> Gulf Intelligence UAE Energy Forum**  
Under the Patronage of  
His Excellency Eng. Suhail Mohamed Al Mazrouei  
UAE Minister of Energy & Industry  
**Abu Dhabi, Jan. 11<sup>th</sup> 2018**

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Hosted by the Energy Institute – IPWEEK  
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(Launch of Middle East LNG Institute)  
**Dubai, Apr. 16<sup>th</sup> 2018**

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**May 7<sup>th</sup> – 8<sup>th</sup> 2018**

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**Abu Dhabi, Nov. 11<sup>th</sup> 2018**

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**Debates – Roundtables – Workshops – Media Hub**  
in Partnership with GCC National & International  
Energy Industry  
**Abu Dhabi, Nov. 12<sup>th</sup> – 15<sup>th</sup> 2018**



**26**

**FOREWORD**

**03 Geopolitics to Trump OPEC Cuts in 2018?**

By Sean Evers, Managing Partner, Gulf Intelligence

**SPECIAL REPORT**

**04 Climate Change and Fossil Fuel – An Examination of Risks for the Energy Industry and Producer States**

By Jim Krane, Wallace S. Wilson Fellow for Energy Studies, Baker Institute for Public Policy, Rice University, Houston, Texas, USA

**OPEC – COMPETITORS TURN PARTNERS?**

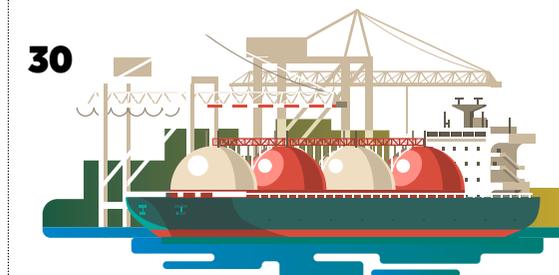
**20 Ministerial Dialogue**

In conversation with UAE Minister of Energy and Industry, H.E. Suhail Al Mazrouei

**24 Oil Price Drivers, Demand and Supply**

By Chris Midgley, Head of Analytics, S&P Global Platts

**30**



**42**



**LNG INSIGHTS: CONSUMER IS KING**

Brought to you by the Middle East LNG Institute

**26 CEO Series**

In conversation with Keith Martin, CEO, UNIPER SE & Chief Commercial Officer, UNIPER Global Commodities, UNIPER SE

**30 A Nimble LNG Giant**

By Luke Stobbart, Senior Pricing Specialist – LNG, S&P Global Platts

**SPECIAL FEATURE**

**32 SNOC – Spearheading the UAE’s New Gas Chapter**

**EOR IN THE GULF**

**36 Advancing EOR Collaboration in the Gulf**

**DISRUPTION IN ENERGY**

**38 CEO Series: Work of the Future as PDO Transforms**

In conversation with Raoul Restucci, Managing Director, Petroleum Development Oman

**42 Could the Era of ‘Lower-for-Longer’ Oil Prices Accelerate Progress to Industry 4.0?**

By Gaurav Sharma, Business Editor & Oil Analyst, International Business Times

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**Managing Partner**  
Sean Evers

**Managing Editor**  
Annette Bontke

**Research Analyst**  
Brian Cozzolino

**Editor & Senior Content Analyst**  
Michelle Meineke

**Contact**  
[info@gulfintelligence.com](mailto:info@gulfintelligence.com)



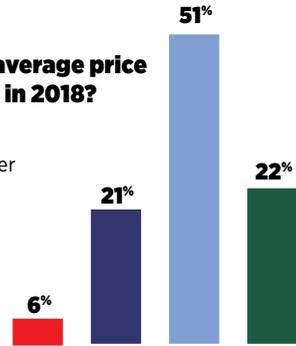
# GIQ polled 250 Energy Industry professionals in December 2017 soliciting their Outlook for the Year Ahead

## SURVEY

Q4 2017

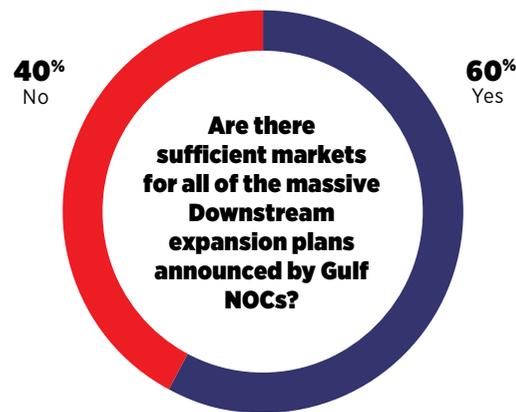
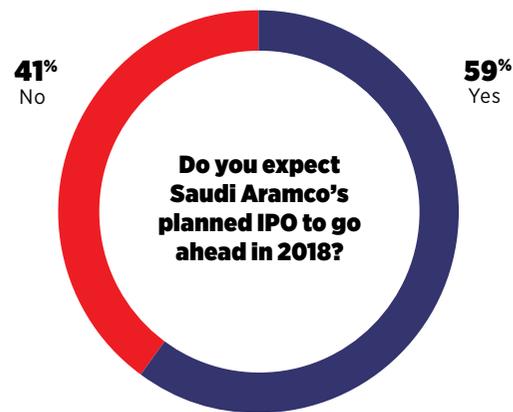
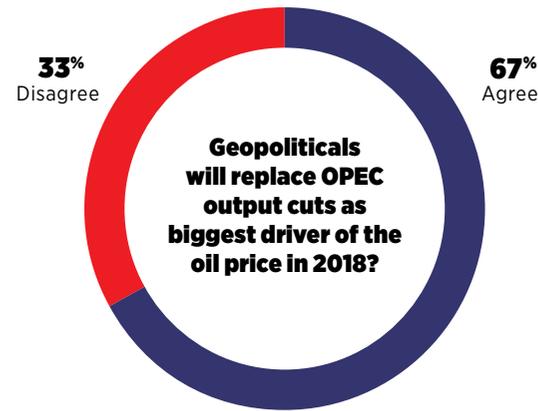
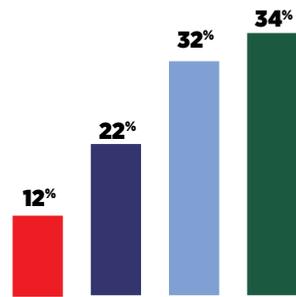
### What will be the average price of Brent crude oil in 2018?

- A. in the \$40s or lower
- B. in the \$50s
- C. in the \$60s
- D. in the \$70s



### What average compliance level do you expect OPEC/non-OPEC to achieve with agreed oil output cuts (1.8mbpd) in 2018?

- A. 100%
- B. 90%
- C. 80%
- D. 70%



## GEOPOLITICS TO TRUMP OPEC CUTS IN 2018?

BY SEAN EVERS  
*Managing Partner, Gulf Intelligence*

**L**iterally, just as I sat down on New Year's Day to review the results of our GIQ Survey: Energy Outlook 2018, North Korea's leader Kim Jong-un came on the television to tell the world he had a nuclear launch button always on his desk – he declared the entire US was within range of North Korean nuclear weapons, adding: "This is reality, not a threat!"

Trump's immediate rebuttal: my Button is Bigger! It was perhaps no surprise then to see the polling on the Gulf Intelligence survey question on whether Geopolitics would replace OPEC output cuts as the biggest driver of oil prices in 2018 – with some two thirds of the 250 energy industry respondents believing that political uncertainty is destined to return to center stage over the coming year.

It has been a decade since oil prices first broke through the holy grail of \$100 a barrel, but perhaps it has been even longer since a notable geopolitical risk premium has played an active role inflating crude above its natural supply-demand equilibrium – with prices quadrupling in the years 2003-2008 when hundreds of thousands of U.S.

troops were engaged in battle in Iraq and Afghanistan. We saw a few smoke signals emerge through the last quarter of 2017 that oil traders were starting to pay attention to the increasing number of unpredictable aspiring strongmen seeking promotion to the top table, with growing concerns that there aren't enough seats to accommodate all those wishing to be heard.

As record inventory levels slowly but surely retreat to their five-year average status quo, traders are having hiccups of nervousness creeping in to the outlook for tightness in supply-demand fundamentals. – some 60% of the GIQ survey respondents expect oil producers to maintain robust compliance through 2018 with the agreed supply cuts.

A majority of those we polled indicated that they expect Brent crude oil to be on average about \$10 a barrel higher this year, with prices forecast to rise into the \$60s-a-barrel range, which, if it materializes, could pump an additional \$300 million daily into OPEC coffers.

While the determined young dictator of North Korea was making his latest bellicose threats against the U.S., President Trump was busy sending his first tweet of the New Year condemning Pakistan, a longstanding ally, for lying and deceit – it may indeed turn out to be the year of who needs enemies when you've got friends like this!

Happy New Year! ■

# CLIMATE CHANGE AND FOSSIL FUEL

## *An Examination of Risks for the Energy Industry and Producer States*

By Jim Krane, Wallace S. Wilson Fellow for Energy Studies,  
Baker Institute for Public Policy, Rice University, Houston, Texas, USA

### ABSTRACT

*This article compiles and categorizes the various forms of climate risk facing the fossil fuel industry. The type and intensity of risk differs greatly among the three forms of fossil fuels, as well as between countries in the developing and developed world. The paper finds heightened risk for the coal industry and reduced risk for oil businesses, due to its lack of substitutes.*

Burning coal, oil, and natural gas is the source of two-thirds of the world's emissions of greenhouse gases. Sales of these fuels also represent the economic underpinning of resource-rich countries and the world's largest firms. As such, steps taken to abate emissions undermine commercial opportunities to monetize fossil fuel reserves. Risks to the industry correlate with progress on climate goals. This article analyzes recent literature on climate action strategy and finds that a new or intensified set of risks has arisen for the fossil fuel industry. These include government policies and legislation, financial restrictions among lenders and insurers, hostile legal and

shareholder actions, changes in demand and geopolitics, as well as the onset of new competitive forces among states and technologies.

The exposure of carbon-based businesses to these risks and the potential for loss is neither distributed uniformly across the sector, nor adheres to a uniform time scale. Shareholder-owned firms in the developed world will be incentivized to react sooner than large state-owned resource owners in developing countries. The fates of the three fossil fuels also appear likely to play out differently. Demand for oil appears insulated by its lack of viable substitutes, while coal businesses are already undergoing climate-related action, pushed by decreasing social acceptance and constraining financial regulation. At the other end of the spectrum, climate action has improved the medium-term viability of low-carbon natural gas. What appears clear is that, as effects of climate change grow more pronounced, the industry faces a future that is less accepting of current practices.



Introduction

Fossil fuel-producing businesses and governments find themselves in an intensifying predicament. Burning coal, oil, and natural gas is responsible for two-thirds of humanity's emissions of greenhouse gases or GHGs. A growing consensus of research concludes that most remaining fossil fuel reserves need to remain underground if humanity is to have a reasonable chance of weakening the advance of climate change. Rendering carbon as "unburnable" endangers business models based on carbon extraction. This includes some of the world's largest firms and economies of two dozen nation-states where exports of coal, oil or gas comprised more than 20% of 2014 GDP.<sup>1</sup>

Relief for the climate reduces commercial opportunity for the fossil fuel industry. Given the stakes, it bears asking: What, exactly, are the risks? How are they manifested and distributed? By Citicorp's estimate, resource abandonment on the scale required to meet the 2°C threshold means forgoing \$100 trillion in fossil fuel revenues by 2050.<sup>2</sup> Following through on such a scale would constitute a disruptive force in global affairs, undermining national budgets and corporate balance sheets while exposing beneficiaries – including pension-holders and ordinary citizens of resource-exporting states—to the myriad risks outlined below.

Whether or not the world decarbonizes to the extent required<sup>3</sup> – and scholars assign a high probability that the 2 °C threshold will be surpassed<sup>4-6</sup> – climate action presents the fossil fuel industry with a new set of risks. These range from reduced wealth and influence for fossil fuel exporting countries; to stranded reserves of once valuable commodities; to various forms of divestment, whether on behalf of insurance companies, pension

funds, or via tools allowing investors to purge portfolios of carbon exposure.

The risk burden is not shared uniformly among the three<sup>7</sup> fossil fuel types. While much of the focus has been on oil companies and countries harboring large crude oil reserves, oil's place in the future energy mix appears relatively assured, due to the long-term nature of developing viable substitutes in the transportation sector. Coal, by contrast, faces a future of decreasing social acceptance and intensifying regulation, particularly in the developed world. At the other end of the spectrum, natural gas' lower carbon content positions it as a medium-term beneficiary of climate action.<sup>8</sup>

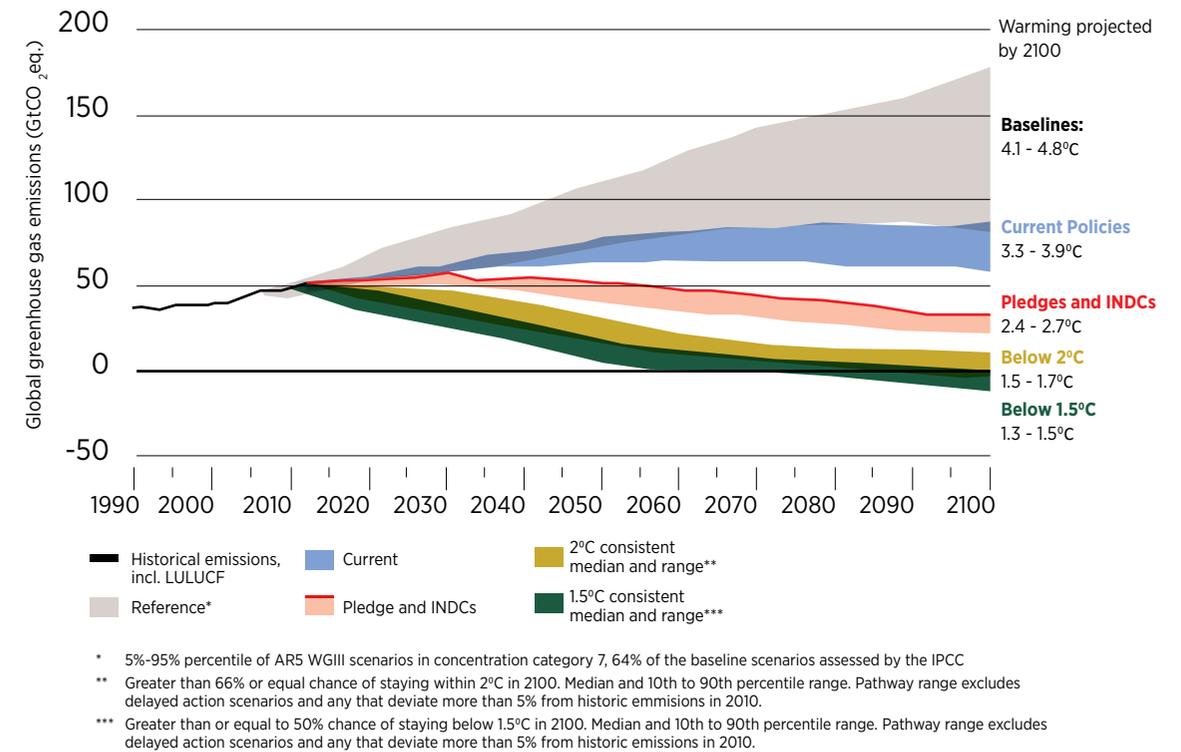
Further, decarbonization risks in the mature OECD economies differ from those in the developing world. In the OECD, where the fossil fuel trade is dominated by publicly traded companies, risks arise from government regulation and abatement actions, as well as shareholder activism. But shareholder-owned firms such as international oil companies (IOCs) also benefit from shorter reserves-to-production timeframes and flexible business models. Some are already adjusting operations to decrease vulnerability to climate action.

In the non-OECD countries, where growth in fossil fuel demand is high and where the largest pools of reserves are held, governments may act in opposite fashion, by protecting state-owned energy businesses from regulations and international pressure. However, the big national oil companies (NOCs) presiding over reserves with decades-long depletion horizons may be more exposed to declining demand and stranded assets. Decarbonization could thus spur geopolitical competition among producers, or even creation of opposing blocs of states which seek to enforce – or avoid – climate action.

**“The big national oil companies (NOCs) presiding over reserves with decades-long depletion horizons may be more exposed to declining demand and stranded assets.”**



Figure 1. Forecast of effects of Paris pledges on future CO<sub>2</sub> emissions. Source: Climate Action Tracker (used with permission).



Risk types

The taxonomy below outlines five main classes of climate risk for the fossil fuel industry:

- (i) **Policy risk:** Government policies, regulations, and pledges that reduce carbon emissions; policies that support competing technology.
- (ii) **Demand risk:** Decline in global fossil fuel demand due to climate factors.
- (iii) **Financial risk:** A broad category consisting of:
  - (a) **Divestment risk:** Shareholder or grassroots activism that seeks to influence producers through financial or reputational means.
  - (b) **Portfolio risk:** Investor avoidance of fossil fuel shares.
  - (c) **Insurance risk:** Antagonism from a business sector in which economic interests are aligned with climate action.
  - (d) **Lending risk:** Reduced availability of investment capital.
  - (e) **Stranded asset risk:** Commodity reserves or capital assets stranded prematurely.
- (iv) **Legal risk:** Lawsuits based on liability for climate change.
- (v) **Geopolitical and Competition risk:** Rivalry for market

share among producers seeking to monetize reserves before they are stranded, and changing relations between countries based on decarbonization activity. There are also physical risks to the industry from climate change itself. These include threats of damage from storms, rising heat intensity, and sea levels.<sup>9</sup> Since physical risks can be expected to affect all businesses regardless of their carbon intensity, this paper does not delve into them.

This paper serves as a compilation of the risk types affecting fossil fuels, based on an in-depth study of recent literature. Beyond offering basic contextual analysis, I do not attempt to quantify risks, their effects on revenue, or their impact on accumulation of atmospheric carbon.

Policy risk

Policy risk is a broader category for what is typically known as regulatory risk. Governments around the world, including at the subnational level, have imposed myriad restrictions on fossil fuel use. Policy action probably poses the greatest risk of any outlined here, for two reasons. First, because many sources examined here – with few exceptions<sup>10</sup> – argue that economic competition

alone will not enable noncarbon energy to replace fossil fuels. Second, because governments' options for intervention are broad. States can create and enforce laws ranging up to and including outright bans of fossil fuels. The government of Finland, for example, has proposed a complete ban on future use of coal in power generation.<sup>11</sup>

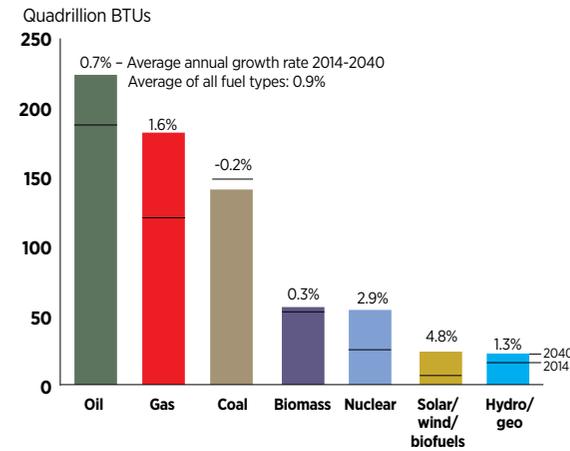
Policy risk includes government pledges such as the Intended Nationally Determined Contributions or INDCs from the 2015 Paris Agreement, as well as unrelated actions such as carbon taxes, cap-and-trade schemes, subsidies for substitute technologies, and regulations that hinder fossil fuel extraction, transportation, or intensity of use.

For the fossil fuel industry, the Paris climate agreement presents a large and uncertain source of policy risk: a global consensus on the need to turn away from fossil fuels that incentivizes regulation.

Nearly every country on Earth has pledged to reduce its emissions in some way. If realized, these national pledges would reduce carbon emissions from a business-as-usual scenario by about 50 gigatons per year by 2050, the yearly equivalent of leaving 23 billion tons of coal or 158 billion barrels of oil unburned. That level of reduction would restrict the increase in average temperature in 2100 to around 3°C rather than 4°C without INDCs.<sup>12</sup> (Fig. 1) Deeper decarbonization is required to reach the 2°C threshold.

**“ Nearly every country on Earth has pledged to reduce its emissions in some way. If realized, these national pledges would reduce carbon emissions from a business-as-usual scenario by about 50 gigatons per year by 2050, the yearly equivalent of leaving 23 billion tons of coal or 158 billion barrels of oil unburned.”**

**Figure 2. Global fuel demand in 2040 — Projections.**  
Source: Exxon Mobil 2016, used with permission.



INDCs approach decarbonization through policies tailored to local conditions. Former US President Barack Obama's pledge to reduce CO<sub>2</sub> emissions by 26–28% below 2005 levels by 2025 depends on retiring much of the US coal-fired power generation fleet and shifting toward natural gas and renewables.<sup>13</sup> The Paris INDCs are nonbinding, however, and there is no enforceable penalty for ignoring them. US President-elect Trump has indicated that his administration may ignore the Paris pledge. Conflicting priorities between administrations in one country suggest the existence of large uncertainties around the implementation of decarbonization policies. Implementation uncertainty adds complexity to firms' response to climate policy, particularly in countries with decentralized systems and multiple veto wielders, or frequent changes in government.

**Carbon pricing**

Other forms of policy risk are embedded in carbon reduction policies include emissions trading schemes such as the European Union's Emissions Trading System, as well as carbon prices and taxes. For example, British Columbia's carbon tax is credited with a 13% reduction in per capita emissions and 16% cut in fossil fuel demand between 2008 and 2013.<sup>14</sup>

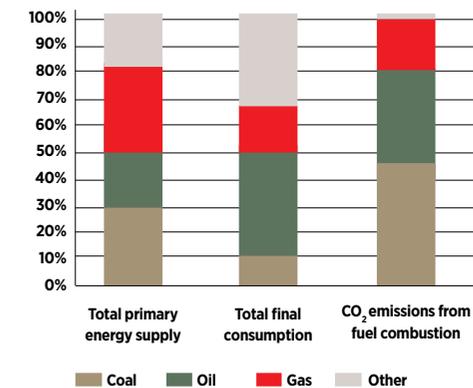
Carbon pricing is based on the notion that externalities, or social costs, should be included in prices for fuels and services. For example, if the costs to public health from emissions of sulfur dioxide, nitrogen oxides, and other coal pollutants were included in wholesale electricity prices, coal might be less attractive than cleaner power generation fuels. Carbon pricing levies a cost for GHG



emissions and the associated damage from warming temperatures, storms, loss of land and property use, and sea level rise. Implementation of carbon pricing is increasing in momentum. The World Bank estimates that 13% of global emission is already subject to a carbon price. If promises made at Paris are fully enacted, some 58% of global GHG emission would be taxed.<sup>15</sup>

Carbon prices range widely and some appear to have had little effect on fossil fuel demand. Demand for transportation, in particular, is highly price-inelastic and probably not very sensitive to moderate carbon pricing. In the United States, a 25–50% increase in gasoline prices is required to reduce travel by 1%, although the effect on fuel demand is stronger.<sup>16</sup> Prominent forecasts of future demand incorporate assumptions for carbon pricing.

**Figure 3. Supply, consumption, and CO<sub>2</sub> emissions by fuel.**  
Source: International Energy Agency, "World energy-related CO<sub>2</sub> emissions," IEA Paris (online database) March 2016. Accessed January 31, 2017.



Exxon Mobil's 2016 Outlook for Energy assumes carbon pricing in OECD countries reaches \$80/ton by 2040. Despite the added cost of carbon and improvements in vehicle efficiency, Exxon expects oil demand will continue growing to 2040, by an average of 0.7% per year.<sup>17</sup>

Demand for natural gas and particularly coal is more sensitive to taxation, since substitute technologies are available. The Exxon forecast predicts coal use dropping an average of 0.2% per year globally, while natural gas demand grows 1.6% per year. Noncarbon substitutes become more competitive and grow more quickly under carbon taxation, with growth averaging nearly 3%/year for nuclear and 5% for renewables (Fig. 2).<sup>17</sup>

In the future, policy risks for the fossil fuel sector could be globalized via the "climate club" scheme conceived by economist William Nordhaus. Countries would align carbon tax policies and impose border tariffs on "free riding" imports from countries where carbon is insufficiently regulated.<sup>18</sup> Countries that avoid climate action would face border taxes on exports to countries in carbon-taxation blocs. Governments are thus incentivized to tax carbon so their exports receive preferential market access.

Anticarbon policies also include myriad other restrictions. These include bans on extraction methods—hydraulic fracturing for oil and gas<sup>19</sup>—and blocking of infrastructure projects, such as the Obama administration's denial of a permit for the Keystone XL pipeline.<sup>20</sup> Government policies to encourage competing nonfossil sources could also thwart demand for fossil fuels. One example is the 2016 agreement between the governments of the United States, Canada, and Mexico to generate half of their electricity from carbon-free sources by 2025.<sup>21</sup>

**Demand risk**

At some point, demand for fossil fuels will start to decline. The notion of “peak demand” is driven by the maturing of developing economies, particularly China’s, and diversification beyond heavy industry into less energy-intensive services. Demand risk is exacerbated by efforts to push economies toward noncarbon energy and higher efficiency.

Few believe that the world will reach peak energy demand anytime soon. But as climate policies come to the fore, governments will inevitably seek to meet some demand through cleaner energy. At the same time, noncarbon options are becoming viable replacements for retiring capital equipment, particularly in power generation. These forces are bound to affect demand for coal and, in the longer term, natural gas (Fig. 3).

Global coal consumption may have already peaked. In 2015, global coal consumption dropped by 100 million metric tons, or 1.8%, compared to 2014 levels. China, which consumes half of global coal, saw demand decline two years in a row, while U.S. coal consumption plunged nearly 13% in 2015.<sup>22</sup> US coal production is forecast to fall another 15% in 2016, reaching its lowest level since 1978.<sup>23</sup>

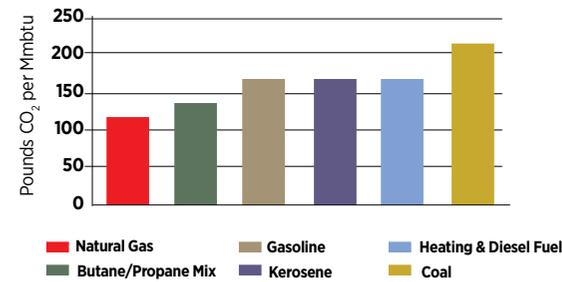
The IEA’s base case for coal demand is a 0.8% increase in yearly demand through 2020. But an alternate “peak-coal scenario” presents the possibility that global coal demand has peaked and will drop by 0.1% per year through 2020.<sup>24</sup> The IEA sees 610 gigawatts (GW) of coal power generation capacity being retired for environmental reasons by 2025.<sup>25</sup>

Natural gas is a different case. Due to its lower carbon content, gas is often described as a “bridge fuel” for a decarbonizing world. Gas turbine power plants can start up quickly and synchronize with intermittent renewables. However, when full lifecycle emissions for gas are included, gas’ promise in mitigating climate change is less assured.<sup>26</sup> The United States and Britain have both reduced their carbon footprints by switching from coal to gas. In 2015, gas and coal supplied equal 33% shares of total US power. By 2016, gas’ share had grown to 34% while coal’s slipped to 30% as a result of environmental action and a glut of cheap shale gas.<sup>27</sup> Since much phased-out coal capacity will be replaced by gas, few observers believe that gas demand will peak anytime soon. Globally, gas is expected to surpass coal as a share of primary energy around 2030.<sup>28</sup>

However, gas, like coal, has substitutes, including some that emit no carbon: nuclear, hydro, wind, and solar energy. Furthermore, the decarbonization that must occur to meet the 2°C threshold does not allow gas to fully substitute for coal (Fig. 4).

**Carbon Dioxide factors by fuel (EIA 2016)**

**Figure 4. Carbon content of fossil fuels relative to energy output.**  
Source: U.S. Energy Information Administration, 2016.



Alternate scenarios are certainly possible. A 2016 report from Bloomberg New Energy Finance predicts that demand for all fossil fuels used in power generation will peak by 2025 and fall thereafter, chased out by wind and solar power with improved battery storage. By the late 2020s, the report argues, it will be cheaper to build and operate a new renewable generation plant than to simply operate an existing coal or gas-fired plant. The crucial element is battery storage, which allows constant output from intermittent generators.<sup>10</sup> However, other costs may reduce opportunities for early retirement of fossil fuel generation, including those associated with upgrades to electricity grids as well as stranded capital equipment.

What about oil? Two-thirds of the world’s oil is consumed in transportation. As such, oil has few substitutes. Only electric vehicles and biofuels offer a reasonable replacement. These suffer from shortcomings, either in terms of energy density, cost per mile, range, and even carbon content. While electric vehicles and battery technologies are improving, so are internal combustion engines. The US Department of Energy forecasts that by 2040, 99% of US transportation vehicles sold will operate on internal combustion engines.<sup>29</sup> In short, oil is unlikely to lose its primacy in transportation without concerted government policies that impose heavy penalties on emissions or favor alternatives.<sup>30</sup>

Perhaps due to such factors, McGlade and Ekins forecast that oil reserves are the least exposed of the three fuels to abandonment by 2050. Just a third of current conventional crude oil reserves would probably be abandoned in a successful 2°C scenario, as opposed to half of gas and 82% of coal reserves.<sup>31</sup>

Even without a near-term competitive substitute technology, oil demand is still subject to decline. A 2016 report from Shell predicts that the world could see total oil demand reach its zenith as soon as 2021.<sup>32</sup> The former Saudi oil minister, Ali Naimi, suggested peak oil

demand may arrive by 2025.<sup>33</sup> The IEA forecasts that gasoline demand may be nearing its peak, as efficiency gains and electric vehicles compensate for growth in the developing world.<sup>34</sup> Exxon, meanwhile, sees no peak before 2040, due to continued growth in diesel and petrochemical demand.<sup>35</sup> McKinsey predicts that oil demand for transportation will peak by 2025, but its use as a petrochemical feedstock will allow overall demand to increase slowly until 2050.<sup>36</sup> While oil will inevitably peak at some point, most forecasts find that demand will tail off gradually, requiring companies to continue producing for decades.

Regardless, oil companies are under pressure to quantify exposure to demand risk and adjust business models to accommodate decarbonization. Academics have called for valuation methods for IOCs that rely on indicators other than booked reserves.<sup>37</sup> Far greater exposure to long-term declines in demand confronts NOCs, which oversee about 97% of global oil reserves and 90% of production.

**FINANCIAL RISK**

*Financial risk is a broad category that covers the potential for higher costs or reduced revenues from five main sources, which are described below.*

**Divestment risk**

In a 2015 speech, Bank of England Governor Mark Carney argued that climate change could precipitate a

major selloff that could result in collapsed valuations.<sup>38</sup> While that has not yet happened, shares in some fossil fuel companies are coming under scrutiny from investors worried about carbon intensity of earnings. Investor groups such as pension funds, religious organizations,<sup>39,40</sup> insurance companies, and universities<sup>41</sup> have shifted investments away from coal. A smaller number of campaigns have targeted oil and gas firms. Activist groups have begun publicizing carbon footprints as encouragement for firms to reduce emissions or shareholders to divest.

Some divestment is based on ethical concerns related to companies profiting while damaging the climate. Some is based on financial grounds, particularly on the likelihood that successful climate action will undercut commercial activity and share values. However, if climate action fails, asset risks may actually broaden. The Economist Intelligence Unit argues that entire portfolios and national economies face weaker returns based on the severity of warming.<sup>42</sup>

Other financial obstacles may compound the risk. These include banks’ unwillingness to lend, legal liabilities from environmental damages, and capital assets devalued by premature shut down.

Divestment participants are among the largest institutional investors in the world, including, ironically, funds responsible for investing fossil fuel profits. The Norwegian Government Pension Fund, the world’s largest hydrocarbon-based sovereign wealth fund with

**“Divestment participants are among the largest institutional investors in the world, including, ironically, funds responsible for investing fossil fuel profits. The Norwegian Government Pension Fund, the world’s largest hydrocarbon-based sovereign wealth fund with some \$900 billion in assets, decided in 2015 to divest from companies that received more than 30% of their revenues from coal.”**

some \$900 billion in assets, decided in 2015 to divest from companies that received more than 30% of their revenues from coal.<sup>43</sup> The Rockefeller Brothers Fund, based on the Standard Oil fortune, eliminated its holdings in coal and Canadian oil sands in 2014.<sup>44</sup> In 2016, the related Rockefeller Family Fund announced it would sell off fossil fuel shares, including holdings of Exxon Mobil—once a part of Standard Oil—due to the company’s public statements that were at odds with its internal understanding of climate change.<sup>45</sup>

Divestment has not usually damaged share prices or debt of targeted companies, since other investors tend to purchase shares that are sold.<sup>46</sup> However, widespread shunning of coal shares is constraining the availability of financing and raising costs. By 2030, divestment could reduce coal demand by a modest amount, around 2.5%.<sup>47</sup> In the oil business, divestment risk only poses a problem for shareholder-owned IOCs, not state-owned NOCs which dominate oil production.

A greater effect of divestment may be “stigmatization” that marks firms as targets for hostile regulation or other secondary effects.<sup>48</sup> Activist groups have publicized carbon footprints and climate responsiveness among various industry sectors. A report from a group called BankTrack exposes lending to coal firms. The Asset Owners Disclosure Project ranks investment funds on climate criteria. A group called Fossil Free Indexes published what it described as the carbon footprint of the \$300 billion CalPERS state employee retirement fund. Had CalPERS directly owned the fossil fuel reserves implied by its share holdings, the pension fund would have ranked as the 55th largest global oil and gas company and the 88th largest coal company, by reserves.<sup>49</sup> The report argued that CalPERS’ holdings exposed California pensioners to climate action risk, while also tarnishing CalPERS’ environmental credentials.

Shortly after the report emerged, the California legislature passed a law forcing state pension funds to liquidate coal-related shares by 2017.<sup>50</sup> As a result, CalPERS put pressure on companies in which it owned shares.<sup>51</sup> The French utility giant, GDF Suez—now Engie—was threatened with divestment if it did not reduce its carbon footprint.<sup>52</sup> In 2016, Engie acted, selling its ownership in 17 US coal-fired power plants with 9 GW of generating capacity, along with others in India and Indonesia, reducing its coal portfolio by a fifth, or 13 GW.<sup>53</sup> Chairman Gerard Mestrallet said coal ran counter to the company’s climate concerns, and pledged to stop building coal-fired power plants. Engie pulled out of another 2 GW in coal capacity it was negotiating in South Africa and Turkey. The firm is shifting its focus toward lower-emission renewables and natural gas projects.<sup>54</sup>

In the United States, coal has been hobbled by competition with cheaper natural gas, as well as declining steel production and regulatory uncertainty. Peabody Energy, the largest US coal mining firm, declared bankruptcy in 2016, preceded similar filings among coal producers Arch Coal, Alpha Natural Resources, Patriot Coal, and Walter Energy. US coal firms lost a combined 31,000 jobs and \$30 billion in share value since 2010. In 2016, half of all US coal was being produced by bankrupt companies in the process of being broken up.<sup>55</sup> Incoming President Donald Trump has declared support for a coal revival, but economic factors – and the probability of revived post-Trump regulation – subject US coal to most risk types outlined in this paper.

#### Portfolio risk

Stock exchanges and financial regulators have increased reporting requirements for firms to declare their carbon intensity and exposure to climate risk.<sup>56</sup> Disclosures have made it easier for investors to avoid fossil fuel shares and tilt portfolios toward “green” indexes. In the United States, the Securities and Exchange Commission requires companies to disclose material risks from climate change and climate action in public filings. These include impact of legislation and regulation on costs, profits, and demand; impact of international accords, including indirect effects such as decreased demand for carbon-intensive products.<sup>57</sup>

MSCI, a company that creates share indexes for investment managers, has developed new indexes and tools that exclude fossil fuel companies or highlight exposure to potential for stranded carbon assets. The company assists in rebalancing portfolios by “deliberately tilting more aggressively toward companies with large and growing renewable capacity”.<sup>58</sup> Likewise, Bloomberg’s Carbon Risk Valuation Tool allows its clients to model the effects of scenarios such as “last ditch decarbonization” on their portfolios.<sup>59</sup> HSBC provides clients with a similar climate risk analysis framework.<sup>60</sup>

Climate risk has thus led to the creation of “green” funds and other products that channel investment into firms that compete with fossil fuel companies.

#### Insurance risk

The global insurance business finds itself on the opposite side of the climate equation from fossil fuel firms. Insurers face increasing losses from climate change, due to the rising frequency of damaging weather events and subsequent payouts. The insurance sector is among those with the largest financial stake in climate progress. In 2016, UN Secretary General Ban Ki-moon urged insurers to anticipate and manage risks—including by

## Lending to global coal industry 2011-2014

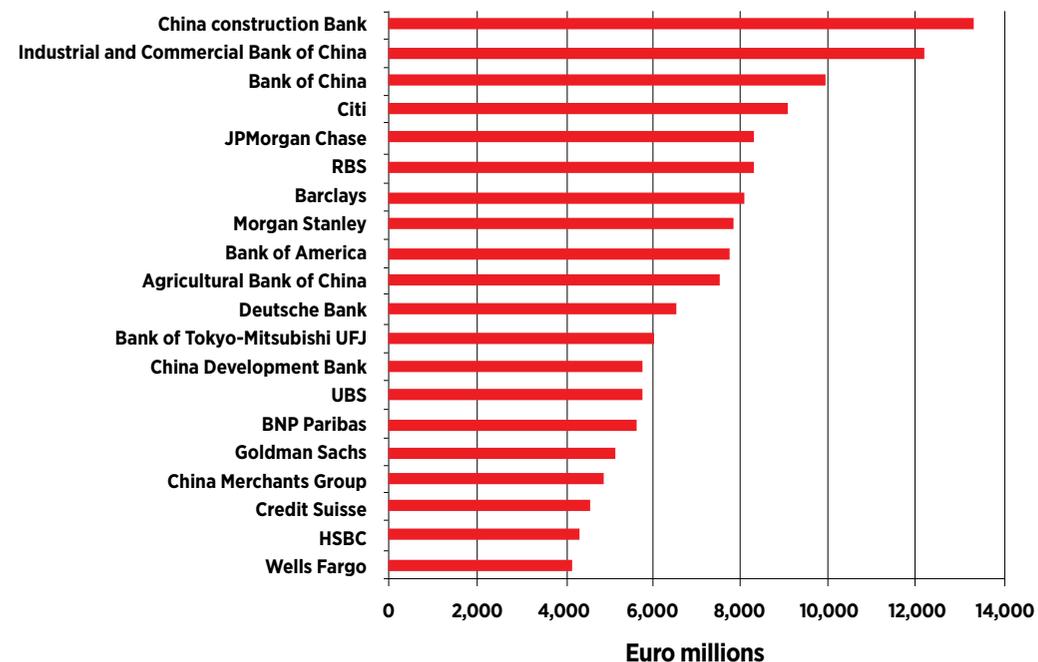


Figure 5. Top 20 banks and their lending to the global coal industry from 2011–April 2014, as reported by BankTrack. Source: BankTrack 2014.

decarbonizing investment portfolios used to pay future claims – so that the industry does not contribute to climate catastrophes that undermine its business.<sup>61</sup>

A further insurance risk has not yet materialized, but is under discussion. Insurers could refuse to provide coverage to coal firms – or the fossil fuel industry at large – as a way to hamper a business that is behind rising property damage claims.<sup>62</sup>

Climate risk is already influencing insurance portfolios. Climate-focused investor advisory group Ceres has tallied fossil fuel holdings worth \$459 billion among US insurance firms.<sup>63</sup> Some are starting to divest. The California Insurance Commission has asked insurers operating in the state to divest from coal and to report holdings in oil and gas firms, including pipeline and transport companies.<sup>64</sup>

The French insurer AXA announced in 2015 that it would divest from its last remaining coal mining and utility assets, worth \$560 million, while shifting into “green” investments that have lower or beneficial climate impacts. AXA CEO Henri de Castries said climate-driven events already represented 15 to 20% of the firm’s business risk. He said it had become “absolutely clear”

that warming beyond 2°C would make it “tougher and tougher and probably impossible” for insurers to cope with property damage.<sup>65</sup> German insurer Allianz, with nearly \$2 trillion in holdings, announced it would reduce coal investment in favor of wind power.<sup>66</sup>

#### Lending risk

A related source of risk for fossil fuel companies is the drying up of financing. In 2013, the US Treasury Department announced that the United States would no longer support coal investment among multilateral institutions, although the US Export–Import Bank participates in coal projects in poor countries.<sup>67</sup> In a similar process to divestment campaigns, activist groups have exposed lending to the coal sector<sup>68</sup> and banks have begun stepping back. Bank of America, Citigroup, JP Morgan Chase, and Deutsche Bank have enacted climate-driven lending prohibitions on coal mining and power plants. Citigroup has mandated a “risk review” prior to lending to businesses in Canadian oil sands.<sup>69</sup> Lending prohibitions shrink the pool of willing financiers, possibly forcing coal businesses to turn to more expensive sources.<sup>70</sup>



Table 1. Dollar values of unburnable fossil fuels in a 2°C scenario.

SCENARIO	Value of unburnable Oil (in trillion USD)	Value of unburnable Gas (in trillion USD)	Value of unburnable Coal (in trillion USD)
WITH CCS	30	22	57
WITHOUT CCS	25	24	62

Note Assumes: \$70 per barrel of oil, \$6.5 per MMBTU of gas and \$70 per metric ton of coal. Source: Citi Research, McGlade and Ekins (2015).

Elsewhere, Brazil’s development bank BNDES has halted financing for coal- and oil-fired power plants.<sup>71</sup> Japanese banks and export credit agencies, which financed big coal-fired power plants in Mozambique and Vietnam in 2015, have since come under pressure to halt coal financing.<sup>72</sup> As OECD banks depart the sector, Chinese lenders have captured the largest share of coal funding opportunities, including the top three spots (Fig. 5).<sup>73,74</sup>

**Stranded asset risk**

If climate action is effective, the OECD believes that assets will inevitably be stranded.<sup>48</sup> Stranded asset risk is not unique to fossil fuels. Any industry might be hurt by advances in technology or customer preferences that render capital equipment underutilized or abandoned prior to the expected investment time horizon. Fossil fuel reserves are already routinely stranded, at least temporarily, by falling market prices. Climate risk is different. Governments, firms, individuals, and international organizations are actively pursuing actions that damage fossil fuel businesses irrespective of prices or availability of substitutes.

Recent estimates by McGlade and Ekins find that roughly 80% of known coal reserves must remain unburned if the 2°C target is to be met. The authors find that carbon capture and storage technology is of little

help, given its expense, the unwieldy parasitic load on power plants, and a lack of carbon pricing that might incentivize its construction. Citicorp estimates that the mining and power industries will lose investments worth \$11.5 trillion over the next 25 years.<sup>75</sup> (Table 1) Further, half of global gas reserves need to remain in the ground to meet the 2°C target.<sup>31</sup>

Financial reports outline the potential for enormous losses in revenues, the risk of which increases relative to concentrations of carbon and the costs of extraction. The French bank Kepler Cheuvreux finds that adhering to the 2°C carbon threshold would, by 2035, leave the fossil fuel industry with \$28 trillion in lost revenues from stranded reserves.<sup>76</sup> As mentioned, Citicorp estimates that the value of stranded fossil fuels will surpass \$100 trillion by 2050. The New York bank believes that climate-inspired reductions in earnings should be considered when weighing creditworthiness of producer companies and countries.<sup>75</sup>

A similar “stranded assets” predicament is said to threaten long-term earnings potential of fossil-fuel based utilities. Electricity providers appear to be overbuilding generation infrastructure to the extent that capital stock will have to be retired prematurely if CO<sub>2</sub> emissions are to be kept within the bounds of a 2°C temperature increase. Complying with the 2°C carbon budget requires that no new power generation plants be built

**“The combined risks to the industry suggest the possibility of a “carbon bubble”. This is the contested notion that market capitalizations of publicly traded companies are exaggerated because the enforcement of carbon targets may prevent them from producing the reserves they have booked.”**

after 2017 unless other infrastructure is retired early, underutilized, or retrofitted with carbon capture and storage technology.<sup>77</sup>

By 2035, myriad fossil-fuel assets could become “stranded,” or unable to earn a financial return prior to the end of their economic lives. The IEA estimates some \$300 billion in unrecovered investments amid nearly \$3 trillion in yearly energy investment of all types the IEA has forecast over a similar period.<sup>78</sup>

- (i) 165 GW of fossil fuel power generation capacity with unrecovered sunk costs of \$120 billion.
- (ii) Oil and gas exploration costs worth \$180 billion.
- (iii) Some \$4 billion in unrecovered coal mine investment.<sup>79</sup>

Examined in this light, Japan’s plans to build 49 new coal-fired power plants with 28 GW of capacity would create risk of stranded assets and write-downs worth at least \$50 bn under various scenarios, because – for environmental or cost competitiveness reasons – the plants would probably be retired before their 2070 investment time horizon.<sup>80</sup>

Should these sorts of forecasts affect share prices of publicly traded firms? A number of climate-based activist groups such as the Carbon Tracker Initiative and the Institutional Investors Group on Climate Change believe that they should, and that climate risks have not yet been priced into oil company stocks.<sup>81</sup>

The combined risks to the industry suggest the possibility of a “carbon bubble”. This is the contested notion that market capitalizations of publicly traded companies are exaggerated because the enforcement of carbon targets may prevent them from producing the reserves they have booked.

However, climate risks are already priced into coal shares and probably into oil company shares. Share prices are based on investor assumptions of future earnings over a relatively short time horizon. Since climate effects accrue gradually and since IOCs hold just five to 15 years of proved reserves, investors are probably betting that production of booked reserves is unlikely to be upended by climate concerns. Analysts and oil company officials have stated that long-term effects of climate on their business models are a different issue than investor expectations for short-term earnings.<sup>82</sup> The transition away from fossil fuels, in particular oil and gas, is a gradual process that is being incrementally priced in by markets.<sup>83</sup> For IOCs, climate risk looks more threatening over the long term, possibly affecting the value of future reserves.<sup>84</sup>

For producer countries like Saudi Arabia or Kuwait, where reserves can support current production for another 50–100 years, successful climate action probably will render some underground reserves unburnable. Of course, a rapid shift in technology that renders fossil fuels obsolete could have the same effect on asset values.

Opposite cases are also possible: energy shares could get a boost from a breakthrough that allows carbon-rich fuels to be exploited without harming the climate. Fossil fuels might also get a reprieve from large-scale adoption of geoengineering techniques that intervene in the Earth’s climate system to reverse the greenhouse effect.<sup>85</sup> And, as mentioned above, there is a high likelihood that humanity will fail to attain the 2°C carbon budget, which pushes climate risk into the future.

**LEGAL RISK**

Legal scholars have long argued that the fossil fuel industry can be held liable for effects of its emissions. Basis for claims extends from compensation for weather damage to property or rising insurance premiums, to broader liability over lost land use, damage to national economies and public health.<sup>86–88,90</sup> Expectation of intensifying climate regulation in the future increases the probability of lawsuits.<sup>89</sup> Suits could be brought by individuals, class-action groups, businesses, or governments; potential targets include single firms, industry groups, and governments.<sup>92</sup>

Improved links between GHG emissions and extreme weather events will intensify legal risk. Tort law and public nuisance law could be a basis for transferring costs to entities that can be shown to have contributed to cause the damage.<sup>90</sup> Other legal actions could focus on producer countries, which could conceivably be sued by victim states in international courts. In 2015, a group of US citizens sued the US government for exacerbating risks to

“life, liberty, and property” by enabling or allowing CO<sub>2</sub> emissions to accumulate in the atmosphere, despite an understanding of the risk.<sup>91</sup> A case study of a single US coal-fired power plant estimated the plant’s liability for climate disasters at \$368 million.<sup>92</sup>

Likely litigation targets will be “deep-pocketed corporations” that could face class-action suits similar to the successful campaign against the tobacco industry.<sup>89</sup> Legal action could also stem from damage to livelihoods of people and businesses in coastal areas threatened by rising seas. Scholars disagree about whether establishing individual liability would be an obstacle<sup>89</sup> or whether it is unnecessary. Allen argues that, in the absence of direct evidence, litigation could be based on “mean likelihood-weighted liability” that an industry’s activity exacerbated the damage.<sup>93</sup>

#### GEOPOLITICAL AND COMPETITION RISK

*Competition among technologies, companies, and producer countries has always been a source of risk in the oil and gas industry. Climate change intensifies the competitive environment. In general, the lower a resource’s cost and carbon content, the more competitive it will be in a climate-constrained market. Big producers face a significant drop in revenues from adherence to a 2°C carbon budget, with NOCs most affected.*

#### Market risk and the green paradox

Climate change could exacerbate competition for market share by encouraging price war behavior. If oil producers believe climate restrictions might lead to stranded assets, they may decide to step up production to reduce risk exposure. Sinn has labeled the phenomenon “the green paradox”, arguing that environmental policies that restrict carbon emissions have the perverse effect of accelerating fossil fuel production, thus exacerbating carbon emissions and global warming.<sup>94</sup>

It is possible that the green paradox is already affecting energy markets. OPEC members Saudi Arabia, Kuwait, and the United Arab Emirates – holders of some of the largest and lowest-cost oil reserves – had until recently favored long-term depletion strategies that limited production and propped up market prices. This future-oriented strategy allowed greater participation by higher-cost producers outside OPEC. But the cartel’s future orientation appears to have diminished. Since November 2014, OPEC-led by Saudi Arabia – has emphasized retaining a share of the oil market rather than sustaining high prices. Despite an OPEC agreement to cut production in late 2016, Saudi Arabia continued to maintain production at historic highs at the time of

“If oil producers believe climate restrictions might lead to stranded assets, they may decide to step up production to reduce risk exposure. Sinn has labeled the phenomenon “the green paradox”, arguing that environmental policies that restrict carbon emissions have the perverse effect of accelerating fossil fuel production, thus exacerbating carbon emissions and global warming.”

writing, pushing higher-cost oil from the market. The Saudi change in strategy was probably driven by rising competition with US shale and other non-OPEC oil.

However, if the Saudis worried that reserves might someday be stranded, they might behave the same way, increasing current production in hopes of reducing the amount of resources abandoned in the future.<sup>95</sup>

Curtailed future oil demand would be disastrous for Saudi Arabia, Venezuela, and other large producer states, few of which have diversified economies ready to move beyond oil. By increasing production and pushing down market prices, they might shift the risk of stranded assets to higher-cost players, including shareholder-owned IOCs. The same phenomenon could be affecting coal producers. For them, selling at a discount is preferable to seeing reserves stranded. By encouraging stepped-up production, the climate threat to fossil fuels can perversely lead to cheaper, more attractive fossil fuels. Over the long term, cheaper prices could destabilize producer economies and trigger social unrest.

#### Other geopolitical risks

A global transition away from fossil fuels represents a major disruptive force in international relations. Declining demand for oil could diminish the strategic importance of petro-states. In turn, importing countries might find



themselves less committed to guaranteeing external security and regime survival in exporting countries. One potential casualty might be the US Carter Doctrine, which declares that the United States will use military force to protect oil exporting states in the Persian Gulf. If the global economy grows less dependent on energy sourced in the Gulf, the United States may feel less compelled to spend some \$50 to \$100 billion per year<sup>96</sup> in protecting its allies in the region.

State-to-state competition could assume more dangerous form. A “green paradox” battle for oil rents could evolve into a quest to shut down competing resources. Verbruggen and Van de Graaf argue that an era of oversupply would incentivize producer states to prevent competitors from producing oil. Actions could range from embargoes to sponsoring armed intervention or terrorism, all of which would be aimed at creating chaos in producing countries, so reserves cannot be produced.<sup>97</sup>

Finally, if decarbonization proceeds on a two-speed track, with developed countries acting to reduce emissions while developed countries engage in carbon-intense industrialization, relations between the OECD and non-OECD could worsen. Developed states could take on a quasienforcement role, imposing restrictions on trade and multilateral funding. Climate action could thus create a new arena for geopolitical competition among opposing blocs.

#### Conclusion

As climate change effects grow more pronounced, there can be little doubt that an industry that produces 68% of human GHG emissions will find itself under increasing pressure. The risks to the industry correlate with progress on climate goals. Unless a technological breakthrough can restrict carbon releases, the fortunes of the fossil fuel industry and the stability of Earth’s climate will be locked in a zero-sum game. Climate’s gain is the industry’s loss and vice versa.

For coal, the threats posed by climate action are already being felt. Coal’s fortunes now rest with developing countries, where decisions to seek China-style, coal-led development will be met by increasing international pressure to choose an alternate path. Mainstream banking has moved away from coal, and new investments are falling to banks in China and Japan. These institutions will come under similar pressure and can be expected to act to avoid reputational damage.

Climate threats to natural gas demand appear further afield, given the fuel’s reduced carbon content. Many anticarbon policies that target coal cede market share to gas. Longer term, however, gas is vulnerable to replacement by lower-carbon substitutes.

Oil, by contrast, is insulated by its unique role in transportation. This does not mean oil firms will be unaffected. Expectations of escalating restrictions

“Countries and firms that pursue decarbonization strategies reduce their exposure to risks outlined above. In many instances, first mover advantage has already been taken. Companies and states that delay may find fewer opportunities and intensified competition.”



encourage increases in current production. Environmental regulation could, through the “green paradox”, lead to lower oil prices, increased demand, and gains in market share by low-cost producers like Saudi Arabia at the expense of higher cost ones like those in North America. Since upstream oil investments are typically based on 20- or 30-year time horizons, one must accept the possibility that financial returns will be affected by climate action.

Further, competition among producers for market share will be complemented by competition between fossil fuels and renewables. Divestment and policy risks will magnify the challenges. Insurance companies and other threatened sectors can be expected to press for stronger action. Institutional investors and individuals will reward companies based on “future proofing” and penalize those deemed too exposed to carbon.

Despite these pressures, it bears remembering that energy transitions play out over many decades.<sup>98</sup> As such, arguments that IOCs face a near-term “carbon bubble” are probably overplayed, particularly if decarbonization is left to market forces. Stranding of reserves, particularly of crude oil, is most likely to be a factor of government policy, risks of which are difficult to forecast. IOCs may weather the climate storm more deftly than fossil fuel-dependent producer countries by modifying business lines. Just as IBM has shifted from computer hardware to services, IOCs are altering their strategic direction. Shell’s acquisition of BG emphasizes a shift from upstream oil toward natural gas. Total has bet on renewables and battery storage. Exxon Mobil is moving into petrochemicals, a process which locks CO<sub>2</sub> inside products rather than burning it.<sup>99</sup> Arguably, states with ingrained political structures based on oil exports will have a harder time adapting.<sup>100</sup>

It is clear that carbon-based businesses and economies face increasing impediments to the consumption of their products. Whether through taxes, legal restrictions, moral arguments, favoritism for competitors, or hampered access to financial markets, the industry faces a future that is less accepting of current practice. Some businesses and perhaps some governments, will not survive.

Going forward, as climate transformation intensifies, intervention can be expected to strengthen. Countries and firms that pursue decarbonization strategies reduce their exposure to risks outlined above. In many instances, first mover advantage has already been taken. Companies and states that delay may find fewer opportunities and intensified competition.

**Summary**

The article reviews recent literature on the potential effects of climate change action on the fossil fuel industry. Categories of climate actions examined include government policies and legislation, financial practices and regulations including restrictions in lending and insurance, changes in demand and geopolitics, as well as the onset of new competitive forces. The article concludes that risk exposure differs greatly among the three fossil fuel types, as well as among opportunities in the developing and developed world. It finds heightened risk for coal industry and reduced risk for oil businesses, due to its lack of substitutes.

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Note: For a version of this article including references see here: <https://www.bakerinstitute.org/research/climate-risk-fossil-fuel-industry/>



# ميناء الفجيرة Port of Fujairah

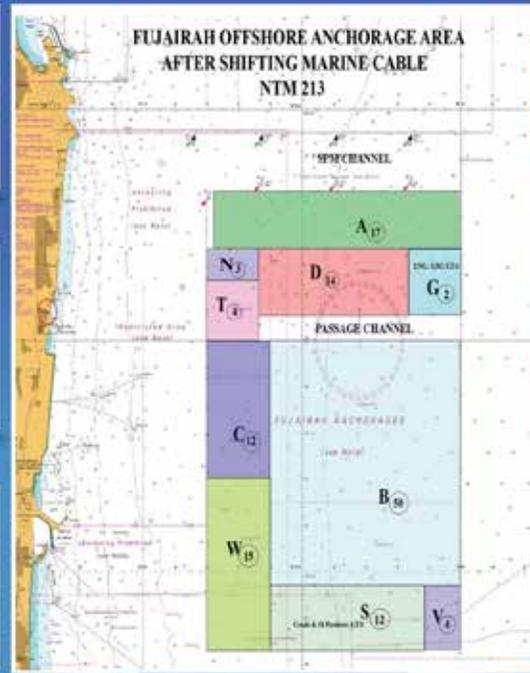


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## MINISTERIAL DIALOGUE

UAE Minister of Energy & Industry, H.E. Eng. Suhail Al Mazrouei, outlines his plans on steering OPEC during his Presidency of the organization for the year 2018 with Sean Evers, Managing Partner, Gulf Intelligence.

*Sean Evers: Your Excellency, you are taking on the Presidency of OPEC in January – a new elevated position one would think in these current times of taking on the mantle of managing the OPEC and non-OPEC production cut agreement. It has put the position of OPEC President into a fairly significant global diplomatic role – would you agree? How active a role do you envisage it will be going forward?*

*H.E. Eng. Suhail Al Mazrouei: Firstly, I really appreciate what the current President, His Excellency Dr. Khalid Al-Falih, has done in terms of diplomacy to keep this group together and the achievements so far. This takes connections, it takes travel, it takes effort, not only by the Minister himself, but by the country, to reach that conformity level. And I hope I can continue the good work*

*that he has done. I don't think it's going to be easy because we still have more benchmarks in the equation. But the conformity level that has been achieved so far has been great. In September, it was 120%.*

*Sean Evers: The compliance has been great, and I suppose the desired effect has been to raise oil prices and reduce inventories. And, of course,*

*there is nobody happier than shale oil producers in Texas and Oklahoma. And I'm wondering, does it continue to make logical sense to be handing them such happy returns and market share as you restrict yours? How does that balance look going forward?*

*H.E. Eng. Suhail Al Mazrouei: Shale oil producers are needed as part of the equation. We cannot now exclude them or think that they are working against us. Yes, they are one of the beneficiaries of the correction in oil prices. But, demand is also better than what expectations were a year ago and look at what the expectation was of what shale oil production would be when we started the output cut deal in January – you will find that they are not achieving the expected levels.*

*Sean Evers: I'm personally a little bit confused by what's happening in shale at the moment, given the declining rig count in the U.S., as oil prices recover. How are you analyzing that, and how does that help you make your decisions about moving forward?*

*H.E. Eng. Suhail Al Mazrouei: It's not a straightforward answer. There are elements to it. What happened when oil prices went down? The market applied significant pressure on the services companies so they had to work harder on improvements. Some of those improvements are here to stay and some are eating at the margins and cannot sustain it for long. They had to continue however to invest because they can't just shut down their operation. So some level of efficiency improvements are going to stay, and we all benefit from them, not only the shale oil producers. Everyone today is talking about the bottom line profit*

**“ I have a dream and that dream is to keep the OPEC and Non-OPEC group together for long and this is something I will hope to work on during my presidency of OPEC in 2018, and hopefully we can convince Non-OPEC to stay – and maybe even increase the number of countries with time. That's the hope. There is potential, we've been working for a year and we will build understanding over time”**

from every barrel of oil – reducing our unit technical cost, trying to improve as much as possible. But in any reservoir, you have sweet places where the pressure is good and the connectivity is good and then you can produce that at a higher rate. Then you have peripheries where connectivity is not that great, and you may not get the same results as you get from the sweet spot. I think this is what's happening in shale oil. During the hard times, they concentrated on the sweet spot and now, they have to go out. And whether oil prices are at \$60 or \$55, they are not an average of \$60 yet. The average for the year is \$52, a great improvement from last year, but you still need an average of higher prices to incentivize investors to come and continue to commit.

*Sean Evers: The two-year period (2014-2016) when OPEC was pursuing a market share strategy lead to a very depressing loss of income for Gulf oil producers. So my question Your Excellency is, will you go back to that strategy if prices go to \$70? What is the threshold price? Is it \$80? \$90?*

*H.E. Eng. Suhail Al Mazrouei: The notion of targeting the price is over. And I'll tell you why. Previously,*

OPEC had 50% of the world supply. Then we started declining and more producers came in – unconventional, and before that, deep sea and Arctic, and so many kinds of crude were entering the competition. So it would be naive to think that now, with 30% of the world supply, we can influence the oil price.

We would need to cut our share of production to 10% to have that effect. I think what OPEC has done was in line with the open market. We just want the investment to come back and when this happens, the market will indicate what price range we will get. And we will remain competitive because we are producing the cheapest oil in the world.

*Sean Evers: What happens when the price recovers to a level in which everybody is quite content? You have a very unique situation right now that you have the cooperation of OPEC and non-OPEC. There's never been a successful partnership like you have right now. What happens when everybody is content and this supply agreement is no longer defined to be required? What do you do with that unique collaboration? Does it get parked in a box or can you sustain it in some way?*



**“The notion of targeting the price is over. We just want the investment to come back and when this happens, the market will indicate what price range we will get. And we will remain competitive because we are producing the cheapest oil in the world.”**

*H.E. Eng. Suhail Al Mazrouei:* I have a dream and that is to keep this group together for a long time and this is something that I will hope to work on during next year – to convince this group to stay together and maybe we can even increase the number within the group with time.

*Sean Evers:* And if it is not anchored in a supply agreement, you can have a different level of cooperation perhaps, or build it around something else?

*H.E. Eng. Suhail Al Mazrouei:* I think there is potential – we’ve been working together for a

year and hopefully, we’ll work for another period of time. And that will build understanding between us. Rarely would you find Russia and Saudi Arabia and the Caspian countries and some South American countries working together and for so long. OPEC is something that very few understand despite the fact that for example, we started to share historical OPEC data with the public last year. There is a level of misunderstanding with what we do exactly and I think with this group, if we can keep them together, in any shape perform, that will be great.

*Sean Evers:* Your Excellency – you alluded earlier to the fact that there’s been a lot of squeezing of margins for the services companies. Is this sustainable? A lot of these companies do have lots of interesting technologies which help the NOCs bring down their OPEX and downtime – but many of them have been squeezed and are potentially leaving the region because there’s just not enough value in it for them. What happens then?

*H.E. Eng. Suhail Al Mazrouei:* They have done remarkably well in efficiency improvement and some of this has been achieved through the application of technology, drilling smarter wells and using artificial intelligence in analyzing data for example. Some of this will remain but they need to work harder around the ultimate services that they do and with that efficiency improvement, their costs should go down.

We have seen robotics being applied increasingly to operations – for example in maintenance – and this is going to affect the whole industry, especially services. If you can do an operation by drone or by a robot which can work 24 hours and doesn’t need a salary at the end of the month, imagine how much that is going to cut from your cost of operations. My expectation is that at higher oil prices, they will start to increase their prices and that’s why it may be challenging for shale oil producers to assume that the same level of cost reduction can be achieved when oil prices edge higher.

*Sean Evers:* Your Excellency – as you take over Presidency of OPEC, and you talk about creating an environment for increased investment, I guess the concern for the market is, as you do go back to

the five-year average of inventory, how OPEC tapers the production cuts that have been instilled? When will the market get an idea in terms of how OPEC returns its barrels to the market?

*H.E. Eng. Suhail Al Mazrouei:* When you reduce your production for a couple of years, you lose around 5 to 8% on the well productivity every year. And those wells that have produced for two years, especially in shale oil, need to be replaced. And this is not always taken into consideration. When we talk about supply and demand, we talk about how much you produce currently and how much demand has increased. But there is something that we as producers fight - which is drilling more wells to sustain what you have. And if there are no investments, then that is going to catch you down the road. Sometimes, you have to reduce your production by force of nature, not by choice because you cannot afford to put more wells or more injectors to sustain the pressure, and that in turn reduces your plateau rate gradually. So, I think it is going to be a combination; we need to see how long we are extending production cuts for, and then we will see who can actually bring their production back to where it was.

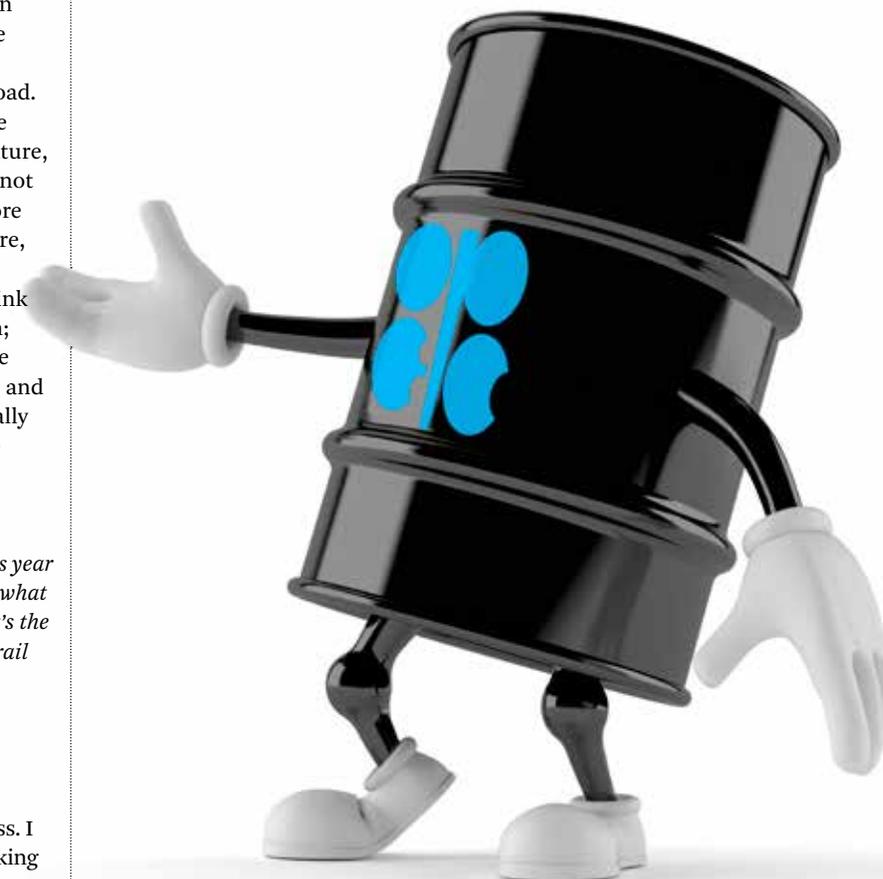
*Sean Evers:* And finally, Your Excellency, a lot of optimism this year – as you go into the year ahead, what may keep you up at night? What’s the unknown unknown that may derail this fairly successfully managed recovery of the oil market?

*H.E. Eng. Suhail Al Mazrouei:* I cannot single out one item that would make or derail the process. I think the process has been working and there are several parameters

**“Shale oil producers are needed as part of the equation. We cannot now exclude them or think that they are working against us.”**

that made it work. One is market fundamentals and the second is the reductions achieved on inventories. I think there is potential we will see more correction and at that time we need to analyze, but one can’t answer for how long production cuts should remain – we would need to see how much of the inventory overhang is left by the end of the first quarter

of 2018. We also need to take into consideration the re-bounce of shale oil with such prices, if those prices are to stay. There are so many parameters when it comes to the price, and anyone who tells you that if you take a certain action, you will get a specific price, doesn’t know the oil and gas industry. ■



# Oil Price Drivers, Demand & Supply

By Chris Midgley, Head of Analytics, S&P Global Platts

## 3 years of low oil prices have

stimulated strong demand growth of over 1.5mbd each year with S&P Global Platts Analytics forecasting 2018 to grow at 1.8mbd. This along with the OPEC and Non-OPEC production cuts has finally started to result in global balances tightening with S&P Global Platts Analytics forecasting that stocks have drawn at 900k bbl during 2017 resulting in surplus crude stocks falling to around 50mb once you take into account the rebasing of natural stocks length given the demand growth over the period.

## Fears of US Shale Oil production

growth and demand destruction from Electric Vehicles (EVs) has dampened the price response with S&P Global Platts Analytics forecasting Data Bent to inch closer towards \$60/bbl during the last 2 months of 2017. However, projects sanctioned pre-2014, when oil prices were above \$100/bbl will add to non-OPEC, non-US Shale supply growth in 2018 (Canada, Brazil, Kazakhstan, North Sea). Despite strong forecasted demand growth, this supply growth along with US Shale supply growth will erode the stock draws of 2017, resulting in softening of markets in the first half of 2018 to around \$55/bbl and thus meriting the need for OPEC production constraint for the rest of 2018.

## However, the deficit of projects

sanctioned over the last 3 years could start to bite as we head towards 2020. Non-OPEC/Non-Shale production accounts for 40mbd of supply and with 3-4% decline rates could result supply tightness as longer term



investments have been cut due to fear of US Shale Production and EVs Growth. In the next 3-4 years, EVs will not be meaningful, even with spectacular demand growth every 1m additional sales of EVs only replaces 30k bbl of demand which should be in put in context with the 1.8mbd growth seen this year and likely in 2018. Regional tensions (such as North Korea) are likely to result in supply disruptions (over the last 40 years there has been a significant disruption every 2-3 years) which with low surplus stocks and OPEC spare capacity could result in price spikes. S&P Global Platts Analytics expect prices to test \$80/bbl before 2022.

**While today's market is anchored** down the back of the curve by producers hedging around \$55-57/ bbl (Brent) limiting upside in the front month to around \$60/bbl

taking into account Dated Brent shifting into Backwardation. S&P Global Platts Analytics to see US Shale Production coming under some price pressure if required to respond to supply tightness. Productivity improvements are starting to plateau and cost are creeping upwards as resources (people and fracking equipment) have become increasingly tight. At the same time “conventional” production costs are coming down, the cost of steel has halved, drilling rigs are being leased at below operating costs and fabrication yards in South Korea are almost empty having let go of majority of their workforce. As such we may see an inversion between US Shale being the price setter (as many commentators suggest) and new conventional marginal capital projects setting longer term price forecasts closer to \$60/bbl. ■

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## CEO SERIES

Keith Martin, CEO, UNIPER SE and Chief Commercial Officer, UNIPER Global Commodities, gives his insights on gas prices and how flexibility is key to doing business in current gas markets with Mustafa Warsame from Gulf Intelligence.

**Mustafa Warsame:** *Does the relative recovery in oil prices give us a more optimistic outlook for LNG? What's your view on the price correlation of LNG to oil going forward? Are Asian players going to be receptive with that price structure continuing, given they've indicated a resistance to it in the past?*

**Keith Martin:** There's certainly a strong correlation in Asia between the price of oil and the price of LNG. But there is a big difference obviously to Europe, which is typically priced off European indices where there's little correlation with the world oil price at times. I think it's very difficult to find an index that works for everybody in Asia, because although we talk about Asia as a single item, in reality it's a collection of different players. I think the simplest thing to do is to keep to oil and gas as the key driver in terms of setting price.

If you look to Europe and how long it has taken for a gas index to emerge, that has been a very long journey. So I wouldn't be surprised if the journey to create an index that actually works for us, from an Asian point of view, is still several years away. I do think there will be a number of participants from Pavilion in Singapore to the JKM, to maybe even China, up till a point in time that they will consider forming their own index.

**Mustafa Warsame:** *What's your outlook for fixed LNG facilities versus floating, given the price recovery cycle? We see floating storage regasification units (FSRUs) in Abu Dhabi, and also in Dubai. Uniper is involved in plans for a FSRU facility in Sharjah. Are we*

*still going to see, as prices recover, an appetite for floating LNG as compared to the previously envisaged fixed onshore facility in Fujairah that has now been shelved.*

**Keith Martin:** I think the difference can be put in terms of technology. FSRUs, for example, can be commissioned quickly compared to

a fixed terminal and it also allows withdrawal after a few years. It's flexible. The technology has led to a plethora of new FSRUs being developed across the world and markets that were rarely even slated to have gas, now have reliable volumes delivered to them all the time. Bangladesh is a recent example and Pakistan is another great case in

**“ Many analysts are saying that the market will rebalance after 2020. And because there hasn't been a price signal to build more liquefaction, there will actually be a shortage and a spike in LNG prices.”**



**“There is nothing like a glut to sort out a glut. In other words, if you make something cheap enough for long enough, there are enough buyers who enter the market, form a contract and that ultimately demands that increase and the price will rise up.”**

point, where the terrain is difficult to lay gas pipelines. FSRUs have gone in and the country has converted the old oil-fueled power stations into gas-powered stations. There is now an almost insatiable demand for LNG in many parts of the world.

*Sean Evers:* With the price recovery, do you expect the appetite for floating storage and regasification to dwindle?

*Keith Martin:* I think the appetite for floating regasification is very high. There’s over 30 different projects at the moment and I think there will be many more to come, as it offers flexibility.

In terms of price risk management, with long-term contracts, it depends upon the

price indexation that you have. It works fine when the price continues to rise, but if the price falls, as it has done over the last couple of years, then you have long-term commitments that are probably losing money. That’s why a lot of the recent negotiations around contracts have been on a spot basis.

*Mustafa Warsame:* How do you see that playing out, as some of the very large long-term contracts come to expiration in Asia from the Gulf over the next decade or so? We have the Abu Dhabi one expiring, Japan, similarly Oman; and then further out, Korea and so on. Would you expect that, for example, the UAE will continue to be an LNG exporter, while also being

*an importer? Many countries do it in Europe, but do you think that will be a likely outcome for this market?*

*Keith Martin:* It can still happen. It depends for instance on the geography and the prices that you achieve. Europe imports a lot of LNG, it holds it in tank and then it re-exports it as well. People are far more price-aware now and there is far more spot activity that allows simultaneously importing and exporting to take place, in a way that it never has before. So the short answer is, yes.

*Mustafa Warsame:* Now that the U.S. is also an LNG exporter, how big is that going to be as a disrupter into Asia for Middle East producers?

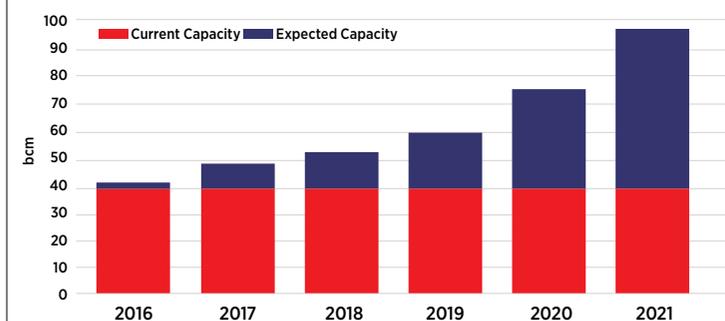
*Keith Martin:* I think the U.S. has already laid out a very good statement in terms of how much LNG it’s going to produce. I think the interesting thing, certainly up until very recently, was that the arbitrage from the U.S. to Asia was non-existent. And what we have seen is a lot of Asian players who have bought U.S. LNG actually looking to place that LNG into Europe. Why? Because they get a better netback than taking it into Asia with the additional cost of shipping, relative to bringing it into Europe. However, I do think there’s also some good news in the LNG market at the moment. China National Petroleum Company holds many long-term contracts and recently, it was saying that it could potentially run short of LNG, and might have to impose restrictions on industrial users. That’s a remarkable state of affairs when we’re meant to be in a glut.

*Mustafa Warsame:* How do you explain that?

*Keith Martin:* There is nothing like

**Where are Middle East LNG Imports Headed Towards?**

LNG imports capacity to surge; and Egypt, Kuwait and Morocco poised as top buyers of liquefied natural gas in the ME region.



Source: GI Research; Bloomberg; APICORP; and International Group of LNG Importers

a glut to sort out a glut. In other words, if you make something cheap enough for long enough, there are enough buyers who enter the market, form a contract and that ultimately demands that increase and the price will rise up. And most definitely we’re seeing some very high prices on JKM this year, which we haven’t seen for many years.

*Mustafa Warsame:* And of course, there’s the ongoing challenge in Asia, of the pollution that the megacities are facing – an incentive for LNG burning fuel.

*Keith Martin:* Exactly. It is two things – most definitely economics is still dictating new LNG development and policy also plays a part particularly in the case of China and its latest 5-Year Plan, which had a considerable increase in the amount of LNG that was to be burned at the expense of coal. Year on year, we’re seeing double digit increases in the amount of natural gas that’s actually consumed in China as well.

*Mustafa Warsame:* There are 50 million tons per year of homeless LNG cargoes through to 2020 and so supply is going to outstrip demand. When will we see that point of inflection when the

demand kicks back in and absorbs all of that supply?

*Keith Martin:* Many analysts are saying that the market will rebalance after 2020. And because there hasn’t been a price signal to build more liquefaction, there will actually be a shortage and a spike in LNG prices. But, if you look at what’s happening in China and also this plethora of FSRUs consuming relatively vast amounts of LNG, the shortage may even come sooner. Many commentators are already starting to speculate that the change is taking place already and that maybe the glut won’t last till 2020. I would also caution a little when we say there is no home for the LNG. This LNG will be available on the water and in reality that LNG will fight for its place and I think Europe could be a battleground for it - most definitely it could displace other forms of generation if the gas is cheap, relative to coal, for example.

*Mustafa Warsame:* How will the 50 million tons affect Asian buyers as they think about their contract renewals when they see that scale of spot opportunity?

*Keith Martin:* I think it already has

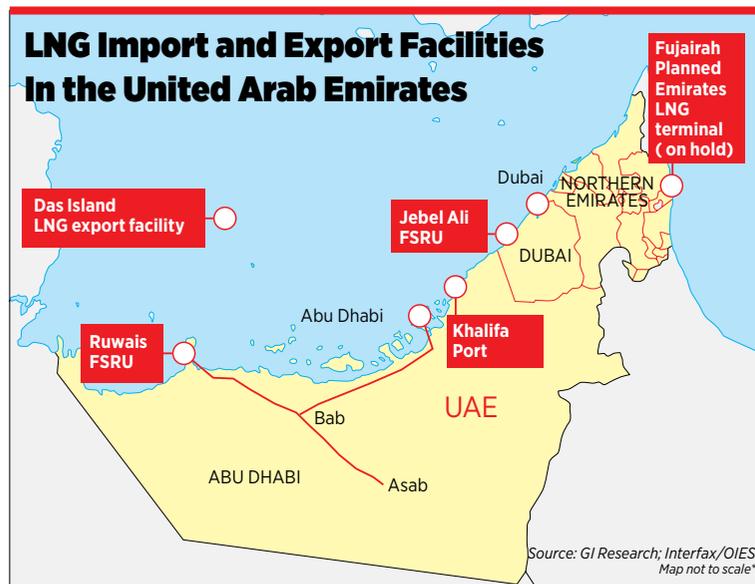
because it’s been well signaled for many years. People have refused to enter into long-term contracts and want to benefit and enjoy these relatively low prices. The key question is whether oil will get bullish again; oil indexation is the primary source of determining the price in Asia, and so then LNG will follow accordingly.

*Mustafa Warsame:* More LNG-forward products have been traded on many markets, including the JKM—in my company we call it JKTC, because we add China and Taiwan to the index. But there isn’t enough visibility on long-term forwards. Can you give us any insight about how we can get more relevant information?

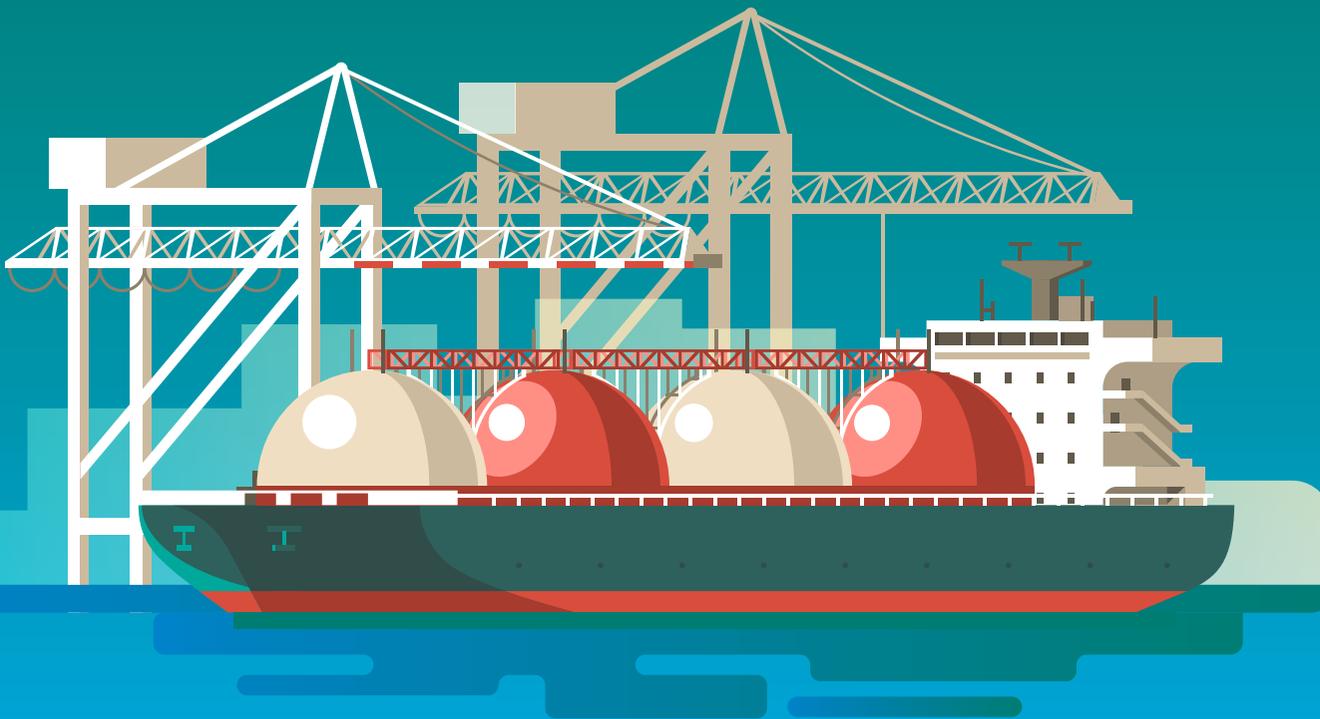
*Keith Martin:* It’s taken over 10-plus years to have European indices which people will rely on and actually trust. Before that, it was very much bilateral negotiations and then eventually these indices started to form. What will be key to the development of the index is trust; can that index be manipulated and is it representative truly of the market that’s there? And to build around that, you need liquidity and storage to back it up. I think to have a bankable product that you could put in and take out would make all the difference in the world. So JKM and Platts will most definitely get more liquid as time goes on, but I think it’s a couple of years before it’s matured sufficiently for that.

*Mustafa Warsame:* What about the outlook for a possible LNG benchmark in this region, east of Suez, let’s say, out of the Middle East? Even Singapore is aspiring to try and build that. Is there demand?

*Keith Martin:* I think the incentive and the requirement is most definitely there but the mechanism is what’s lacking. ■



Source: GI Research; Interfax/OIES Map not to scale\*



# A Nimble LNG Giant

By Luke Stobbart, Senior Pricing Specialist – LNG, S&P Global Platts

**A**s global liquefied natural gas (LNG) production capacity increases, Doha is seeking to defend its country's position as the world's largest exporter of the super-chilled fuel. Rising competition from a diverse set of LNG suppliers, led by Australia and the US, and lower global LNG prices have seen Qatar respond with plans to increase production from its North Field.

In April 2017, Doha lifted its self-imposed ban on further development of the offshore North Field, the world's largest conventional non-associated gas field with recoverable reserves of

around 900 Tcf (25.5 Tcm). This equates to around 13% of global proven gas reserves. Qatar plans to develop the southern section of the field over a period of five to seven years. Once completed, the project is expected to yield additional capacity of 4 Bcf/day, which equates to about 20% of the field's current output.

Most of this gas will be directed towards new LNG, with the country's export capacity rising from 77 million mt/year to 100 million mt/year. Qatar is well positioned to make a market share play, as it has one of the lowest costs of production for its LNG globally thanks to the scale of its operations, low production costs from the giant

North Field and the co-production of natural gas liquids (NGL) along with LNG.

However, at the same time, the decision to increase production is likely to extend the period of the global LNG oversupply into the 2020s. This will further boost the bargaining power of customers, put more pressure on spot prices and accelerate the transformation of the business landscape into a shorter, more flexible market. The latter is something Qatar and other legacy suppliers have long resisted.

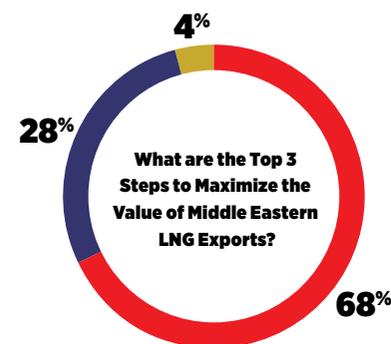
With fewer and fewer opportunities to sell on an oil-linked long-term basis, the producer faces a crossroads. It can either continue to

adjust its business model to capture value in a changing market or risk being relegated to the role of low-cost supplier to a growing community of aggregators.

Signs of change are already evident. Faced with limited growth and expiring contracts in Northeast Asia, Qatar has increased its cooperation with trading houses and portfolio aggregators to place excess volumes into short-term tenders issued by emerging and less creditworthy customers.

The exporter has also taken a more direct approach to marketing its LNG in emerging markets across the Middle East, South Asia and Southeast Asia. In July 2017, Qatar's state LNG shipping company Nakilat signed an agreement with Norwegian shipping company Hoegh LNG to stimulate fresh demand in emerging markets for Qatar to sell its LNG via floating import terminals.

Qatar's long-term marketing strategy has also been impacted, with RasGas having renegotiated the pricing formula of its sizeable contract with Petronet in favor of the Indian buyer amid low spot prices in Asia-Pacific. The Indian government has actively encouraged its domestic importers to seek better contractual terms.



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Buyers in Japan, the world's biggest LNG import market, will also be encouraged by a recent ruling from the Japan Fair Trade Commission that destination clauses – long preferred by exporters – may be anti-competitive. This ruling could have lasting implications on the market's supply-demand balance and trading dynamics as it enables importers to sell-on their excess volumes.

## Shifting Sands

The sands of the LNG market closer to home are also shifting. Fast rising regional gas demand in the Middle East has made it a major emerging market for LNG, but one which is now threatened by rising regional pipeline supplies as offshore gas fields in the East Mediterranean come on-stream.

By 2016, five Middle Eastern and North African countries – including Jordan and Kuwait – were importing LNG. Jordan is a good case study of an importer that has challenged traditional buying formats since it entered the market in 2015, kicking off a

trend for other emerging buyers and providing traders with new opportunities in the LNG space.

Jordan has incorporated a more short-term ethos into its buying strategy. Most of the country's gas demand has been covered by two-year and five-year contracts with portfolio seller Shell, with the remainder secured via tenders seeking one or two cargoes and usually awarded to traders. Jordan's bigger tenders have also been split into small tranches, allowing multiple awardees, and opening up opportunities for smaller trading houses that would otherwise struggle to supply larger volumes.

While the buying strategy of Jordan and other LNG importers in the region with growing appetite is still evolving, expanding international supplies and changing buying patterns are likely to give them more leverage when negotiating new term contracts, if they choose to employ term contracts at all. Locally-sourced cargoes will have a clear transport cost advantage – and be a plus for Qatar's growth ambitions. ■

## Company Profile: SNOC

# Spearheading the UAE's New Gas Chapter

**I**n November 1978, a team of engineers crisscrossing 600,000 acres of Sharjah's desert pinned down a sweet spot; the Sajaa asset. Their efforts paid dividends. When the Sajaa-1 well was drilled in May 1980 to 16,656 feet – roughly six times the height of the world's tallest building, the Burj Khalifa – it was one of the largest gas discoveries in the UAE at the time. The engineering team worked without today's technological luxuries – real-time updates from mobile phones and satellites – and navigated their way to success by unrolling dog-eared maps of the desert on the hot bonnets of their four-wheel drive vehicles. This pioneering spirit heralded the beginning of Sharjah's energy industry.

Fast forward three decades and Sharjah National Oil Corporation (SNOC) was established in 2010 by the Amiri decree of Sharjah's Ruler His Highness Dr. Sheikh Sultan Bin Mohammed Al Qasimi. Tasked with exploration, production, engineering, construction, operation and maintenance, SNOC was also handed the golden keys to operating and managing the Sajaa assets.

SNOC had access to the other legacy infrastructure pre-2010. Sharjah's bullish streak after the discovery of the Sajaa asset continued with the discovery of the nearby Moveyaid field in October 1981. Just one year later, the first cargo of 500,000 barrels of condensate was exported from the Sajaa plant on the oil tanker 'Amoco Savannah' – the birth of Sharjah's gas exporting business. Gas sales started in 1983 to Sharjah Electricity and Water Authority (SEWA) and later to Dubai and the Northern Emirates in a new pipeline network. An agreement to build a liquified petroleum gas (LPG) terminal and export facilities in a new harbour at

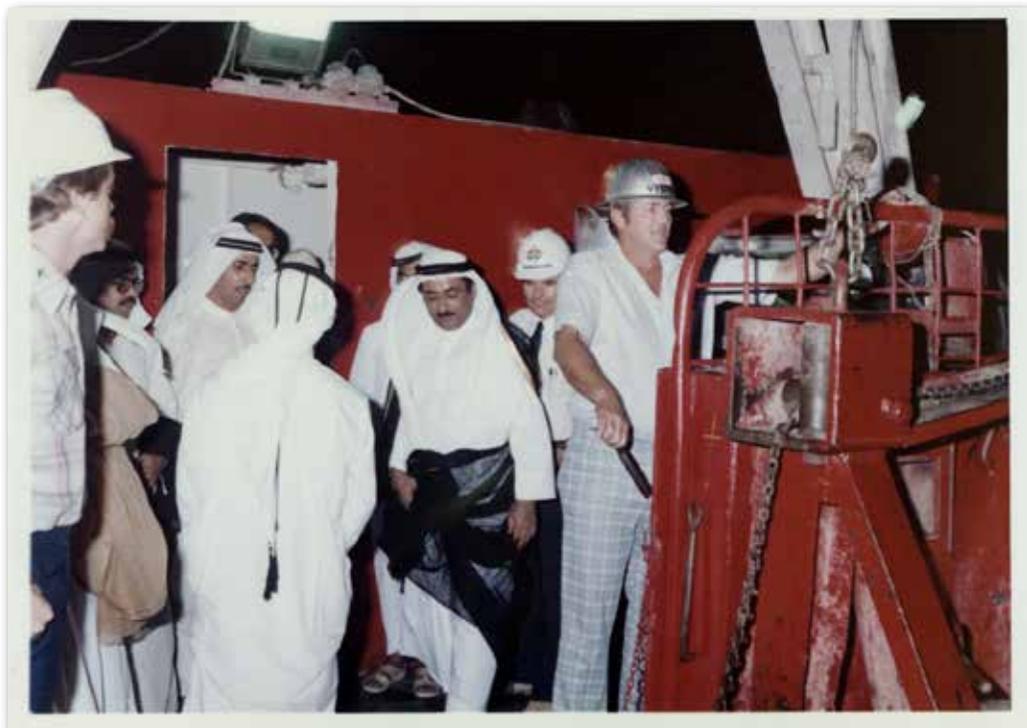
Hamriyah was signed in 1984, thus laying the foundation for a new Port facility in Sharjah, with it exporting its first load of LPG in 1986. Two world records followed in 2003. One was for the high efficient recovery of LPG (Propane & Butane liquid) and another for a world-leading coiled tubing under balance drilling (CTD) campaign, which was managed by BP and the Sharjah Government.

"It makes business sense for SNOC to leverage the infrastructure and resources already available in Sharjah, due to decades of hard work since 1980. This will better ensure gas security for the next generation in the UAE and beyond. SNOC is available and ready to deepen its footprint in the UAE's gas ecosystem," explains Sheikh Sultan Bin Ahmed Al Qasimi, Deputy Chairman of Sharjah Petroleum Council (SPC) and President of SNOC. "Sharjah also benefits from a strategic position along the coastline and in the centre of the country's seven emirates, which means SNOC can provide an uninterrupted supply of gas across the UAE at a time of significant growth in demand. It is a win-win situation for all."

Just seven years since its inception, SNOC owns and operates 53 wells distribute in three fields and 2 hydrocarbon liquid storage and export terminals. The condensate terminal was constructed in 1981 in Hamriyah and has two 500,000 barrels tanks and one offshore Single Point Mooring (SPM) buoy for VLCC tanker loading. Constructed in 1986, the LPG terminal has a dedicated loading jetty inside Hamriyah Port and Free Zone with 400,000 barrels and 300,000 barrels of propane and butane storage capacity, respectively.

The Hamriyah Port is the only location in the Northern Emirates with existing infrastructure





Ruler of Sharjah visits Saja'a Plant in 1981



and connectivity capable of sending more than 1 billion standard cubic feet per day (Bscfd) efficiently into the market. All pipelines in the Northern Emirates converge at Saja'a, giving it the ability to transfer this gas to anywhere in the UAE – a valuable convergence of infrastructure in a region that lacks an intra-GCC gas pipeline network. These pipelines are owned and operated by SNOC, SEWA, Emarat, Dana Gas, DUSUP and Dolphin.

“We recognize the urgent need of the Northern Emirates for a reliable supply of natural gas that can be easily distributed to support large and small consumers, from the big power generators to small businesses. SNOC is already able to provide that level of much-needed flexibility,” said Hatem Al Mosa, Chief Executive Officer of SNOC and Secretary General of SPC. “The Saja'a complex has traditionally been the centre of the gas supply business in the Northern Emirates and it is well-placed to continue supporting the region.”

**Fortuitous Timing**

SNOC's growth is well timed to help meet the demands of the UAE's growing population, with an 17% rise by 2030 as today's 9.4 million increases to 11.05 million.. SNOC also provides services to Anabeeb company for importing jet fuel into Hamriyah port for transit to support the rapidly-growing business at Sharjah International airport. The airport has handled 4.6 million passengers and more than 30,000 aircraft movements this year alone

SNOC's deal in May this year with SEWA for a 10 years gas sales agreement targeting the supply of natural gas for Sharjah Electricity and Water Authority (SEWA) power generation in Sharjah, follows the company's joint venture with Uniper in October last year to import liquefied natural gas (LNG) into the emirate's Port of Hamriyah. The joint venture between SNOC and Uniper will supply natural gas to the three power stations operated by SEWA. First gas deliveries to SEWA from the 10-year

**Sharjah National Oil Corporation Headquarters**

agreement will be in early 2019 and some of the gas will flow from the Hamriyah port jetty directly into the SEWA 'Hamriyah' power station. Additional gas will flow to SNOC's Saja'a gas field complex and will supply the other SEWA power stations. The import project will have a capacity of 3-4 million tons of LNG per annum (mmtpa) and a send out capacity range up to 1000 million standard cubic feet per day (mmscfd).

“The Emirate has had to rely on an expensive, unpredictable commodities market, which means SEWA has been selling power for less than its cost of production,” Al Mosa said. “But that is changing as the deal between SNOC, Uniper and SEWA will ensure Sharjah has a guaranteed gas supply at attractive prices. This is a major milestone in SNOC's growth story and indeed, Sharjah and the UAE.”

Gas storage is the next stage in SNOC's evolution. SNOC owns the ideal size reservoir

for such a project, which is located close to its gas complex. The LNG import project will provide the required volumes to start this, which allows storing excess gas in the winter for its production in summer to satisfy the summer peak demand. It also provides a readily available strategic reserve to respond to unexpected operational or market problems. Requiring significant capital investment for the project, SNOC is planning a phased project with the first tranche potentially starting in 2021. a Pilot studies to test existing infrastructure are being carried out to optimize the final project design.

As the UAE's gas demand continues to swell, SNOC's leadership will ensure that the company is a collaborative and flexible partner. The days of crisscrossing desert tracks may have been replaced by modern technology, but the entrepreneurial and determined spirit that sparked Sharjah's energy industry is still alive and well. ■

# Advancing EOR Collaboration in the Gulf

By Qasem Al Kayoumi, Technical Center Manager & Member of Upstream Leadership Team  
Abu Dhabi National Oil Company

**T**he EIA has forecast that 30% additional energy will be required by 2040 - that's around 30 million barrels per day (b/d) or three Aramco's - not a small amount. Yes, there is U.S. shale and there are electric cars that will also reduce demand for fuel, but I don't believe the contribution of these two factors will be sufficient to meet global energy demand.

Most of current supply is coming from conventional reservoirs which are declining, and some of them very fast so we need to do something to sustain and improve recovery. Hence, the importance of Enhanced Oil Recovery (EOR) and Improved Oil Recovery (IOR).

Globally, primary and secondary recovery rates are currently around 30% to 35%. We are lucky here in Abu Dhabi that the number is around 50% thanks to favorable water and flat conditions and rock and fluid interaction. But that leaves 50% of our resources underground as untapped, and we should not leave it as such.

EOR is not a cheap business. However, we have seen examples where what we thought would be very expensive, was in fact realized economically, like with unconventional and fracturing technology. We can achieve what we want from EOR economically and we have no other option actually with current global prices and the competition we have from other renewable energy.

To make EOR economically viable, we need to focus on four areas: talent development, technology, partnership and investment.

ADNOC is developing its talent by collaborating with renowned universities such as Norway's Berk University where Emirati ADNOC PhD students are working hand in hand with leading researchers in various hi-tech technologies. At London's Imperial College, our PhD students are working on rock physics and at Heriot-Watt University, they are developing techniques in carbonated water and low salt water injection. These are just small examples of how we create or we develop our talent. We are very proud in ADNOC that we have a mix of IOC partners from around the world who have helped us bring technology and knowhow and developed our talent.

On technology, we are working to develop formulas where chemicals can have an impact on the very aggressive condition of high temperatures and high solutions that will help to improve efficiencies. I'm also proud to say that we have just finished establishing a subsurface center of excellence in ADNOC HQ that will house the latest technology in field development in EOR and modelling and visualization. This center will be able to house 4 subject matter experts from geophysics and reservoir engineering and all the way to digital oil fields.

Around 10% to 15% of our oil now is actually recovered by EOR, mainly by miscible gas



injection. We have the CO<sub>2</sub> Al Riyadhha project - a unique project in ADNOC - and I believe we are just at the start with CO<sub>2</sub> field injection and have many other phases to come.

We are also proud to say that we have one of the latest technologies when it comes to extended reach drilling and MRC wells. In one example offshore, we have four artificial islands and our plan is that these will cover the giant Upper Zakum field with hundreds of MRC wells drilled from these four centers. We have proven the concept of horizontalization and simulation of tight reservoirs, and we now have areas in Upper Zakum where we thought we would never be able to produce and where the rock is producing around 5,000 b/d.

We are also planning to test polymer injection, so all in all, we have an EOR roadmap in ADNOC where we are systematically

implementing all these techniques in our reservoirs from the laboratory, to piloting, and then to the full scale projects.

As far as partnership is concerned, we work with IOCs, service companies, academia such as Khalifa University and Rice and Penn State University. We also have cross country GCC collaboration such as our plans for a joint industry project focusing on EOR.

Last but not least is investment which is crucial to sustain our business and the only way is to have smart investment where we can optimize resources as much as possible.

I would like to thank Gulf Intelligence for arranging this EOR workshop and I hope that the sessions will help us to better interact and share knowledge and come up with some recommendations. ■

# Work of the Future as PDO Transforms

Petroleum Development Oman (PDO) will turn to a fully-fledged energy company over the next decade encompassing hydrocarbon and renewable energy generation and water management, an official from PDO said. The majority state-owned firm has already taken strides in fields of alternate energy with projects such as Glasspoint Miraah and Ras Al Hamra redevelopment and “has a goal to play a major part in Oman’s solar and renewable future.” Raoul Restucci, Managing Director of PDO, outlines the NOC’s future plans in an interview with Brian Cozzolino, Research Analyst, Gulf Intelligence.



## CEO SERIES

**Brian Cozzolino:** *Let's begin with an outlook for PDO's production.*

**Raoul Restucci:** I have the privilege to work in a company that in a difficult, challenging, price environment has continued to grow. The 550,000 barrels per day (b/d) in 2005 reached 600,000 b/d recently and we'll be growing to 650,000 b/d and 700,000 b/d over the next 5 to 10 years.

There's a need and there's an opportunity in Oman for employment creation; it's about delivering new value streams, and from an opportunity perspective, we're well positioned to actually play a key role in some of those emerging new industries and we need to understand how to best position ourselves.

PDO has many examples where we're well ahead of the curve. PDO's WRFM (well reservoir facilities management) and Exception-based surveillance programme for instance is a best practice globally that we're planning to monetize into a new value stream. We're setting up a new company to launch it in the region and beyond.

**Sean Evers:** *You're essentially saying you're going to grow the business 20% or somewhere in that direction – where is that 20% going to come from?*

**Raoul Restucci:** It's not in terms of initial value streams. We're focusing on leveraging our human capital which is a competitive advantage we have in this region and arguably in many locations globally. It's recognizing that although the solar business is at an early, if not

embryonic, stage in Oman, the opportunity is absolutely huge. And we're doing a lot about it.

We're currently developing, together with Glasspoint, the largest solar steam plant in the world. Phase one is on stream, phase two is on the way. We're removing the pilot plant to install new technology for phase three. We're increasing efficiencies while progressing a more modular approach that will further reduce total costs.

We are also in the process of completing installation of 19,500 PV cells in our car park. Six megawatts to support PDO Headoffice requirements. It's less about the solar itself and more about how we run the operation, how we maintain, how we understand the supply chain, how we understand how well positioned Oman is to play in that space.

By the end of the year we'll be tendering out for 100 MW in our installations. We're working together with OPWP and engaging with them to see how we can assist them in their 500 MW project.

**Brian Cozzolino:** *In this new activity that PDO moves into, renewables, water, etc. – would you envisage the requirement to hire more staff beyond your 9,000 currently and what staff skill sets will they need to have?*

**Raoul Restucci:** I don't believe we need to grow our headcount because of the dramatic efficiency which we're seeing; exception-based surveillance enables our systems to identify the problems with our wells and now we're focusing on

fixing and not finding problems. Within two or three years, we won't even be doing that; we'll be elevating the deployment of the staff to other activities. So that's a continuous journey. I don't think you're looking at significant increases in the establishment. What you are working on is establishing a supply chain for the industry, in this case, the renewable industry, where the employment and market opportunity is absolutely huge.

**Brian Cozzolino:** *In that regard, do you think Oman is behind or ahead of the curve on renewables? Obviously, it's quite an active project throughout the region. We've seen very big developments in Abu Dhabi and Riyadh and so on.*

**Raoul Restucci:** There's a lot going on but much tends to be in individual silos, so the integration under one authority, one management, will enable and accelerate the whole process significantly. But I'm confident that we're starting to see a lot of engagement, a lot of alignment. If you look at the key projects around the region, in Abu Dhabi, in Dubai, in Morocco, in Jordan, in Saudi, major plans and ambitions have been announced, but with less emphasis on the in-country value, and local supply chains. And that's an area where we've done extremely well in - as an industry in oil and gas, and we can easily transform that to renewables.

**Brian Cozzolino:** *You have been quoted previously as saying that you're going to identify sweet spots in the context of*

*PDO's new business opportunity that you will look to build. I'm curious how do you set the criteria for identifying a sweet spot? Is it a pull approach of seeing what the demand in the market is – for example – demand for solar energy so you then try and meet that. Or are you going to take a different approach, where you identify what you are really good at and then push that out as a service or product?*

**Raoul Restucci:** It's a combination of both. There's no doubt that we'll focus on areas where we believe we understand the business model. And that's a key challenge. If you look at the coal, steel and electrical industries, major providers like RWE, EON, EDF, are really struggling to move into a new business models. Similarly, for oil and gas where the margins tend to be pretty high at \$40 or more, to move into the renewables business where the margins can be incredibly thin and where the manufacturing often suffers from oversupply and where many companies have gone bust, it's critical to understand what it takes to win.

**Brian Cozzolino:** *Is it a downstream approach?*

**Raoul Restucci:** Yes and that requires a very different mentality, rigour and leadership. Lean, efficient and stable processes and, often, you're having to set up and spin off different entities because that don't suffer from overheads and legacy business models and are simply unable to manage large capital-intensive projects with efficient downstream types of operations.

Sean Evers: When you consider that, how do you think PDO and national oil companies in general can manage their dual mandate of profit and the national commitment to employment. For example, if

**“ We will open training programs to the industry, and we've got some world class facilities for this.”**

ARAMCO goes public, it will be very difficult to see how it maintains that dual obligation. Similar developments in ADNOC. How do you see that going forward as a challenge?

**Raoul Restucci:** I struggle with the understanding of the conflict. They go hand in hand. We don't do ICV because it's a corporate social responsibility need; we do ICV because it's simply good business. When you look at the direct, indirect and induced values that you create through that new supply chain, it's just enormous, and dramatically improves costs.

The renewables business in the region is expected to grow in excess of 200,000 people over the next five years and will see more than \$200 billion dollars being invested in the same period. We want a piece of that. So it's not about establishing huge new organizational upgrades; it's more about ensuring that the supply chain is delivered and that it's also very sustainable.

**Brian Cozzolino:** *In terms of grabbing some of this opportunity that PDO will be driving, what should the private sector supply chain in Oman be doing now in order to get ready to transform themselves?*

**Raoul Restucci:** It starts with the private sector recognizing that it needs to really step up in terms of creating employment opportunities for Omanis. Secondly, it's about working with government and seeking legislation that will enable the private sector to grow. Less talking and more doing. We are engaging monthly with TRC on how

we can progress key technologies and we've engaged recently with government to look at curriculums and review how we help each other. We're also challenging the Cloud constraints because at the moment that's a significant disadvantage – we won't be able to secure a step change in digitalization unless Cloud access is opened up. There are also a number of technologies that we want to test, a number of algorithms, sub-surface simulation technologies that we want to avail of but we're currently unable to do that because of sovereign data transfer constraints.

**Brian Cozzolino:** *What impact will digital technologies have on the energy industry in the Middle East over the next decade?*

**Raoul Restucci:** I think the impact will be transformational. We've been on this journey for quite some time. Three years ago, we used to manage 50,000 data points in production. Today, we manage a billion data points a day and unless you've got augmented facilities to deal with that, we're going to really struggle to manage. I really wonder who is ready and positioned for it. There's a lot of discussion in terms of what we need to be doing and a lot of companies are focusing on transforming the digital expertise into value.

**Brian Cozzolino:** *Which aspect of Middle East or Oman energy operations will digital technologies impact most? Health and safety, development, production, maintenance or integrated planning?*

**Raoul Restucci:** I would say it will

have a dramatic impact on all. On safety, we drive the equivalent to the moon and back every single day. We can reduce this exposure and cost significantly. The key is how you monetize production - that's where the dollar needs to be made. You can have the most efficient maintenance program, but if you don't deliver more barrels, there's a bust there somewhere. So it's really about determining what the key driver will be that will make the bigger difference to monetization, value-creation and production and we see enormous opportunities on maintenance, on exploration, on seismic and on safety. And this is not only in terms of logistical improvements but also in asset integrity assessments.

**Brian Cozzolino:** *Do you think early or accelerated adoption of these tools by PDO and the skills around deploying them, could give you an opportunity as you transform to offer that as a professional service in the market? And going forward, where could you possibly take some of this expertise and offer it into regional markets?*

**Raoul Restucci:** In some areas, we're really at an advanced stage and in others, we're lagging. At this stage, we have 23 digitization projects. The reality is that there's probably another 50 to 100 which are just clambering at the door and we're trying to control them. There are the Microsofts and Oracles of this world who can't wait to provide us with their own bespoke solution. But they also want our data and we're saying, no, let's first make sure that we've got our common data systems to enable various plug and play arrangements.

Again, it all comes down to understanding where you can create the most value. We've got a fantastic portfolio within our concession and



we've been growing in a challenging period. We've got so much human capital, so much know-how. We recently presented to the Board, opportunities in PDO Services, PDO International, and transforming PDO into Energy Development Oman (EDO), which covers these additional streams. On the services side, there are also many areas that we can add considerable value - as a contractor, a subcontractor or in service delivery, because we've got best practice in a number of areas; that's what we're focusing on.

**Brian Cozzolino:** *How will the new PDO present itself in 2018?*

**Raoul Restucci:** We have three or four areas that go outside our normal mandate, where we will start sharing expertise and know-how with other entities. We will open training programs to the industry, and we've got some world class facilities for this. We have established a dedicated company that is integrating with national entities to monetize in house systems and create value for Oman Inc. – to demonstrate how we manage sub-surface data and system optimization and acceleration of field development plans. You're going to also see project management consultancy on a number of themes. ■

# Could the Era of 'Lower-for-longer' Oil Prices Accelerate Progress to Industry 4.0?

By Gaurav Sharma, Business Editor & Oil Analyst, International Business Times

**T**he oil price is stuck in the modest middle unable to escape the \$50-60 per barrel range, with little on the horizon to suggest it would touch three figures anytime soon. For many, the current situation has become an era of 'lower for longer' oil prices that's here to stay. The oil and gas industry's response in its wake has been to improve process efficiencies by finding accelerants for its own march toward Industry 4.0 or the Fourth Industrial Revolution.

From the deployment of artificial intelligence (AI) to drones, blockchain to advanced analytics, the possibilities are endless. So what does it all mean? Especially as regions and

segments, upstream and downstream are more than likely to find their own digital Alamo at very different speeds.

With such a critical topic in view, the 7th Gulf Intelligence Energy Markets Forum 2017 in Fujairah, UAE decided to tackle the subject via an industry roundtable on the digital revolution that is among us and disruptive technologies the energy industry needs to pay attention to, with a specific emphasis on downstream operations.

The lively audience of senior industry professionals was addressed by a distinguished panel that included Irina Heaver, Partner and Head of Commercial at



Fichte & Co., a seasoned legal industry expert who has of late turned her attention to the introduction of emerging technology by traditional businesses.

Alongside her were entrepreneur Rabih Bou Rashid, Chief Executive Officer of Falcon Eye Drones, the first company of its kind providing drone services to the energy industry in the Middle East; and Salman Yousuf, Managing Director of TAKELEAP, an award-winning specialist in the virtual and augmented reality space.

Popular perception that the oil and gas sector is lagging other segments of the economy when it comes to digitization was certainly not popular among the attendees.

To quote one delegate, the sector has always deployed huge volumes of data, well before the expression 'big data' even gained the currency it has today. Additionally, robotics has been a constant keen component of offshore exploration – from unmanned submarines to mechanical claws.

### A Question of Resources

However, in 2017 and beyond, the sector's challenge is to take digital adoption to the next level for myriad deployments from digital applications aimed at increasing reservoir limits to an accentuation of the utilization of 4D seismic imaging, using smart procurement management software to improve material price variance to connected petrochemical plants.

And it doesn't end there – smart analytics premised on information gathered from sensors pegged to infrastructure can revolutionize operations, help reduce health and safety incidents, assist in water conservation and aid in reduction of CO<sub>2</sub> emissions.

Virtual and augmented reality (AR & VR), and the usage of drones in aiding and enhancing health and safety practices is also undeniable.

While enthusiasm is one thing, actual adoption and allocation of resources is quite another and it is the latter that is of concern.

For instance, many roundtable participants opined that the usage of drones for inspecting downstream infrastructure in the Middle East is still in its infancy and often viewed with suspicion, compared to other regional markets. Some also said there is often an unnecessary attempt to reinvent the wheel, by requesting an AR or VR solutions where none are required.

A major challenge is the issue of resources – in trying times for the industry; many decision makers seem reluctant to trigger capital expenditure on a platform that is unlikely to yield short-term returns.

Additionally, for those willing to invest, especially in AI and connected plants – thereby endorsing the industrial internet of things (IIoT) – the testing phase, given the oil and gas sector's rigorous emphasis on health and safety, makes deployment much slower compared to other sectors.

By that token, labeling the sector as a digitization laggard comes across as an oversimplification rather than an accurate description of the situation.

### Of Transparency and Blockchains

At a time when there is renewed emphasis on data transparency, for instance by the Port of Fujairah in its quest to become a global storage hub, many on the roundtable felt blockchain is fast becoming an invaluable tool.

In simple terms, a blockchain is akin to a digitally distributed ledger that can be replicated and spread across many nodes in a peer-to-peer network, thereby minimizing the need for oversight and governance of a single ledger.

Each transaction on the ledger is recorded and added to the previous one. These additions result in a growing 'chain' of information. The technology underpinning it – used by cryptocurrencies like bitcoin – could become key to transparent contracts, data processing and much more.

In the eyes of many, blockchain holds the potential to freshen up processes and standards and become integral to circular collaborative ecosystems in the oil and gas industry, and by extension in the utilities market.

Since no single party is entrusted with all the information, blockchain essentially self-monitors, providing data reliability, and even address issues of fraud and corruption. Many on the roundtable viewed blockchain as part of a more efficient "new normal."

Furthermore, delegates felt blockchain was not so much the transfer of payments, but rather the smart coding of contracts that self execute; an enticing digital development in the current climate. That said, there was recognition that mass adoption of blockchain within and beyond the Middle East still has some way to go akin to cognitive computing to predictive analytics in the oil industry.

**“The key takeaway was glaringly obvious – innovate or die.”**

### Ultimate Objective of Boosting Efficiencies

The roundtable found widespread acknowledgement that digitization is not an end goal but a constant process, and the ultimate objective remains one of boosting process efficiencies. Therefore, narrowing the focus down to five disruptive technologies oil and gas companies in the Middle East ought to take notice of was hard.

However, based on the deliberations, participants narrowed it down to the following, in no particular order: (1) Digital risk management using data analytics (2) Incremental usage of robotics, including inspection drones (3) Artificial Intelligence (4) AR and VR usage for health and safety training and (5) blockchain.

Whether it's a case of developing new digital technologies or simply adopting or fine tuning existing technology, remains open to conjecture, but underpinning all of the above is innovation and the industry's appetite for it, which in the eyes of many is growing by the day. The key takeaway was glaringly obvious – innovate or die. ■



# Gender Equality: NEW ERA

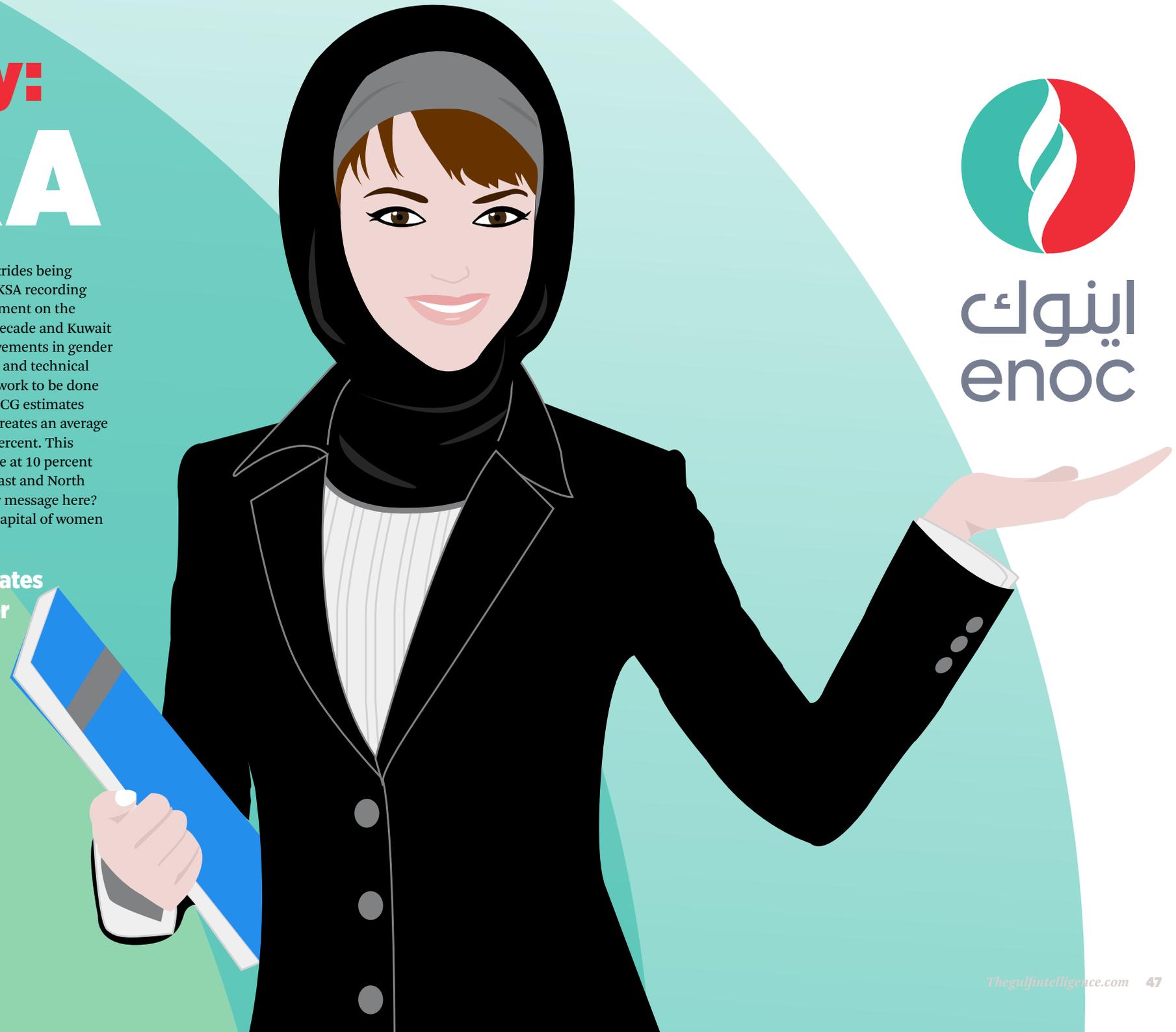
**S**upporting and empowering female leaders is essential to leveraging the intellectual dividend of Dubai and the wider UAE. The importance of achieving gender equality in the workplace is increasingly engrained as a symbol of social maturity and economic growth in company cultures – and the value of these efforts is clear.

The UAE is one of the best-performing countries in the Middle East and North Africa (MENA), according to the 2017 World Economic Forum's (WEF) Global Gender Gap Report. The country has reported notable improvements in gender parity in ministerial positions and wage equality for similar work. The UAE also comes close to fully closing its gender gap on the Educational Attainment sub-index. The bullish sentiment is supported by research from Boston Consulting Group (BCG) in September this year, showing female participation in the workplace at 46 percent in 2014 compared to 34 percent in 2000. This remarkable progress is largely attributable to the leadership's progressive mind-set.

“Our job is to provide an environment that unlocks women's potential. One that protects their dignity and femininity, helps them create the necessary balance in their lives, and values their talents and potential. Given this environment, I am confident that women will perform nothing short of miracles,” said His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai.

While there are positive strides being made across the GCC, with KSA recording the region's largest improvement on the overall Index over the past decade and Kuwait reporting significant improvements in gender parity amongst professional and technical workers, there is still much work to be done in this region and beyond. BCG estimates that gender inequality still creates an average global income loss of 13.5 percent. This figure is the lowest in Europe at 10 percent and highest in the Middle East and North Africa at 27 percent. The key message here? Leveraging the intellectual capital of women pays – literally.

**“ BCG estimates that gender inequality still creates an average global income loss of 13.5 percent.”**



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# 'Women in Energy Award'

**ENOC supports the UAE's 2030 agenda for sustainable development, which encompasses gender equality as a key goal. The UAE's ambitious plans include raising the country's ranking to one of the top 25 countries to promote gender equality by 2021.**

Therein lies the value of ENOC's inaugural 'Women in Energy Award'. Celebrating the longstanding achievements of women who have shown exceptional leadership and have been catalysts for positive change is essential to sustaining positive momentum. Acknowledging their efforts also helps inspire younger generations to join one of the UAE's most valuable sectors.

"The success of this organisation has only been possible because of the dedication, commitment and continued support that we see from our employees. To every female employee working at ENOC, I am thankful and appreciative of your constant efforts juggling your responsibilities and duties at work as well as outside of work. To help you realise your goals and achievements, we will continue to enable each and every one of you by encouraging you to take on more responsibilities to drive your professional and personal growth; and as a result, contribute to our Group's success story," said His Excellency Saif Humaid Al Falasi, Group CEO at ENOC.

Entry for nominations for the 'Women in Energy Award' is open to employees of all nationalities working in any of the organisations under the Dubai Supreme Council of Energy and who have at least three years of experience within the industry. Entries will open in January 2018 and close in May 2018.

## AWARD CATEGORIES:

### Business category

- Best Woman Leader
- Best Woman Leader in the Renewable Energy Sector
- Best Woman Technocrat
- Best Young Woman Leader
- Best Woman Entrepreneur

### Professional category

- Best Innovator of the Year
- Best Professional Personality
- Best Thought-Provoking Woman Leader

### Social category

- Best Corporate Social Responsibility (CSR) Contribution
- Best Volunteering Program for Sustainable Development

## ENOC'S GENDER ETHOS:

At ENOC, salary relates only to the skills required for the job; remuneration is not influenced by gender. Whilst the Group recognises that the male to female ratio is currently weighted towards males, efforts to increase equality are underway. This includes investing in key initiatives such as the establishment of 'ENOC Women's Committee' which is charged with identifying and addressing any barriers in the careers of women working at ENOC, and the annual 'Women's Day', an event that harnesses the power and intellect of women in leading positions to inspire and motivate their fellow female colleagues.



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## Total number of female employees at ENOC:



## Percentage male and female employees in ENOC:



## Six actions to empower female leaders of tomorrow in the GCC

- 1 Including gender diversity as a strategic objective
- 2 Ensuring engagement of senior leadership and middle management
- 3 Fostering retention of high-potential female employees
- 4 Promoting the development of women
- 5 Advocating for women in leadership through positive promotion of role models
- 6 Ensuring fairness and removal of conscious or unconscious biases Source: BCG

## A quick history: Emirati women rising



Source: Compiled using data from The National

**Shaikha Al Haddad**

**Head of ENOC Women's Committee and Sr. Manager, ENOC-Wellness & Social Affairs**

"The establishment of our women's committee is a true testament to our Group's efforts to promote and foster a culture of equal opportunity for both women and men. Today we see ample evidence that an organisation's prospects are conditioned by how engaged women are in the workforce. Industries are now realising that the empowerment of women is a factor of success in business, as well as a condition for

effective development. We are in the midst of progressive change, and I feel honoured to have been appointed to steer our women's committee. My duty as Head of ENOC Women's Committee is to engage my fellow female colleagues to participate fully, so that together with our male counterparts, we can be the combined force that will make ENOC the UAE's innovative energy partner, delivering sustainable value and industry-leading performance."

**Hend Ali Al Rumaithi**

**Director Internal Audit & Chief Ethics & Compliance Officer**

There are no boundaries to what professional women can achieve with perseverance and hard work. My ambitious and positive attitude is largely thanks to my family, especially my grandfather – my greatest inspiration. His strong work ethic is an admirable characteristic that I proudly try to emulate. He invested in my mother's education and raised her to be a valuable contributor to the UAE's future. She went on to become one of the top ten high school graduates in the UAE before pursuing a career in education and entrepreneurship. My father, a self-made man, raised his sons and daughters alike with an emphasis on strength, self-reliance

and confidence. My mentality has certainly been nurtured by all their forward-thinking traits. ENOC has also constantly encouraged me and other women in the organisation to explore professional opportunities and push our limits. This supportive ethos is best illustrated by the fact that I was the only female auditor in the department when I joined ENOC ten years ago – now women account for 50 percent of employees in the department. ENOC appreciates the value of gender equality in the workforce, such as empowering women with the establishment of the ENOC Women's Committee in 2015.

**Best advice for young ladies entering the working world?**

- Compete fiercely and fairly, be confident and strong.
- Learn about how you can actively contribute to Dubai's goal to become the world's number one city.

**Alia Busamra**

**Chief Sustainability Officer**

I was a keen student and my family – especially my mother and grandfather – encouraged me to pursue a career that would actively contribute to the growth of the UAE. My older sister also helped by advising me on how to navigate what was then the very male-dominated world of engineering; she studied Electrical Engineering and I pursued Chemical Engineering. When I joined ENOC fifteen years ago, it was Dr Waddah Ghanem Al Hashmi, our Executive Director, EHSSQ & Corporate Affairs, who inspired and guided me to develop into a true professional in the field of Sustainability. Our Chief Energy Officer in 2007, Mr P. Radhakrishnan, also mentored me and guided me through my Post Graduate studies to achieve my absolute best. Both gentlemen were gender-blind and instrumental in expanding my professional expertise and personal confidence. Hard work does pay off; in 2010, I was one of fourteen Young Future Energy Leaders (YFEL) members selected among

150 delegates – following a 'case study competition' focused on solar energy – to attend the European Future Energy Forum 2011 in Geneva, Switzerland. The competition was designed to assess YFEL members' critical thinking skills and ability to understand the link between technology and policy in the renewable energy industry. We were also treated to a surprise tour of Solar Impulse, the record-breaking long-range experimental solar-powered aircraft project. After the trip, I was honoured to be one of the five YFEL members nominated to debrief His Highness Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces about the trip. His Highness' inspiring words during our brief meeting form an essential part of my motivation to achieve more. No one should impose ceilings on our ambitions, and we should be equally proactive by turning hurdles into learning opportunities.

**Best advice for young ladies entering the working world?**

- Education, education, education. Whatever you learn in the classroom is valuable in the working world. Skills and knowledge lead to greater confidence and an ability to think innovatively.

**Shamma Al Rahmah**

**Head of Strategic Planning and Portfolio Management**

My manager, a woman, played a vital role in inspiring me to work hard and gain experience so that I could compete on a level-playing field with male colleagues during my early days at EPPCO in 2000. Her support and my efforts paid off; my confidence grew, and I became more than able to hold my own in what used to be a male-dominated environment.

Encouraging gender-equality has a direct impact on the bottom-line. Motivated employees perform better and as a result, boost a company's overall financial performance – gender equality is a win-win. The unwavering support shown by His Highness Sheikh Mohammed bin Rashid Al Maktoum for

women across all sectors in Dubai is heartening. The positive guidance from His Highness has encouraged women across the emirate to work hard and regard their professions as a national duty. His Highness has imparted a great deal of pride into our working ethos. Women make up nearly 30 percent of the UAE's cabinet – this speaks volumes in a world where female politicians are still unfortunately well-outnumbered by men.

I am a member of many committees at ENOC, including the Tender Board Committee where I used to be the only female member. Today, there are three of us – a small but significant illustration of ENOC's forward-thinking attitude.

**Best advice for young ladies entering the working world?**

- Learn the fundamentals of your job as greater understanding will lead to stronger performance.
- Think carefully about how you can add value to your department, company and the UAE.

- Be a team player with a positive attitude who relishes taking on more responsibility.



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## Why Uniper?

We're well positioned to play a key role in ensuring supply security. We have:

- a broad geographic footprint with positions in Europe's main generation markets and in Russia
- comprehensive capabilities in the operation and management of individual generation assets and optimization of generation fleets
- profound technical knowledge gained in the development and use of energy technologies
- the market access of a proven trading and optimization platform at Europe's key trading points and on global markets along with a significant position in the midstream gas business
- a detailed picture of the interrelationships between market participants, technologies, and energy systems
- deep expertise in regulatory regimes and market designs

# TWO ENERGY WORLDS

The energy landscape has shifted. Changing customer behavior, new technology, and increasingly global markets are creating two distinct energy worlds.

**The classic energy** world has the indispensable task of ensuring supply security. Alongside it is emerging the new world of distributed energy solutions. Uniper's portfolio will combine large-scale power generation and the effective management of global and regional energy supply chains. E.ON will focus on the new energy world with renewables, distribution networks, and customer solutions. Both worlds require distinctive business models and capabilities. Both worlds present challenges and opportunities. Both worlds are needed to meet the world's energy needs in the decades ahead.

### A strong energy company

Uniper has the right assets, knowledge, and skills to succeed in the classic energy world. We have a deep understanding of global and regional energy markets, regulatory regimes, and market designs. We have a wide range of capabilities in the construction, management, and operation of large-scale energy assets as well as the optimization and risk management of assets and contracts. And we have long-standing relationships with industrial customers, municipal utilities, system operators, and our suppliers. These strengths and networks reinforce one another.

There are three main areas in which we deploy our strengths:

- We help ensure security of supply in Europe as it transitions to a low-carbon future

The growth of intermittent renewable generation increases the need for flexible power plants that can meet fluctuating demand at short notice; our generation portfolio is well suited to this task. In addition, our midstream gas business helps ensure supply security through a diverse portfolio of long-term gas contracts along with gas storage, transport, and regasification capacity.

- Our trading activities connect global commodity markets

Global trading in commodities like natural gas and coal is bringing energy markets from America to Asia closer together. As markets become more interconnected and dynamic, they create more opportunities for

companies that can build bridges between regional markets, respond swiftly to changes in supply and demand, and use their knowledge of supply chains to better manage commodity risk. Uniper has a flexible portfolio of long-term gas import contracts, coal, and LNG. This portfolio not only enables us to meet our own fuel needs but also to provide our customers with bespoke products and services.

- We support the development of power markets outside Europe with our own generation activities and our services for third parties

Uniper has a significant platform of technologically advanced generation assets across Europe and in Russia. As the demand for dispatchable generation capacities is growing in a number of markets, we're well positioned to market our capabilities in building and

operating assets and in supplying fuel to third parties.

From gas fields and power stations to customers: Uniper helps keep energy reliable

We offer a broad range of energy products, services, and solutions. Our business portfolio encompasses most of the stages of the energy value chain. We have a stake in a gas production business in Russia and procure climate-friendly natural gas under long-term supply contracts and at trading venues. With LNG becoming a more prevalent source of gas, we're active in sourcing, transport, and regasification. In addition, our hydro, coal and gas power stations play an important role on the upstream end of the electricity value chain.

**John Roper, Managing Director, Head of Middle East Uniper Global Commodities SE**  
E: [John.Roper@uniper.energy](mailto:John.Roper@uniper.energy)

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