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ADNOC ADIPEC 2013 KNOWLEDGE FORUM

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ADNOC ADIPEC 2013 Knowledge Forum Leaves Its Mark

THE INAUGURAL ADNOC ADIPEC 2013 Knowledge Series certainly left its mark at the ADIPEC 2013 Conference and Exhibition that took place in the UAE's capital from November 10-13.

Held at the ADNOC stand in association with Gulf Intelligence over a period of three days, leading energy officials and executives participated in discussions and engaged with a large audience on some of the industry's hottest topics, ranging from developing a gas strategy for the UAE to the role of R&D in a world of post-easy oil and gas to national oil companies moving down the value chain and across the world.

What became clear from the Knowledge Forum debates is that the energy industry is undergoing a period of profound change that, above all, will require a new level of collaboration among all the stakeholders in the sector and beyond. Whether it's managing valuable resources such as gas in the most efficient way to meet future demand or embracing a culture of innovation that paves the way for breakthroughs in new R&D centers in the UAE and elsewhere in the Gulf, it can't be achieved single handedly.

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Produced by Gulf Intelligence on behalf of ADNOC

Developing a Gas Strategy

By Fatema Al Neaimi, Gas Allocation & Planning Division Manager, ADNOC

There can be little doubt that natural gas is a precious source of energy in the United Arab Emirates.

Today, gas accounts for more than 99% of the fuel mix used to generate electricity in the UAE. Power generation in turn accounts for almost 60% of the country's total gas consumption, while the remainder is being used as feedstock in rapidly expanding industries, such as petrochemicals and for reinjection into depleting oil fields in order to increase their productivity.

And though the UAE sits on some of the world's largest conventional hydrocarbon reserves, the world's growing demand for energy has left the country short of domestic gas supplies, prompting the government to import this energy source via the Dolphin Pipeline from Qatar and, in the future, in the form of liquefied natural gas (LNG) via the emirate of Fujairah.

According to long-term forecasts, even with the addition of nuclear power and more renewable sources to the UAE's energy portfolio, gas will retain its position as the dominant feedstock in power generation and water desalination for many years to come. As such, addressing the UAE's widening gas supply-demand gap is critical and may well be the biggest challenge the country will have to overcome in the next 10 years 'if the lights are to stay on' without interruptions.

The UAE hasn't always been in this position. A major exporter of LNG and crude oil, the country has traditionally been a provider of energy to consumer markets around the world, in particular to Asia, where Japan absorbs more than 90% of Abu Dhabi's LNG production under a long-term supply agreement.

Over the past 50 years, the role of gas changed dramatically in the UAE – like in other parts of the world. Being considered a byproduct from oil production without much use in the 1960s, gas emerged as an environmentally-friendlier fuel for power plants in the 1970s and 1980s, which subsequently led to Abu Dhabi's long-term LNG supply deals with Japan. And as domestic energy demand in the UAE continued to be manageable throughout the following two decades, gas remained somewhat on the back burner.

This changed over the past 10 years, when rising crude prices began to fuel a period of unprecedented economic growth in the UAE and the wider Gulf region, driving up energy – and gas – demand on the back of industrial expansion and population growth rates of 10-15 percent.

In light of the domestic gas challenge, Abu Dhabi National Oil Co. (ADNOC), which manages the nation's hydrocarbon resources on behalf of the government, has embarked on a range of large-scale gas development schemes such as the Integrated Gas Development (IGD) initiative, which will soon boost offshore gas production by 1 billion cubic feet a day (cfd).

ADNOC is also progressing swiftly with the implementation of some of the world's most ambitious sour gas developments at the Shah and Bab fields. The former is set to produce 1 billion cfd of gas from 2014, while the latter is due to add another 500 million cfd from 2020. While these fields will be costly, complex and more risky to develop due to the highly sulfuric nature of the gas contained therein, they will provide much-needed relief for the local market.

Moving ahead with the implementation of these projects is a testament to ADNOC's commitment to ensuring gas supplies to the local market. They are also part of a broader gas strategy being developed by ADNOC's Gas Directorate, which was established in 2012 and works closely with partners such as Dolphin Energy, Mubadala Development Co. and Emirates LNG Co. on developing a holistic approach to the gas sector challenges.

The strategy doesn't end here, however. Implementing carbon dioxide (CO_2) capture usage and storage (CCUS) projects such as the one announced by ADNOC in partnership with Masdar this month and applying nitrogen injection technology among other enhanced oil recovery (EOR) techniques will play an increasingly prominent role in the Abu

Dhabi's oil sector in the future, thus freeing up gas to be used elsewhere.

While supply-side management is integral to the domestic gas strategy, managing demand is equally important. Naturally, this will have to involve a review of gas prices, which is presently being conducted at the government level. To be sure, it is an issue that will have to be dealt with sensitively as many gas-reliant or energy-heavy industries are operating on the basis of certain gas and electricity prices. Still, it's an issue that will need some tackling.

At the same time, there is an urgency to proceed with initiatives aimed at enhancing energy efficiency across both industry and individual levels. On the latter side, in particular, raising awareness on the real price of gas and electricity will be seminal to change habits and introduce a more efficiency-oriented mentality.

None of the above can be achieved single-handedly. It entails close collaboration among stakeholders in the energy sector and beyond. It won't be easy but I am confident it can be achieved. And while gas will remain a precious source of energy, managing it in the best possible way will go a long way to ensure that it will be available in sufficient amounts to sustain the UAE's future economic ambitions.

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DEVELOPING A GAS STRATEGY

PANEL HOST: Fatema Al-Neaimi, Gas Allocation & Planning Division Manager, ADNOC
Dr. Klaus Langemann, VP Middle East, Wintershall
John Roper, Head of Middle East, E.ON Global Commodities SE
Andrew Vaughan, VP for Abu Dhabi, Kuwait and Syria, Shell
MODERATOR: Sean Evers, Managing Partner, Gulf Intelligence

MODERATOR: In the UAE natural gas demand now outstrips supply, while at the same time Abu Dhabi continues to export gas to Japan and is planning to import LNG into Fujairah -- what is ADNOC's strategy for addressing this growing in-balance over the short-term and the long-term?

FATEMA AL NEAIMI: This is a very critical question which until recently was rarely talked about in this region.

When we look at the historical timeline of gas developments in Abu Dhabi you would see that in the 1960's it was a byproduct, an undesirable thing. Then in the late 70's it was exported as LNG to Japan. In the late 80's, the development of the gas was mainly focused on how it impacted the economics of liquids. It was not until the last decade with the Shah and Bab sour gas fields that for the first time you are seeing gas developed exclusively for meeting local demand.

So you could say the history of gas in Abu Dhabi has been through 4 stages, to where now it is recognized as a very import source of energy to meet soaring power demand. Since 2000 the UAE has witnessed very fast economic growth, which saw the population leap by some of the highest rates in the world, and you have at the same time consumers that are high, high, high in terms of per capita consumption.

This challenge was added to by the government's vision to move the economy towards diversification, which has created an industrial sector that transformed from being

a modest energy consumer to a very active high-demand consumer.

Tackling these critical issues has been the priority of ADNOC's Gas Directorate in its first year of operations.

MODERATOR: Shell has obviously taken some big steps towards natural gas and increasingly it defines itself as a natural gas company -- what is Shell's overarching gas strategy?

ANDREW VAUGHAN: I think there are 3 factors that underpin Shell's gas strategy and they're all driven by economic growth, particularly in Asia.

One - there is a large amount of gas in the world, with some 250 years of supply at current levels of consumption, which makes it significantly more plentiful than oil.

Secondly - gas is also relatively cheap, particularly if you look at the US where the result of the shale revolution has driven the price down to record low levels. And even if you look at the cost of LNG, or the cost of pipeline gas, and compare that with the consumption of oil, then gas is still a very affordable product as an energy source.

Thirdly - it's environmentally sensitive. You get significantly less CO_2 from burning methane in power stations than from burning coal or oil.

There is still increasing demand for liquid fuels, for oil, but they're availability isn't as abundant as it used to be. We can see a time when liquid fuels will cease to be the major part of the energy mix. Gas, on the other hand will grow significantly because of its desirability as a fuel to power economic growth particularly in Asia and in the Middle East. We're looking at 7% growth in gas demand in the Middle East for the next few years. That's an astonishing number and it's going to take quite some challenge to meet it.

MODERATOR: Klaus, what is Wintershall's overarching gas strategy?

KLAUS LANGEMANN: In Germany we have been engaged with natural gas production as of the late 1960s and implemented a Russian gas-to-Europe strategy as of the early 1990s. So from our experience at Wintershall, we can understand the situation in the Middle East at the moment where there's a lot of demand for additional natural gas but the local supply is lacking a little bit behind.

I strongly believe that it is exactly the right way to go for Abu Dhabi and other Middle Eastern countries to bring their more difficult gas resources like Sour Gas on-stream, because this is what the states have under their own control and can develop.

MODERATOR: John, E.ON recently secured a gas supply agreement with Qatar for supplying Europe. E.ON has been integral in securing Germany's gas needs over the last 50 years, what is the outlook for the future?

JOHN ROPER: Germany has been importing pipeline gas into Europe from Russia and elsewhere for many, many years. In recent years, governments throughout Europe have begun looking at diversifying supply of gas into Germany and the EU -- E.ON has always been at the forefront of those import contracts.

MODERATOR: Fatema, how important is it for ADNOC's new Gas Directorate to be engaged with the other national entities tasked with gas management, such as Dolphin and Mubadala Petroleum?

FATEMA AL NEAIMI: We have seen a greater integration of the national entities responsible for securing and managing the country's gas portfolio -- you can't imagine how much we work together now. Sometimes during the summer we're meeting on a daily basis. It is physically as if we're living in one office.

ADNOC has a natural leadership role to play in this space as we are the main supplier to the extended users -- if you are supplying

one customer then your life is much easier, but if you have an extended list of stakeholders which includes the energy industry, power generators, as well as contracts with neighbors like Dubai and Oman, then you have so many other people to coordinate with and that's what gives you the leadership role.

However, no matter how much we invest, no matter how much we bring in additional gas supplies into the market, we have to also look at the other side of the coin - we have to look at the consumption habits as well because you could swallow as much gas as you bring into the market with the current prices. So we have to look at demand side management and we have to look at a more optimum, more efficient uses of these valuable resources.

MODERATOR: Do you envisage that we may move away from re-injecting gas as a tool to maintain oilfield pressure?

FATEMA AL NEAIMI: It's not something to look for in the future as it's already happening. There is a CO2 pilot injection project and we also have nitrogen injection to free up some of this gas. So there is an ongoing effort to try and optimize the gas used for injection. Yes, we are still big users of gas for injection, but this is something that is required to achieve another valuable production target with liquids.

MODERATOR: Andrew, Shell is now playing an integral role in the development of the Bab gas field -- looking at this supply-demand imbalance that the region is facing, will these sour gas projects come on-stream fast enough to address this discrepancy?

ANDREW VAUGHAN: The first thing, developing indigenous supply is by far the best thing that Abu Dhabi can do. It will bring the lowest cost, the most economic resources to bear. But they will take time to develop as they're technically very challenging. We have quite some years to go before Bab will be on-stream -- we're targeting towards the end of the decade. You've got to do them safely and at the right pace.

Every country needs a strategy that has a balance between satisfying the short-term demand and being prepared for long-term.

KLAUS LANGEMANN: The lead time for bringing sour gas projects on-stream can take from 5 to 10 years. I think all the right steps are being taken to bring this indigenous supply on-stream as quickly as possible, but it will be a challenge to meet gas demand in the short-term. Either way, it's important not to rely on one single source of energy, yes we should bring the gas on as soon as possible, but you have to also think about nuclear energy, you have to also think about renewable energy and in the end you have to think about greater efficiencies.

MODERATOR: John, looking to LNG as a solution for the imbalance is clearly going to be a fairly expensive option, especially when you consider a local market in which gas is currently priced at $1.50 per mbtu?

JOHN ROPER: I think you have to make the distinction between short-term pricing and long-term pricing. And I'm sure that if you speak to Emirates LNG, their focus will be very much on supplies of LNG into the UAE with long-term contracts that allow them to push the price of an mbtu down. Now, inevitably it's going to be a market price. I don't think there's any such thing as cheap LNG, but LNG does have different prices currently in different markets.

MODERATOR: Saudi Arabia is now consuming a quarter of its own oil production and the demand graph is moving up all the time -- do you think new gas supplies can come on stream fast enough to change the trajectory of oil consumption in the region and push that graph down?

KLAUS LANGEMANN: I think over the next 4 or 5 years it will be hard to move that crude oil demand trajectory downward, but I think the right steps are being implemented as there's a broad realization

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that you shouldn't waste your precious crude oil at $100 a barrel for burning in power stations as it doesn't make sense economically nor environmentally.

MODERATOR: John, what in your opinion is the biggest cause of increased consumption in the region?

JOHN ROPER: Without question it's economic growth. The population increased dramatically over the last few years. The governments very wisely have taken decisions to diversify away from a purely petroleum-based economy, so new industries are starting up and those industries require energy. And gas is the most efficient and effective way to supply that energy. So it's economic growth driven by a growing population that is demanding a better standard of living.

MODERATOR: Fatema, can consumption habits be curtailed through removing subsidy?

FATEMA AL NEAIMI: In the summer of 2010, after a long meeting with our water and power company, I left the office to go to a local health club. The temperature outside was 45 degrees when I went into this spa and inside my therapist had a heater plugged into the power. I asked her for the reason and she said because there was a central AC controlled by the gym which kept the rooms chilled at a freezing temperature so the therapist had to put on a heater to keep patients comfortable -- so you have an AC working and heater working at the same time.

The main driver for these habits is mainly because there is no sense of the value of this power because electricity and water is provided at a heavy discount to market price. So if we can give some sense of the value of this power to the consumer then they would rationalize their demand.

JOHN ROPER: You're also seeing that governments throughout the region taking the opportunity to give themselves flexibility by putting in Floating Storage Regasification Units that allow a fairly quick ability to bring gas into the marketplace.

Kuwait is now contemplating a land-based regasification facility because they've been importing LNG successfully over the last few years.

I think the reality of the market environment means that you have to have flexibility in the way that you're allowed to import and flexibility is not supported by monopolistic situations, both on the buying and the selling fronts.

FATEMA AL NEAIMI: We've talked about the demand side, but to encourage investment into developing new gas supply, like the Shah and Bab fields, there also needs to be an attractive pricing for the gas. There needs to be a careful strategic study on how to implement a new gas price structure and it needs to be done in coordination with the government and led by the government, and this review is ongoing.

MODERATOR: What are the key elements that should be considered in such a review?

ANDREW VAUGHAN: I think there are the two factors to make a good sustainable strategy, ensure you have multiple sources of gas and that you're resilient to changes in demand.
JOHN ROPER: I would also add to Andrew's comments that you really do have to look at consumption etiquette.

The Dubai government has mandated that the air conditioning temperature in public buildings should be increased slightly -- they calculated that back-out to the number of LNG cargos that they can save on an annual basis if they change the a/c by 1 degree and it was significant.

KLAUS LANGEMANN: Gas, of course, is important and you should diversify sources of gas in your country, but at the end of the day it's important that you have several sources of energy.

That said, it is my belief that a company should focus on its core competencies. I would not recommend that a national oil company diversifies for example into renewables because it's a completely different technology and market mechanisms. There should be a different entity set up for that, like in the UAE we have Masdar, but it would make sense to have all the national actors integrated into one management architecture.

MODERATOR: Klaus' point is well taken to stick with your core competencies, but Andrew, what about diversifying downstream – the development of the sour gas fields like Bab does offer some opportunities in this area?

ANDREW VAUGHAN: There's a very substantial sulfur stream that will come out of Bab as there is out of Shah and over the last few years Shell has developed a number of technologies that can add value to that stream.

So rather than just selling elemental sulfur into the global markets which are very volatile, we have new technologies which to turn sulfur into a value add products like building materials and fertilizer and we will certainly look for opportunities to develop these technologies with local industry here in the UAE.

MODERATOR: Do you think it will be possible to format a successful gas strategy that addresses the supply-demand imbalance without addressing subsidy or gas pricing?

JOHN ROPER: I think in the long-term it's going to be very difficult to do that. If you continue to avoid the issue of subsidy you're going to waste an enormous number of resources and an enormous volume of resources.

FATEMA AL NEAIMI: The situation is a bit complex when it comes to supply and demand. There is no one magical solution. Not by ADNOC, not by Emirates LNG, not by even nuclear. It needs the work of all these parties together to try to address the supply shortage as well as the demand side.

Role of R&D in Post-Easy Oil/Gas Era

By Mr. Ali Al-Jarwan, CEO, ADMA-OPCO

The United Arab Emirates

-like neighboring Gulf States—has made great strides in recent years, in building and advancing domestic research and development (R&D) capabilities, and in so doing fostering a greater culture of innovation among the National youth population.

According to the Global Innovation Index (GII) 2013, published earlier this year, the UAE now ranks top in the Middle East-North Africa region in four pillars – institutions; human capital and research; infrastructure; and business sophistication. Overall, the UAE ranks 38th in GII, which looks at 142 countries worldwide. This is a tremendous achievement.

R&D and innovation haven't always played a prominent role on the UAE's domestic agenda. Over the past two decades, the UAE's focus has been on working towards greater economic diversification, using access to cheap energy to build and power world-scale aluminum and steel complexes, and utilizing feedstock such as natural gas to develop large-scale fertilizer and petrochemical industries.

Much has been achieved. Today, the UAE is a leading crude oil and gas producer, an industrial center, and a logistics and transportation hub.

However, with hydrocarbons being a finite resource, the UAE has recognized the need to continue transforming itself into a knowledge-based economy to sustain long-term economic growth and generate job opportunities for the country's young and growing population. This transformation will only be successful through pursuing innovation and R&D on a much greater scale than seen in the past, with such institutional development as the introduction of PHD programmes.

As the latest data from the United Nations Educational Scientific and Cultural Organization (UNESCO) shows UAE gross domestic expenditure on R&D stood at 0.47% in 2011, compared with Finland's 3.78%, Germany's 2.84% and the US's 2.77% in the same year. This means there is still work to be done, especially when you see neighboring Qatar has committed to 2.8%.

In an increasingly globalized world, a country's competitive edge and ability to attract foreign investment over the long term will largely be determined by its ability to gain competitive advantages through innovations. This makes the investment into R&D and developing a culture of innovation a necessity, not an option.

In the energy sector, the creation of leading R&D facilities will go a long way to fostering innovation and help the UAE on its quest to become a knowledge economy, while at the same time delivering technological solutions for the post-easy oil era, especially in the area of Enhanced Oil Recovery (EOR).

With energy demand in the UAE—and globally—on an upward trajectory through 2050 with the global population to jump from 7 billion today to 9 billion by 2050, there is an ever-greater need to make more efficient use of the existing finite resources and to find new ways of reaching harder-to-access ones such as heavy oil and sour gas through new solutions and technologies. Investing in and building R&D capacities and capabilities sit at the heart of meeting this future energy challenge.

For national oil companies (NOCs) anywhere in the world, investing in R&D is a logical extension to building on their existing expertise and infrastructure. Many have recognized this. Since 2005, five of the world's largest NOCs—PetroChina, Petrobras, Sinopec, Lukoil and Statoil—have grown their research budgets to $5.3 billion. This compared with $4.4 billion for international oil companies (IOCs).

In the UAE too, ADNOC is raising its game on the R&D and innovation front. Over the past five years the company has been boosting R&D spending to unlock the country's resources, i.e. to work on finding the optimal ways of producing oil from complex reservoirs, tight reservoirs, and tar

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formations (tar-mat) for example in order to determine what the best methods are to ensure sustainable production. Research into carbon dioxide (CO2) injection for EOR is one important example of the research being conducted.

There are various channels to pursuing this type of research and investing in it. Academia is one of the key channels. As such, working towards developing and deepening collaboration between industry and academia has to be a priority from a company perspective. Creating platforms for knowledge sharing and joint research within the oil industry is equally important. And all the industry stakeholders—NOCs, IOCs, service companies and independents—have a role to play in helping to build the National Capacity needed to drive local solutions to local challenges.

The government has a responsibility to lead from the front in such areas as expanding education capacity building, needed to provide a sufficient flow of graduates and post-graduate students, and policy makers must set and create the regulatory frameworks conducive to fundamental and applied research -- the list of challenges is long. There can be little doubt that it won't be an easy task, but one fundamental hurdle has been overcome: recognizing it is a must-have, rather than a nice to have. But knowing this, the important thing will be to set the right priorities. This means focusing on organizational capabilities, identifying talent and giving them time to innovate.

Nurturing talent is of the essence if an innovation culture that produces groundbreaking R&D is to be established. It's also about putting in place best practices in companies, across the industry and to learn from each other through know-how and technology exchange.


R&D

THE ROLE OF R&D IN POST EASY OIL/GAS ERA

HOST: Mr. Ali Al-Jarwan – CEO, ADMA OPCO
Mr. James McCallum – CEO, Senergy
Mr. Pieter Kapteijn – Technical Director of the Maersk Oil TriGen Programme
Mr. Sultan Al Hajji – Vice President, Total United Arab Emirates
MODERATOR: Mr. Sean Evers, Managing Partner, Gulf Intelligence

SEAN EVERS: What is the role of research and development in the Post Easy oil and gas era?

ALI AL-JARWAN: In the world today we have about 1,700 billion barrels of recoverable oil reserves, and the easy oil I think is behind us. Now we are struggling to maintain the plateau. The UAE is committed to produce 3.5 million barrel oil per day and some of it easy for the coming few years, but a lot of it will be difficult.

So, the message is we have to invest as early as possible in R&D, and we are starting from five years ago to invest more on research and development to unlock resources. And what I mean by unlocking resources, is to see the optimum way to produce oil from complex reservoirs, tight reservoirs, and what will be the best method to ensure sustainable production.

The idea is really to achieve a cultural shift where the top management realizes that R&D is a real game changer --they have to believe in this and we have to invest money in R&D.

SE: On the target of 3.5 million barrels, do you have access to the technology you need today to reach that point?

ALI AL-JARWAN: You see the technology is available, of course, through mainly service companies, because this is a competitive age. And we are trying very hard to deploy this technology as fast as possible, including taking the risk of trying and failing maybe one time but succeeding four times, and leadership has to show this is sort of guts. But this is a continuous journey. I mean it's not one exercise, it is not one application; it is rather a combination of all the best efforts and it's continuous improvement.

SE: What is Total's perspective on the role of R&D in post-easy oil?

SULTAN AL HAJJI: The fact of the matter is that the major oil companies are still investing a lot in R&D. In our point of view, R&D should be part of our core business in the future to go further in our growth – in the five years up to 2017 Total is budgeting something like $8.8 billion in R&D. More than all the service companies can do combined.

Taking into consideration that from now to 2035 the demand for energy will grow by something like 32% and so we have to find ways and means beyond what we know today. It could be conventional, it could be unconventional or it could be a technology we know, but the worst scenario would be if we don't find a technology for resources that we don't know about at the moment.

SE: How do you prioritize from a perspective of Total that scale of R&D spend -- is it upstream/ downstream? Is it EOR?

SULTAN AL HAJJI: We have to invest in a combination of all these three sectors: upstream, downstream and EOR because one sector cannot be isolated at expense of the others. Total is in agreement with ADNOC's target to reach 70% recovery rate of its reservoirs, and EOR is the best solution for that. We have an

obligation to do heavy investment in research and development to support ADNOC and any other partners to achieve their targets.

SE: James, could you please provide your thesis on the role of R&D in post easy oil and gas era from an oil energy services company perspective?

JAMES MCCALLUM: I think it's very important to take a look at the different roles that each of the players actually have in the whole development of the sector. What the service sector has to respond to, in a world which is increasingly moving to a collaborative environment rather than a competitive environment in this space, is working with everybody across the supply chain. If you're a supermajor and you're developing technology by yourself, spending eight, nine, 10 billion dollars on the technology that you will require for the next decade, who's providing the technology for the other thousands of operating oil and gas companies that are out there? And there are literally thousands of companies out there looking to develop the production that is needed for the world to meet its demand requirements. So, clearly the big, big service companies have a very important role to perform.

One cannot ignore, however, we are still carrying with us a dearth of talent in the industry, and that talent is the very source of the development of the new technology. So, there are much bigger questions as we look towards the long-term supply, demand imbalance. And, for me, the biggest question we have to ask ourselves is where is the talent coming from that's actually going to do this R&D development?

SE: Pieter, is R&D in the post easy era a key differentiator for independent energy companies to have a place at the top E&P table?

PIETER KAPTEIJN: It has to be for a company the size of Maersk Oil. Of course what we want to be a preferred partner, and to be a preferred partner you have to be able to show that you add value to your partner's business. And we believe that the key is to have competitive capabilities, and capabilities are not just technology, they are the people. They are the work processes. They are the way in which you integrate capability into your business not only today, but for the lifecycle of an asset.

And the way in which we get an edge on the service companies is that we have practiced competence in the whole cycle of doing a development, and that's something that service companies still find difficult to do.

How do we access new ideas? We do that by networked R&D. So, we believe that we're too small to do all things by ourselves. We select the areas in which we want to compete. And then we set up the networks broad, cross-cultural, cross-discipline, across the world to be able to access those ideas that we need to be practiced competent in the future. That's the approach.

SE: Obviously R&D is not going to give us an immediate solution today, how does ADNOC go about prioritizing future solutions for here in the UAE?

ALI AL-JARWAN: R&D is a long journey, and journeys start with priorities, different priorities. In the short-term, it is identifying the talent and giving them time to innovate. Transfer of technology does not come by the words only of lips. You have to apply it. And you take the chance to, even if you fail, you know, and that's why we have a process of experimenting and doing pilots in the fields and investing money.

Over the next 40 years we have to emphasize an R&D leadership commitment from the national oil companies and seek partnership with the international oil companies who

"Over the next 40 years we have to emphasize an R&D leadership commitment from the national oil companies and seek partnership with the international oil companies who want to come to Abu Dhabi. They need to differentiate themselves, need to have a strong commitment to lead in research and development, and make some breakthroughs in areas of importance to the UAE. "

ALI AL-JARWAN

want to come to Abu Dhabi. They need to differentiate themselves, need to have a strong commitment to lead in research and development, and make some breakthroughs in areas of importance to the UAE.

SE: Sultan, as we face the expiry of the Abu Dhabi concessions over the coming years, what do you think the new partnerships need to have to be successful in the years ahead?

SULTAN AL HAJJI: Let me take it back a little bit, 75 years ago, when Total arrived in the region. That's our legacy. And we have been tested and have proved our commitment to the region, and especially to the development of the local manpower. I think that's the key to look at.

Any international major company coming to the area needs the resources of human capabilities to go further into R&D, and we are proud to say that we have collaborated with the Petroleum Institute where we have two R&D laboratories. I think the transfer of knowledge will only happen by having commitment, having these laboratories in place and training the local people to take over in the near future.

In addition to that we have to create a culture of R&D, which is what we are missing today in this region. We have to support the culture of R&D where we are investing to yield the fruits in five to 10 years. At Total, we're not looking for short gains, we're looking for a partnership which is win-win for both sides.

SE: Pieter, in terms of the idea of the R&D being done here locally, developing local solutions for local challenges, is that necessary -- why can't we just buy it off the shelf from some other part of the world?

PIETER KAPTEIJN: One of the problems of R&D is not so much the finding of solutions, it's actually taking the new technologies all the way into the field and making money from deploying them. And in Qatar we are in a happy situation where we have the Maersk Oil Research and Technology Center, a long-term commitment because commitment is essential. But what we think is the great strength of that is that it sits close to one of the largest offshore oil fields in the world, Al Shaheen. And that means that the ideas that we have, we can tailor them for application in the field so that the whole cycle of coming all the way from an idea to actually a deployed solution and learning from that is much easier. So, being close to application is always a good thing from an R&D perspective.

SE: James, how important will it be going forward into the post-easy era that companies wishing to compete in this market will need to have a differentiator technology—however niche it might be?

JAMES MCCALLUM: The industry doesn't have the resources to actually set up bespoke research centers every single place that we actually have

an operating oil field to develop. The reality is is that we can achieve a great deal by doing a great deal more around understanding best practice, and as an industry we're often very, very poor at that. We try to relearn lessons everywhere we go, and we try to design bespoke pieces of equipment to do a job which sometimes other pieces of equipment can do perfectly well.

If you can take technology from another part of the world, bring it into a region like the Middle East and then tailor it, and then through that tailoring deliver best practice, then that is a great solution.

SE: Taking up the point of utilizing new technologies from other parts of the world -- what is the application of the shale gas technology here in the Middle East?

JAMES MCCALLUM: Yeah, I think of course it's potentially viable. But one of the things that seem to be a common misunderstanding is that all shales are the same. All shales are not the same. And indeed when you take a look at the different producing environments even within the United States, there is a real transparency now coming through in a conversation about post easy oil. But, you know, we're definitely post easy shale gas, for instance. And if you're a super major having invested hugely into United States in that space, they'd be the first to tell you we're in post easy shale gas or post easy shale oil.

Now, there's a huge amount of learning going on in that space. One of the things—which is I think it's very, very worthy to note—is that the whole shale gas area of development actually came about as a consequence of very small oil and gas companies working with service sector companies to actually do something in what was considered almost, if you like, the dregs end of the oil and gas industry.

PIETER KAPTEIJN: The problem with networked R&D across the world with many partners is that you have to be a good partner. So, partnering is in itself a capability, it's a talent that you have to develop because partnering is about win-win, right? Now, you both want to make money, but you also want to differentiate yourself, so there's always tension in the partnership.

And if I look at what we did, for instance, with TriGen—the program that I'm involved in—is we took a rocket technology from a small company in California, Clean Energy Systems. And then we said, "We can use this in our business, but we can't use it straight in our business. We need a partner to bring it into the oil industry." And then we found Siemens to be able to do that. But managing that partnership is one of the biggest challenges of getting R&D all the way from an idea into the field.

SE: Can we have your views on the subject? Did we take the microphone? Please. And then the microphone can move across the front row. But if you could give it back to the gentleman, I'd like your own views on answering your question. What's your outlook for shale?

SE: There have been many comments about the need to develop the manpower needed to take us further – the challenge is not in capital investment, the matter is in human investment -- what are we not doing sufficiently well in that space?

SULTAN AL HAJJI: Our Japanese colleagues have divided human development in two ways. They say hardware is an asset you can buy -- you could be here in Abu Dhabi, in New York or in Tokyo – it can be bought. But what you can't buy is a software development, which are people.

So, what do we have to do—take us to the third way—we have to first of all believe in R&D, whether in hospitals, in oil companies or in the shops, we have to believe in R&D. That's why certain European countries are much more advanced than other countries in the Middle East for R&D.

SE: Given the global trend towards renewable and the issues of climate change, does it indeed make sense any more to invest in hydrocarbon R&D?

PIETER KAPTEIJN: I think we all believe that the hydrocarbon molecules are there. It's not an issue that they're not there. It's getting harder and harder to get at them. In the future many companies and countries are struggling with getting the right energy mix. And, of course, one of the big drivers of that is to bring down the carbon footprint of that energy mix.

So, if you look at renewables, there will always be a balance between renewables and fossil fuel. And for the foreseeable future, the bulk of the energy has to come from fossil fuels. But there will be an increasing pressure on the industry is to reduce its carbon footprint.

So, maybe one of the longer-term challenges that we're facing and that we should have R&D around is how do we do our bit for providing the energy that the world needs

in the least possible CO2 footprint. The industry is moving wholesale to CO2 EOR, and therefore it can make its contribution to reducing the greenhouse gas emission by doing it in a way in which we actually reduce the carbon intensity of our industry.

SULTAN AL HAJJI: The former energy minister of Saudi Arabia famously said the stone-age didn't end because of a shortage of stones. Having said that, in 2035, the dependence on oil and gas will be 53%, exactly 1% less than as we are today - 54%! So we will still have a gap that other sources of energy will have to fill, whether it is solar energy, nuclear energy or biomass.

Total now calls itself a mixed-energy company. That's our belief so much that we bought a company called SunPower out of California—which is the best solar voltaic company in the world—because we believe in R&D and because we believe we have to have an alternative solution for oil and gas. Not because you don't need it, but because we need to increase the volume.

JAMES MCCALLUM: I was just going to say that the simple answer to the question is that we are obligated to demonstrate our part in responsible energy policy and delivery. And I think as we look at the world today, we've perhaps begun our careers in the oil and gas sector alone providing hydrocarbons, but most of us are actually also involved now in providing alterative energy sources. My own company is involved in particularly offshore wind and wave development, as well as the kind of hydrocarbon work that we actually do.

SE: Do you think we're not doing enough R&D local solutions for local challenges in the EOR area, let's say?

SULTAN AL HAJJI: I would like to say that today Total's investment with Petroleum Institute and Masdar is in digital rock physics. That's for today and tomorrow of course. And the other one lab we have PVT—which is pressure volume temperature—as well as for today and tomorrow, because in R&D you meet today's demands and give it more volume for the future.

JAMES MCCALLUM: If you look at what has been achieved in the course of the last five to 10 years across in Oman, for instance, facing a dilemma around mature fields going into decline, serious decline, what can be done to turn that decline around. They've had some fantastic success. And I think if we can do far, far more in that space it would be a very successful early win.

PIETER KAPTEIJN: This move towards EOR, if you read the statistics of all the mature water floods in the next two decades, 50% will have to move into the EOR domain. Much of that is going to be CO2. If your current facilities are not kitted out to handle CO2, you will have to change them. Managing a CO2 flood is a lot more challenging than managing a water flood.

SE: I would like to tackle the question of building a culture of R&D in the Gulf – how do we achieve that?

SULTAN AL HAJJI: Total supported a science festival in Abu Dhabi in November. That's where the small kids experience curiosity and discovery. We have to take a lot of small steps that will take 10 years to bear fruit.

First of all we have technical education problems. We have to come back to the basics of creating laboratories and research among our kids. I was surprised when one of my colleagues told me today that up to 12th grade we don't do any laboratory work except by digital showing the students what you're supposed to do. The industry needs to cooperate together to create this culture because one hand doesn't clap.

PIETER KAPTEIJN: I think one of the biggest issues that we have in collaboration to date is the whole thinking about intellectual property. Who makes money from what and how do you manage your partnership as a win-win while you still recognize and respect the rights of the individual contributors? IP designed for collaboration is one of the most difficult things I've done in my career as a CTO.

And I find that there's not enough flexibility to actually take the risk of a relationship longer term and to see how this develops. People want to cut up the cake and slice it up and divide it before the actual work is done and the option has been generated. And I think rethinking the way we handle IP is core to making this possible.

SE: There is a lot of talk that the future concessions in Abu Dhabi are going to be divided up not as consortium, but as individual operators in order for best technology to be deployed because partnership may not be the right model?

ALI AL-JARWAN: I think we appreciate strong and long relationship with the IOCs. They are very valuable of course and they create a challenge for us and we create a challenge for them also. We have the top five IOCs operating in Abu Dhabi; each is differentiated from our point of view, either in geology or smart water to inject or smart technology. So we have to find ways to facilitate the need for intellectual property protection —and this is their right of course for it provides a competitive edge – and at same time we have to secure best technology for our field development. As time goes by we have more choices of partners that satisfy these criteria and capability.

When working in a group, before you go to execution you have to have a technology plan, and you have to connect the technology plan to the business plan. This needs to serve everyone's unique value over the short and long term.

I think to build a culture for R&D we are in a much better state today than yesterday, and tomorrow it will be better than today. This is all about nailing down the details and moving forward with the best ideas, so that little by little we will get improvement, and eventually over the period of 10-15 years you will have a leap forward.

MODERATOR: In terms of the very mature fields -- in the place that has got the most mature fields in North America the success in getting that last oil has largely come from much smaller companies – what is the future of those last barrels in the Middle East?

ALI AL-JARWAN: I think we will continue with same fundamental testing of best practices, taking the challenge to do it better and better. We will embrace the knowledge wherever it is, either from consultants, service companies, a laboratory in Oklahoma, for instance, wherever it is from, a continuous improvement, a step-by-step approach.

PIETER KAPTEIJN: I think sometimes we have to realize that the oil industry is a food chain. It's an ecosystem. And if ecosystems get pressurized by their environment, they usually pull together. You get better integration. So, there's a lot more space for us to work together, to create more value for everybody rather than trying to cut it up and say, "This is for the service companies, this is for major oil companies." I think we're reaching a phase where cross-industry collaboration will take another stage forward in my mind.

JAMES MCCALLUM: If you went to the North Sea in 2002, the UK sector, there were about 13 oil companies developing all of the licenses in the UK sector. Today there are 72. If you go to the Norwegian sector around about the same time, there would have been about four. Now there are 65. So, what actually happens is the industry continues to evolve. It develops different types of companies to take on the different challenges.

SULTAN AL HAJJI: I think the collaboration between the IOCs, NOCs and the small company, if they have cutting-edge technology then you always have to coordinate with that so it can take us to the last barrel. The fact that today Total is searching for deep offshore in the Middle East was not done two years ago. The

"The ultimate benchmark is how much new technology is developed and applied in the field to enhance oil recovery. And this requires the nurturing of talent, to have a lot of talented people engaged and empowered, and to urge them to think aloud and to think out of the box to create the innovations that deliver solutions."

ALI AL-JARWAN

price of the oil will dictate I think how deep we can go to the last barrel.

SE: How do we overcome the challenge in the industry of no one wanting to be the first to test a new technology?

PIETER KAPTEIJN: Everybody wants to be a fast follower, but no one wants to be first. If you look at the actual R&D spent on the total lifecycle, the energy industry has a very low percentage spent if you compare it to much more competitive industries like IT and computing and even banking.

What strikes me is that we haven't found the model yet to do lifecycle sharing of risk. If we would work together, if we would have for instance—if we would have one field that the whole industry owns that is the test field for all new technologies, challenging field, high pressure, high temperature, carbonates, you know, enhanced oil recovery, this rate at which the industry would become better would be much faster than what it is today.

I think that the problem we have is that we are a long-term industry that is increasingly driven by short-term performance obligations. And I think if you take it to its extreme, you almost find that everybody who has shareholders is driven towards the short term. That is not good for innovation. It's not good for renewing the industry. It's not good for collaboration. It's not good for partnership. I think we have to reset our sights given the challenges that we have. EOR, global warming, all that stuff, we really need to reset our sights to the medium to long term and find a collaborative model to address those challenges that are going to be core to the industry in the next two or three decades.

SE: What weighting do you think Abu Dhabi should give to the deployment of best technology when evaluating bids for concessions?

JAMES MCCALLUM: I think that the region has to embrace best practice to a much greater extent than it historically has. Not just in the region, but what's actually happening in other parts of the world. It has to get extremely collaborative both in terms of the development of new technology, but also the application of knowledge.

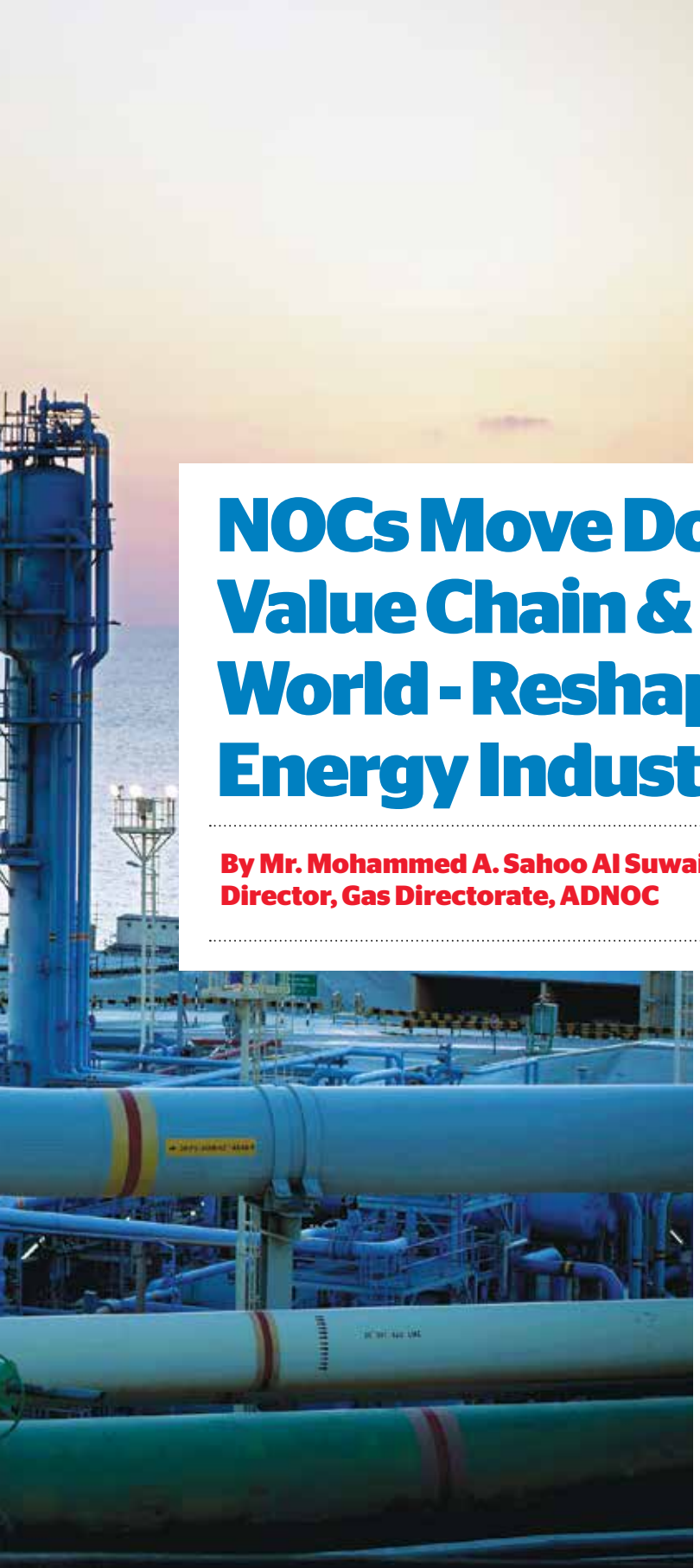
The industry is undoubtedly entering a new era where, if you like, the differential between service sector company, independent oil and gas company, NOC company, and international NOC company is becoming very blurred. And I think in that space, that's an environment where going back to Ryan's point, if we show real leadership, we can drive collaboration against, if you like, the history that we've actually seen.

SE: Sultan, what are your thoughts on the blurring definitions in the energy industry – how should supermajors adapt to that?

SULTAN AL HAJJI: I think the ultimate challenge for us is meeting future demands of our partners, obviously we have to adapt ourselves to what they're looking for. If they want 70% recovery rates, we need to develop the R&D solutions to deliver that 70%. If our partners want more local manpower trained and developed, then we have to meet that challenge.

The best performers in that space will do the best in this market.

ALI AL-JARWAN: I think this is the era of how fast we can achieve new technology deployment, how much R&D we apply, how much we are planning for new technology, how much we are pursuing it. The ultimate benchmark is how much new technology is developed and applied in the field to enhance oil recovery. And this requires the nurturing of talent, to have a lot of talented people engaged and empowered, and to urge them to think aloud and to think out of the box to create the innovations that deliver solutions.



NOCs Move Down the Value Chain & Across the World - Reshaping the Energy Industry?

By Mr. Mohammed A. Sahoo Al Suwaidi,
Director, Gas Directorate, ADNOC

The transformation of the national oil companies (NOCs) as we know it has been a recurring theme over the past decade.

Driven by a mix of sustained high oil prices and buoyant global energy demand, many NOCs around the globe have used years of windfall revenues to adjust their strategies and make large investments into building up their technical capabilities, expanding their footprints internationally and pushing down the industry value chain.

At the same time, NOCs' financial strength has given them greater leverage and independence in pursuing their evolving strategies. On top of this, NOCs today control more than 90% of the world's conventional oil and gas reserves, compared with less than 10% in the 1970s, when international oil companies (IOCs) were the main resource holders – a seismic shift in the balance of reserves control.

As a result, the posture of the NOCs has changed significantly. Where in the past, the state-run companies relied on IOCs as their partners of choice when facing large and complex oil and gas field developments, and their operations were essentially focused on their home markets, NOCs today are in a position to compete or partner with IOCs on an equal footing, and even pursue investment opportunities and projects on their own, both at home and abroad.

Unlike most IOCs, there has also been a trend among NOCs towards greater vertical integration that has seen incumbents extend their business portfolios into petrochemicals and chemicals, storage and shipping, as well as trading of refined petroleum products. This has enabled NOCs to operate along the whole oil and gas value chain of producing, marketing, transporting and selling their products – from the raw material to the specialist chemical.

Most NOCs may not be driven by the need to generate returns for their shareholders as their privately-held peers but—with some exceptions—they operate as profit-orientated, commercial entities. Of course, being state owned, the primary goal of NOCs is and will remain that of fulfilling government directives, developing local resources, helping ensure energy security, and supplying energy to the domestic market at affordable prices.

"The posture of the NOCs has changed significantly. Where in the past, the state-run companies relied on IOCs as their partners of choice when facing large and complex oil and gas field developments, and their operations were essentially focused on their home markets, NOCs today are in a position to compete or partner with IOCs on an equal footing, and even pursue investment opportunities and projects on their own, both at home and abroad."

Going forward, NOCs will seek to fulfill the dual goal of meeting government objectives and commercial targets; venturing into international territories can help on both fronts. On the one hand, this will provide access to new markets for their products and to resources that can help meet domestic energy requirements; on the other, it's a way of transferring technologies and know-how.

With this in mind, the Shale Energy Revolution being witnessed in North America is as much a challenge for NOCs as it is an opportunity. As shale oil and gas developments have moved into the realm of economic feasibility, the energy industry's supply-demand dynamics and global energy trade patterns have started to change fundamentally. As it stands, the U.S. is on track to becoming a leading oil producer and a gas exporter over the coming years. What once was considered a key target market for oil and gas producers may soon become a competitor for new markets.

But it is also a chance to get a foothold in a growth market and to gain access to technologies such as hydraulic fracturing, which, at some point in the future, may also have to be applied in NOC's home markets.

At present, the majority of NOCs aren't in a position to take on Shale opportunities in North America on their own given the lack of proprietary technology in this area, which is why they will need to pursue acquisitions and initiate new collaborations involving NOCs, IOCs, independents and oil service companies. NOCs may be the new industry heavyweights but there can be little doubt that for the foreseeable future, NOCs will—in many instances—continue to seek the expertise of IOCs in large-scale, complex projects with high technology input or the need for specific market access.

Given the enormity of the energy industries' future challenges, co-operation between all stakeholders will give companies an opportunity to leverage their different skill sets, whether in terms of technology or human resources. Generally speaking, there is certainly a need for this kind of collaboration at a time when the industry is facing a worsening shortage of experienced engineers and feeling the pressure of having to continue advancing technologies for the extraction of hydrocarbons from the rising number of harder-to-access reserves.

Just as the energy industry at large will continue its transformation, the ongoing evolution of NOCs will continue to play their role in shaping it.

NOCs MOVE DOWN THE VALUE CHAIN & ACROSS THE WORLD – RESHAPING THE ENERGY INDUSTRY?

Mr. Steve Peacock – COO, Mubadala Petroleum
Mr. Anders Hatteland – Senior Vice President MENA, Statoil E&P Division
Mr. David Dalton – Regional President, BP Middle East
Mr. Rami Qasem – CEO, GE Oil & Gas, MENAT
MODERATOR: Mr. Sean Evers, Managing Partner, Gulf Intelligence

SEAN EVERS: I will start with Anders to open up on the theme.

ANDERS HATTELAND: Statoil is a listed company but our largest shareholder is Norway's Ministry of Petroleum. Back in 2001, we were listed on the New York Stock Exchange and Norwegian Stock Exchange. One-third of our shares are owned by private hands. The government is not involved in our operations at all. They don't have any selected members on the board. So, we run as a normal IOC. Since 2001, we have grown tenfold internationally, producing around 2 million barrels in total, 700,000 barrels a day from international operations. By 2020, we believe that that will pass or be around 1.1 million, 1.2 million internationally and 2.5 million in total. So, you could say that the international part is the really increasing part of Statoil.

SE: Why did Statoil arrive at the decision to become an international player beyond the North Sea, which is typically your natural home place?

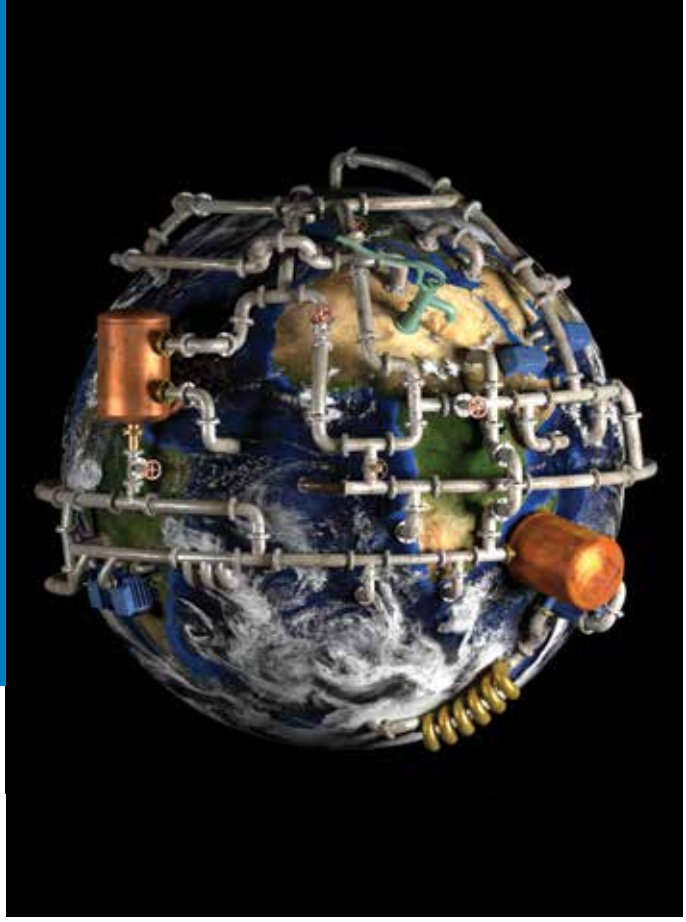
ANDERS HATTELAND: It is the home base and will continue to be for quite some time. But there's no doubt that, in the end, if the company wants to grow, then you need to go abroad as well. We thought the Norwegian Continental Shelf (NCS) was quite the mature area. The last couple of years have actually shown that it is not anymore. In the midst in the south where it's a really mature area, we made a discovery which is between 1.5 billion to 3 billion barrels. So, there's room for surprises as well.

SE: Steve, what are your thoughts as the local international national oil company?

STEVE PEACOCK: We're a good example of the term reshaping, which has connotations that edges are blurring and maybe old definitions don't as easily apply anymore. I mean we look a lot like an IOC. We operate in E&P in 12 countries, 300 mbd of production, 800 million barrels of resources, so across the whole value chain. We look like a standard IOC in many ways, moderate size, but we're not listed like most IOCs. We have a single, very supportive shareholder called the Government of Abu Dhabi and all of the strengths that that brings in terms of financing, government relationships. But we're not the national oil company.

SE: I'm wondering how should we interpret the announcement this week vis-à-vis your closer alignment with ADNOC?

STEVE PEACOCK: The full extent of that new relationship is obviously yet to be revealed in detail. But if you just stand back and look at the rationale for it, it seems relatively obvious. We have international experience. We've been in business since 2007, so are still young, but not that young. Then you've got ADNOC, which has obviously huge capacity, huge potential, has been around a lot longer, and we're both owned by the government. We're both there ultimately to serve the interests of



the nation, so it makes sense. We'll be talking about exploration overseas initially as one of the main topics.

SE: Your thoughts, David, on the thesis?

DAVID DALTON: BP has a history of being a national oil company, and we've over time migrated to be a fully-fledged IOC. I think a lot is made of the evolution of national oil companies into the IOCs' traditional territory. I don't see this as a competition. I think IOCs and NOCs increasingly form very powerful partnerships, and we each bring something different. And I think, as Steve and Anders said, national oil companies ultimately have a duty to their parent country. IOCs have a duty to their shareholder. National oil companies do bring strength supported by the national governments. IOCs bring something different.

SE: Being able to define what the company is, what is Mubadala Petroleum, what is BP? Is that important anymore? Does the bank who lends money want to know what you are?

DAVID DALTON: Of course, the company's purpose is fundamental. And BP is an international oil and gas company providing oil and gas to our customers around the world. Being clear about that purpose is important. And there is a subtle difference between the purpose of BP and I would suggest the purpose of Mubadala that isn't necessarily a negative difference. It can be a symbiotic difference that works together well.

SE: Your thoughts, Rami, on the theme?

RAMI QASEM: We've been serving all the NOCs, IOCs for many, many years. The way we look at this from an OEM (original equipment manufacturer) perspective, we have to find different ways to partner with the IOCs and NOCs, making sure they are more competitive, more advanced in their technology, and able to reach into different places that they weren't thinking of exploring. We would like to maintain our core competency as a technology provider, and we would like to keep an equal distance between our friends from the IOCs and NOCs where we're able to add the right value across the whole chain of the oil and gas industry.

SE: Do you rule out that the idea of moving more into the equity opportunity, more upstream?

RAMI QASEM: Time will tell.

SE: Since 2007 the NOCs have spent over $300 billion on assets and corporate acquisitions, for example the 2012 acquiring of BP's Russia's assets for $61 billion by Rosneft. And we see many examples of NOCs competing and acquiring. Is it now a point that the NOCs are dominating in that acquisition space?

STEVE PEACOCK: Well, you'd have to say yes just by the statistics of the last several years. So, the follow-on question is: why is that and is that a trend that will continue?

SE: What's the consequence of that? I would suggest IOCs might argue they still are the harbinger of the best technologies.

DAVID DALTON: Well, I think it's true. At this point in time IOCs still have the leading edge in technology. But those boundaries are blurring as well. National oil companies are developing capability rapidly. NOCs have been aggressive in acquisitions, but mainly they run their assets in partnership with IOCs.

STEVE PEACOCK: Partnerships aren't unusual. Maybe the players and the nature of the partnerships are changing a little bit. We always have a phrase, "Partner with purpose." Ideally, you would like to pick your partnership that has the relevant and specific strengths for the opportunity at hand. Now, you don't always get that choice. We have our favorite partners that we've worked with over the years. We'll have new partners going forward. And there will be a mix of NOCs and IOCs, because ideally that will be the mix that makes sense.

SE: Anders, what are your thoughts on the NOCs dominating, and do you put yourself in that category?

ANDERS HATTELAND: The trend is clear. Especially the Asians are acquiring much more than the IOCs. If they want to spend the money that way, I think that's fine. They might have other drivers. But still, I believe especially the Asians also are commercial; they are all commercial in the end.

SE: NOCs coming together in the international arena to the possible exclusion of the IOCs, married with a bit of good technology. How does that challenge the super majors' business model globally?

DAVID DALTON: We have seen some of that happening. But one thing I observe is that that's usually focused on producing assets. One thing that IOCs still lead in is taking exploration risk, taking risk to make discoveries, to establish new provinces, to establish new fields. And I think that is still a unique territory for IOCs. When we see NOCs cooperating, it's mainly further down the value chain. Now, over time, they may well gain an appetite for exploration risk, but that's not something that I think we see today.

SE: Rami, the former BP CEO has said that NOCs going international won't work—Statoil is an exception to that—because they have different agendas, different shareholders to please. Can that model work in your opinion because of the likes of GE, Siemens and others that can bring that technology needed?

RAMI QASEM: I see it's going to work in some countries. It's all about the appetite to take risk. IOCs just have more appetite to go into foreign and maybe lower margin. But we have seen it from NOCs in the region like Aramco and others that may think of going beyond their borders. And this is something we should be ready for. The technology differentiator, the ability to add value – I think that's going to be the key thing. BP's appetite to take a bigger risk than a Statoil, this is still something to differentiate IOCs from NOCs in the next few years.

STEVE PEACOCK: Going back to the point that NOCs going overseas won't work. I think it definitely won't work if you're not clear why you're doing it. So, what is the purpose? Is it security of supply? Is it to take the know-how that you've created domestically and apply it to genuine good commercial opportunities overseas? I observe where companies do struggle is when that articulation is not clear. You end up with a portfolio of individual assets scattered around the world and there's very little coherency.

ANDERS HATTELAND: I couldn't agree more. One of the questions is: why do some NOCs become IOCs and are successful? It's when you start to mix politics with business, that's a disaster as the purpose becomes unclear. Statoil concentrates on where we think our competence is and that's mainly in upstream. We have for e.g. divested our retail business and only do downstream if it adds value to the upstream.

SE: Analysts seem to struggle defining IOCs if they don't have reserves. Do we need to change that?

DAVID DALTON: The market and the IOCs are responding to the market's push to move away from volume to value. We're seeing that across the spectrum of the major oil companies. Almost every international

"NOCs coming together in the international arena to the possible exclusion of the IOCs, married with a bit of good technology. How does that challenge the super majors' business model globally?"

SEAN EVERS

company now is following the same focus of moving away from a pure barrels objective to an objective that is really focused on value to the shareholder.

Fundamentally, the upstream business returns have not been great over the last few years. Returns have been diluted. And I think the focus on value is absolutely essential. But barrels are important because our business is about finding and processing barrels. So you can never leave the volume completely behind.

ANDERS HATTELAND: In the end, it's value, value, value. That's the only thing the shareholders care about. Of course you could say that the barrels are your bank account more or less, but it depends on the various contracts, the margin per barrel. It doesn't help to have 1 billion barrels in Abu Dhabi if you don't earn money on it. Then it's better to have something else. You need to strike a balance there.

I think that's one of the challenges around the world now because you are pushed on the fiscal terms by the host governments and costs are going up. At the same time the whole world needs much more energy to lift more people out of poverty, but it needs to be at affordable prices at the ame time as we have to curb the CO2 emissions. How is the world going to solve it? That's why we need both the IOCs and NOCs. We need however to solve this together and then the host government cant not squeeze, squeeze, squeeze on government take. The world will then have a big issue.

SE: We did have some announcement in the recent past of ADNOC offering more value to the IOC at Upper Zakum, the Exxon project.

ANDERS HATTELAND: Just to add to this, you need capital in order to lift these kinds of projects. And if the IOCs can't get a decent return, then the capital will flow to other industries. And what will then happen in the end? There won't be the energy that we need.

SE: I just want to move on to the other transformational elements that are impacting the energy industry, most notably gas. Can we merge these two things, NOCs going internationally at a time in which gas is becoming a transformational aspect?

DAVID DALTON: It's interesting that most of the NOCs are not pursuing gas assets. I think the exception is Statoil of course, who have a more rounded portfolio. But if you look at the Chinese NOCs, almost all are focused on oil. I think gas development continues to offer a complex challenge to any company. The multidimensional aspects of a gas value chain—both upstream and downstream, sometimes

crossing borders—that's a piece of territory that the IOCs traditionally have had a strength in and continue to have a strength in. Building gas value chains is not something that's easy to do.

SE: Infrastructure has to be built, managed and maintained. The whole cost of that, it plays to the strengths of the super majors. Would that be fair to say?

DAVID DALTON: I believe so, but think it will be eroded over time as we see NOCs developing more and more capabilities. It comes back to what is the purpose. The purpose of many of the international NOCs, especially from the Far East, seems clear, which is to capture liquid resources to feed home markets. And that's not yet the case with gas so dominantly.

STEVE PEACOCK: If you look back why NOCs have gone overseas into gas historically, it's been driven more by the fact that they're a major customer of it, and therefore the opportunity to take relatively small positions around the world maybe not only as a way of diversifying supply, but gaining market knowledge has been a key driver. And the big consumers of gas as nations have been traditionally Japan, Korea, etc. You may find as other nations move to being importers of gas, an increasing interest in being in the gas market overseas. But not at the expense of it being profitable.

SE: Anders, is the whole idea of positioning gas as a transformational part of the industry a bit just jargon-esque? Is it a transformational thing?

ANDERS HATTELAND: First of all, this is cleanest fuel we have. We need to develop gas. One of the issues is of course, to build the whole value chain, it's extremely expensive and the prices are uncertain. It's a big bet as well to develop it. And East Africa, Statoil made some huge discoveries, 15 Tcf, 17 Tcf; but commercially, it's quite challenging due to costs and government take. For the IOCs it's all about creating shareholder value in the end.

SE: Not to beat a very tired drum, but shale in America, is that a transformational event?

DAVID DALTON: Shale has been transformational in America, no question about it. However, I am skeptical that the same revolution will occur globally. I think we will certainly see success for shale gas in some other places, but I don't see it being transformational in the way it has been in the U.S., primarily because of the above-ground factors that are key to success—the efficiency of the supply chain, the fiscal regime, the ability to access land.

SE: We talked a bit about NOCs turning into INOCs, but I also want to look at the change of structures in the industry vis-à-vis IOCs offloading downstream assets, service companies moving upstream in Mexico, trading companies bidding for upstream assets. What is the consequence of this?

ANDERS HATTELAND: I think it's important that the various companies really stick to their core skills, number one. It's also that the return on the downstream has been more limited than the upstream. A lot of the downstream

activities—especially retailing, refineries—have been struggling. It will be different in Asia because they really take the crude they need to process it before they can use it. That's why I think you see a lot of refineries there. That trend will probably continue, and I think you will see the IOCs offloading more and more of the refinery business.

DAVID DALTON: BP believes that we continue to create value by having a vertically integrated company. No question about that from BP's perspective. But also, as Anders says, the downstream has been challenged in terms of returns. And over the last few years, over the last decade, BP has rationalized its refining portfolio to refocus it to high-quality refining assets. And we continue to do that. But there's absolutely no intention of spinning off the downstream.

From BP's perspective, I can give an example which is the Whiting Refinery in the Midwest in the U.S, which is tailor-made to process Canadian heavy. This creates a unique asset for the company and a uniquely valuable asset. These sorts of assets, where you can integrate upstream and downstream, still exist and are great sources of value for the company.

SE: Can I ask you to speak to the other examples, let's say the trading companies taking on more assets, the service companies starting to look upstream. Those sorts of changes, are they transformational?

DAVID DALTON: I believe they're on the margins, but we'll continue to see it happening. I think, again coming back to Anders point, it's about what is the purpose, what are you trying to achieve, what is creating shareholder value, what's your business model? I do see some of the service companies migrating upstream and that's constructive. But I don't see it being revolutionary and transformational.

SE: Is $100 oil the ultimate transformational factor in the industry today and going forward?

ANDERS HATTELAND: The industry needs at least $100 in order to make a profit that's competitive with other industries. And if you are going to get people out of poverty and so on, they need energy. We believe that energy demand will increase by 40% in the next 20 years. That's quite a lot. And when you look at the cost level in the industry for the moment, I hardly see that come down. Then you need $100 in order to survive.

SE: Has it been transformational in the last three years since it's arrived back after the crash?

ANDERS HATTELAND: The transformational part is more the cost level increase.

STEVE PEACOCK: I'm struggling with the word transformational. I think what we're seeing at the moment actually is a relative period of stability or even price, if you like. I think one of the things that that's doing is that projects have in some ways relied on or been bailed out by a constantly, steadily rising oil price. I'm not seeing the benefits of that at the moment.

We're not on our wave of a constantly rising oil price anymore and that means cost management is key, being clear about what you're getting into and why you're getting into it.

DAVID DALTON: Three years of $100 oil is something that none of us would have expected 10 years ago and it certainly has transformed the industry. But the industry is self-correcting and margins are being squeezed, costs are rising. Gradually, as Steve says, some of those projects won't look so attractive even at $100.

We'll have to see a reversal of that. It may not be a reversal of price, but I think companies need to get more and more efficient and again, that's the pressure of the markets, the expectations of the shareholder still pushes IOCs to really perform and increase efficiency.

SE: Rami, does $100 oil get the attention of GE Oil and others?

RAMI QASEM: One thing I can share is that, as a services solution provider, we're not really enjoying the extra margin of $100 oil. The challenge on everyone is to make sure that they maintain or improve profit, whether it's $100 or $100-something. I think the question is -- are we going to be able to provide the right technology and solution where it's more reliable and profitable? I'll give you an example. If we look at what we have today in terms of operation and we are able to have more reliable, more efficient production across the whole oil and gas space, one percent efficiency improvement in the global gas-fired power plant fleet could yield a 66$ billion savings in fuel consumption. So, there's a huge responsibility for all the companies in this space to make sure we partner with everybody.

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