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For our 2016 WPC Yearbook we have selected the theme ‘Leading through Change’ and focused on how the industry adapts during the challenges presented by fluctuating oil and gas prices.

The recent 15th Ministerial Meeting of the International Energy Forum (IEF) in Algiers provided a review of the oil market outlook and the stability challenge, and the WPC contributed to these key discussions where energy transition post COP21 was the main focus.

We also continue to support and encourage the young members of our industry, and we recently enjoyed the 5th edition of our youth event – the “Future Leaders Forum” which was hosted in Rio by our Brazilian National Committee and IBP, and provided the largest gathering of young professionals in the petroleum industry. This edition was developed under the heading of  “Game changers: New leaders for a new competitive energy industry” and offered discussions on topics such as industry sustainability and climate change, energy poverty, business leadership, and technology and innovation.

With less than a year to go, the Turkish Organising Committee are very focused on the planning and development of our 22nd World Petroleum Congress, which will take place in Istanbul in July 2017. The technical programme is developing very well as we consider submissions from industry experts who will join us as leading speakers. The selection of the final group is a difficult task for our session chairmen, with the calibre and quantity of entries so high.

We are also entering an exciting time as we consider where the 23rd World Petroleum Congress will be held. During the Annual Council meeting in Bahrain in December 2016, our members will vote between two excellent candidates – the US and Canada. This meeting also provides our 70 member committees the opportunity to meet old friends and network.

Supporting our services to the industry as well as these important events, the WPC also provides industry updates on selected topics through our educational series of industry guides. For 2016 we have expanded these with a very interesting and very well received guide on ‘Biofuels’ which was launched officially in Rio – the ideal location given Brazil’s huge input into this alternative energy resource. Additionally, our new Careers in Oil & Gas guide enables us to encourage young people to join our diverse industry by providing them with insights into the oil and gas sector and the career paths it can offer across so many disciplines, and this will be launched in 2017.

The annual WPC Publications also focus on the key technical, social, environmental and management challenges impacting global energy issues, which are complemented by Youth Magazines presenting the perspective of young professionals from the industry.

The WPC will continue to provide a key service to its members and industry by bringing together all stakeholders and sharing perspectives on leadership, diversity, technical innovation, responsible operations, global cooperation and sustainability, and we look forward to involving old and new friends in all these discussions.
Over the past few years, global energy markets have entered a period of significant and far-reaching change. The world’s energy landscape has been fundamentally transformed by new technologies. Because of expanding supplies and increased efficiencies, we have entered a new era of global energy abundance. This new era has brought tremendous benefits to the world, but, for the energy sector, it is also introducing new challenges.

In 2014, at the last World Petroleum Congress, our industry discussions took place within the context of several years of a sustained uptrend in energy markets. Yet today the energy sector and many governments are grappling with a wholly different set of questions: How to navigate the current market downturn.

It is clear that new market realities are continuing to put pressure on companies around the world. In response, these realities will demand a re-doubling of our focus on fundamentals: We must control costs, exercise capital discipline, create our own margins, and execute projects with new efficiencies and innovations. In addition to these new market challenges, the industry is facing a host of policy changes around the world, as many nations seek ways to meet environmental goals through increased regulation.

But even in the midst of this far-reaching change and these new challenges, there are some constants to guide us. In fact, several key factors that have long shaped our industry will continue to be critical: The growing demand for energy worldwide; the importance of innovation to meet our shared aspirations for energy and the environment; and the need for sound policies to enable the investment and international cooperation that lead to success.

The long-term challenge

The challenges we face will be similar to those a century ago or even two years ago: We must meet the world’s growing energy needs in a safe and responsible way – especially as those energy demands are projected to grow significantly in the decades ahead.

ExxonMobil’s latest Outlook for Energy projects a 25 per cent increase in global energy demand by 2040, even with substantial gains in energy efficiency. This is equivalent to adding the current energy use of North America and Latin America combined.

Leaders in government and industry must recognize that this massive and growing energy demand reflects, and enables, progress. It means nations are poised for economic growth, and billions of people in the developing world may soon enter the middle class – gaining access to improved transportation, modern healthcare, better education, and greater opportunities.

To expand the supplies of energy needed for this economic growth and human advancement, the world must pursue all sources of energy – wherever and whenever they are economically competitive.

The world will need wind, solar, and nuclear power. But credible analysts and researchers agree that, in the decades ahead, oil, natural gas, and coal will continue to provide the vast majority of the world’s energy due to their flexibility, availability, and affordability.

For this reason, billions of people around the world will depend on the oil and natural gas industry’s ability to expand supplies. But this is just one part of the industry’s dual-natured challenge. The second critical part of our long-term energy challenge is to reduce the emissions associated with energy use. In this way, we can help mitigate the risks of climate change.

Expanding supplies while reducing emissions will require extraordinary investment and innovation. It will require the industry to look beyond the current state of markets to anticipate the energy and environmental needs of 10, 20, or 30 years down the road. We will need long-term planning and discipline.

But for those companies that plan for the long term and continue to invest throughout the cycle, there will be great opportunities ahead.

The importance of innovation

Technology has shaped our industry’s past and present, and it will certainly transform our future.

This new era of energy abundance is the direct result of industry innovations that have opened up energy resources from offshore deepwater, made it possible to develop oil sands safely and responsibly, and unlocked vast new supplies of oil and natural gas from shale rock.

Expanding supplies of energy have led to a realignment of global energy supply and demand, which is reflected in recent price declines. But just as technology has led to expanding supplies, it will also be the key to success in the current market downturn. Innovation can help us
to find new efficiencies, lower costs, and maximise resource values.

For example, the US shale industry has demonstrated remarkable resilience throughout the market downturn thanks to continued technological advances such as enhanced completion techniques. These advances, which have both decreased costs and improved well production, have increased the amount of tight oil that can be developed at a given investment level by 70 per cent over the past three years. Technology will also remain instrumental in our industry’s overall mission to find integrated solutions – solutions that expand supplies while simultaneously reducing emissions.

The shale revolution has proven that innovation can help us achieve both our economic and environmental goals. The influx of affordable and cleaner-burning natural gas into the energy mix has helped reduce US carbon dioxide emissions to levels not seen since the mid-1990s. Remarkably, these reductions have come even as the US economy has grown about 60 per cent and added 50 million more energy consumers.

By expanding global access to natural gas and employing clean-energy technologies like cogeneration and other efficiency techniques, we can continue to meet increasing energy demands and do so with a lower carbon footprint.

In addition to deploying proven technologies, we must invest in promising next-generation solutions that could help change the course of our energy future. At ExxonMobil, we are researching the possibility of producing advanced biofuels from algae and pursuing ways to make carbon capture more affordable and scalable in hopes of achieving the next breakthrough.

The need for sound policies

In order to successfully address the market challenges we face today, as well as to meet the needs of tomorrow, the world will continue to need sound and stable policies.

We must put in place policies that enable the long-term planning, cooperation, and investment necessary to spur innovation and technological advancement. Free trade and free markets will remain vital to the development of economic energy supplies and our ability to pursue the most cost-effective approaches to address the risks of climate change.

Throughout history, we have seen the power of free markets to encourage growth, development and mutual benefit. Unfortunately, we have also repeatedly witnessed the adverse consequences that follow when governments attempt to pick winners and losers, tilt or limit the field of competition, and constrain the free flow of goods and services in markets.

Sound policies have never been more important to the future. Economic growth around the world remains anemic. Policymakers must put in place policies that lead to investment, opportunity, and hope. Economies around the world need regulatory reform that enables investment and innovation, and spurs the competitive dynamism that produces robust growth. The success of the energy industry, and every sector of the global economy, depends on sound government leadership.

Our industry has proven that we can expand supplies in increasingly safe and environmentally responsible ways, and our investments and innovations have led to extraordinary successes and a better life for billions of people.

With continued resolve and the right policies, we can build on this progress and create an even brighter future.
The energy landscape has changed dramatically since the last World Petroleum Congress of 2014 in Moscow. Oil prices have lost more than half of their value; international gas prices have slumped; upstream investment in oil and gas projects has shrunk; climate change has moved higher up the global agenda and renewable energy deployment has accelerated substantially.

The 22nd World Petroleum Congress, to be held in Istanbul, Turkey, in July 2017, will provide energy policy makers and industry leaders with an opportunity to reflect on these major changes, and try to look beyond the short-term fog of uncertainty to chart a course toward a more stable and balanced future oil market, and discuss the challenges for the industry. The IEA has always maintained a close collaboration with the petroleum industry, and the WPC provides an excellent forum for discussion and reflection on developments in the energy market and their significance.

Upstream capex cuts reshape the geography of the oil markets

When the WPC last met in 2014, oil had been trading at an average price of over US$100 per barrel (bbl) for three years. By early 2016, oil prices had fallen below US$30/bbl, their lowest level since 2003, as increased supply from members of the Organisation of Petroleum Exporting Countries (OPEC), resilient production of light tight oil in North America and sustained output in Russia, Brazil, the North Sea and elsewhere weighed heavily on the market.

The response of the oil and gas industry to the price collapse has been dramatic. According to the IEA’s World Energy Investment 2016 report, investment in the oil and gas sector fell by 25 per cent in 2015 and is set to drop a further 24 per cent in 2016, a reduction of more than US$300 billion. This is an unprecedented decline, even when accounting for the fact that the plunge in oil prices triggered massive cost deflation in the upstream oil and gas sector in 2015 and 2016. Prices for services and equipment in the oil and gas sector fell by about 30 per cent in just two years, following on the heels of a doubling in costs over a much longer time period between 2000 and 2014.

The oil and gas industry has proved itself to be highly responsive and dynamic in its reaction to abrupt changes in market conditions. This stands in sharp contrast to a common perception of the sector as “rigid” or “conservative”. Capital and operating costs have been dramatically reduced, not only as a result of squeezed margins for contractors and service companies, but also due to significant operational and technological efficiencies. The IEA estimates that around two-thirds of the headline reduction in upstream spending seen in 2015 and 2016 was due to lower costs, with reduced activity levels accounting for the remainder.

Of course, the oil and gas industry is cyclical in nature and inflationary pressures may be on the horizon. But in the absence of a significant increase in oil prices in the short term, the effects of cost deflation and efficiency improvements will likely keep overall investments depressed in 2017. If investment in upstream oil and gas even declines slightly in 2017, it would mark the first time in history that we have seen declines in upstream spending for three consecutive years.

The scale of the spending cuts is large enough to have already had a measurable impact. New oil discoveries in 2015 were at their lowest level for 60 years. At 6.5 billion bbl, the total resources allocated to fields that were given development approval in 2015 were the lowest ever in a single year since before the 1960s. Preliminary estimates for 2016 indicate a continuation of this trend. Unless activity picks up quickly, medium-term oil output will be affected.

The transformation of oil market conditions sets the stage for a new “drama”. In the past few years, oil supply growth has largely been dominated by once-declining producers such as the US, thanks to the rise of light tight oil. Now, low-cost regions are again in the driving seat of global oil production, mainly as a result of resilient activity levels in the Middle East and Russia. Over the past year, while global oil supply has been nearly flat,
Middle East oil production has expanded by more than 1.5 million barrels a day (mb/d) to a new historical record of 32 mb/d. At 35 per cent of global production, the Middle East’s share is at a level not seen since the 1970s. At the same time, Russia has expanded its oil production despite international sanctions and is close to its highest levels in the post-Soviet period. Together, the Middle East and Russia represent almost half of the world’s oil supply, while oil output in North America has declined by more than 0.9 mb/d as upstream investment has more than halved in just two years.

Alongside a changing geography of production, investments by key players in the market have also rebalanced. Sustained investment activities in the Middle East and Russia have raised the share of investment by National Oil Companies (NOCs) to an all-time high of 44 per cent of global upstream investment. Investment by the International Oil Companies (IOCs) declined by about US$60 billion, as spending in the offshore sector – an area where international companies lead in terms of technological capacity and production – was hit the hardest.

Another twist in the storyline comes from the demand side. The geography of global oil consumption is changing rapidly as trade shifts from West to East. Between 2010 and 2015, oil consumption in IEA countries, once the engine of global oil demand growth, declined by more than 0.5 mb/d while OPEC members increased their consumption by 1.3 mb/d. According to the IEA World Energy Outlook 2015, the centre of gravity of global oil demand is set to continue shifting eastwards. India, China and Middle East could account for all of the net increase in global oil demand over the next two decades.

The result of resilient oil supply in the face of low prices and lower demand growth has been a massive buildup of crude and oil product inventories and a lower-for-longer outlook for oil prices in the near term. However, this should not be cause for complacency about oil market security. Lower oil prices bring benefits to consumers today but shrinking investments can lead to supply shortfalls and future price spikes. A balance needs to be struck that ensures continued investment in upstream oil and gas projects in order to satisfy the expanding levels of demand seen in our scenario. Let’s not forget that around 80 per cent of global upstream annual investment is needed just to keep output at current levels, by compensating for declining production from mature fields.

Two years of turbulence in the oil and gas sector have led to multiple changes. The bottom line is that while the challenges facing the industry have not diminished, the resulting restructuring heralds opportunities for resilient players. Climate change is now an established feature of the policy landscape and the pressure for responsible resource development will only increase. Oil’s dominance in the transport sector in the medium term may be undisputed, but the timeframes in this business demand a longer-term outlook. A constructive dialogue about future scenarios for both supply and demand is as important as it has ever been.

Turkey, host of the forthcoming WPC gathering, plays an important role as a transit route for oil and gas from the Middle East and Central Asia and as a link between East and West. As such I believe it is therefore a very appropriate venue for the WPC theme “Bridges to our Energy Future.”
The past two years or so have seen the global oil market go through a significant period of readjustment. Crude oil prices have fallen significantly, many investments have been deferred and some cancelled, manpower has been laid off, supply has been greater than demand, stocks have risen above their five-year average, and the market has been searching for balance.

This year the market has showed some signs that supply and demand are on course to align, although inventories remain a significant concern. Since the end of 2013, the five-year average for OECD commercial stocks has risen from a negative level of 85 million barrels to a surplus of around 340 million barrels towards the end of the third quarter 2016. There is no doubt that this development has strongly impacted crude prices, and continues to impact them today. Moreover, for the same period there has also been a rise in non-OECD inventories, plus an expansion in some non-OECD strategic petroleum reserves.

It is vital the issue of the stock overhang is addressed to restore balance to the market. In order to accelerate the ongoing drawdown of the stock overhang and bring the rebalancing forward, the OPEC Conference decided on September 28, 2016, at an Extraordinary Meeting held in Algiers, to opt for a new OPEC-14 production target. OPEC is committed to evolving a ‘sustainable stability’ to the market.

It should be stressed, however, that given that non-OPEC supply increased by over 5 million barrels a day (mb/d) between 2013 and 2015, compared to OPEC keeping supply fairly stable over this period, it should be viewed as something that all major producers look to tackle together. We have heard encouraging statements and have had consultations with some non-OPEC producers, such as the Russian Federation.

There is no doubt that the industry will recover; this has been another cycle, albeit an extremely challenging one, in the industry’s history. It has bounced back from others, and it will emerge revitalised from this one.

Of course, it is essential to maintain focus on the near-term, but it is also crucial to recognise how this cycle could affect the medium- and long-term outlook, and understand the potential impact of other challenges facing the industry.

In this regard, two key issues will be underscored in this article: investments, and climate change.

Investment requirements
In the current depressed price environment, a major medium- and longer-term issue relates to investment. In looking ahead, it is clear the world desires more oil, and this means more investment. OPEC sees oil demand increasing by 16.4 mb/d between 2015 and 2040 to reach 109.4 mb/d, with non-OECD countries leading the way.

This demand growth is driven by developing countries, as they continue to industrialise, develop their infrastructure, and as billions look to have access to modern energy services for the first time. In terms of oil-related investment requirements, these are estimated to be around US$10 trillion over the period to 2040. These are huge investments that need to be made.

However, the present situation is putting this future at risk. We are currently witnessing a dramatic drop-off in oil industry investments. For example, global exploration and production spending fell by around 26 per cent in 2015, and a further 22 per cent drop is anticipated this year. Combined, this equates to above US$300 billion.

It is vital to keep in mind the link between the marginal cost, the price and investments. It leads to the question: Are current prices at a level that will see all the necessary future investments take place? We also need to keep in mind that new barrels are needed not only to increase production, but to accommodate for decline rates from existing fields.

The upshot is that if the necessary new capacity does not come online in the coming years, the market could move from one of too much supply, to one of not enough. It is important to remember that the previous high oil-price cycle was the outcome of a lack of investment in more supply. And the low oil-price environment of today is the result of too much investment in high-cost production during that period.

Sustainable development
Alongside the requirement for more oil in the decades ahead, there is also the need for more from all energy sources. Energy demand is set to increase by close to 40 per cent between 2015 and 2040, as the global population expands and economies grow, and as billions seek access to modern energy services.

At the same time, however, alongside these economic and social challenges, it is vital to place environmental challenges, specifically climate change and the need to reduce emissions.

For the global energy industry, the basic challenge is twofold: To supply enough energy to meet demand and help provide access to modern energy services for all. And to
ensure that this is done in a sustainable way, which balances the needs of people in relation to their social welfare, the economy and the environment.

In OPEC’s outlook, oil and gas are anticipated to continue to supply more than 50 per cent of the global energy demand by 2040. Of course, this is only one outlook. Other forecasts will no doubt be different. But it is important to recognise that there has not been any major outlook predicting that non-fossil fuels will overtake oil and gas in the decades ahead.

The energy mix cannot be changed overnight. This will take many decades. Yes, we need to continue to push the development of renewables, and many of OPEC’s member countries are making great strides in this regard. However, we also need to appreciate that oil and gas will continue to be a major part of the future.

For oil, the products derived from this precious natural resource are fundamental to our daily lives. It is not just about transportation, but a whole host of everyday products.

Of course, there are environmental issues regarding the emissions that come from fossil fuels. But given their continued importance to individuals, business and the global economy, we should look at ways and means to overcome this challenge.

OPEC welcomes the COP21 Paris agreement, and in this regard, believes that we need to look to human ingenuity to not only advance energy efficiency and help deliver renewables and the technologies that allow them to develop at a greater scale, but also to find solutions in technologies for fossil fuels that reduce and ultimately eliminate emissions.

Our global energy future and the challenges the industry faces need to be viewed over all time horizons; the short-, medium- and long-term are all interlinked. What is clear is that over all timeframes we will need more energy and a stable platform for the necessary investments to take place. It means looking at all the various energy options available, appreciating just what each of them can provide to a growing global population in the coming decades, and taking into account a variety of inter-related issues concerning social welfare, economics and the environment.

We need to be realistic about our energy future. And ensure that all the possible energy options and technologies are explored, developed and utilised. Of course, none of us can plot the exact path of our energy future, but the shared objective must be a stable and sustainable energy future for all.
The economic benefits of an energy dividend

By John Watson
Chairman and CEO, Chevron Corporation

For more than 150 years, society has developed and grown in step with the availability of affordable oil and natural gas. Every modern convenience that we know – light, heat, digital communication, transportation, mechanised agriculture – each is enabled by this safe and abundant source of energy. With more than 2 billion people forecast to join the ranks of our global population over the next 35 years, the demand for oil and natural gas will only continue to rise. In fact, the International Energy Agency predicts total energy demand to grow more than 30 per cent over the next 25 years. At the forefront of this predicted energy consumption is oil and natural gas – a trend driven largely by more people around the globe aspiring and ascending to a more prosperous existence.

However the narrative of 21st century prosperity, fueled by affordable and reliable energy, is still out of reach for billions of people. In developing nations worldwide, citizens lack access to safe and abundant energy supplies. Despite the breadth of today’s energy market, more than a billion people still live without electricity. Even more people are forced to burn elementary sources of biomass, including wood, crop residue and animal waste, in order to heat their homes and cook their meals. Sadly, this process takes a deadly toll on millions. The World Health Organization estimates more than 4 million people die each year from illness attributed to household air pollution caused by cooking with solid fuels.

Nations rich with natural resources have an opportunity to stem the tide of energy poverty and introduce a healthier and more prosperous existence to people in need. By developing domestic resources, nations can lead by example as they help to advance economies and meet projected energy demand. Importantly, responsible energy development also creates an energy dividend that aids local businesses, consumers and governments. The US, for example, has greatly benefited over the past decade from a strong energy dividend spurred by domestic development.

Dramatic breakthroughs in energy production – enabled primarily by the combination of hydraulic fracturing and horizontal drilling – have charted a new course for America’s long-term energy outlook and ushered in a profound shift for our nation. Tapping into resources once considered unrecoverable, such as tight sand and shale rock, domestic natural gas production has grown nearly 50 per cent over the past decade. The nation has witnessed even greater growth in the production of domestic crude oil over that same time frame, with output up more than 80 per cent to an estimated nine million barrels per day. Today, the US is once again viewed as a global leader in energy production.

With a steady and affordable supply of energy on-hand, US manufacturing has increased while American households have benefitted from lower energy prices. The US Energy Information Administration found that household energy costs declined 14 per cent between 2008 and 2014. During this period, household expenditures also decreased by 17 per cent for gasoline, 25 per cent for natural gas and 28 per cent for fuel oil. Meanwhile, America’s strong manufacturing growth – buoyed by the availability of shale gas – is projected to continue through at least 2025, which in turn helps to support US competitiveness and drive GDP growth.

Despite the cutbacks and tough decisions associated with a low-price energy environment, present and future demand remains strong for our products. As such, our industry must continue to balance short-term cost management with expected growth in energy demand over a longer-term horizon. Seizing this opportunity requires an honest and ongoing conversation about the role of energy in society, and a strong, common sense policy framework that encourages innovation, access and open global markets, while balancing environmental and climate goals.

The consistent theme of innovation

Innovation is a consistent theme in the progression of the US and global energy story. From the intrepid wildcatters of the late 1800s to the vast complexities of modern day exploration, energy production continues to advance thanks in large part to innovative technology. At Chevron we consider innovation to be a competitive differentiator. Our highly skilled employees develop and deploy some of the world’s most sophisticated technologies, enabling safe, efficient oil and natural gas production across tough geographies. Our technological prowess is further enhanced through partnership and collaboration. We work with universities, government labs and other companies to pioneer new solutions that improve outcomes and address environmental concerns. As the American energy landscape continues to evolve, innovation will be the catalyst pushing it forward.

Sound policies fostering research and technology provide a helpful blueprint for more effective energy production – and eventually, an even stronger energy dividend. Through
innovative thinking and advanced twenty-first century technologies, our industry can access and produce natural resources in a safe, environmentally secure manner. With abundant oil and natural gas in and around the US, safely increasing industry access will benefit our nation and many others.

Current estimates suggest that US federal lands hold enough recoverable natural gas to heat more than 60 million households for the next three centuries, and enough oil to power nearly 94 million cars over the next 50 years. Increased development of our natural resources will generate more jobs, more revenue and even more opportunity for millions of people. In 2015 alone, Chevron spent more than US$15 billion with American suppliers, including US$2 billion with small businesses and nearly US$800 million with women- and minority-owned businesses. Globally our spend totaled US$54 billion on goods and services, helping to stoke healthy economies worldwide. A regulatory framework encouraging access, along with investment and development in oil and natural gas, will strengthen this outlook even further.

Finally, the energy industry’s long-term interests are best served by policies that allow for oil and natural gas to be domestically produced, consumed, and imported or exported in response to free trade principles and market conditions. Open markets and the free flow of energy help to foster economic growth and global stability.

Our industry has rewritten the American energy future by moving from scarcity to abundance. Pivoting toward that opportunity has helped to create an economic dividend that bolsters consumer pocketbooks, lowers household energy costs, increases manufacturing output and promotes improved living standards worldwide. While not all resource-rich nations have the same geology as North America, we all share the same opportunity – harnessing domestic development to make life better for people at home and around the globe. And based on predicted demand trends, it is an energy opportunity that will only
The successful conclusion of the 15th International Energy Forum Ministerial Meeting on 26-28 September in Algiers has greatly enhanced the global energy dialogue. A historic breakthrough was achieved. On the 25th anniversary of the IEF energy dialogue, relations between hydrocarbon producing and consuming countries still provide the backbone of global energy security and will underpin market stability well into the 21st century. An enhanced producer-consumer dialogue is essential to reduce growing uncertainties and accelerate investment in secure and healthy energy markets, given the many challenges that importing and exporting countries face.

Following a period of significant decline in energy prices and subsequent investment shortfalls which have increased market turbulence and uncertainties in short and medium term energy outlooks, the over-arching theme chosen for the IEF15 Ministerial was “Global Energy Transition: An enhanced role for the dialogue”. The energy transition theme was chosen to act as a catalyst to help enable an orderly transition that works for all IEF stakeholders in recognition of the successful conclusion of the “UN Sustainable Development Agenda to 2030” and the “Paris Agreement” that look set to influence longer-term energy market developments.

What is new, what is left unchanged?

New oil market developments continue to surprise, while change unfolds. Unconventional production has rekindled illusions of energy independence and shifts in demand and supply within producer and consumer countries give the impression that differences in interests have eased and are somehow less pronounced today. In the big picture, however, the geography of world energy markets remains the same. A closer look shows that these new developments will not significantly alter the uneven distribution of resources and variations in costs of production, or differences in demand and supply growth potential across the world. The fall in oil prices, slowing exploration and upstream investment, as well as the rapid deployment of new technologies to accelerate energy transition will affect producing and consuming countries differently over time. Accordingly, the producer-consumer dialogue has only sharpened focus on what are in fact tightening co-dependencies between energy investment and trade flows within a much more competitive and dynamic energy market environment.

Sharing agendas to broaden engagement

The IEF provides a key platform for energy decision makers to respond more reliably to the diverse economic, demographic and sustainability requirements of the world, as the attendance of more than a hundred official delegations at the 15th IEF Ministerial shows. They have made the conversation more vibrant and engaged as energy market risks and opportunities have become increasingly multifaceted over the past two and a half decades. To reduce uncertainty and accelerate investment in orderly energy transitions, the dialogue stands better prepared than ever to strengthen global energy governance and contribute to healthy and reliable energy market functioning in closer alliance with new stakeholders and in support of global goals of energy transition.

Building on our trilateral work programme with the IEA and OPEC

Resources are plentiful but uncertainties are huge, stemming from diverse economic growth forecasts and the need to meet environmental and climate change goals. This has resulted in more diverse and tentative longer term energy market outlooks that show considerable variation. Projections of energy demand by 2040 vary by well over 30 million barrels a day, depending on assumptions. The recent IEA world energy outlook shows non-OPEC supplies vary across scenarios, while OPEC assessments show that non-OPEC supply will not exceed 60 million barrels a day, leaving it to OPEC producers to balance the market.

The IEF has made considerable progress in enhancing market transparency through dialogue in the context of the IEA-IEF-OPEC work programme agreed at the IEF12 Ministerial Meeting hosted by the government of Mexico in Cancún on 29-31 March 2010. IEF Ministers also acknowledged the renewed encouragement from the G20 Energy Ministers Meetings in Istanbul, Turkey on 2 October 2015 and in Beijing, China on 29-30 June 2016, to continue this fruitful collaboration to further improve market transparency through the Joint Organisations Data Initiative (JODI) and deepen collective understanding of energy outlooks, and the interaction between physical and financial markets.
Amidst the present day resurgence in oil market volatility, and these longer term uncertainties that also raise questions about who maintains spare capacity or provides swing supply, delegates observed that the stability challenge remains. Recognising that oil markets will rebalance in time, they noted that volatility is likely to remain elevated as markets test new thresholds. The significant decline in exporting countries’ revenues, the sharp contraction of upstream investment and the extended layoffs in the oil industry that pose structural challenges for both consuming and producing countries can become more manifest as current supplies take time to clear. Overall volatility appears less pronounced than in previous episodes, in part due to greater transparency and improved understanding of physical and financial energy market interactions through stakeholder dialogue.

By building on the success of the well-established trilateral work programme with the IEA and OPEC, and fostering partnerships with other relevant organisations and regions, the IEF will continue to play a central role in helping to reduce uncertainties and accelerate investment in support of global goals. In this respect it is worthwhile to mention that IEF ministers agreed to enhance dialogue on more efficient use of energy through implementation of new energy technologies, and to share more widely experiences and know-how in building healthier and more sustainable energy markets in future.

Dr Pierce Riemer, Director General of the WPC, with Dr Sun Xiansheng at the September 2016 Ministerial meeting of the IEF in Algiers
While the world economy runs on oil, the oil industry runs on capital which has become more difficult to source during the current industry downturn. The oil and gas sector has experienced one of the most precipitous declines in oil prices from US$100 per barrel in 2014 to as low as US$27 per barrel in 2016. The escalation of oil prices from 2009-2014 and the massive investment in the sector has resulted in a supply bubble that has forced the industry to recalibrate the fundamentals. We have seen a slow but deliberate recovery over the past few months putting the current price in the very approximate range of US$40-50 per barrel. However, is this a sustainable recovery?

First, we need to examine the question of how did we get to this point? Since the financial crisis of 2008, central banks around the globe have increased the supply of money, artificially kept interest rates at historically low levels, and devalued currencies. This surge in financial liquidity along with new discoveries like US shale, cutting edge technological advancements that allowed us to extract previously inaccessible reserves and insatiable demand for oil in the emerging markets fuelled the dramatic growth in production and the rise in oil prices in excess of US$100 per barrel. It also led to investments in the energy sector which were neither accretive nor economically sustainable along with an out of control cost base. Producers of every size globally had access to capital from banks, the capital markets, and private equity. This easy access to capital resulted in a significant expansion in the supply of oil which eventually out-paced the global demand.

As after all great boom periods, the fall is usually swift and dramatic. By the end of 2014, the oil and gas industry, despite high prices, had sowed the seeds of the largest cyclical downturn since the mid-1980s. In October 2014 OPEC, led by Saudi Arabia, refused to cut production to bolster falling prices sending a clear signal to the market. At the same time, demand in the emerging markets and China began to stagnate, accentuating the price drop. The industry reaction has been swift and painful. Producers were forced to cut capital expenditures, sell marginal assets, reduce staffing and restrict dividends to preserve cash flow. Since the end of 2014, the industry has reduced capital expenditure plans by US$370 billion through 2017, and US$620 billion through 2020. It is estimated that the industry will spend US$1 trillion less on finding and developing reserves between 2015-20, stoking fears about potentially tight supplies in the coming years.

There has been a glimmer of hope as oil prices have moved upward in the last few months. High yield volumes for the sector have increased over the past three months, easily exceeding the preceding 12 month period. This is a clear signal that investors are cautiously beginning to flow back to the sector.

The most encouraging market, and one that has virtually saved many players in the industry, has been the equity market. The equity market, especially in the US, has been more accessible to a diverse number of battered oil and gas companies. In 2016, oil and gas companies have issued US$9.2 billion in stock offerings, the largest volume since 1999 for the sector. Issuers have included a wide variety of companies from Marathon Oil Corp to Weatherford International PLC. The equity market

By Peter Gaw
Global Head, Oil and Gas Industries, Standard Chartered Bank

Glimmer of hope

The high-yield and investment-grade debt market which had been the primary liquidity source for the industry from 2009-14 virtually shut down for 2015 and the first quarter of 2016. Investors and funds experienced a significant erosion in value as bond quality deteriorated. US E&P companies issued a paltry US$280 million in bonds during the first quarter 2016, the lowest level in more than a decade. There has been a glimmer of hope as oil prices have moved upward in the last few months. High yield volumes for the sector have increased over the past three months, easily exceeding the preceding 12 month period. This is a clear signal that investors are cautiously beginning to flow back to the sector.

The most encouraging market, and one that has virtually saved many players in the industry, has been the equity market. The equity market, especially in the US, has been more accessible to a diverse number of battered oil and gas companies. In 2016, oil and gas companies have issued US$9.2 billion in stock offerings, the single largest volume since 1999 for the sector. Issuers have included a wide variety of companies from Marathon Oil Corp to Weatherford International PLC. The equity market

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has been the primary liquidity source to fund the much reduced capital expenditure programmes in the sector. It also is a clear indication that investors have bought into the recovery story. The industry always says that the cure to low prices is low prices. The industry has responded and adjusted to the new realities of the cycle. Over the past few months, we have witnessed a slow but deliberate rise in prices towards the US$50 per barrel level. More importantly, it appears that industry has re-established the equilibrium between supply and demand which should continue the positive recovery.

Nevertheless, the question remains of how quickly the debt markets will return to support the continued recovery. The financial community has historically short memories and tends to repeat the same boom and bust mistakes from one cycle to the next. However, I am expecting greater discipline amongst the banks and bond investors due to the depth of the downturn and financial losses realised over the past 2 years. The regulators have clearly highlighted the commodity sector from a risk perspective, and this will continue to challenge banks in growing exposure in the near term. Banks and bond investors will focus on high-quality players with a diverse portfolio of assets and a conservative balance sheet. The marginal players in the industry will continue to struggle to find new capital.

As a result, the industry will continue to run a cash deficit as prices recover. In order to maintain the momentum of the recovery, the industry will need to complete its divestment programmes in order to de-leverage and close the gap on cash flow deficits. Currently, there are over US$200 billion in global oil and gas assets identified for divestment. The two biggest challenges on divestments are closing the gap between the bid and offer spreads, and identifying new buyers. The current price recovery should assist in closing the price gap between buyers and sellers. However, finding new buyers/investors in the market poses a far greater challenge. The Chinese national oil companies who dominated the buyer market for the past five years have clearly backed off further international expansion focusing on internal governance issues. Private equity which maintain a sizeable war chest have focused more on midstream and downstream rather than upstream assets. The rest of the industry is focused on de-leveraging and cash conservation. Inheriting another player’s problematic assets is no longer an exciting proposition. The industry will continue to struggle to complete the growing divestment goals. This will likely hamper the pace of the recovery and reinvestment in the sector.

Never as good, or bad, as it seems

Despite all of these challenges, I remain optimistic that we are entering a more positive phase in the industry. I agree with the adage that it is never as good as it seems and never as bad as it seems. In actuality, the oil and gas sector was not healthy at US$100 per barrel. The industry had become bloated with marginal projects, high costs, excessive leverage and a level of asset concentration that made it extremely vulnerable to a downturn.

It is critical that the industry does not cover up failures in strategy simply by enjoying the benefits of higher prices. The industry must become more introspective on its strategy and asset mix. The upstream sector must establish a more symbiotic relationship with the oil field services sector to control cost while reducing cyclical vulnerability to the service sector. I remain confident that capital will continue to flow at an increasing rate to this vital sector in the world economy. However, banks and financial investors need to be more disciplined in terms of whom they back and the structure of transactions. Private equity will continue to play a key role in supporting and backing new management teams and more innovative strategies. Perhaps we were complacent and forgot that the oil and gas industry is, and always will be, a cyclical sector. As such it requires investors who are experienced, have a longer-term perspective and can withstand the volatility.
Russian oil and gas in the new reality

Dr Tatiana Mitrova,
Energy Research Institute, Russian Academy of Sciences

Russia is one of the key participants of the global oil and gas markets. It is among the largest hydrocarbon resource holders, producers and exporters, with nearly 6 per cent of global proved oil reserves, 13 per cent of world oil production, 12 per cent of the global oil exports and 17 per cent of the global gas reserves, 19 per cent of global gas production and 24 per cent of the global cross-border gas trade. It is a dominant supplier both for Europe and for neighbouring CIS countries, and holds great influence over these regional markets. Nevertheless, despite this extraordinary position, Russia (and previously the Soviet Union) has always been a “price taker”, just accepting the market conjuncture and never trying to influence it. It has always stayed away from OPEC’s attempts to rebalance the oil market, and even in the gas market, where it has potentially huge leverage, it has just followed price movements (driven by oil-indexed prices in the long-term contracts), without any attempts to impose its own agenda.

Therefore with the recent downward turn of the commodity price cycle, Russia had to adapt to the far lower oil and gas prices and export revenues, which was extremely painful for the country’s economy: Hydrocarbons provided more than 50 per cent of the federal budget revenues in 2011-2014 and dropped down to just 34 per cent in 2016. This external shock from the sharp oil price decline was exacerbated by the imposition of international sanctions in response to Russia’s actions in Crimea, which undermine investment and technological capabilities of the Russian oil and gas sector.

The common expectation was that the Russian economy, as well as hydrocarbons output, would collapse, but amazingly for many observers, the oil and gas sector demonstrates an opposite dynamic, recalling the famous words of Winston Churchill that “Russia is a riddle wrapped in a mystery inside an enigma”.

Oil: Magic of cheap ruble and past investments

Recently there have been very strong expectations that Russian oil production has approached its peak as the production rates of the Soviet legacy fields in Western Siberia, where more than 60 per cent of Russian crude is currently produced, are in steep decline. However, in reality, despite low prices, economic crises and sanctions, in 2015 Russian oil companies increased their oil output by 1.4 per cent (Figure 1) and exports by 9 per cent (Figure 2), and in 2016 the growth continues.

The main contribution to the growing oil production was provided by gas condensate and by the new greenfields, where major investments were made in the period of high oil prices prior to 2014. These are reaching their plateau and will not now be stopped in any price scenario. Moreover, Russian production costs went down significantly, due to a nearly 60 per cent ruble devaluation. Since the Russian companies incur most costs in rubles, lower oil prices were offset by the ruble devaluation. Russia’s system of oil taxation has further softened the blow – it was mainly the Russian federal budget which took the heat of the oil price decline: The progressive scale of export duty means that the state is the main beneficiary of high oil prices, and loses a significant part of its revenues at lower oil prices, while oil companies have nearly the same revenues. Tax concessions, adopted in 2013, became another factor which helped to sustain production volumes, as they stimulated oil output growth in the new Eastern Siberian fields.

So, past investments in the new greenfields, ruble devaluation, specific taxation concessions, and also depressed domestic demand for liquids, ensure record high production and export volumes – at least for 2016-2017.

Post 2018-2020, some steep production decline is becoming inevitable, due to accelerating depletion rates in mature fields and delays in the commissioning of new projects resulting from capex constraints and the expected ongoing impact of the sanctions. In this time frame, Russian oil output will be mainly defined by the tax regime and financing availability (which depends on oil prices and financial sanctions) (Figure 3).
Under favourable conditions, it would be realistic to foresee production raised to 560-570 million tonnes per annum. But if oil prices and taxation are less advantageous, production decline would begin in the next few years. With weak macroeconomics, there is a growing likelihood of an oil tax increase, and the sanctions over time will exacerbate the existing problems associated with depleting financial resources. If sanctions stay in place, Russia will also face technological difficulties developing its offshore and unconventional resources or implementing enhanced oil recovery. In the critical scenario of low oil prices, macroeconomic challenges and thus additional taxes, production declines could be even sharper. So, in the long term, the trajectory of Russian oil production is expected to be declining, but the speed of this decline is extremely uncertain.

Gas: Big ambitions and stranded investments
Russia was dynamically raising its gas production in the “golden age” of 1998-2007, but since 2008, production has dropped significantly (Figure 4) and still has not recovered, due to the demand slowdown in the domestic and European markets, and lower supplies to CIS countries. This decline is solely demand-driven: On the supply side, Russia has been investing heavily since 2008 and now possesses huge spare production capacities of 150-170 billion cubic metres per annum (bcma), which are projected to increase up to 250-265 bcma by 2020 as a result of the past investments – similar to the oil sector.

Due to the weak demand, Russia has not restored its pre-crisis export volumes to Europe (162 bcm in 2006 vs 126 bcm in 2014 – Figure 5), though 2016 might be more optimistic, as low oil prices make Russian gas one of the cheapest and most attractive options in the market. At the same time the Ukrainian conflict dramatically reduced CIS sales volumes, while gas exports to Asia are now limited to Sakhalin LNG exports, and the recently signed deal on pipeline gas supplies to China is only a longer-term prospect.
In the longer term, the Russian gas sector undoubtedly has capacity for sustainable production growth — the resource base is huge, and is sufficient to meet domestic and export demand. As Russia has no gas resource constraints, its future gas production will depend solely on the degree of market demand and availability of investments to build the new gas transportation infrastructure. In the high demand scenario, the call on Russian gas results in rather bullish production projections, increasing from 650 bcm in 2010 up to 820 bcm in 2025, though these figures are still much lower than the previous production targets of 870-970 bcm in the General Scheme of gas industry development drafted in 2008-2010.

Summing up, the resilience of Russia’s oil and gas output and recent growth of its hydrocarbon exports came as a big surprise to the market: When the country found itself in painful economic crises and increasing international isolation, expectations were much more pessimistic. Nonetheless, Russia’s vast resource base, low-cost hydrocarbon production and momentum of past investments ensure that the country will remain a major oil and gas exporter in any scenario, and therefore its influence should not be overlooked.
Canada at a crossroads in its future hydrocarbon output

By Dr Jennifer Winter
University of Calgary, Alberta

These are challenging times for oil and gas producers worldwide, and Canada is no exception. The country ranks sixth worldwide in terms of oil production and third in terms of reserves. For natural gas, Canada is third in terms of production and 18th for reserves. Despite these vast endowments, the future of Canadian oil and gas production has become less certain in recent years. Historically, Canada has been a net exporter of both products, primarily to the United States. The shale revolution has resulted in a resurgence in US production, creating a competitor out of a former customer. This has compounded market access constraints.

In the case of oil, there is a sole pipeline to Canada’s West Coast; all others send Canadian product south to the US. The majority of these pipelines are at capacity, resulting in a switch to rail. Current low oil prices have squeezed Canadian producers even further.

In the case of natural gas, Canada lacks export facilities beyond pipelines to the US. A steady decline in exports to the US has prompted a search for other markets. And while there has been substantial interest in building LNG export terminals on both West and East coasts, projects have been slow to move beyond the planning stage. Some projects have even been put on hold due to worsening market conditions. What’s worse, these physical and market challenges are not the end of the story.

Energy is a controversial topic in Canada these days. Support for the continued development of Canada’s hydrocarbon resources is not universal. In particular, energy infrastructure such as pipelines and LNG export facilities have become lightning rods in the discussion around what the future of energy use should look like. As stated above, access to other markets has been stymied by a lack of export infrastructure and challenging market conditions. Given all this, the future of oil and gas development certainly seems bleak. But is it?

Energy use underpins our economy and our society. There is a clear positive correlation between energy use and economic activity. Even the most stringent International Energy Agency scenario – assuming the world meets commitments to keep global warming to no more than two degrees Celsius – projects substantial and continued use of oil, coal and natural gas. There is a continued future for fossil fuels, particularly for natural gas.

The question becomes, then, who will continue to produce hydrocarbons, and will Canada be one of them? Canada has the benefit of stable governments, robust institutions, and in

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**Figure 1: Canadian Natural Gas Production and Exports (2010-2040)**

![Graph showing Canadian Natural Gas Production and Exports (2010-2040)](image)

*Source: National Energy Board reference case from Canada’s Energy Future 2016*
general, stable policies. But Canada is also limited by a lack of current export infrastructure, and in the case of oil, is on the high end of the cost curve. At least one oil sands operator is musing publicly about ‘high-grading’ – optimising output to achieve the highest quality rather than the maximum quantity. Low oil prices have substantially reduced investment in the oil sands. Prices will need to recover to above US$70 per barrel, and look set to stay there for a long time, before the oil sands become an attractive investment again. And even then, when comparing a long-term oil sands project to quicker payoff shale plays, investors may choose a quicker-payoff.

The future of natural gas production is also uncertain. While Canadian producers are more than capable of supplying domestic demand, increased production from the Marcellus and Utica has priced Western Canadian gas out of Eastern Canada. As shown in Figure 1, exports after 2028 are primarily from LNG from Canada’s west coast. The current supply glut in international LNG markets, combined with low oil prices, has placed Canadian greenfield projects at a disadvantage. While there is still potential for exports, this is most likely to occur after 2020, and perhaps even 2025.

Canadian politicians have been very active on the environmental side, adding to costs relative to other major producing jurisdictions. In 2007, Alberta introduced a price on emissions for large emitters, and in 2017 will introduce a broad, economy-wide carbon tax. In 2008, British Columbia introduced an economy-wide tax on combustion emissions. Quebec implemented a cap and trade system in 2013, and joined it to California’s emissions trading scheme in 2014. Most recently, Ontario has announced it will join the Quebec-California cap and trade system. Also significant is the federal government’s renewed commitment to climate policy: at last year’s Paris climate summit, Prime Minister Trudeau stated “Canada is back” and “here to help.” Moreover, the federal government has indicated there will be a minimum carbon price in Canada by the end of 2018.

Most significant is Alberta’s decision to implement a carbon tax, because it is the first major oil and gas-producing jurisdiction in North America to do so. Moreover, Premier Rachel Notley was joined by CEOs from major oil and gas companies (including the oil sands) as she made the announcement, indicating widespread industry support for the new policy. Premier Notley has promoted the carbon tax and other new policies as making Alberta “one of the world’s most progressive and environmentally-responsible energy producers.” The premier is a champion for market access as
well, showing that strong environmental policy can go hand in hand with energy (and economic) development.

Part of Alberta’s new Climate Leadership Plan is a cap on total emissions from the oil sands, of 100 million tonnes (Mt) per year. However, this will not necessarily constrain production – Figure 2 shows oil sands production and emissions out to 2040. In 2014, total emissions from oil sands production were just under 48 Mt, and production plus upgrading emissions were 65.5 Mt. Average emissions were 46.3 kg of carbon dioxide equivalent (CO2e) per barrel for mining, 65.2 kg of CO2e per barrel for in situ, and 51.5 kg of CO2e per barrel for upgrading. Based on 2014 average emissions intensities, oil sands emissions from production only exceed the 100 Mt limit in 2038. When upgrading is added, the limit is exceeded in 2024. If oil sands producers are able to reduce their emissions intensity – Alberta’s new carbon tax only adds to current incentives to do so – then it is quite possible this cap will never bind in any real sense.

The future of Canadian oil and gas production

Canada has robust and responsible regulation of energy development, both federal and provincial. Despite this, energy development, and energy infrastructure in particular, is controversial. Oil pipelines are subject to the most – often strident – debate, as communities across Canada protest that they bear the risk of spills but receive none of the benefit. This clash has been compounded by politicians making statements both for and against various pipeline projects, as it gives the appearance of politics affecting regulatory decision-making. Not only does this undermine the public’s confidence in the regulatory systems, it also creates uncertainty.

This uncertainty has been detrimental to business investment, and certainly costly. This, combined with low oil and gas prices, makes the future less than rosy. However, Canadians still need and use energy, and at the very least there will be continued domestic demand. Producers would undoubtedly prefer to have export opportunities as well, but that will require Canadians to get over their inner (and largely hypocritical) angst over energy use and transportation.

Policy changes can, have and will add costs to energy production. The hope is that recent changes to environmental policy and regulatory policy (such as the current review of the National Energy Board’s scope and mandate) will pave the way to a more constructive and less adversarial discussion about Canada’s role as an energy producer and exporter. It is this, more than global prices, which will determine the direction of Canadian oil and gas production.

Canada lacks sufficient export outlets for its major energy resources such as these oil sands developments in northern Alberta
Middle East turmoil: The impact on the energy sector

By Laura El-Katiri, Independent Energy Analyst

The Middle East has in recent years been shaken by political and economic turmoil to an extent not seen in decades. Escalating conflict and violence in Iraq, Syria, Yemen, Libya and Nigeria have shut down, and increased uncertainty over, considerable volumes of OPEC and Middle East crude oil production. The lifting of international sanctions against Iran since January 2016 has lowered the potential for inter-state conflict, but added pressure on already oversupplied oil markets by planning to raise its production to pre-sanction levels, a contentious issue inside OPEC that adds to the already raw geopolitical tensions across the Middle East region – most principally between Saudi Arabia and Iran.

Yet, all is somewhat different and at the same time strangely familiar when we look at past instances of geopolitical conflict in the Middle East and oil market dynamics. Different in the sense that the oil price decline since mid-2014 has actually rendered much of our previously held perceptions redundant so that conflict and uncertainty in the Middle East translates into a higher risk premium, higher oil prices. While conflict in the Middle East has been intensifying, oil markets have actually been oversupplied and price dynamics reflect this reality on the fundamentals side.

But there is also familiarity. For instance where regional divisions have been evident in Middle East oil producers’ position towards collective action on oil markets, where the collapse of global oil prices since 2014 has been accompanied by the decision by the OPEC not to intervene until their most recent meeting in September 2016. This left oil prices to decline as a policy to leave price formation to the market, a policy only now seemingly abandoned although we have yet to see how OPEC will implement its most recently agreed production ceiling.

This is one part of the story. On the other hand, the decline in global oil prices has left the region fundamentally challenged to find ways of coping with a low oil price environment that many expect to last far longer than originally thought. With regional oil producers’ budgets remaining exceptionally dependent on oil export revenues – which account in many cases for over 90 per cent of central government revenues – the Middle East remains highly vulnerable to changes in global oil prices. The past two years have hence seen the proliferation of political reshuffles and economic reforms, including cuts to energy subsidies – once deemed an untouchable policy instrument across the Arab world. It is probably also this aspect which has provided the backdrop to the latest OPEC meeting’s decision to limit output.

An inconvenient truth

Not everyone in the region felt the collapse in oil prices globally was inevitable. Indeed, the initial reaction of many energy ministers was that the fall in global oil prices would be a temporary event, and that prices would not fall below a certain threshold.

To a certain degree, the initial price drops of prices from a range of US$100-110 per barrel between 2010 to early 2014, down to a more moderate price range of US$80-90 in the later summer 2014 were not yet seen as alarming developments, at least in certain quarters of the Middle East. Nor was there clarity about the duration of the oil price slump. After all, the previous three to four years had been characterised by an unusual degree of price stability on global markets – with various supply-side shocks including supply disruptions in conflict-torn Libya, Nigeria, Iraq and Yemen offset by the decade’s most notable supply-side development, the historic surge in US shale oil production from unconventional fields.

Time for economic reform

A further year into the oil price decline, the position of many Middle East oil producers began to tangibly change, with no market fundamentals in sight to come to producers’ rescue. Demand for oil has been sluggish, including in growth markets such as China and India. Both Iraq and Iran have ambitions for the near future to maximise their production and revenue stream, the former’s oil production having proven fairly resilient to internal political strife, while US shale has shown to be a much more permanent feature of oil markets than many might have originally thought.

With declining oil prices for more than one and a half years, dwindling oil revenues have become a factor in what may yet go down as the most unprecedented reform period in the region’s economic history – particularly in the politically more stable countries of the Arab Gulf, such as Saudi Arabia, the United Arab Emirates (UAE) and Qatar.

Mirroring earlier domestic energy price reforms in Iran in December 2010, other Middle East producers – Saudi Arabia, Oman, Bahrain and Qatar – have since engaged in partial or comprehensive reform efforts to tackle domestic energy subsidies, charging their own consumers more realistic prices for energy. This is no small development. Middle East governments have provided citizens with subsidised
energy, water and food as part of their unwritten social contracts – the provision of welfare services and cheap essential products in return for political consent. This basic equation has proven effective in protecting many Middle East oil producers from the kind of political turmoil seen in other parts of the region and in North Africa in 2011 and 2012, generally termed the Arab Spring. Reforming policies of supporting the public through subsidised energy could have proved a risky venture, but economic reform efforts in producers such as the UAE and Saudi Arabia have so far shown the opposite is true, and that economic reform can be achieved even in oil producing states.

Economic reform has since gone a long way in the region. Saudi Arabia, a country in the midst of a generational transition, announced far-reaching plans for what it calls its national economic transformation that is meant to “wean” the country’s economy off its “addiction” to oil. The move which has been accompanied by the publication of the first ever comprehensive long-term plan for the country’s economy, Saudi Arabia’s Vision 2030, has also been marked by the parallel reshuffling of senior government positions, including the retirement of the long-serving oil minister, Ali Al-Naimi, and his replacement by former Aramco CEO Khalid Al Falih, in a new super-ministry of energy. In a parallel step almost overshadowing all other reform efforts, the Kingdom announced the listing of shares of national oil company Aramco on public stock markets in 2017/2018. If and when this plan materialises, this could indeed signify a significant and highly symbolic shift in Saudi policymaking, with wider consequences for the Middle East’s regional economic transition and its efforts to move beyond oil.

Shifting role of OPEC

The parallel role of Middle East producers inside OPEC has since assumed a further marked shift from past positions. While there is visible disaccord within the producer organisation – nothing new for long-term observers – about the way in which OPEC should engage within the current low oil price environment, OPEC has in effect turned to an observer role for much of the past few years. This has led various outside observers to predict the “death of OPEC”, unable or unwilling to use its collective weight to stabilise world oil prices. The decision by OPEC in September to agree on the first output ceiling in eight years presents a notable break with the past year’s policy, although symbolic in nature more than anything else.

The irony is that where OPEC used to be viewed as a cartel interested in driving up oil prices, the group has in recent years been criticised for not acting to raise oil prices above a certain minimum level. This apparent shift in OPEC’s role reflects the changing relations between Middle East oil producers and their traditional consumer markets on the one hand, and their security partners on the other. With much of the Middle East’s incremental supply growth now going into Asia – the world’s main growth market for energy demand – traditional markets in Europe and North America are re-defining their relationship to the region’s oil producers. The US, formerly import-dependent for a large share of its energy needs, has in recent years evolved into a major centre of energy supply through the exploitation of unconventional oil and gas resources. This makes the US a major competitor on world markets to Middle East producers, in oil and, increasingly, in liquefied natural gas (LNG). US shale producers, and this is another paradox of today’s oil markets, may be key winners of the September OPEC agreement if it succeeds in raising the price of oil sustainably.

What the future holds

Uncertainty surrounds the future for the region’s oil producers. The duration of the current downward price cycle will affect government budgets throughout the Middle East. Some appear more resilient to longer periods of low revenues than others; Saudi Arabia along with Gulf Cooperation Council members Kuwait, Qatar and the UAE have been engaging in domestic economic reform as one way of responding to increasing fiscal pressures – albeit softened considerably by these countries’ significant savings in foreign assets – and parallel popular expectations for the continuation of these states’ longstanding socio-economic model. The Middle Eastern state, as central distributor of jobs, incomes and economic opportunities, remains a critical factor in the region’s economic and political stability in the long-term. Other countries, particularly Iraq, Syria and Yemen face profound problems that are unconnected with the level of oil prices. High oil prices during the 2000s contributed nothing to these countries’ stability. Nor does the political turmoil in the Middle East raise international oil prices as it would have done in the past. Even with war across the Arab Levant and Yemen, alongside global supply disruptions to the crude oil market, oil prices remain relatively low.

LEADING THROUGH CHANGE

Supply
The last decade in Latin America has been hostile for the oil and gas industry. The sector has been marked by heavy state intervention, regulatory volatility and outright nationalisation in some cases. But 2016 marks an inflection point. Numerous elections and recent political developments suggest as much, with incumbent populist governments losing their footing or being rejected outright. The shift emerged following presidential elections in Argentina, won by Mauricio Macri in November 2015. Since then, opposition wins in Venezuela’s legislative elections; the impeachment process against Brazil’s President Dilma Rousseff; and the election of a technocrat and former World Bank economist in Peru have sent firm signals that populist, left-of-centre governments have lost their lustre across the region.

The timing of the political upheaval in Latin America was not entirely unexpected, due to the growing fiscal strain governments have been under. The bust in the commodity cycle – largely due to the economic slowdown in China – has stymied Latin America’s growth story. Near the bottom of a commodity super-cycle, the prices for key commodities such as copper and oil have collapsed from their respective highs, thereby shrinking government budgets. Since June 2014, the Brent benchmark dropped 77 per cent to a low of US$25.76 per barrel in January 2016. And a strengthening US interest rate has stiffened economic headwinds against emerging economies. These conditions have placed enormous pressures on fiscal accounts, particularly among the major hydrocarbon producers. As a result, public spending has retrenched, turning off the tap on largely pro-cyclical economic models.

Renaissance on the horizon
This year will be defined by economic adjustment as Latin American countries attempt to regain their economic footing. New governments are focusing efforts on their most urgent needs: namely stabilising currencies and cutting government expenditures. Such programmes require time to fully execute and may create political costs in the short term. However, Verisk Maplecroft is forecasting an overall improvement in the risk environment for the oil and gas industry over the medium term out to 2020 across the region. In particular, our Asset Risk Index (ARI) – developed in conjunction with Wood Mackenzie – anticipates that from these economic changes will flow a more attractive investment environment for oil and gas. As a result, ease of entry is likely to improve, while fewer regulatory obstacles and a smaller state presence in the sector are anticipated, among other favourable developments. With this in mind, we take a look at some of the region’s major oil and gas producers.

Argentina turns a corner
The Vaca Muerta shale formation in Argentina has generated significant industry interest in recent years, but regulatory volatility and economic uncertainty under the previous government stunted investment. However, the economic adjustment programme implemented by the Macri administration has generated early success and may offer a model for neighbouring countries. The administration is focused first on stabilising the economy. Once its economic footing is improved, the Macri administration can then shift its attention more fully to the oil and gas industry. In particular, it is expected to build on earlier incentives announced in the 2014 Hydrocarbon Law. Alignment between domestic prices and the global oil market is planned, but this will be gradual as the government is under pressure to mitigate the inflationary impact on local provinces.

Still, there are local risk conditions to monitor, including organised labour which requires special attention due to its historic influence. In addition, stubborn inflation has eroded purchasing power and exacerbated tensions in wage negotiations. However, more market-friendly policies and less political intervention will provide a stable foundation for Argentina to begin to optimise development of its hydrocarbon resources.

Brazil attempts to right its path
In Brazil, the government has been preoccupied with a severe economic recession and the on-going corruption scandal, which has delayed efforts to pass sector reform in congress. However, the new administration of President Michel Temer is expected to promulgate changes to the mandatory pre-salt operatorship on Petrobras on new pre-salt blocks this year, among other proposals.

Local content is another obstacle that will require government attention, but we anticipate growing flexibility over time, including less onerous requirements in subsequent licensing rounds. According to Wood Mackenzie, close to 40 per cent of all production by 2025 will require at least 59 per cent local content in the development phase. Without changes, complying with local content commitments will become the largest obstacle confronting the industry.

Brazil’s oil services sector will also take time to recover,
as local service firms have been implicated in the recent corruption probe or filed for bankruptcy as their major client, Petrobras, cuts spending. And political uncertainty may remain in the background through the 2018 elections as investigations over allegations of graft continue. Nevertheless, the trajectory is favourable for foreign companies as Petrobras pursues an aggressive divestment programme and the government is eager to modify measures that have slowed development and hampered investment.

**Venezuela reaches a tipping point**
Finally, Venezuela, with its estimated 240 billion barrels of remaining commercial and technical reserves, also appears to be at the cusp of change. Efforts by Caracas to meet its sovereign debt commitments have resulted in growing scarcity of food stuffs and medicine leading to social unrest. Coupled with escalating triple-digit inflation, dismal popular support for the current government and substantial sovereign debt payments (principal and interest) coming due through mid-2017, the government’s manoeuvring room is shrinking. Some economic stabilisation programme will be required.

Unlike Brazil and Argentina, reform to the oil and gas sector will likely occur in tandem with any economic adjustment, as the industry accounts for 96 per cent of exports revenues and 45 per cent of fiscal receipts. These will open up opportunities for foreign investment. However, momentum for new investment will likely be contingent on a new government taking office. Moreover, such an administration will also be tasked with repairing credibility and reducing political uncertainty in order to fully restore investor confidence.

**And the ideological pendulum?**
Latin America has been marked by stark swings in the ideological pendulum in recent decades – with the 1990s privatisation wave under the Washington Consensus being followed by a sharp shift in the other direction and rising expropriation risk in the 2000s. While we are once again at the point of an inflection, the cycle may be different this time around. Greater transparency, stronger institutions and contracts, and a growing middle class may bode well for long-term contractual stability.

In particular, contracts have evolved to better respond to the volatility in oil markets, thus reducing the incongruities that lead to unilateral changes by governments in a price upturn. On the institutional front, corruption investigations underway into some of the region’s national oil companies (Petrobras, Ecopetrol, Pemex) support a shift towards improved corporate governance and transparency in the sector. Over time, these developments strengthen potential domestic partners in the region and augur well for the wider petroleum industry.

While an active civil society may lead to additional scrutiny on environmental and community issues upfront – more meticulous attention by oil and gas companies at the initial stages of a project will reduce the risk of more costly disruptions later on. Particularly in an era of social media, securing social licence to operate increases in importance for operators. At the same time, the region’s growing middle class will also ensure more political consensus around more moderate policies. These developments should give rise to more durable agreements between government, foreign partners and local communities and reduce the cyclical volatility which the region has been prone to.
Next year, the UK offshore oil and gas industry celebrates a significant anniversary. In March 1967, first gas landed from the West Sole field off the North Humberside coast, marking the beginning of 50 years of successful oil and gas production from the UK Continental Shelf (UKCS) and one of the country’s greatest industrial stories.

The industry has demonstrated great enterprise over the intervening period, overcoming often major physical and economic challenges to recover 43 billion barrels of oil and gas from a hostile offshore environment which pushed innovation and the use of new technology to new frontiers. For over five decades, the sector’s activities have attracted billions of pounds of investment to the UK, supporting hundreds of thousands of highly skilled jobs across the country. Development of the UKCS has underpinned the emergence of a world-class supply chain that exports goods and services around the globe. It has also contributed to the country’s security of energy supply, currently producing half the UK’s oil and gas needs and earning the Treasury billions of pounds in tax revenues – at the last count, a total of over £330 billion in today’s money.

But today, the UK offshore oil and gas industry stands at a critical juncture. Appreciating an oil price in excess of US$100 per barrel, companies across the sector have since had to deal with a sharp drop to an average of US$41 per barrel this year. Capital investment in the basin is forecast to fall to around £9 billion in 2016 from its peak of £14.8 billion in 2014. There is very little drilling activity taking place and with expenditure rapidly declining few new development projects proceeding. The supply chain has been particularly impacted. Companies have suffered a decline in revenues of almost 30 per cent on average over the last two years; for some sectors the decline has been even greater. The personal impact has been great and the industry is expected to support 120,000 fewer jobs in 2016 than it did two years ago.

**UKCS boosts competitiveness in response to investment challenge**

By Deirdre Michie, Chief Executive, Oil & Gas UK

*Supply Industry drive to cut operating costs on rigs like these in Scotland’s Cromarty Firth*
The UK’s decision to leave the European Union adds an additional dimension of complexity for many of our members in the already testing business environment. In the short term, we see three main challenges: distraction from managing our way through the downturn; a loss of positive influence over ongoing and future policy development in Brussels; and uncertainty, making it difficult for our members to make longer-term investment decisions. In addition, the ability to access the EU market for our goods and services could become more difficult, unless appropriate provisions are made to facilitate ongoing trade and maintain access to the energy market.

Yet, the industry’s response to today’s difficult market conditions demonstrates once again the measure of its tenacity. A year ago, many expected prices to recover in 2016. Twelve months on, the perception of future price growth has changed significantly and companies are now positioning themselves to survive and succeed in the “lower for longer” oil price environment.

Although both economic and political turbulence may not yet be over, Oil & Gas UK’s recently-published Economic Report details the efforts that are being made by the industry in managing its way through the downturn, with a view to positioning itself to make the most of any potential upturn.

Sustainable cuts in costs
The industry’s focus has increasingly turned towards delivering efficiency improvements. Oil & Gas UK’s Efficiency Task Force (ETF) has acted as a catalyst to encourage a pan-industry review of business processes, standards, cultures and behaviours. The efficiency push by companies across the industry and the ETF have been key drivers behind the anticipated 45 per cent fall in unit costs from their peak of US$29.30 per barrel in 2014 to around US$16 per barrel this year. As the report illustrates, such significant gains would not have been realised through natural cost deflation alone, offering some reassurance about the sustainability of the improvement to the long-term health of the business. Lower unit costs have enabled some fields to continue operations that might have otherwise been uneconomic.

While some of the giant fields of the past, such as Brent, are now being decommissioned, there has not been as widespread a rush to cease production on the UKCS as might have otherwise been expected.

The recent improvement in UK production is testament to what can be achieved when the basin’s competitiveness is addressed and attention is focused on unlocking new developments. Major production efficiency gains in existing assets, coupled with a raft of important oil and gas projects that have come on-stream over the past two years, resulted in a 10.4 per cent increase in production last year, the first upturn in 15 years – a trend forecast to continue in 2016.

There have also been fewer business failures than many expected, a tribute to the companies that have responded to the downturn by differentiating their value offering and diversifying both into new geographies and new products and services.

Looking ahead, many challenges still remain for this sector and the actions we are taking will help to determine the future of the industry. Provided cost and efficiency improvements continue and commodity prices hold up, revenues may begin to increase in 2017 across the supply chain.

However, we cannot expect a viable future if we fail to build on past investments. The lack of new development projects must be urgently addressed if we are to avoid a repeat of the sharp production decline that dominated the early part of this decade. While costs have fallen significantly, efficiency has increased, and the fiscal regime has been improved, many potential investors are unable to access the finance they require to develop assets.

The rate of exploration drilling has to improve and be more successful. This aim is being assisted by a £40 million government-funded acquisition of seismic data from areas around the Shetland Isles, South West Britain and in the Central North Sea. Encouraging all forms of drilling, including development, over the next 12 to 18 months will be vital for the industry’s future. We must also begin to tap into the opportunities offered by the undeveloped small pools that have remained on the shelf for many years.

Maximising the economic recovery of the remaining barrels requires the continuation of a constructive and highly focused partnership between government, the industry, the Treasury and the Oil and Gas Authority. With a new industrial strategy forthcoming, the oil and gas supply chain must be recognised alongside the likes of the aviation, aerospace and automotive sectors as vital components of the UK economy.

With the right frameworks and market conditions, Oil & Gas UK believes that many more billion barrels may yet be recovered and that, with 50 years of history behind us, our industry story has still many chapters to unfold over the decades to come.
On the 20th of June this year a Stavanger newspaper printed a lengthy article titled: Two years since the downturn started. The article serves as a chronological review of the two years which have passed since the oil price started its steep decline from US$115 dollars per barrel on June 20 2014. Stavanger is Norway’s “oil capital” and is particularly hard hit by the industry’s downturn, but the implications are significant for the entire Norwegian economy. In 2015 the oil and gas sector accounted for 17 per cent of GDP, 20 per cent of government revenue, 26.5 per cent of all investments and 42 per cent of our total exports. Furthermore, the industry employs people in all but 15 of Norway’s 438 municipalities.

Cost reductions have led to approximately 40,000 layoffs in the industry – a significant number in a small country such as Norway. We need to acknowledge that behind the statistics there are people, families and communities that are deeply affected by the reduced activity.

Hence, the situation has triggered substantial national press coverage and public debate. For the last two years everybody has been speaking about the “oil crisis” and what we should do “after” oil and gas. Environmentalists and others are also questioning whether Norwegian Continental Shelf (NCS) oil and gas production will be acceptable or even profitable in the long term given the reduction of greenhouse gas emissions that will be required to meet global targets for curbing global warming and the recent advances in renewable energy production. Based on the press coverage and public debate, it may seem like the future of Norway’s oil and gas industry is bleak.

I have spent a lot of time visiting member companies; operators, exploration companies and suppliers. In my meetings with the industry, I experience optimism. I meet senior executives that are dedicated to cutting costs, developing new technologies and revising their thinking in order to remain competitive in the face of lower prices. Statoil, the largest NCS operator, has reduced the average break-even oil price in their NCS project portfolio from above US$ 70/bbl in 2013 to US$ 41/bbl in 2016 and the efficiency improvement work will continue.

On the 18th of May, the Ministry of Petroleum and Energy announced the 23rd licencing round awards. For the first time since 1994, new exploration acreage was offered to the petroleum industry, opening up new areas of the Barents Sea, including parts of the previously disputed area along the Norwegian-Russian border.

We have reason to believe that there are significant amounts of oil and gas in the Barents Sea. The region is considered an immature petroleum province and new discoveries in recent years encourage this optimism. According to the Norwegian Petroleum Directorate the Norwegian Barents Sea may contain as much as 10 billion barrels of oil and gas equivalents.

Most prognoses on future energy consumption predict that even within the 2 degree target for global warming, the share of oil and gas in the future energy mix will be substantial. Norwegian oil and gas production is subject to strict environmental regulations and has for many years paid a CO2 price that is substantially higher than in most other oil and gas regions. As a result, the NCS CO2 emission per produced barrel of oil equivalents is more than 50 per cent below the global average.

Optimism on behalf of the Norwegian Continental Shelf

By Karl Eirik Schjøtt-Pedersen, Director General, Norwegian Oil and Gas Association
Moreover, we believe that there is a large potential for reducing Europe’s CO2 emissions by replacing coal-fired power plants with gas-fired plants as the latter have less than half of CO2 emission per KWh produced electricity. In the longer run it is also our view that carbon capture and storage may have a significant emission reduction impact both for power production and for other industrial segments.

The Norwegian oil and gas industry is embracing the ambitions and international commitment agreed in Paris, and is prepared to work aggressively to reduce our future carbon footprint.

Currently we are working on a policy roadmap for 2050 that will outline tough ambitions for value creation and greenhouse gas reductions as well as indicating follow-up actions. We need to stretch our ambitions farther than we believe is possible and force ourselves to develop the solutions and technology which are required to deliver on the ambitions. This is a commercial, and a moral responsibility.

The roadmap is developed in a joint effort by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries, the Norwegian Shipowners’ Association, and the Norwegian Confederation of Trade Unions (LO). The work will be presented in mid-August along with a more detailed climate report.

As representatives of the Norwegian oil and gas industry, we in the Norwegian Oil and Gas Association have made it a priority to take part in the debate about the industry’s future. Frequently this is a debate in which emotions and perceptions rather than facts, dominate. The perceived reality influences our general reputation and the decisions taken by the politicians about the industry’s operating parameters. Thus, if we are not present in shaping the public perception then we leave it to others, to define us. We cannot predict the future accurately, but the knowledge of the industry dynamics as well as analyses and projections of the future, give us a good understanding of the main challenges and possibilities we face as we enter our 50th year anniversary of operations on the NCS.

We know that there are substantial amounts of oil and gas out there, yet to be discovered and produced. According to the Norwegian Petroleum Directorate, we have so far produced only half of the estimated NCS resources.

And, even though the rate of investments on the NCS has been reduced during the past two years, we are still at a historic high level, and our most reliable prognoses indicate that we will remain at the current level for a long time. This level of investments equals six times that of the total manufacturing industry in Norway combined.

Even with a loss of 40,000 jobs in the industry since 2014, we are still a dominant employer in Norway, with more than 250,000 people employed directly or indirectly in petroleum activities.

The world is slowly moving towards the age of low emissions and we believe that low carbon emissions from our operations will become increasingly important as a competitive advantage in the decades to come. Going forward, our emission reductions will need to happen in parallel to the relentless efforts to add new profitable barrels through exploration, innovative field developments, efficient operations and increased recovery initiatives. In this context the Norwegian Continental Shelf will remain competitive for many years to come.
As global crude supplies have increased in recent years due to the shale boom in the US and the return of Iran to international markets, storage has become a key concern. In the US alone, total hydrocarbon inventories (outside of the emergency Strategic Petroleum Reserve) have increased over 30 per cent in 2015-16 versus their average levels, adding approximately 350 million barrels of crude and products that have needed to be managed. This type of rapid increase can strain supply chains, and certainly had a role in bringing oil prices down from previous highs. However, by being able to store, manage and transport these supplies, commodity trading firms have played a key role in stabilising oil markets at recent levels.

Commodity trading is at its heart a fundamentally physical business, based on robust supply chains and particularly on extensive logistics networks encompassing production facilities, ports, terminals, pipelines and storage facilities spanning the globe. Storage in particular plays a key role in these logistics networks, both as commercial storage for crude oil, refined products such as gasoline and diesel, and Liquefied Natural Gas (LNG), and in the strategic petroleum reserves which consuming countries build to see them through periods of supply volatility.

As in many industries, the current level of product supplied at any given point in time may not match the current level of demand, either globally or on a country-specific level. The imbalance can work in either direction, with too little or too much supply versus the level of apparent demand. In commodities futures markets, instances where the prompt or spot price is higher than future months (which are therefore at a discount) is known as backwardation, and can be caused by supply disruptions or a surprise to the upside in demand; conversely, a situation where future supplies are priced higher (at a premium) to the prompt price is known as contango. If the level of contango in the market is large enough, it can outweigh the cost of storage, which makes it economic for traders to store crude or products in order to capture the timespread value.

We saw this type of “super-contango” in global crude markets in 2015, when tepid demand and robust supplies led to an oversupplied market, causing prompt prices to fall sharply. By storing the excess crude, much of it on floating storage vessels or tankers, commodity traders were able to help absorb the surplus volumes and ensure the market was not flooded. Once demand picked up, helped considerably by the lower price of crude, the volumes stored offshore were brought into consuming centres around the world.

The importance of storage can be seen in other ways as well. In recent years, the advent of shale oil in the US has led to significant surpluses of crude supplies in the middle of that country. At times, these volumes have threatened to exceed available storage capacity in the region. In commodities futures markets, instances where the prompt or spot price is higher than future months (which are therefore at a discount) is known as backwardation, and can be caused by supply disruptions or a surprise to the upside in demand; conversely, a situation where future supplies are priced higher (at a premium) to the prompt price is known as contango. If the level of contango in the market is large enough, it can outweigh the cost of storage, which makes it economic for traders to store crude or products in order to capture the timespread value.

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We saw this type of “super-contango” in global crude markets in 2015, when tepid demand and robust supplies led to an oversupplied market, causing prompt prices to fall sharply. By storing the excess crude, much of it on floating storage vessels or tankers, commodity traders were able to help absorb the surplus volumes and ensure the market was not flooded. Once demand picked up, helped considerably by the lower price of crude, the volumes stored offshore were brought into consuming centres around the world.

The importance of storage can be seen in other ways as well. In recent years, the advent of shale oil in the US has led to significant surpluses of crude supplies in the middle of that country. At times, these volumes have threatened to exceed available storage capacity in the region. In commodities futures markets, instances where the prompt or spot price is higher than future months (which are therefore at a discount) is known as backwardation, and can be caused by supply disruptions or a surprise to the upside in demand; conversely, a situation where future supplies are priced higher (at a premium) to the prompt price is known as contango. If the level of contango in the market is large enough, it can outweigh the cost of storage, which makes it economic for traders to store crude or products in order to capture the timespread value.
Oil is far from the only commodity where storage plays an important role. The LNG market has undergone significant changes in recent years, changes which are likely to continue for the foreseeable future and will make storage an increasingly important factor in the market. We have seen rapid demand growth globally, as economies have developed and their citizens’ income levels rise, in turn leading to demand for both more and cleaner power generation. We have also seen a number of countries, including Egypt, Jordan, Argentina and Kuwait, facing temporary shortfalls in power generation, and turning to FSRUs (Floating Storage and Regasification Units) in order to access the market more quickly. The increase in the number of LNG importers has been met with a similar trend on the supply side, with new sources as disparate and far-flung as the US, Australia, Russia and the eastern Mediterranean all coming into play. As a result, the market has shifted away from its traditional model of a handful of consumers buying directly from a handful of key producers. Instead, we are seeing an increasing fragmentation of the LNG market.

Smaller consumers are becoming more prevalent in the LNG market. Whereas previously the active buyers were the major consumers of Japan, Korea and the EU, who would contract on a long-term basis to buy LNG in the tens of millions of tonnes per year (mtpa), the recent trend has increasingly been of countries such as Jordan, Argentina and Egypt looking for short-term strips of cargoes for periods under a year, typically across a season. These new importers generally import less than 10 mtpa, whereas Japan alone imports more than 80 mtpa.

The shift away from pure point-to-point, fixed term and fixed volume agreements has taken place rapidly over the last few years, initially coming in the form of shorter-term contracts such as the three-year one (compared with the traditional 20-year contracts) signed between Centrica, a major UK energy company, and Qatar, one of the largest LNG suppliers. We are now seeing countries turn to even shorter-term contracts to meet seasonal upicks in electricity demand. Indeed, in September 2016 over 35 cargoes traded on a spot tendering basis for Q4 delivery, amounting to approximately 2 million tonnes of supply, a marked increase from past years, when minimal numbers of cargoes were tendered on a spot basis. Over 75 per cent of new importers in the last 5 years have not signed a contract longer than one year.

The unique and difficult physical nature of natural gas means that in order to transport it, the gas must undergo supercooling and pressurising to transform it into LNG, which can then be transported by ships. This complex handling increases overall costs, and also means that LNG cannot generally be stored in the same manner as oil or other commodities like metals or coal, or at least not as easily. As the LNG market continues its fragmentation as outlined above, the emerging consumers who may be more seasonal or shorter-duration than traditional markets will need a more flexible supply chain that will allow delivery of cargoes on a shorter, more responsive timeframe, particularly given weather concerns and seasonal demand swings. As such, the ability to store LNG will become increasingly valuable, given the role it will play in being able to meet the more demanding nature of the market in the future.

In many ways, storage is one of the unsung stars of the global energy supply chain. Despite its low profile however, storage looks set to play an ever-increasing role, as global energy markets become more complex, integrated and volatile, and energy supply chains move to a more flexible, robust and just-in-time model to help meet the needs of a changing market.

**Figure 3: China stocks up 20%**

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Source: China NDRC, China Customs, Press Releases, Trafigura Research | Source: China NDRC, China Customs, Press Releases, Trafigura Research
Reducing the energy intensity of China’s economic growth

By Wang Yilin
Chairman, China National Petroleum Corporation

Having experienced over 30 years of rapid growth, China’s economic development is entering a ‘new normal’ featuring increasing optimisation of the economic structure by lowering the speed of growth and shifting it from a factor-driven to an innovation-driven pattern. In adapting to this new normal, the Chinese government has put forward a development concept summed up as “innovative, coordinated, green, open, and shared”, and it has been committed to facilitate supply-side structural reforms. In the next 5-10 years, China’s economic development mode and pattern will undergo profound changes.

China’s development has been a process of accelerated industrialisation, and its economic growth heavily depends on energy consumption. In 2015, the country’s total energy consumption was 4.3 billion tons of standard coal equivalent, of which oil consumption was about 521 million tons, representing increases, respectively, of 90 per cent and 30 per cent, compared with the year 2000. In the face of growing energy and resources constraints and serious environmental challenges, the Chinese government proactively advocates energy reform. In June 2014, President Xi Jinping proposed the energy sector should achieve a revolution in the four areas of “consumption, supply, technology and institutions”, and should strengthen international cooperation in a comprehensive way. Tackling climate change, promoting green and low-carbon development as well as constructing an ecological civilisation should be included in the national economic and social development plan, from which a concrete programme can be drafted on the following lines.

First, prioritise energy-saving, improve energy efficiency, and control total consumption. Statistics from China’s National Energy Administration show that the country’s energy consumption elasticity coefficient dropped to 0.13 in 2015 from its peak of 1.67. During the period of 2011-2015, energy consumption per unit of GDP was reduced by 18.2 per cent, and the average annual growth rate of oil consumption dropped to 4.2 per cent from 6.6 per cent in the period of 2006-2010, though this is still notably higher than that of some developed countries. China needs to pursue rational control of overall energy consumption, in such a way to achieve a rather faster and less energy-intensive development. By 2020, the country’s total primary energy consumption will be controlled at 4.8 billion tons of standard coal equivalent, of which oil demand will be 608 million tons, and will reach 680 million tons in another 10 years, which means that, in the period of 2016-2020 and 2021-2030, China’s annual oil demand growth will decline to 2.4 per cent and 1.1 per cent respectively.

Second, focus on domestic supply, strengthen international cooperation and ensure energy security. According to the “Energy Development Strategic Action Plan (2014-2020)” by the Chinese government, China must depend on domestic supply as the main channel to ensure its energy security. In the field of oil and gas, we will intensify domestic exploration and production activities to achieve strategic replacement of hydrocarbon reserves and steady growth of production according to the overall plan of “proceeding with development of eastern and western China onshore, expanding to the offshore, growing oil and gas in parallel, and strengthening unconventionals based on conventionals”. Meanwhile, we will be committed to international cooperation for energy security by accelerating the construction of strategic oil and gas pipelines. It is expected that by 2020, total domestic production of primary energy will reach 4.2 billion tons of standard coal equivalent. The energy self-sufficiency rate will be kept at 85 per cent.

Third, stick to low carbon energy, optimise energy mix, and cut pollution emissions. China’s energy mix is dominated by traditional fossil fuels, especially coal. We need to focus both on the development of non-fossil fuels and efficient use of fossil fuels to form a rational energy mix through reduction of coal, increase of natural gas, wind, solar, geothermal and other renewable energies as well as nuclear power. According to major energy research institutions, non-fossil fuels’ share in the primary energy mix will reach 15 per cent by 2020. As a relatively green and low-carbon fossil fuel, the natural gas share in China’s energy mix is less than 6 per cent, but will rise to 10 per cent by 2020. Natural gas enjoys great potential for rapid growth with possible demand of 350 billion cubic metres in 2020.

Fourth, insist on innovation, deepen reform, and promote technological revolution. China will deepen the reform of the energy sector, in particular on oil and gas, in an effort to deregulate market access of all segments in the whole industrial chain and make the market play the decisive role in resource allocation. In technological innovation, we strive to surpass while catching up with our peers through
building up a technological innovation system. Green, low-carbon, and intelligent development will be the strategic targets. We will dedicate more efforts in the exploration and development of unconventional and deep water resources, efficient use of coal, as well as innovation in distributed energy, smart grid, renewable energy, and energy storage by carrying out major pilot projects.

CNPC, as China’s largest oil and gas producer and supplier, upholds the mission of “Caring for Energy, Caring for You” and sticks to the strategy of “resources, market, internationalisation and innovation”. CNPC is committed to build itself into a world-class integrated international energy company. In recent years, CNPC has been pursuing the rapid growth of natural gas as a strategy to achieve green development. We strengthened gas cooperation with energy companies in neighbouring countries and have built a cross-border gas transmission network. Natural gas’ share in our domestic oil and gas production rose to 41 per cent in 2015 from 36 per cent in 2011. Over 70 per cent of the gas production and supply comes from CNPC. With the gas pipeline network covering 30 provinces nationwide, CNPC plays a strong role in promoting China’s less energy-intensive growth as well as a less carbon-intensive energy mix. Looking ahead, we are ready to join hands with international peers in making new contributions to the sustainable development of human society through building mutually-beneficial partnership and a global energy security community.
The Indian oil and gas sector is more than a century old, tracing its origins back to the first oil strike in Assam in the northeast in 1889. So the country’s oil and gas story runs parallel to the growth of the global oil industry.

Whether it is India’s post-independence industrial and agrarian revolutions, the automobile boom, the growth of the aviation industry, the mainstreaming of LPG in urban kitchens, all have been fuelled by this vital sector of the economy. India is today poised to be a driver of global economic growth. This will see a steep increase in its energy consumption. The combined share of oil and gas in India’s energy basket, at 29 per cent in 2013, is expected to rise to 32 per cent by the year 2040. As the third largest consumer of energy in the world, India is an attractive market for international oil and gas exporters as well as oil and gas companies keen to partner with Indian companies.

India is already a top destination for FDI. It has an excellent banking system, many reputed institutes of management and engineering, a productive and skilled workforce, enjoys a demographic advantage, and has a large mass of aspirational customers who are driving demand.

The oil and gas sector, under the Ministry of Petroleum and Natural Gas, is geared to meet the challenge of making energy accessible and affordable across the socio-economic divides.

Tapping the upstream potential
With India dependent on imports for more than 80 per cent of its oil consumption, exploration and production is a critical area that requires a robust strategy for long-term energy security. India’s 26 sedimentary basins cover an area of 3.14 million km², of which 1.35 million km² area is in deepwater, 0.4 million km² in shallow water and the remaining 1.39 million km² area is on land. While the true prospectivity of Indian reserves is yet to be established, 61 per cent of the forecast reserves of 28 billion tonnes (oil and oil equivalent of gas) are also to be harnessed.

The Government of India envisions a complete re-engineering of the sector. The new strategy focuses on enhancing domestic oil and gas production and bringing substantial technology and investments from abroad. Other unconventional hydrocarbon resources that are being pursued by India are coal-bed methane (2,599 billion cubic metres) and shale gas/oil reserves and gas hydrates (estimated in significant recoverable quantities). Besides efforts to raise domestic production, India’s national oil and gas entities have also acquired 24 oil and gas blocks abroad.

Strategic crude oil storage is another area of government focus, with the creation of the Indian Strategic Petroleum Reserves Ltd and the construction of storage at three locations of 5.3 million metric tonnes.

The new Hydrocarbon Exploration and Licencing Policy (HELP), promoting ease of doing business and investing from abroad, plus an ambitious target of a 10 per cent cut in crude oil imports by 2022 offer an excellent opportunity to intensify exploration efforts within the country.

The increasing popularity of natural gas – in industry, homes and transport (as compressed natural gas in cars) – is built on a natural gas pipeline network of over 16,200 km. It is expected that, in about five years, this network of trunk gas pipelines will increase to about 30,000 km.

India emerges as a refining hub
With a total refining capacity of 230.1 million metric tonnes per annum (mmtpa) against a cumulative consumption of 177 mmtpa in 2015-16, India is the second largest refiner in Asia and is a net exporter of finished and value-added products. Its 23 refineries have been performing to international standards, and the fall in crude oil prices has contributed significantly to the profitability of the refining sector.

With India’s oil demand projected to grow from the current 177 mmtpa to 490 mmtpa by the year 2040, a similar increase in domestic refining capacity will be needed, including expansion of existing capacity and new greenfield refineries, with a mega-refinery on the west coast. In this sector, a number of collaboration and investment opportunities lie in refinery configuration, upgrading auto fuels to Euro-VI norms, refinery-petrochemical integration, catalyst and technology development, carbon footprint reduction, hydrocarbon loss control, energy efficiency management, advanced process control, real-time optimisation and advanced shutdown management systems.

India is now a major exporter of refined petroleum products. In 2015-16, it exported 43.8 million tonnes of petroleum products, including lubricants and petrochemicals.

In the wake of rapid urbanisation and the automobile sector boom, the country’s fuel station network, currently numbering over 53,000, is bound to witness a huge expansion. They are also being modernised and automated on a massive scale. Value-added services and non-fuel businesses at fuel stations are also emerging as attractive propositions in line with international trends.

Fuelling the world’s third largest energy consumer

By B. Ashok,
Chairman, Indian Oil Corporation
LPG as a cooking fuel

India is one of the world’s largest markets for Liquefied Petroleum Gas (LPG) as cooking gas in kitchens. With a goal of raising the penetration of LPG from the current 61 per cent of the population to over 85 per cent, LPG use is being aggressively promoted in rural India. Over 100 million new domestic gas connections are to be realised in the next three years, half of them with subsidy for poor families. The LPG retail network is also being expanded, opening up investment opportunities in new LPG bottling plants and bulk LPG transportation.

The management of subsidies for LPG as cooking gas has been innovatively rationalised through a countrywide Direct Benefit Transfer (DBT) scheme, whereby the cash subsidy is directly transferred to the bank accounts of the beneficiaries, making it possibly the world’s largest cash transfer programme for households. Demand for another petroleum product – aviation fuel – is also benefitting from government expansion of civil aviation, with the addition of 34 new airports to bring the total to 125 around the country.

The road ahead

Looking to the future, Indian oil and gas companies are pursuing research in areas like shockwave-assisted fracking, tribology and refining technologies. Indian Oil’s R&D centre has developed several world-class refining processes such as INDMAX (for LPG/propylene maximisation), OCTAMAX (for higher production of high-octane gasoline with improved RON) and INDAdeptG (for production of BS-IV gasoline from INDMAX gasoline stream).

Fuelling India’s rapid economic growth calls for a concerted and sustained strategy to increase energy efficiency and manage growth in energy demand, along with tackling the multiple facets of energy policy, including pricing, promoting bio-fuels, accelerating transition to Euro-VI grade auto fuels, and putting in place a robust plan to ensure secure energy supplies and equitable distribution at stable, affordable prices. Against the backdrop of India becoming a hotspot of hydrocarbon expansion, Indian Oil is organising the 12th edition of the PETROTECH International Oil and Gas Conference and Exhibition in New Delhi in December 2016.

Investing in people is important for the future. India’s oil and gas sector has an excellent pool of talented technical professionals, and their expertise will be most beneficial in all international partnerships. In view of the massive growth in the sector, the government has set up a Hydrocarbon Skill Sector Council (HSSC) which has a roadmap to train nearly two million people over the next 10 years in 134 different roles pertaining to the upstream, midstream and downstream, as well as the construction and services sectors.

Overall, the Indian oil and gas industry is robust, responsible and responsive, and is capable of taking on the emerging opportunities and challenges. Today, as a resurgent India rises, the oil and gas sector stands committed to creating a brighter tomorrow for the country’s 1.25 billion people.
Turkey is well placed to serve as a hub for oil and natural gas supply headed to Europe and other Atlantic markets from Russia, the Caspian region, and the Middle East. Turkey has been a major transit country for oil and is becoming more important for natural gas.

Since 2010, Turkey has experienced a fast growth in total energy demand among countries in the Organization for Economic Cooperation and Development (OECD). Unlike several other OECD countries in Europe, Turkey’s economy has avoided the prolonged stagnation that has characterised much of the continent for the past several years.

Turkey’s proved oil reserves is recorded as 334.5 million barrels in 2015, located mainly in the southeast region of the country. Although Turkey’s production of liquid fuels has increased since 2004, it is much less than what the country consumes each year. In 2015, Turkey produced 51,000 barrels a day (b/d) of crude oil whereas total liquid fuels consumption averaged 796,000 b/d more than 90 per cent of which came from imports. According to the International Energy Agency, Turkey’s crude oil imports are expected to double over the next decade since Turkey continues to experience significant growth. Although Turkey is not a major oil producer, it plays an increasingly important role in the transit of oil because Turkey is strategically located at the crossroads of the oil-rich former Soviet Union and Middle East countries, and the European demand centres. It is home to one of the world’s busiest chokepoints, the Turkish Straits, through which 3 million b/d (over 3 per cent of global supply) flows on average.

As with oil, Turkey is a large consumer of natural gas but a small producer. In 2015, Turkish natural gas reserves are recorded as 3.7 billion cubic metres (bcm) and Turkey produced only a small amount of natural gas, with the total production amounting to 0.4 bcm in 2015. Turkey’s natural consumption averaged 48.8 bcm last year which makes Turkey more import-dependent for natural gas than oil. Over the last decade, Turkey has been the second country, after China, in terms of natural gas demand growth and is becoming an important transit state for natural gas. Turkey is one of the few countries in Europe where natural gas consumption continues to show strong growth. Turkey’s growing consumption has helped spur development of multiple pipelines to bring natural gas into the country, and while it has left little natural gas available for export, new supplies have been contracted and new pipelines are under construction that will increase both Turkey’s imports and exports of natural gas.

On the other hand, when we look at nearby regions of Turkey, a key part of ensuring secure and affordable supplies of energy to Europe involves diversifying supply routes. This includes identifying and building new routes that decrease the dependence of EU countries on a single supplier of natural gas and other energy resources. Many countries in Central and South East Europe are dependent on a single supplier for most or all of their natural gas. To help these countries diversify...
their supplies, EU actions to expand the Southern Gas Corridor involve cooperating closely with transit countries including Azerbaijan, Georgia and Turkey. Taking into account the huge potential of Algeria, both for conventional and unconventional gas resources, as well as the new gas resources in the East Mediterranean and the associated infrastructure development plans, the Mediterranean area can act as a key source and route for supplying gas to the EU.

Recent gas finds in the Eastern Mediterranean
Since 2009, international interest in the Eastern Mediterranean’s offshore oil and gas resources has followed a cycle from widespread excitement, to a stall in activity, to disappointment and back to excitement again. The Levant Basin has seen several discoveries that could have a big impact on domestic economies. However, unless circumstances locally, regionally and globally align favourably, the area may not fulfill its potential as a gas exporter. The Levant Basin possibly has 1.7 billion barrels of recoverable oil and 3,500 bcm of recoverable gas lying under the seabed. The discovery of the Zohr field, the eighth largest gas discovery since 2005, has reignited excitement in the region. Following these discoveries, gas from the Eastern Mediterranean is thought to have the potential to transform the region and global energy markets. Any domestic production should therefore improve countries’ finances, while bringing in foreign capital and promoting job creation throughout the supply chain. For natural gas in particular, building the infrastructure will prove a major undertaking.

Nuclear-related sanctions were lifted on Iran in January, 2016 and Iran could emerge as OPEC’s biggest source of growth. This assumes that Tehran gains access to capital and provides sufficiently attractive terms for international oil companies to tap its vast oil fields. However Iraq is likely to remain OPEC’s second biggest crude oil producer after Saudi Arabia. Exports from the Middle East are expected, by some estimates, to increase to more than 19 mb/d by 2021 as production from low-cost OPEC producers remains strong. Accordingly, by 2021 the region could account for 54 per cent of the global export market, a rise of three percentage points from 2015.

Underpinned by rising populations, the medium-term outlook for African oil demand is for growth at an average rate of 3.5 per cent to 2021. West African producers may face problems with marketing their crudes over the next couple of years. Any energy forecast for Libya can only be speculative as long as the challenges for control of the country continues.

Managing Change
Taking into consideration these developments, the harsh fall in oil prices has changed the market conditions drastically. Although this situation has many extremely unpleasant effects like unemployment of thousands of people based on budget and investment cuts, hard times are always great teachers. Companies have learned how to adjust themselves to conditions of tight budgets, invest more soundly, look for opportunities in mergers and acquisitions and focus more on technology in order to work more effectively.

Today companies look for cooperation to minimise risks, investment in technological development to increase efficiency, and development of human capital. While the first two is more predictable and measurable, the most important influence on the future is human capital. Not only should companies invest in their future leaders, but the future leaders themselves should also do so. This period is the perfect time to learn about change and how to manage it. In other words, “Leading through change” is more important than ever today. For overcoming the crises and barriers to sustainable development, tomorrow’s leaders should focus on adaptability, financial expertise and international cooperation. These three factors are the basic talents any potential leader needs in this industry to succeed.
As a major economic and geopolitical power, Turkey has to follow and try to influence the global energy dynamics as much as possible because its energy is plugged into the world system where decisions and choices in Riyadh, Beijing, Moscow, Brussels and Washington DC will bear direct consequences for Ankara.

Turkey has high ambitions for the future, aspiring to become one of the world’s top 10 economies (currently 17th) by 2023. This is unlikely to occur in that timeframe, but the ambition remains and might be achieved later down the road. Regardless of the botched military/religious coup attempt and subsequent government purges, Turkey’s energy demand, investment requirements, role as a major east-west corridor within the region, geopolitical position and long-term ambitions will remain as important as ever. Turkey’s role is critical to the success of regional energy integration projects. In fact, Turkey is likely to use this development to consolidate its emergence as the key regional power.

Turkey has a young and increasingly better educated population; its middle-class is gaining in importance; it is able to realise large-scale infrastructure projects; and it is carrying out an urban transformation with incredible speed. All these have generated strong energy demand growth, much above the world average, and will continue to do so – provided that the country retains its political cohesion and national security.

Second only to China, Turkey is the country in the world where the demand for energy supplies has increased most during the last two decades. The Turkish government predicts that energy needs are set to increase 7 to 10 per cent each year for the next 20 years. Turkey is poorly blessed with domestic energy resources. Its own oil and gas reserves account for only a tiny fraction of its rapidly rising demand. The country’s soft underbelly is its heavy dependence on imports: more than 60 per cent of all the energy it consumes – this ratio is 98 per cent in natural gas and 93 per cent in oil.

As a significant emitter of carbon dioxide and ideal territory for solar, wind, hydro, geothermal and nuclear energy, Turkey is set to become a major player in the world’s increasingly important climate change and green energy transition.

On a conservative estimate, Turkey needs to invest a minimum of US$12 billion each year over the next decade in energy and associated infrastructure, but its household savings and local capital are not enough to sustain such levels of investment. Fresh sources of capital (in the form of equity or debt) are desperately needed to ensure that long-term and low-cost finance is available to the energy sector, ranging from nuclear, to natural gas storage facilities, upgrading of power plants, pipelines and energy efficiency as well as in oil and gas exploration and production.

The ownership patterns in the energy sector have also undergone drastic transformation. Today Turkey’s private sector represents 64 per cent of the energy economy and will likely control 75 per cent in the next decade (compared to 34 per cent 13 years ago) and the public share has shrunk to 36 per cent – a complete reversal of the roles. Turkish Petroleum, BOTAS and the Istanbul Gas Distribution Company are poised for some sort of privatisation and/or incorporation.

The outstanding debt of the Turkish energy sector exceeds US$50 billion, some of which may need to be rescheduled if the more fragile companies are not to go bankrupt. The energy import bill has been as high as US$50 bn, although thanks to lower energy prices it came...
down to around US$30bn in 2015.

Therefore, energy is not simply a commercial commodity for Turkey to fuel its ever-demanding machines of the economy but it represents a vital national security matter. Turkey strives to achieve this security by drawing on multiple fuels and sources, and by attracting significant international capital and technology into major energy and associated infrastructure projects.

Turkey is not only a significant energy consumer. It is also geographically close to 72 per cent of the world’s proven oil and gas resources, and thus commands major chokepoints and transit routes for energy shipments between major energy producing areas in Russia, the Caspian Sea basin, and the Middle East, and European consumer markets. Turkey could thus become the ‘Silk Road of the 21st century.’

Turkey’s leadership is clearly acting increasingly in pursuit of its own perceived self-interest in foreign and security policy, rather than following the views, or even dictates of Washington, Moscow or Brussels. This is having a huge impact on its energy partnerships. This kind of posture – not so much neo-Ottoman as neo-non-aligned – could well be the most important new dimension of Turkish foreign policy over the next decade. It will shape the way the US deals with Turkey, and complicate Europe’s relationship with Turkey as an EU candidate.

Turkey is Gazprom’s second largest market after the EU, but this changed somewhat as a result of the recent tension between Ankara and Moscow. Now that both Erdogan and Putin have forged a new partnership in St Petersburg in August 2016, Russia will remain a critical energy partner. Turkey’s first 4,800 megawatt nuclear power plant, Akkuyu, is due to be built by Russia with a budget of US$25 billion.

Despite difficulties in sustainable supply, Turkey is the only market for Iranian gas exports to date. It is the major outlet for Azerbaijani oil via the BTC pipeline, and gas via the South Caucasus Pipeline and future TANAP pipeline. Iraq’s (and its Kurdish region’s) access to Mediterranean markets is through Turkey’s Yumurtalik deep-sea port. After a six-year hiatus in relations, Tel Aviv and Ankara signed a reconciliation deal in June 2016. There is a strong possibility that east Mediterranean gas could possibly flow through Turkey to European markets, if the economics were to justify it.

Generally, Turks are becoming less content to be a simple ‘bridge’ over which energy flows. Rather, they aspire to become a regional ‘hub,’ extracting greater value for the oil, gas pipelines and power interconnections that criss-cross their country, and to turn this role into economic, foreign or security policy gains.

**Key messages**

If Turkey is to execute successfully its energy strategy, I believe that business and government leaders should:

- View Turkey’s energy policy as a sub-set of a wider government vision, incorporating environment, taxation, competition, investment, trading, commerce and foreign policy into the energy calculus;
- Take further steps to create competitive energy markets by restraining increases in energy prices, facilitating customer switching between electricity and gas suppliers, reforming electricity trading platforms, and introducing market mechanisms in pricing;
- Invest more in green energy technology and human capital, focus on exploiting domestic energy resources such as wind and geothermal in the Aegean region, photovoltaic power in the Mediterranean, central Anatolia and the south east, and small hydro and offshore wind in the Black Sea;
- Double efforts to improve energy efficiency and conservation through an all-encompassing demand-side management policy;
- Let energy-intensive and polluting industries locate or re-locate to the energy-rich countries in the neighbourhood, and turn towards smart/intelligent technologies and sectors that bring higher added value and cleaner energy systems;
- Support the transformation of Turkey into a genuine regional energy hub by market and price liberalisation, building physical infrastructure, encouraging capital markets through conducive legal and institutional frameworks, and adopting a “soft power” approach in foreign policy so as to inspire trust among producer, transit and consumer countries;
- Build internationally competitive “energy champions” through the public-private and international partnerships, and not another series of state-owned or controlled enterprises;
- Create a Turkey Energy Fund to provide long-term and low-cost seed capital to energy projects and deals.
European refining: Renaissance or Indian summer?

By John Cooper, Director General, FuelsEurope and CONCAWE

For European refining, 2015 was notable in that, after a pattern of regular closures over several years, there were no closures, and at the time of writing there have been none in 2016 either.

With lower crude prices since mid-2014, global demand has responded, in particular with stronger demand for gasoline, and there is much published data showing the improvement in refining margins worldwide and also in Europe, during 2015. Certainly, the annual results of several of the integrated international oil companies have shown the value of the vertically integrated business model, with the downstream sector in several cases delivering the lion’s share in earnings.

A question we are regularly asked is “does this show a long-term shift in outlook for EU refining, towards a rosy future?” Our short answer is that we don’t know, but that there are many reasons to be cautious. In summary, there are crude and energy market uncertainties, competing transport and fuel technologies, the evolution of global refining competition, new business models for refiners, the economic outlook for the EU and also the world economy, and last but by no means least, EU energy, climate and environmental policies. Taken together these create substantial challenges ahead.

With crude oil prices having fallen by over 50 per cent from highs in the 2008-2013 period, refined fuel costs for many customers globally have also fallen, but for road transport customers in Europe the fall in percentage terms has been much less, due to the high levels of taxation. This is one reason why we see that recent demand growth has been mostly outside of the EU, and therefore disproportionately benefitting non-EU refiners.

Gas prices in Europe have come down but so have those of the key competitor regions, the Middle East, the US, and Russia, meaning that their competitive advantage of lower energy costs is maintained. We have seen announced projects for several new large complex refineries in the Middle East, where such new capacity will likely be competitive in importing into Europe, being able to benefit from the lower gas prices and also exemption from most European regulatory costs, therefore probably putting additional competitive pressure on EU refiners when they come on stream.

We are also seeing in several locations, refineries being acquired and operated by companies with a different business model, such as airlines or trading houses. In the recent past these refineries might have been expected to close, but so far, their new owners clearly see viability in continued operation. Last but not least, Europe has some of the most ambitious energy, climate and environment policies in the world, for refineries manufacturing fuels, but also for vehicles emitting CO₂ and pollutants affecting air quality.

This is likely to have a substantial effect on demand for liquid fuels over the long term, as shown by energy outlook publications of some of the major oil companies. For the European fuels market, vehicle regulation is arguably now the key long-term determinant of both the overall demand for petroleum fuels, and the mix of grades. It is for this reason that FuelsEurope is advocating strongly for future vehicle policy to be technology neutral, to pursue the most cost-effective policies, and also to have a linkage with fuel regulation.

Carmakers have been under pressure for some years now to develop strategies to reduce CO₂ emissions from their cars to meet a fleet-average standard, currently, and up to 2020, of 130 grams of CO₂ per kilometre (CO₂/km). Their short-term challenge is to be ready to meet a standard of 95g CO₂/km from 2021, and reportedly at the time of writing, a very challenging fleet average in the range of 68-72 g CO₂/km from 2025 or 2030. Clearly such reductions will bring proportional reductions in fuel consumption from the light vehicle fleet. In addition to this, there is now growing political momentum for electrification mandates in certain countries, in particular the Netherlands and Norway. Furthermore, there is growing support in some cities for severe restrictions on the use of Internal combustion engine vehicles, with a vision for electric-only vehicles within a decade.

The electrification vision

The vision for electrification of light transport is increasingly clear — and despite current low sales numbers, and challenging economics (when large subsidies and incentives are discounted), the refining and fuels industry in Europe takes this possibility very seriously. Technology will have to progress a lot before this is a cost-effective route to emission reduction. However, we do need to recognise that electrification will gradually become more competitive, will likely continue to receive strong support, and will play a significant role in transport in future.

It is a sobering exercise to consider what widespread electrification could look like by, say, 2050. Light transport could in theory be fully electrified, even though the costs of the transition, in terms of years of incentives, and also the building of millions of charging points and relevant infrastructures,
would be huge. This could mean the loss of much of gasoline demand and perhaps one third of diesel demand. Clearly the future of refining in Europe would be very challenging with even further reduced gasoline demand.

As the industry association representing Europe’s refining and marketing industry, we have fully recognised climate change as a global challenge, and also recognise the air quality problems in our cities. Now, more than ever, we believe that we have to promote the most responsible use of petroleum. This means that we should support achievable standards for efficiency in cars, and for full compliance with air quality emission standards.

We can also see that the current technologies for replacing petroleum in transport (to meet climate objectives) are amongst the most expensive of all options available in any field. We also see that many sectors of transport have no practical option but liquid fuels. But it seems unwise to sit back and expect today’s fuels to be suitable forever. We must think and prepare for the longer term by finding ways to reduce the carbon intensity of liquid fuels. We should seriously consider all technologies that can reduce the life-cycle GHG intensity of liquid fuels, from advanced biofuels, to use of green hydrogen and green power, carbon capture and storage, and power-to-liquids. Where these can be cost-effective, competitive routes to lower GHG emissions, we should find ways to implement them. But we will also need long term policy stability that enables business to make such business investments.

We should also be pressing for carbon price convergence in the longer term to make sure Europe’s costs for reaching its climate targets are kept to a minimum, enabling society to always pursue the lowest cost options whatever the sector, and in a technology-neutral way.

The other big driver for change in road transport is the failure of many EU cities to meet urban air quality standards, and also the responses from regulators and industry to the diesel emissions scandal. This has intensified the calls for electrification of cities. However we believe these calls are premature and that there are alternative solutions. A recent report by our research affiliate CONCAWE (Conservation of Clear Air and Water in Europe), based on detailed expert modelling of fleet emissions and urban air quality, shows that vehicle fleet turnover, specifically toward the latest technology Euro 6 vehicles, will over the next 15 years bring major improvements in compliance with air quality standards, with outcomes little different from that which could be achieved with full electrification of the vehicle fleet. This shows clearly that air quality standards can be met whilst continuing the responsible use of petroleum-based road transport fuels.

So what are the implications for investment from these environmental pressures? Our industry has shown time and again that it can deliver innovation and implement new technologies. But the scale of today’s environmental challenges are great, and we will need a clear view of the policy framework for many years, perhaps decades, to be able to justify the large investments that may be expected to meet these environmental pressures.

Complete mix of opportunities and threats
So, to summarise, and to answer the question posed in the title: Renaissance or Indian summer? 2015 may have been a good year for global margins but there are too many challenges to competitiveness and to the outlook for demand to describe this as a “renaissance” for Europe’s refiners. To meet the challenge, the European industry will need to continue its efforts to remain competitive, as the capability to supply from outside of Europe grows. It will need to continue to advocate for fair treatment in policy, and also to continue to promote and practice the most responsible use of petroleum. But most important of all, it must also consider how it can step up to the challenge of meeting societal and policy expectations in the path to lower-carbon transport, and a lower carbon economy. In doing so we must all be realistic that this path is a complex mix of opportunities, and threats. ‘Indian summer’ may not be the most accurate characterisation after all, as 2015 is now behind us, and the road ahead is certainly tough. But with innovation in technology, careful investments and a constructive engagement with policymakers, Europe’s refining and fuels industry can surely carve a path to continue to supply Europe’s liquid fuel needs for many decades ahead.
What progress has been made to improve the efficiency of refining, and what major challenges remain?

Crude oil, a natural resource, requires refining before it can be used. During the refining process crude oils undergo structural changes and contaminants must be removed such as sulphur, nitrogen, oxygen, water, metals and inorganic salts. Hence, refining adds value by converting crude oil into a range of refined products, including transport fuels such as ultra-low sulphur gasoline and diesel fuels.

Modern refineries have pools of refined products with physical characteristics such as density, volatility and boiling range; chemical properties relating to sulphur and aromatics content; and chemical performance characteristics such as the octane rating or smoke point. The finished product requires multi-component blending.

Refiners’ major challenges are to satisfy market demand and supply. This can involve using refinery processes with catalyst technologies and heavier feedstocks to make the right products that are both environmentally clean and in demand. The cyclical demand between gasoline and diesel can swing from one direction to the other, depending on various factors including process availability, capacity, costs and pricing.

How is the refining sector adapting to use more diversified feedstock, including unconventional oil shale and oil sands?

The main challenge for technology is to optimise heavy oil production with cost-effective and environmentally sound methods. Unconventional oil resources have major issues. The recovery factor remains very low, at about 15-20 per cent with high extraction costs, so it becomes difficult to operate economically. Shale oil and oil sand production is more expensive than conventional crude oil, and its energy intensity has a negative impact on the environment. However, I believe much of the crude oil supply rebalance will come from these two resources. Reliable technological treatment of diversified feedstocks (heavy or extra heavy) is very difficult, because a method that works in one situation may fail utterly in a different one. Hence, it is essential that the properties of these resources should be fully understood at the molecular level before selecting a production scheme. The major problem with heavy oil feedstock is the complexity of the feedstock and the analysis of its components.

Using diversified feedstock in downstream refining requires more intense operating conditions and higher cost for the processing to produce gasoline and distillate fuels. Thus, the chemical composition of an unconventional crude oil heavily affects the downstream sector. Technologies such as blending, direct up-grading as well as thermal processes need to be further developed in order to be cost-effective.

What can be done to improve the reliability of refineries, to minimise corrosion and to shorten turnaround times in maintenance and upgrading?

Petroleum refining is a high-risk industry, as refineries are vulnerable to a variety of corrosion phenomena. Corrosion can cause leaks of hydrocarbons, sometimes leading to serious accidents. In order to mitigate the corrosion risk, refineries should implement a sound risk management strategy considering the corrosivity of feedstock and the processing conditions. Material selection for refinery equipment and piping should consider the characteristics of feedstock in terms of corrosive sulphur compounds, salt content, and acid content. Implementation of an effective risk-based inspection strategy, based on the identified corrosion loops and anticipated material degradation mechanisms, is also essential. The corrosion risk management strategy should involve advanced corrosion monitoring and non-destructive testing techniques. Occurrences of corrosion need to be properly recorded and investigated to identify root causes.

How is the refining sector coping with the challenges of tighter environmental regulation to reduce emissions and health hazards?

Refineries are making it a priority to respond to tighter environmental specifications. Refining processes are changing, with newer or improved ones such as isomerisation and alkylation process, replacing liquid catalysts with solid (zeolite or super acids) based catalyst technologies.

The profitability of refining can fluctuate very sharply – does this have an impact on the level of research as well as investment in refining?

The complex, sophisticated refineries can handle a very wide range of crude oils and blends to deliver the highest value of products demanded by the market. However, high-value products are the shared output of basic research as well as of technological refinements. Refining margins are the difference in value between the products produced by a refinery and the value of the crude oil used to produce them. Thus, the role of maximising the product slate using innovative technology (research) definitely influences refinery investment as well as integration of refineries with other petrochemical complexes to add value.
Many types of crude oil are extracted around the world. The market value of an individual crude stream reflects its quality characteristics. Two of the most important quality characteristics are density and sulphur content. Density ranges from light to heavy, while sulphur content is characterised as sweet or sour. Crude oils that are light (higher degrees of API gravity, or lower density) and sweet (low sulphur content) are usually priced higher than heavy, sour crude oils. This is partly because gasoline and diesel fuel, which typically sell at a significant premium to residual fuel oil and other “bottom of the barrel” products, can usually be more easily and cheaply produced using light, sweet crude oil. The light sweet grades are desirable because they can be processed with far less sophisticated and energy-intensive processes.

Worldwide, the petroleum refining industry is entering into a significant era due to the depletion of light crude. The light crude sources are turning into heavy or extra heavy, which contains large amounts of contaminants such as metals or asphaltene, and produces a large fraction of bottom of the barrel residue after distillation. Thus, the future composition of the crude slate is a key issue facing refiners who need to invest strategically in order to process larger quantities of sourer crude. Crude quality is vital not just from the refiner’s interest for refining yields and environmentally-friendly products. Refinery operations have to evolve and include next-generation processes and catalysts to fulfill the demand for high-quality transportation fuels. Since the quality of these products has to be improved to satisfy stringent environmental regulations, refineries, which have been traditionally processing light crude oils, face drastic changes in their petroleum feed. The heavier crude oils produce a greater share of lower-valued products (residue) with simple distillation and require additional processing to produce the desired range of products.

At the same time refineries are under great pressure to meet market demand for high-quality fuels, especially in gasoline and diesel. The world demand for diesel fuels is increasing while fuel oil demand is decreasing. Refiners increasingly have to deal with the presence of high levels of impurities occurring in the processing of heavy feed stocks, such as:

- Large amounts of residue;
- High levels of metals, causing permanent deactivation of the catalysts;
- High nitrogen content, especially basic nitrogen, resulting in the temporary deactivation of acid catalysts;
- Higher coke deposition and poor yield of liquid products, resulting from higher contents of conradson carbon residue and asphaltene in the crudes;
- High sulphur levels in the feedstocks.

Dealing with heavy crude

Potential technology options to deal with heavy crude oil include:

- Direct use of heavy oil as fuel for power generation;
- Blending heavy oil with light conventional oil to produce medium-quality crude oil suitable for refining in many conventional refineries worldwide;
- Blending heavy oil with synthetic crude oil produced from heavy oil to produce medium quality crude oil;
- Medium upgrading to medium-quality crude oil;
- Full upgrading using a hydro-treating process (conventional and non-conventional) or carbon rejection processes for conversion into sweet synthetic light crude oil.

The heaviest fraction of heavy crude oil is represented by the most complex molecule of asphaltenes. Asphaltenes are the precursor of the most hetero atoms and metals. Metals in the asphaltene aggregates are believed to be associated with the asphaltene sheets, making the asphaltene molecule heavier than its original structure. Therefore, the design of catalyst formulation requires a balance between textural properties, the number of active sites and resistance to deactivation. Therefore, it will be mandatory for researchers to understand the chemistry of complex fossil fuel feedstocks that will be required in order to design suitable catalysts and conditions for processing. Among all commercially applied options, catalytic hydro-processing, either as pretreatment or as upgrading, remains one of the most promising technologies for conversion of heavy oils.

The required conversion of heavy crude to distillate cannot be accomplished by only changing the process parameters or operations. New catalyst formulation and technologies will be required to achieve higher conversion and increased selectivity to the distillate range of products. On the other hand, the distillate fraction of heavy crude also contains large amounts of sulphur, nitrogen and aromatics. This is also becoming more important as refiners seek ways of gaining competitive advantage in a climate of generally poor global refining margins.
Heavy crude oils and extra heavy crude oils account for a major part of global oil reserves. They are expected to play a crucial role in boosting oil production in the near future, considering the limited discoveries of new conventional crude oil fields and the depletion of existing ones. Heavy and extra heavy crude oils, however, are less economically viable than conventional crude oils and can only with difficulty be processed by most existing refineries because they contain substantial amounts of asphaltenes and high levels of sulphur and metal impurities. The challenges associated with heavy oil processing result in limited market demand and commercial exploitation.

One viable option that can be used is the concept of upgrading, in which the heavy oil is partially upgraded by cracking only the heaviest fraction — the vacuum residue (VR). Thus, the objective behind the proposed heavy crude upgrader is not to produce a refined petroleum product, but a synthetic crude oil as an export commodity for countries producing heavy oil. Partial upgrading has been commercially employed to produce synthetic crude oils from Canada’s oil sands and Venezuela’s Orinoco tar sands. These commercial synthetic crude oils are unique as they do not contain vacuum residues (VR) and produce high yields of middle distillates and vacuum gas oils (VGO). Therefore, such synthetic crude oils are expected to find their way into the refineries as a substitute to the conventional low-sulphur crude oils.

Crude oil upgraders are distinct from refineries and normally have a smaller footprint and much simpler configuration, which result in a substantial reduction in the investment cost. The concept of the crude oil upgrader is schematically illustrated in Figure 1. The atmospheric distillation column in the crude upgrader has a much simpler configuration than the one installed in refineries because it does not require the separation of products into multiple streams; thus, only crude and vacuum flashers are needed. The distilled fractions from both flashers are hydro-treated to reduce the sulphur content in middle distillates and VGO. The VR from the vacuum flasher, on the other hand, is thermally treated to produce a cracked oil of various light distillates such as naphtha, kerosene, and gas oils. The cracked oil is then hydro-treated, before being mixed with the pre-separated fractions from the distillation units to make a low-sulphur synthetic crude oil. The unconverted residual carbon from the thermal cracking is recovered as a byproduct in the form of pitch or coke, depending on the type of the thermal cracking process.
cracking process. The yield of synthetic crude oil from such an upgrader is expected to be in the range of 85-95 per cent, with the rest as byproducts in the form of off-gas and residual pitch or coke. Synthetic crude oils from such upgraders are unique since they do not contain residues and have a low level of impurities. The post-distillation hydro-treatment also helps in stabilising the olefinic hydrocarbons that are expected to form by thermal cracking. Figure 2 illustrates how the partial upgrading of a heavy crude oil, with API gravity of 16º, can produce a low-sulphur synthetic crude oil with 45º API gravity. The VR fraction was totally eliminated from the synthetic crude oil and in turn the lighter fractions have increased. The material balance in Figure 2 clearly indicates that the synthetic crude quantity is less than that of the heavy crude oil, which is attributed to the formation of by-products like pitch and coke and of off-gas.

The concept of heavy crude oil upgraders can be used in both the upstream and downstream. In the downstream, the upgrader should be integrated with an existing oil refinery to enable easy exchange of products or by-products, whereas the upstream upgrader should be set up near oil wells (field upgrader) to dilute the high viscosity heavy crude oil with synthetic crude oil. Different upgrading scenarios are proposed for the refinery-integrated and field upgraders by modifying the upgrader capacity and/or design configurations. The different configurations are achieved by selecting either a mild hydrocracker or a hydro-treater to treat the VGO from the vacuum flasher. Such selection depends on whether the upgrading or the sulphur reduction is prioritised. The changes in design configuration also involve the use of different reliable decarbonisation/thermal cracking processes to treat the VR. In the conceptual design of some refinery-integrated upgraders, the gasification option is utilised to improve the economic feasibility of the upgrader.

Synthetic crude oil can be marketed as a good substitute for the low-sulphur light crude oils. Alternatively, it can be blended with heavy crude oils to produce a medium-type synthetic crude. The market analysis indicates that the medium-type synthetic crude has higher demand because it is more compatible with the prevailing specification of existing conventional refineries. To illustrate the commercial prospect of the heavy crude oil upgraders, a price model was established for the heavy crude oils and the synthetic crude oils, where the price of heavy crude oil is estimated based on the average price of sour-type crude oils over 8 years while the price of synthetic crude is estimated from the average price of sweet-type crude oils. Based on this pricing model, the upgrade margin or the difference in price between heavy and synthetic crude oils is calculated for the different proposed upgrading scenarios.

The outcome of this study indicates that the technical viability and the economic feasibility of heavy crude oil upgrading depend on the upgrader capacity, its design configuration, and the upgrade margin. The upgrade margin, or the spread between synthetic crude price and feed crude price, proved to be the most influential factor for the feasibility of the upgrader. The study also indicates that the conceptual design of the upgrader can be further optimised, based on market demand, product price, and worldwide development plans for heavy crude oil.
The depth and length of the oil industry downturn has impacted all market participants. It has reminded us that “old school” economics are still at work and the path to returns looks like execution and collaboration.

Oil prices began falling in 2014 and, without mercy, sent shock waves through the global economy. Undeniably, this oil industry downturn is one of the most significant macroeconomic events in decades. More than 350,000 energy jobs have been lost, mostly weighted toward oilfield service companies, with some reducing their workforce by as much as 80 per cent. Capital expenditure has been radically reduced, and bankruptcies and restructurings are quite commonplace as we sort through the wreckage of this downturn. While the last two years have been plagued with uncertainty, we believe that 2016 marked a bottom and we are in the early innings of a recovery.

Old school economics
While the pace and shape of recovery are never a precise science, the basics of supply and demand are always at work. If we consider a conservative 3 per cent annual decline in production, we should see a 14 million barrel per day gap grow over the next five years. This may be a conservative estimate, as capex starvation should only serve to exacerbate the gap. Additionally, global demand continues to grow at 1 - 1.5 per cent per year, adding another 6 million barrels of demand per day by 2020. In total, we are looking at a gap of about 20 million barrels per day, which, put into perspective, is the equivalent of adding two new Saudi Arabias worth of production. The advantage here is that economics always wins and the market will recover.

We collectively spend a lot of time talking about things that will change and speculating on what those changes will mean for our industry. I believe, however, we get the most value from spending time on what’s not changing, and making sure our strategy – meaning our operating system – is uniquely built to meet these unchanging demands. Producing economic barrels of oil is the path to profitability. This may have gone out of style over the last decade, but lowest cost per barrel of oil equivalent (boe) is always important, now more than ever, and is achievable in any market.

Take for example a highly collaborative relationship between Halliburton and a small operator on a production project in west Texas. We listened to the customer drivers — fastest returns and biggest estimated ultimate recovery from a field — and responded with transparent designs for well placement, spacing, lateral length and surfactants. In this case, our insight led to doing less rather than more to deliver the most barrels at the lowest cost per boe. For example, shorter rather than longer laterals, and customising a lower-cost treatment, made for the best results. The success is clear — this operator now produces the most barrels per well on a cost per boe basis, nearly 10 per cent better than the next best and 45 per cent better than the third best. Despite being a much smaller operator lacking many of the same trappings of its larger competitors, this company achieved the lowest cost per boe through successful collaboration with Halliburton, working together to make the best use of the capabilities of both companies.

What recovers first and why?
The important question is not if the market recovers, because we know that it will, but where it happens first. In our view, the recovery starts with unconventionals, followed by mature fields, then deep water.

Unconventionals: The unconventional barrel is the fastest incremental barrel of oil to get to market, meaning it will be the first to fill demand. It is also the shortest-cycle return barrel, making it attractive not only for filling demand, but also from a return standpoint. The unconventional barrel has the best glide path. We continue to see efficiency gains in terms of lowering cost, as well as substantial room to improve recovery factors.

Mature Fields: The second group to recover will be mature fields, representing the largest market in the world. These are the lowest risk opportunities because the reservoirs are very well understood; however, they are harder to ramp up to scale.

Deep Water: The slowest to recover will be deep water. This market requires more money up front and a longer wait for returns. With 7 to 10 years from discovery to barrels in the tank, deepwater incremental barrels will be the last barrel of oil to market. Exploration continues to get tougher every year – reservoirs have been smaller and smaller, making it increasingly difficult to achieve lowest cost per boe, with a few notable exceptions. From an efficiency perspective, you also get fewer opportunities to test efficiency solutions in deep water than onshore. With fewer attempts to get it right, it is more challenging to drive efficiency quickly.

While driving to the lowest cost per boe remains critical, another thing that is not changing is customer demand for
reliable service delivery. The market demands effective technology that is clearly correlated to producing more barrels or reducing overall cost. Additionally, the market demands that the companies that develop the technology are clearly accountable for delivering the technology. Service companies have to ‘execute in the last mile’, meaning they must be present and ready to execute work on location. This requires them to have a substantial global footprint, sufficient infrastructure and reliable processes to ensure they are fully integrated in the important markets where operators are active.

Collaboration: How we work

The range of working arrangements is limited only by our imagination, but the one thing all these arrangements have in common is the requirement for collaboration. Our view is that the future requires collaboration and engineering solutions to maximise asset value for operators. This means we listen to operators’ needs and respond with transparent solutions. By doing so, we are trusted to help maximise asset value, which means producing more barrels or lowering cost, both of which generate a lower cost per boe.

We collaborate not only with our customers, but also internally. At Halliburton, the focus of collaboration is not driven by a commercial model, but rather it is a means of delivering efficient, responsive solutions. This requires technology responsive to customer needs, developed at a low cost, and aligned with customers’ processes and operational constraints. Returning to the earlier example of the small west Texas operator – we know collaboration works. We can achieve fantastic results under any conditions as long as we collaborate openly and effectively.

We are in the early innings of a recovery and collaboration affects everything we do to drive out cost in the industry. While we cannot control the price per barrel, we can control the cost per barrel. Service companies must remain dead-focused on delivering what’s important to their customers. What was, is, and will remain most important over time is maximising asset value by helping to produce more barrels or to reduce cost – or in the best case, both.
Environmental stewardship through green technologies and services

By Jean-François Poupeau, Executive Vice President, Corporate Development and Communications, Schlumberger

Technological innovation in the industry during the past 10 years has focused on efficiency – faster drilling, longer laterals, and more horsepower – with the ultimate goal of boosting production. During the next decade, the industry has a compelling opportunity to become a leader in global environmental stewardship by not only producing more with less, but by employing a smarter approach that uses technology to enhance production while using less equipment, deploying cleaner chemistry, reducing water usage and lowering emissions.

The technological advances that will propel the industry to a leadership position are on the horizon, and are already being implemented before the well is drilled and during the drilling, cementing and completion phases. Reducing the industry’s environmental footprint is a philosophical change as much as it is a change in process – requiring a combination of best practices and systems, and technologies that build upon one another to provide ongoing sustainable benefits.

Schlumberger has adopted a unique engineered approach that raises the bar for planning and making good decisions based on reservoir understanding and the integration of state-of-the-art technologies and services. Good planning that includes an environmental stewardship approach can result in fewer but better wells, which in turn translates to a reduced use of water and chemicals, less truck traffic and lower emissions.

An engineered approach is particularly important as the industry seeks to meet the world’s growing demand for primary energy while also replacing the supply that is naturally lost to decline. As the industry seeks to gain access to new arenas, such as expanding unconventional development to international markets, it needs to assure communities and governments that it can drill and complete wells safely and responsibly.

Understanding the reservoir

Environmental stewardship begins with the reservoir. Conventional sandstone and carbonate reservoirs have high-quality, high-permeability rock that enables hydrocarbons to flow naturally. Conversely, unconventional shale reservoirs have poor rock quality with low permeability and porosity. Therefore, for unconventional wells to be economically viable, operators drill a high number of wells, and often horizontal wells that must be hydraulically fractured using water, sand or proppant and chemicals. When using a common geometric completion approach, approximately 40 per cent of the perforation clusters and more than 40 per cent of the hydraulic fracture networks do not contribute to production, resulting in 40 per cent of the unconventional wells in North America being uneconomical.

A broad array of reservoir characterisation tools, workflows and modeling techniques have been developed to refine the industry’s ability to understand the subsurface. These include basin, reservoir and petroleum systems modeling, as well as petrophysical analyses to gain a clearer picture of the reservoir’s production potential.

Reservoir data is critical in building a basin-specific, three-dimensional model that can be fine-tuned as new wells uncover even more data from core samples and other downhole data. When integrated into a comprehensive workflow, this information provides an even more detailed picture of the reservoir.

A detailed view of the subsurface allows operators to identify “sweet spots” to better position and drill wells, and design more effective completions. This reservoir-centric approach significantly improves the likelihood of drilling fewer, more productive wells and minimises the use of resources to drill and complete wells that cannot be productive.

Even the early steps of the data gathering process provide an opportunity for the industry to lead the way by engineering technologies with environmental stewardship in mind. For instance, three-dimensional seismic acquisition vessels that use advanced surface marine cables, or streamers, designed with a special casing, benefit from reduced drag and fuel consumption. When the casing is damaged, the streamer can be refurbished and used for its original purpose, which adds another three years to its life. The next time the streamer needs refurbishing, it can usually be repurposed and used for another eight to 10 years. Recycling these streamers at the end of their life saves money and avoids waste of tons of useful materials.

Minimising drilling impact

Today, technologies and processes developed specifically for shale-drilling enable operators to drill highly deviated trajectories through hard reservoir rock of varying thickness and orientation, while at the same time to minimise the impact on local communities in terms of noise, traffic and emissions. Sophisticated measurement-while-drilling and logging-while-drilling tools enable geo-steering to keep the drill bit in the target reservoir’s sweet spot, ensuring that...
wells are delivered in a timely manner. Adjustments to the trajectory can be made in real time, thus raising the potential productivity of every well drilled.

The practice of drilling multiple wells from a single location, known as pad drilling, reduces rig and truck traffic and delivers greater operational efficiency. Schlumberger has developed an extensive portfolio of non-aqueous, synthetic-based drilling fluids that meet regulatory standards and provide environmentally friendly alternatives to oil-based muds.

One non-aqueous drilling fluid system was designed so that cuttings can be used as a soil or soil amendment. Developed to biodegrade rapidly, the base fluid has a low terrestrial toxicity. Other drilling fluid components were designed to minimise conductivity and enhance plant growth. The system offers an attractive alternative to traditional treatment and disposal of cuttings.

Less water and greener chemicals
Hydraulic fracturing, a methodology that has been used for more than 50 years to stimulate tight gas and tight oil reservoirs, results in economic flow rates. Early in the shale revolution, the approach involved geometrically placing stimulation treatments equally across the entire lateral. Due to the varying nature of shales, however, an estimated 30 to 40 per cent of a typical well did not contribute to production using this methodology. Thanks to advances in technology, companies can now strategically place treatments by modeling fractures and refining and reducing the actual materials required for the process.

For example, a completion and design software platform enhances field design, by modeling the fracture propagation to determine the optimal spacing for stimulation treatments. By stimulating sections of the reservoir with the most production potential, companies are eliminating unnecessary use of resources in sections that will not contribute to production.

Schlumberger has developed a number of technologies to improve production while reducing water and proppant requirements. These include a service platform that sequentially isolates fractures to ensure that every cluster in each zone is fractured and contributes to productivity. For example, flow-channel fracturing opens pathways in the fracture to enable the flow of hydrocarbons. This technique is now being used in one out of every four stimulation treatments Schlumberger pumps globally.

Modern chemistry has also enabled Schlumberger to conserve freshwater supplies through the use of brackish water and other water sources not viable as drinking water or for agricultural purposes. Schlumberger recycles and reuses as much produced water as possible for repeated stimulation treatments. This closed-loop system – use, recycle, reuse – reduces the hazardous-loop waste from water treatment and filtration, and helps limit the need for costly disposal wells.

In the offshore environment, our mobile water treatment system separates waste water from drilling fluids, which allows recovery and reuse of the drilling fluid. In addition, the water recovered from the treatment process meets the discharge limits for offshore discharge and therefore reduces the emissions associated with shipment of the waste back to shore for treatment.

Just as technological innovation has been key to revolutionising shale development, it will continue to play a critical role as the industry promotes a smarter, less-is-more philosophy going forward. Using an integrated, reservoir-centric approach that combines new methodologies, state-of-the-art technologies, modern chemistry and greater transparency is already proving to be effective in reducing resources and emissions. By continuing to build upon the advances already in place, the industry is poised to take global environmental stewardship to a new level by demonstrating that hydrocarbon recovery can be productive with a significantly reduced footprint.
Partnering with customers is the key to innovation

By Lisa Davis,
Siemens Board Member for Oil and Gas

Some 170 years ago, Werner von Siemens and Georg Halske tinkered with their ideas alone in a modest courtyard workshop in Berlin. Today, innovation processes have radically changed. They are far more collaborative and team-driven. At Siemens, we now depend on the concept of Open Innovation, based on the idea of working closely with our customers and external partners to jointly explore new areas for innovation. Our experts also venture outside the company to seek new partners in the highly creative start-up scene. Our goal? Enrich our own know-how with new ideas that drive innovation, help secure the success of our customers, and strengthen our own market position. We know, in the end, that when customers profit from our innovations, they will remain loyal to us – in both good times and bad.

When markets undergo challenging developments, innovative technologies can be the key to turning an industry around. Faced with falling oil prices, the oil and gas industry is now looking to technical solutions to cut costs and boost efficiency. When the price of oil began falling in mid 2014, the industry’s initial reaction was to cancel projects, postpone plans and make only urgently required investments. Today, US$45-50 per barrel has become the new reality, forcing the industry to search for new products, solutions, and business models that restore profitability and provide greater security against future crises. Seeing a crisis as an opportunity, not a catastrophe, leads to new ideas on how to survive – and profit – in a changing business arena. The oil and gas industry is now focusing on cost cuts and greater productivity while, of course, ensuring the highest safety standards.

The best way to find new solutions is to rely on processes that encourage all partners to contribute their respective industry and technical know-how. This pooled expertise can then be harnessed to develop the most efficient and cost-effective applications. Provided that the best ideas, practices and experience of all partners are used, there are many potential benefits. Flexibility, transparent processes and close cooperation are key to innovation. And they are essential for restoring and sustaining the success of all partners even against changing market conditions.

Create added value from upstream to downstream

By applying electrification and automation in the industry, new technical solutions are becoming available along the entire oil and gas energy value chain. Digitalisation not only further expands this potential, but opens up the way to completely new applications.

One excellent example for collaborative thinking, creative development and innovative implementation is the pressure-reducing station in Lubmin, Germany, located at the transfer point between the Nord Stream pipeline and the pipeline operated by Wingas, a long-standing lead customer of Siemens. The gas travelled for three days, and its pressure dropped to some 110 bar. In order to match the pressure specification of the pipeline system following the landfall, the gas is further expanded to 102 bar. In the case of the expansion of natural gas in a pipeline, measures have to be taken before the gas may travel on in order to avoid the freezing of pipes and appliances.

For heating natural gas at a pipeline facility, gas-powered boilers would be the natural choice. But there are ways to use energy in a more efficient and ecologically thoughtful way, such as using the 420 to 500 degrees Celsius waste heat of a gas turbine’s exhaust gas. In addition to providing heat, the gas turbine can also simultaneously generate electricity. In the case of the Lubmin station, enough electricity is produced to supply around 50,000 households with up to 200,000 megawatts a year. Two functions are thus intelligently combined to further increase the plant’s overall efficiency.

The heart of our solution is the new SGT-750 industrial gas turbine based on a holistic 3D design developed using Siemens PLM software NX and Teamcenter. Thanks to the turbine’s numerous sensors and data points, customers can keep track of its status via their access to product data and interfaces. Infrared cameras provide continuous online monitoring of critical rotating parts. And our Sinalytics platform enables us to guarantee continuous remote monitoring of the plant – around the clock, every day of the year. The turbine satisfies our customers’ key priority: guaranteed high efficiency and availability. Our engineers also focused on optimally reducing maintenance requirements. As a result, the turbine has an availability record of over 99 per cent. Requiring only 17 downtime days in 17 years of operation, we have designed a market leader.

Digitalisation as game changer

Most other industries have moved from electrification to automation to digitalisation, and are now implementing new technologies to further optimise operations and profit. The oil and gas industry, however, needs to catch up here, particularly with digitalisation. Today’s turbulent market landscape offers the industry an opportunity to boost its competitiveness by harnessing new technologies. It can learn from other sectors and adapt...
proven digital applications in its own systems. We can provide these applications. By collecting data and knowing how to analyse it, for instance, we can rapidly translate immense quantities of information into continually optimised operational decisions. This capability requires both extensive domain know-how and expertise in complex analytics. In the end, such digital support can be applied in all industry processes – from designing production facilities to optimising services. The more data generated by the whole system, the more possibilities there are to influence and improve individual processes within that system. This leads to safer processes and lower production costs, and ensures faster, more efficient and more reliable operations along the entire oil and gas value chain.

Greater efficiency thanks to additive manufacturing
Additive manufacturing, commonly known as 3D printing, is one of the most promising and innovative technologies of our time. Pointing to the future of manufacturing, this production method already merges the virtual and real worlds. In this process, parts made of plastics, metals or other materials are built up – added – layer by layer based on three-dimensional, software-generated plans. Thanks to the incremental process, forms can be created that would not be possible with traditional casting, milling or forging methods. The technology will not only revolutionise the supply of industrial parts, but enables the creation of completely new and highly complex component designs. At our facility in Finspong, Sweden, we use additive manufacturing to produce spare burner tips for gas turbines. The metal powder bed melting process has been used for years there, and has largely been taken over for the repair of burners, marking a revolution in the service sector. The first 3D-created spare burner heads for heavy-duty gas turbines are now in commercial operation, like at the Brunn CCPP in the Czech Republic. Advantages for the customer: higher flexibility and speed, lead time reduced by 75 per cent.

Modern software applications not only support the planning, operation and servicing of new or existing plants, but optimise their staff training as well. Today, an exact 3D depiction of an oil and gas installation can be visually experienced without ever having to set foot in the plant itself. One of our customers, Total E&P, used the immersive training simulator of our COMOS Walkinside to train field operators for its Pazflor FPSO. While Pazflor was making the three-month journey from a shipyard in South Korea to an oil field 150 kilometres off the coast of Angola, its future crew was being trained onshore in Angola. Once Pazflor arrived in place, the crew was immediately ready to begin work. In another example, digitalisation supports integrated operations for offshore platforms. For its Ivar Aasen project in the North Sea, Norwegian operator DetNorske wanted to keep the platform crew as few as possible and to largely monitor control platform operations from land. Our solution was to deliver an onshore remote operations centre with fully integrated electrical, automation and digital solutions for monitoring critical equipment and providing expert support based on real-time big data processing and analytics.

Security first
Along with the operation of a plant and safety of its crew, the protection of plant data generated by digitalisation processes is critically important. The oil and gas industry increasingly sees the need to give priority to cybersecurity. In fact, cyber – along with Health, Safety and Environment (HSE) and terrorism – has become a top concern for oil and gas executives. This concern has been further heightened by a spate of costly cyber-attacks in recent months, such as the mega event at Saudi Aramco when 35,000 computer terminals went down within just a few hours.

To counter such threats, the industry must focus and commit resources to integrate and push cyber vigilance across all enterprise levels. Companies have to rethink their security fundamentals and develop an industrial cyber security strategy. Moreover, they must install an effective cyber-governance model and establish infrastructure defences that include extensive cyber training. Siemens has led the way here by both securing our own products and by developing premium cyber security solutions to protect our oil and gas customers. IT security is one of the 10 key technology fields in which Siemens is conducting intensive research and development to advance the state of the art for industry. We are also contributing to standardisation and promoting the sharing of information and threat intelligence. We use these capabilities to assess risks, secure infrastructure, and develop solutions for ensuring secure data handling across all operations – from the field to the control centre and ultimately for the entire enterprise.

Open Innovation processes depend on combining the know-how of many partners and various industries, and on early and close collaboration among technology suppliers and customers. They help businesses develop and implement new ways to produce more cost-effectively, more efficiently and with greater security – even in challenging times. And the key rule here is clear: only those who are able to react with speed and agility to short-term or extreme market changes can maintain a competitive edge over the long term.
What challenges did you face in making it to the top of Hindustan Petroleum?
Since the day I joined Hindustan Petroleum Corporation Limited (HPCL) in July 1979, I have enjoyed each and every responsibility I was entrusted with. My focus has always been on learning, performing with passion and collaborative team-work to achieve excellence. When I look back, the downstream industry has evolved over the years in line with the dynamic changes and complexities of the market, and a number of innovative marketing and technology concepts have been introduced. Employees who performed, had the right attitude and demonstrated leadership capabilities were rewarded with personal promotion. There were job challenges at every stage, which I could overcome, with a firm belief that in order to succeed one has to take on challenges, manage risks and deliver excellence.

One major challenge faced was the roll-out, on a strict timetable, of an enterprise resource planning system, an integrated suite of applications to manage the business effectively and automate processes, at more than 450 locations across India covering over 4,000 users. This completely transformed business processes. Another challenge was to leverage technology for business growth and to transform the IT department from a back office support function to becoming a partner to all the business units. Today, all the financial, business and service delivery processes at HPCL are e-enabled. Challenges on the marketing front centred on growing the business at a time when crude prices hovered around US$100 per barrel, markets were volatile, the burden of subsidies was increasing and there was a slowdown in the market. Related to this were the challenges of developing supply chain and distribution infrastructure, at a time when there was monetary tightening and resource constraints, while also leveraging scale, nurturing talent, ensuring brand and service standards at distribution partners and building HPCL to be a customer-centric company.

What changes did you make at HPCL?
Given the buoyant market conditions and the increasing competition in the downstream sector business due to deregulation, the focus was on strengthening the company’s profitability with sustained growth. With profitability as a key focus area, a central Integrated Margin Management (IMM) system was created at HPCL for maximising the overall margins across the crude-to-customer value chain. A number of processes were institutionalised under IMM, and this new entity has started making significant savings for HPCL.

Another initiative towards cost optimisation was the centralisation of procurement activities to leverage the economies of scale, which has started yielding substantial savings for the corporation. With the deregulation of the downstream market and a positive outlook for GDP growth, India is expected to be a major destination market for major oil companies, which will result in a highly competitive market landscape in future. To continue to stay ahead of the competition and be a relevant and strong player in the future, we laid out a strong vision for HPCL. A detailed transformational exercise was undertaken at HPCL for...
identifying the growth aspirations under different scenarios and a long-term perspective plan up to 2030 was developed with a well-defined implementation process.

To give impetus to growth, strategic expansion and strengthening of infrastructure were identified as key focus areas which saw large capital investment and expansion of distribution and supply chain network. To participate in the emerging business of natural gas, a new business unit was created and processes put in place which helped HPCL foray into retail marketing of LNG for the first time. Technology was identified as a key competitive strength and a number of operational excellence and customer-centric initiatives leveraging technology were launched, and a state of the art R&D centre at Bengaluru was commissioned. Relentless pursuit of excellence and differentiation saw HPCL post its best ever refinery performance and lead the industry in growing market sales.

Employees are the mainstay of any organisation. A number of initiatives were undertaken to align the employees to the organisation’s objectives and to instil a culture of high performance. A unique programme, based on experience, to development leadership is being undertaken to create a ‘leadership pipeline’ at both senior and middle management levels. The performance management system was simplified, made transparent and aligned to the business objectives.

Your professional background was in marketing. Do you think oil and gas companies with substantial downstream and consumer-facing activities like HPCL tend to attract more women than companies focused on exploration and production? Or is the oil and gas industry becoming less of a male bastion in general?

Yes, to the second question. Over the past few decades the oil and gas industry has evolved significantly and offers a wide range of career options to women. The latter have made inroads in both upstream and downstream oil industry and are increasingly breaking gender stereotypes by taking on every kind of responsibility. At HPCL, women employees constitute around 8 per cent of the total workforce and we have seen a consistent increase of females in new recruits every year. Over the last 4 years, about 12 per cent of the new officers who joined HPCL were women. In contrast to earlier times, when women preferred roles in finance and human resources, today they are increasingly enrolling in various branches of engineering and taking up leadership roles across functions in sales, refineries, projects and operations that were traditionally a male bastion in downstream companies. Similarly, in upstream companies, women are being positioned in the mainstream functions and not restricted to support functions of human resources and finance. I am hopeful that we will see many more women working in field jobs in upstream companies in the future. In summary, growth opportunities are increasing and as long as the women in the industry give their best as professionals, they will get due recognition.

How essential are good data systems – which you helped modernise at HPCL – in a country as large and as complex as India?

Digitalisation is considered critical for speeding up economic development. Technology-based solutions enable developing countries like ours to leapfrog over some constraints imposed by lack of physical infrastructure. In this direction, the government’s ‘Digital India’ programme offers technology-enabled inclusive growth which addresses various challenges being faced by the country in a sustainable way. In the downstream sector, technology infrastructure and robust data systems are necessary to improve productivity, transparency and efficiency across all spheres of operations and provide a sustained competitive advantage. A multitude of IT solutions have been developed and institutionalised at HPCL to enable managers to do their job effectively. Various technology-based solutions have been implemented to help consumers and business partners carry out transactions easily and to bring better visibility of information to all stakeholders. IT systems have helped HPCL to develop a decision-making culture, based on data and facts.
Two recent landmark agreements will heavily influence the global energy strategy and its planning for the coming decades: the September 2015 approval of the 2030 Sustainable Development Goals (SDGs) and the Paris Agreement under the United Nations Framework Convention on Climate Change reached in December 2015.

One fundamental aspect of the post-2015 development agenda is the placing of energy at its centre, something that OFID and like-minded institutions achieved by working diligently together under the umbrella of Sustainable Energy for All (SE4ALL), an initiative from the UN Secretary General supervised by a board of 48 members including multinational oil and gas companies, OFID and others. The objectives of SE4ALL are to ensure universal access to modern energy services, double the global rate of improvement in energy efficiency, and double the share of renewable energy in the global energy mix by 2030. All of the three goals serve the purpose of complementing the Paris Agreement’s emphasis on climate change mitigation. For instance, embracing the transition to modern energy sources with regard to clean cooking reduces both deforestation and atmospheric pollution, and expanding electricity access using renewables in decentralised locations can help lower emissions.

In approving the 17 SDGs, the UN General Assembly endorsed a more participatory approach similar to what had been demonstrated to work under SE4ALL. In other words, the agenda was shaped not just by governments but also by consultations with the private sector and civil society. This method represented a departure from the UN’s previous Millennium Development Goals which were formulated by developed nations. The new SDGs now include both developing and developed countries working together to achieve universal goals.

OFID and energy access
This spirit of collaboration constitutes the core of OFID’s energy access approach which includes oil and gas companies to engage them in the discussion to achieve Sustainable Development Goal 7 (to ensure access to affordable, reliable, sustainable and modern energy for all). The overall goal is to leverage the enormous potential of the industry, to build upon its leadership, technology and much relevant business experience, and at the same time, to provide a platform for oil and gas companies to collaborate with other stakeholders on specific action focused on energy access.

OFID’s support for such initiatives constitutes a part of its 2012 Ministerial Declaration on Energy Poverty, which included a US$1 billion revolving endowment that funds energy access projects for the energy poor in developing countries. This commitment translated the will of the summit of the heads of states of OPEC Member Countries in Riyadh in 2007, which identified energy poverty eradication as a key solution to alleviating poverty in general and has mandated OFID and other OPEC aid institutions “to work towards that aim and study the ways and means of enhancing this endeavour in association with the energy industry and other financial institutions.”

To facilitate the implementation of the above mandate and disbursement of the committed amounts, OFID signed several MOUs with multi-lateral development banks, financed common projects with commercial banks and extended a series of grants to NGOs, in addition to the following two major efforts:
• Leading a Task Force on Energy of the members of the Arab Coordination Group (ACG) working together with the OECD Development Assistance Committee. This task force was established to determine the feasibility of the two groups partnering to reduce energy poverty in sub-Saharan Africa.

By Faris Hasan, Director, OPEC Fund for International Development
• Acting as a key participant in the ‘deep dive’ process, through which the ACG and the World Bank Group agreed to consult on enhancing their cooperation in achieving SDG 7, and providing analytical and financial resources for its implementation in 21 sub-Saharan countries.

Oil and gas industry cooperation
This work with financial institutions gave OFID a head start in fulfilling the other half of the mandate: to cooperate with the energy industry, in particular with the oil and gas sectors. OFID, together with the World Petroleum Council (WPC) worked on the preparation for a symposium to introduce a proposed Oil and Gas Industry Energy Access Platform (EAP) with the following main objectives:

• Share best practices, data and disseminate knowledge about energy access solutions,
• Leverage industry capabilities to support access to energy,
• Help the industry identify corporate social responsibility opportunities in host countries, and harmonise robust, practical and cost-effective approaches for facing energy access challenges,
• Foster communication within the industry on energy access solutions,
• Contribute to better integrate energy access in policies and projects at country level.

EAP working areas
As the oil and gas Industry has adopted corporate social responsibility as part of its business to address the social challenges of its host communities, there is an increasing focus in addressing energy poverty. This is important particularly in developing countries, as access to affordable modern energy is critical to foster local economic development and attain sustainable development. EAP members are promoting activities in several areas, including:

• Clean cooking solutions including liquid petroleum gas (LPG),
• Mini-grid solutions,
• Utilisation of gas flaring from oil production facilities for energy access,
• Distribution of off-grid electricity products,
• Gas to power for communities,
• Ecosystem and markets, such as local content, skill development, supply chain assessment, assessment of the local needs.

The EAP provides for the engagement in specific solutions or in the design of shared roadmaps; gaining clearer understanding of potential solutions and new options in order to develop and share them. Additionally, EAP members discuss their work on specific initiatives such as the Zero Routine Flaring by 2030 Initiative, the Climate and Clean Air Coalition, the Oil and Gas Climate Initiative, or partnerships with governments as well as other international bodies and industries.

EAP general principles
The following principles reflect elements that companies consider when engaging in the EAP and inform all activities under the EAP:

• The facilitation of inter-stakeholder dialogue allows for the exchange of experiences, critical factors, and issues with regard to energy access projects, facilitating collective learning and improved knowledge management.
• The Identification of possible synergies between EAP member programmes and projects and exchange on specific areas with potential for cooperation and synergy in order to maximise the value added and ensure high leverage, effectiveness and efficiency.
• While members joining the EAP can work together, they individually define the work plan of their own contributions, in recognition of their different capacities and circumstances.
• The collaborative approach offered by the EAP does not impact its members’ ability to develop and support their individual programmes focused on access to energy, according to their business portfolios.

Co-operative initiatives like the EAP help realise both the SDGs and the Paris climate agreement. Furthermore, by bringing oil and gas companies to the same table, together with other stakeholders the EAP provides a two-fold benefit: an improvement in the quality of life by reducing energy poverty and strengthened global economic security. That is why pioneering companies like Total, Shell, Schlumberger and OMV have already joined the platform, and are working together with OFID, WPC, IGU and GLPG as well as others like the Shell foundation to be the nucleus to draw other visionary companies to this opportune platform.
Climate change affects the political and social environment in which the industry operates and presents risks to our markets, infrastructure, and people. Historically, IPIECA has been a catalyst in bringing the industry together to focus on climate change issues to facilitate broader understanding and enable companies to improve. Our vision is for an industry that improves its performance in line with society’s expectations. IPIECA established its Climate Change Working Group in 1988 and since then, the group has monitored climate science and policy discussions, engaging with international processes and stakeholders, including leading industry engagement with the United Nations Framework Convention on Climate Change (UNFCCC) as well as the Intergovernmental Panel on Climate Change (IPCC). It particularly focuses on providing best practice guidance on greenhouse gas (GHG) emissions monitoring, reporting and management, covering areas such as energy efficiency, flaring reductions and raising the standards and transparency of reporting. IPIECA also has a track record of convening expert workshops to explore key climate-related issues and inform both the industry and stakeholders.

Most recently, IPIECA’s work on climate has included:

**Low-emissions pathways**
- Our ongoing work following the successful outcome of the Paris Agreement at COP-21 has included a workshop on low-emissions pathways, which focused in detail on the outcomes from Paris, including countries’ mitigation pledges, the gap to reaching a well-below-2°C goal, the role of carbon markets, and the UN Sustainable Development Goals. Low-emission pathways and the prospects for various technologies that would be necessary, including renewables, batteries, electric vehicles, nuclear power and carbon capture and storage (CCS) were also explored. Our work will continue over a multiyear work programme.

**Reporting**
- A pilot climate reporting framework, which provides voluntary guidance for oil and gas companies when developing climate-related corporate sustainability reports. The framework was prepared in support of the IPIECA/API/IOGP Oil and gas industry guidance on voluntary sustainability reporting.

**What is IPIECA?**
IPIECA is the global oil and gas industry association for environmental and social issues. IPIECA was formed in 1974 following the launch of the United Nations Environment Programme (UNEP). IPIECA is the only global association involving both the upstream and downstream oil and gas industry, and is the industry’s principal channel of communication with the United Nations. Our membership covers over half of the world’s oil production.

IPIECA helps the oil and gas industry improve its environmental and social performance by:
- Developing, sharing and promoting good practices and solutions.
- Enhancing and communicating knowledge and understanding.
- Engaging members and others in the industry.
- Working in partnership with key stakeholders.

Through its member-led working groups, IPIECA brings together the collective knowledge and expertise of oil and gas companies and associations. The working groups draw on the skills and experience of our international membership and operate with support from a secretariat. IPIECA currently has working groups that address the following areas: biodiversity, climate change, fuels and products, health, oil spill preparedness, reporting, social responsibility, and water.

- The IPIECA/API Estimating petroleum industry value chain greenhouse gas emissions – an overview of methodologies to inform the industry on value chain GHG emissions estimation and approaches.
- The IPIECA/API guidance document on Addressing uncertainty in oil and natural gas industry greenhouse gas inventories. This two-part guide summarises the technical considerations important for understanding and calculating GHG emission inventory uncertainty.

**Methane**
- IPIECA’s factsheet on methane emissions in June 2015, which explores methane emissions and their wider implications, and the associated challenges,
opportunities and continuing efforts within the oil and gas industry to address them.
• An IPIECA/OGCI (Oil and Gas Climate Initiative) workshop looking at methane data and studies from natural gas supply chains in North America and beyond, particularly focusing on the similarities and differences to that region and where hotspots and gaps in knowledge may lie.
• The current development of guidance on definitions, terminology and methane management.

IPIECA welcomes the Paris Agreement
Global leaders reached a historic agreement on the reduction of GHG emissions at the UNFCCC Climate Change Conference (COP-21) in Paris in December of last year. IPIECA welcomed the Paris Agreement, seeing it as a crucial step in global efforts to address climate change. It is the culmination of six years of work by nations to reach a new agreement, during which efforts deployed by all stakeholders – governments, business and civil society – have intensified and contributed to reaching an ambitious outcome.

IPIECA had called for an effective and clear agreement as part of its Paris Puzzle communication in the run-up to COP-21. The Agreement is an important milestone that will send a strong signal going forward, but more work and action by all stakeholders will be needed going forward.

A pathway to a low-emissions future
We believe it is possible to address climate change risks whilst also meeting growing global energy demand and supporting economic development, and the oil and gas industry must be a key part of the solution.

IPIECA supports the Paris climate agreement as an important milestone in tackling climate change
on the challenge. The series of six papers address what we see as key components of efforts to address climate change, and demonstrate the industry’s commitment to meeting the challenge.

Much more needs to be done to address climate change. With the right policy frameworks and enablers to encourage investment in transforming technology, the public and private sectors and civil society can cooperate to achieve effective solutions.

Sharing the oil and gas industry’s expertise and vision
The industry’s history of innovation, global reach, knowledge and technical expertise positions it to help develop and provide credible future energy solutions. At IPIECA, we believe that the industry is already playing a part in this transition and will continue to do so, by improving the efficiency of existing technologies and resources, and contributing to the development of new ones.

We see the role of natural gas, government-led market mechanisms, carbon capture and storage, and the use of lower carbon fuels, together with effective policy mechanisms, as the necessary components in any practical response to address GHG emissions, and deliver on the goals set by the Paris Agreement.

Climate change will continue to be a key priority for IPIECA throughout 2016 and beyond.

The IPIECA Paris Puzzle: The pathway to a low-emissions future

- IPIECA recognises that addressing the risks of climate change is a challenge for our generation and will be for those to come. Meeting the challenge will require actions from all parts of society. Significant policy action, technology development and business response will be needed over many decades. The oil and gas industry can play a key role in helping society to meet the challenge.
- IPIECA supports and encourages governments in their efforts to reach an effective and clear international agreement to reduce greenhouse gas emissions and to manage the risks of climate change.
- IPIECA believes it is possible to address climate change risks while also meeting growing global energy demand and supporting economic development. As an industry we are already taking a range of actions across our own operations and products to support these goals.

IPIECA has published fact sheets on a range of emissions-related topics, including:
- Meeting energy needs: The unique role of oil and gas;
- Effective policy: The driver of results;
- Managing our emissions: Energy conservation and beyond;
- Natural gas: Into the future; and
- Carbon capture and storage: A key technology for delivering a low-emissions world;

What is the Paris Agreement?

The Agreement reached at COP-21, for the first time committed all countries to undertake action on climate change and report on their progress.

The Agreement:
- “Aims to strengthen the global response to the threat of climate change... by holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels”;
- aims to peak GHG emissions as soon as possible and reach net-zero in the second half of the century;
- commits all countries to regular reporting, including on mitigation, adaptation and finance;
- agrees five-yearly cycles for increasing national plans and targets starting in 2020, supported by global stock-takes (from 2018) to assess progress;
- makes commitments in climate finance, setting US$100 billion per annum as the floor for financial transfers from developed to developing countries from 2020; and
- introduces the foundation to support the development of global carbon emissions markets through trading mitigation actions, and incentivises clean development.
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Phasing out routine flaring and putting the gas to productive use

By Dr Pierce Riemer
Director General, World Petroleum Council

In the 1990s I worked on a methane venting flaring reduction programme with the IEA, World Bank and industry partners. At that time, just Africa – and mainly Nigeria – flared and vented more natural gas than Europe consumed every year. The project only lasted a few years, but satellite photographs showed some significant early results.

But we remain concerned about the waste of flaring and its impact on the climate, because although the emissions are now only the equivalent of 25 per cent of what Europe consumes, Europe is consuming much more than it did in the 1990s. Thousands of gas flares at oil production sites around the globe still burn approximately 140 billion cubic metres of natural gas annually, causing more than 300 million tons of CO₂ to be emitted into the atmosphere.

To try to phase out this habitual flaring of gas for other than safety or technical reasons, the United Nations and the World Bank last year introduced the “Zero Routine Flaring by 2030” initiative. This has now won the endorsement of some 20 governments, an equal number of oil companies with the active encouragement of the WPC, and more than a dozen leading development aid agencies.

By way of explanation of the problem, it should be remembered that natural gas is a mixture of several hydrocarbon gases, including methane (normally around 90 per cent), ethane, propane, butane and pentane, as well as carbon dioxide, nitrogen and hydrogen sulphide. The composition of natural gas can vary widely, depending on the oil or gas field. Natural gas is referred to as “wet” when hydrocarbons other than methane are present, “dry” when it is almost pure methane, and “sour” when it contains significant amounts of hydrogen sulphide.

During conventional and unconventional oil production, associated gas is produced from the reservoir together with the oil. Much of this gas (mostly methane) is now utilised or conserved because governments and oil companies have made substantial investments to capture it. Nevertheless, some of it is flared because of safety, technical, regulatory, or economic constraints.

Flaring of gas contributes to climate change and impacts the environment through emissions of CO₂, black carbon and other pollutants. It also wastes a valuable energy resource that could be used to advance the sustainable development of producing countries. For example, if this amount of gas were used for power generation, it could provide about 750 billion kWh of electricity, or more than the African continent’s current annual electricity consumption. While associated gas cannot always be used to produce power, it can often be used in a number of other productive ways or conserved (for instance, re-injected into an underground formation).

The “Zero Routine Flaring” brings together governments, oil companies, and development institutions which recognise the flaring situation described above is unsustainable from a resource management and environmental perspective, and which agree to cooperate to eliminate routine flaring no later than 2030.

The Initiative pertains to routine flaring and not to flaring for safety reasons or non-routine flaring, which nevertheless should be minimised. Routine flaring of gas is flaring during normal oil production operations in the absence of sufficient facilities or amenable geology to re-inject the produced gas, utilise it on-site, or dispatch it to a market. Venting is not an acceptable substitute for flaring, because uncombusted methane is an even more powerful greenhouse gas than flared gas.

Viable markets needed for the gas

Governments that endorse the Initiative undertake to provide a legal, regulatory, investment, and operating environment that is conducive to upstream investments and to the development of viable markets for utilisation of the gas, and the infrastructure necessary to deliver the gas to these markets. This will provide companies the confidence and incentive to invest in flare elimination solutions. Governments will require, and stipulate in their new prospect offers, that field development plans for new oil fields incorporate sustainable utilisation or conservation of the field’s associated gas without routine flaring. Furthermore, governments will make every effort to ensure that routine flaring at existing oil fields ends as soon as possible, and no later than 2030.

Oil companies that endorse the Initiative will develop new oil fields they operate according to plans that incorporate sustainable utilisation or conservation of the field’s associated gas without routine flaring. Oil companies with routine flaring at existing oil fields they operate will seek to implement economically viable solutions to eliminate this legacy flaring as soon as possible, and no later than 2030.

Development institutions that endorse the Initiative will seek to facilitate its implementation through the use of financial instruments and other measures, particularly in their client countries. They will endeavour to do so also in client countries that have not endorsed the Initiative.

Governments and oil companies that endorse the Initiative
will publicly report their flaring and progress towards the Initiative on an annual basis. They also agree to the World Bank aggregating and reporting figures on flaring.

Representing the WPC, we were in Paris for the COP21 climate conference to put forward our point of view. We support and encourage governments and all stakeholders in their efforts to reduce greenhouse gas emissions and manage the risks of climate change. We also appreciate that they have a challenge ahead to meet their growing populations’ energy demands and support economic development in their countries.

Our global membership will have a role to play in the transition to a low-carbon future. With oil as the main fuel for transport around the world, it will remain a key part of the energy mix while alternative technologies continue to be developed further. We also must not forget all of the oil and gas based items, around us every day, such as pharmaceuticals, clothing, polymers, fertilisers – the list is endless.

In cooperation with the OPEC Fund for International Development (OFID), WPC is working to showcase how the oil and gas industry is helping to bring people out of energy poverty in order to achieve the Sustainable Energy for All goal of the UN. This fits in nicely in an environment, particularly in Africa, where any methane saved from flaring could be utilised for power generation, for use as a compressed or liquefied gas, or converted to chemicals.

We were also in Paris to lend our support to this World Bank initiative. The well attended COP side meeting highlighted the high number of WPC member countries that have already signed up to the Initiative and illustrated how well this fits in with our energy poverty alleviation work.

The oil and gas sector has the technical know-how to develop solutions which will have an important part to play in contributing to a sustainable energy future and we will help all stakeholders meet the challenges ahead. For hundreds of years, energy has enabled growth which has led to economic and social wellbeing. Our challenge for the future is to achieve this in a clean and sustainable manner. We are all committed to playing our part.

*The aim is to eliminate all routine flaring of natural gas by 2030 to reduce emissions*
Host governments increasingly impose local content policies (LCPs) to try to gain as much economic and social benefit as possible from their oil and gas reserves, beyond just extracting taxes and royalties from oil and gas companies. Governments of country members of the World Trade Organisation are not allowed to have overly restrictive regulations in this regard. Nonetheless, the local content issue often puts them at odds with companies, whose traditional approach is to “do the minimal possible to be in compliance.” Very often this situation creates insoluble conflicts; governments want more local content in equipment and employment, while the international oil companies want less, particularly when they are under market pressure to be more cost-efficient.

What is the correct way forward, and the correct attitude, to prevent a worsening of this conflict? How can we reverse the gathering momentum of LCPs in order to create a more fruitful form of cooperation?

Firstly, parties must reconsider their standpoint and better align their collective interests. It is not difficult to understand that a common interest exists. An oil and gas reserve in its original form has no value, neither for governments nor for oil companies. Both parties have a basic interest to explore, and to produce something useful for the market. Both parties have an interest to do this as effectively and as efficiently as possible, and in a controlled and regulated manner. Efficiency is in the interest of the government because the more efficient a company, the more competitive it is, and the higher its potential profit, for eventual distribution between the state and the company.

It is realistic for both parties to want the host country’s industry and services to be developed, and for work possibilities for local people to be increased. It is also quite obvious that certain imported products and services can be extremely expensive (for instance, expatriate employees), and this increases so-called “cost oil” expenses, reducing an oil company’s earnings and the host country’s tax revenue.

In addition, stable and well established rules and regulations can help companies to continuously improve their processes and performance. In such circumstances, local employment is beneficial, and its development a critical factor for success. But to identify and utilise the common interests of governments and oil companies, collaboration and close cooperation is an absolute necessity.

Very often a lack of cooperation, and poor communication, results in a lose-lose situation, widening the gap between the two parties. The host government introduces more restrictions and bureaucracy focusing on compulsory targets (set percentages of local services and employees), and then financially penalises non-fulfilment of these targets. On the other side of the fence, oil companies try to minimise their activity in order to fulfil their obligations defined in the LCPs.

While I do not believe there is a general solution, or a well-functioning recipe that can be applied to every case, I would like to pick up on an element that I consider to be one of the most important of these LCPs. It is also the most long-lasting and difficult to change: the need for local expertise and local management to be employed, and for local services to be used.

In many cases, the quality of services and employees currently does not exist. This leads to a “catch-22.” Local workers don’t get jobs because they don’t have the expertise, but they cannot get the expertise because they are not being given the jobs.

The solution to this situation can be found by looking outside of our particular industry. Both the petroleum industry and governments could learn much from more manpower-intensive industries such as car manufacturing. A good example can be found in how the car manufacturing industry has boomed in central and eastern Europe.

Slovakia is today the biggest car manufacturer in the world, based on production of cars per capita, and its neighbour, Hungary, is also among the top players. Things didn’t start this way. In the beginning the situation was poor, but in many cases car manufacturers participated intensively in local high school and university education – even though high-quality basic education was, and is, the fundamental task of the local government. Input from both players was very much needed for the industry to acquire correctly qualified workers. Of course, the beginning was difficult and at first more ‘expats’ were needed to start, and then build up, production.

At that time the Slovak government had to tolerate a low level of local content and, additionally, support the necessary steps to boost the education system. After some years, however, the common efforts paid off. Not only was the local content, the number of local employees and local services increased, but companies successfully trained highly-qualified experts who can now be sent to production facilities in other countries.
Almost all oil companies have their own recruitment and introductory programme for fresh graduates. MOL Group has its international 'Growww' programme that takes newcomers, from all countries where MOL operates, and provides intensive classroom and on-the-job training in their first year.

To find the best candidates before graduation, and particularly to increase their knowledge, in some countries university departments were established and these have been partly, or completely, financed by the company.

One further element of local content policies is unavoidable today – namely, society’s expectations of company behaviour. Expectations related to corporate responsibility are growing in developed countries. They are even clearer in less developed ones, where most of the oil and gas reserves are found. In these countries, company contributions to infrastructure development, or healthcare system improvement, are expected.

The key factor for success is to tailor the local content programme to the specific needs and capabilities of the company and the country. Close collaboration is a must between the partners. It requires an understanding of each other’s priorities and goals, and the willingness to remain flexible when finding the means to meet these goals.

Ultimately, successful collaboration between companies and host countries will be based on flexibility, transparency, and good faith. Without these elements, no local content policy will reach its goal, and will instead be a curse placed on everyone.
Bapco is a unique company, which has never stood still. The first to discover oil in the Arabian Peninsula in 1932, it started exporting in 1934 and refining in 1936. Since then, it has expanded into refining, distribution of petroleum products and natural gas, sales and exports of crude oil and refined products. In the course of this expansion, it has become a leading environment, health and safety champion regionally.

Bapco is committed to the protection of the environment, which it integrates under one umbrella with occupational health and process safety, endeavouring to create a zero-harm and incident-free workplace. Key to this was Bapco’s adoption in the early 1990s of Process Safety Management (PSM), which has become the cornerstone of its safety culture.

Following a series of catastrophic accidents in the petroleum and petrochemical industries in the 1970s and 1980s (Flixborough, Seveso, Bhopal, Piper Alpha and others), it became clear to safety regulatory bodies in the US, Europe and elsewhere that a fresh approach to safety was vital to avoid recurrences of these major, high-consequence incidents. Investigation of these incidents indicated that the safety concepts then existing, in the form of prescriptive legislation and a reactive approach to the management of Health and Safety in industry were ineffective, and failed to ensure the active participation of all employees in the creation of a positive safety culture.

In order to create this culture, Bapco carefully reviewed many new safety management systems that existed then, and one of the approaches that we adopted was the PSM system. The reason for this was that we as an oil and gas organisation had exerted most of our efforts around personnel safety and the prevention of injuries, and that we had not really addressed process safety with the same aggressiveness and focus as personal safety. We realised the need to involve all of our employees and those of our contractors in our safety programmes.

We realised only by drawing on the vast and diverse knowledge and experience of all of our employees and by channeling this into a company-wide atmosphere of safety awareness would success be achieved. This systematic approach identified the strengths of the organisation and those areas or systems requiring improvement. Once these were identified, a comprehensive safety management system aimed at the proactive identification, evaluation and control of hazards was created, together with the means to measure and quantify its effectiveness and contribution to the profitability and continuity of the business.

We soon realised that PSM could only be effectively implemented if we were able to diligently assess and identify risks and hazards associated with our operations; to put in place effective control measures that were regularly monitored; to have in place comprehensive and robust health and safety programmes; to engage senior and middle management in showing support and involvement in safety programmes; to ensure a high level of participation by all employees and contractors; to establish robust and meaningful audit and review mechanisms; and to measure our performance through a set of leading and lagging indicators.

The 12 elements of process safety management

After a comprehensive assessment of the gaps in our systems, we chose the following elements to help us to augment and strengthen our management of health and safety.

**Process Safety Information (PSI)**

Plants should have accurately documented information on hazardous materials, process technology and design of process equipment. This information is essential for process hazard analysis and should be readily accessible to appropriate personnel in the operations, maintenance, inspection and engineering departments.

**Process Hazard Analysis (PHA)**

A process hazard analysis should be performed for any facility subject to the PSM programme. A PHA involves a systematic review of a process to identify possible hazards, evaluate possible consequences and determine whether the existing systems and procedures provide adequate control and protection.

**Operating Procedures**

Plants should have written operation procedures specifying conditions and steps for each phase of an operation, the consequences of deviation from these instructions and steps to make corrections. It should also document hazards arising from materials used during the process and specify precautions to take as well as control measures in the event of a hazardous release or exposure.

**Health and Safety Training**

Training and refresher training must be provided to all workers who are currently involved in a process and also to those who are newly assigned. The training should cover the basic knowledge required for the process and emphasise specific safety and health requirements, as well as procedures to be followed during emergency operations.
Contractors Safety
It is essential that contractors know and understand the hazards of working in a process. The contractor management team has a responsibility to identify potential hazards associated with the company’s work and should make the contractors aware of hazards. Training of contractor personnel and facility safety procedures help protect the facility and employees.

Pre-Startup Safety Reviews
The purpose of Pre-Startup Safety Reviews (PSSR) is to verify that all elements required for safe operation of the process have been properly addressed prior to startup. This ensures that the construction is in accordance with the design specifications, all necessary procedures for safe operation are completed, the applicable PSI is up-to-date, personnel responsible for operating and maintaining the process are properly trained, and all the recommendations made during the PHA have been clearly addressed.

Mechanical Integrity
The purpose of the Mechanical Integrity assessment is to ensure that equipment is in a condition suitable for its intended service for the specified duration of service. Mechanical integrity is accomplished through written maintenance and inspection procedures, employee training and qualification, and quality assurance procedures.

Safe Work Practice
The objective of the Safe Work Practice element is to provide for the safe conduct of operations, maintenance and modification activities, especially the opening of process equipment or piping, lock-out of electrical and mechanical energy sources as well as work that involves ignition sources, entry into confined spaces, and use of heavy equipment.

Management of Change (MOC)
The purpose of this element is to ensure that change is reviewed with the same degree of care and skill as the original design of the plant, and to prevent introduction of new, uncontrollable hazards into the workplace.

Incident Investigation
The objective of the Incident Investigation is to systematically identify the fundamental cause of process-related incidents and develop and implement corrective measures to prevent recurrences.

Emergency Planning and Response
An emergency action plan and an emergency control centre should be established to ensure that the facility is prepared to react, control, and mitigate events arising from a process or equipment failure. Each facility should strive to be self-sufficient in terms of emergency response, using the services of outside agencies only as backup or in the event of a catastrophe.

Audit
The purpose of the audit element is to provide periodic feedback to the management on the adequacy and effectiveness of the PSM system. Based on the audit findings, the management can relocate resources and redirect emphasis as necessary to improve the overall effectiveness of PSM.

Checking on effectiveness
To continuously improve upon process safety performance, it was essential for us to implement effective leading and lagging process safety matrices. To enable us to benchmark our performance against other industries and to be in line with industry best practices, we decided to utilise the guide issued by Center for Chemical Process Safety (CCPS) to measure and classify our process safety incidents. We also wanted to make sure that our performance was transparent and accessible to the whole organisation. So we created one of the most elaborate and comprehensive HSE Dashboards, which enables us to drill down and make comparisons with previous years. This data is now reviewed and analysed on a daily basis by line managers and on a monthly basis by senior management, the review enables them to look at areas of concern where improvements are required.

One of the major recent initiatives that we have decided to implement was to integrate all of our interrelated HSE procedures, programmes and processes under a unified system called Operational Excellence Management System (OEMS) which is based on a Chevron model. OEMS is the Systematic Management of process safety, personal safety and health, environment, reliability and efficiency to achieve world class performance. OEMS is another system that we voluntarily chose to adopt and implement because it is designed to integrate and align all current HSE systems under one unified structure and matrices. OEMS truly enabled us to involve the whole organisation by making company departments and individuals accountable for its implementation. It also created a strong sense of pride and ownership. No longer do we talk about HSE management being owned and managed by one department – now there is collective and collaborative responsibility, and all of us are stakeholders and must see to its success.
As a non-advocacy, non-political organisation the World Petroleum Council (WPC) has accreditation from the United Nations (UN) as a non-governmental organisation (NGO) and is registered as a charity under UK law. WPC is dedicated to the promotion of sustainable management and use of the world’s petroleum resources for the benefit for all. WPC conducts the triennial World Petroleum Congress, covering all aspects of the industry, including management of the industry and its social, economic and environmental impact.

**Vision**
An enhanced understanding and image of the oil and gas sector’s contribution to sustainable development.

**Mission**
The World Petroleum Council is the only organisation representing the global oil and gas community. WPC’s core value and purpose centres on sustaining and improving the lives of people around the world through:
- Enhanced understanding of issues and challenges
- Networking opportunities in global forums
- A neutral platform for dialogue with all stakeholders
- Cooperation and partnerships with other organisations
- An opportunity to showcase the industry and demonstrate best practice
- A forum for developing business opportunities
- Information dissemination via congresses, reports, special meetings and workshops
- Initiatives for recruiting and retaining expertise and skills to the industry
- Awareness of environmental issues, conservation of energy and sustainable solutions
- Engaging the next generation

**Values**
WPC values strongly:
- Respect for individuals and cultures worldwide
- Unbiased and objective views
- Integrity
- Transparency
- Good governance
- A positive perception of energy from petroleum
- Science and technology
- The views of all stakeholders
- The management of the world’s petroleum resources for the benefit of all

**Key strategic areas**
- **World Class Congress** to deliver a quality, premier oil and gas congress
- **Inter-congress activities** to organise forums for cooperation and other activities on specific topics; and to engage WPC members and all stakeholders
- **Cooperation with other stakeholders** to add value by cooperating with other organisations to seek synergies and promote best practice
- **Communication** to increase awareness of WPC’s activities and oil and gas operations, through enhanced communication, both internally and externally
- **Global representation** to attract and retain worldwide involvement in WPC
- **Youth and gender engagement** to increase the participation of young people and women in oil and gas issues, including a dedicated Committee for the development of active networking opportunities with young professionals
- **Legacy** to manage a central WPC legacy fund to benefit communities and individuals around the world, based on WPC’s mission.

### World Petroleum Congresses

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<tr>
<th>Year</th>
<th>Congress Location</th>
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<tbody>
<tr>
<td>2017</td>
<td>22nd WPC Istanbul</td>
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<tr>
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<td>1933</td>
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A Confident Future Starts in Vancouver

Naturally Progressive: Creating a Sustainable Future Together
“What is Petrobras doing to improve its management?”

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