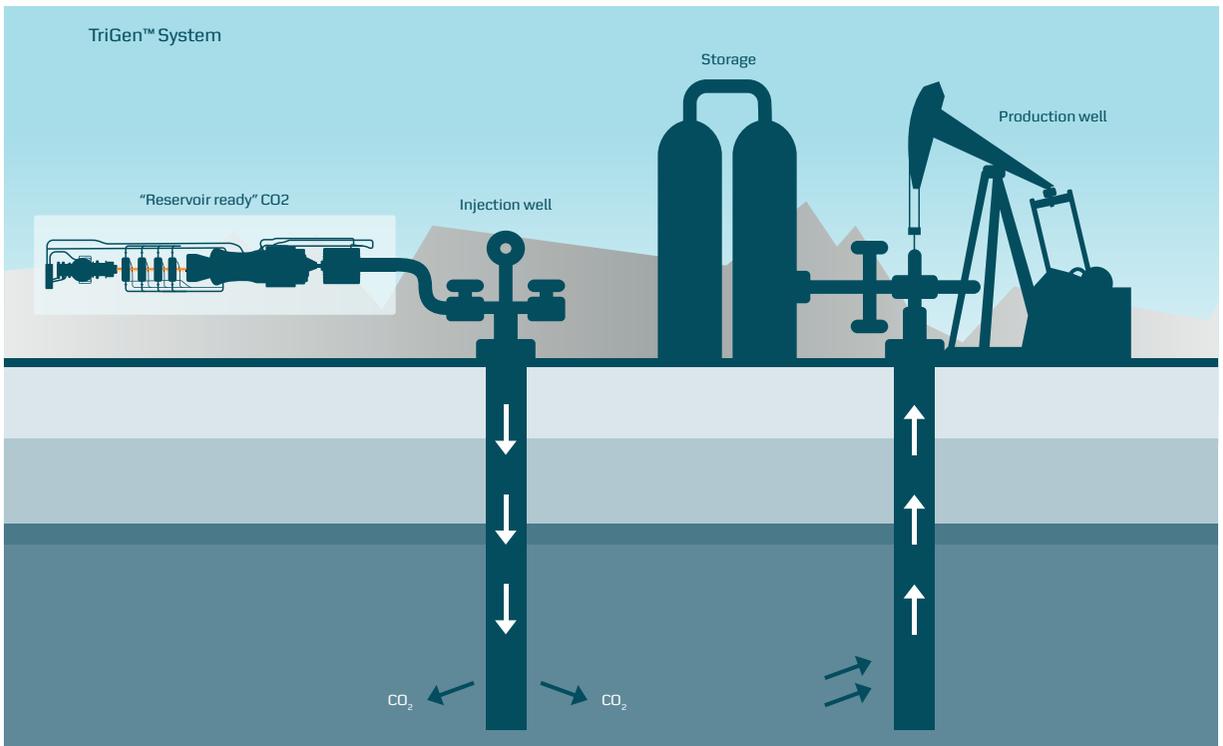


First Quarter 2014

Energy Outlook

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Outlook to 2020: Navigating the known knowns and the unknown unknowns?

THERE is no doubt a lot of noise in the short-term echo chambers of the energy barrel, is it ever thus you may holler! But whether it is the so-called “U.S. Shale Revolution” or the so-called “China slowdown” for that matter or the “Renewal of Abu Dhabi Concessions”, they all cloud the immediate horizon, while industry decision making tends to be more focused on the medium-term outlook.

It is to 2020 so that we turn our crystal ball in this publication for insights into some of the major trends that will play out over the next five years. . .

Gulf States aren’t just among the world’s largest energy exporters; they are also fast emerging as major energy consumers in their own right, eating into their oil export capacities. OPEC’s domestic oil consumption has increased seven fold in 40 years, with largest member Saudi Arabia now consuming 2.5 million barrels of oil per day, or some 25% of current production, and at this rate of growth energy consumption in the kingdom is forecast to double by 2030.

Power demand in the Middle East is set to increase by 76% between 2010 and 2040, the US EIA estimates, thus making a diversification of the region’s energy mix a must. At the same time, energy remains heavily subsidized across MENA. However, voices are rising saying these subsidies aren’t sustainable.

Today, Asia is the principal customer for Gulf energy, with as much as 70% of exports from the region now being consumed in India, China and Japan and the Republic of Korea. At the same time Europe is looking for new sources of energy supply to reduce its dependence on Russia, with Turkey sitting at the historic crossroads to be a conduit for much needed oil and gas looking for exit routes from Iraq and Central Asia.

National Oil Companies are going global and could have an increasing impact on the direction and dynamics of the present-day petroleum sector. When ranked on the basis of proven oil & gas reserves, 17 of the top 20 oil & gas companies in the world are NOCs. International Oil companies control less than 10% of the world’s proved oil and gas resource base.

There are many opinions on where these trends will take us over the coming years, and one voice that will become increasingly stronger is that of Women in Energy who now make-up the majority of science students entering regional universities.

Sean Evers

Managing Partner, Gulf Intelligence



CREATING OPPORTUNITY in renewable energy

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UAE Needs to Curtail Energy Consumption Habits

**HE Suhail Mohammed Al Mazrouei,
Minister of Energy, United Arab Emirates**



THE GULF States have enjoyed significant economic growth in recent years and, as a result, the countries are now emerging as significant energy consumers, driven by a rapidly expanding industrial base, higher living standards and strong population growth.

The UAE has become one of the largest Arab economies and, according to the IMF, in 2012 ranked 33rd globally. Last year, the country's GDP grew by more than 3%; this year it is seen reaching almost 4%. Economic growth and power demand are expected to continue rising on the back of Dubai's successful bid to host the Expo 2020 where global players will gather to share innovations and discuss issues such as the global economy, sustainable development and improved quality of life for the world's population.

All this requires the UAE to come up with new and creative ways to meet its energy requirements in a cost-efficient and environmentally-friendly manner that will sustain rapid economic and demographic growth.

Securing reliable energy sources for any country is one of the most fundamental basics for building a future economy. The UAE decided to diversify its energy sources to support future economic growth and to ensure that its position as a reliable oil supplier will be maintained. To this end, plans are now under way to raise oil production capacity to 3.5 million barrels per day by 2017.

The UAE Ministry of Energy will develop the required regulatory framework to enable

such diversity and to promote energy conservation through the application of technology and changing the behavior of consumers to ensure the wise use of resources. The status quo of high income and low energy prices has created some in-efficiencies, adding pressures on hydrocarbon resources and the environment. A general change in habits would help drive the region's competitiveness and boost efficiencies in the longer term.

Given the trend of Gulf countries emerging as major energy consumers, it is clear that the region has entered a new era. It will now require new policies to manage and meet domestic energy demand, while at the same time ensuring commitment to customers across the world.

“The status quo of high income and low energy prices has created some in-efficiencies, adding pressures on hydrocarbon resources and the environment. A general change in habits would help drive the region's competitiveness and boost efficiencies in the longer term.”



In recent years, modern technologies have created a revolution in the production of non-conventional hydrocarbon resources, such as shale oil and gas. This has led to increased speculation that OPEC and conventional energy producers will be impacted negatively due to the view that this development may lower the price of oil and gas produced from conventional sources, especially natural gas prices.

However, this concern is exaggerated to some extent and in particular with regards to crude oil. The increase in the cost of shale oil production and the environmental effects associated with it show that the production procedure may face significant challenges or turn out to be on a smaller scale, thus disqualifying it from competing with conventional oil production.

With regards to the potential impact of shale gas on conventional gas prices, the picture is slightly different in this case. Conventional natural gas prices rose during the past years as a result of growing demand for the resource. Some producers sought to link natural gas prices with crude oil prices.

The production of shale gas has helped to fulfill part of the growing demand for

natural gas, especially in the U.S. and Canada. This may affect the sale price of gas in long-term contracts, in particular when it comes to the start of exports from North America or if obstacles that prevent the exploitation of shale gas in other parts of the world are overcome.

There is no doubt that the success of shale gas production in North America is due to the presence of well-developed infrastructure such as the existence of pipeline networks and support services that helped in reducing the duration and cost of production.

If the progress in shale gas production is to be continued, it will have a positive effect on the stability of gas prices, which in turn would help the usage of gas in wider areas such as increasing its use in electricity production or in the transportation sector or industries.

In conclusion, the shale gas revolution will have a positive effect in balancing the traditional gas markets. Demand for gas is increasing and competition between different energy sources, including renewable or clean energies, gives countries the opportunity to choose between these sources according to each country's circumstances and economic feasibility. ■



HE Suhail Mohammed Al Mazrouei, Minister of Energy, United Arab Emirates



LET'S POWER OUR FUTURE WITH ENERGY WE COULDN'T USE BEFORE.

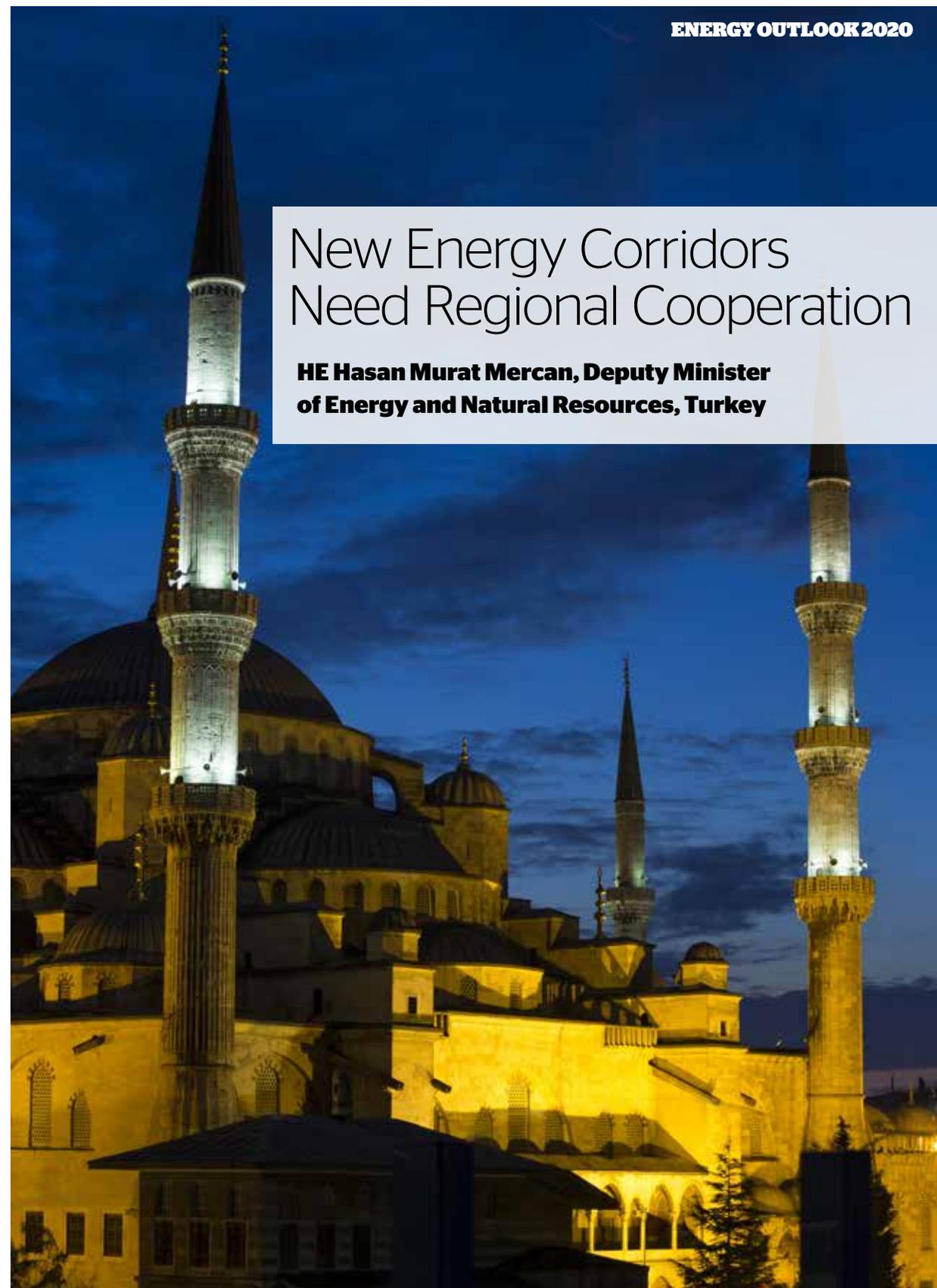
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LET'S GO.

New Energy Corridors Need Regional Cooperation

**HE Hasan Murat Mercan, Deputy Minister
of Energy and Natural Resources, Turkey**





INTERNATIONAL political and economic developments in the recent past have had considerable implications on world energy markets and highlighted the urgent need for establishing an effective regional cooperation and coordination mechanism.

The energy sector is one area, where the effects of globalization can be observed easily. In a time of ever changing context it is important to confront the energy sector's fundamental long-term challenges: energy security, climate protection and energy access for all.

Global energy security remains on top of political agendas worldwide. Interdependence among energy producers, consumers and transit countries determines the urgent need for reliable trans-border transit as well as cooperation in the development of economically-viable energy transportation systems.

Countries with insufficient energy

resources are seeking new ways to cover their energy needs in a timely, economically, uninterrupted and efficient manner. In other words, countries would like to procure energy not only at any cost but also to meet their need by securing routes and transportation systems in order to support their economies.

Turkey is the world's 17th largest economy and the fastest growing one among OECD countries. It has become one of the fastest growing energy markets. According to the latest BP statistics, Turkey ranks 21 among primary energy consumers worldwide at total energy consumption of 119.2 million ton equivalent petrol (tep). Turkey is the world's 20th biggest natural gas consumer with a 46.3 billion cubic meters consumption. Today, Turkey meets 72% of its energy demand from primary energy imports.

Therefore, energy diversification and

deployment of indigenous resources have become political priorities. The use of nuclear and renewable energy and coal is a must for Turkey.

According to the International Energy Agency, global energy demand is expected to rise by one-third from 2011 to 2035, with fossil fuels being a major contributor to this increase. World oil demand will grow from 87 million barrels per day (bpd) in 2011 to 101 million bpd in 2035. Natural gas demand is set to rise 48 percent in the same period.

Continuously growing energy demand implies that energy security will be achieved through—in addition to exploration of new sources and application of new technologies—the building of new supply chains. Those chains consist of physical infrastructure such as pipelines and ships, and international relations.

Providing access to the Mediterranean basin for Russia, the Caspian nations, Iran and Iraq, Turkey is well positioned as an energy transit country. As of 2011, the Russian Federation, Turkmenistan, Kazakhstan, Azerbaijan, Iran and Iraq claimed 25.3 percent of proven oil reserves and 52.2 percent of proven natural gas reserves. In total, 4 million bpd of crude and oil products were traded through Turkey in 2010, which represented 5.9 percent of daily global oil trade.

Since 2006, the Baku-Tbilisi-Ceyhan Main Export Oil Pipeline has been transporting oil from Caspian Sea offshore fields through Azerbaijan, Georgia and Turkey to the Ceyhan Marine Terminal on the Turkish Mediterranean coast from where it's shipped via tankers to Europe. The Iraq-Turkey Crude Oil Pipeline with an annual transportation capacity of 70.9 million tons, operational since 1976, transports oil produced in Kirkuk and other areas of Iraq to the Ceyhan terminal and on to world markets via tankers.

In coming years, Turkey will intensify its activities to become an energy terminal and hub for delivering energy materials from the Middle East and Caspian to global markets, thanks to its geographical and geopolitical position.

Within the concept of such energy policy, the Trans-Anatolian Natural Gas Pipeline (TANAP) project has emerged to deliver Shah Deniz Stage 2 production. Key agreements for the TANAP project were signed between Turkey and Azerbaijan in 2012 and construction is scheduled to start

“ In coming years, Turkey will intensify its activities to become an energy terminal and hub for delivering energy materials from the Middle East and Caspian to global markets, thanks to its geographical and geopolitical position.”

in 2015, with first gas flows planned at the end of 2018.

In December last year, the Shah Deniz consortium announced the final investment decision for the Stage 2 development of the Shah Deniz gas field in the Caspian Sea, offshore Azerbaijan. The final investment decision is vital for the realization of TANAP and projects linking with it.

The project is the backbone of the Southern Gas Corridor that will enable Turkey and the EU to strengthen their gas supply security by diversifying source countries and routes. TANAP will facilitate the realization of other projects within the Southern Gas Corridor. In the long term, the additional gas from Turkmenistan via the Trans Caspian Natural Gas Pipeline could also be delivered by TANAP to Europe.

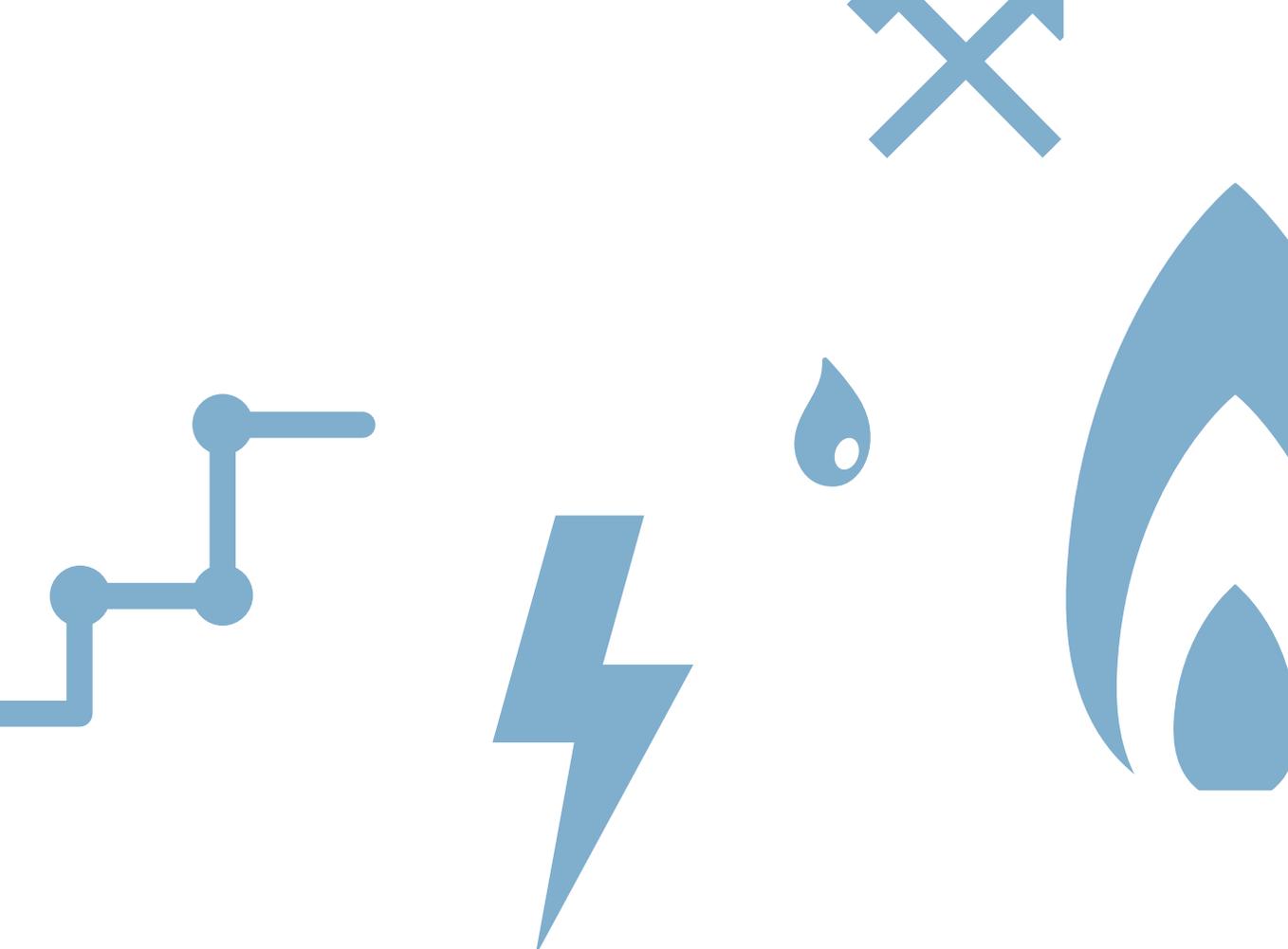
Last year, Turkey and Turkmenistan signed a framework agreement on transporting natural gas from Turkmenistan to Turkey via the Trans Caspian Natural Gas Pipeline, which will make substantial contributions to Turkmen gas exports to Turkey and Europe.

Iraqi gas has great potential for enhancing both Turkey's and European countries' energy security and plays a significant role in market dynamics. From a governmental perspective, Turkey's aim is to create more gas-to-gas competition by using the Iraqi gas in the Turkish gas market, depending on the political stabilization in Iraq.

Turkey today is a powerful regional player, strategically straddling both East and West. Oil and gas have played, and will continue to play, a game-changing role in this part of the world. In this context, Turkey will pursue its multi-dimensional energy diplomacy in order to enhance both national and regional energy security. ■



HE Hasan Murat Mercan, Deputy Minister of Energy and Natural Resources, Turkey



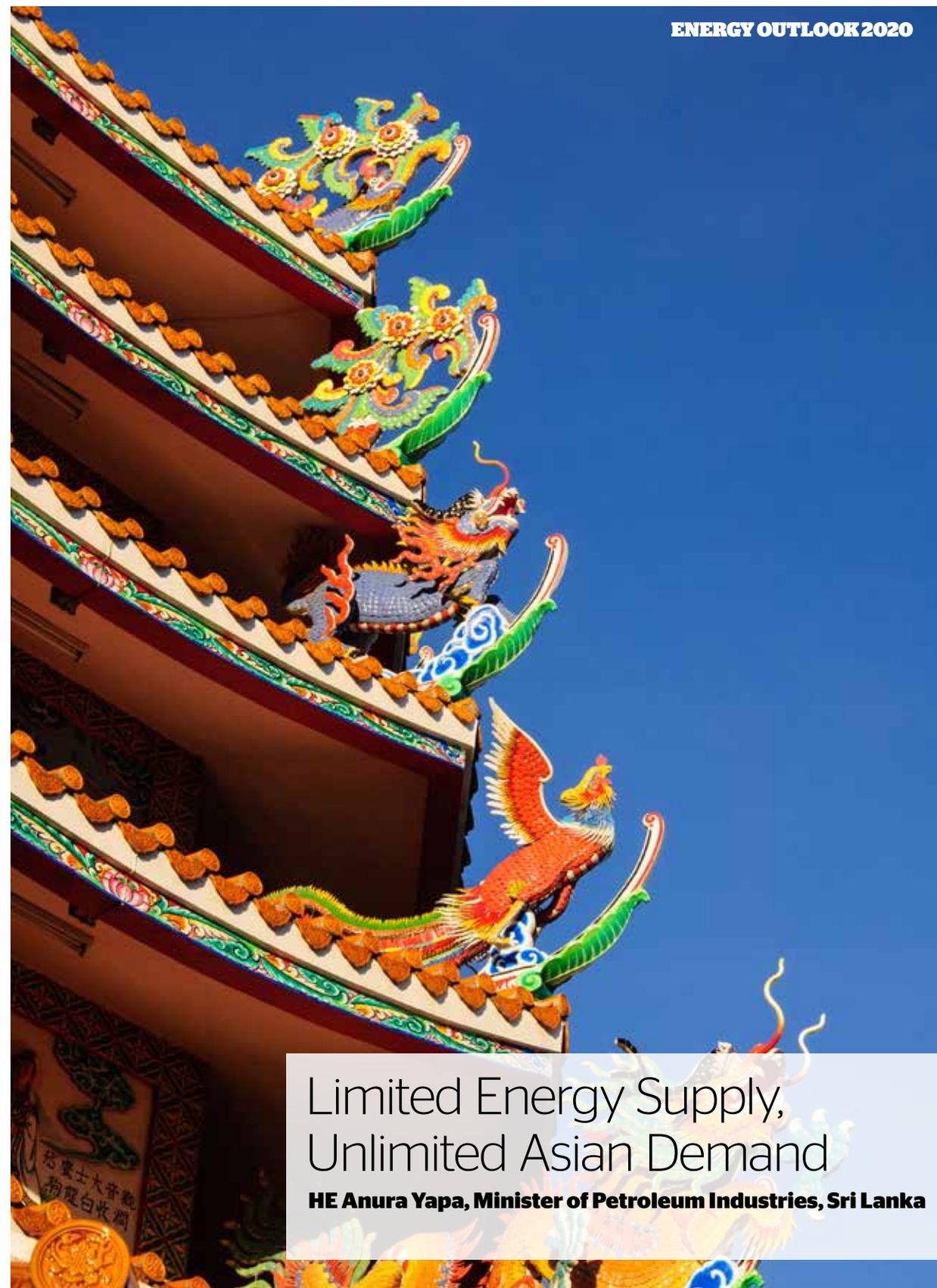
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Limited Energy Supply,
Unlimited Asian Demand

HE Anura Yapa, Minister of Petroleum Industries, Sri Lanka

ASWELOOK to the Asian region, we see that we are living through an incredible transformation. Growth and economic prosperity have led to the emergence of a large rising middle class, who, while increasing the quality of their lives, are placing increasing demands for energy to fuel their growth. China and India have been among the world's fastest growing economies for the past two decades.

In Sri Lanka too, we are witnessing an increase in energy demand of 7-8 percent annually, and this will be further bolstered by rising GDP per capita, which has increased almost 13 percent per year from 2007 to 2012. Rising GDP per capita translates to more consumption of goods and services, and thus, to more energy demand. For example, vehicle registrations in Sri Lanka have increased 12.6 percent from 2010 to 2012.

Given the incredible growth that is happening all throughout Asia, and the continuation of that growth for the foreseeable future, it is imperative that we

seek new and alternative sources of energy to fuel that growth.

East Africa has become an exciting new source of hydrocarbon energy that may help meet Asia's voracious demand in the short term. More hydrocarbons have been discovered in East Africa in the last two years than anywhere else in the world. Over \$1 billion is being invested by East African governments annually with a projected annual increase of 60 percent until 2018 for the specific purpose of exploration and production of the abundant hydrocarbon reserves.

However, the future growth of Asia cannot be driven by hydrocarbons alone. The region needs an ample supply of clean, affordable energy to continue its rapid growth in the coming decades. The rising prosperity in the Asian region will have a profound effect on global energy consumption patterns going forward, and this will pose a challenge to energy planners to develop sustainable sources of energy to meet the needs of Asia.

Looking across Asia, we see clear signs of commitment and investments in renewable energy sources. China leads the world in installed renewable energy capacity—both including and excluding hydro—and has sustained annual wind additions in excess of 10 gigawatts (GW) for four straight years. Half of the hydropower installed worldwide last year was in China. Solar and biomass-fired electricity are expected to grow tenfold over the period 2010-2020. In April last year, Prime Minister Manmohan Singh called for a doubling of India's non-conventional energy supply from 25,000 megawatts (MW) in 2012 to 55,000 MW by 2017.

In Sri Lanka, targets set by our government for electricity generation envisage a minimum of 10 percent of our energy mix coming from non-conventional renewable energy sources. For the transport sector, we are targeting 20 percent of transport energy to come from renewables by 2020. A number of energy projects in biomass, marine, small hydro, solar and wind have been approved.

While we anticipate a reduction in the share of hydrocarbon in the energy mix for Asia going forward, it is clear that, at least in the short term, coal will play a crucial role in supporting Asia's growth. For instance, the planned 500 MW coal power plant in Sri Lanka will significantly enhance our generation capacity and reduce average generation cost of a unit.

However, we all know that as Asia rapidly becomes more industrial, we need to be aware of the best ways to safeguard the environment. While there is interest in promoting the use of renewable energy sources in Asia, the significant initial outlays required for building solar or wind infrastructure has deterred some of the still developing Asian nations from embarking on large scale public projects in renewable energy like the UAE's Masdar initiative.

The government of Sri Lanka has been keen to incentivize private investment into alternate energy options wherever possible. For example we support subsidized loans through state and private banks for households or companies who adopt solar net metering systems, to "sell" electricity generated via renewable sources to the national grid. These subsidized loans enable people to make the initial investments in renewable energy, and also recoup their investment faster.

There is great opportunity here for investors from forward-thinking countries



“ The rising prosperity in the Asian region will have a profound effect on global energy consumption patterns going forward, and this will pose a challenge to energy planners to develop sustainable sources of energy to meet the needs of Asia.”

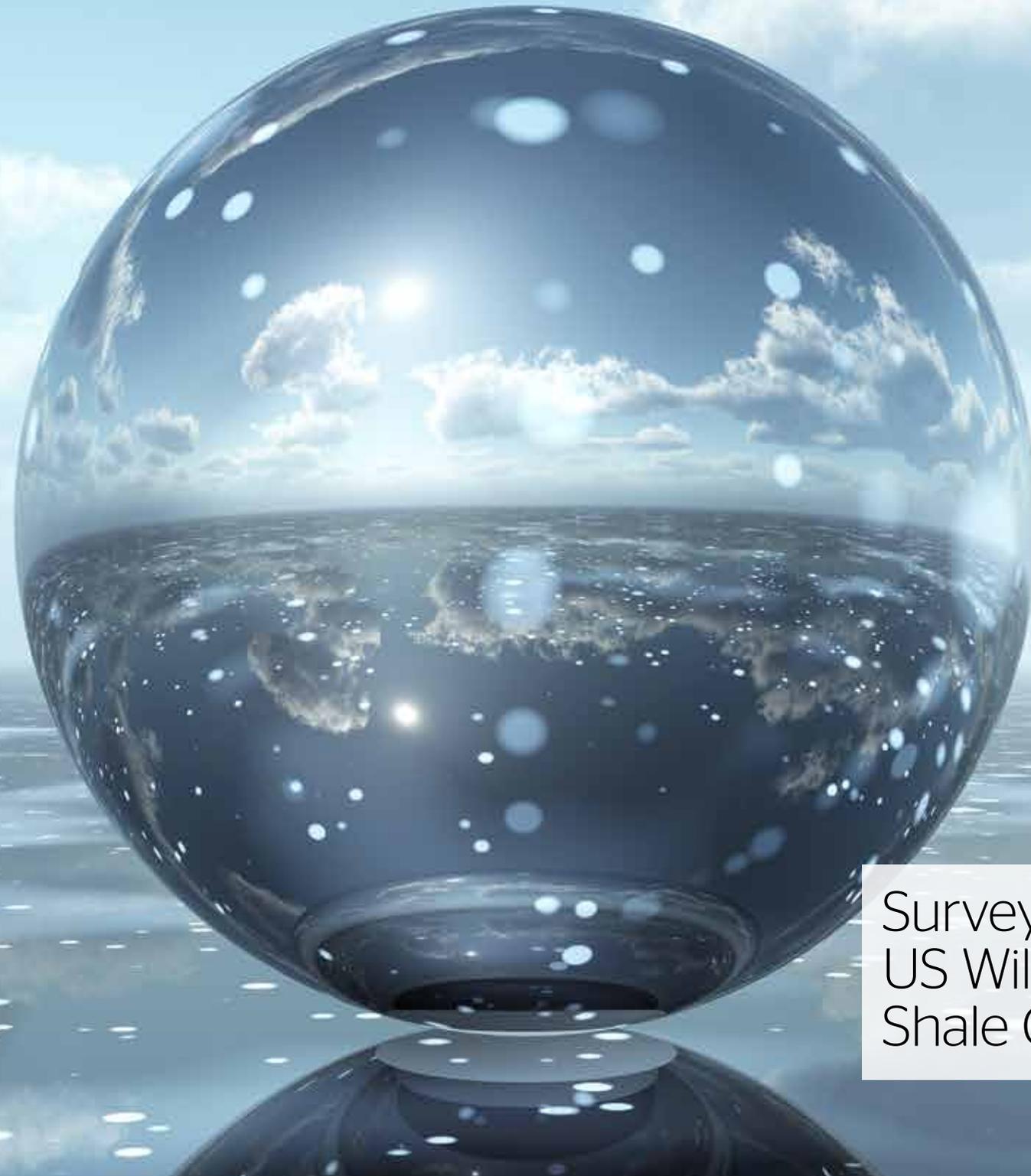
like the UAE to have the greatest impact. While investing in renewable energy has not always been a smart business move in the past, the return on investment on wind and solar power has been increasing in recent years. Corporations have been leading the way in the U.S. with big companies like UPS pledging to shift their energy mix significantly. What will be heartening for investors to hear is that several companies that adopted renewable energy options in the U.S. actually reported an ROI of 15 percent or higher.

It is evident then that—even as the energy mix shifts—there is plenty of potential for many different parties to benefit from the unlimited growth story of Asia.■



HE Anura Yapa, Minister of Petroleum Industries, Sri Lanka





Survey Says: Until 2020,
US Will Dominate World's
Shale Gas Production

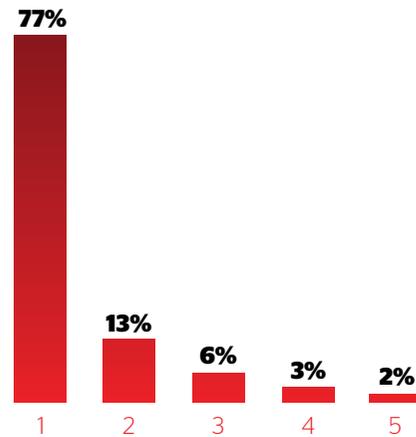
MUCH has been said about the transformational changes brought about by the U.S. shale energy boom. Over the past five years, the world's biggest economy has been able to sharply cut its natural gas imports and is now well on track to become entirely self-sufficient in coming years. For liquefied natural gas exporters, who once saw the U.S. as a major export destination, it means looking for alternative markets for their resource. They may not have to search for long.

At the UAE Energy Forum held in Abu

Dhabi in January, more than three quarters of the 160 Gulf-based energy executives and officials participating in an industry survey, expressed the view that the U.S. will top the list of shale gas producers by 2020, while only 13 percent thought that energy-hungry China, which is sitting on the largest shale gas reserves outside the U.S., will do so. Fewer still think that the Gulf states, South America or Europe will play a role as shale gas producers. For conventional gas exporters, this may be good news. ■

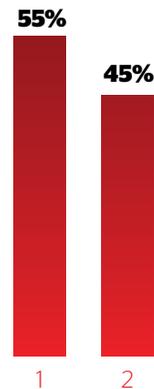
Q1: Which country or region will be the world's largest Shale gas producer in 2020?

- 1. US
- 2. China
- 3. Gulf states
- 4. South America
- 5. Europe



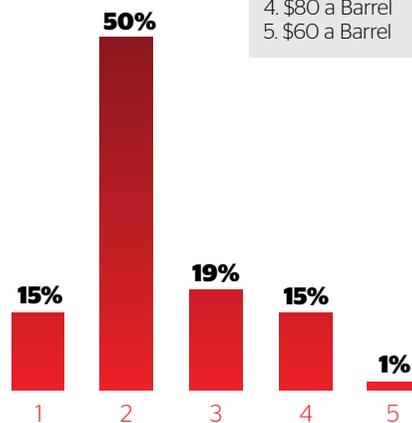
Q2: Will the US be energy independent by 2020 i.e. only need US/Canada and Mexican oil?

- 1. Yes
- 2. No



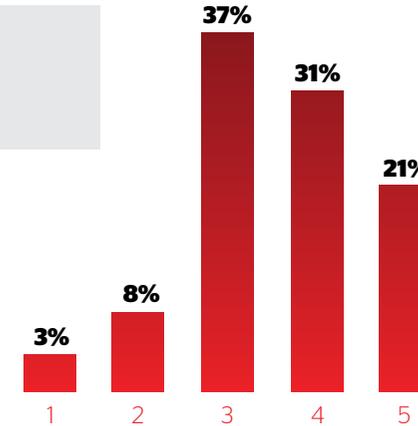
Q3: What price will Brent crude oil average over the coming years THROUGH TO 2020?

- 1. \$150 a Barrel
- 2. \$120 a Barrel
- 3. \$100 a Barrel
- 4. \$80 a Barrel
- 5. \$60 a Barrel



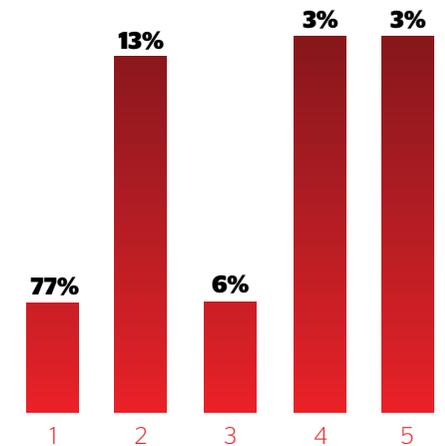
Q4: OPEC currently consumes more than 25% of its own oil production of 30 MBPD-What percentage will it cost in 2020?

- 1. 20%
- 2. 25%
- 3. 30%
- 4. 35%
- 5. 40%



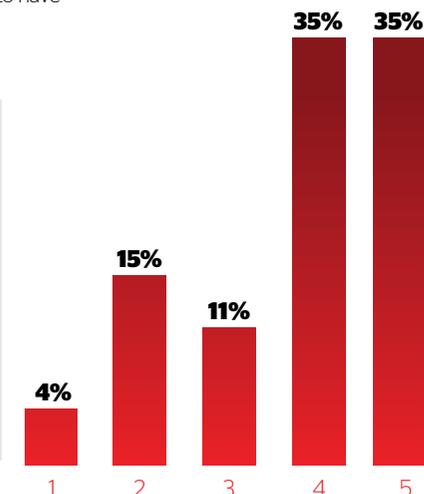
Q5: Increasingly, NOCs are exploring new partnerships from the classic IOC, such as other NOCs or independant energy companies or even in some cases such as Mexico with oil service companies-Is this a trend that marks the beginning of the end of the IOCs leadership role as we know it?

- 1. Yes, the end is high
- 2. No, IOCs/Super Majors will rebound and dominate the next energy wave
- 3. Noc-Noc likely to be the dominant partnership of the future
- 4. Biggest change over next 5 years will be energy services companies playing an increasing role as the primary partner for NOCs
- 5. All you can say for sure is everything is changing and the destination is unclear



Q6: Abu Dhabi has set a 7% Renewables target by 2020 and announced that it aims to generate 30% of all electricity via low-carbon energy sources under its Economic Vision 2030. Which of the following is the most important initiative to enact to have realistic chance to reach targets?

- 1. Govt support for Private-Public Partnerships
- 2. Improving price transparency in the energy sector in particular will be essential to incentivize the private sector into investing in the production of clean power
- 3. Education & public engagement is a key pillar to support Abu Dhabi's clean energy targets
- 4. Government has a critical role to play in creating markets and policies that accelerate development and deployment of clean energy technologies
- 5. Subsidies in thePower sector need to be restructured to bolster greater Efficiencies





The Critical Role of R&D
in Post-Easy Oil & Gas Era:
No Longer a Nice to Have?

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 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

“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).”

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.

Mr. Ali Rashid Al-Jarwan has been the CEO of Abu Dhabi Marine Operating Company, ADMA-OPCO, since June 2006. ADMA-OPCO is a major producer of Crude Oil and Gas from the offshore areas of Abu Dhabi and operates two major fields Umm Shaif and Zakum which are considered among the world's giant fields. ■



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



IOCs & NOCs Need to Craft New Partnership for 21st Century

Martin Bachmann, Member of the Board of Executive Directors, Exploration & Development, Wintershall

HOW CAN we shape our industry, energy markets and energy partnerships in a way that energy supplies are secure in the future? We can only master this task if we work together, if there is cooperation between the International and the National Oil Companies (NOCs).

The world has changed fundamentally. The global market for oil and gas is now a market of state-run corporations: around 85 percent of all oil and gas reserves are controlled by NOCs. In the 1970s this was just 15 percent. Whether in Saudi-Arabia, Russia, Venezuela or the United Arab Emirates, the NOCs have the oil and gas.

And with an oil price of \$100 per barrel, they also have the money to use their resources. That is the second fundamental shift that we have seen since the 1970s. Back then, it was the financial strength of the international companies that opened doors for them to cooperate with the major NOCs. Certainly, money still plays a role today. But it is no longer the decisive factor.

Companies that want to come out ahead in the global race for energy resources and form partnerships directly at the source have to offer more today. But what makes an international oil company (IOC) attractive for the NOCs? They need technologies and technological know-how to get more energy out of their fields. They need strong partnerships that allow them to grow more, that allow them to become an important player outside their home country too and to find their way to new production markets.

It's not just about technological expertise and the willingness to share it. It is about technological performance, collective performance. The geological conditions in the reservoirs are becoming increasingly complex--sour gas fields, tight gas--and not to mention the challenges of unconventional oil deposits.

The NOCs have some immense fields that they can only make limited use of with conventional technology. It is becoming technologically more demanding at the sources but not necessarily less feasible. This is because some IOCs offer the expertise and performance to cope with precisely this challenge.

One current example is Schizophyllan, a biopolymer that is generated using a fungus that grows worldwide. It produces a sugar that we use as a thickening agent and which, most importantly, is 100 percent biologically degradable. With the biopolymer we make the water solution that we inject in the reservoir more viscous. This way we hope to recover significantly more oil from the reservoir rock.

The technology, which we are developing together with our parent company, BASF, is currently being tested by Wintershall in



Martin Bachmann,
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an onshore oil field in north Germany. The ecological benefits of this procedure are convincing; so convincing that international partners such as Statoil want to work with us on the offshore application.

But technological expertise is not enough. It is also about a new “partnership culture”. We need partnerships that create comprehensive win-win situations between NOCs and IOCs that pave the way to the sources in the large producing countries for the IOCs and, on the other hand, help the NOCs gain access to the sources outside their regions of

origin too. This is how international ties and strategic partnerships are created that bring diversification and security to both sides.

Wintershall has been active since 1958 in Libya, for example, and has firm roots in society there. With investments of more than \$2 billion and over 150 wells sunk, we are one of the largest oil producers in the country. We have just built a pipeline through the desert in cooperation with Libyan National Oil Corporation. This was a first: never before had a foreign operator carried out pipeline construction for the Libyan NOC.

In Abu Dhabi, we are also active as a partner – as part of our cooperation with ADNOC. We are working together on the technical appraisal of the sour gas and condensate field Shuwaihat. Our experience in developing and producing from sour gas fields in Germany, which we have gained over 40 years, provides the technological basis for this cooperation.

As much as the relationship between IOCs and producer countries has changed in the last few decades, the situation in these countries themselves is also marked by radical change. This is something we have to consider carefully when we think about the future of the energy markets and the potential in cooperating. After all, the major producing countries in the Middle East will become important consumers themselves.

According to the International Energy Agency, Energy consumption in the Middle East has already more than tripled in the last 20 years from 212 million tons of oil equivalent in 1990 to 640 million tons in 2011. And there is no end to this growth in sight.

By 2030, annual energy consumption could even climb to 900 million tons. That would mean a fourfold increase in consumption since 1990. The rapid increase in demand affects natural gas in particular. It is forecast to see an eightfold rise in the same period. These figures are impressive. But they also raise the question of how these countries will be able to meet their own energy requirements in the future without losing their position as the world’s most important export region for oil and gas.

And here the answer is the same: with diversification and innovation. Furthermore, partnerships with the IOCs and their countries of origin can also be a vital tool in responding to this challenge.

The challenges in securing the world’s future energy supply are immense. Adding together our individual strengths is not enough here. We must multiply them – with comprehensive partnerships between the NOCs and IOCs. ■

PARTNER OF CHOICE

Teaming with **ADNOC** on the Al Hosn Gas Project, the UAE’s premier natural gas development at the Shah Field.

الشريك الأفضل

نشارك **أدنوك** في مشروع الحصن للغاز بحقل شاه، أحد أهم مشروعات تطوير الغاز الطبيعي بدولة الإمارات العربية المتحدة.



“The NOCs have some immense fields that they can only make limited use of with conventional technology. It is becoming technologically more demanding at the sources but not necessarily less feasible. This is because some IOCs offer the expertise and performance to cope with precisely this challenge.”



Occidental Petroleum Corporation

Developing a Sustainable Gas Strategy

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.

“Implementing carbon dioxide (CO₂) 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.”

The strategy doesn't end here, however. Implementing carbon dioxide (CO₂) 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.

The potential for renewable energy in MENA is enormous: the region is blessed with all the natural resources necessary for a vibrant renewable energy sector: lots of sunshine, strong winds and, in a few places, powerful rivers. MENA's solar potential is considered to be exponentially higher than that of all other renewable resources combined, and is even thought to be enough to meet the current global demand for electricity.

According to World Bank estimates, the region receives between 22 percent and 26 percent of all solar energy striking the earth. This roughly translates to a potential solar power equivalent of 1 to 2 million barrels of oil per square kilometer per year. In addition to solar, the MENA region also has significant

wind potential with wind speeds in countries such as Morocco, Egypt and Tunisia amongst the highest in the world.

Last year, MENA had 19,300 MW of renewable energy capacity, or about 10 percent of total installed capacity, enough to power more than 7 million homes, although it was largely in the form of public sector hydropower in Iran, Egypt, Iraq, and Morocco. Recent incentives introduced by some governments could result in over 100 GW of installed capacity from renewables in the region by 2030.

The Red Sea has become a hotbed for renewable energy, with substantial wind and solar power capacity being planned in Egypt and Jordan.

But MENA can do much more when it comes to renewable energy, which only accounts for 4 percent of the aggregate primary energy consumption. That's far behind an average of 17 percent for the rest of the world.

The big question is: How does the region reach its potential? To this end, the following factors need to be carefully examined and addressed in order to push the process forward:

REGULATORY FRAMEWORKS: To boost investments, states need transparent regulations on energy and must be willing to partner with the private sector, which has the expertise to make major projects a reality. Despite the large scale renewable energy initiatives that have been launched by some countries in the region, the requisite regulatory framework is often lacking. This regulatory inadequacy, which could range from the absence of an independent regulator to the lack of effective tariff or net-metering mechanisms, continues to be a major deterrent for investment in renewable energy.

SUBSIDY REFORM: The true cost of electricity production using fossil fuels is not clearly understood, either by the general public or even policy makers in some instances. This often results in misleading conclusions and inappropriate comparisons between end-user tariffs, cost of subsidized hydrocarbon-based generation and the cost of renewable energy.

TRANSMISSION GRID CAPACITY: Often cited as a major challenge to implementation of renewable energy, it is estimated that countries in the MENA region would have to



spend over \$30 billion in the next five years to ensure that sufficient grid capacity is available to support their ambitious expansion plans.

RESOURCE DATA: Lack of reliable, long-term and site-specific wind and hydrological resource data in a number of countries makes it difficult to estimate energy output over the long-term. Countries can undertake widespread resource measurement campaigns to reduce uncertainty and facilitate interest by the private sector.

Opportunities for investors are emerging across the region and MENA attracted substantial capital towards renewable energy in 2012 with \$4.8 billion invested, 40% higher than 2011 and roughly twice as much as in 2010.

In the past, the high cost of renewable energy technology, like solar panels and wind turbines, made many investors wary. But rapid advancements have made solar photovoltaic cells dramatically cheaper.

According to Bloomberg New Energy Finance, installation costs for utility-scale solar PV plants have dropped by over 40 percent since 2010 and are expected to fall by a further 25 percent by 2020. Wind turbine prices have also been dropping and newer turbines have become more efficient at capturing the available wind resources, especially in areas with low to medium levels of wind.

In many cases, the price of wind and solar equipment already rivals that of conventional technology, especially when subsidies for fossil fuels are excluded. The balance is expected to swing further in favor of renewables if the

price of oil and gas continues to rise and if carbon taxes, or similar measures, are adopted.

The World Bank estimates that by 2040, total investment needs in MENA's energy sector will exceed \$30 billion a year, about 3 percent of the projected regional GDP. That makes renewables a good bet for forward-looking investors.

What will the renewable energy sector look like in 2020? The renewable energy sector will have grown by leaps and bounds. Cost of solar PV will be much lower than today – maybe 20 to 30 percent lower. Utility scale solar PV installations will become common-place across the region; this could be the case with rooftop installations as well. It is also likely that solar power could be applied towards water desalination given its tremendous potential, the challenge of water scarcity in the region and the energy intensiveness of the desalination process.

The balance of power in the region, which is now highly skewed towards conventional thermal generation, will change considerably. The GCC will no longer be subsidizing its oil and gas reserves for use in power generation, but will instead be using them in a much more economically efficient manner. Gas-based power plants are likely to be used to meet base-load demand, coupled with renewables. Expensive oil-based generation will be more limited to meet peak power demand.

Overall, the tremendous fiscal resources that are currently used to subsidize energy in the region will be freed-up and put to more productive use in other socially important sectors, such as education and healthcare. ■



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



INOCs and Independent Arab Energy Companies to Emerge on Global Stage as 2020 Players?

SEANEVERS of Gulf Intelligence moderates a debate with Rashed Al Suwaidi, Chairman, Horizon Energy; Rashid Al-Jarwan, Executive Director, Dana Gas; Sean Korney, Partner, Baker Botts; Ali Mahdi Aldabbagh, General Secretary for the Iraqi Intellectual Group (former State Minister & Official Spokesman for the Iraq Government

SEANEVERS(SE) I would like to begin by asking Rashid Al-Jarwan, Executive Director of Dana Gas, what your outlook will be vis-à-vis new partnerships, what they make look like. Do you expect to be drilling oil in Abu Dhabi within five years?

RASHID AL-JARWAN Dana Gas, which was only formed in 2005, now produces about 70,000 barrels of oil per day equivalent through our operations in Egypt and the Kurdistan Region of Iraq. This positions us as among the leading producers in these fast developing markets.

SE It does bring up the point about the opportunity for independent Arab energy companies or for INOCs for that matter going into other markets, perhaps the opportunity to develop the smaller space, the smaller marginal field that maybe the bigger players do not have the economics or the appetite for. Do you see that opening more in the region?

RASHID AL-JARWAN I think it is. Over the past 10 years, we have seen Egypt for example incentivizing the private sector and encouraging investments in to the sector in order to enhance domestic production. Independents, like Dana Gas tend to be more nimble in their decision making and this helps significantly hasten investment decisions and hence participation.

There are other examples such as in the Kurdistan region of Iraq where, because of certain risks and challenges, independents in the private sector can contribute significantly by not just taking on marginal fields but in the case of Dana Gas, even becoming the principal operator in the market. In many frontier markets, majors hesitate to enter due to geo-political concerns and the resultant risk-reward equation while local political considerations often disallow NOCs from participating.

Dana Gas is also unique in that we are a Middle Eastern company and this reflected in our understanding and appreciation of the local dynamics and ability therefore to offer solutions that are tailor made to suit local market challenges without compromising on creating world class facilities.

SE Dr. Aldabbagh, when Iraq was taking on its tender period and awarded a number of contracts, it obviously had a lot of the major players, but some Chinese national oil companies as well. Obviously we're seeing things change a little bit in Iraq vis-à-vis the appetite of the international companies to the deals that were offered or signed. Is that changing the view at all in Iraq for looking for alternative partners? Do other players, other national oil companies from Asia have an opportunity for more there? Or small players... like we've seen in Kurdistan?

DR. ALI MAHDI ALDABBAGH The model of Kurdistan is totally different from what we had from the bid rounds in Baghdad. In Kurdistan, politics had played a major part in the decisions on concessions. You could see that from some of the Turkish companies, which did not get qualification in Baghdad, but have been allowed to work in Kurdistan because Turkey is a very important partner for them, and a corridor for their oil exports. The same is applicable for Dana Gas. Dana Gas was not allowed to enter the bid rounds because of politics since it had participated in Kurdistan.

SE Sean Korney - in terms of Kurdistan being the one area in the region where there is clearly active opportunity for smaller players, for international/national oil companies, if you want to call them that—we've got Dana Gas there; Mubadala Petroleum looking there; TAQA looking there. Can that model replicate itself in other parts of the region? Or do you think Kurdistan is unique for whatever reasons and that smaller players, INOC players, won't have opportunity in the southern Gulf, let's say?

SEAN KORNEY I think the Kurdistan Region is unique because it was unexplored and unexploited for such a long time, and then it had a system where wildcatters and small companies were welcome. We've seen an evolution where bigger companies are coming in and buying up some of the smaller companies.

So, the first answer is yes, it is unique, but I think that you can have that situation elsewhere in the Gulf. If the governments open up additional acreage which is attractive to smaller companies, but not attractive to larger companies as we've been talking about, then there's nothing preventing some of the people with an entrepreneurial spirit - the Dana Gases and the like, and even smaller ones - people who have split off from a career at ADNOC and want to try

“ For the past 50 years, IOCs have taken things for granted. They have to change their attitude into more of a partnership spirit, where some benefit also comes from the outside, from the customer, from the network, from their infrastructure.”

Rashed Al Suwaidi



something on their own - from taking up those opportunities.

SE Rashed - you made a rather strong, bold statement in your opening remarks that IOCs have a limited opportunity here going forward, so who is going to deliver the technical and production capacity ambitions of the region in partnership of course with the NOCs? How do you think that will play out?

RASHED AL SUWAIDI What I said earlier is that for the past 50 years, IOCs have taken things for granted. They have to change their attitude into more of a partnership spirit, where some benefit also comes from the outside, from the customer, from the network, from their infrastructure. For example, what Occidental has done with Mubadala - taken them to Bahrain and also to Oman and so on.

Another example is Oman - where the government has decided to take small fields from PDO and auction them to smaller companies. Why? Because smaller entrepreneurial companies are more active, more responsive and more responsible; they come forward and invest the money and they do it faster.

Also, international oil companies don't have technologies. What they have is their brand name and financial muscle. And they have the infrastructure and above all, they have political support.

SE And they also have the legacy and reputation of having delivered.

RASHED AL SUWAIDI I agree with that. They have delivered, and will continue to deliver. But what I am saying is they have to change the way that they're doing business because the world is changing.

But we do have to remember that governments also have a lot of responsibilities - social responsibilities - which sometimes prevent them from acting as fast as the private sector. Subsidy is a big issue for example, in Egypt, of energy and food and also here in the UAE.

The other point is that we have to protect our demand security in the market with our customers, the Japanese, the Chinese, the Indian, and the Koreans.

SE You're indicating indirectly that you're not doing enough with your customers at the moment.

RASHED ALSUWAIDI Yes, exactly. Our customers are also our stakeholders. We should have a model where they should know what we are doing in our own country - that they are partners with us here and that they know our problems and are ensured of security of supply.

SE We have a comment from the audience. Please, Andrew if you'd like to just introduce yourself.

AUDIENCE MEMBER, ANDREW VAUGHAN

My name is Andrew Vaughan with Shell here in Abu Dhabi. At the risk of sounding defensive, I have to take issue with the fact that I believe the IOCs do have a huge role to play in the future, just as they've had a huge role to play in the past.

I think the contribution that the IOCs and the independents have made to the development of national oil companies has been enormous. We just completed a 75-year history for ADCO. And I don't think ADCO would be where they are today were it not for the contribution that our companies made decades ago in their development.

But I think there is also a huge future, and particularly in technology. Technology is not just about transferring technology from A to B. It's about how you apply the technology. Shell is probably the biggest researcher and developer of new technologies in the business.

Taking that technology and applying it is what makes the difference. It's what has helped us to build the Pearl GTL plant in Qatar. It's what's helping us now to help PDO to develop their enhanced oil recovery fields in Oman.

We have a massive contribution to make alongside the independents and alongside the NOCs. The future is going to be enormously challenging and we all have a role to play, be it the application of technology or the development of expertise or the transfer of knowledge.

Yes - traditional boundaries amongst different types of companies are blurring and that's a good thing because it really is about integration,

collaboration and development of a new industry.

SE Sean - the point that there has to be more value exchange embedded in partnerships on a contractual basis rather than just through CSR - the actual development of young national capacity for example. Are you seeing that this needs to be more prevalent?

SEANKORNEY There are two things that go



“In many frontier markets, majors hesitate to enter due to geo-political concerns and the resultant risk-reward equation while local political considerations often disallow NOCs from participating.”

Rashid Al-Jarwan

“The model of Kurdistan is totally different from what we had from the bid rounds in Baghdad. In Kurdistan, politics had played a major part in the decisions on concessions.”

Ali Mahdi Aldabbagh

to the partnership point. You have to look at the asset that's on offer, the terms that are on offer and what are the additional asks from either the host government or the NOC. Your needs determine who your partners are.

As to the different types of partnerships going forward, I think you will see some successful partnerships between the NOCs and their customers. We've seen Chinese companies going into Saudi Arabia and then giving a reciprocal invitation to the Saudis to participate in a refinery in China and similar buyer/seller relationships.

SE We have a question here in the front, please.

AUDIENCE MEMBER, ROBIN MILLS Yes, thanks. Robin Mills from Manaar Energy Consulting.

If we look at the U.S. shale gas and shale oil revolution, it was very much lead by small entrepreneurial independent companies. The super majors have entered into that game rather late.

Does the panel think that, given that many countries in this region are short of gas, we could see a similar revolution in this part of the world to meet the region's gas needs? And if so, what would need to happen in order for small entrepreneurial companies like Dana Gas or others to lead that kind of a revolution?

SE Rashed, would you mind addressing that?

RASHED ALSUWAIDI Some of the oil or gas reservoirs here are really challenging, and they need proven management. Will we have smaller companies in Abu Dhabi? I'm not in a position to answer that. But I think in the region we have seen Oman doing it, and they were very successful. And we have mentioned Kurdistan where it has also been done successfully.

RASHID AL-JARWAN If we take the UAE, for example, Dana Gas now has a presence by beginning to develop the Zora field, offshore Sharjah and Ajman. That's a relatively small

field which was discovered previously but was abandoned due to pricing and demand dynamics. Things have changed significantly and so the opportunity came for Dana Gas to say, "Okay, we will develop that gas. We will set the new commercial value for that gas," and the construction stage of the project has begun with production expected in a few months. Once we have proven that Dana Gas can indeed develop a complex area offshore, it will be easier to come onshore and also move in to larger fields and projects.

SE The question of the day, which hasn't been mentioned yet, is that we are in very uncharted waters, where the ADCO concession has expired. I'd like to ask all the panelists what their views are on what the renewal might look like. Will it be different?

SEANKORNEY It will be vastly different. There is a whole different universe of companies who are interested in this asset, so I think what you'll end up with is a very different mix of partners; probably chosen very carefully by ADNOC for different reasons. A reason might be that they bring a superior technology. Or that they bring the market. Or it may be that you need to or you'd like to grow a bigger relationship with a particular country that's a consumer. The decision will be based on both quantitative and qualitative factors.

RASHED ALSUWAIDI I agree that it will be different. The IOCs need to change to a new model that's different than the model they have had in the past and market is the most important.

RASHID AL-JARWAN Dimensions are definitely different. Market consumers are important. Your long-term partners have actually been buying your products. Your history of relationship is important. I don't think that can be neglected. Newcomers, new partnerships, new decision makers. I think there are a lot of elements that will eventually produce something different. ■



Clean Energy Ambitions: Investible and Achievable

**Richard Doidge, Managing Director,
Maersk Oil Middle East**

AS THE GULF STATES grapple with the challenge of managing soaring domestic energy demand and meeting their ambitious clean energy targets, carbon dioxide (CO₂) injection for enhanced oil recovery (EOR) will soon become a necessity rather than an option for the hydrocarbon-rich region.

So far, Gulf Cooperation Council (GCC) member Oman has been the only state in the region having launched EOR programmes on a commercial—rather than pilot—scale in a bid to stem and reverse years of declining crude production. But as the era of “easy oil” is also coming to an end across most of the region, along with the awareness of the potential to significantly increase oil recovery, the application of EOR techniques will become a reality in many other GCC countries.

At the same time, Gulf States are facing a natural gas crunch driven by a sharp rise in domestic energy demand on the back of population growth, energy subsidies, industrial expansion and secondary oil recovery via gas injection. The tightening gas-supply balance in countries such as Oman, Saudi Arabia, Kuwait and the UAE has left them searching for additional supplies, such as LNG imports in the UAE to avoid future shortfalls.

The development comes against the backdrop of a rising energy demand globally, in particular in emerging markets such as China and India. This demand growth will, for the foreseeable future, still be met by conventional fuels, with coal and gas meeting roughly two thirds of global power demand by 2030. Alternative energies such as nuclear and renewables will play an increasingly important, but still relatively small, role in the global energy mix over the next 20 years.

As a result of the ongoing reliance on hydrocarbons, greenhouse gas emissions, including CO₂, will continue to rise.

Managing this increase will be seminal if a damaging spike in global temperatures is to be avoided. As such, capturing the CO₂ emitted from industries and power plants, and storing it underground in depleted oil and gas fields or deep saline formations will have to play an increasingly prominent role in transiting the world to a sustainable low-carbon economy.

The challenge facing Carbon Capture and Storage (CCS) is that it still tends to be positioned as costly given the infrastructure needed to be put in place in the initial project stages.



To make it attractive and enable implementation on a large scale, governments will need to provide regulatory frameworks and economic incentives conducive to investing in CCS. The incentives can price CO₂ emissions, either via tax or a cap-and-trade system – or involve the purchase of CO₂ by oil companies to implement EOR projects. The latter option provides an economic incentive for capturing CO₂ given that the technique can significantly boost oil recovery (in some cases by an additional 15% of the oil in place).

Governments and international organisations have recognised the importance of CCS as a way of battling climate change. According to the International Energy Agency (IEA), CCS projects should contribute around 20% of the CO₂ emission cuts needed in order to mitigate climate change in the longer term.

For the Gulf States, the application of CO₂ EOR on a larger scale provides two obvious advantages. It allows natural gas that would be used otherwise for injection into oil fields for secondary recovery to be freed up to meet other domestic requirements, for example in power generation or industrial use, or to limit the costly import of LNG. Moreover, it helps limit emissions in a region that has one of the world's largest carbon footprints.



This won't happen, however, unless governments set a standard price for carbon, similar to what other countries have done elsewhere. For example, Canada's Alberta province, home to the country's vast oil sands reserves, levies a fee of \$15 per tonne of carbon emitted by large producers. Australia recently introduced a new carbon tax of about \$21 per tonne of CO₂ emitted.

The lack of a benchmark carbon price makes potential CCS projects challenging for project developers and investors -- why pay a higher price for CO₂ to inject into oil fields when it is cheaper to use subsidised conventional natural gas instead.

However, the issue needs to be looked at from a bigger-picture, longer-term perspective and can't be separated from a country's larger clean energy goals, its requirements for higher oil recovery from CO₂ EOR, and the region's tightening gas supply-demand balance. With these issues

in mind, the economics of EOR and CCS projects will change.

Improving transparency in the energy sector in particular will be essential to incentivise the private sector to invest in renewables and clean power with full carbon capture. As such, publicising the unit cost of producing different forms of electricity in the local market is a key requirement. Project developers and investors need to be aware of local electricity tariffs for conventionally generated power versus zero-emission, clean power and renewables.

Once a premium has been determined for each kilowatt hour of power generated from clean sources, project developers are in a position to decide on whether a project is economically feasible and what solutions will best be applied in the local market. In short, a transparent, level playing field is a pre-requisite to having the private sector play an active role in meeting the region's clean energy targets.



“ The future success of Private-Public Partnerships are key in meeting the Gulf’s clean energy targets, and improving price transparency in the energy sector in particular will be essential to incentivise the private sector into investing in the production of clean power.”

The debate about clean energy goals in the wider Gulf region can’t be had without tackling demand-side management and the issue of subsidies, which aren’t sustainable in their present form. According to International Monetary Fund (IMF) estimates, energy subsidy costs in GCC countries ranged from 9-28% of government revenues in 2011.

Reforming these costly energy subsidies by bringing domestic fuel prices and electricity and water tariffs closer in line with those in international markets would strengthen government finances, help put a lid on a runaway domestic energy demand, and support the transition to less energy-intensive modes of production. Although politically

sensitive, the realities in the long term will mean that the issue will need to be addressed in earnest.

At the same time, subsidies that support the introduction and feasibility of clean power and CCS projects will be desirable to incentivise initial investments. However, plans to taper off these subsidies after a certain period of time will have to be built in any such incentive scheme.

None of the above should happen in isolation – there needs to be a concerted effort with joined-up thinking. Only then can the Gulf region countries ensure that their clean energy ambitions will be investible and achievable. ■



Richard Doidge,
Managing Director,
Maersk Oil Middle East

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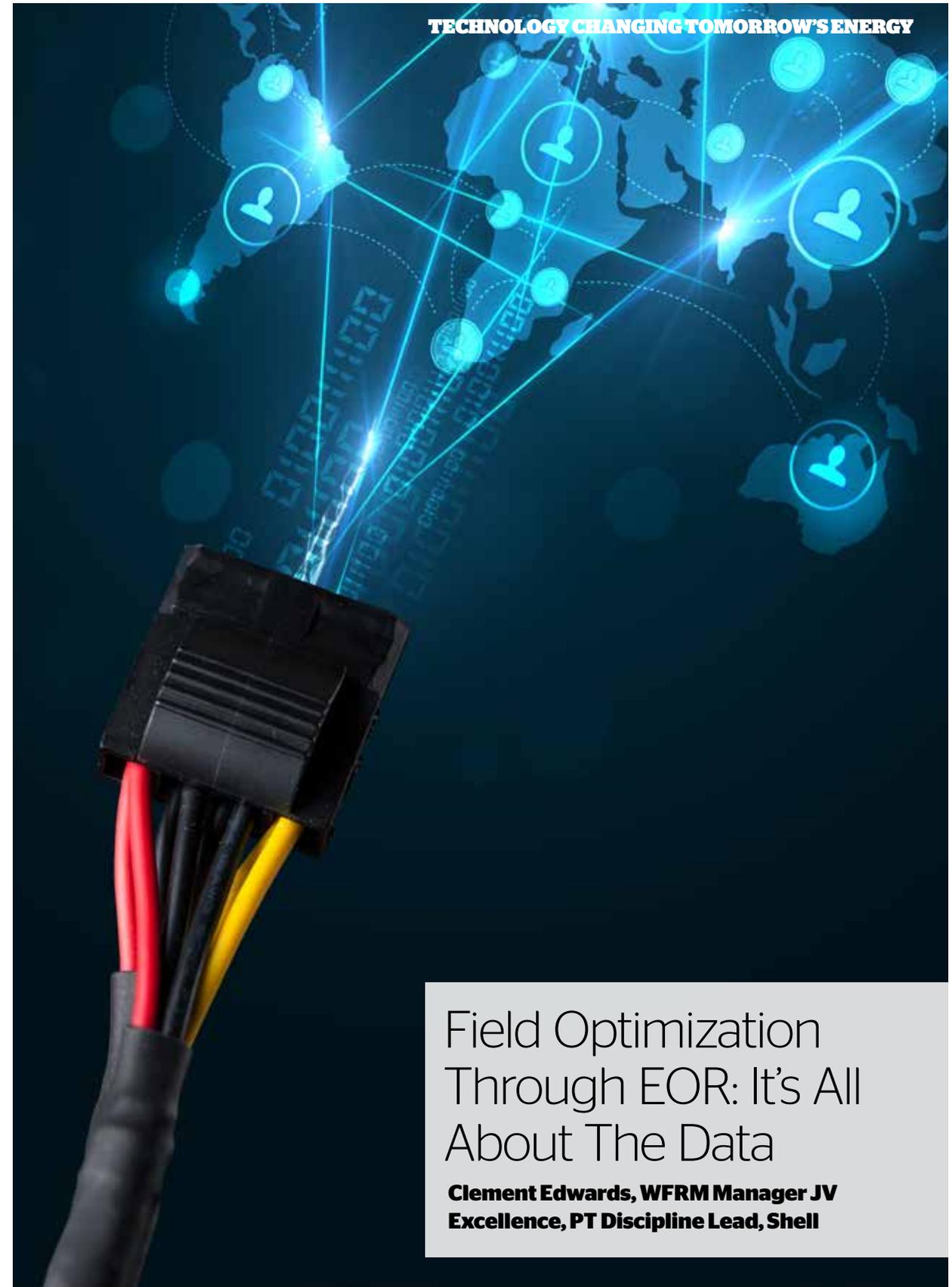
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TECHNOLOGY CHANGING TOMORROW'S ENERGY



Field Optimization Through EOR: It's All About The Data

**Clement Edwards, WFRM Manager JV
Excellence, PT Discipline Lead, Shell**

OVER THE PAST DECADE, the global oil industry has undergone what may well be described as the most transformative period in its history to date.

Ongoing innovations in techniques such as enhanced oil recovery (EOR) have injected new life in many ageing oil fields and brought the development of many new ones into the realm of economic viability. Around the globe, the application of innovative EOR techniques such as gas injection, steam injection and polymer flooding in conventional oil fields are driving up recovery rates, including in the Middle East, where the era of cheap oil has come to an end.

With world energy demand forecast to double by 2050, developing these conventional resources will remain a top priority for energy companies in the foreseeable future – despite an abundance of unconventional reserves such as shale oil, which have increasingly become commercially feasible to develop.

At the same time, advances in information and communication technology are changing the way oil companies communicate, operate and process increasingly large amounts of data running into petabyte territory, or into the millions of gigabytes. From raw exploration data to real-time production data, refinery process-related data, and trading and retail data – few industries have to handle the breadth and volumes of information being generated in the oil sector today.

Managing and evaluating data has always played an important role in decision-making processes in the oil industry – and will do even more so going forward. As the energy industry seeks to access harder-to-reach reserves in ever-more remote and challenging environments, companies will be dealing with more complex data in their operations.

Developing sound strategies to integrate and manage data and using it in smarter, faster ways can be a key differentiator for energy companies, affect project economics, and make or break the successful application and operation of technologies such as EOR in oil fields.

The rationale for putting in place a comprehensive data strategy is therefore clear. Poor data management and difficulty accessing it means its value is bound to decline over time and the ability to make field-critical decisions will be affected negatively. Availability of and access to data containing potentially crucial information on the other hand is a precondition for the successful search and development of oil

reserves. It also improves efficiencies and helps avoid duplication.

Gathering and managing data is one thing. Evaluating it another. As such, it is essential that experienced engineers, not IT specialists, take ownership of the data to verify its quality and ensure that it meets expectations and industry standards. After all, just as using poor data leads to poor decision making, the availability of quality data will ensure sound decision making.

Similarly, the visual presentation of the data in 'digestible form' is important so that petroleum engineers are in a better position to analyze and respond. Simple decisions should be automated and harder ones guided. This is of particular importance in an industry where swift decision making is often critical.

There is also a growing need for technological capabilities that allow collaboration from anywhere and anyone at any time. This requires the creation of a master data set, which ensures that the data is secure, while allowing that it is also accessible simultaneously by multiple users. All this will ultimately help reduce risks, boost efficiencies and subsequently drive the discovery and production of more oil.

None of the above will be truly successful without entrenching best practice and data management awareness throughout operating companies. But introducing new ways of managing and evaluating data will require a mindset change away from the traditional structures and ways of thinking. Educating staff on the value of the data they are using and the need to handle it systematically and rigorously will be therefore be seminal to reap the benefits of putting in place the right infrastructure. Training and mentoring new engineers in these practices will equally be a must.

The importance of data gathering and management is also being recognized by national oil companies (NOCs) in the Middle East. Petroleum Development Oman (PDO), in which Shell holds a 34% stake, is a case in point. PDO's data management system is among the most advanced and, after years of implementation, has contributed to the company reversing a period of declining oil production through the application of various EOR techniques.

Just as data management has supported PDO's transformation into a leading EOR company in recent years, it will drive similar changes in other parts of the region. The industry's transformative years are far from over. ■



Clement Edwards,
WFRM Manager JV
Excellence, PT
Discipline Lead, Shell



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Solving the Talent-R&D-
Technology Nexus in the
Energy Industry

James McCallum, CEO & Chairman of the LR Senergy Group



WE'VE HEARD IT ALL BEFORE: the energy industry lacks engineers and the situation isn't going to get any better any time soon. Why? Well, as we all know the oil and gas industry's workforce is aging and about half of its experts are set to retire within the next five to 10 years. The bigger problem is there continues to be a dearth of new talent joining the industry so we better step it up or else may be left in dire straits.

The industry doesn't just need petroleum engineers. Yes, we want them all but we need to look further. At a time when the oil and gas industry is undergoing a period of fundamental change, what we need urgently is young talent from all types of backgrounds, including from geology, maths, IT and analytics. For these are the people who will

drive innovation in future technologies – because that's what it is all about at a time when the world's long-term energy demand outlook knows only one direction – up – and new hydrocarbon resources are becoming harder and harder to access.

New technologies are needed to develop previously out-of-reach resources such as shale and tight oil and gas that are often located in some of the world's most challenging territories. As an industry, we also need to work constantly on advancing existing technologies to make reservoirs more productive, more efficient and more effective in the way that they produce hydrocarbons – this is certainly something that's highly relevant for an increasingly maturing region like the Middle East.

But to develop these technologies, the industry needs to develop new talent. Attracting this talent to the industry therefore is of fundamental importance for the future of energy – whether in the Middle East or other parts of the world. The big question is where will the talent come from that's actually going to carry out the research and development (R&D) activities that will produce breakthrough technologies and improve existing ones?

As it stands, most companies will be hard pressed to finding sufficient numbers of people who have the required skill sets. Competition for talent is fierce, with energy companies essentially vying for the same—and limited—talent pool. According to the World Petroleum Council, U.S. universities turn out somewhere to the tune of 430,000 lawyers every year but, for example, only 430 geologists.

Sure, the picture looks somewhat different in India and China, where larger numbers of graduates in engineering and other energy industry-related subjects are entering the market every year. The problem is that most oil and gas companies may still find it hard sourcing talent with the specific skills they need, including knowledge of particular languages.

The reasons for the lack of graduates seeking jobs in the oil and gas industry are well known. The industry has an image problem, in particular in regards to its environmental implications. Going forward, each company needs to be prepared to answer questions over its commitment to the planet, to responsible energy policy within the company and to responsible energy R&D.

The industry is also perceived as being low tech, which means tech-savvy graduates look towards Silicon Valley and the IT sector for employment rather than the oil and gas industry. Moreover, of those graduates who may consider a career in energy, not everyone will be willing to work in remote locations and harsh conditions. Due to the industry's cyclical nature in the past, there are also concerns over job security.

In short, the industry at large has a big task ahead redesigning and improving recruitment strategies and efforts, polishing its public image, and offering attractive and lucrative careers. This has to start with getting involved much more closely at primary school level in a bid to encourage interest in science from an early age. Of course, it then needs to be made

“The industry at large has a big task ahead redesigning and improving recruitment strategies and efforts, polishing its public image, and offering attractive and lucrative careers. This has to start with getting involved much more closely at primary school level in a bid to encourage interest in science from an early age.”

sure that this carries through to secondary-school and university level.

Communicating the industries' opportunities both in terms of careers and state-of-the-art technologies are equally important, just as the implementation of company-internal coaching and mentoring programs that offer long-term professional development and mentoring programs.

Each company will have to do its part. But the issues are bigger than one company. There needs to be a greater pooling of resources to change the industry's image, to put in place best practices and to learn from each other through know-how and technology exchange.

Collaboration will also be integral to driving the kinds of innovation and R&D that will attract new talent into the oil and gas industry. But the onus isn't just on the industry. Collaboration needs to be deepened also between industry and the other stakeholders such as governments and academia.

For the Middle East, and the Gulf countries in particular, which have identified education and R&D as key drivers on their quest towards becoming knowledge economies, there is an opportunity to create an environment that attracts more of its large, young population into sciences and, subsequently, into the energy industry in the future. If successfully implemented, this could go a long way contributing towards solving the talent-R&D-technology nexus. ■



James McCallum, CEO & Chairman of the LR Senergy Group

MENA Set to Emerge as Hotbed of Activity for Renewables and Clean Energy

Adil Marghub, Senior Manager, Infrastructure & Energy, IFC

THE POTENTIAL FOR renewable energy in MENA is enormous: the region is blessed with all the natural resources necessary for a vibrant renewable energy sector: lots of sunshine, strong winds and, in a few places, powerful rivers. MENA's solar potential is considered to be exponentially higher than that of all other renewable resources combined, and is even thought to be enough to meet the current global demand for electricity.

According to World Bank estimates, the region receives between 22 percent and 26 percent of all solar energy striking the earth. This roughly translates to a potential solar power equivalent of 1 to 2 million barrels of oil per square kilometer per year. In addition to solar, the MENA region also has significant wind potential with wind speeds in countries such as Morocco, Egypt and Tunisia amongst the highest in the world.

Last year, MENA had 19,300 MW of renewable energy capacity, or about 10 percent of total installed capacity, enough to power more than 7 million homes, although it was largely in the form of public sector hydropower in Iran, Egypt, Iraq, and Morocco. Recent incentives introduced by some governments could result in over 100 GW of installed capacity from renewables in the region by 2030.

The Red Sea has become a hotbed for renewable energy, with substantial wind and solar power capacity being planned in Egypt and Jordan.

But MENA can do much more when it comes to renewable energy, which only accounts for 4 percent of the aggregate primary energy consumption. That's far behind an average of 17 percent for the rest of the world.

The big question is: How does the region reach its potential? To this end, the following factors need to be carefully examined and addressed in order to push the process forward:

REGULATORY FRAMEWORKS: To boost investments, states need transparent regulations on energy and must be willing to partner with the private sector, which has the expertise to make major projects a reality. Despite the large scale renewable energy initiatives that have been launched by some countries in the region, the requisite regulatory framework is often lacking. This regulatory inadequacy, which could range from the absence of an independent regulator

“In many cases, the price of wind and solar equipment already rivals that of conventional technology, especially when subsidies for fossil fuels are excluded. The balance is expected to swing further in favor of renewables if the price of oil and gas continues to rise and if carbon taxes, or similar measures, are adopted.”

to the lack of effective tariff or net-metering mechanisms, continues to be a major deterrent for investment in renewable energy.

SUBSIDY REFORM: The true cost of electricity production using fossil fuels is not clearly understood, either by the general public or even policy makers in some instances. This often results in misleading conclusions and inappropriate comparisons between end-user tariffs, cost of subsidized hydrocarbon-based generation and the cost of renewable energy.

TRANSMISSION GRID CAPACITY: Often cited as a major challenge to implementation of renewable energy, it is estimated that countries in the MENA region would have to spend over \$30 billion in the next five years to ensure that sufficient grid capacity is available to support their ambitious expansion plans.

RESOURCE DATA: Lack of reliable, long-term and site-specific wind and hydrological resource data in a number of countries makes it difficult to estimate energy output over the long-term. Countries can undertake widespread resource measurement campaigns to reduce uncertainty and facilitate interest by the private sector.

Opportunities for investors are emerging across the region and MENA attracted substantial capital towards renewable energy in 2012 with \$4.8 billion invested, 40%



higher than 2011 and roughly twice as much as in 2010.

In the past, the high cost of renewable energy technology, like solar panels and wind turbines, made many investors wary. But rapid advancements have made solar photovoltaic cells dramatically cheaper.

According to Bloomberg New Energy Finance, installation costs for utility-scale solar PV plants have dropped by over 40 percent since 2010 and are expected to fall by a further 25 percent by 2020. Wind turbine prices have also been dropping and newer turbines have become more efficient at capturing the available wind resources, especially in areas with low to medium levels of wind.

In many cases, the price of wind and solar equipment already rivals that of conventional technology, especially when subsidies for fossil fuels are excluded. The balance is expected to swing further in favor of renewables if the price of oil and gas continues to rise and if carbon taxes, or similar measures, are adopted.

The World Bank estimates that by 2040, total investment needs in MENA's energy sector will exceed \$30 billion a year, about 3 percent of the projected regional GDP. That makes renewables a good bet for forward-looking investors.

What will the renewable energy sector look like in 2020? The renewable energy sector will have grown by leaps and bounds. Cost of solar PV will be much lower than today – maybe 20 to 30 percent lower. Utility scale solar PV installations will become common-place across the region; this could be the case with rooftop installations as well. It is also likely that solar power could be applied towards water desalination given its tremendous potential, the challenge of water scarcity in the region and the energy intensiveness of the desalination process.

The balance of power in the region, which is now highly skewed towards conventional thermal generation, will change considerably. The GCC will no longer be subsidizing its oil and gas reserves for use in power generation, but will instead be using them in a much more economically efficient manner. Gas-based power plants are likely to be used to meet base-load demand, coupled with renewables. Expensive oil-based generation will be more limited to meet peak power demand.

Overall, the tremendous fiscal resources that are currently used to subsidize energy in the region will be freed-up and put to more productive use in other socially important sectors, such as education and healthcare. ■



Adil Marghub,
Senior Manager,
Infrastructure &
Energy, IFC



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Transformational Economics
2020: Survey Say

RICHARD DEAN moderates a panel discussion with: Timothy Fox, Head of Research & Chief Economist, Emirates NBD; Dr. Gıyas Gökent, former Chief Economist, NBAD; and James McCallum, CEO & Chairman, LR Senergy Group, debate the answers to an Industry Survey of about 160 energy executives and officials conducted at The Gulf Intelligence UAE Energy Forum 2014, held in Abu Dhabi on Jan. 13.

RICHARD DEAN Let's begin by looking at the bigger picture through to 2020, because it seems like we've had a transformational shift over the past six months or so. If we'd been here this time last year, we'd have been talking about the BRICS and emerging markets driving energy demand through to 2020. But that seems to have changed - the BRIC's are losing steam, and the comeback kid, if you like, of the global economy is the OECD, North America.. So, Dr. Gıyas, if I can turn to you first of all, is this a medium-term shift through to 2020, the return of OECD and the decline of emerging markets?

DR. GIYAS GÖKKENT I don't think so. I think what you're referring to is a relative slowdown. Whereas perhaps the Chinese economy was growing at 10% per year, they're slowing down to 6% or 7% per year. I think ultimately because of convergence, because the emerging markets are still in the catch-up phase, you will continue to see more rapid growth in emerging markets. That will simply mean around 4% or 5% growth rather than the more rapid pace that we saw earlier. And the incremental demand for energy will continue to be I think focused on the emerging markets.

RICHARD DEAN Tim, what's your view at Emirates NBD? This shift towards the OECD as an engine of growth, is that going to last through 2020?

TIMOTHY FOX I think what we're seeing is a normalization whereby the developed world is starting to get on top of its problems. Five or six years after the crisis in 2008, we are finally coming out of it, and the United States inevitably is leading the way. And as that happens, it pulls up other parts of the world economy.

I agree with Gıyas. I don't think it's mutually exclusive. I think everybody will enjoy the recovery. The emerging world may see slightly softer rates of growth than in the past. The developed world needs to add more

growth to what it's been doing in recent years. It needs to start to pick up back to previous potential growth rates; we're still quite a long way away from those. So, it is an encouraging time at the start of 2014 and we will probably see the developed world continue to pick up within the next few years.

RICHARD DEAN James McCallum, if I can bring you in here. You're not a dismal scientist. You're not an economist. You're an engineer by training. You're now a business leader. How do you read these shifts, if indeed they are shifts?

JAMES MCCALLUM As an engineer and CEO obviously I monitor the macro influences of the energy market. When you look at what's happening in the world today, one thing which constantly seems to be missed and one of the biggest economic shifts of the last five to six years, is that the Chinese economy has moved significantly from being almost entirely an economy built on exports to one built also on internal demand from within China. If you move from an export-based economy to an internally balanced economy, you build in sustainability and that's a very important shift. Similarly the United States has used abundant shale gas, which is enabling it to produce lower costs of energy, to increase its levels of manufacturing fueling economic growth both domestic and international.

RICHARD DEAN Let's find out what the audience thinks and look at the first survey question please Will the global economy witness another major shock before 2020?.

The audience voted 50/50.

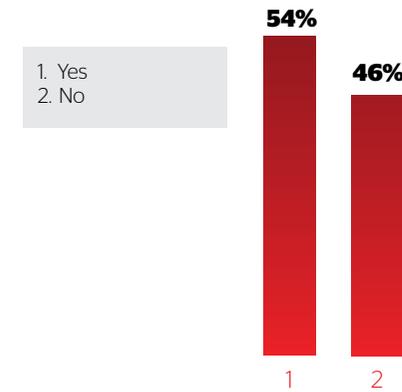
Gıyas - can I ask you how you voted?

DR. GIYAS GÖKKENT I said yes. I'm a traditionalist. I believe that cycles will continue around every seven to ten years. But where those problems arise is the question.

TIMOTHY FOX I hold a similar view - I can remember the 1987 stock market crash and the next one following that in terms of magnitude was clearly 2008.

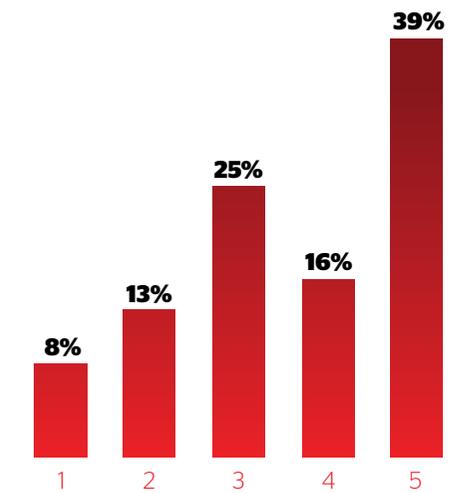
But during that 20-year gap, there were quite a lot of other things going on. There were ERM crises. There were crises in Russia. There were crises in the emerging markets in Asia, in Latin America. There was the dot-com bubble crash. So every few years, you do get a kind of a crisis but I'm not sure we're going to get one of the scale of 2008.

Q1: Will the the global economy witness another major shock before 2020?



Q2: which of the following will present the biggest economic challenge through to 2020?

1. Declining US/EU Middle Class real incomes
2. Explosion of new Asian middle class consumption
3. Global sovereign debt levels
4. Global population growth
5. Youth Unemployment



“When you look at what's happening in the world today, one thing which constantly seems to be missed and one of the biggest economic shifts of the last five to six years, is that the Chinese economy has moved significantly from being almost entirely an economy built on exports to one built also on internal demand from within China.”

JAMES MCCALLUM

RICHARD DEAN OK. Let's look at the next question which is on a related theme and a little more granular. Which of the following will present the biggest economic challenge through to 2020? One - declining U.S. or European middle class real incomes. Two - the explosion of the new age in middle class consumption. Three - global sovereign debt levels. Four - global population growth. Or Five - youth unemployment.

Youth unemployment is the winner. We know that here in the Arab world, youth unemployment particularly is an issue. Gıyas?

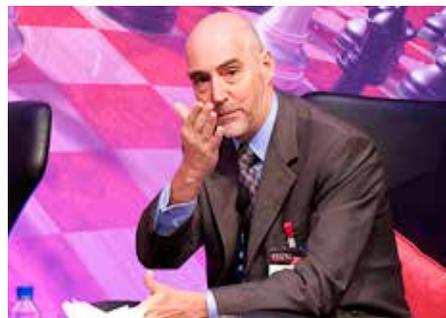
DR. GIYAS GÖKKENT It depends where you are on the cycle. As you move away from 2008, as you move away from the crisis in the Eurozone and so on, obviously the picture should improve. So, I'm not that pessimistic; and population growth rates are actually slowing down so I don't think unemployment is going to be a more pressing issue than is currently the case or indeed compared to the levels seen in the recent period of slowdown in Europe in that case of that region, for example.

RICHARD DEAN I voted on the issue of sovereign debt which to me is a big issue. We have just kicked the can down the road and we've sowed the seeds of all kinds of problems going forward. That's my view. How about you?

DR. GIYAS GÖKKENT There's a reason why sovereign debt levels, particularly in the OECD, have gone up. It's almost a duty of governments to lean against the wind in tough

“Generally, when you look at periods of interest rate tightening, that tends to be negative for commodities and about halfway through also for stock markets. So, in terms of asset price volatility, I think we’re not done by any stretch of the imagination, so I’m expecting some problems for emerging markets.”

GIYAS GÖKKENT



times and to stimulate economic activity. So when the private sector pulled back as it did after 2008, governments had to engage in deficit finance. Looking forward, what we’re told essentially is that U.S. debt levels will stabilize and then come down slightly. Then, if the long-term issues of aging and associated expenditures such as Medicare are not addressed, there will be a long-term problem.

I voted for population growth because there’s going to be more demand on resources and, ultimately, resources are finite.

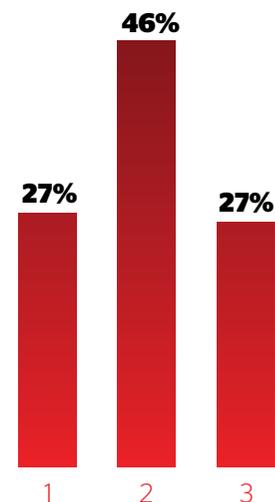
RICHARD DEAN James, how did you vote?

JAMES MCCALLUM Global population growth. Areas like Africa with a significant emerging middle class, a similar emerging Chinese population, all of whom want to step up from their pushbike to their motorcycle and then to a Mercedes-Benz car, this potentially has a massive effect on the world from an economic standpoint.

But I could have also voted for youth unemployment which is a growing issue particularly here in the region, but also elsewhere in Europe and the United States.

Q3: After 5 years of loose Monetary policy, we appear to be entering a period of tightness-Which of the following outcomes do you most align with?

1. Money will get more expensive, curtailing production capacity expansion, Which in turn will squeeze energy prices higher
2. Getting back to normal trend lines of monetary policy will make it easier to predict future supply and demand cycles, and increase investment in building energy capacity
3. Emerging markets will suffer capital flight and a period of economic weakness, lowering demand and with it the price of oil



If you’re looking towards sustainability in any economic agenda, then we have to look to the youth. It’s always been disappointing to me that I work in an industry where we don’t properly address the forward path of knowledge need and consequently fail to effectively engage youth in seeing our industry as a viable and exciting career for life.

RICHARD DEAN Let’s look at another survey question - about monetary policy and tapering - after five years of loose monetary policy, we do finally appear to be entering a period of tightness. Which of the following outcomes do you most align with?

The results indicate that most of the audience thinks we’re going to be getting back to normal. Tim, this speaks to your idea about a return to normalization.

TIMOTHY FOX I think it’s healthier that we are moving to that phase. I voted for option Two. I think it is important that the world economy and the political system gets back to a kind of normalization in terms of interest rates, interest rate setting, the price of capital, which will all lead to equilibriums in demand and supply. It will create investment opportunities and the potential for growth. It’s been unhealthy that we’ve had extraordinary monetary stimulus for so long. This has distorted markets and incentives in the United States and globally. Eventually interest rates will rise and when that does happen, it will be for the right reason, because of an improvement in the global economy.

RICHARD DEAN James - as an engineer and business leader, how big an issue is monetary policy for you?

JAMES MCCALLUM We look at it from the standpoint of gaining access to capex for investment in the projects we want to drive forward so what is the availability of project finance liquidity, and finally how will any changes in policy support or otherwise broader investment instruments, debt investment vehicles, and ultimately equity investment vehicles which support corporate growth. So, it’s very important.

RICHARD DEAN Thank you. And Gıyas?

DR. GIYAS GÖKKENT I voted for option Three. Tightening hasn’t yet really taken place in the U.S. We are still in a period of extremely accommodative monetary policy. And if you look at when interest normalization is going to occur, it’s actually not for another year or two. So, the fallout from interest rate normalization hasn’t yet fully taken place. I think there is plenty of opportunity and space and time for these things to happen. Generally, when you look at periods of interest rate tightening, that tends to be negative for commodities and about halfway through also for stock markets. So, in terms of asset price volatility, I think we’re not done by any stretch of the imagination, so I’m expecting some problems for emerging markets.

RICHARD DEAN Gentlemen - your 30

second conclusion please on the global economy through to 2020?

JAMES MCCALLUM One of the global economic drivers that we are seeing increasingly effect the energy industry is diversification with many new independent companies coming to the fore with interests in not only conventional resources but unconventional and renewable resources too. The associated thought leadership being shown in many major suppliers is to get closer and closer to their customers needs through knowledge partnership and collaboration. Small independents are popping up everywhere and when characterized generally by people who have a real can-do attitude, who may have been in a major, then stepped out, wanted to do something new - roll the dice one more time and deliver something really special. This along with the internationalization of many NOC’s is leading to a vigorous entrepreneurialism across the Energy industry as it seeks to deliver the world sustainable low cost fuel sources that can be relied on. As long term energy supply is one of the principal foundations of our global economy, I look to the future with optimism.

TIMOTHY FOX I’m certainly on the optimistic side. But I would like to highlight the problems that might occur. I think a lot of problems in the last few years have been pushed under the carpet, and I think those could come back to the surface eventually if steps are not taken while the global economy improves. Also in relation to regulations and controls which will limit leverage, these are going to inhibit growth and may slow the recovery, which may compound risks in terms of what we talked about on youth unemployment and social tensions. I guess I’m speaking more as a European in this context.

DR. GIYAS GÖKKENT I see commodity prices softening in the coming few years, so that’s great for economic activity. Policy will normalize, so you will see interest rates go back to 4% instead of 0%. In terms of fiscal policy, I think you’ll also see less deficit financing than we’ve seen in the past few years, particularly in the developed economies.

But I think you’ll continue to see this convergence story, this relative erosion in the influence of the developed economies, and greater say for the emerging markets and particularly India and China. ■



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