

Energy & Resources Predictions 2012



Contents

Foreword	1
And you thought gold was expensive? Prices of rare earth metals to remain high, but volatile	2
Is a bigger oil company better? Are demergers likely to increase amongst integrated international oil companies?	3
The future is getting smaller The coming energy breakthroughs using nanotechnologies	4
The 'Golden Age of Gas' One scenario for future natural gas markets	6
The corporate water footprint The next 'tipping point' for energy companies	8
Who owns the Arctic and the South China Sea? The emergence of the new geopolitical risk paradigm	10
A dynamic duo Solar-enhanced oil recovery	12
The consumer has spoken Energy use and the great recession of 2008-2009	13
Learning to love complexity The future of oil field services	15
Piracy on the high seas Now it's for real	16
Contacts	18

Foreword

Welcome to our 2012 Energy & Resources Predictions report.

This is the third year in which we have published our predictions for the year ahead.

Over the last 12 months, there has been no shortage of themes impacting energy and resources globally. These themes are diverse as they are geographically dispersed.

February was the start of the 'Arab Spring' with the largest impact on oil markets being felt in Libya. Libya is Africa's third largest oil-producer but in the five months since the civil war began, crude production has dropped from 1.6 million b/d to less than 100,000 b/d. Libya's domestic consumption is estimated at 270,000 b/d, and over 85% of Libya's light, sweet crude was exported to Europe before the unrest. The International Energy Agency has predicted that Libya's crude output will not recover to pre-crisis levels until 2015. Since the conflict began in February, global markets have lost an estimated 145 million barrels of Libyan oil according to some estimates leading to triple digit prices for both Brent and WTI.

The Japanese earthquake in March reignited the heated debate over whether nuclear power will ever experience a renewed renaissance. In a June referendum, Italy's government rejected plans to build new nuclear plants; in Switzerland, the government voted to phase out its 3,049 MW worth of nuclear reactors by 2034; and Germany's parliament voted to phase out the nuclear fleet, which supplies over 20% of its electricity, by 2022. On the other hand, the US Nuclear Regulatory Commission in July concluded that there is "no imminent threat" to the safety to the US's 104 operating nuclear reactors, and the UK appears to be continuing to move towards a period of nuclear new-build.

Rising global commodity prices – which are due in part to rapidly-growing Chinese demand – have fed into industry's costs in China. China's voracious appetite for all classes of raw materials has forced mining commodity prices upward, leading to generally improved profits at mining companies but potentially setting the stage for a future pricing correction.

A new focus on water has appeared, in what many are calling a "water footprint." A water footprint is an indicator of water use that looks at both direct and indirect water use of a consumer or producer. Discussion and debate on corporate water footprints is likely to become one of the key themes throughout 2012.

Rather than focusing on the predictions themselves, companies and their management teams should consider the underlying issues that makeup these predictions and how they might help to formulate future strategy. These issues should stimulate debate, inform possible options and may even help identify potential courses of action.

I hope you enjoy reading this years' Energy & Resources Predictions report. Should you wish to discuss any of these issues in more detail, or provide your feedback on the themes we have selected, I would be delighted to hear from you.



Carl D. Hughes
Global Head – Energy & Resources

And you thought gold was expensive?

Prices of rare earth metals to remain high, but volatile

No doubt about it. Gold remains one of the most valuable investments this year – up 24.6% since January – being eclipsed only by silver – up nearly 30% since the beginning of the year.¹ But, if you think that gold is the only investment game in town, consider the growth rate of four of the 17 so-called ‘rare earth’ metals.

Since the beginning of 2011, europium oxide, one of the main ingredients in LCD screens and fluorescent lighting, grew by 180%; dysprosium oxide, included in such items as nuclear reactors, hybrid cars, lasers, and sonar systems, grew by 137%; terbium oxide, used in hybrid cars, fluorescent lighting, and sonar systems grew by 128%; and neodymium oxide which is a component of cell phones, hard drives, and wind turbines, grew by a meagre 74%.

These four, and the other 13 elements that make up the group of 17 rare earth metals, may not sound familiar now, but they soon could be. These metals are increasingly being used in everyday components that are vital to the green economy – everything from parts in wind turbines, batteries in electric vehicles to energy efficient lighting. In our view, demand for the majority of these high-tech, rare earth metals will outstrip supply in the short-term, at least until 2015.

What are the drivers for the high growth rates of these rare earth metals and can high prices be sustained?

First and foremost, it’s worth noting that China supplies roughly 95% of the world’s rare earth metals and approximately 75% of them are located in Inner Mongolia.² Other producers are Brazil and to a lesser extent Malaysia. In terms of reserves of rare earth metals, 30% lie in China with the US coming in behind.³ Traditional mining countries such as Australia, Canada and South Africa also have large rare earth reserves.

Since the beginning of 2011, China has held firm on rare earth export quotas which is likely to keep exports of these strategic metals on par with last year’s levels. To ensure that its domestic producers have enough rare earth metals for its own use, the Chinese government plans to build 10 strategic reserves capable of storing more than 200,000 tonnes of rare earth oxides. Moreover, the fact that many other countries’ ability to ramp up production of their rare earth reserves will not occur for several years to come, can be taken as a sign that supplies are likely to be tight for the foreseeable future, pushing up prices accordingly.

Our view

As supplies continue to be tight and consumer and business demand for everyday products including clean technologies remains robust, we expect that prices for rare earth metals are likely to remain high and volatile for the next few years.



Is a bigger oil company better?

Are demergers likely to increase amongst integrated international oil companies?

For the last 50 years, the vertically integrated oil and gas company model has reigned supreme. By owning all parts of the value chain, companies are able to control the entire spectrum of activity – from upstream exploration and production (E&P), through midstream transportation and storage, all the way to downstream refining and retail. This model has served the industry well; but some are now challenging the status quo by splitting their upstream and downstream operations into separate units. Does this new activity make sense and are there likely to be further splits or demergers over the near term?

Given today's high oil prices and focus on finding new areas for development, it may make sense for some oil companies to split their upstream and downstream units into separate companies. One recent example offers a case in point. A former integrated company – one with both E&P and refining segments – had an enterprise value that was equal to 3.8 times its EBITDA, as of 1 June 2011. On an EBITDA basis, large E&P companies trade at multiples of around 6, and refiners with no E&P businesses trade at multiples of around 5.⁴ The company's spinoff of its entire refinery network (completed on 30 June) has yielded shareholders a 69% windfall since it was announced seven months ago.⁵ This would appear to suggest that splitting upstream and downstream assets enables individual companies to create additional value for shareholders.

For another company, splitting into separate entities comes during the process of selling some US\$15 billion worth of assets in the period to 2013, whilst needing to improve shareholder returns after a series of major acquisitions prior to the financial crisis which left its balance sheet strained.⁶ Additionally, management may find it easier to sharpen its focus on each separate business, while internal difficulties inherent in allocating capital to different sectors of operations within a business will disappear. Investors too, may benefit from the resultant transparency of value and value drivers.



Our view

So, how likely do we think it is that there will be further demergers in the near term? We believe that further such splits will occur over the next two or three years within the ranks of the integrated international oil companies. Those companies severely constrained by the financial crisis and experiencing slow organic growth may find additional value in splitting their assets as each unit may be worth more than a single entity.

However, some large vertically-integrated companies may maintain their current structure for several reasons. First, many of them own shipping assets whose worth may be difficult to assess given the current state of vessel overcapacity. Secondly, as some own renewable energy assets, these take time becoming profitable enough to sell. Finally, the most important reason to stay intact may simply be that many are amongst the largest and most profitable companies in the world – and maybe bigger is better.

The future is getting smaller

The coming energy breakthroughs using nanotechnologies

The science of small things, or nanotechnology, is about to grow by leaps and bounds. Consider solar cells embedded in paint to turn a house into one big solar panel? Or “quantum dots” that attack cancer, cell by cell, while leaving healthy tissue untouched? Or batteries for mobile phones that charge in seconds instead of hours?

While there is no universally accepted definition of nanotechnology, some have defined it as the “area of engineering that involves working with materials or developing devices that are smaller than 100 nanometres in at least one dimension.”⁷ That’s about 1,000 times narrower than the width of the average human hair. While most electronic technologies today already use nanotechnology, many of these new applications take it to an extreme. Ground-breaking research continues to be conducted on applications in the fields of agriculture, medicine, computing, manufacturing, transportation and energy.

Nanoparticles and nanomanufacturing techniques are expected to have long-term impacts on energy transmission and use. For example, nanotechnologies have the potential to make transportation fuels more efficient, potentially reducing the likely increase in demand for long-distance shipment of liquid fuels. Fuel economy of vehicles may increase as well. Materials used for the construction and maintenance of pipelines and electricity transmission lines made from nanoparticles may be stronger but occupy less volume than today’s materials, thereby reducing both the company’s carbon and water footprints. Nanotechnology has the potential to accelerate the development of cleaner, more efficient energy sources and uses. Energy-related technologies in which nanotechnology is likely to play a role include the following:

- Lighting
- Transportation
- Renewable energy
- Energy storage

Lighting

In many of the industrialised nations, a significant portion of all electricity is consumed using incandescent and fluorescent lighting. Due to their compactness, durability, low heat generation and electrical efficiency, light-emitting diodes (LEDs) now rival the less-efficient products in many respects. Newer discoveries – such as one where researchers coated an LED with a thin layer of quantum dots which produced a hybrid LED that yielded warmer, white light similar to that of an incandescent lamp – could have wide commercial and industrial applications.

Transportation

The one area where nanotechnology may really prove its worth is in diesel fuel additives for more efficient combustion. Commercially-available products have improved diesel fuel combustion, thereby reducing fuel consumption and exhaust emissions. The additive uses nanoscale particles of cerium oxide to catalyse the combustion reactions between the diesel fuel and air. Fuel economy benefits of up to 10% have been demonstrated in independently assessed field trials under commercial operating conditions.⁸

Renewable energy

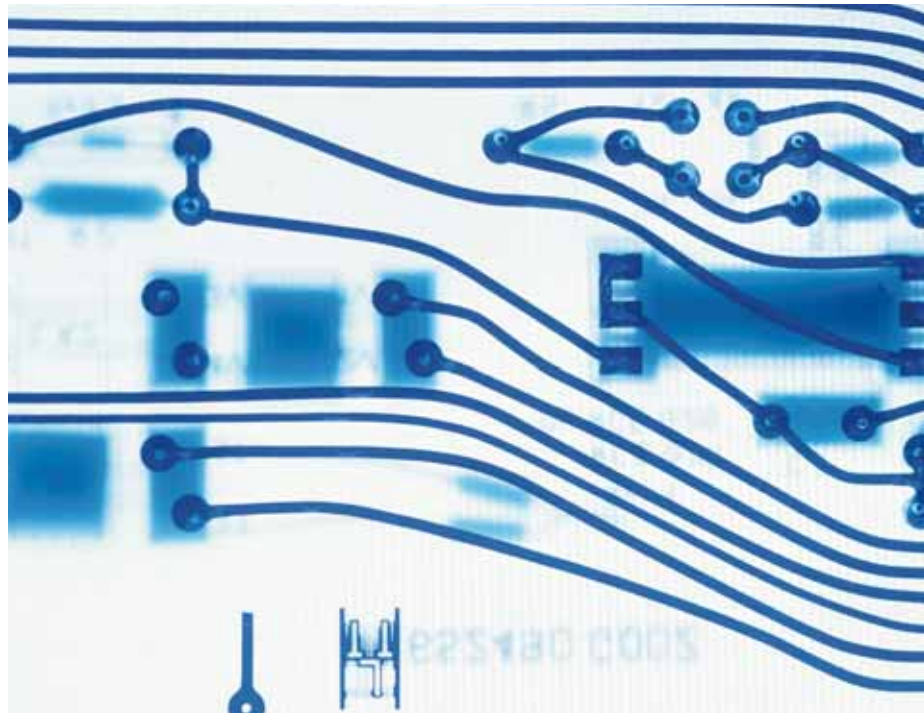
Nanotechnologies are also showing promise in facilitating the generation of electricity directly from solar, wind and geothermal resources. This has wide implications in the renewable energy sector but also for oil and gas. Using such energy at, or as close to, the source as possible could enable distributed energy production of electricity, thereby minimising transmission losses and reducing the need for right-of-way-based transmission of electricity. More efficient electricity transmission may enable increased generation in remote locations – non-populated areas with abundant renewable resources – to be sent to high energy demand areas via nanoenhanced transmission. Solar photovoltaic technology, which currently relies on crystalline-silicon wafers that are costly to produce, is deployed economically only in limited settings. Replacing costly technology with quantum dot nanocrystal technologies could make valuable contributions to improving the efficiency of solar energy systems, in addition to being less costly to produce.

Energy storage

The ability to store energy locally would reduce the amount of electricity that needs to be transmitted over power lines to meet peak demands. Energy storage could allow downsizing of baseload capacity and is a prerequisite for increasing the penetration of renewable and distributed generation technologies – such as wind turbines – at reasonable economic and environmental costs. Reliable energy storage is critical to the increased use of wind and solar because they are inconsistent resources. Nanotechnology may play a role in distributed generation through the development of cost-effective energy storage in batteries, capacitors and fuel cells. Some have predicted a scenario that suggests by 2050, homes, businesses and office buildings would have their own local electrical storage device capable of providing 24 hours worth of uninterrupted power supply.⁹

Our view

Nanotechnology research will continue unabated over the long term with some economists predicting a US\$1 trillion global market for nanoproducts over the next 10 to 15 years.¹⁰ A market this large will have implications for the energy sector. Roof-top solar panels could become obsolete simply by converting sunlight into electricity via a paint-like substance that can be sprayed on rooftops. Researchers have already proven that nanocrystals could be as efficient as the most expensive solar cells, for a fraction of the cost.



The science of small things, or nanotechnology, is about to grow by leaps and bounds.

The 'Golden Age of Gas'

One scenario for future natural gas markets



Over the past five years, the North American natural gas market has been a focal point as previously uneconomic shale gas deposits have transformed the region into a producer's paradise. While the so-called 'shale gas revolution' has arrived and is likely to lead to a 'golden age of gas,' increased supplies combined with the slowdown in demand, have sent North American gas prices down accordingly. This scenario has implications not only for North American gas producers, but also for those from other parts of the world.

While technology has played a leading role in unearthing these previously unreachable gas deposits, producers continue to face a great deal of uncertainty. To unlock the economic potential of shale gas resources, large investments are necessary. However, these investment decisions require an understanding of the rapidly changing market dynamics related to new gas supplies and uncertain demand growth in OECD economies. These decisions are complicated by a plethora of complex and interrelated domestic and international forces that influence natural gas markets. Some of the questions that producers are asking are:

- How will the anticipated increase in global liquefied natural gas (LNG) supply affect the US?
- How will the continuation of China's immense appetite for energy affect US and world gas prices?
- How will the announced shutdown of nuclear power in Japan, Germany and other countries affect worldwide gas demand?

In order to address these questions, Deloitte MarketPoint applied its integrated North American and World Gas Models to analyse the future impact of North American gas on energy markets and developed three scenarios, one of which is discussed here.¹¹

Reference scenario – economic recovery spurs growth in gas demand

Under the reference scenario, we assumed that continued economic recovery from the recent recession would spur steady growth in demand for natural gas in North America and elsewhere, especially in non-OECD economies such as China and India. Projected world demand for natural gas (shown in Figure 1) grows at a yearly rate of 1.9% until 2030, with Asia and the Middle East showing the fastest growth, above 3% per year. Growth in Asian gas demand is led by China which is projected to continue its rapid growth, although not quite as fast as in recent years. We project during this period an average annual demand growth rate of 4.6%, still quite high, but much lower than China's growth rate of 13.8% per year during the past decade. In this scenario, growth in US natural gas demand is likely to be driven by the electricity sector, which will grow at substantial rates.

Figure 1

Demand (Bcfd)

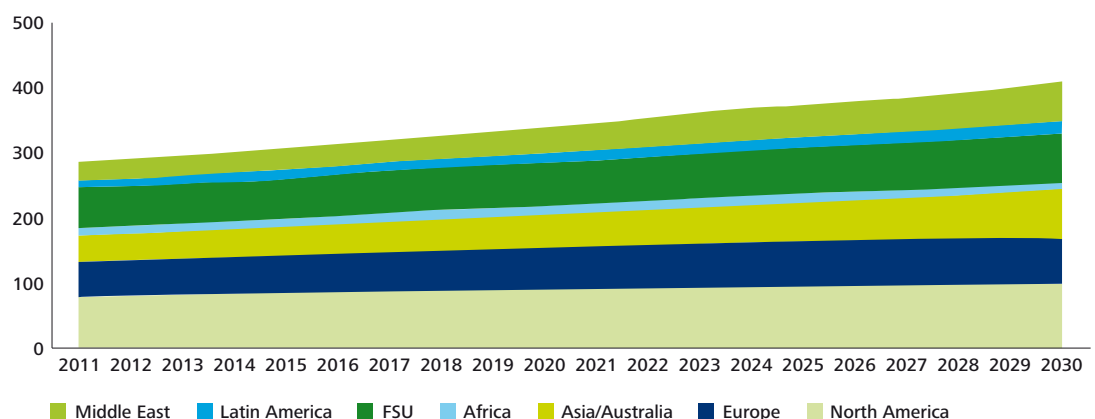


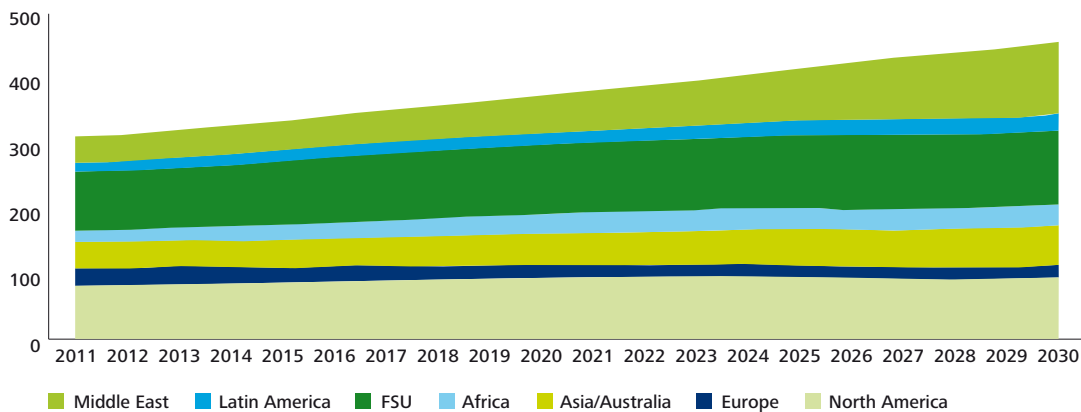
Figure 2 shows the projection of natural gas production by region. Based on the assumptions in the reference scenario, the Middle East is projected to provide much of the incremental supply, a direct consequence of the region's massive resources and forecasted increase in export capacity. The production rate in the Middle East is projected nearly to triple over the next two decades. Some of that production is projected to serve rapidly growing domestic markets whilst the rest is expected to go to other regions via LNG or pipelines.

The Asia/Australia region is projected to be the next fastest-growth region, but its growth in volume is considerably less than that of the Middle East. The CIS, including Russia and Caspian republics with prolific supply basins, is currently the largest producing region in the world. CIS production is projected to hold fairly steady and then grow moderately due to increased production out of Kazakhstan and Turkmenistan, both of which hold significant resources and have relatively small domestic markets.

Perhaps somewhat surprisingly, North American production under this scenario is projected to remain flat. The much-anticipated rise in shale gas production merely sustains current production.

Figure 2

Production (Bcfd)



Our view

Based on this scenario, natural gas consumption for electricity generation is projected to drive North American natural gas demand higher during the next two decades. In the US, the power sector, which accounts for nearly all of the projected future growth, would increase by about 50% – approximately 10 billion cubic feet per day. Gas will become the fuel of choice for several reasons: tightening environmental regulations, expectations of ample supply at competitive prices, and the need to back up intermittent renewable sources such as wind and solar to ensure reliability.

The corporate water footprint

The next 'tipping point' for energy companies

Water is quickly becoming an important issue: according to a recent Globescan/Circle of Blue survey, 15,000 people across 15 countries – both developed and developing – found that 70% ranked water shortages to be a “very serious” problem. Water-related themes in fact, represented the number one and number two concerns identified, with even climate change ranked sixth. This is surprising given that drought is already causing acute water shortages in large parts of Australia, Asia, Africa, South America and certain portions of the US.

Business is beginning to respond to the challenge of water management. Many of the world’s largest companies have identified water reduction targets as have some multinational high-tech companies.¹² 147 high-profile companies have reported their water usage to the Carbon Disclosure Project’s Water Disclosure Project, while dozens more have become signatories to the United Nations Global Compact’s CEO Water Mandate. Other groups have recommended that investors assess the reliance of their portfolios on water resources and their vulnerability to problems of water availability and pollution,¹³ and the US\$457 billion Norwegian Government Pension Fund recently announced that it would evaluate the water risk of the 1,100 companies whose equity it holds.¹⁴



Energy and resources companies have long been significant users of water:

- A typical 500MW coal-fired power plant draws about 2.2 billion gallons of water each year from nearby water sources, such as lakes, rivers, or oceans, to create steam for turning its turbines.¹⁵
- It takes up to 13 million gallons of water to open up a single well in the Eagle Ford shale region in Texas.¹⁶
- Nearly 70% of corn used for ethanol is produced in regions where 10 to 17 litres of water are consumed to produce one litre of ethanol.¹⁷
- Nuclear energy consumes 400 gallons/MWh with once-through cooling and 720 gallons/MWh with wet cooling towers.¹⁸
- Gaining water access rights are one of the key challenges for mining companies seeking to commence new operations in South America today.

Furthermore, given the prediction that the world’s population may grow to over 9 billion people by 2050,¹⁹ water will remain one of the most important energy-related issues over the coming decades. While government’s role will remain one of developing public policy to confront the issue, business will be called upon to do its part. Understanding the statistics above will likely lead to more stakeholder accountability, scrutiny and improved management of business water use. What steps can energy and resources companies take now to seize control of their water usage? We have identified a few:

Understand your overall water usage – and water intensity. This is by no means a straightforward question. The World Business Council for Sustainable Development recently identified 19 different water-measurement tools in their March 2010 report.²⁰ No tool or methodology has yet to emerge as a clear leader in the rush to set standards: the most useful tools incorporate some element of context, benchmarking an organisation’s use of water against what is available from local water sources.

Understand where your company's water use occurs.

Much of the difficulty in addressing the water question stems from the essential local nature of water use. Due to the difficulty of transportation, a litre of water in Antwerp cannot substitute for a litre of water in Angola if your company operates in regions under water stress – defined by the United Nations Environment Programme as demand for fresh water exceeding supply over a given period – the constraints on your water use will be far greater.

Understand the specific kinds of business risk that emerge from water use.

These risks can be broadly divided into two categories: physical risk and regulatory risk. Of these categories, the first is best understood by business, with some 73% of those surveyed by CERES reporting some degree of exposure to physical risk via water (droughts, rising prices, needed capital expenditure). Regulatory risk can also pack a serious punch. The mining industry has seen a rash of lawsuits which are aimed at shutting down businesses operating in sensitive water regions. A comprehensive enterprise risk management strategy should now include company use of water resources.

Understand the opportunities that may emerge from adeptly managing water use.

The silver lining to the water footprint cloud is that businesses that use water intelligently are likely to reap significant financial and commercial benefits. On the most basic level, techniques that limit water use or allow for the reuse of grey water may produce easily quantifiable cost savings – and a resulting competitive advantage. Opportunities exist for companies to develop technology that aids in this process; the growth curve of this sector could be quite similar to that experienced as renewable energy has developed over the last few decades.

Understand your water sources – including those across your supply chain – and how they can be modified.

The key to ensuring continued water supply to your business is to understand where this water comes from. Is this water supply threatened, either by increased demand from others, or changing physical conditions? Even if water is plentiful, are your rights to it secured on a long-term legal basis?

Our view

As Malcolm Gladwell stated in his best seller “The Tipping Point: How Little Things Can Make a Big Difference,” the processes and mechanisms by which some trends achieve exponential popularity while others sputter and fade into oblivion have long been thought to be mysterious and resistant to analysis. However, Gladwell’s central argument is that there are actually a number of patterns and factors that are at play in virtually every influential trend, ranging from the spread of communicable diseases to the unprecedented popularity of a particular children’s television show. If you analyse the evolution of any major phenomenon, the author suggests that you will find that the processes involved are strikingly similar.

In our view, in the energy and resources sectors, we have already seen both companies and individuals adjust their energy usage behaviour in lowering their carbon footprint. Now, watch for businesses and consumers lowering their water footprint in the same way.

Business is beginning to respond to the challenge of water management. Many of the world's largest companies have identified water reduction targets.

Who owns the Arctic and the South China Sea?

The emergence of the new geopolitical risk paradigm

Oil and gas companies have always dealt with risk in one form or another, but the recent events in the Middle East and North Africa demonstrate how geopolitical risks pose problems for the oil and gas industry. Unfortunately, it seems that geopolitical risks may become a way of life for these companies. The increasing consumption and demand of natural resources has led to a scavenger hunt for new supplies by companies and countries alike. This search is leading to the exploration of areas without well-defined borders where geopolitical disputes could be imminent. Two examples of potentially hostile areas are the South China Sea and Arctic regions.

Whilst the borders of both regions have been disputed in the past, the predictions that both are oil and gas wealthy have intensified the political tension between disputing countries. Even though the South China Sea has yet to be explored in depth, early predictions by Chinese analysts put oil reserves at over 200 billion barrels. However, American scientists predict reserves to be much lower, around 28 billion barrels. According to the US Energy Information Administration, the South China Sea could hold about 900 trillion cubic feet of natural gas reserves which is equivalent to the proven reserves of Qatar.²¹ As for the Arctic region, it currently accounts for a tenth of the world's known conventional oil reserves.²² More importantly, the US Geological Survey estimates that the region holds 13% of the world's undiscovered oil reserves and nearly a third of its natural gas deposits.²³

So far, disputes in both regions have been peaceful, but recent events illustrate how that could easily change. In June of this year, Vietnam claimed that a Chinese boat had damaged a research cable that was connected to a Vietnamese seismic survey boat. Whilst Vietnam claims that the boat was within its exclusive economic zone (EEZ), China says that the ship was outside the EEZ.²⁴ In 1982, the United Nations Convention on the Law of the Sea (UNCLOS) specified EEZs for each country. Vietnam states that this was the second research cable in recent weeks to be damaged by the Chinese. In response, Vietnam conducted live-fire naval exercises off of its coast the following week. Other countries in the region are becoming increasingly uneasy as China becomes more assertive in its claims to the waters. As a result, all countries involved in the dispute – which includes China, Vietnam, Taiwan, the Philippines, Malaysia, and Brunei – have ramped up their naval presence.

Even though the risks of working in the area continue to heighten, it does not seem to be deterring companies from entering the market and pushing the boundaries. Over recent months, oil and gas companies have been pushing the boundaries by expanding their exploration work in the contested waters. A Filipino mining company plans to drill two wells and conduct more seismic surveys in search of natural gas next year and plans on investing US\$86 million in the area by 2013. Additionally, a Chinese national oil company and a Vietnamese petroleum company plan to expand their exploration and surveying efforts in the area.²⁶

In the Arctic, five nations – Canada, Russia, Denmark, Norway, and the US – currently hold jurisdiction over the region. Whilst these countries have been more willing to negotiate with each other than the nations of the South China Sea, there are signs that conflict could be ahead. Norway has moved its military headquarters to Bodo which resides within the Arctic Circle, and Russia has plans to create two army brigades to protect its polar territory.²⁵ Furthermore, Canada is conducting its largest military exercise in the region which involves more than 1,000 troops.²⁷

Recently, two oil and gas companies agreed to a US\$2.2 billion deal to begin drilling in the waters north of Russia. The two companies plan to begin exploratory drilling by 2015 and hope to begin production early next decade, if everything proceeds as planned. The area that will be explored is estimated to have 36 billion barrels of recoverable oil.²⁸

A second duo of oil and gas companies has also started to invest billions in the Arctic region. The US has given one company conditional approval for up to 10 wells over the next couple of years in the shallow waters off the coast of Alaska; however, additional permits are still needed.²⁹ Whilst Greenland has issued 17 exploration licences to 11 companies for its west coast, the second of two companies is the only one currently test-drilling.³⁰

Our view

Whilst there are risks to establishing operations in the South China Sea and the Arctic, the potential rewards could be even greater. All governments involved in both regions say they are committed to peaceful negotiations to solve all border issues. The Association of Southeast Asian Nations (ASEAN) is attempting to resolve the conflict through a multilateral resolution, and China has been able to setup bilateral solutions with most of the countries involved. Norway and Russia have proved their willingness to negotiate peacefully by splitting a disputed area of the Barents Sea in half just last year. The main question is what will happen once a major discovery is found in an area of dispute? Will governments stay true to their commitments of peaceful resolutions or is it all just rhetoric?



A dynamic duo

Solar-enhanced oil recovery

Enhanced oil recovery has long been a proven technique for coaxing stubborn oil out of the ground. The recovery process has traditionally relied on burning natural gas to produce steam but now solar-enhanced oil recovery may prove to be a viable alternative. Solar-enhanced oil recovery (SeOR) works by locating an inexpensive glasshouse structure housing solar mirrors adjacent to an oil field. The technology can not only reduce a company's carbon footprint but steam may be produced more cheaply than by using natural gas.

Enhanced oil recovery is nothing new; its use dates back to the 1950s and 40% of California's oil production currently depends on steaming subterranean rocks in this manner.³¹ The steam, however, is produced using natural gas, that whilst relatively cheap now, may prove to be more costly in the years ahead. Furthermore, even though natural gas burns cleaner than many other fossil fuels, it adds to oil's climate footprint.

The process for producing steam from solar power is currently being demonstrated in the middle of a 100-year-old oil field in California.³² On roughly a half-acre plot, sits a single glasshouse, within which are solar-reflecting mirrors suspended from the ceiling by wires. As the sun passes overhead, a motorised system slowly adjusts the wires, positioning the mirrors to catch the optimal amount of rays. The mirrors concentrate the sunlight and focus it on a network of water filled pipes suspended from the roof of the glasshouse. The water boils into steam, which is continuously injected deep into oil wells, where it decreases the viscosity of, and thus enhances the recovery of, the crude oil.

Advocates for SeOR point to economic factors when making their case for this new process. In one scenario, taking the estimated capital costs and the lifetime cost of the plant into account, a firm could produce steam at US\$3.78 per million British thermal units (btu). Steam from gas comes in at roughly US\$5.79 per million btu.³³ Additionally, glasshouses themselves are easy to buy, quick to erect and simple to clean. Moreover, sheltering the mirrors from the wind allows them to achieve higher temperature rates and prevents dust from building up as a result from exposure to humidity.

Whilst SeOR sounds like a promising solution, the technology does have its drawbacks. For the technology to prove itself on a large scale, a typical oil field would need roughly 100 acres of glasshouses to satisfy its daytime needs. Large fields would require additional acres. Moreover, there remains a need for some natural gas after the sun sets.

The big worldwide potential for SeOR is in the Middle East where gas that previously was used for export purposes is now being kept at home to help develop domestic economies. For example, Oman used to have an abundance of natural gas and even built an LNG export terminal, but since its oil production peaked in 2000, the country has had to redirect some of that gas for enhanced oil recovery purposes. Other Middle East nations could face the same dilemma.

Our view

Whilst in its infancy, SeOR has the potential of revolutionising enhanced oil recovery due to the low cost of glasshouses and the price of producing steam. The technology is likely to show most promise in areas where there is an abundance of sunlight and in areas where the easy oil has been extracted or is heavy in nature.



The consumer has spoken

Energy use and the great recession of 2008-2009



In many parts of the world, the energy marketplace is rapidly changing due to the recession of 2008-2009 and the continued slow economic growth seen in recent months. Nowhere is this truer than in the US. But in which direction is energy heading? What are consumers and businesses thinking and doing about energy efficiency and choice? Where are the providers of energy and energy-related products and services making inroads and where are they not getting the necessary traction?

Deloitte US and strategy and market research firm Harrison Group are in the process of completing a nationwide, US study – the Deloitte reSources 2011 Study³⁴ – to provide insights that can be useful in helping organisations make energy-related investment and business decisions. The study seeks to understand the actions that businesses and consumers are taking to manage their energy usage and what motivates them to adopt new practices and technologies. It also illuminates the degree to which they are concerned about energy management and what solutions they are turning to today, as well as what offerings may appeal to them in the future.

The study captures two views. The first is the consumer view, which is based on more than 3,000 demographically balanced online interviews.

The second is the business view, which will be based on one-to-one interviews with senior executives, as well as over 400 online interviews with business decision makers.

Among the results from the consumer portion of the survey are the following:

Resourcefulness trumps personal carbon footprint

- 90% of consumers say they have become more resourceful as a result of the 2008-2009 recession.
- 87% are looking at every spending category to see where they can save.
- However, only 55% are very concerned about their personal carbon footprints.

Demand waves goodbye, maybe for good (or at least a long time)

- 68% of consumers took extra steps to reduce their electricity bill due to the recession.
- And even as the economy improves: 95% do not intend to increase their electricity usage.

Consumers take limited action today to conserve electricity

- Over three-quarters cite turning off lights when not in use, even for just a few minutes, and setting thermostats lower in winter and higher in summer.
- Only 20% view replacing old appliances with more energy efficient ones and insulating their homes well as being among the top few things they see themselves doing to save electricity in the future.

Consumers are uninformed, but not uninterested

- 20% say they don't know if they have a choice in their electricity provider.
- 62% say they don't fully understand the resources their electricity companies use to generate power.

However ...

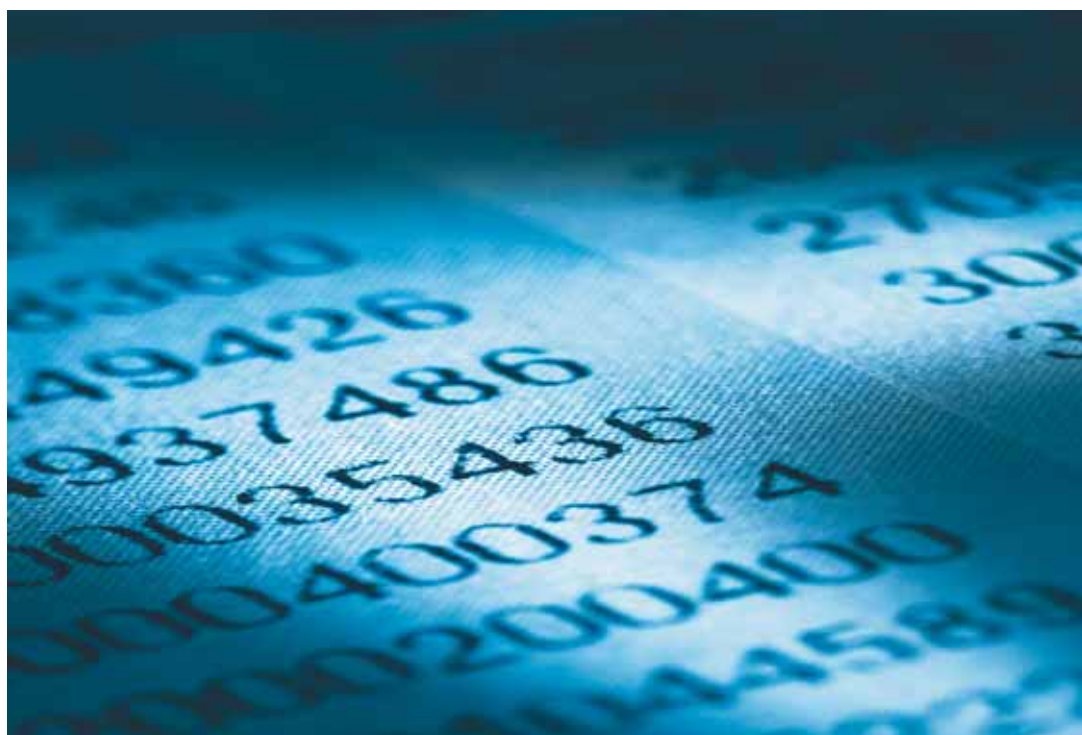
- While only 14% agree they have been offered the opportunity to buy green energy from their electric utility.
- Approximately two-thirds would like their electricity companies to invest in wind and solar, and are willing to pay a surcharge for these options.

Generation Y consumers seem willing to adopt new smart energy technologies ... where's the app for that?

- 28% of Generation Y respondents say they are likely to purchase a smart energy application versus 18% of total respondents.
- One-third of Generation Y respondents say they are willing to pay a small amount to have a meter/timer control system for some of their major household devices to manage electricity use better, versus 22% of Baby Boomers and 16% of mature respondents.

Our view

The Deloitte reSources 2011 study gauges customer interest, perception and receptiveness across regions and demographics regarding tactics for managing energy, smart technologies, electric vehicles, the environment, and climate change in the US. The findings are likely to invite Board-level debate and discussion, both within the US and internationally, regarding the implications for strategy and future investments. The consumer has spoken.



Learning to love complexity

The future of oil field services

The offshore sector is one of the most complex businesses in the world. Very many, highly diverse, companies – from oil super majors to small service providers – have to work together seamlessly in circumstances that are highly unnatural to man. Nevertheless the sector is pretty successful at it and is as such a major contributor to a safe and prosperous world.

However, based on 40 Deloitte interviews with executives of offshore oil & gas companies across all continents and all stages of the value chain, we predict that complexity of the offshore value chain will continue to grow substantially in the next decade. We think four factors will drive this trend.

First, as is well known, the days of easy oil are over. In order to supply the world with 50% more energy by 2025, the sector will have to go all out to find and produce more oil and gas. Already today, a large part of the world's 150 mega offshore projects are in technically complex areas like Brazil (22 mega projects), West Africa (37) and the Arctic (6). And with the majority of offshore reserves in deep water off Brazil and Western Australia, the share of complex projects will surely increase.

Second, as locations of operations disperse, National Oil Companies (NOCs) will become more demanding. Brazil is a case in point. It may require as much of 80% of local content under new legislation. Contractors now either have to deal with local suppliers, set up their own operations or negotiate waivers with the Brazilian government, one of the most complex bureaucracies in the world.

Furthermore, Western countries are getting more demanding. As for any big business, think of banking, the industry operates under a magnifying glass. The US government not only enforces environmental, anti-corruption and safety standards on oil companies – it also holds them responsible for all the behaviour of all of their contractors.

Finally, the days are over when companies can shift risks to the oil companies and governments via reimbursable contracts. Lump sum is back and probably for good. A glut of new equipment, ordered before the financial crisis, is coming on the market now, increasing buyer power. And competition will further intensify as China scrambles for resources.

Our view

Oil field services companies will have to raise the bar. Though some will achieve this on their own, increasing complexity may very well trigger a new round of industry consolidation.



Piracy on the high seas

Now it's for real



Piracy has taken on a whole new meaning in the 21st Century. Instead of swords, sailboats, and chests of gold, it is machine guns, speedboats, and large tankers of oil. Over the last decade, piracy has resurrected itself and finding a way to slow its growth and prominence has been difficult. Each year, attacks have steadily increased, and there are no signs of change in sight. According to the International Maritime Bureau, the first six months of 2011 have seen 266 attacks worldwide, compared to 196 in 2010.³⁵ Somali pirates have led the way in the resurrection of this once dying industry. Of the 266 attacks this year, 178 have come from Somali pirates. This led to 22 successful hijackings, 362 hostages, and 7 crew members killed.³⁶

With 20% of the world's commercial shipping passing through the Gulf of Aden and the Suez Canal,³⁷ piracy has a big impact on economies, especially in Europe, that rely on the timely arrival of much needed goods. 80% of the trade that passes through the Gulf is with Europe which also includes one third of its oil supply.³⁸ It is estimated that piracy costs the international community between US\$7 billion and US\$12 billion per year.³⁹

Whilst Somalia has the largest number of pirate attacks, this year has seen a surge in piracy on Africa's Gulf of Guinea coast. The number of attacks in the Gulf of Guinea is unclear due to consistent underreporting.⁴⁰ However, there have been 16 reported attacks off the coast of Benin so far, where as in 2010, there were zero. Additionally, there have been six reported assaults off the coast of Nigeria and three more near the coast of Ghana, West Africa's most stable country.⁴¹

Unlike Somali pirates, pirates in the Gulf of Guinea tend to be much more violent and focus their attacks on the offshore oil and gas industry. Due to the oil wealth of West Africa, targeting oil and gas tankers and refineries is easy and profitable, while they are extremely difficult to defend. Furthermore, pirates are more enticed to attack oil tankers and refineries because of the wealth disparity that oil has created in their countries.

According to economists, continued attacks in the region could result in a spike in global oil prices. Also, while attacks in the Gulf of Aden have a large impact on Europe, piracy in the Gulf of Guinea could have the same type of impact on the U.S. By 2015, the U.S. plans to import 25% of its oil through West African shipping lanes.

However, shipping companies are probably taking the largest hit due to the pirate attacks. Each year, more and more of their crews are taken hostage which has resulted in higher and higher ransoms. In 2005, the average ransom was around US\$150,000, and by 2010, the average was up to US\$5.4 million which totaled to US\$238 million in ransom payments.⁴² Furthermore shippers passing through risky waters are now regularly being asked to pay for extra insurance known as Additional War Risk Premium (ADWRP), which is increasing operating costs by hundreds of thousands of dollars. In certain cases, kidnap and ransom insurance might be tagged on as well. Overall, new risk premiums alone can rise to between US\$75,000 and US\$100,000 for a round-trip voyage.⁴³

So, what can be done to prevent piracy? Cooperation in the international community has led to an increased naval presence in the Gulf of Aden, but Somali pirates have extended their reach to the Indian Ocean which is nearly impossible to patrol. The pirates have started to use hijacked ships as “mother ships” which allows them to pirate further away from the coast of Somalia and use their smaller, faster boats to initiate attacks. As for patrolling the waters of the Gulf of Guinea, West African countries do not have the military capacity to do so effectively.

Shipping companies have started to take matters into their own hands to help reduce attacks. More and more ships are starting to have citadels, or fortified rooms, for the crew to retreat to while they wait for help. However, these citadels must be strong enough to withstand pirate assaults and have enough supplies and air conditioning for 24 hours while waiting for naval reinforcement. Another option has been to hire armed security for the voyages, but there has been reluctance to do so because of the fear that lethal shootouts will endanger the crew.

Our view

Unfortunately, until such time as governments and international groups find solutions through diplomatic channels, maritime piracy shows no signs of slowing down any time soon. Without the help of a stable government in Somalia, there appears to be little that can be done to shut down pirate strongholds on land. And while citadels may temporarily disrupt pirate attacks, the fear is that it is only a matter of time before pirates begin to use explosives to breakthrough those barriers. Piracy is a financial and business risk issue with no clear cut solutions.

With 20% of the world’s commercial shipping passing through the Gulf of Aden and the Suez Canal, piracy has a big impact on economies, especially in Europe, that rely on the timely arrival of much needed goods.

Contacts

Global Energy & Resources Leadership

Carl D. Hughes

Global Head – Energy & Resources
+44 20 7007 0858
cdhughes@deloitte.co.uk

Phil Hopwood

Global Mining Leader
+61 3 9671 6461
phopwood@deloitte.com.au

Adi Karev

Global Oil & Gas Leader
+86 10 8512 5321
adkarev@deloitte.com

George Cambanis

Global Shipping & Ports Leader
+30 210 6781101
gcambanis@deloitte.gr

James Leigh

Global Water Leader
+44 20 7007 0866
jleigh@deloitte.co.uk

Felipe Requejo

Global Power Leader
+34 9151 45000 ext. 1655
frequijo@deloitte.es

Jane Allen

Global Renewable Energy Leader
+1 416 874 3136
janallen@deloitte.ca

Regional Energy & Resources Leadership

North America

John McCue

Deloitte US
+1 216 830 6606
jmccue@deloitte.com

Europe, Middle East, Africa

Carl Hughes

Deloitte UK
+44 20 7007 0858
cdhughes@deloitte.co.uk

Dick Cooper

Consulting
+1 403 261 8115
dcooper@deloitte.ca

John England

Enterprise Risk Services
+1 713 982 2556
jengland@deloitte.com

Jean Michel Gauthier

Financial Advisory Services
+33 1 55 61 69 11
jgauthier@deloitte.fr

Doug King

Audit & Accounting
+44 20 7007 0863
djking@deloitte.co.uk

Brad Seltzer

Tax
+1 202 220 2050
bseltzer@deloitte.com

Julian Small

Oil & Gas Tax
+44 20 7007 1853
jsmall@deloitte.co.uk

Latin America

Ricardo Ruiz

Deloitte Argentina
+54 11 4320 4013
riruiz@deloitte.com

Asia Pacific

Kappei Isomata

Deloitte Japan
+81 92 751 0931
kappei.siomata@tohmatu.co.jp

Notes

- 1 Javier Blas. "Gold drops \$160 an ounce in two days." *Financial Times* August 24, 2011.
- 2 Patti Waldmeir, "China predicts rare earth shortage." *Financial Times* September 4, 2009.
- 3 "What's the rare earth war all about?" *Industry Updates* April 28, 2010.
- 4 Reuters Hedgeworld. "Two Better Than One at Marathon Oil." June 1, 2011.
- 5 Joe Carroll, Jim Polson. "Conoco to Spin Off Refining Unit." *National Post* July 15, 2011 pp. FP 5.
- 6 Dow Jones News Service. "Conoco Overhaul Set to Also Include Breakup." July 14, 2011.
- 7 From Solar Paint to Instantly Charged Batteries, IEEE Experts Say the Future Looks Big for Nano; IEEE NANO 2011 Conference Illustrates IEEE Leadership in Advancing Nanotechnology in Healthcare, Electronics, Energy, and Other Fields.
- 8 http://www.oxonica.com/energy/energy_envirox_casestudy_stagecoach2007.php
- 9 Argonne National Laboratory. Potential Impacts of Nanotechnology on Energy Transmission Applications and Needs. November 2007.
- 10 Ibid.
- 11 http://www.deloitte.com/view/en_US/us/Industries/oil-gas/c74f4d55ab541310VgnVCM3000001c56f00aRCRD.htm#45
- 12 <https://www.gtmresearch.com/articles/read/shipping-chemicals-and-water-how-sony-and-hp-are-tackling-green-goals/>
- 13 <http://www.wri.org/publication/watching-water>
- 14 <http://www.ft.com/intl/cms/s/0/9d02556c-e128-11de-af7a-00144feab49a.html#axzz1W4uZlroU>
- 15 http://www.ucsusa.org/clean_energy/coalvs/c02b.html
- 16 Suzanne Goldenberg "Water shortages threaten renewable energy production, experts warn." *The Guardian* June 27, 2011. <http://www.guardian.co.uk/environment/2011/jun/27/water-shortages-threaten-renewable-energy>
- 17 May Wu, Marianne Mintz, Michael Wang and Salil Arora. "Water consumption in the production of ethanol and petroleum gasoline." *Environmental Management* September 2009 pp. 981-997.
- 18 Nuclear Energy Institute. "Water use and nuclear power plants." <http://www.nei.org/resourcesandstats/documentlibrary/protectingtheenvironment/factsheet/water-use-and-nuclear-power-plants/?page=3>
- 19 Worldwatch Institute. "U.N. Raises "Low" Population Projection for 2050." <http://www.worldwatch.org/node/6038>
- 20 <http://www.wbcds.org/web/water4business.pdf>
- 21 "Q&A: South China Sea Dispute." *BBC News*. 19 July 2011.
- 22 Ward, Andrew. "Battle Hots up for Arctic Resources." *The Financial Times*, 4 July 2011.
- 23 Simon, Bernard. "The Arctic: Through icy waters." *The Financial Times*, 18 July 2011.
- 24 Gold, Russell. "Arctic Riches Lure Explores – Exxon, Rosneft, Shell set to Pour Billions into Potentially Huge, Risky Prospects." *The Wall Street Journal*, 1 September 2011.
- 25 Ibid.
- 26 Bernard. "Through Icy Water".
- 27 Hansen, Flemming Emil. "Denmark Opts for Private Investment in the Arctic." *The Wall Street Journal*, 24 August 2011.
- 28 Gold. "Arctic Riches Lure Explores --- Exxon, Rosneft, Shell set to Pour Billions into Potentially Huge, Risky Prospects."
- 29 Ward. "Battle Hots up for Arctic Resources."
- 30 Cummins, Chip. "Canada Escalates its Arctic Presence." *The Wall Street Journal*, 22 August 2011.
- 31 "Solar heat for oil wells: Mirrors in glasshouses can be used to heat stones." *Economist* August 13, 2011.

- 32 Forbes. <http://www.forbes.com/sites/christopherhelman/2011/02/28/glasspoints-solar-power-gives-new-life-to-old-oil-fields/>
- 33 Ibid.
- 34 <http://www.deloitte.com/us/resourcesstudy2011>
- 35 "Somali Pirates Threaten European Oil Security." *The Wall Street Journal*, 22 July 2011.
- 36 Baldwin, Derek. "Piracy wave set to hit households in the GCC." *Gulf News*, 28 August 2011.
- 37 "No stopping them: For all the efforts to combat it, Somali piracy is posing an ever greater threat to the world's shipping." *The Economist*, 3 February 2011.
- 38 "Somali Pirates Threaten European Oil Security."
- 39 Baldwin. "Piracy wave set to hit households in the GCC."
- 40 Look, Anne. "Pirate Attacks Surge in Gulf of Guinea." *Voice of America*, 18 August 2011.
- 41 Leigh, Karen. "Pirates of the Atlantic: Africa's Other Coast Gets its Share." *Time*, 7 September 2011.
- 42 Baldwin. "Piracy wave set to hit households in the GCC."
- 43 "Unrest, Piracy Pile More Costs on Oil Shipping." *Platt's Oilgram News*, 11 March 2011.

www.deloitte.com/energypredictions2012

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee, and its network of member firms, each of which is a legally separate and independent entity. Please see www.deloitte.com/about for a detailed description of the legal structure of Deloitte Touche Tohmatsu Limited and its member firms.

Deloitte provides audit, tax, consulting, and financial advisory services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's approximately 182,000 professionals are committed to becoming the standard of excellence.

Deloitte member firms around the world provide comprehensive, integrated solutions to the energy and resources sector. These solutions address the range of challenges facing energy companies as they adapt to changing regulatory environments, to political, economic and market pressure, and to technological development. Deloitte member firms' in-depth expertise in this dynamic sector serves as an indispensable resource for a significant portion of the world's largest energy companies. Deloitte member firms have been designed to provide the energy and resources industry with unparalleled service, innovation, and critical thinking.

Disclaimer

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively, the "Deloitte Network") is, by means of this publication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

© 2011 Deloitte Global Services Limited

Designed and produced by The Creative Studio at Deloitte, London. 14279A