

Special Report



SHALE

COULD SHALE OIL SPOIL OPEC'S \$70/BL PARTY?



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- 03 Foreword**
Ahoy Geopolitical Gamechangers?
By Sean Evers, Managing Partner, Gulf Intelligence
- 04 The Middle East's Energy Industry: Top 10 Things to Watch in 2018**
- 06 OPEC in 2018? Onwards and Upwards**
Interview: H.E. Suhail Mohamed Al Mazrouei
Minister of Energy & Industry, UAE and President of the OPEC Conference 2018
- 10 Energy Outlook 2040**
Today's Upheavals and the Impact on Tomorrow's Energy Security
By Tim Gould, Head, Energy Supply Outlook Division, International Energy Agency
- 12 A Geopolitical Crystal Ball: Key Challenges for the Energy Sector in 2018?**
By Erwin Kroell, Senior Vice President, Middle East & Africa, OMV Exploration & Production GmbH
- 14 US Midterm Election: Trump win vs Trump lose – Impact on Energy Policy and Politics?**
By Professor Sophia Kalantzakos, Global Distinguished Professor, Environmental Studies & Public Policy, New York University Abu Dhabi (NYUAD)
- 16 Middle East-India: Energy Allies in the 21st Century**
By Annette Bontke, Managing Editor, Gulf Intelligence
- 18 LNG: Elbows Sharpen in Crowded Market**
By Michelle Meinenke, Editor & Senior Content Analyst, Gulf Intelligence
- 20 GIQ Industry Survey: Outlook for the Energy Industry in 2018?**
- 22 Taming the Black Swan: Price Outlook for 2018?**
International Panel: Is an oil price spike just around the corner?

- 28 Energy Partnerships: What Lies Ahead in the Future of Consolidation and Diversification?**
By Dyala Sabbagh, Partner, Gulf Intelligence
- 30 Circular economy: Changing the Record**
By Alexander Bencini, Manager, Gulf intelligence
- 32 4th Industrial Revolution: Will the Energy Sector Keep Ahead of the Curve?**
By Mahin Siddiqui, Research Analyst, Gulf Intelligence
- 34 Technology and the Transition of Energy**
By Lord Adair Turner, Chairman, Energy Transitions Commission
- 36 Electric Vehicles: Does Progress Signal Peak Oil Demand?**
By Sean Evers, Managing Partner, Gulf Intelligence

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Ahoy Political Gamechangers?

I had just sat down on New Year's Day to review the results of our *GIQ* Industry Survey: Energy Outlook 2018 when North Korea's leader Kim Jong-un came on the television to tell the world he always has a nuclear launch button on his desk. He declared the entire US was within range of North Korean nuclear weapons, adding: "This is reality, not a threat!" Unsurprisingly, two thirds of the 100 energy industry survey respondents believe 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/bl. But it has been even longer since a notable geopolitical risk premium has played an active role in inflating crude above the natural supply-demand equilibrium. Prices quadrupled between 2003 and 2008, when hundreds of thousands of US troops engaged in battles in Iraq and Afghanistan.

We saw a few smoke signals emerge through the last quarter of 2017. Oil traders started to pay

attention to the increasing number of unpredictable strongmen seeking promotions to the top table at a time when there are not enough seats to accommodate all the booming voices.

As record inventory levels slowly but surely retreat to their five-year average, 60% of survey respondents expect oil producers to maintain robust compliance to the OPEC-non-OPEC deal to cut production by 1.8m b/d throughout 2018. Still, hiccups of nervousness are creeping into the outlook.

The majority of those polled believe Brent crude will be around \$10/bl higher this year with oil prices forecast to be into the \$60s/bl range. If so, it could pump an additional \$300m a day into OPEC's coffers.

While North Korea's determined young dictator was making his latest bellicose threats against the US, President Trump was busy sending his first tweet of the New Year condemning Pakistan, a longstanding ally, for lying and deceit. There may be a new mantra to 2018: 'who needs enemies when you've got friends like this!' ■

OIL PRICE: A Curve Ball Awaits?

Will expectations of \$60s/bl range for 2018 ring true...and have energy companies hedged sufficiently if not?



SAUDI ARAMCO'S IPO: Red Herring or Record Breaker?



The consequences of the world's biggest IPO in late-2018 will be significant, whichever way the pendulum swings. Will others follow suit?

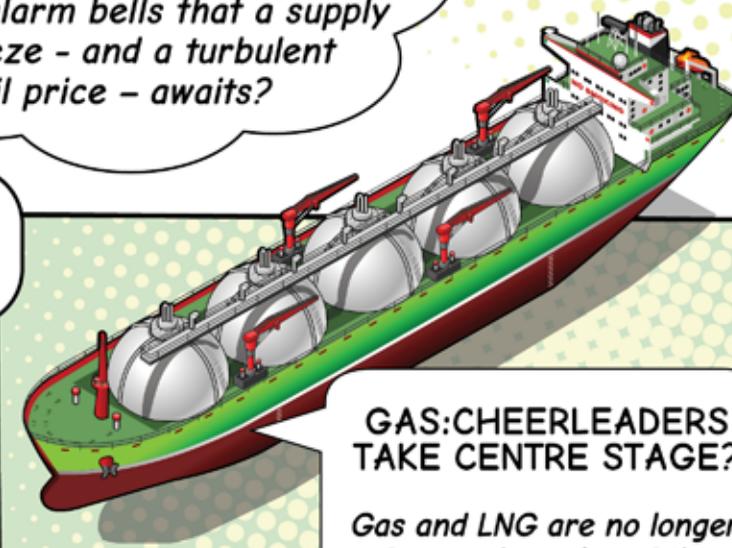
OPEC 2.0: A Marriage on the Horizon?

How will OPEC's unprecedented cooperation with non-OPEC permanently rewrite its historic repertoire in 2018?



DOWNSTREAM DARLINGS

Will investment rates gain pace fast enough in 2018 to silence alarm bells that a supply squeeze - and a turbulent oil price - awaits?



GAS:CHEERLEADERS TAKE CENTRE STAGE?

Gas and LNG are no longer favoured cousins of the golden child, oil. Security of supply will be a leading theme in 2018 playbooks.

THE MIDDLE EAST'S ENERGY INDUSTRY

Political Peacocking Rules the Roost?

Geopolitics could be the biggest driver of oil prices in 2018, with the US, North Korea, Saudi Arabia and Venezuela being just a few of the countries to watch.



TOP 10 THINGS TO WATCH IN 2018



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A Painful Goodbye to CHEAP CASH?

Who are the winners and losers with major infrastructure projects as central banks eye monetary tightening in 2018 i.e. higher interest rates?



CYBER CRIME: Are Digital Padlocks Good Enough?

Will energy companies do enough to stop the world's new and invisible mafia from stealing corporate secrets and halting operations in 2018?



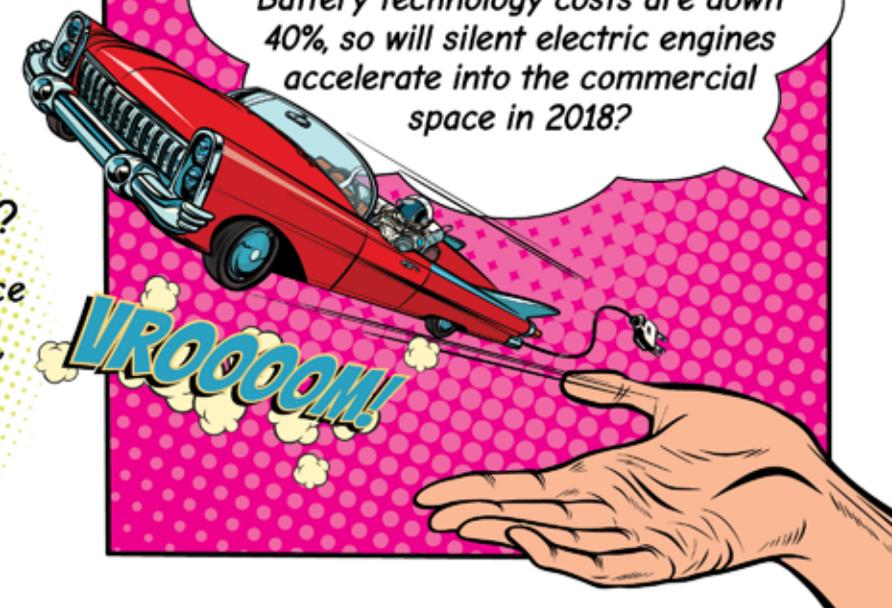
The Shine of Green Halos Brightens?

Can the region keep up its pace of world-breaking renewable projects, or will the 'comfort' of stable oil prices and expensive lending dent momentum?



Pedal Down for Electric Vehicles?

Battery technology costs are down 40%, so will silent electric engines accelerate into the commercial space in 2018?





OPEC IN 2018? ONWARDS AND UPWARDS

FIRST INTERVIEW

H.E. Suhail Mohamed Al Mazrouei
Minister of Energy & Industry, UAE
and President of the OPEC Conference 2018

Moderator: Hadley Gamble, Middle East Anchor, CNBC

Hadley Gamble (HG): Let's talk about how to keep OPEC and non-OPEC on track for 2018 and beyond. The gentleman who's charged with doing that in 2018 is His Excellency, Suhail Al Mazrouei. Are we at the point where OPEC can declare mission accomplished?

H.E. Suhail Al Mazrouei: No. First of all, OPEC is committed to what they decided when we met last November, which was to continue with this deal for a full year. So, we need not to forget that this is the agreement. And, there is, of course, positive market sentiment that we are seeing today. The market is balancing, and this is what we have been saying – the issue was the timing and how long it would take. And the way we look at it, we should not look at a quarter or just a month to assume the full price of the year. Last year, we started the quarter

with a strong price. And then towards the middle of the year, everyone was disappointed from where we started to where we were.

There are cyclic events that happen every year on the demand side and they affect the market. We need to take into consideration that we are in winter and demand is typically higher in winter. You have the second quarter and you see some softening, you see some refineries go to maintenance and you see demand changes. So, the cyclic event of supply and demand is something that we live every year. There is a reason that OPEC meets twice a year. The good thing is that this group is staying together. The compliance level is what's important to me. And as we have seen in November, when the prices were high compared to where they were in previous months, we achieved

122% compliance. I am confident of the commitment of all the countries attending. Something interesting happened. Not only the countries that signed the agreement attended when we met in November, but some observers attended as well. This means that there is a dynamic of joining the clan. And that's what's important; seeing this group start something new. This group has been complying at a very difficult time. And my expectation is that this compliance will continue in a very strong manner for the full year.

I have no doubt that the market needs further correction. We cannot forget that we have more than 100m barrels from the five-year average that still needs to be taken care of. The market fundamentals in 2017 have been good, but we are looking forward to another healthy year of production in 2018.

“ On average, 2017 was a good year. But we have seen \$40/bl and we have seen almost \$70/bl within 12 months. For policymakers and people who are looking at budgeting for a country, that is not a healthy fluctuation.”

HG: Please give us a little preview of what happens in June now. Is there a price point at which this agreement might be something that needs to evolve and change?

H.E. Suhail Al Mazrouei: No, I don't think it's about price. The concern is to achieve that balance between supply and demand.

HG: And we're not there yet.

H.E. Suhail Al Mazrouei: We're not there yet, because there is more than 100m barrels to be removed if we believe that the five-year average is a good reference point for us. And if that is true, then we still have some room to achieve that level. And when we achieve that level, there is the other question: do we have enough investments coming to the market to bring new oil for which there is demand? Whatever forecast you have does not necessarily mean that the world is going to meet it. The expectation for next year, in terms of global economic growth is strong, at least what we had in 2017. So, if we have that, the expectation is to have new investments coming to the market.

But there is good news. ADNOC have announced a \$109bn investment in the next four years throughout the value chain and Saudi Aramco have announced a similar level in the next three years. So national oil companies (NOCs), and international oil companies (IOCs) with time, will put down more investments. And that's what we targeted. We need to incentivize investors to come and invest in the market. The pace of that would trigger a correction and take care of the

supply and demand imbalance. If we achieve that level, then we will not have shocks to the world economies, with very high or very low prices. On average, 2017 was a good year. But we have seen \$40/bl and we have seen almost \$70/bl within 12 months. For policymakers and people who are looking at budgeting for a country, that is not a healthy fluctuation. The lower the fluctuation, the better we can plan for our economies and when we can achieve a point where is less of a need for deals like this.

HG: When you look at the price heading towards \$70/bl, do you think speculators are behind that? Or is this something that's sustainable?

H.E. Suhail Al Mazrouei: We are moving into an environment where there is less speculation, less geopolitics and it is more about market fundamentals. World economic growth and demand was higher than expected. Same for the compliance level. I'm kind of disappointed to see that people are still not trusting us with an average. We started this in a very difficult year and we achieved an average compliance of 100%. And we're still not seeing the trust that this compliance is going to stay. We're going to surprise you positively and you'll see a higher compliance level moving ahead.

HG: You mentioned some price shocks and I want to ask you about a Citi report that was recently released. They talked about potential wildcards; war, tensions in the Middle East and the uncertainties of the

administration in the White House. How does OPEC plan to deal with the Trump factor?

H.E. Suhail Al Mazrouei: We do not deal with geopolitics in general. I will not speak about countries and choices of people; people choose their presidents and we respect that. This is something that we don't discuss. What we discuss is the laws and regulations that could affect the market. The US market has been supportive of this industry. The growth of shale oil is something that could come as a rescue at a certain time. The only issue with shale oil that we have highlighted before is the pace of production. We need to adhere to something that is within supply and

HG: What's your expectation for the global trends for output and how is that going to impact countries in this region?

H.E. Suhail Al Mazrouei: We have proven when we made the deal – and we've been through cycles of convincing the world that the deal is working – that OPEC is strong, and that OPEC is playing a key role in the stability of the market. Ask anyone today and they will tell you that the deal has been working and OPEC has helped the market recover. OPEC will continue to be a strong organization. This phenomena of getting others to join OPEC in the course of market recovery and achieving enough demand to incentivize investments into this industry is an area where interest is growing.

This commodity is something that we need and we will continue to make it cleaner. We are environmentally sensitive in all sectors, whether it's in the energy sector or whether it's in the transportation sector. We will continue evolving and developing ourselves with the technology and the adherence to the international community when it comes to making this industry safe and we will continue to produce oil to fuel the world's economy.

HG: A little bit about countries that might be experiencing shock in terms of production.



“ If a crisis comes, everyone will move. You will find us responsible and you will find that we're responsive in terms of the action needed for anything that is a major event. This group (OPEC and non-OPEC) is strong – it's like a family. This level of engagement is intense.”

Are you worried about countries like Iran, like Venezuela? Do you think they're going to get in trouble this year?

H.E. Suhail Al Mazrouei: No, I'm not worried that we will have a big shock and even if there is a big shock, we can always meet, discuss and help one another. When Libya was out and when Nigeria was experiencing some unfortunate events, the group helped each other. And we will meet if needed. If a crisis comes, OPEC can always meet. But we need not to assume that this group is not going to do anything and just sit if a crisis comes. If a crisis comes, everyone will move. You will find us responsible and you will find that we're responsive in terms of the action needed for anything that is a major event. This group is strong – it's like a family. This level of engagement is intense. Any country can call on the others for help if they need it and they will be there. And that's why many other countries have expressed an interest to join and they are looking forward to cooperating.

HG: You mentioned that some countries are using this opportunity to diversify their

energy mix. Of course, Saudi Arabia comes to mind. Do you agree that the Saudi Aramco IPO will happen this year?

H.E. Suhail Al Mazrouei: I trust what the leadership of Saudi Arabia says. They have told us that they will revise their prices when it comes to gasoline and diesel and they will fix the system – and they have done it when they said they would. We have used this difficult time, when the oil prices went down, to rethink our whole strategy of energy. To rethink how efficient, we are. Can we improve the system that we have? Are we ready for the future? For the UAE, we designed an energy strategy that is diversified and takes us to 2050. ADNOC has done a tremendous turnaround. They're looking at all the bits and pieces of their value chain and trying to optimize here and there. From 2015 to today, everyone has achieved higher efficiency.

Everyone has benefited from the efficiencies and everyone has sharpened their pencils and looked at every opportunity to optimize. The industry today is strong, because we have worked innovatively with our contractors to create values and we have used the latest

technologies to look at the value chain to improve efficiency and optimize production.

HG: There are some that would speculate that US shale producers are swing producers now and it's no longer Saudi Arabia. What's your take?

H.E. Suhail Al Mazrouei: Everyone needs to have a spare capacity to become a swing producer, but at a certain level. So, and you need to decide based on the economics, what is that level?

If this commodity is stable, then people can plan. But, if there is a \$20-\$30/bl shock within the year, or between the planned budget price of oil and the actual price, then we will always have a problem, regardless of whether that price is lower or higher. The whole process that we've been through in terms of trying to control our production is to minimize that effect.

Now we have the last part to achieve the balance. Sure, we will have different dynamics in 2018. But we have grown in terms of our ability to cope with this issue. We have a stronger group.

*Source: CNBC
*This is an edited transcript

“ I'm disappointed to see that people are still not trusting us with an average. We started this in a very difficult year and we achieved an average compliance of 100%. And we're still not seeing the trust that this compliance is going to stay. We're going to surprise you positively and you'll see a higher compliance level moving ahead.”

Energy Outlook



Today's upheavals and their impact on tomorrow's energy security

By Tim Gould, Head, Energy Supply Outlook Division, International Energy Agency

Our new World Energy Outlook is really the story of four major upheavals that we see in today's energy system and how they might shape future trends: the continued dynamism of US shale, cost reductions in renewable energy technologies, the growing importance of electricity in the energy system and the changes underway in China.

In regards to shale, we are in the middle of an unparalleled expansion of the US' oil and gas production, comparable to or exceeding any sustained rise that we have seen historically. This puts the US very much at the center of oil and gas developments, at least for the next 10 years. In the oil market, the projected rise in US production could account for as much as 80% of global demand

growth over the period to 2025. In the late 2020s, we project that the US will become a net exporter of oil, still a large importer of heavy crudes, but already a slightly larger exporter of lighter crudes and refined products.

And if you take North America altogether – Mexico, Canada and the US – this region becomes the largest single provider of additional crude to the global market to 2040, bringing an extra 4m b/d. In absolute terms, all other parts of the world are still far behind the volumes exported from the Middle East, which remains by far the largest crude exporting region in the world. But growth in crude availability means a reshuffling of the pack of crude suppliers; North America moves up ahead of Russia, Africa and Latin America to become the second largest crude exporting region. This has some

profound implications for trade flows.

In regards to gas, new LNG projects are starting operations this year in the US. While it is clearly not the cheapest LNG, especially when it arrives in some distant Asian markets, it is a catalyst for some very interesting changes that are taking place in global gas markets in terms of shorter contract durations, loosening of linkages to oil and greater destination flexibility.

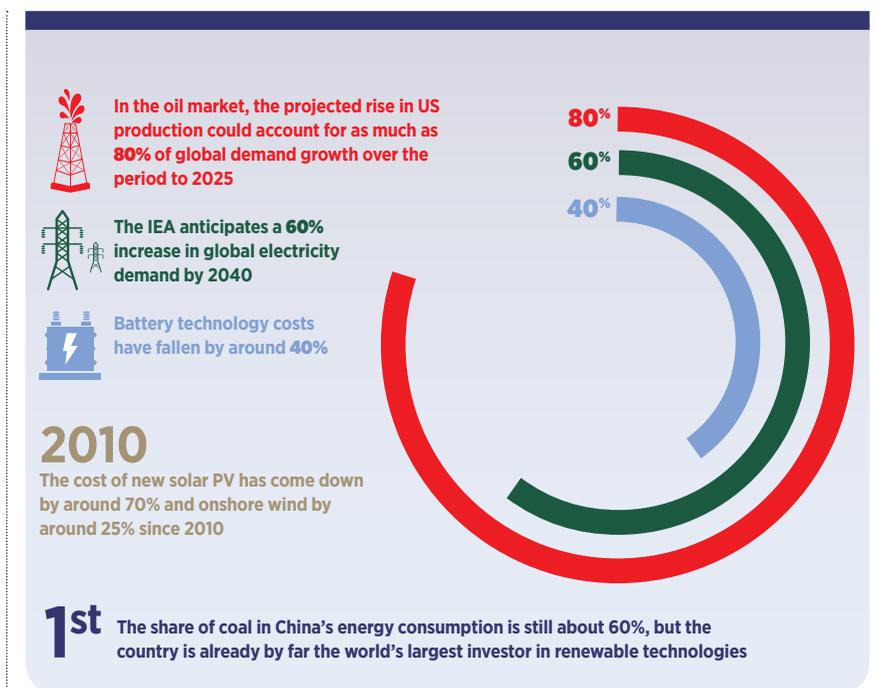
The second upheaval is the reductions in the cost of clean energy technologies – also a revolution that has yet to run its course. Since 2010, the cost of new solar PV has come down by around 70%, onshore wind by around 25%, and there have been striking reduction in offshore wind cost in some recent auctions in Europe and elsewhere. Battery technology costs have also come down by about 40%.

As a result, within ten years in the case

China needs to add an electricity system the size of today's US to meet its projected demand. The priority in many ministries of energy around the world will become how to manage these changes in the electricity sector, which are really at the vanguard of this energy transition that we are seeing today."

of India, and slightly longer in the case of China, solar PV is set to become the cheapest form of new power generation (on a levelized cost basis). That helps to explain why some two-thirds of global investment in power generation goes in our main scenario to renewable technologies. And it means that some of the other generation technologies are going to take a hit – first and foremost coal-fired power generation. There's around 200GW of coal-fired power under construction around the world at the moment and, once that wave of new capacity comes online over the next three to four years, the net additions of coal fired power to the global power generation fleet really slows to a trickle.

For policy makers, the rise of renewables is a major opportunity, but also creates some new policy challenges. So far, the focus has been to provide support to get wind and solar capacity deployed in the system. In the future, the big question will be how to integrate larger shares of these variable renewables into power systems. Currently, the global share of wind and solar is about 5%. But by 2040, this could be around 20% on average globally and in some markets, particularly Europe, significantly higher than that. That will create new demands on the power system – for operational flexibility through grid strengthening,



through the application of storage, through demand-side response and through other mechanisms that will be increasingly be the focus of the electricity security discussion.

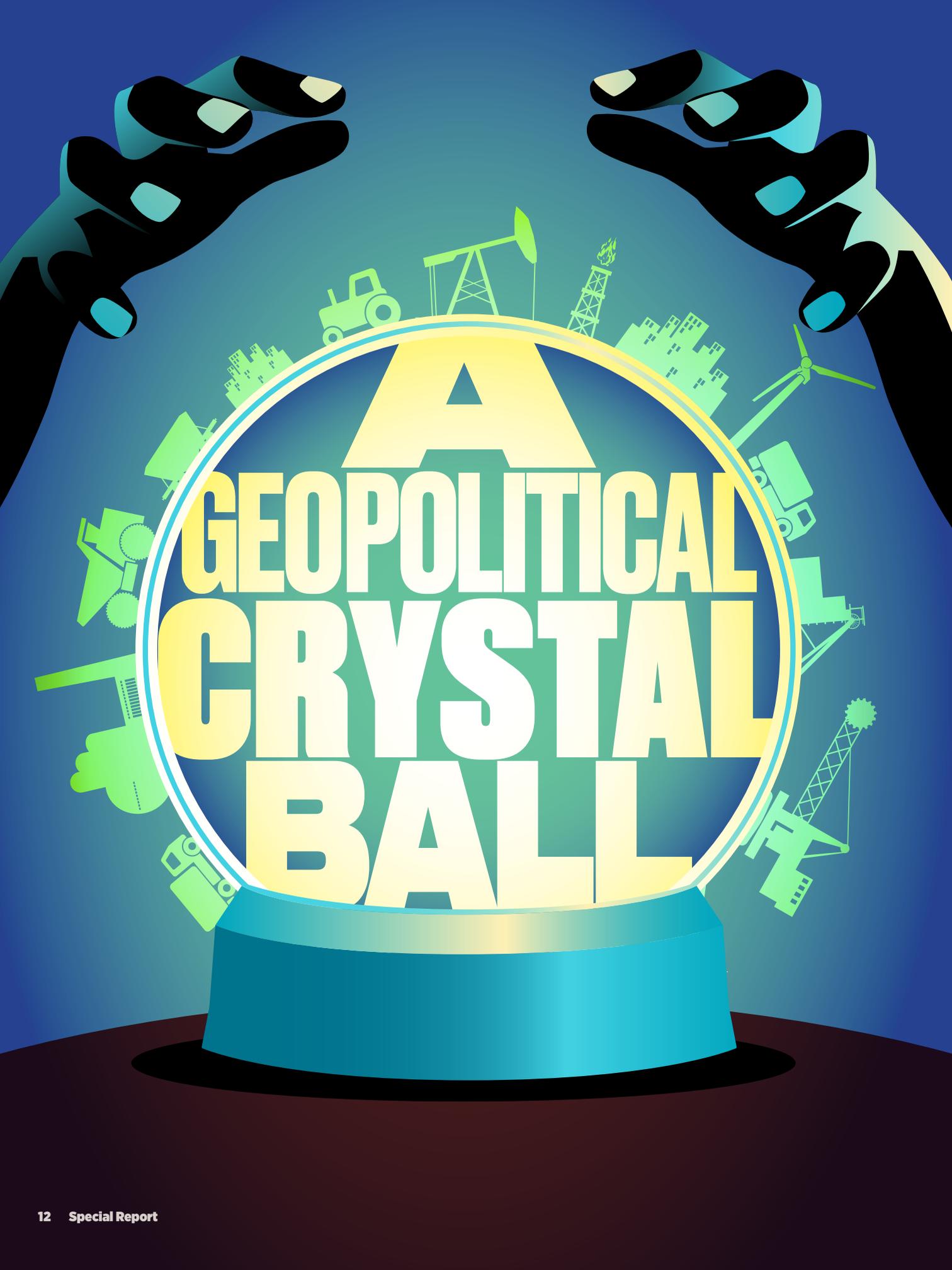
Electricity is likely to account for an increasing share of our global energy use. In our main scenario, we anticipate a 60% increase in global electricity demand by 2040, twice the rate of the anticipated increase in primary energy consumption. This will be driven by a number of factors, including a rising demand for cooling. In China, for example, electricity demand by 2040 just for cooling could be the equivalent of all of Japan's electricity consumption today. The second driver is the mass use of electric devices and the increasing intersection between the digital and energy economies. And thirdly, the new uses of electricity in our lives, such as electric vehicles and mobility.

In our projections, China needs to add an electricity system the size of today's US to meet its projected demand. The priority in many ministries of energy around the world will become how to manage these changes in the electricity sector, which are really at the vanguard of this energy transition that we are seeing today.

Finally, there is China's push for a new phase in its economic development, away from reliance on

heavy industrial sectors and towards a cleaner energy mix. China's desire to make its skies blue again is becoming a serious motivator of policy and one which is going to have very profound implications for the Chinese energy system. The share of coal in China's energy consumption is still about 60%, but the country is already by far the largest investor in renewable technologies. In 2016, half of global deployment of solar PV was in China, with more than 60 GW of new solar capacity. In our view, coal demand in China probably peaked in 2013 and will drop by more than 15% between now and 2040 in our main scenario.

We are used to seeing huge Chinese influence on oil and coal markets, but China is also a rising force in global gas. The country's switch away from coal for residential heating and for industry has meant a surge in LNG imports, which are increasing year-on-year by about 40%. And China's profile in oil markets is also likely to change. The country will be a huge player – China becomes the largest single consumer of oil by around 2030 – but no longer the main driver of global growth. In our projections, oil demand flattens by the late-2020s as China aggressively pushes an agenda on fuel efficiency and becomes an undisputed leader in the use of electric cars and buses. ■



Key Challenges for the Energy Sector in 2018?

By Erwin Kroell, Senior Vice President, Middle East & Africa, OMV Exploration & Production GmbH

Energy markets and geopolitics are two sides of the same coin; the geopolitical DNA of energy markets means the two are inextricably linked. In this sense, the year ahead is best described as a weather forecast: largely blue skies with a chance of showers and maybe the occasional storm. Let's start with the blue skies. This year's economic picture has a tinge of rosiness. Global growth forecasts for 2018 and 2019 have been revised upward by 0.2% to 3.9%, reflecting increased global growth momentum and the expected impact of the recently approved US tax policy changes, according to the International Monetary Fund (IMF). Some 120 economies, accounting for three quarters of global GDP have seen a pickup in growth in year-on-year terms in 2017. This marks the broadest synchronized global growth upsurge since 2010. Plus, emerging and developing Asia will grow at around 6.5% over 2018 and 2019, which is broadly the same pace as in 2017. It is good news for the Middle East that its biggest client base is also the region accounting for over half of the world's growth.

The Middle East is also benefiting from China's large investments into its 'One Belt, One Road' initiative, as the country aims to deepen its economic ties in the Middle East, Asia, Russia and Africa. Chinese capital in the UAE's Hassyan Clean Coal project and Oman's Duqm port, to name just two, illustrates how blueprints in Beijing are having a tangible impact. As a united region, the

“Greater transparency will play an integral role in helping grease the wheels of finance in the Middle East, especially as ‘lower for longer’ oil prices encourage national oil companies to increasingly seek more foreign direct investment for energy projects.”

Middle East also received a major nod of political support with International Atomic Energy Agency's (IAEA) backing of the UAE's plans to start operations at its Barakah Nuclear Power Plant this year – the first such project in the Arab world. And let's not forget that political and public momentum for low-carbon energy growth and the Paris Agreement are now an integral thread in the geopolitical equation. The Green Energy Barometer Survey conducted by Edelman Intelligence interviewed more than 26,000 people across 13 countries and found that 82% of people support the idea of a world fully powered by green energy.

Where are the potential clouds and occasional storms – what could challenge the energy sector in 2018? Despite the unprecedented success of compliance to the OPEC and non-OPEC agreement to curb production by 1.8m b/d this year, doubts persist. The market continues to question whether compliance goals will stick in 2018 and whether a clear exit strategy from the policy has been understood and agreed upon by all members. There is also the geopolitical uncertainty in the

Arab world; Syria, Iraq, Yemen to name a few. The region's political and social crises are hindering the progress of energy roadmaps and deterring much-needed foreign investors, especially those with a more delicate risk-reward appetite. The UN warns that nearly 15m Syrian and Iraqi refugees are internally displaced people scattered across the region. And it remains to be seen what impact the success – or failure – of the initial public offering (IPO) of 5% of Saudi Aramco in late-2018 will have on geopolitical and economic sentiment in the region. Greater transparency will play an integral role in helping grease the wheels of finance in the wider Middle East, especially as 'lower for longer' oil prices encourage national oil companies (NOCs) to increasingly seek more foreign direct investment (FDI) for energy projects. The GCC's robust credit ratings should help considerably.

The only certainty is that 2018 will be a busy year and where there is action, there is a reaction. An ability to flex will be the best method for riding the potential wave of turbulence. As well summarized by American actor Will Rogers in the early 1900s: "Even if you're on the right track, you'll get run over if you just sit there." ■



“As dysfunctional as the government is today, it will become utter chaos if Republicans lose control. As things stand, what they say today on policy may not be policy next week, which makes planning very difficult.”

GEOPOLITICS: US Midterm Election

TRUMP WIN VS. TRUMP LOSE

What it means for Energy Policy and Global Geopolitics?

By Sophia Kalantzakos, Global Distinguished Professor, Environmental Studies & Public Policy, NYUAD

T There is a 50/50 chance that Republicans lose the House and it is 40/60 that they lose the Senate. Republicans have controlled the House for 18 out of the last 22 years. So, if they lose control, it will be a serious and significant change in American politics.

If the Republicans do lose control of the Congress – some are reportedly not even seeking re-election – this would allow for a renaissance of people to come into the political arena.

A Democratic Congress will mandate the President as to what he can or cannot do and will seek to force his hand on issues like the Paris Accords. There will be investigations and perhaps even the initiation of impeachment hearings. And as dysfunctional as the government is today, it will become utter chaos if Republicans lose control. As things stand, what they say today on policy may not be policy next week, which makes planning very difficult.

If the Democrats do win, they will place a higher priority on diplomacy. That in itself would make it more difficult for the Trump Administration to do what it wants to do. There are also fundamental differences on climate change, human rights and economic advantage. We would certainly see policy shifts coming out of Washington. But the danger for Democrats is that they are always perceived as playing partisan politics, which can turn voters off. So, they should shout less and focus rather on holding Republicans accountable on specifics.

There is no issue more than energy where a change in partisanship would mean a complete change in rules and regulations. The Republican Party today accepts renewables, but it doesn't embrace them and it is not going to put them on a higher playing field than traditional energy. The Republicans also do not see Washington as being

effective in regulation or on the expansion of clean air and clean water. The Environmental Protection Agency under Trump has a completely different mandate than what it had under Barack Obama. No department agency has ever had fewer employees than what is has right now.

The Trump administration has also demonstrated a massive lack of diplomatic skill on the international stage; this has never happened before and part of that is because Trump has completely cut off his Secretary of State. There is a lower degree of cooperation globally as a result and world leaders are speaking their mind more than pursuing diplomacy. It is Trump who has set this tone over the last year. Corporations in the US have to have more meaningful interaction with other regions, which has been lacking under Trump's administration.

How the state of international politics will affect energy prices is hard to tell. What we do know is that we will see continued pressure on oil prices with an expansion of the fracking industry. The Trump Administration is less concerned about environmental impact and more concerned about jobs. Trump has adopted the phrase “energy dominance” – this means more American oil and more American gas. He believes that the more America produces, even with the environmental consequences, the more economically secure the country will be.

And as he promotes this economic nationalism, he is also at the point of blowing up trade deals that have worked for a number of years.

But despite his intention to become more energy independent, a US economy that is continuing to expand with a growth rate that might reach 3% this year and with unemployment that's continuing to drop, it is unlikely Trump's economic policy will enable the US to lessen oil imports significantly any time soon. ■

MIDDLE EAST – INDIA

Energy Partners in the 21st Century

By Annette Bontke, Managing Editor, Gulf Intelligence

A new strategic tone is underpinning the next chapter in the millennia-old story of commercial ties between India and the Middle East, spurring unprecedented change on both sides. Historical bilateral relationships are rapidly evolving into partnerships. The Middle East is a key stepping stone in India's 'Think West' policy, as New Delhi strengthens its global influence westwards. It also makes economic sense for the Middle East – a world-leading energy exporter – to ramp up its

1st
The agreement marks the first time Indian oil companies have participated in an Abu Dhabi oil and gas concession

40
The offshore concession stretches over four decades

eastwards charm. India and China are forecast by consultants PwC to take second and first place, respectively, in the league table for the world's biggest economies by 2050. And the UN expects both countries to be the most populous worldwide by 2024, with 1.4 billion people each. India takes the lead up to 2050, with 1.66 billion people. The country's energy consumption will climb by 4.2% a year by 2035, which is faster than that of all major economies in the world, according to BP. Clearly cooperation between the Middle East,

“A good partner with deep local knowledge is critical, which is an oft-underappreciated fact in our increasingly interlinked world. We cannot make the mistake of believing we all do business in the same way.”

China and India is a win-win deal – a point not lost on either side. Trade between India and the Gulf alone reached \$137.7 billion in 2014-2015 – from \$5.5 billion in 2001 – according to Brookings. China is also one of the largest foreign investors in the Middle East, as per its 'One Belt, One Road' initiative. What does this mean for the region's energy markets, especially amid intensifying competition from increasingly robust exporters in the US? In short: huge potential. The Middle East has the energy resources that India needs – oil, LNG, petrochemicals, primarily – while India is a coveted import hub. Plus, Gulf countries, home to small populations, are heavily reliant on importing workers – an area where India holds considerable value. Brookings estimates that India's diaspora in the Gulf numbers up to 8 million, which is sizeable considering the UAE's population alone is 9.4 million.

Learning how companies operate is key; there are different etiquettes, expectations and capabilities across the Middle East and India. Applying an

10%
India's ONGC-led consortium awarded 10% stake in Abu Dhabi's Lower Zakum

2.2bn
Will contribute AED2.2bn (\$600m) participation fee

9th
Agreement effective as of March 9, 2018

3
Lower Zakum is one of three new separate concession areas that make up the former ADMA offshore concession

Source: ADNOC

American, British or European style mentality to projects in India will not work. A good partner with deep local knowledge is critical, which is an oft-underappreciated fact in our increasingly interlinked world. We cannot make the mistake of believing we all do business in the same way. Transparency must increasingly overtake corruption in each country, to enable new ventures to quickly gain traction while sustaining global operating standards. The latter is especially pertinent if the countries seek support from investors further afield, such as Europe and the US. India's score of 40 out of 100, according to the Transparency International Corruption Index 2016, means the state needs to keep improving its handling of petty and large-scale corruption scandals. China has focused its anti-corruption efforts in recent years on snaring "tigers and flies" – corrupt public officials, both big and small – but remains at the poor score of 40. The Middle East also has some catching up to do. As each hurdle is lowered, today's plentiful opportunities will only flourish. ■

ELBOWS SHARPEN IN CROWDED MARKET

By Michelle Meineke, Editor & Senior Content Analyst, Gulf Intelligence

Exporters are vying to dominate a golden goose – LNG. Global gas demand is expected to grow by 1.6% a year for the next five years, with consumption reaching almost 4,000 billion cubic meters (bcm) by 2022, up from 3,630 bcm in 2016 – a 10% climb. Jostling elbows to capture market share abound, especially in Asia. China will account for 40% of this growth, according to the International Energy Agency (IEA), which aligns with the UN's forecast that the country will be the world's most populous nation with 1.44 billion residents by 2024. India is not far behind.

Whether the Middle East's historical upper hand of low operating costs, natural gas resources, port developments and a hefty rolodex of clients will protect Qatar's role as the world's biggest LNG exporter remains to be seen. The Middle East remains the largest LNG exporter throughout the BP Outlook, but represents 25% of global LNG exports by 2040 – down from 35% in 2016. The US is looming increasingly large. The IEA estimates it could challenge Qatar and Australia for global leadership among LNG exporters by 2022 – a very short four years away. If successful, this would be an astounding shift in the US' energy narrative, for the country only exported its first LNG cargo from the lower 48 states in late-February 2016. The US is already the world's largest gas consumer and producer and is forecast to account for 40% of the world's extra gas production to by 2022.

And Qatar's response to defend its coveted patch? One step Doha took was lifting a 12-year self-imposed ban on development of the world's biggest natural gas field, the offshore North Field, last April. It will take up to seven years before the development of the southern section of the gas field brings production up to 100m t/yr – a 30% increase on current volumes. The news has given pause to both established and emerging producers eyeing expansion plans in today's well-supplied market. Budding exporters, such as Mozambique, face an even steeper climb to market entry and there are inevitably some raised eyebrows in the US and Australia.

“It will be a busy year as the Middle East must reaffirm its export footprint and increase domestic gas production – quickly. A golden goose can fly out of reach.”

All exporters must adjust to importers' growing preference for short-term and spot contracts, including Japan, the world's biggest importer. Spot LNG trading made up 18% of total LNG volumes in 2016, according to the International Group of LNG Importers (GIIGNL). In an industry driven by big-ticket investments for infrastructure, investors typically reassured by the decade-plus supply contract deals will need to update their risk-reward approach.

The Middle East must also address its rather exposed Achilles' heel – an urgent need for gas. LNG imports into the Middle East have grown by more than 380% over the last three years, during a time when deliveries to traditional demand centers have been relatively stagnant or in decline. In 2014, the region imported 4.3m mt of gas as LNG, or just under 2% of the global total LNG imports, according to Platts Analytics' Eclipse Energy. By the end of 2016, this figure climbed to 20.9m mt, at 7.9% of the global total. Intensifying demand is unlikely to ebb, as BP Outlook anticipates a 54% increase in the region's energy consumption up to 2040. US ships setting sail for coastlines in the Middle East – a region home to 40% of the world's natural gas reserves – highlights how the region needs to rethink its puzzled gas management strategies. Kuwait, Dubai, Egypt and Jordan have taken US deliveries so far. It will be a busy year as the Middle East must reaffirm its export footprint and increase domestic gas production – quickly. A golden goose can fly out of reach. ■

LNG

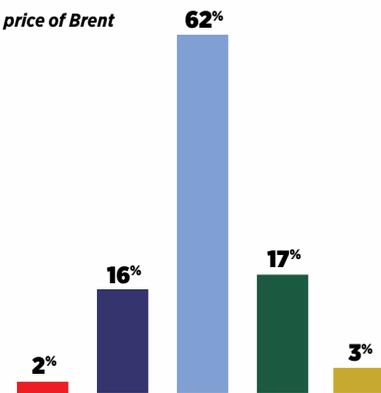


SURVEY RESULTS

Outlook for the Global Energy Industry in 2018?

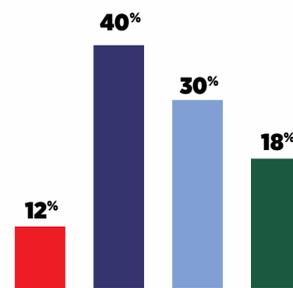
What will be the average price of Brent crude oil in 2018?

- A. in the \$40s or lower
- B. in the \$50s
- C. in the \$60s
- D. in the \$70s
- E. in the \$80s or above



What average compliance level do you expect OPEC and non-OPEC to achieve with agreed oil output cuts of 1.8m b/d in 2018?

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



Which of the following is a bigger risk to global economic growth in 2018?

- A. Monetary tightening by major central banks i.e. raise interest rates
- B. Practically NO monetary tightening by major central banks i.e. money remains essentially free



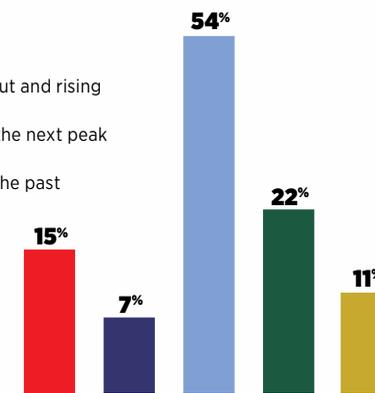
35% No 65% Yes

Do you expect Saudi Aramco's planned IPO to go ahead in 2018?



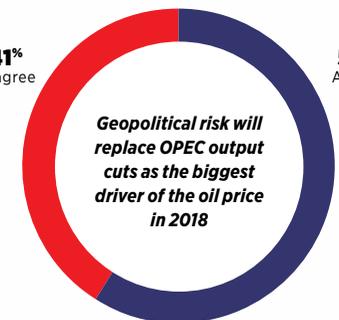
Where are we in the cycle in terms of oil prices and CAPEX?

- A. We are still declining
- B. We are at the bottom
- C. We have bottomed-out and rising
- D. We are approaching the next peak
- E. Cycles are a thing of the past

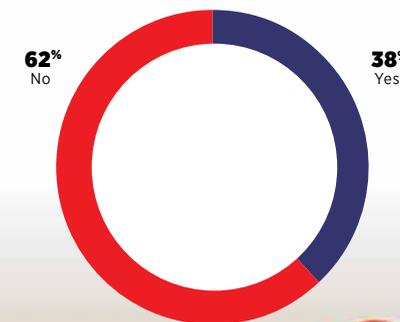


41% Disagree 59% Agree

Geopolitical risk will replace OPEC output cuts as the biggest driver of the oil price in 2018

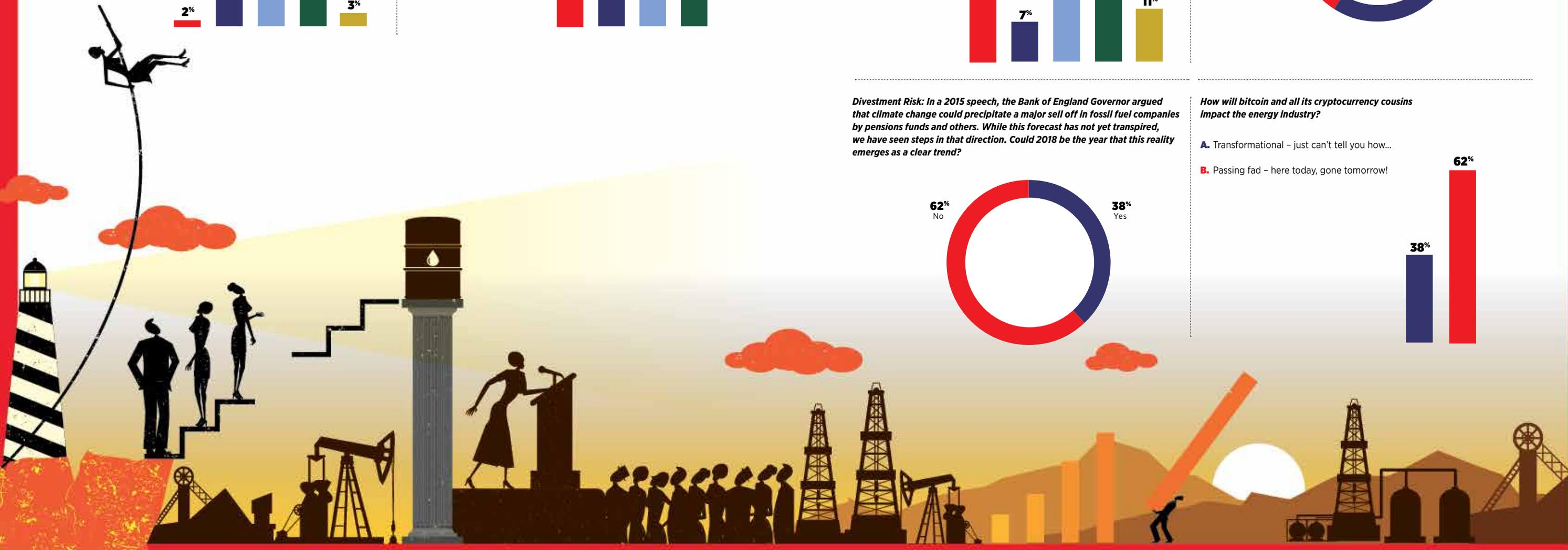
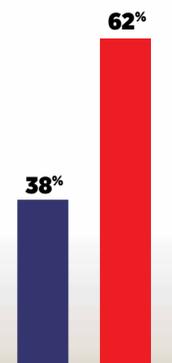


Divestment Risk: In a 2015 speech, the Bank of England Governor argued that climate change could precipitate a major sell off in fossil fuel companies by pensions funds and others. While this forecast has not yet transpired, we have seen steps in that direction. Could 2018 be the year that this reality emerges as a clear trend?



How will bitcoin and all its cryptocurrency cousins impact the energy industry?

- A. Transformational – just can't tell you how...
- B. Passing fad – here today, gone tomorrow!



TAMING THE BLACK SWAN

INTERNATIONAL PANEL



Is an oil price spike just around the corner?



PANELISTS:

- Chris Midgley, Head of Analytics, S&P Global Platts
- Tim Gould, Head, Energy Supply Outlook Division, International Energy Agency (IEA)
- Robert Johnston, Chief Executive Officer, Eurasia Group
- Dr. Edward L. Morse, Managing Director & Global Head of Commodities Research, Citi
- Moderator: Sean Evers, Managing Partner, Gulf Intelligence

Dr. Edward L. Morse: The cycle has changed and we're in a new range of \$25 that looks like it's currently close to the peak. It is not clear where the bottom is, but we are in a low-price environment compared to where we've been and prices are elevated right now for many physical and financial reasons. I don't see the wide band of \$25 changing in the next two or three years. We have no real regulator in the market and without this, financial flows tend to exacerbate seasonality. It is no accident that right now speculative money is well over a billion dollars' worth of net length. That's a record amount. If you look at correlations between the net length of non-commercial participants in the oil market and the price, there happens to be a very close correlation. If you look at the last year when the net length of speculators in the market was at a peak, it was when oil was at \$55/bl, basically from the OPEC meeting in November 2016 through to the beginning of March 2017. And then the net length went down by more than half and Brent was trading for a while in June at just about \$45/bl. The financial flows are there and so is the volatility.

Chris Midgley: Speculators are back in the market, but only to a certain extent. When you've got all that speculative extra net length in the market, you've got to understand what's on the other side and on the other side, there is a lot of hedging activity. So, that's the reason why this isn't particularly a shocking level of speculative length in my mind. The fact that you can generate a yield in commodities now means that the commodities market is that much better supported. I would be less inclined to suggest that it's heading back down to sub \$60/bl levels anytime quickly, because there is some yield for investors to make out of the market.

Sean Evers: Tim, I'd like to hear your view of where we are in the cycle.

“ We always tend to think about geopolitics as a supply-side factor; disruptions in Libya, Iran sanctions and other factors like that. But I think the key theme this year is possibly demand-side shocks in terms of increasing economic fragmentation, rising trade tensions – what we call protectionism 2.0. All that at some point could feedback into the demand for diesel, jet fuel and so on.”

Tim Gould: Our view is that we shouldn't take for granted that the tightening in supply we've seen over 2017 continues into 2018. We do have a demand growth outlook for 2018 at around 1.3m b/d, but there's a lot of resilience. There's a lot of steam left in the shale revolution and in our view, non-OPEC increases by some 1.6m b/d over the course of this year. So, in fact, you have a slight stock build in the first half of the year. You must also bear in mind that the \$60/bl price point also takes some of the heat out of demand growth in some markets.

Sean Evers: Will geopolitical risk replace output cuts as the biggest driver of the oil price in 2018? Some might argue that that has already started to happen. The Eurasia Group recently published its top ten risks of 2018, claiming geopolitics in the world have moved from a definition of recession to one of depression.

Robert Johnston: We always tend to think about geopolitics as a supply-side factor; disruptions in Libya, Iran sanctions and other factors like that. But I think the key theme this year is possibly demand-side shocks in terms of increasing economic fragmentation, rising trade tensions – what we call protectionism 2.0. All that at some point could feedback into the demand for diesel, jet fuel and so on. So, it's important we keep the geopolitical discussion tied to the demand-side as

well. The second point I would make is that we also have to consider that the relationship between geopolitics and OPEC policy is quite close. The interest of all the countries within OPEC – the government policy and national oil company policy around production and investment – also reflects their geopolitical national interests. A case in point is Saudi Arabia and its new leadership, Vision 2030 and their long-term goals, all of which will shape some of their OPEC policy goals.

Sean Evers: But are you not pleasantly surprised by how OPEC manages to apparently park geopolitics very firmly on the sidelines in their planning?

Robert Johnston: Yes, but we also look at the national interest of individual producers, their own economic goals, diversification, political change and how that supports their need for a certain oil price or certain strategy for OPEC as well.

Sean Evers: How do you reconcile Eurasia's outlook of a geopolitical fallout this year, while in a parallel corridor, equity markets are hitting a record nearly every day?

Robert Johnston: The reason that our view has not gotten as much attention as it should have is this disconnect between the markets and what appears to be a fairly negative set of geopolitical conditions. Structural trends at the



Where's the crystal ball when you need it?

L to R: Chris Midgley, Head of Analytics, S&P Global Platts; Robert Johnston, Chief Executive Officer, Eurasia Group; Dr. Edward L. Morse, Managing Director & Global Head of Commodities Research, Citi; Tim Gould, Head, Energy Supply Outlook Division, International Energy Agency (IEA)

geopolitical level may be moving fairly slowly, whether it is the relative decline of the US and its disengagement from the world, the strength and the rise of China as an economic power and as a geopolitical actor as well, the growth of interesting conflict in the technology sphere, cyber conflicts – all these are things that the markets don't seem to be paying as much attention to.

Sean Evers: Why do you think the markets are generally oblivious to pricing this in?

Robert Johnston: The difference between the marginal cost of supply and actual price often has a lot to do with speculation or with geopolitics. The North Korea story, the Iran story and others are factors that have played a significant role. Perhaps Venezuela as well. But I would agree with you, and that's what's analytically interesting about it. Why haven't we seen financial markets more broadly look at these prospects for geopolitical fragmentation and renewed protectionism as a potential incumbent

“ Why haven't we seen financial markets more broadly look at these prospects for geopolitical fragmentation and renewed protectionism as a potential incumbent risk? The answer is probably a lot to do with tax cuts in the US and other microeconomic factors. But at some point, perhaps, the geopolitics will kick in again.”

risk? The answer is probably a lot to do with tax cuts in the US and other microeconomic factors. But at some point, perhaps, the geopolitics will kick in again.

Sean Evers: Dr. Morse, what are your views on why the markets are not digesting what seems to be a substantial geopolitical noise across the world?

Dr. Edward L. Morse: Because the markets are chasing whatever they think is the highest return available to them in a very short time. The market is not

reflecting long term investments. The OPEC meeting last year was not the only reason why there was money flowing into commodities, and into oil in particular. Another reason was that bonds were terrible and there was a multi trillion-dollar rotation out of bonds. Some of it went into this much smaller oil market, which is half a trillion dollars. So that's the problem with looking at it in terms of geopolitical risk; it's really an effort to find returns in the short run.

Sean Evers: Tim, is the greater risk for the cycle from the supply or demand side?

Tim Gould: There is a lot of talk now about peak demand, but the substantial impact is somewhere down the road. And for us, it's still much too early to write the obituary for oil. There are dramatic events happening within the passenger car segment of oil demand, but we need to remember that this is some 30% of the total. There is plenty of buoyancy and there is plenty of momentum in some other big sectors, whether that's trucks or maritime or aviation or petrochemicals. So up until the mid-2020s, we're still seeing quite significant growth and after that, you start to see the significant uncertainty kicking in, at the very least a dramatic slowdown in oil demand growth.

“ OPEC needs to be asking: does it have enough production to put into the market to avoid prices moving into the \$80/bl?”

Sean Evers: How do OPEC and non-OPEC eventually extract themselves from their production cut agreement in this next 12 months and yet keep markets stable and performing as they wish?

Chris Midgley: We often say that prices dropped in 2014 because of oversupply, but we forget that a lot of the reason was a shock drop in demand down to 600,000 b/d. We were in a world that assumed that global oil demand would grow at around 650,000 b/d year on year. Today, after three years with arguably 1.5m b/d of demand growth, we will perhaps have 2m b/d this year and 1.8m b/d next year. A lot of that is being stimulated by price and income elasticity – high income relative to energy prices, while interest rates are low.

“ We're about to repeat 2014 with the US adding, between NGLs and oil, 1.5m b/d in 2018. And we'll see Brazil and Canada adding another 500,000 b/d and at today's prices, you could add another half a million to that. So that could be a problem for OPEC.”

“ There is a lot of talk now about peak demand, but the substantial impact is somewhere down the road. And for us, it's still much too early to write the obituary for oil.”

In the US, the second-hand car lots are just full of small cars, hybrid cars and 80% of sales are in SUVs and trucks. We are now into a period where this 1.5m b/d type of demand growth is likely to linger for a while. The danger is that we then get a price spike, causing a fast reversal. I think that's where OPEC needs to be worrying; does it have enough production to put into the market to avoid prices moving into the \$80/bl?

Sean Evers: Edward, I'd like to get your view on how the OPEC, non-OPEC agreement might look to expire as the year goes on.

Dr. Edward L. Morse: The underlying problem is not just shale – it's the conventionals. The trigger years were 2010-2014, when the Libyan revolution took a lot of oil out of the market, then Yemen and Sudan and Iran sanctions all kicked in. In 2010, the three big suppliers plus Russia, Brazil's deep water, the US' deep water and shale and Canada's oil sands, collectively added less than 600,000 b/d to the market. Then, in 2014, they added 2.3m b/d and the Saudis decided to go into a market share battle because they had lost half of their share in China and the US, the two largest markets in the world. And that combination was very significant. But the real geopolitical significance of what happened was that by 2014, the Atlantic Basin, including Europe and Latin America, became supply positive, one of OPECs traditional honey patches. The Atlantic Basin is now permanently

a surplus supplier to world markets, which leaves only one place in the world, the Pacific Basin, to put incremental production into the market.

We're about to repeat 2014 with the US adding, between NGLs and oil, 1.5m b/d in 2018. And we'll see Brazil and Canada adding another 500,000 b/d and at today's prices, you could add another half a million to that. So that could be a problem for OPEC.

Sean Evers: I would like to touch on the topic of divestment away from fossil fuels. In a 2015 speech, The Bank of England Governor, Mark Carney, argued that climate change could precipitate a major sell off in fossil fuel companies by pension funds. While this forecast has not yet transpired, we have seen steps in that direction, particularly towards coal. We have seen the Norwegian Sovereign Wealth Fund indicate a move away from investing in fossil fuel companies. Could 2018 be the year that this reality emerges as a clear trend?

Robert Johnston: This is really about the robustness of the long term upstream business model. Carbon is one factor along with changes in the transportation sector and other variables that are impacting that. We would argue that obviously the Trump administration is certainly not prioritizing climate change policy in any way and that's raised a lot of questions about the future of the Paris Agreement. However, we're still moving towards the world of de-carbonization, in large part because our clients in the private sector are still doing that. You compliment that with state and municipal governments playing a big role, and China perhaps for geopolitical reasons also trying to assert some leadership in the climate movement. There are other stories besides Trump in the climate change story that suggest that we're still, albeit in an uneven way, moving towards de-carbonization. ■

**This is an edited transcript.*

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ENERGY PARTNERSHIPS: What Lies Ahead in the Future of Consolidation and Diversification?

By Dyala Sabbagh, Partner, Gulf Intelligence

National and international energy companies have spent the last three years transitioning through a very challenging period. They have taken a hard look at their portfolios, non-core businesses and focused on driving efficiencies up and costs down, through consolidation and restructuring. Further diversification and new models of partnership are yet to come and one size will not fit all with companies holding differing starting points and targeting different markets, for example. All these factors will drive behavior in terms of the types of joint ventures they may seek on technology, renewables or traditional energy practices.

National oil companies (NOCs) in the Gulf are now very well established and mature compared to 10 or 20 years ago and they are taking an active lead role in driving the future strategy of their energy space.

Many have begun demonstrating a new investment focus on refining, petrochemicals and even trading. Meanwhile, advances in technology continue to drive down costs in onshore and offshore production, as well as renewables. These significant reductions in break even and cost levels are rapidly opening up new opportunities within the energy sector and allowing companies to rebalance their portfolios across the whole value chain.

NOCs are also diversifying outside of the region and opening their doors wider for countries and companies to come in. Forging alliances with external stakeholders, who can ensure that the specialties needed to extract the most value – that extra 1% – are brought in, is becoming an established realization.

An evolving outlook from the finance community is also likely to impact what shape new investments and partnerships take in the immediate and medium term. Very limited funds have come into the oil and gas industry in recent years and that sentiment has taken a significant turn in the past year with the oil price recovery, which is currently at least heading upwards. Financial institutions are also becoming more sensitive and accountable to their public and so may direct funds more willingly to oil and gas companies that are demonstrating ‘green’ credentials and actively diversifying their energy portfolios.

Electricity will become an increased area of focus for energy companies, influenced by the growth in personal gadgets at home, electric cars and electrical power generation. Saudi Aramco is

“One challenge that has not yet been cracked is battery storage. Perhaps oil and gas companies will consider focusing investment into that area in the near future?”

building 40GW of electrical power capacity by 2040 and investing in solar power – a fact that perhaps would not have been conceivable ten years ago.

Solar PV costs are today a quarter of what they were eight years ago and forecast to decrease another 60% in the next 20 years. Onshore and offshore wind power costs are also expected to drop 70% and 46%, respectively, during the same period. All this points to the renewables equation undoubtedly becoming a much larger part of the energy mix. One challenge that has not yet been cracked is battery storage. Perhaps oil and gas companies will consider focusing investment into that area in the near future?

Price stability is also being sought and is critical to encourage uninterrupted capital expenditure into the energy sector. Strategies to manage seasonal swings in gas demand and consumption continue to be a challenge in the region. Striving for a decentralized system on the trading of energy, for example, could open up opportunities to new business models that make more economic sense.

Countries and companies could also collaborate more effectively on innovation and R&D to address the challenge of developing technology locally. This already exists in Europe, in the US and China. The venture capital culture is virtually non-existent in the Gulf and that is what critically drives innovation elsewhere in the world.

Practically speaking, it will probably be the bigger institutions like the UAE’s ADNOC and Saudi Aramco that need to take the initiative to encourage such progress, with support from government policy and regulations. There has already been some action on incorporating new technologies into old business models with some success. Whoever takes that step to bring this new standard into the 2020s and 2030s – be it a new company, a national or international entity – will dominate the industry. ■

CIRCULAR ECONOMY

Changing the Record



Calls for a circular economy are not new – but the volume is now significantly louder. Industrial evolution over the last 150 years and cheaper energy in recent decades has created a linear economy, which has caused attitudes to reuse, repurpose and recycle to relax worldwide. Now, triggers like ‘lower for longer’ oil prices, rising power demand and water scarcity, means the tide is turning and the Middle East’s energy sector is looking at old practices with new eyes. Pressure will only build as the increasingly populated world faces an energy-hungry future; consumption in the Middle East alone will climb by 54% by 2040, according to BP Outlook.

The benefits of a circular economy are aplenty, with the World Economic Forum (WEF) describing it as a trillion-dollar opportunity, with huge potential for innovation, job creation and economic growth. It will also help this region to support the Paris Agreement, potentially reducing global CO₂ emissions embedded in products by 33%. In the UAE, Abu Dhabi’s Al Reyadah is the world’s first commercial carbon capture utilization and storage (CCUS) facility in the Middle East and North Africa, for example. Previously, Emirates Steel was the source of 1% of the UAE’s total CO₂. Now the carbon capture program sequesters up to 800,000 tons of CO₂ a year from the plant, which replaces the natural gas that was historically used.

By Alexander Bencini, Manager, Gulf intelligence

It will take time for energy companies – particularly the beating heart of treasuries in the Gulf – to shift their status quo. Regulatory and social change is key.

Ministries in the Middle East have started reviewing and updating waste regulations to redefine whether something is classed as waste or a by-product. Oman plans to have a new national waste management regulation, for example. A new waste-to-energy-to-water facility in Oman, will supply renewable energy and desalinated water from 700,000 tons of waste a year, according to Ramboll, which assisted the national waste management company, Be’ha. For energy companies with significant stockpiles of hydrocarbon-contaminated soil, the clarification could mean dormant raw materials are leveraged for road and building construction, for example. Industrial operators at ports, refineries and well sites can also explore how to expand their symbiotic relationships to find a new ‘home’ for their waste.

Ultimately, this will lead to more eco-industrial resource recovery parks. Denmark’s Kalundborg Symbiosis is the world’s first well-functioning example of industrial symbiosis, where public and private companies buy and sell waste from each other in a closed cycle of industrial production. It offers a 21st century textbook example of how saving and recycling materials makes both economic and environmental sense.

Major energy companies are also taking significant steps. Total has committed to recovering more than 50% of its waste, to implement waste reduction and zero waste to landfill programs at its sites, to develop

polymers containing up to 50% recycled plastic and equip 5,000 service stations worldwide with solar panels, including 800 in France.

Among other plans, Total aims to install potential capacity of 200 MW – the equivalent of the energy used by a city of 200,000 people – which will reduce the company’s CO₂ emissions by 100,000 tons each year. And in the North Sea, the Royal Society for the encouragement of Arts, Manufactures & Commerce (RSA) estimates that the total value of decommissioning up to 2040 will be £46bn. Currently most of the materials and equipment from these platforms is recycled, with very little re-use or remanufacturing – but now the value in reusing these assets is higher than recycling. Regulators must also create an architecture that encourages positive change and a springboard for small and medium-sized enterprises (SME) to explore energy applications in the circular economy. MENA Research Partners (MRP) forecasts that the number of SMEs in the GCC will rise by 156% in the next five years, with the sector worth \$920bn. How can this huge potential of financial and human capital be correctly channeled to support the growth of a circular economy?

Partnerships between industry-government-academia are frequently encouraged, but more is needed on academia-academia engagement. Such institutions need to carve out a strategic platform to enable brainstorming and innovative R&D to explore sweet spots of opportunity, such as the geo sequestration of carbon dioxide. Having a common voice would encourage joint funding mechanisms and loosen the purse strings of international investors. A public education process is also needed to ensure bottom-up support for the government-led change – public momentum is a must. Relearning the values of a circular economy is like trying to speak an oft-forgotten language. It takes time to become fluent, but practice makes perfect. ■

“Relearning the values of a circular economy is like trying to speak an oft-forgotten language. It takes time to become fluent, but practice makes perfect.”

4th Industrial Revolution

Will the Energy Sector Keep Ahead of the Curve?

By Mahin Siddiqui, Research Analyst, Gulf Intelligence

In the next hundred years, we will transition through as much technological change as we have done in the last 43 centuries. This runs the risk of putting many ideas, companies and even economies out of business. Preparation is key. Is the energy sector ready to cope with this pace of innovation and will the transition to a tech savvy industry from what has historically been more of a slow mover progress smoothly?

Data science, Artificial Intelligence (AI) and robotics are developing at great speed and we have to ensure the sector maintains its integrity. The next generation of cyber security, sensors, 3D printing, 4D seismic, blockchain, digital oil fields, enhanced oil recovery (EOR) technologies and digital twin simulation, should all lead to better management and maximization of asset value. Autonomous systems in the sector, such as unmanned vehicles, are gaining substantial traction, as well as technologies around augmented reality and situation awareness. All are going to be hugely important for both downstream and upstream sectors. The 'Prelude' – a floating LNG facility commissioned by Shell and designed by Technip,

the largest of its kind in the world – illustrates a phenomenal piece of innovative engineering.

The power of what we can do with the disruptive technology offered by the 4th Industrial Revolution is immense, but the industry is possibly undermining its value. Companies must ask themselves every day what can possibly be automated; any who are not factoring AI into their business plans will fall behind. The sector has been open to new methodologies, but in a very contextualized manner. It needs to learn to embrace technology and assess the impact it has on time, cost and processes.

What has changed fundamentally is magnitude and affordability. Cloud

technology, for example, is a major enabler of business value and cognitive services. It has improved operational recovery rates, predictability and health and safety significantly. Energy is a capital-intensive industry, so optimization of production by even 1% translates into huge money and an improved competitive edge. The 4th Industrial Revolution is all about digitalization and integration across the value chain, to create value networks.

Integrating digitalization into the organizational culture of business is also key. Training the next generation of employees to adopt new technologies is and will continue to be a challenge. It will be as important for the industry to be able to innovate from within, as much as bracing itself for any technical disruption that may come from outside. Managing the wider insecurity of people around the pace of change is critical.

Working in parallel with business, educational systems need to do a better job of fully equipping the next generation with the right skills in emotional intelligence, creativity, resilience, curiosity, critical thinking and judgment. Technology empowers people – not the reverse. ■

Don't call us,
we'll call you...

Technology & the Transition of Energy

By Lord Adair Turner, Chairman, Energy Transitions Commission



The impact of new technology on energy is going to be bigger than what most people currently realize.

Over the next 10 to 15 years, we are heading towards a low-cost energy world both for fossil fuels and for renewables, with the two linked together. Renewables will start to compete with oil in electric vehicle markets, but simultaneously the power of technology is also bringing down the production cost of fossil fuels.

The attitude of pension funds and other institutional investors in fossil fuel companies is changing. We are going to see investors tightening their focus on the strategies oil and gas companies are pursuing, with a lot of pressure on those still invested in thermal coal to get out. Fossil fuel companies will be scrutinized on how robust their strategies are, not just for the cycle over the next year or two, but for the longer term. For example, we are already seeing companies like Total and Shell make strong statements about how the balance of their business between fossil fuels and renewables will shift over time. Thermal coal use is incompatible with the Paris Agreement commitments; the developed world must get out of burning coal in power stations as quickly as possible.

The Energy Transition Commission is currently working with the Indian Government on how rapidly they can move beyond coal and we believe that beyond the 40GW of coal power stations already under construction there, there will probably be no more coal fired power stations built thereafter.

As chair of the UK's Climate Change Committee, in charge of our de-

carbonization program in the UK, if you'd asked me back in 2008 how we should take the carbon out of electricity production, I would have said we need to use a combination of three technologies: renewables, fossil fuels with carbon capture storage and some nuclear. But the facts have changed. Since 2008, the cost of solar has dropped by 90%, lithium ion batteries by 80% and onshore wind by 75%. I did not anticipate those changes, but they create a new reality to which many people have not yet woken up.

The short-term impact of these changes on the oil price may be negligible, but by 2030 they will be very significant. In particular, electric vehicles are going to happen far faster than people realize. With the declining price of lithium ion batteries, it might be cheaper to buy an electric vehicle than an internal combustion engine by 2025, as well as being much cheaper to run it. Oil will retain its other uses, such as for petrochemicals and heavy transport like trucking and aviation, but the impact of the new technologies will gather pace over time.

Solar is a huge natural resource here in the Middle East. In countries like Saudi Arabia and others, such as Mexico and Chile, we have seen solar power winning auctions at below 2 cents per kilowatt hour. Coal just cannot compete with that, even before you take into account its environmental impact. And where the sun does not shine, we can still build power systems based primarily on renewables, with short term flexibility provided by batteries and gas turbines providing seasonal backup, but running

“If you'd asked me back in 2008 how we should take the carbon out of electricity production, I would have said we need to use a combination of three technologies: renewables, fossil fuels with carbon capture storage and some nuclear. But the facts have changed. Since 2008, the cost of solar has dropped by 90%, lithium ion batteries by 80% and onshore wind by 75%.”

sufficiently for a few hours that the average carbon intensity of electricity is still very low. ETC analysis shows that it will be feasible within 15 years, and far earlier in some favored regions, to build power systems based almost entirely on renewables at total cost well below coal-based systems. As renewable electricity prices collapse, there is also huge potential for green hydrogen, produced by electrolysis, to play a major role in the decarbonization of fertilizer and steel production, long distance trucking and shipping.

In the short-term, oil prices look to be supported at \$60/bl or maybe slightly above due to the balance of current supply and demand and the reasonable effectiveness of current OPEC and non-OPEC supply cuts. But given the sheer capacity of US shale producers and their decreasing production costs – many of which are below \$50/bl – the moment oil goes above \$70/bl, you are going to see more supply coming on stream and prices coming back down.

The other main factor to impact oil prices in the short-term is what happens in China and Chinese demand. The buoyancy of the Chinese economy in the last two years has surprised the World Bank, the International Monetary Fund (IMF) and all the major forecasters. Before 2016, rapid Chinese growth was underpinned by rising bank and non-bank credit provision, but with the inevitable consequence that leverage was rising to potentially unsustainable levels. Since 2016, policy has switched to provide fiscal stimulus with the fiscal deficit as percentage GDP rising from close to 0% in 2014 to almost 4% today.

That has given an enormous stimulus to the global economy and is a key reason why oil and other commodity prices recovered in 2017. The question now is whether the Chinese authorities can put in place the policies to support continued strong growth, at say 6% per annum, over the next 10 years. My judgment is that they probably can, but there could certainly be bumps along the road and any significant slowdown of Chinese growth, even if only temporary, will lead to lower oil prices. ■

ENERGY & TRANSPORTATION: *Does the Progress in EVs Signal Peak Oil Demand?*

By Sean Evers, Managing Partner, Gulf Intelligence

Globally, light and heavy vehicle transportation fuel accounts today for 60m bl/yr out of a total consumption of almost 100m barrels. Determining the pace at which the electric vehicles (EV) market will develop and how soon it will make a serious dent in fuel demand requires an assessment of many moving parts.

Which sectors of transportation are going to electrify first and how quickly? For some, like aviation and shipping, electrification is simply not the easiest decarbonization or energy security option. And in the vehicles segment itself, there will be a differentiation between the types of users. Today, high volume, short distance utilization, such as that exercised by taxi fleets, makes economic sense, for example, due to battery power efficiency and advantages. But it is not as plausible for heavier or more long-distance transport. Other factors include the status of fuel taxation in any individual country as well as where the oil price is in general. And when you then add the component of automation and apps – self-driving vehicles and ride sharing – you could start seeing really dramatic implications for energy demand. Shared economy is already playing an important role for internal combustion engine (ICE) cars and fuel usage and there will be many new forms of unpredictable innovations to come as the EV market develops.

China is, as always, the big elephant in the room. The country is going all in on electric mobility – and not just in cars. There are already many electric buses on the roads and at least 200 million electric scooters and that's with China only having 120 vehicles per 1,000 inhabitants – an average rate below many other parts of the world. Comparatively, the US has 700 per 1,000 inhabitants. So, how the Chinese market for EVs evolves will have a huge

impact on the future of oil markets.

The country is going to push hard on its EV agenda for reasons of industrial strategy, energy security and a serious agenda to clean up its local air quality. This means it is likely to go beyond buses and into heavy transport. A major landmark will be when the decision is made to stop the sale of fossil fuel cars altogether. Committing to an environment where it is not selling ICEs is not only an environmental consideration, it also brings an industrial competitive advantage. China will never be able to match Volkswagen or Mercedes Benz in terms of their 100-year expertise on ICEs. But if they shift the terms of competition to electric motors, they are as well placed.

Another element that will influence the pace of take up of EVs is the dramatic fall in the cost of renewable electricity. Almost monthly, we get a new segment across the world that shocks with the latest low prices achieved. The pace at which renewable electricity can take over from coal-fired electricity is critical and has got to factor into climate change plans; striving for an integrated balance of what is being done on decarbonizing electricity versus EV usage must go hand in hand.

In the UK, it is forecast that there will be no coal in the electricity system by 2025. China is confident that by the same date, it will be able to generate electricity at 3 cents per kilowatt hour from huge renewable facilities in remote areas in the country and transmit the supply to demand centres on the east coast at 5-6 cents per kilowatt hour.

The cost of battery power also plays a critical role. Prices are falling. The 2017 Bloomberg New Energy Finance survey said the average buying price for a batch is \$209 per kilowatt hour, down from a \$1,000 per kilowatt hour in 2010 – that's an 8% drop in seven years. Others believe it may get to \$100 by 2025, even without

using lithium ion or other technologies.

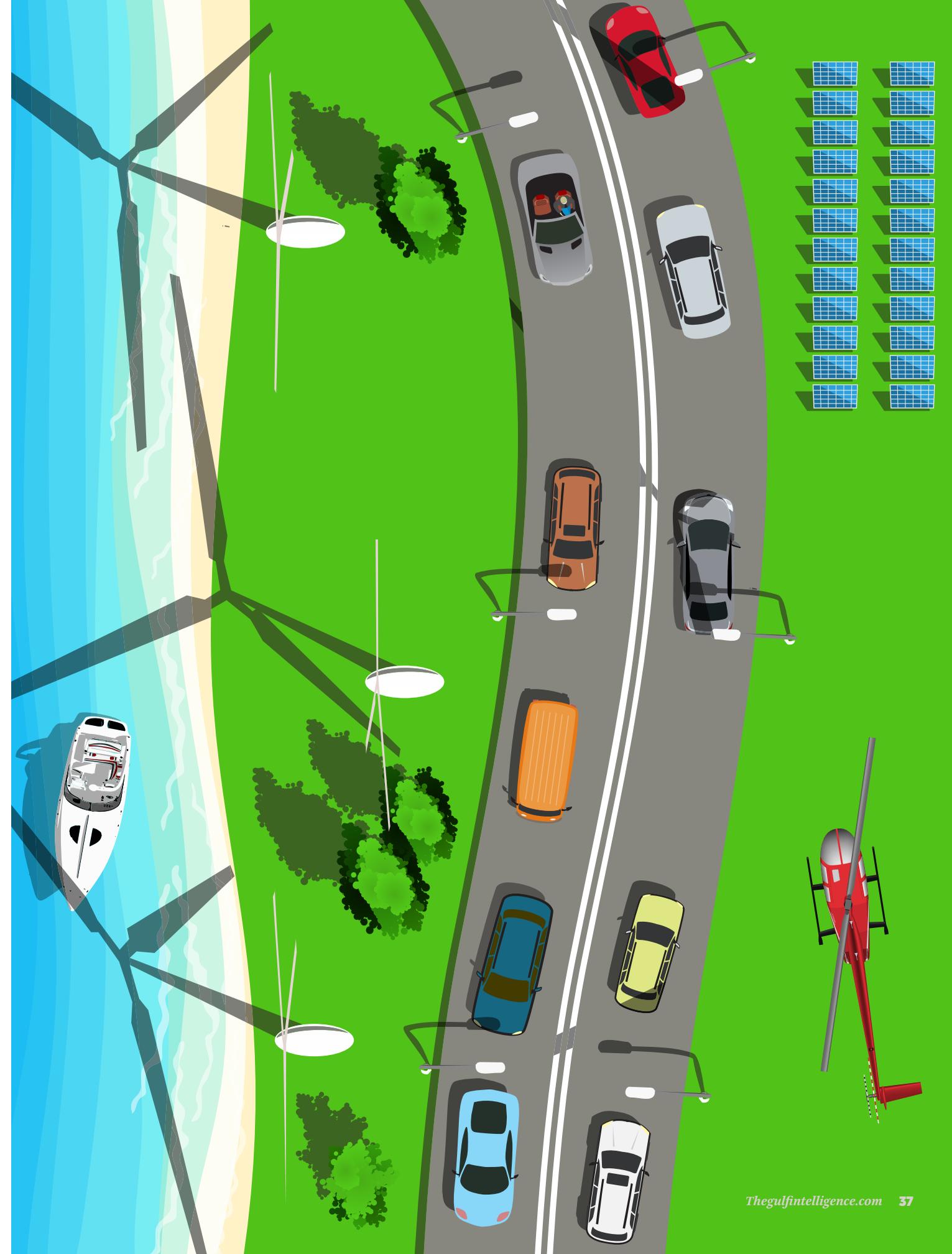
The world has clearly changed from what we thought it was only 10 years ago and it is now likely that light duty vehicles are going to head towards electric drive trains fueled by either battery or hydrogen fuels for longer range travel. By the early 2020s, in many countries, we could have a total operating lifecycle cost which is lower for an EV than an ICE.

There are currently 2 million EVs on the road out of 1 billion cars globally. By 2040, there will be an estimated 2 billion cars on the road. The more bullish end of projections puts EVs at 60-70 million by 2025, but that would still not be a game changer for the oil market.

According to the International Energy Agency (IEA), most of the impact from EV transportation on oil demand will start to be felt in the 2030-2040 period. The rule of thumb roughly is that for every 100 million EVs on the road, 1m b/d of demand is removed from the system. Oil demand is therefore expected to start flattening by 2030.

The largest share of EVs in any individual country by some distance is Norway – almost one third – which is the product of very aggressive government support for purchases of electric cars. Other countries are far behind. The Netherlands at 6%, Sweden at 3% and others at 1% and below.

China took over from the US in 2015 in terms of total volume. In 2016, 25 million new cars were sold in China, half a million of which were electric. In percentage terms this may be small, but the market is growing rapidly and variables – such as taxes, battery costs, upfront capital costs of EVs versus ICE cars, and EV charging infrastructure – will all continue to influence the pace of change in the world's largest consumer market and elsewhere. ■





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.

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.

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.

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.

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