

Third Quarter 2015

Energy Outlook

*Energy Industry Being Disrupted
into Unknown New Definitions*



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Oil, natural gas and solar energy – 100,000 women and men

COMMITTED TO BETTER ENERGY



If Oil Companies were New York Yellow Cabs, Who is their Uber?

MORGAN STANLEY'S research shows that cars are driven just 4% of the time, which is an astonishing waste considering that the average cost of car ownership is nearly \$9,000 per year -- It might be one explanation why UBER is valued at a whopping \$50 Billion. U.S. Transportation fuel consumption accounts for over 70 percent of total U.S. oil consumption, and more than 65 percent of that amount is for personal vehicles. American drivers consume about nine million barrels of gasoline per day for personal transportation, about 45 percent of total U.S. oil consumption, and big bucks await anyone who can accurately forecast what those stats will look like in 10 years time.

The energy industry is being disrupted into new definitions that aren't exactly clear yet but as the new head of the International Energy Agency, Fatih Birol, tells us in this publication, a lot is at stake -- "the situation is no longer black and white, roles are blurring. In a time when roles are less clear, it is even more important to share information, to speak up on important issues, to be transparent about priorities. The stability of the global energy system, and hence the stability of our organizations, businesses, communities, and societies, depends on such cooperation."

One such subject that binds all these stakeholders is the arrival of carbon emissions and carbon pricing at the top of the global agenda. In an unprecedented step, six of Europe's largest oil and gas companies came together

in May to script a letter to the UN requesting to let them help devise a plan to stop global warming. The hand of cooperation was offered as nearly 200 countries prepare to sign a global climate pact at a UN conference in Paris in December, with some countries seeking an agreement that includes a deadline for phasing out fossil fuels.

An international consortium of Islamic scholars and academics issued the Islamic Declaration on Climate Change on August 18th in Istanbul calling on the world's 1.6 billion Muslims, who live in countries that host much of the world's known oil & gas reserves, to play an active role in combating climate change and have urged governments to conclude an effective universal climate change agreement in Paris at the end of the year.

With Climate Targets in Mind, Energy Efficiency is the Way to Go, Arafat AlYafei, CO2/N2 Development Manager at ADNOC argues in this publication "that there is now little doubt that the world won't be able to burn all known fossil fuel reserves if it is to meet the climate targets governments have set themselves" under the goal to limit greenhouse gas emissions and global warming to no more than 2C.

Perhaps technology will emerge to provide the necessary solutions for all stakeholders - but I wouldn't count on it.

Sean Evers
Managing Partner, Gulf Intelligence



Energy Industry Definitions are Blurring

**By Dr. Fatih Birol, Executive Director,
International Energy Agency**

I WILL start by stating what all of us here already know – the global energy system is in a state of transition. New suppliers are shaking up markets. Demand is increasing across emerging economies while it is almost flat elsewhere. Meanwhile legitimate concern over climate change is causing governments to take long hard looks at their energy sectors and ask what can be done? In the next few minutes I would like to present my views on what I call a new chapter for producer-consumer dynamics and the role of the Middle East in global energy markets in the next years to come.

Much potential exists with the growing number of people who are seeking better standards of living, modern appliances, and access to transportation. Today 1.2 billion people across the world have no access to electricity, mainly in sub-Saharan Africa – where two out of three lack access. The 800 million people in sub-Saharan Africa consume the same amount of electricity as New York City. Here there is great promise for renewable energy: hydro, solar and wind. However there is absolutely no scenario under which oil and gas do not play a significant role. Even in established economies, where low carbon targets are needed to meet environmental objectives, oil and gas will continue to play a key role in the energy mix.

Today, in many countries, energy decisions are being taken against the background of the wider environmental considerations, including local air pollution and climate change. The energy sector is a major contributor to this challenge. Indeed there is no scenario under which the challenges of climate change can be tackled without major contributions from the energy sector. I expect that the climate summit of world leaders later this year in Paris will result in pragmatic policies being put in place to help address these challenges.

I BELIEVE THE CURRENT MARKET DYNAMICS BRING US TO A NEW CHAPTER IN CONSUMER-PRODUCER RELATIONS

Many of you in this room remember a time when the relationship between producers and consumers could be described as “difficult”. Despite fundamentally depending on each other for growth and prosperity, there were many areas in which priorities did not match.

The relationship between producers and consumers is evolving because, ultimately, the dividing line between the two that was once clear is now blurring. Who is now a producer,

who is a consumer? Some countries that were once major energy importers are now ramping up supply and becoming important producers. At the same time some countries that were once major exporters find themselves facing a surge in demand at home.

If we look back over the past six years, oil production growth in IEA countries has been three times higher than in OPEC countries. On the consumption side, in this time, while oil consumption in OPEC countries has increased substantially, it has declined in IEA countries.

These trends show that the situation is no longer black and white, and that the roles are blurring, bringing us closer together than we ever were before, helped by ever growing global energy trade, which has opened up new markets.

What is critical for all of us then is that we pursue dialogue and real cooperation. In a time when roles are less clear, it is even more important to share information, to speak up on important issues, to be transparent about priorities. The stability of the global energy system, and hence the stability of our organisations, businesses, communities, and societies, depends on such cooperation.

IN THE COMING DECADES WHAT ROLE CAN THE MIDDLE EAST EXPECT TO ASSUME?

While countries such as the United States, Canada and Australia and others are increasing production, in my view, this does not change the fact that the Middle East is – and will remain – absolutely critical for oil and gas markets for many years to come. We simply do not expect any other region or country to replace the Middle East in its position as the world’s top exporter.

Indeed we must not underestimate what is in store for us in coming decades. Consider that in Asia, outside of OECD countries, 1.5 billion new passenger cars could be on the road by 2040. That’s equivalent to 1.5

“If we look back over the past six years, oil production growth in IEA countries has been three times higher than in OPEC countries.”



times the total number of passenger cars on the roads today, worldwide. Consider the inestimable number of mobile phones that will be manufactured, bought, and charged all across Asia. And consider the fact that to reach the per capita electricity consumption that the United States had in 1965, developing Asia would need to add over 5000 GW of new power generation capacity. This corresponds to more than four times the entire power plant capacity of the US today.

That, ladies and gentlemen, is potential. That is what is in store for us tomorrow.

THERE ARE MANY DISTINGUISHED GUESTS IN THIS ROOM TONIGHT, FROM A NUMBER OF COUNTRIES IN THE MIDDLE EAST.

Your countries have done great service to the energy industries here in the region, but also to countries and people around the world. Qatar is an excellent example, with its efforts to ship LNG to Japan in the wake of the devastating 2011 earthquake and tsunami. That action alone was proof of the undeniable relevance and

importance of Middle East producers.

And of course it all starts from the top. Having leaders like His Excellency Al-Attayah enables the valuable resources from this region to move to those regions where they are in demand. But this is not a story of supply and demand, not a story of simple economics.

This is a story of human development. It is a story of the future well-being of people from all regions of the world. There are simply too many people in the world who remain without access to the energy that we take for granted, every single day. The efforts of His Excellency and those who he has inspired will continue to ensure that energy – the lifeblood of economics, societies, and civilization – continues to flow to where it is needed most. Energy improves the lives of those who simply ask for the opportunity to participate in the modern life that we have been so fortunate to enjoy. ■



Dr. Fatih Birol, Executive Director, International Energy Agency

Remarks made during the 2015 Abdullah Bin Hamad Al-Attayah International Energy Awards

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Delivering Energy in a More Complex and Competitive World

**By Alistair Routledge, President & General Manager,
ExxonMobil Qatar Inc**





THESE are certainly interesting times to be in the energy industry. During my 25 years in this cyclical industry, I have been through these times in the past and I predict these times will certainly come again, which is why the exchange of ideas and constructive dialogue are all the more relevant.

The energy industry must recognize that delivering the energy the world needs—in a safe and reliable manner—is a humanitarian

challenge, not just a business imperative. Affordable, reliable supplies of energy are a necessity for individuals around the globe to benefit from the modern conveniences—sanitation, health care, education, transportation and economic growth—that the privileged take for granted. Energy makes all of that possible.

Over the next few decades, population and income growth and an unprecedented

expansion of the global middle class are expected to create new demands for energy. ExxonMobil sees global energy consumption rising by about 35 percent from 2010 to 2040.

Meeting this demand will require more than resources and access to resources. It will depend on vision, innovation and sound policy. For an exemplary model, one needs look no further than Qatar of what will be needed to meet new energy demand.

In early 1990s, Qatar faced the challenge of developing the world's largest non-associated gas resource, the North Field. His Highness the Father Emir had a vision to maximize the value of Qatar's North Field, and to build a strong international partnership that could encourage long-term investment and maximize the value of Qatar's resources for the advancement of all.

ExxonMobil's predecessor and my heritage company Mobil had the privilege of being invited by the state of Qatar to help develop the North Field. Today, ExxonMobil celebrates more than 20 years of this partnership with Qatar Petroleum, and joint ventures with RasGas and Qatargas. The benefit of combining each company's unique strengths is evident now, thanks to the Father Emir's vision and the wise leadership of His Excellency Abdullah Bin Hamad Al Attiyah during his tenure as Minister of Energy and Industry.

Qatar has made—and continues to make—a major contribution to the historic shift that is underway toward the greater use of natural gas worldwide. Truly, energy lives here in Qatar.

The Qatar example shows why governments must be prudent, so as not to stifle development or the investments in innovation that improve safety and performance. Qatar shows us that regulations can strike an appropriate balance between proper risk management and economic viability.

Most importantly, Qatar offers an example of what happens when a government creates a framework of sound and stable legal and tax policies that do not change with the ups and downs of commodity price cycles.

ExxonMobil Qatar is proud of what the company has been able to accomplish over the past 22 years with the State of Qatar. As the company continues along this journey, ExxonMobil is committed to helping Qatar achieve its National Vision 2030 by providing the energy to develop human potential; the energy to invest in research, safety, health and the environment; and the energy to grow this thriving society.

We also remain committed to our



“The energy industry must recognize that delivering the energy the world needs - in a safe and reliable manner - is a humanitarian challenge, not just a business imperative.”

partnership with Qatar Petroleum: to prudently manage the North Field and to continue finding innovative and efficient ways of bringing energy to a growing and increasingly interdependent world.

In conclusion, the world's energy marketplace grows more complex and more competitive, but as we look to the future, we should take pride in our shared ability to play a vital role in supplying the energy that people need to prosper in a modern world. ■



Alistair Routledge,
President & General
Manager, ExxonMobil
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THE FUTURE OF ENERGY - DISRUPTION!



Energy Efficiency is the Only Way
to Go to Meet Climate Targets

By Arafat Al Yafei, CO2/N2 Development Manager, ADNOC

THERE can be little doubt that the world won't be able to burn all known fossil fuel reserves if it is to meet the climate targets governments have set themselves. Over 80 percent of coal, 50 percent of gas and 30 percent of oil reserves are "unburnable" under the goal to limit greenhouse gas emissions and global warming to no more than 2C.

According to recent University College London research, published in Nature journal, the Middle East would need to leave about 40 percent of its oil and 60 percent of its gas underground; the majority of the huge coal reserves in China, Russia and the U.S. would have to remain unused; undeveloped resources of unconventional gas, such as shale gas, would be out of bounds in Africa and the Middle East, and very little could be exploited in India and China; and unconventional oil, such as Canada's tar sands, would be unviable.

In short, for the world to be able to limit man-made global warming to the level that world leaders have already agreed to, oil and gas companies would have to leave much of their proven oil and gas reserves in the ground. National oil companies (NOCs) control approximately 90 percent of the world's oil reserves and 75 percent of production. Of the top-25 oil and gas reserves holders and producers, 18 are NOCs, according to 2011 World Bank data.

With this in mind, it's obvious that NOCs will have to play a seminal role in contributing to the mitigation of greenhouse gas emissions. But the challenge isn't really about leaving hydrocarbons underground to meet the 2050 target. Instead, the biggest challenge is for the world to become much more efficient in the ways it uses energy.

The reason is clear. The current world population of 7.2 billion is projected to increase by 1 billion over the next 12-14 years and then reach 9.6 billion by 2050, according to a United Nations report published in mid 2013. This increase in turn will fuel primary energy demand. The International Energy Agency (IEA) last year estimated that world energy demand will rise by 37 percent by 2040.

And—like it or not—for the foreseeable future, this demand will continue to be met largely by conventional resources – oil, gas and coal. Renewables, nuclear power and hydro energy will also play a role in meeting global demand but they alone won't be able to satisfy it.



With that in mind: what can we do to ensure that future energy needs will be met without increasing the pressure on the environment and natural resources? One answer is that the world needs to step it up when it comes to improving energy efficiency.

Boosting efficiencies in existing infrastructure such as power plants, industrial plants, buildings and in transportation would go a long way towards reducing the impact of energy use on the environment and saving natural resources. This is of particular importance in the Middle East, where rapidly growing populations, seawater

desalination requirements and a push towards industrialization are driving energy consumption at an unprecedented pace.

How will we get to a vastly more efficient world? It won't be an easy task by any standard.

Nor is addressing climate change a task that can be solved by or is the responsibility of a single sector, country or region. It's everybody's responsibility; everybody has a role to play. It is the responsibility of governments, national and international organizations, international oil companies (IOCs), NOCs and other industries to

“ The biggest challenge is for the world to become much more efficient in the ways it uses energy.”

take the initiative and invest in being more efficient. Ultimately, with long-term energy demand set to remain on an upward trajectory, being efficient will be essential to reducing per-capita energy consumption and emissions.

In the United Arab Emirates, Abu Dhabi National Oil Co. (ADNOC) has initiated an efficiency drive across its group of companies. From carbon dioxide (CO2) capturing and injection to cutting flaring levels to working towards achieving zero water discharge and using more solar energy in its operations – the list of ADNOC's efficiency initiatives is long and growing.

These initiatives were complemented recently with Al Reyadah - the carbon capture, utilization and storage (CCUS) joint venture being developed by ADNOC and Masdar next to Emirates Steel Industries. On an emirate-wide level, the Abu Dhabi government has set a target calling for 30 percent of the emirate's annual electricity to be generated using low-carbon and renewable energy sources. All of these initiatives are geared towards being committed to creating a more sustainable economy.

We know these initiatives alone aren't going to solve the world's climate and emissions problems and a lot more needs to be done. But at least we are starting; we are improving and advancing the learning curve. This in turn will enable us to tackle the technical and commercial challenges ahead and will hopefully enable us to make valuable contributions to raising efficiency levels around the world and ensure that the 2050 target of 2C will be met. ■



Arafat Al Yafei, CO2/N2 Development Manager, ADNOC



Market Patterns Shifting:
Changes in Global LNG Supply-
Demand Dynamics

**By Birger Balteskard, Manager Global LNG Marketing,
ConocoPhillips**

THE GLOBAL liquefied natural gas (LNG) industry has come a long way since the world's first commercial LNG plant at Arzew in Algeria started up in 1964. Last year, the industry reached a major milestone, celebrating its 50th anniversary.

The past decade in particular has seen LNG take off, with demand for the fuel outpacing all other fossil fuels, growing by an estimated 7.6 percent annually since 2000. This compares with growth rates of 1-3 percent for crude oil. Last year saw a record high of 243.6 million tons of LNG being traded, up 4.5 million tons from 2013, according to IHS Waterborne Energy data published in January.

Ten years ago, there were only 11 countries importing LNG; today this number is closer to 25. Global LNG demand growth has been driven largely by a combination of rising energy needs, in particular in South Korea, Japan, China and India, and a general trend

towards utilization of cleaner-burning fuels in power plants to reduce carbon emissions.

LNG has also become more popular due to its greater flexibility compared to pipeline gas, making it the fuel of choice during times of unexpected demand spikes—Japan's soaring LNG imports following the Fukushima nuclear catastrophe being a case in point—and adding an element of energy security. It's therefore little surprise that a lot of new markets see tremendous benefits in importing the super-cooled gas.

On the supply side, the LNG sector has been shaped to a large extent by an ambitious investment program in Qatar over the past decade, which has turned the Gulf state into the world's biggest LNG producer with capacity of 77 million tons a year. Qatar was the main contributor to global liquefaction capacity doubling between 2000 and 2012, and in 2013 it's LNG capacity exceeded that of the next three largest producers combined



– Malaysia, Australia and Indonesia.

But it hasn't been all smooth sailing for the LNG industry. The past six to seven years in particular have seen fundamental changes taking place that hadn't been foreseen. In 2008, the economic downturn reduced demand for LNG globally and in particular in Europe. Another unexpected development over the past five to six years was the scale and speed at which the U.S. shale gas boom unfolded. ConocoPhillips, like other oil majors, had been investing in significant capacity to import LNG into the U.S. As recently as 2006, industry had been anticipating LNG import volumes to reach as much as 100 million tons by today. As it stands, there's no need for that at all. The shale gas boom has not only reduced import volumes into the U.S.; the sector is gearing up for a substantial build up of LNG production capacity, eventually turning the country into a large exporter of the fuel.

Most recently, the industry—and the wider world—were surprised by the rapid decline in oil prices, which has also affected the LNG industry. So when looking at everything that has happened over the past six years, the inevitable question is: what do the next six years hold for the future of the energy industry?

In March 2011, the destruction of Japan's Fukushima nuclear power complex by a devastating tsunami didn't just knock out that plant; the Japanese government subsequently took all atomic power units off the grid, driving up demand for LNG, which to a large extent was met by Qatari deliveries.

A lot of unknowns remain but what we do know is that there are substantial amounts of new LNG coming on stream in Australia. Indeed, the country is expected to overtake Qatar as the world's largest supplier of LNG by the end of the decade with an aggregate liquefaction capacity of around 86 million tons per year.

New capacity additions will also come from the U.S., where one LNG export terminal is scheduled to start operating in 2015 and three others in Texas, Maryland and Louisiana have finalized the investment decision process and are scheduled for construction. Other projects are in the pipeline in Western Canada and East Africa. From 2013 to 2018, global LNG supplies are set to increase 15 percent to 426 billion cubic meters.

Against this backdrop of new capacity additions, the dynamics of the global LNG market are bound to change further over



“A lot of unknowns remain but what we do know is that there are substantial amounts of new LNG coming on stream in Australia.”

the next five years. It is likely that LNG will become more like crude oil, i.e. a much more common commodity and it will continue to increase in popularity.

This is especially true for China given that natural gas consumption in the country currently accounts for only 4 percent of prime energy demand and only a fraction of that is being met by LNG imports. And while economic growth in China is slowing, it remains at a solid 7 percent, and it's expected that not only will its expanding economy drive imports but other factors such as pollution, which the government has started tackling in earnest, will also be a trigger. ■



Birger Balthesgard,
Manager Global LNG
Marketing,
ConocoPhillips

Can F1 spin-off Big Data Technology to Avert Crash in Oil & Gas Production

By Mike Phillips, Head of Simulation Systems, McLaren Applied Technologies



HOW can a racing car travelling around a short track at speeds well above 200kms for a couple of hours help overcome the challenges faced by the oil and gas industry? Let me explain. A Formula One car, or any car for that matter, is just a big physics model, a big mathematical model. It's relatively easy to construct. We use that model to design and develop the car, because simulation is faster, cheaper and more reliable than building test cars.

Once you've got a really accurate model of the car, why wouldn't you use that in a race to actually work out the performance of the vehicle and use data from the car in real time to optimize the car throughout the race?

And that process is what we're rolling out, at McLaren, to other industries, including oil and gas and pharmaceuticals, to help deliver solutions that cut time, cut costs and increase revenues.

The oil industry is increasingly heavily invested in Enhanced Oil Recovery technology to maximize output from mature ageing fields, and having the opportunity to

model a reservoir before spending \$100s of millions of dollars on drilling a well makes good commercial sense.

Data mining is the traditional way of looking ahead by looking backwards, looking at big chunks of historic data to tell you what happened yesterday or last week, last month or last year. But if you can use a little bit of historic data and combine that with models and simulations of the system you were trying to achieve and use that to make forward predictions, then that's much more useful.

You can run scenarios about what the future might look like and make better decisions. If you can take that one step further and do that in real-time, then that's a real game changer. Data mining has its role, but it's only part of the story.

The trick is to understand the problem in the first place, the business challenge or the key performance indicator that the company is trying to optimize, and use data to create a tool that people can understand and use. It's very important in our work to address the human-technology interface.

More and more companies are building that capability and even if they don't want to develop tools in-house, they need to be an intelligent customer. That means they need to know what they're buying because they're probably being pitched every day by software providers who've got the latest and greatest tool that's going to solve all their problems!

I think we're different at McLaren in that we don't have a product to sell. We're selling design and technology capability to build tools. Sometimes we do partner with people to deliver that tool, but we're normally working with the end-user to design and develop a customized solution for them rather than fitting an existing solution to their problem. Happily, what we're seeing more and more is the customer having the intelligence to know what's good and what's bad.

We find that in the industries that rely on technology to enhance performance or to be better than the competition, when they get it right, it's really, really valuable; or if they get it wrong, it's really, really catastrophic.

The oil and gas industry is a great example. Very high operating costs, and therefore, non-productive time is a bad thing; but equally, the environmental cost and reputational cost of getting something wrong is also a big thing. So oil and gas is a great place to use it and is a focus of reaching out to advance the benefits of cross-bred technology that might not previously have been seen as a natural fit.

How our ideas have come to be adopted is clearly illustrated by our first venture into the world beyond the racetrack and that was drug development. A major pharmaceutical came to us and said, "You guys did telemetry

“ I think people have moved on from pure big data because it's too backward looking, and it's not actually much use in an operational sense.”

on race cars, can we do telemetry on people? Can we put sensors onto people so that when we're giving them drugs in a trial we can understand how they're reacting in real time?

And that way we can speed up the way we develop drugs.”

To develop a drug can take 10 years and a billion dollars, so if you can just take a few months out of that it's worth doing. We hadn't anticipated this scenario. It needs industry to come and say, hey guys, here's a real interesting challenge, can you solve it?

I think people have moved on from pure big data because it's too backward looking, and it's not actually much use in an operational sense.

So companies are now looking at more real-time predictive analytics that they can use in the day in the operation to optimize performance. That's a much more interesting area.

For oil and gas in particular, faced with myriad financial and ecological concerns in a world of dwindling resources, the simulated modeling of their challenges and outcomes is the only real way ahead. ■



Mike Phillips, Head of Simulation Systems, McLaren Applied Technologies



HOW to create win-win frameworks necessary for energy industry to co-operate on developing water treatment technologies for the cleaning of produced water from Qatari fields?

The water challenge, faced by all economic sectors in Qatar, domestic and industrial, is still not one that's well understood, and contrary to popular perception it's complicated and costly. The development of a National Water Strategy would go a long way to overcome these hurdles by helping align all stakeholders around a common narrative in pursuit of practical solutions.

Qatar ranks fifth in the world of water-scarce countries, and despite this fact the population of the Emirate has more than tripled over the last 20 years while at the same time the country has built one of the largest industrial sectors in the developing world. Being one of the most arid countries and a major hydrocarbons producer, the development of water treatment technologies for the cleaning of produced water from Qatari oil and gas fields is in the interest of most national and international stakeholders operating in the country.

Water plays an integral role in the oil and gas industry and is by far the largest waste stream associated with hydrocarbon recovery. Today, the average water-to-oil production ratio stands at about 3 to 1, but in some cases may climb three times as high or more in ageing reservoirs. In the U.S. alone, water production is now estimated to be in the range of 60 million-70 million barrels a day on the back of rising oil and gas output over the past five years.

The trend is clear. As global hydrocarbon production increases, in particular from shale and carbonate reservoirs, the volume of produced water—water brought to the surface

from a hydrocarbon well—also increases. Against this backdrop, the reduction, reuse, recycling and disposal of produced water has become an ever-more pressing issue for the global oil and gas industry, bringing with it a whole new level of challenges ranging from high treatment cost to potential toxicity of the treated produced water and public acceptance.

Most produced water today is being used for reinjection to enhance recovery from existing oil and gas fields. However, with water being a scarce resource around the globe, produced water also represents an opportunity to utilize the resource, in particular in Gulf States such as Qatar, which generates most of its fresh water through energy-intensive and costly desalination. If properly treated, produced water can be reused in agricultural, municipal and industrial operations among others.

Research and development of new technology for the treatment of water has thus far not made as much progress as other areas of science like for example electronics - even large established international water companies like Veolia or Suez only spend a fraction (less than 0.5%) of their turnover on R&D.

Qatar is looking to correct that with the importance of water been reflected in the government's decision to name water security as one of three research and development (R&D) priorities alongside energy security and cyber security.

Water models in Qatar are quite different to other water management systems around the world, so there's room for innovation that can be tailored very specifically to the country. And unlike most countries in Europe or elsewhere where the motivation to innovate and find

water solutions may not be as critical due to their geography, in Qatar the challenges of food security and water shortages are serious.

Still, creating more sustainable, economic and environmentally beneficial solutions for the treatment, re-use and disposal of industrial waste water for the benefit of Qatar's economy and society requires greater collaboration amongst stakeholders in the energy industry. This is difficult to establish in the absence of a regulatory framework or national water strategy so that the industrial and domestic sector can ultimately work towards a common goal.

While IOCs in Qatar are carrying out R&D into produced water individually, there is little, if any, collaboration within the industry on the issue.

The National research institutions are well positioned to play an increasingly active role in facilitating a win-win framework so that R&D partnerships could emerge between oil and gas industry stakeholders, both national and international, to carry out joint research into produced water issues. This facilitation could even extend beyond the energy sector in Qatar and enable cross-industry collaboration on produced water.

The Qatar Environment and Energy Research Institute (QEERI), as an applied research institute, can play an important role in this regard by taking on some of the risk for stakeholders in testing technical solutions as well as facilitating and encouraging them to integrate their vertical strategies, share diverse water solutions and bring ideas from the lab to market.

Launched in 2011, QEERI is the member of Qatar Foundation for Education, Science and Community Development entrusted to conduct and coordinate long-term and multidisciplinary research that addresses critical national priorities concerning energy and the environment. It plays a key role in supporting two of Qatar's Grand Research Challenges: Energy Security and Water Security. Its research on the development of energy efficient water desalination technologies, water re-use and water quality and recharging of the aquifer will deliver benefits to all sectors in Qatar, including oil and gas.

As water is a multidisciplinary field, it needs many parties to conduct the required research, but with limited qualified human capacity available locally it is also important that a coordinating body ensure the avoidance of too much duplication. The Qatar National Research Foundation has made notable contributions in this regard by funding people in many research activities.

TECHNOLOGY OPTIMIZATION & COLLABORATION



In a recent energy industry survey supported by ExxonMobil Qatar, some 60% of respondents identified Integrated Water Resource Management as the top research priority in the context of produced water in Qatar and the wider Gulf region, with the remaining 40% of respondents divided equally over Desalination & Solar Desalination, Groundwater Sustainability and Water Demand Management.

The large quantity of produced water generated from oil and gas production worldwide can be potential resources for various applications, including potable consumption – the latter however faces challenges such as high treatment cost, potential chronic toxicity of the treated produced water, and most notably public acceptance, which is no different in Qatar.

This is where an integrated water management structure operating across multiple sectors under the umbrella of a National Strategy could deliver maximum benefit in educating the public as to the overarching benefits of produced water and eroding commonly perceived myths – a good example of this educational role was presented in a recent QEERI study that analyzed the quality of Qatar's tap water versus bottled water, which proved that tap water in the country was just as safe as bottled water, either locally produced or imported brands. ■



Dr. Mohamed Al-Sulaiti, Technical Interface Coordinator, ExxonMobil Research Qatar



Innovation in Lubricants is Critical for Staying in Tune with Changing Engine Technology

By Thangapandian Srinivasalu, Executive Director, Gulf Petrochem Group

AFTER few years of austerity and pent-up consumer demand, India's automotive market is finally entering the fast lane. Rising incomes in one of the world's fastest-growing economies are driving purchases of cars and motorcycles in cities and rural areas. At the same time, improvements in engine technology and environmental regulations are transforming the needs of consumers.

Motorists are looking for lubricants that not only protect, clean and extend engine life but also optimize consumption and performance.

A partnership between GP Petroleums Ltd. and Repsol SA may offer a model for how India can satisfy this anticipated surge in consumer demand without accelerating the nation's dependence on imported petroleum products or adding to its carbon footprint.

GP Petroleums, a subsidiary of U.A.E.-based Gulf Petrochem Group, will produce Repsol automotive lubricants at its manufacturing units in India and begin marketing the Spanish company's products in October 15. Repsol's record of successful

TECHNOLOGY OPTIMIZATION & COLLABORATION

“Motorists are looking for lubricants that not only protect, clean and extend engine life but also optimize consumption and performance.”

innovation is especially relevant because Indian motorists will be facing new and unfamiliar challenges from now to 2020.

Engine technology has evolved rapidly in recent years, and pressure has mounted on engine manufacturers to do more to control harmful emissions amid growing global concern for the environment. This transformation in technology is creating a market for hybrid and electric cars in developed countries, and many Indians will probably develop a similar taste for greener vehicles.

Indian domestic automotive standards traditionally follow European norms, and lubricant manufacturers are now catching up with technology and specifications to match the new European requirements for engines. Meanwhile, infrastructure improvements in India are narrowing the gap between prices for petrol and diesel and contributing to growth in demand for both types of engines and cars.

Unprecedented economic and demographic changes are also shaping the automotive market. Indians are among the world's biggest buyers of motorcycles, and increasing prosperity will accelerate this trend, just as it's already doing for sales of Smartphones. This is especially true for many millions of young people who value convenience and aspire to a more affluent lifestyle than that of their parents. In the countryside, higher incomes are spurring demand for motorcycles and farm vehicles. In cities, India's expanding middle class is hungry to own cars.

Each new vehicle that hits the road this year is more technologically advanced than those that preceded it last year, and motorists need sophisticated lubricants that can protect their engines and enhance their driving experience.

However, this rising demand risks aggravating India's reliance on imported additives and oil products. India imported 38 percent of its fossil fuels in 2012, up from 15 percent in 1990, according to the U.S. Energy Information Administration. In 2013, the country was the world's fourth-biggest consumer and net importer of crude oil and petroleum products, after the United States, China and Japan. India consumed an average of 3.7 million barrels a day of petroleum products that year, almost four times its total liquids production.

Consumers in India receive large subsidies for retail prices of LPG and kerosene, and this puts more upward pressure on overall demand. Consumption of fuel products grew

by 2.9 percent in May from the same month a year ago, while petrol sales increased by 8.9 percent over the same period. On the supply side, insufficient investment in producing more crude oil and liquids has resulted in output growing more slowly than demand.

All of this creates a policy conundrum for the government as it seeks to meet rising demand, secure affordable energy supplies, and attract investment in hydrocarbon production and infrastructure.

There is a bright spot: Despite India's status as a net importer of crude oil, investment in new refining capacity has made it a net exporter of petroleum products. Its total oil-refining capacity amounts to almost 250 million tons per year compared with an annual consumption of less than 175 million tons. Most of the nation's refineries have been modernized or are being upgraded.

Conditions are ripe, therefore, for Repsol's partnership with GP Petroleums. GP has plants in Daman and Vasai and a project to build a third -- a 100,000-ton-per-year blending facility at Pipavav, Gujarat. GP already has a strong niche in the market for industrial lubricants, and it aims also to acquire assets to expand its bunker fuel business. By tying up with Repsol, the company can now push aggressively into automotive lubricants.

Repsol, for its part, has one of Europe's biggest commercial technology centers, where some 400 scientists and researchers are working to create more efficient and environmentally sustainable products. The company's development of clean-burning LPG for use in cars is one example of its success in finding greener solutions to motoring needs.

By harnessing its ample manufacturing capacity and marketing network to an innovative product line of lubricants, GP Petroleums can make a significant contribution as India, like the rest of the world, seeks to reduce harmful carbon emissions. ■



Thangapandian Srinivasalu, Executive Director, Gulf Petrochem Group



Time for New Era of Collaboration in the Gulf to Deliver R&D Breakthroughs in Carbonate Reservoirs

By Dr. Philippe Julien, Director, Total Research Center Qatar

COMPLEXITY reduction and knowledge building is the name of the game when it comes to the exploration and development of Carbonate reservoirs.

Carbonates are truly challenging because they are heterogeneous at all scales, from the microscopic level all the way up to the macro engagement of the entire field, featuring layers of high and low permeability, as well as fractures. This in turn poses a significant problem when it comes to reservoir characterization, modeling and simulation technologies – and for optimal production.

Carbonate reservoirs can be found in limestone and dolomite formations that were mostly formed from the shells of plants and animals in ancient shallow seas. Of the world's

proven conventional hydrocarbon reserves, more than 60 percent of oil and 40 percent of natural gas are found in carbonate reservoirs, from which typically only up to a third of the available oil resources are recovered. Over the past decade, two-thirds of all giant discoveries holding more than 500,000 barrels of oil equivalent were located in carbonate reservoirs.

In the Middle East, approximately 70 percent of all proven conventional oil and as much as 90 percent of gas reserves are located in carbonate reservoirs. Across the Gulf region, Qatar's Al Khalij and Abu Dhabi's Northeast Bab fields are for instance among the carbonate reservoirs being developed by international and national oil companies.

But even though carbonate reservoirs are very common and despite ongoing research efforts into their characteristics, they are—and large—still poorly understood, and the challenges associated with their development remain substantial. Almost all technical domains show specificities when dealing with carbonates, whether in geology, geophysics, geochemistry, reservoir modeling, enhanced oil recovery and CO2 storage and production. This is a problem. With global energy demand estimated to roughly double by 2050, more of these resources will have to be tapped if the world's rising thirst for oil and gas is going to be met in the future.

In order to achieve optimum reservoir performance, detailed understanding of their petrophysical, geological, geomechanical and dynamic properties is seminal. Given the technical difficulties and complexities involved in developing carbonate reservoirs, and a general need to develop a better understanding of these reservoirs, there is a significant need to step up research and development (R&D) activities aimed at developing innovative technologies that will help discover more such reserves, improve understanding of their complex nature, and enhance production and recovery rates.

The industry has recognized this and several R&D projects have been set up already. One example is the Total Research Center – Qatar, which was first inaugurated in 2009 and which has teamed up with the Qatar Petroleum Research & Technology Center on a joint acid stimulation research project, which is designed to increase production from the country's carbonate oil and gas fields.

But researchers tend to have different opinions on what R&D activities to prioritize to advance the understanding and production of carbonate reservoirs. This is by no means unusual and, of course, all areas involved in research on carbonate reservoirs are important and relevant in their own right. It underlines, however, that—given the complexities involved—there is an opportunity to foster coordination, communication and collaboration among the various research domains and across the industry.

This should also entail sharing information and experience, which would lead to greater alignment, better focus and improved efficiencies in R&D activities. Information sharing in Qatar could be facilitated, for example, through a platform such as the Qatar Science & Technology Park (QSTP).



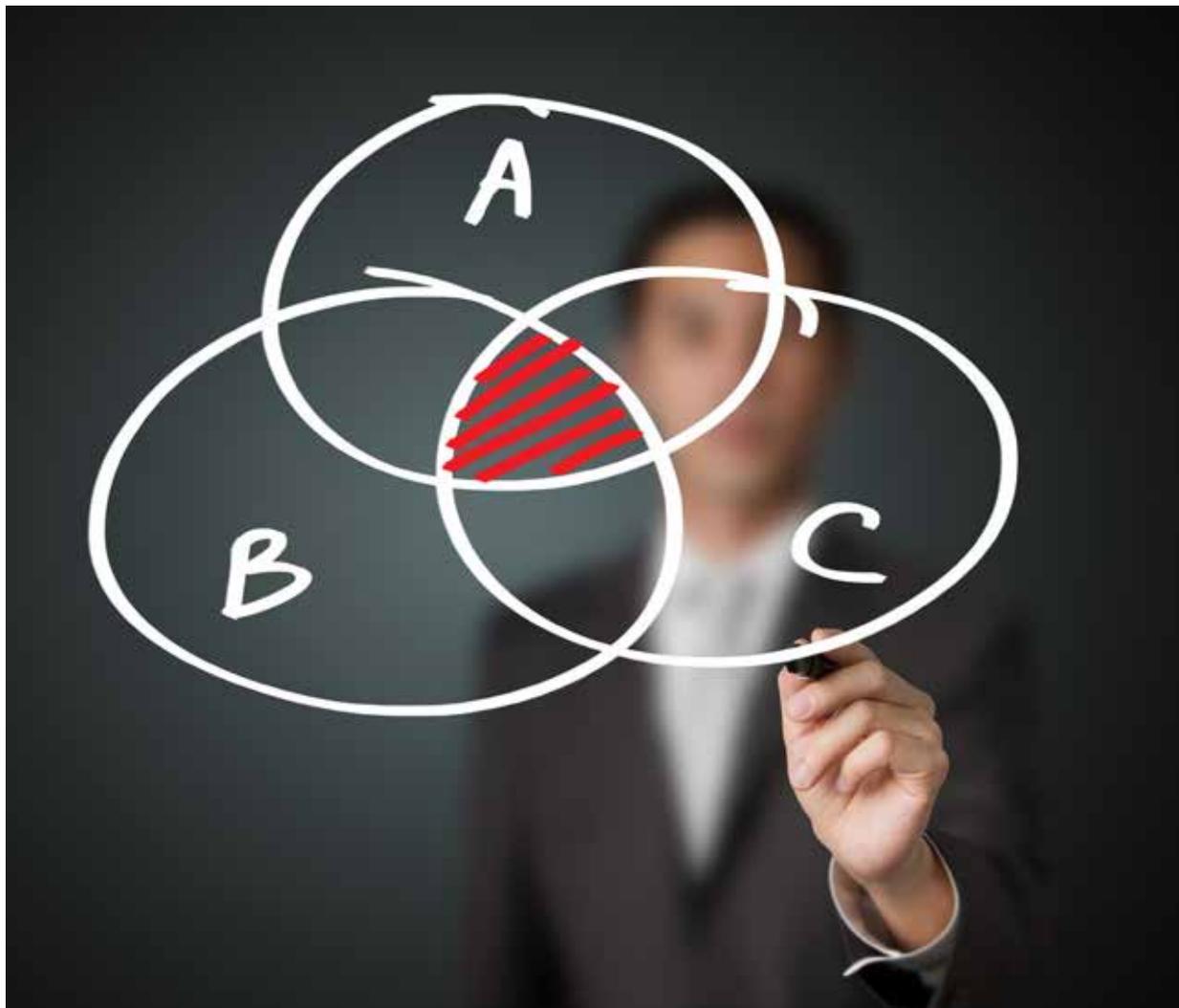
“ In the Middle East, approximately 70 percent of all proven conventional oil and as much as 90 percent of gas reserves are located in carbonate reservoirs.”

Another complexity in tackling hydrocarbon production from carbonate reservoirs is that they generate substantial volumes of water, with the water-to-crude production rate often as high as 9:1. Finding different ways of managing this water will be an important aspect going forward. And since water issues do not sit at the core of an oil company's business, it may be a good starting point for greater information sharing and collaboration. To this end, it may well be worthwhile for the Qatar National Research Fund (QNRF) to consider promoting research in this domain, either through pilot projects or applied research.

Some of the solutions to these technological challenges may also come from other industries in the form of Crossover Technologies. From aerospace to automation, robotics and medicine, there are numerous innovative technologies that have the potential to revolutionize the oil and gas industry further in coming years. And to identify potential solution opportunities for carbonate reservoirs, the establishment of platforms to share R&D knowledge and experience would be an important starting point. ■



Dr. Philippe Julien,
Director, Total
Research Center Qatar



Open Minds to Lead Oil & Gas Industry to Crossover Innovation with Other Industries

By Dr. Wafik Beydoun, R&D Division Manager, ADNOC



WHETHER it may be key developments from the defense industry, or robotics or cyber security, many companies are discovering that they can benefit from breakthrough innovation originating in fields not obviously related to their own; they just need the openness to benefit from them.

How should we in the oil and gas industry change our current R&D practice and perspectives to embrace this cross-industry, cross-science innovation and benefit from it? One straightforward way is to create platforms between different industries to exchange knowledge. This would help identify where we share common challenges

and interests with other industries.

The outcome of such an exchange/discussion could be simply classified in 3 categories: (1) There is no interest in technological crossexchange, so we each continue with our R&D business 'as usual' activities; (2) There maybe new solutions from outside the industry that are ready, or nearly available, from which we can benefit – in this case little adaptation/ development may be required before using it in our industry; (3) There is no solution as such, but there is mutual interest to solve a joint challenge/need – we then actively seek a cross-industry R&D cooperation to work jointly on a solution.

In the past seven months, I have noticed real growth in the discussion of how such cross-industry opportunities can benefit our industry. We've seen an effervescence of ideas from different industries – For instance, in February 2015 during the major defense conference IDEX, I was part of a panel organized by TDC, where they were discussing how everyone could benefit from sharing cross-industry technology and development. It is encouraging to see these industries trying to get closer together and this type of cross fertilization is certainly the way ahead.

In the Technology Review journal (MIT publication) last year, they listed ten breakthrough technologies in 2014 including drones, smart phones, cyber-security, brain mapping - among many other ideas all across the technology landscape, all industries included. If we are open enough we can find ways to seek, work with and benefit from these breakthrough technologies that will considerably broaden our horizons and impact our industry (see red text on figure).

For instance, industrial drones are already used in oil and gas for surveying and monitoring our installations; cyber security is a crucial element of all our systems. Development in these areas offer clear benefits to our operations and accelerate our own innovation.

The question is, are we really doing enough to understand and embrace these new technologies? Obviously, we strive to innovate in our own business, but we need to look outwards, to expand our circle of knowledge, to add another dimension to our outlook and to do this we need to look to other industries and to academia.

This is not a one-way process. Our own R&D has been extensively influential across the world and our encouragement for start-ups and feeder companies that benefit our industry is essential.

Integration between academia and industry will be the key to ensure that Abu Dhabi's emerging R&D ecosystem can deliver applied research. Governments tend to be continuous supporters of mature technologies, but play other key roles as all-important regulators and as underwriters of risky projects.

But when it's time to move on from the mature technology, ready to deploy or at least develop new technology and thinking. That's when the industry should take over, working and integrating in a crucial partnership with academia, IOCs/NOCs and the service sector.

TECHNOLOGY OPTIMIZATION & COLLABORATION

“Our own R&D has been extensively influential across the world and our encouragement for start-ups and feeder companies that benefit our industry is essential.”



Technologies that increase Oil Recovery are obviously one of our main priorities at ADNOC. If you look at IOR/EOR technologies that are primed for development, we see that we will be addressing issues involving chemical engineering, nanotechnology, material sciences, sensors, automation and robotics. And these are exactly the type of spheres of expertise where we can learn so much from other industries, perhaps even from areas that we would not normally recognize any common ground. What is the most significant contribution that international energy companies partnering with ADNOC can make to help put the UAE in the world top-10 for R&D? Simply, it is to locate and/or help develop mission critical research labs in Abu Dhabi that support their global operations; also to incubate, mentor and partner with young, local innovation entrepreneurs.

We have already started seeing these kinds of startups, at least in the defense industry in Abu Dhabi. I think the next wave will be an automatic spread of startups in the oil and gas industry, providing services, new tools and new technologies.

I don't see any difficulty in funding, if they propose sound projects, and we are already seeing ideas turn into reality. As this movement gathers momentum, it will propagate across other industries. It's a win win situation. ■



Dr. Wafik Beydoun,
R&D Division Manager,
ADNOC

How Can IOC's Optimise Initiatives to Add Value to Qatar's Economy?

**By Lorenza Porciello, Head of Legal & Corporate Affairs,
Maersk Oil Qatar**



LOCALIZATION policies such as Qatarization sit at the core of regional governments' economic diversification strategies. Under the Qatar National Vision 2030, the Qatarization objective is to provide 50 percent or more of Qatari citizens with employment in private and public-sector entities. Adding value to the local economy also involves developing local supply chains which helps foster the growth of small and medium-sized enterprises, with a view to these SMEs ultimately also becoming drivers of innovation and technology.

"Maersk Oil is part of one of the world's largest conglomerates, the Maersk Group, which has operations in some 130 countries. In Qatar, our extensive operations within shipping and logistics in addition to oil and gas, means that we can deliver value across many different parts of the value chain. As an example, Maersk Line handles some 35 percent of Qatar's exports and 21 percent of the country's imports, while Maersk's freight forwarding company DAMCO service over 100 companies, across different industries here. Looking forward, mega-projects such as the 2022 World Cup and the new Hamad Port project will open up further trade and partnership opportunities for multi-national companies to share best practice, embed expertise and international standards – all of

which can help deliver long-term in-country value (ICV).

As a responsible operator, what's critical to us is that the value we deliver to the State is sustainable for both our business and for the country. Sustainable growth relies on the successful transfer of knowledge to the local market and close partnerships, like the one we here in Qatar with Qatar Petroleum (QP) - built over decades of working closely together to achieve a common goal - to develop the country's largest and most complex offshore oilfields, delivering the greatest possible value from this important national asset.

In Qatar, where there is a small, native population, supporting knowledge transfer and local capacity building, in the form of Qatarization, is a key component to effectively delivering ICV. Maersk Oil's approach therefore is not simply to employ nationals, but to develop expertise, experience and leadership skills among Qataris, to help develop the leaders and specialists of the future. In the current oil price environment, a focus on greater cost efficiency is ever important, but so too is a continued commitment to developing local talents, in order that they have the skills and the knowledge to carry the business forward and maintain long-term value for the business and country.



A similar approach can be applied when working with local suppliers, where the application of global standards and training can build local knowledge and expertise, improve performance, quality, efficiency and safety, and ultimately support local suppliers in playing a bigger role in their country's growth. This is something we're strongly committed to and in 2014 over 60 percent of our goods and services were sourced locally. And not only can IOC's help support established businesses, but they can also play a role in supporting SME development, by the same transfer of skills and knowledge to the local market.

Fundamentally, knowledge transfer is the key to sustainable growth and prosperity. Therefore effective collaboration between industry, academia and the government is critical to delivering ICV and economic development. It's important, as we have done, to listen to local partners, authorities and committees to better understand their needs and how we can draw upon our own organisational competencies to help support them; a win-win solution.

We're of course fortunate to have the Qatar National Vision 2030 to offer guidance in this regard, as well as strong leadership from His Highness Sheikh Tamim bin Khalid Al-Thani the Emir, and His Highness the Father Emir before him. In alignment with supporting the goals of that vision, Maersk Oil in Qatar has made an active commitment to making a real and positive impact in the areas of

health, education and local capacity building and the environment, in addition to making a major economic contribution through the safe and reliable production of over one third of Qatar's daily oil production.

For example, by building on the strong partnerships that we have with local universities such as Texas A&M Qatar and Qatar University, to reach out and actively encourage students interest and uptake in STEM (Science, Technology, Engineering and Mathematics) education at a young age, we are helping the nation's youth see the fulfilling career path offered by the energy industry. This in turn will help fuel the pipeline of future specialists and technicians in particular, which the future industry needs to succeed. We have also been working closely with university advisory committees to help that analyse and advise on the curriculum to ensure, for example, that mechanical engineering students graduate with the relevant knowledge and skills for what the industry needs not only now, but also in 10 years' time.

As IOCs operating in host countries, delivering in-country value is something we're all responsible for. As international companies with a broad range of global experience, we should focus on going beyond compliance and seek to exceed, rather than simply meet, host governments' expectations, whether via favourable procurement or hiring policies, environmental management or social investment programmes." ■



Lorenza Porciello, Head of Legal & Corporate Affairs, Maersk Oil Qatar



Education Reform Needs a Paradigm Shift to Keep Up With Innovation

By Youssif Saleh, General Manager, Qatar Shell Research & Technology Centre

THE SPEED at which technological innovation has swept through global industries over the past 30 years has moved at an ever increasing rate, and is set to exponentially accelerate over the coming years. This will result in a need for energy companies to recruit employees who are already equipped with the required Information and Communications Technology (ICT) skill sets, talents and approaches needed to solve the technical challenges that are faced in this sector.

The oil and gas industry will always be in need of petroleum, chemical and drilling engineers, but it is the latest and non-traditional skills found for example in data scientists and data analysts professions that didn't exist five years ago - that will be in high demand.

The quality of education at basic, vocational and higher levels will be of fundamental importance to ensuring the talent needed to sustain and accelerate future innovations to be effective in the 21st century workplace.

Education systems and the curricula found in many schools around the globe are similar to those of a generation ago. Many would argue that they haven't evolved with the rest of the world or changed that much over the past 100 years, and the growing need for root reforms is common on a global scale. Qatar was ranked 101st out of 142 countries in the global education rankings listed in the 2014 Global Innovation Index, and 60th in Reading, Science & Math.

Modern education will have to focus on foundations of science, technology, engineering and math (STEM) skills for younger students to prepare them for the highly demanding technological careers.

According to research, students tend to lose interest in science by the time they're eight years old, so schools are under pressure to adapt their teaching methods to stimulate and retain interest amongst students from an early age.

In the future, universities will need to teach their students a mix of both theoretical and

practical skills; such as team work, leadership and managing projects. This is particularly relevant for Qatar, which is transforming into a knowledge-based economy.

One of the main challenges that educators face globally is how to link knowledge to the latest technology. There is still a wide and visible gap between the education delivered and the technology on the market. This is why it's fundamentally important that students are taught the necessary skills needed to be at the top of their field.

A paradigm shift is needed in the teaching methodology from the traditional role of conveying knowledge and content for retention, to one that teaches students how to think strategically and finding practical solutions to potential challenges. Technology must be included at every step of the educational experience to retain the interest of the millennial generation.

The various stakeholders - government, academia and industry sectors - will have to partner together in order to achieve progress on these critical educational issues. What are needed are educational models which bring together industries such as oil and gas, alongside innovative government policies and flexible educational institutions. An example of this could be an early-education curricula directly developed in close collaboration with the energy industry instead of being an afterthought.

The Qatar Shell Research and Technology Centre (QSRTC) continues to work closely with universities and schools to develop Qatari research talent and enhance technical capabilities as part of its support to the Qatar National Vision 2030.

Qatar is investing a lot in the education sector but having better stakeholder alignment would be very beneficial - such as seeing more government investment in national talent and capacity. This will enable the next generation to develop new technologies that will support Qatar's journey towards a knowledge-based society. ■



Youssif Saleh, General Manager, Qatar Shell Research & Technology Centre



DEDICATED TO SUPPORTING THE QATAR NATIONAL VISION 2030

At Qatar Shell we apply our global experience to support the realization of Qatar's National Vision 2030. Together with our valued partner QP we contribute to the Economic pillar by developing Qatar's energy industry. Partnering with other Qatari institutions we also contribute to the Human, Social and Environmental pillars. Both our award-winning Qatarisation and our Corporate Social Responsibility programmes seek to bring measurable social development for the benefit of the state of Qatar.



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Coming in from the cold?

Iran's energy sector gears up for the post-sanctions era

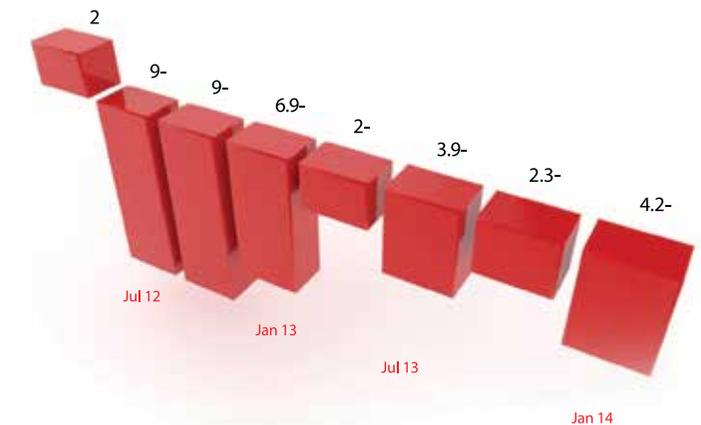


IRAN is positioning itself for the potential lifting of international sanctions, a move that would revive the Islamic republic's ailing energy industry, pave the way for its return as a major oil exporter and provide much-needed stimulus to the domestic economy.

Pending the recent conclusion of an accord on the country's controversial nuclear program between Tehran and the five permanent UN Security Council members Britain, France, Russia, China and the US plus Germany (P5+1), the Islamic Republic may see relations with the rest of the world return to normal as early as this year, a development that would not only reverse the fortunes of its struggling economy at a time when Brent crude prices have more than halved to around \$50 a barrel since mid-2014. It would also open the biggest bonanza for international energy companies since the ouster of Iraqi President Saddam Hussein in 2003.

Iran, holder of the world's fourth-largest proved oil and the second-largest proved natural gas reserves, has been hard hit by UN and international bilateral sanctions imposed on the country in 2006 and 2010 on top of existing US sanctions¹. But it was the latest set of even more stringent measures enacted by the US and the European Union (EU) in late 2011 and 2012 that had the most devastating impact on the local economy.

FIGURE 1 IRAN GDP ANNUAL GROWTH RATE (%)



Source: www.tradingeconomics.com, Central Bank of Iran

**4TH
LARGEST
PROVED OIL**

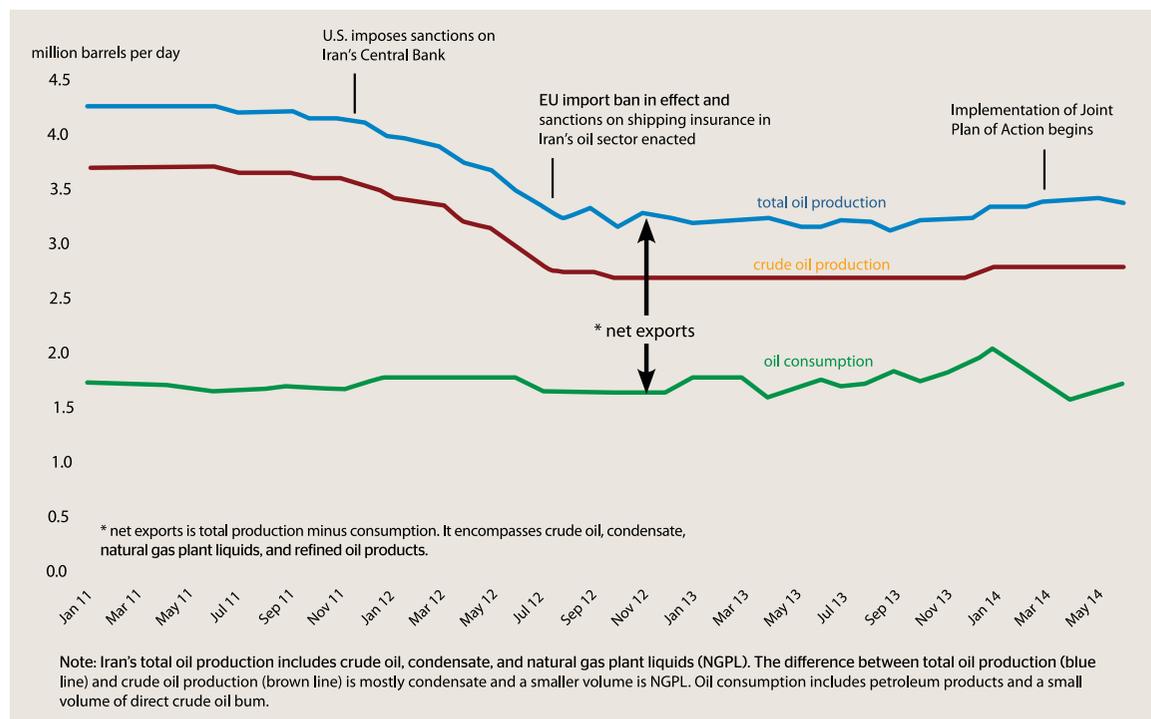


**2ND
LARGEST
NATURAL
GAS RESOURCES**



1. The US has used sanctions against Iran since the 1979 Islamic revolution and increasingly since the mid-1990s with a particular focus on convincing Tehran to limit the scope of its nuclear program.
 2. IMF Country Report No. 14/93: <https://www.imf.org/external/pubs/ft/scr/2014/cr1493.pdf>

FIGURE 2 IRANIAN PETROLEUM AND OTHER LIQUIDS PRODUCTION AND CONSUMPTION, JANUARY 2011 TO JUNE 2014



Source: U.S. Energy Information Administration

ECONOMIC IMPACT

According to the International Monetary Fund's (IMF) latest Article IV Consultation report on Iran published in April, the sanctions have had a contractionary impact on the economy, with real gross domestic product (GDP) half of 2013/14, real GDP was estimated to have declined by about 2.5 percent, compared with the same period in the previous year, the IMF said². Between June 2012 and February 2014, Iran recorded negative GDP growth for seven consecutive quarters³.

"Since early 2012, international trade and financial sanctions brought renewed shockwaves and pushed the economy into a deep contraction. A series of sanctions restricting oil exports, the supply chain of some key sectors (like automobiles), and transactions of international and domestic banks, impaired Iran's ability to conduct international current and capital transactions and brought a sharp decline in income," the IMF said in its Article IV report.

The Islamic republic's energy sector has been among the most severely affected by the various embargoes in recent years. Since first imposed in 2006, UN sanctions have prevented Iran from securing much-needed foreign investment, technology and expertise for its energy sector, stymieing developments especially in upstream oil and gas. A large number of projects has either been cancelled or delayed. As a result, the country has struggled to expand production capacity at its oil and gas fields, and to halt and reverse declines at its mature fields.

Since another round of stringent EU and US sanctions was levied on Tehran in late 2011 and 2012, the country's economic situation has dramatically worsened. Aimed at impeding Iran's ability to sell oil, the sanctions led to a 1 million-barrel a day (b/d) drop in crude and condensate exports in 2012 versus the previous year. Once OPEC's second-largest oil producer, Iran now ranks behind Iraq in terms of oil and liquids production, averaging only about 3.2 million b/d in 2013, compared with about 4.2 million b/d in 2011⁴.

3. See Figure 1
4. See Figure 2



The economic price of falling oil production and exports in particular has been hefty. According to IMF figures, Iran's oil and gas export revenues slumped by 47 percent to \$63 billion in the 2012/13 fiscal year⁵ from \$118 billion a year earlier. The IMF estimates that oil and gas export revenues declined by another 11 percent to \$56 billion in the 2013/14 fiscal year. Without a deal that would allow Iran to ramp up crude exports again to make up at least in part of today's cheap oil prices, fiscal revenues would likely fall as low as \$23.7 billion this financial year, the World Bank said in January.

The crippling effect of the latest round of sanctions, combined with the election of moderate Hassan Rouhani as Iran's president in June 2013, is widely considered to have played an important role in Tehran's decision to agree to the establishment of a Joint Plan of Action (JPA) with the P5+1 in November 2013.

Under the JPA, which came into force in January 2014, Iran agreed to halt expansion of its nuclear program in exchange for limited sanctions relief for a six-month period to seek a comprehensive solution to the Islamic republic's nuclear plans. The original July 2014 deadline was first extended to November 24 and subsequently to June 30 this year, with a view to reach a framework agreement in March – the deal that was just announced.

While sanctions have remained in place during the talks, the JPA has brought some benefits to Iran. While temporary sanctions relief hasn't allowed Tehran to ramp up its oil sales, the country has been able to boost sales from condensates, which under the JPA aren't considered as crude oil. As a result, Iran's oil and condensate exports stood at an average 1.4 million b/d during the January-May 2014 period – above 2013 export figures and thus an additional revenue earner⁶.

"The sum of crude oil plus condensate sales to Iran's six big customers has been running about 350,000 b/d higher during the first six months of last year than the same sum was during the last six months of 2013. That's worth more than \$13 billion a year to Iran," Washington, D.C.-based consulting firm Foreign Reports said in a report published in July.

With hopes high that the sanctions on Iran are indeed going to be lifted, the country's (re-)appointed minister, long-time technocrat Bijan Namdar Zanganeh⁷, has moved swiftly to unveil a new oil contract model that will replace the unpopular buyback schemes. Aimed at drawing more foreign companies to invest in and develop Iranian hydrocarbon reservoirs, the new, so-called Iran Petroleum Contract (IPC) is still being finalized but indications are that it will be a major improvement on the old buyback model. ■

5. Iran's fiscal year ends March 20
6. See Figure 2
7. Zanganeh was appointed petroleum minister by President Hassan Rouhani in 2013. He previously served in this position from 1997 until 2005.



Qatar. Adding genius to the equation.

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