OLIVER WYMAN

VOLUME 2

THE OLIVER WYMAN ENERGY JOURNAL

MARSH GUY CARPENTER MERCER OLIVER WYMAN

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INTRODUCTION

Change has become the only constant for today's energy industry. Unprecedented shifts are forcing oil and gas companies, utilities, governments, investors, regulators and even consumers to rethink basic assumptions that have guided the energy sector for decades worldwide. To stay ahead of the profound transformation under way, business and government leaders must forge new strategies, operating models and risk mitigation tactics.

With this in mind, it is our pleasure to share with you the second edition of the *Oliver Wyman Energy Journal*. This collection of perspectives represents the latest thinking across our Energy practice on the resulting new risks and opportunities that will impact not just the energy sector, but also every company and person that depends on it.

I hope you find the *Oliver Wyman Energy Journal* informative and valuable.

Yours sincerely,

Francois Austin
Head of Energy Practice

TRANSFORMATION

CONTENT KEY

Oil and Gas

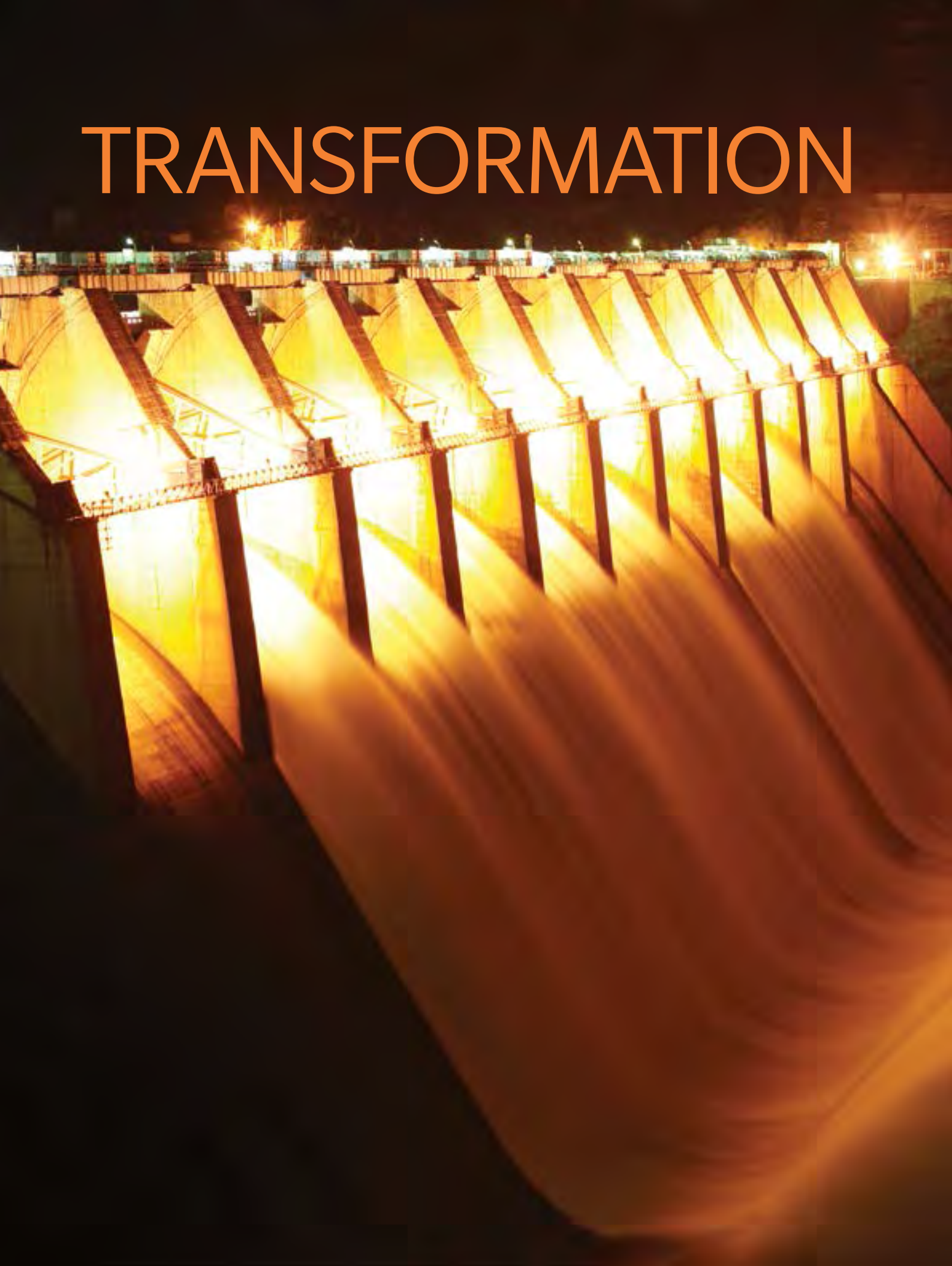
Utilities

STRATEGY

OPERATIONS

RISK

TRANSFORMATION



ENERGY JOURNAL | VOLUME 2

The Rise of Regional Oil Markets
The New Balance of Power in Oil
The New Make vs. Buy Calculus
The World Energy Trilemma

THE RISE OF REGIONAL OIL MARKETS

UNITED STATES SHALE COULD HERALD REGIONAL OIL REVOLUTION

Bernhard Hartmann • Saji Sam • Bruno Sousa

The United States is transforming itself into the world's largest oil producer, nearly independent of foreign suppliers, thanks to technology that allows profitable oil and gas production from shale. (See "The New Balance of Power in Oil" on page 13.)

This is upending the oil market by injecting fresh supply and shifting trade flows. But the shale phenomenon could become a global revolution as other areas of the world view the US less as a supplier, and more as a harbinger of regional markets. The confluence of volatile oil prices, abundant global shale resources, technology to extract these resources and geopolitics could push companies to produce oil and gas closer to where it is consumed. Such regional markets could upset the political world order in the long term, changing power dynamics between traditional oil producing nations and consumers. (See Exhibit 1.)

North America, South America and China are prime candidates for regional markets given the magnitude of technically recoverable unconventional oil and gas these regions hold. Unconventional oil and gas markets have achieved maturity in the US, providing a potential blueprint for other basins around the world. Since the US bans oil exports, the market is already somewhat decoupled from the rest of the world. Local oil trades at a discount to global oil markers, such as Brent.

South America has massive reserves; Argentina, Brazil and Venezuela together hold close to 250 billion barrels of oil equivalent in unconventional resources, 80 percent of which is gas. Of these resources, Argentina alone accounts for 65 percent. In China, the total technically recoverable unconventional resources are estimated at 225 billion barrels of oil equivalent, 85 percent of which is gas.

EXHIBIT 1: GLOBAL UNCONVENTIONAL OIL AND GAS RESOURCES

The success factors that enabled the shale revolution in the United States are hard to replicate, but not impossible over time

KEY FACTORS CONTRIBUTING TO THE UNCONVENTIONAL BOOM IN THE US

Source: EIA, JP Morgan, World Resources Institute, GEDI, Oliver Wyman analysis

225 billion

The number of barrels of oil equivalent in unconventional resources in China

REPLICATING THE US SHALE REVOLUTION

Yes, the US shale revolution will be challenging to replicate. American independent oil companies have enjoyed access to cheap capital in a low interest-rate environment. The US oil industry was already well-developed when shale production began. Pipelines and rigs were available, more were quickly built and an established network of quality roads allowed for smooth transportation of equipment. Water is plentiful in the major US shale basins, and mineral rights laws make drilling possible and very attractive in many communities.

Other regions of the world lack some of those factors, and will have to develop the market in their own ways. The absence of surface infrastructure and water in the regions endowed with shale resources could prove to be challenging for China. Argentina will have to build market confidence to attract the investment needed to develop the ecosystem to enable a shale revolution, driven by the private sector.

But the technology and existing oil reserves offer hope that the political and infrastructure development is worth the effort. If regions can overcome the politics, environmental concerns and capital requirements of producing their own resources, they could cut dependence on traditional suppliers, and control their own energy policies.

This would mark a historic shift in the longer term. Until now, most of the world's oil has been produced in countries with high political risk, including political instability, conflict and insurgency. The list of top 10 oil exporting countries includes such high-risk nations as Russia, Iraq, Nigeria and Venezuela. In some cases, the cost for an oil company to mitigate that political risk is high enough to prompt executives to scout for shale opportunities in stable regions instead of investing in risky countries with less attractive fiscal regimes.

OPEC may have intended to squeeze North American shale producers as it has maintained production levels in the face of falling oil prices and protected market share. However, the drop in oil prices doesn't necessarily put North American newcomers out of business.

Unconventional exploration and development in some of the most productive shale oil fields, such as the Bakken in North Dakota and the Eagle Ford Shale in Texas, is competitive with oil produced by conventional methods. In some areas, unconventional shale production has a break-even price as low as about $40 a barrel, on par with some conventional production. Lower oil prices have prompted producers to cut back on capital projects, tempering demand for oil field services and supplies. Renegotiating with suppliers will bring that break-even price down even further. In addition, many shale companies are focused intently on efficiency and technology improvements, pushing the break-even price low enough to put shale on par with oil fields of many traditional oil producing countries.

GRAPPLING WITH LOWER OIL PRICES

Lower oil prices are instead squeezing some of the traditional producers. Our research shows that $50 oil puts some of the politically unstable oil producing countries under considerable stress as they grapple with lower oil revenue in their national budgets. Those most at risk include Nigeria, Venezuela, Iraq, Iran and Russia. These countries might try to work with other producers to manage supply volumes in hopes of resurrecting oil prices. The Gulf Cooperation Council producers such as Saudi Arabia, the United Arab Emirates, Kuwait and Qatar have

250 billion

The number of barrels of oil equivalent in unconventional resources in South America

amassed considerable wealth during the past decade in their reserves and sovereign wealth funds. While these countries could withstand a few years of $50 oil by depleting their financial reserves, they would come under stress after five to seven years of low oil prices. They are betting on the resurgence of global demand to push prices up.

As OPEC countries and other traditional producers come under pressure from oil prices, the US gains political leverage as it becomes less dependent on those suppliers. The US independence of Middle East oil may shape perceptions of the region's vulnerability to security crises, with other countries obliged to play greater roles.

For example, a recent global risk report produced by the World Economic Forum in cooperation with partners including Oliver Wyman points out that more widely available liquefied natural gas from the US could undermine the Russian Federation's negotiating leverage with consumers in Europe and Asia. Washington may use LNG exports to achieve foreign policy goals. Other regions might be able to build their own bases of political influence by producing more of their own energy, reducing their historic dependence on other nations. A number of energy companies have already been testing shale production in various European countries, such as Germany, Poland, Romania and Lithuania. However, in many places, shale oil operators must overcome deep environmental concerns.

PREPARING FOR A WILD RIDE

Many governments and national oil companies are becoming interested in developing regional and national supplies as a key path to energy independence and affordable energy. But those countries will have to sort out a slew of issues, from community concerns and zoning issues, to mineral rights ownership and a new relationship with old suppliers. Local oil prices could react, and it could be a wild ride.

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THE NEW BALANCE OF POWER IN OIL

FRACKERS ARE CHALLENGING TRADITIONAL SWING PRODUCERS

Bernhard Hartmann • Rob Jessen • Bob Orr
Robert Peterson • Saji Sam

Abdalla Salem el-Badri, secretary general of the Organization of Petroleum Exporting Countries (OPEC), said in April 2015 that the cartel's decision to continue to pump oil in spite of collapsing prices is inflicting pain on United States shale producers. Six months later in its September monthly oil-market report, OPEC wrote: "All eyes are on how quickly US [oil] production falls."

North American oil producers are experiencing widespread pain as a result of rock-bottom oil prices. One after another, US-based independent oil producers such as EOG Resources Inc., Carrizo Oil & Gas Inc., Rosetta Resources (now part of Noble Energy) and Whiting Petroleum Corp. have reported missed-earnings estimates and plans to cut production.

Many may need to contract even further. Banks re-examining their portfolios may charge them higher interest rates if shale producers' credit ratings are downgraded, which will lower their cash flows. In addition, the recent hemorrhaging of talent and equipment at oil field services companies could make it more difficult for North American shale producers to "turn on" additional drilling and pressure pumping. Consider: At present, they have only half as many rigs at their disposal as they did in 2014.

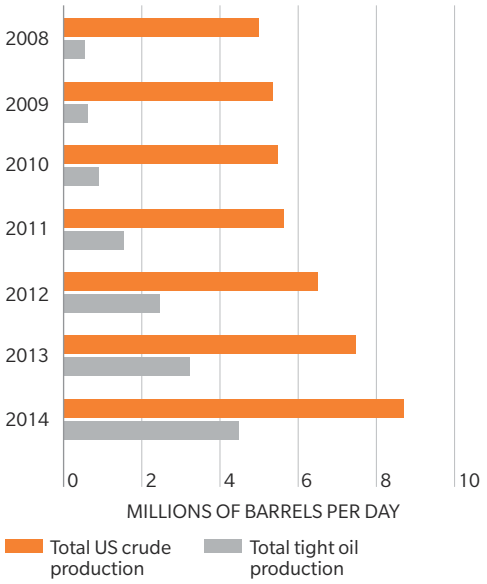
But it's way too early to count US-based shale producers out as major players in the oil markets in the future. Rather, what's happening marks an historic shift in the companies acting as market-driven swing producers by reacting swiftly to falling prices.

AN HISTORIC SHIFT

Over the past six years, "tight" oil, also known as shale oil, has soared from about 10 percent of total US crude oil production to approximately 50 percent. That means the US oil industry is producing roughly 4 million more barrels of crude oil every day than it did in 2008, according to the Energy Information Administration (EIA).

EXHIBIT 1: THE DRAMATIC RISE OF AMERICAN OIL

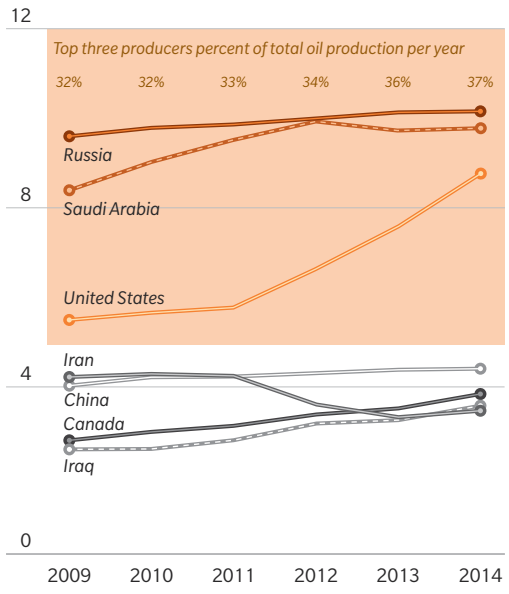
Greater amounts of shale oil are boosting crude oil production in the United States...



Source: EIA, Oliver Wyman analysis

... putting it on par with the world's other top producers, Russia and Saudi Arabia

MILLIONS OF BARRELS PER DAY



Source: EIA, Oliver Wyman analysis

As a result, the gap is closing between US crude oil production and the world's other two top producing countries, Russia and Saudi Arabia. From 2009 to 2014, Russia grew its production from 9.5 million barrels per day to 10.1 million, while Saudi Arabia expanded its production from 8.2 million to 9.7 million barrels per day. Meanwhile, US daily oil production soared by more than 60 percent, from 5.4 million barrels per day to 8.7 million barrels. Together, these three top producers now account for almost 37 percent of the world's total crude oil production. (See Exhibit 1.)

The EIA expects the new status quo to continue. In the first six months of 2015, US monthly crude oil production ranged from a high in April of 9.6 million barrels per day to 9.3 million barrels per day in June of 2015. The agency believes that US production will average 9.2 million barrels per day in 2015 and fall to 8.8 million barrels per day in 2016 assuming the "lower for longer" pricing environment continues.

STRONGER RESILIENCE

The main reason that shale producers are proving to be resilient is that they have continuously improved their drilling and fracturing technology, increasing their drilling efficiencies and stretching their capital expenditures. Our research shows that over the past three years alone, many American shale producers have cut their unconventional oil drilling and completion costs by 15 percent to 25 percent on average. In fact, North American shale producers are already working toward reducing their break-even point by as much as half. A lower break-even point could put shale on par with the oil fields of many national oil companies.

The gap is closing between the United States' crude oil production and that of the world's other two top producing countries, Russia and Saudi Arabia

Many North American shale producers have also exercised much greater discipline in managing operating expenses, recalibrating oil drilling activity with cash flows and planning for the "lower for longer" oil-pricing environment. Leaders in the industry have developed vast portfolios of operations, which enable them to cut back on drilling in high-cost areas while ramping up their drilling in lower-cost fields. They have also hedged portions of their production at much higher prices so that they can still make a financial profit even when their variable costs exceed the market price.

By contrast, the cost of drilling oil in the Middle East is starting to climb. To maintain or improve production from maturing fields, Middle Eastern national oil companies will need to adopt enhanced recovery methods using more expensive technologies. They also will have to consider tapping into new reservoirs and fields, many of which are of a lower quality. It will likely cost more to produce a barrel of oil from these sourer, heavier and tighter supplies.

So in effect, as OPEC acts less like a traditional "swing producer," North American shale producers are stepping into the role. Since 1973, Saudi Arabia and other OPEC members have acted as swing producers by increasing or reducing their oil output to help the global market adjust to shortages or surpluses in supply and volatile prices. North American shale producers are now responding to market supply and price changes.

Although some producers are unable to financially withstand the continued "lower for longer" oil price environment, most unconventional producers are proactively adjusting their production and cost profiles until prices rebound to more desirable levels. By allowing their producing shale fields to deplete naturally and curtailing drilling of new development wells, they are slashing their production in response to oversupply and low prices. But once supply tightens and the price of oil recovers, North American shale producers can quickly ramp up production in a matter of months, rather than years, by deploying currently demobilized rigs in factory-mode drilling.

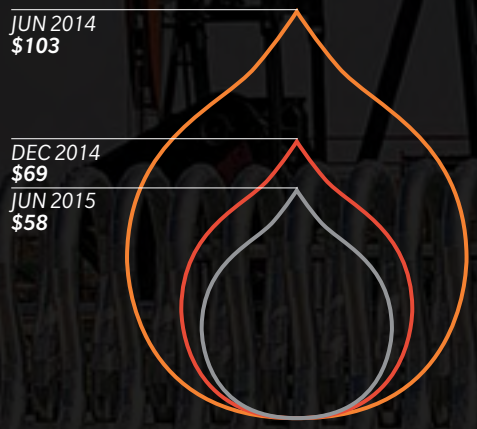
EXPANDING RANKS

Within the next decade, more unconventional oil and gas producers may also join existing players' ranks. Shortages in rapidly growing regions such as Asia and Africa are likely to be further exacerbated by a rising number of countries taking unilateral action to cope with local scarcities. And the US has shown one relatively inexpensive and fast way for countries to seek energy independence is by exploiting their own unconventional oil and gas resources.

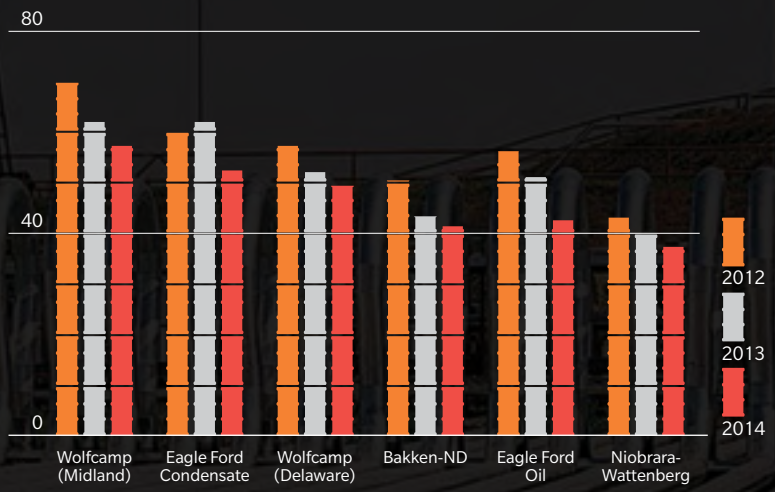
EXHIBIT 2: THE GLOBAL RISE OF SHALE PRODUCTION

North American shale producers are becoming more efficient...

SPOT WTI CRUDE OIL PRICE



US SHALE BREAK-EVEN COSTS, $ PER BARREL OF OIL EQUIVALENT



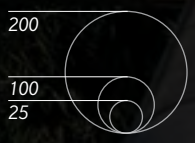
... serving as a blueprint for more potential shale production worldwide

TECHNICALLY RECOVERABLE UNCONVENTIONAL OIL AND GAS RESOURCES
IN BILLIONS OF BARRELS OF OIL EQUIVALENT, 2013

1,241 Unconventional **gas**

345 Unconventional **oil**

1,586 **Total** billions of barrels of oil equivalent



Countries with significant potential for unconventional oil and gas recovery

*The Kingdom of Saudi Arabia has more than 6 trillion cubic square feet of unconventional oil and gas resources, according to oil field services companies operating there.
Source: EIA, NDIC, IEA, ConocoPhillips investor presentation, Oliver Wyman analysis

Until now, the US has dominated the unconventional oil and gas market in large part because its players have better access to cheap capital, stronger mineral rights laws, availability of water for fracking, and an entrepreneurial, market-driven supply-chain ecosystem. So far, no other country has been able to replicate these conditions successfully. But in time, countries such as Argentina, Russia and China could figure out how to improve their environments for unconventional oil and gas drilling – potentially resulting in more regionalized oil markets in the long term. The estimated 156 billion barrels of oil equivalent unconventional resources in the US are only a small fraction of the approximately 1.6 trillion barrels of unconventional oil and gas that exist worldwide. (See Exhibit 2.)

So what steps should governments, national oil companies and oil majors take to stay ahead of these shifts? Most are tightening their belts to survive currently low oil prices by eliminating less valuable capital expenditures, renegotiating supplier contracts and reconsidering stock buybacks and dividend payouts, which have exceeded the oil majors' cash flows in recent years. Some are also opportunistically revamping their portfolios of businesses, workforces, supply chains and risk management practices.

BECOMING NIMBLE

While these are practical short-term steps, the answer to sustaining performance in a lower oil price environment is to be nimble, flexible and efficient in responding to supply-demand dynamics. To come out on top, governments and companies should take advantage of market distress while they can by rebalancing their resources to better meet shifting domestic and overseas demand and supply dynamics before the economic cycle reverses.

Governments in the Middle East, especially, should learn from the processes, organization, supply chains and other capabilities developed by North American shale players. They need to improve their ability to deploy capital in initiatives that will maximize their localization by creating more jobs, while expanding their range of substitutes for energy imports and potential exports. They should pick up the acreage, technology, talent and capabilities they need to compete in an oil market made up of many more nimble shale producers.

Frackers are showing that a new, more market-driven, invisible hand is not influencing oil prices but, rather, being driven by them.

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THE NEW MAKE VS. BUY CALCULUS

HOW UTILITIES CAN REMAIN RELEVANT TO CUSTOMERS WHO PRODUCE THEIR OWN POWER

James Basden • Adam Witkowski • Tim Wright

The days of the traditional electrical power utility are numbered. Disruptive forces – a combination of supportive government subsidies and advances in technologies such as micro combined heat and power boilers, solar photovoltaics and battery storage – are making it relatively easy and cost-effective for people in developed countries to unplug from the grid. Yes, fossil fuel prices have fallen, but photovoltaic and battery storage prices are also dropping quickly.

As a result, residences and small businesses are rapidly becoming more energy independent, producing electric utilities' core product – electricity. We estimate that every two minutes a home or business in Europe and North America goes solar.

MORE POWER GENERATED BY CUSTOMERS

If current trends hold, our research shows, the amount of power generated by utilities' residential and commercial customers in Europe and North America will rise by more than 60 percent within the next five years, reaching a record amount of approximately 400 terawatt hours per year. While that represents but a small portion of the entire power universe (the United States alone generates 10 times that amount of electricity), this amount is steadily growing. By 2050, customers in Europe and North America will generate the equivalent of $104 billion worth of electricity, up from about $44 billion today, provided energy prices stay close to their present level, supportive regulations remain in place and low-cost technologies become even more commonplace. (See Exhibit 1.)

The major shift underway in electricity generation is similar to upheavals that other industries have experienced, and have emerged all the stronger for it. Consider the telecommunications industry. In the 1990s, when deregulation fundamentally reshaped the market, smart competitors refocused their attention on anticipating and meeting their customers' preferences – by pioneering a wide range of alternative products and services. Most now provide not just basic land line phone service but also Internet, cable and applications that

Every two minutes a home or business in Europe and North America goes solar

enable phones to communicate with, and remotely manage, everything from home security systems to car temperatures to bill payments.

COMING OUT ON TOP

To come out on top of this disruptive wave, utilities, too, will need to better anticipate and meet their customers' needs – even if that means enabling customers to become their competitors. Specifically, utilities are best positioned to understand the economics of power generation. Instead of just trying to sell their power, they should sell their knowledge, by advising a broad range of customers on whether they should invest in making their own electricity.

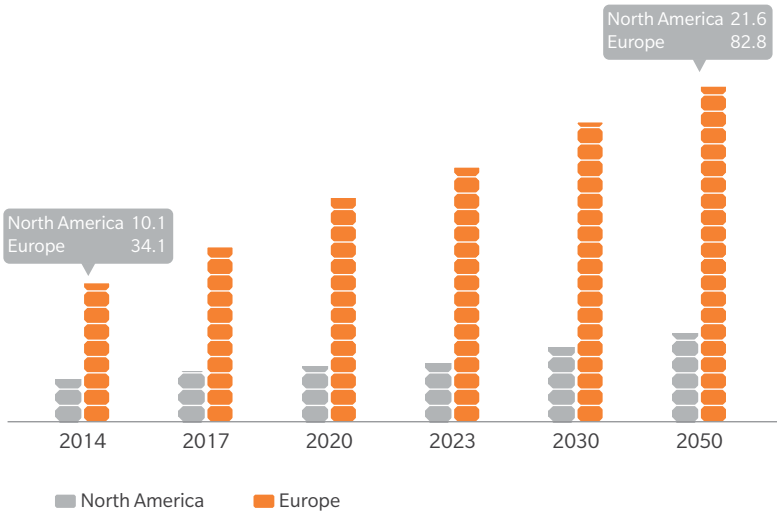
Increasingly, customers, ranging from businesses to households, are turning to a variety of sources for energy to ensure that their power is secure, abundant, hassle-free, cheap and sustainable. But they need technical expertise and practical support – the core competencies of utilities. In addition, utilities (like telecoms before them) will have to streamline and automate their legacy operations while investing in developing their people. Employees will need to be capable of articulating and delivering a much more expansive range of new products and services than is currently offered.

Finally, the electric utility of the future will have to be at the forefront of incubating, developing, investing in and implementing new energy-related technologies. To do so,

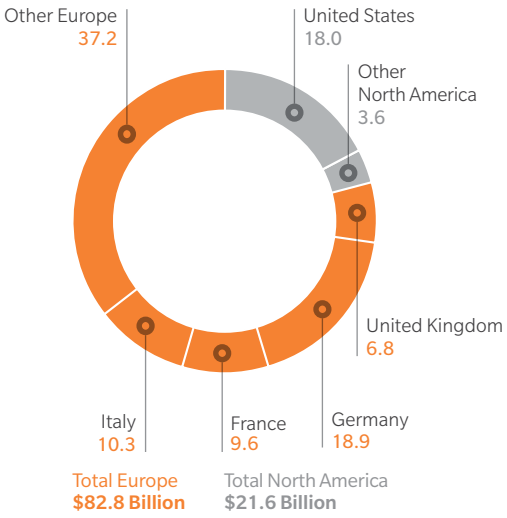
EXHIBIT 1: POWER PLAY

Residences and small businesses are becoming more energy independent

MARKET VALUE FORECAST OF RESIDENTIAL AND COMMERCIAL POWER GENERATION ($ BILLION)



PROSPECTIVE MARKET VALUE IN 2050 SPLIT BY CORE COUNTRIES ($ BILLION)



Source: Oliver Wyman analysis

utilities will need to cooperate effectively with a much broader network of investors, researchers, government policymakers and development programs.

DIVERSIFIED ELECTRIFICATION

It's tempting for utilities to think customers' fledgling efforts to produce their own electricity are temporary. They're not. They portend a new, more diversified wave of electrification that will alter our way of life. Utilities need to become more attuned to customers' needs – and start acting as both expert providers and advisers – to remain part of their old customers' new electric equation.

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THE WORLD ENERGY TRILEMMA

PROGRESS TOWARD BALANCED, SUSTAINABLE ENERGY REMAINS SLOW

Francois Austin

Energy sustainability is not just an opportunity to transform societies and grow economies, it is also a necessity – a prerequisite to meet growing energy demand in many parts of the world and to reduce the global carbon footprint. In order to build a strong basis for prosperity and competitiveness, individual countries must balance the three core dimensions of what Oliver Wyman and the World Energy Council have defined as the energy trilemma: affordability and access, energy security and environmental sustainability.

Our annual Energy Trilemma Index ranks 130 countries on their performance in meeting the demands of the energy trilemma and assesses how well countries are balancing the three dimensions. (See "The World's Top 25 Sustainable Energy Systems" on page 24.)

As highlighted in this year's Index, the transition toward balanced and sustainable energy systems is slowly taking place. Over the past five years, positive developments have been recorded in terms of access to energy, share of renewables in the electricity generation mix and rate of energy-efficiency improvements. Global energy intensity has decreased by 4.2 percent and carbon dioxide emissions intensity has fallen by 4.5 percent in that time, while the global electrification rate has risen to 85 percent, with an additional 222 million people gaining access to electricity from 2010 to 2012.

Still, many countries face obstacles to achieving a successful balance across the energy dimensions. This year, only two countries, Switzerland and Sweden, managed to obtain an AAA balance score across all three dimensions. The United Kingdom's score was amended to AAB, as its energy equity performance suffered in comparison to other leading countries.

Several countries, including the UK, Japan and Germany, are identified on the 2015 Watch List as being likely to experience a significant change in Index performance in the near future. These positive or negative changes can be driven by deep transitions in their energy systems – be they of a regulatory nature, concerning the energy supply mix or related to infrastructure changes to improve the resilience of their energy systems. In 2015, South Africa and the United States were added to the negative watch list, while the Philippines and Serbia are now on watch for overall positive trends in the coming years.

The energy challenges faced by each country are unique and complex, as evidenced by the variability in performance across the trilemma dimensions and contextual factors. Yet the transnational nature of energy markets and environmental issues necessitates a perspective that extends past the country level.

Energy sector leaders have spoken about the need for a clear international dialogue and a robust, sustainable policy framework to ensure research and investment is targeted at delivering sustainable energy systems. Progress across the dimensions of the energy trilemma remains slow, and can only be sped up by creating frameworks that give certainty to investors.

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This story is adapted from an article that first appeared on BRINK

THE WORLD'S TOP 25
SUSTAINABLE ENERGY SYSTEMS

What country leads the world in providing stable, affordable and environmentally sensitive energy? As the 2015 World Energy Council/Oliver Wyman Energy Trilemma Index results below show, 14 countries – Australia, Austria, Canada, Colombia, Denmark, France, Norway, Singapore, Spain, Sweden, Switzerland, the United Kingdom, the United States and Uruguay – rank within the top 25 countries across two core components of sustainable energy systems as defined by the World Energy Council and Oliver Wyman – energy security, energy equity and environmental sustainability. But only two countries – Sweden and Switzerland – rank within the top 25 countries across all three dimensions, according to the index which is based on an analysis of 60 data sets used to develop 22 indicators across 130 countries. To date, only one country – Switzerland – has managed to rank within the top 10 nations in balancing across all three dimensions.

- Leader in each of three dimensions
- Leader across two dimensions
- Top 25

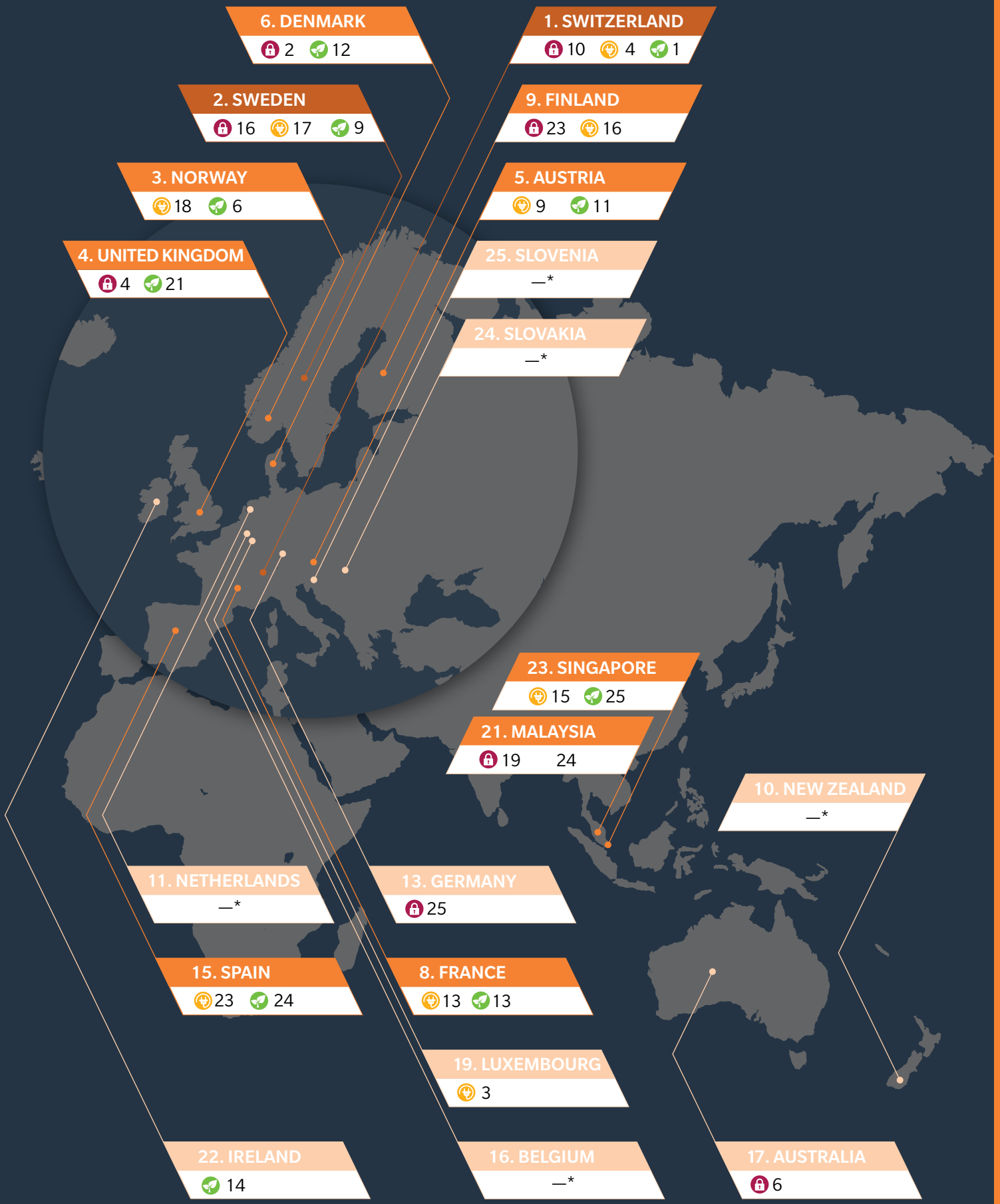
* Dimensional score is below 25, but overall balance score is high

Top 25: Energy Security
The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure and the ability of participating energy companies to meet current and future demand

Top 25: Environmental Sustainability
The achievement of supply and demand-side energy efficiencies and the development of energy supply from renewable and other low-carbon sources

Top 25: Energy Equity
The accessibility and affordability of energy supply across the population

Sources: World Energy Council and Oliver Wyman


6. DENMARK
2 12
1. SWITZERLAND
10 4 1
2. SWEDEN
16 17 9
9. FINLAND
23 16
3. NORWAY
18 6
5. AUSTRIA
9 11
4. UNITED KINGDOM
4 21
25. SLOVENIA
—*
24. SLOVAKIA
—*
23. SINGAPORE
15 25
21. MALAYSIA
19 24
10. NEW ZEALAND
—*
11. NETHERLANDS
—*
13. GERMANY
25
15. SPAIN
23 24
8. FRANCE
13 13
19. LUXEMBOURG
3
22. IRELAND
14
16. BELGIUM
—*
17. AUSTRALIA
6

STRATEGY

ENERGY JOURNAL | VOLUME 2

Empowering Utilities

Power Generation Disruption

The Industrialization of Commodity Trading

The Mexican Retail Fuels Revolution

EMPOWERING UTILITIES

THE NEW RULES FOR KEEPING THE LIGHTS ON

Thomas Fritz • Joerg Staeglich • Tim Wright • Gerry Yurkevicz

Driven by the rise of new energy technologies, climate change and fluctuating energy demands, utility markets in developed economies are undergoing rapid and radical changes in direction. Oliver Wyman conducted a recent study on global utility markets and discerned three primary patterns in terms of structural market shifts. Diverse countries are characterized by either: 1) decentralized generation under government-set targets; 2) monopoly regulation at the local level; or 3) balancing market competition with strong regulatory oversight. The energy markets of Germany, the United States and the United Kingdom each represent one of these patterns.

Structural shifts such as these can have a large impact on value creation and destruction. As an example, Germany at one time had a centralized energy system with nuclear and lignite ("brown coal") power plants owned by large, vertically integrated utilities. Due to the *Energiewende* program, however, small-scale renewable generation capacity has increased (such as photovoltaic and onshore wind), resulting in a highly decentralized market and the devaluation of incumbent energy assets. As a result, the enterprise value of the three largest German utilities fell between 2008 and 2014 by as much as 58 percent. (See Exhibit 1.)

ENERGY MARKET TRENDS

All countries we examined are showing a mix of market shifts to some degree, and future market directions could change rapidly. Three trends in particular are worth noting, as these will have an outsize influence on utilities' future planning.

Increased regulatory focus: Market regulatory policy is naturally influenced by political ideology and global trends. From a utility's perspective, this means that they must think in terms of scenarios and actively engage in the political and regulatory debate. As energy market volatility is unlikely to diminish, utilities will need to develop collaborative viewpoints on future regulatory direction, typically by supplementing direct lobbying and engagement with the indirect support of customers, suppliers and other stakeholders.

Utilities will need to become more creative and adaptive

Successful utilities also must be flexible enough to respond quickly and effectively to regulatory policy change to avoid value destruction, such as through stranded assets, and find new growth opportunities. This nimbleness is a competency that many larger incumbent players struggle with given the legacy nature of their businesses and static organizational structures.

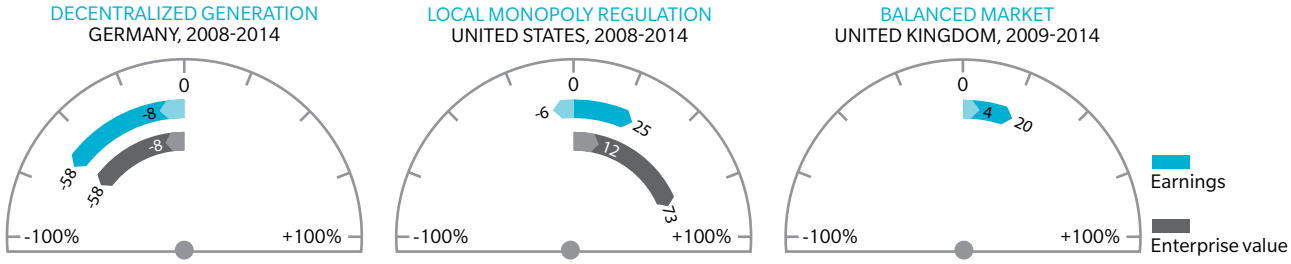
Renewables-based and decentralized generation: Utilities will need to find new end-customer solutions and mark out positions in the renewables-driven generation market. As technology progresses and climate change becomes more of an issue worldwide, renewable energy will become more important in all markets. But given that many renewable technologies are characterized by small and distributed generation units, a higher share of renewables will likely mean a higher level of decentralization. The climate targets set at the 2015 Paris Climate Conference underline the need for renewables and increasing levels of decentralized generation on a global level.

The situation of customers being able to generate their own power is particularly challenging for utilities. They will need to develop new services and solutions to maintain customer relationships and the associated earnings, as well as positioning themselves in these more competitive generation markets.

Market diversity: Once-homogeneous energy markets are being broken up into different regulatory and pricing sub-markets, requiring utilities to build out specialized knowledge and capabilities in response. Large monopoly utilities may want to consider alternatives such

EXHIBIT 1: ELECTRIC UTILITY VALUE CREATION AND DESTRUCTION

Structural market shifts are having a big impact on electric companies' earnings and value



- Declining profits in the generation business
- Drop in wholesale prices due to increased renewables, which make up more than three-fourths of the total generation profit pool and are mostly in the hands of new market players

- Differentiated picture depending on degree of regulation and reflecting business strategy
- Pipes & wires and vertically integrated utilities have achieved the best gains in earnings (+25%) and enterprise value (+73%)
- Hybrid utilities with both regulated and non-regulated business show the worst performance (earnings -6% and enterprise value +12%)

- Large differences along the value chain
- Decline in conventional generation erased nearly 50% of the original profit pool
- Renewables as well as domestic gas and power supply have had positive effects on value

Source: Oliver Wyman analysis

as moving to more decentralized business units or even to a holding company structure as a means of increasing adaptability while reducing complexity.

RESPONDING TO CHANGE

The speed at which energy markets are changing today and the increasing number of moving parts in terms of policy levers and regulatory bodies means that utilities will need to become more creative and adaptive. And while sources of value are splintering under the weight of shifting markets, the following success factors need to be the focus for any utility: performance optimization, regulatory management and customer centricity.

Performance optimization: Performance optimization for many utilities starts with pulling classic levers such as reducing variable costs. As an example, all three major German utilities, in the face of decentralization and renewable energy targets, have implemented performance improvement programs, realizing some $8.7 billion in sustainable cost improvement since 2008.

In the light of ongoing performance challenges, however, moving from traditional, top-down approaches to end-to-end performance optimization that engages all levels of the organization has become crucial. To enable such optimization, for example, German utilities E.ON and RWE are splitting their companies in two – separating the conventional generation business from renewables generation, grids and retail. Active management of risk is important as well, to ensure utilities can weather the kinds of disruptive changes that can erode value and strand assets.

Regulatory management: Successful utilities are using scenario planning to understand the entire range of possible evolutionary paths for regulation and technology and thus where

Moving from traditional, top-down approaches to end-to-end performance optimization that engages all levels of the organization has become crucial

value is most likely to be created (or destroyed) across the energy value chain. This information can provide a starting point for engaging regulators, government, rating agencies and investors in discussing the implications of future developments and shaping constructive regulatory partnerships.

As an example, a midsize US energy company with significant financial issues worked to strengthen its relationships with state regulators and officials and to take a more active role in shaping policy. In particular, the company emphasized the quality and relative low cost of utility services plus the job creation benefits of utility operations and purchases within the state. By then delivering on its promises in terms of core utility operations and meeting regulatory initiatives, it was able to reduce regulatory lag and de-risk earnings. Over the past five years, the company has continually earned its allowed returns, grown earnings through an aggressive capital investment program and achieved best-in-class stock market performance.

Customer centricity: In the past, customers could do little to influence utility performance and earnings. But the uptick in competition in retail means that customers have more choices; customer satisfaction is becoming directly linked to earnings in the more regulated parts of the value chain (such as in the UK). And with utility bills taking an ever-larger bite out of customers' wallets, energy consumers in all markets show less confidence in energy retailers' ability to deliver value for money.

One way in which energy retailers are trying to retain (or regain) customer trust is through innovation. It is now common to see utilities investing in new propositions and new technologies to improve the quality, transparency and sustainability across all of their services. For example, British Gas, the UK's largest energy retailer, provides about one million utility customers with home maintenance services (such as boiler care, electrical and plumbing installation and maintenance) and leads the market in the use of smart metering and energy management technologies, which offer customers greater transparency and control of their energy usage. Even those utilities that have limited interfaces with customers, such as network operators, are facing a ramp-up in financial incentives and penalties from regulators as a means of improving levels of end customer satisfaction.

A NEW ENERGY ECONOMY

In summary, global utility markets are being challenged by the ongoing transformation to a new energy economy – one that will utilize a wider swath of energy sources and

technologies and increase both competition and regulatory pressures, while reducing greenhouse gases, promoting resource sustainability and increasing energy efficiency. It's a disruptive process, as both industry and regulators try to figure out the best way forward and optimal cost-benefit trade-offs. There is no getting off this ride, however: Utilities must recognize the status quo is no more and prepare themselves to meet any and all challenges that this transformation will bring.

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POWER GENERATION DISRUPTION

GERMANY'S CASE FOR CHANGE

Thomas Fritz • Dennis Manteuffel • Joerg Staeglich

Energiewende (or "energy transition") is one of Germany's largest ongoing projects: a paradigm for the rapid and disruptive changes that many electricity markets are now facing or soon will face, as regulatory and consumer pressures to reduce fossil fuel usage grow and the costs of renewables-based generation continue to fall.

Due to its early adoption of renewable energy, Germany is now a good example of the kind of turbulence that can be expected as electricity markets transition. Its Renewable Energy Act (EEG) of 2000 (since amended several times) gives renewables priority and investment protection. Germany now meets more than a quarter of its electricity demand through renewables – a figure that is expected to rise to 80 percent by 2050. It's a mission that has found widespread approval: More than three-quarters of German private households, energy utilities and industrial companies that we recently surveyed (in collaboration with the Technical University of Munich) see the realignment of the energy sector and Germany's pioneering role in a positive light.

Nevertheless, there are clear hurdles to making renewables-based generation a reality. *Energiewende*, for example, envisions households and businesses investing directly in their own renewables-based power generation capacity – a leap that many are unwilling or unable to make without subsidies. Utilities, on the other hand, face the loss of their central role in power generation and the challenge of repositioning themselves to avoid stranded assets and value destruction.

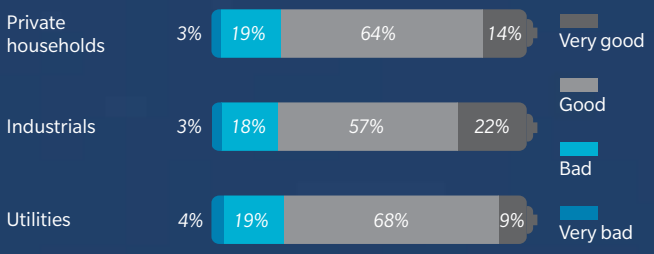
NO GUARANTEE OF SUCCESS

Despite popular acceptance of *Energiewende*, our survey found that 49 percent of private households still have doubts about its ultimate success. Most critical are questions over implementation: 80 percent of households consider the resulting rise in on-grid electricity prices to be a severe burden. And though a distinct majority is generally willing to invest in renewables (wind, photovoltaics and geothermal are popular), as many as two-thirds report that they will only do so if they receive some kind of subsidy. Even then, 40 percent are not prepared to invest more than $1,100 in green technologies. Nearly two-thirds of our households surveyed expect their investments to pay off within three to five years. (See Exhibit 1.)

EXHIBIT 1: THE CURRENT STATE OF GERMANY'S ENERGY TRANSITION

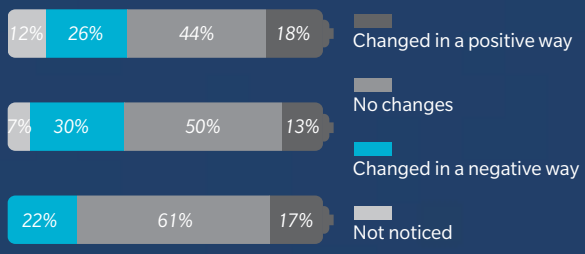
More than 75 percent of private households, industrials and utilities support Germany's Energy Transition...

HOW WOULD YOU RATE GERMANY'S ENERGY TRANSITION?



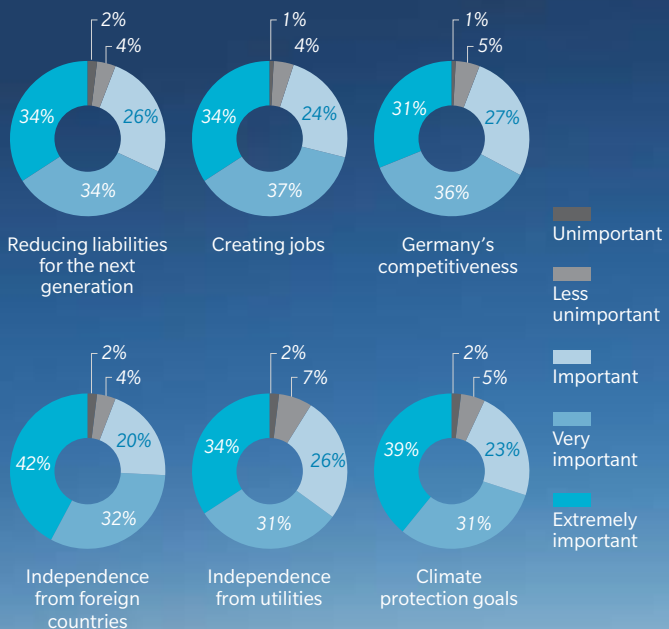
...however the recent changes to the German Renewable Energy Act are regarded as insufficient by all groups...

HOW HAVE YOU EXPERIENCED THE CURRENT CHANGES IN THE GERMAN RENEWABLE ENERGY ACT (EEG)?



...and the government needs to take this into consideration in the lead up to the next election since 58 percent of respondents agree it will influence their vote

HOW IMPORTANT ARE THE FOLLOWING ELEMENTS OF THE *ENERGIEWENDE* TO YOU, AS A PRIVATE HOUSEHOLD?



WILL THE *ENERGIEWENDE* INFLUENCE YOUR VOTE IN THE NEXT ELECTION?

Source: Oliver Wyman analysis

Businesses are skeptical, too. Some 70 percent of those surveyed believe that energy procurement costs will rise in the wake of *Energiewende*, and 67 percent don't intend to build their own generation capacities – although all respondents said that adequate subsidies might make them more willing to invest. Of those industrial companies that do tend to invest, they are banking on renewables to improve their company's image (77 percent) and reduce costs (62 percent).

The German utilities we surveyed are primarily critical of energy policies: 83 percent view amendments made to the renewable energy law in 2014 as ineffective or counterproductive. In addition, only 30 percent of utilities expect that the expansion of both network and storage capacity needed to make the energy transition workable will be realized in the foreseeable future. And yet, utilities are optimistic about their own future, as 83 percent of survey respondents reckon that they are now well prepared for upcoming challenges, and 65 percent think that retail energy still offers significant opportunities.

A CHANGING ROLE FOR UTILITIES

To stay competitive as renewables increase in a market and customers begin to generate (at least some) of their own power, Germany's example shows that utilities must reconsider the way they sell energy. As revenue from central generation assets declines, utilities must develop a better understanding of how customer needs and wants are evolving in response to the energy transition (and related cultural and technological changes), adopt innovative sales tools and business designs and develop simple, efficient solutions.

In short, *Energiewende* in Germany and the increased focus on renewables in other countries will require utilities to undergo a transformation – from asset-heavy energy providers to broader, asset-light service providers. By identifying their customers' specific, unmet needs, utilities can begin to build out new business designs, with the goal of delivering a consistent customer experience. Insurance, home repair, "smart home" technologies and installation and maintenance of renewables-based generation and storage equipment are just a few options that utilities could offer their customers.

For example, all of the large German utilities offer photovoltaic home installation services to their customers. RWE, one of the largest utilities, also provides customers with solar energy storage and home automation systems and runs a network of charging stations for electric vehicles. British Gas, which supplies natural gas in the United Kingdom, is remaking itself into a "caretaker" for its customers' homes, providing bundled heating and safety solutions. The Hong Kong and China Gas Company (known as Towngas) sells its own white label appliances and offers bespoke kitchen design.

Germany's energy transition should serve as a wake-up call for utilities everywhere. Renewables and direct generation are part of a wave of disruption and innovation that will impact many energy markets in the future – much in the same way that mobile phones disrupted the previously static landline telecom industry and the Internet caused dislocation in a wide swath of retail and media business models. These other instances have demonstrated that treating innovation as a threat will end your business in a hurry; planning ahead, on the other hand, can open up tremendous new sources of value.

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THE INDUSTRIALIZATION OF COMMODITY TRADING

WHAT ASSET-BACKED TRADERS' STRONG RESULTS MEAN FOR THE FUTURE OF INDEPENDENT TRADERS

Alexander Franke • Ernst Frankl • Christian Lins • Adam Perkins
Roland Rechtsteiner • Graham Sharp

One after another, the commodity trading industry's traditionally leading independent traders have been increasingly stagnating, as the prices of everything from copper to crude oil remain stuck at rock-bottom levels. By contrast, the world's slow-moving top asset-backed trading giants are announcing rock-solid results.

Has the commodity trading industry been turned on its head? No, but the turnabout shows that it's obeying a new set of rules – a seeming contradiction that only makes sense in light of an ongoing transformation of nonconformist commodity trading into a mature industry. The strong trading results of longstanding oil majors and other asset-backed traders provide a glimpse into the potential of strategies that will work in the future. The commodity traders that have come closest to achieving established, institutionalized global machines designed to generate earnings reliably in spite of market conditions are now at the head of the pack.

The trailblazers in the commodity world, in short, are industrializing. Oversupplied markets, rising customer expectations and higher costs resulting from tighter governance, reporting and asset management requirements are fracturing the principles of commodity trading that once ruled the industry. Among the casualties: Superstar commodity-trading individuals accustomed to operating solo. The new rules require more than ingenuity, agility and speed. They call for systematically achieving superstar results by transforming market and competitor intelligence gathered from personal networks into tradable institutional knowledge, offering structured customer solutions and monetizing "optionality" – defined as the options available to run, manage and extract the most value from their portfolios globally. Leading players are metamorphosing into light-footed, one-stop shops able to finance, store, transport, refine and distribute commodities globally with machine-like efficiency, avoiding operational or financial strain.

INSTITUTIONALIZING OPERATIONS

For now, major energy companies and other asset-backed traders are the furthest along this path. For example, in the first three months of 2015, BP's profit fell only 20 percent compared to the same period in the previous year, even though crude oil prices were cut in half. Similarly, the trading arms of Total and Shell helped to support their overall group results by taking advantage of favorable forward market conditions and storage capacity along their logistics chains. As a group, top-tier asset-backed traders have been growing their gross margins more than three times as fast as independent traders since the financial crisis. The top five asset-backed trading giants have bounced back strongly from the crisis, growing their gross margins as a group by more than 15 percent every year ever since 2010. By contrast, the gross margins of the top five independent traders have expanded annually by only 5 percent. (See Exhibit 1.)

As a result, tightly run, independent traders are, in a rare shift of industry dynamics, following the example of asset-backed traders, rather than the other way around. Independent traders are striving to institutionalize their operations without sacrificing their nimbleness and entrepreneurial drive. To that end, they are introducing middle-management positions to break down the organization's dependence on a handful of key individuals in order to gather and act quickly on market intelligence from anywhere in the world.

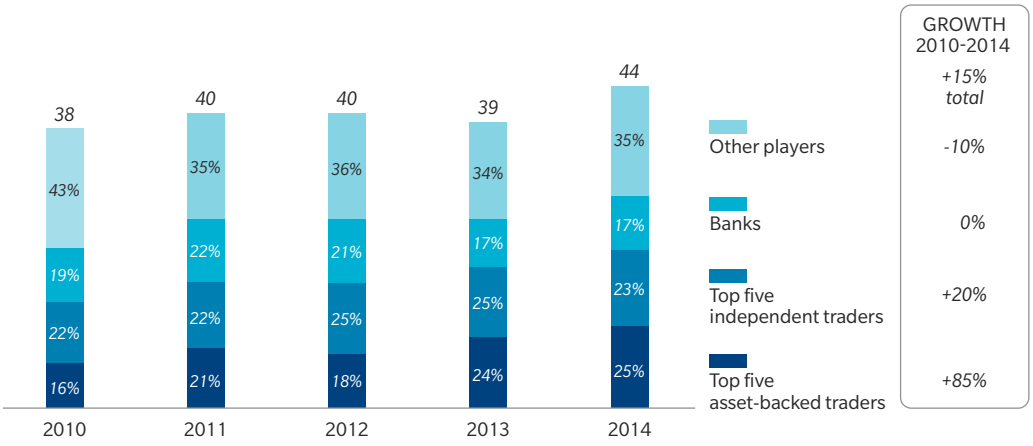
At the same time, they are shifting towards a more rules-based, management-run model, with explicitly defined delegations of authority and institutionalized processes around investment decision making and

EXHIBIT 1: THE COMMODITY TRADING GAP

Top asset-backed traders with more institutionalized operations have gained significant market share after the financial crisis compared to their independent trading peers

COMMODITY TRADING POST FINANCIAL CRISIS GROSS MARGINS OVERALL AND BY PLAYER

MARKET SHARES IN PERCENT
($ BILLION)



Note: Top five = five largest players in 2014
Source: Oliver Wyman analysis

capital allocation. Many are also building out their corporate functions, such as corporate finance, strategy and external communications. They are even involving their compliance and legal departments more in complex issues such as customer relationships. Some are going as far as to outsource and offshore routine administrative work and to publish comprehensive annual reports.

Of course, no single playbook works for every player. Established commodity producers and other asset-backed traders are presently demonstrating greater resilience to difficult market conditions by centralizing supply and trading operations to optimize the returns from their massive global portfolios of production, processing, logistics and retail assets, as we predicted in "The Dawn of a New Order in Commodity Trading" Acts II and III, which appeared in the *Oliver Wyman Risk Journal* in 2013 and 2014.

At the other end of the spectrum, many top independent traders are developing standardized tool kits to invest along their logistics chains in storage terminals, transportation, domestic distribution and retail chains with a broad network of customers and partners. In recent months, Castleton Commodities International, backed by private investment vehicles and family trusts, bought Morgan Stanley's oil business for an estimated $1 billion. Through subsidiaries, Vitol and Trafigura partnered with private equity and sovereign funds to expand into retail fuel distribution networks and gain control over transportation and storage assets. A Japanese trading firm joined with three Japanese oil-refining companies to form a new liquefied petroleum gas trader called Gyxis.

For most companies, the commodity-trading makeover underway requires attaining significant scale and sophistication, while not jeopardizing flexibility. Traders scramble to develop scope through capital-efficient partnerships and contracts and then seek to differentiate their services to avoid becoming commoditized themselves.

3x

How much faster top-tier asset-backed traders have been growing their gross margins compared with independent traders over the past five years

That's why commodity traders with a narrow commodity or regional footprint are rapidly expanding and forging closer relationships with customers. For instance, more midsize players active in trading only a few commodities are developing comprehensive, global cross-commodity portfolios and are broadening their offerings to counterparties in order to form longer-term relationships. A new wave of petrochemical companies is also building out trading capabilities in related commodities or service offerings.

RAISING THE BAR

For companies struggling to adapt, the industry's coming of age is problematic. Consider: The revenues from investment banks' commodity trading operations, many of which

were forced to sell their physical assets and were ultimately sold off, have stagnated over the past five years. Most niche players lacking scale and sophistication have shrunk. For example, commodity hedge funds primarily betting on price directions without assets suffered massive capital outflows over the period.

In general, the industry's greater scale and sophistication raises the bar, both for those existing traders seeking to grow and for those companies considering entering commodity trading. New entrants' resolve is being tested as never before, especially as commodity prices remain flat in the near term.

Independent traders are suddenly imitating asset-backed traders, rather than the other way around

Successful strategists are designing large systems and industrialized platforms that can maintain the high degree of entrepreneurship and individual talent required for them to act swiftly on monetizing opportunities. Hence the question becomes: Will independent traders industrialize to the degree required to continue to take on established top-tier asset-backed traders as they have done in the past? And if independent commodity traders improve their resilience, will asset-backed traders be able to go on building out their capabilities and gaining market share at the same pace?

To be sure, while the current industry shift underway is significant, independent commodity traders have a solid track record of being able to not just meet, but also to exceed the industry's challenges. Still, the answer depends on whether players can recognize – and pull – the three key levers that have led to the exceptional growth and profitability of top-tier asset-backed traders in recent years. Those organizations approaching the large-scale change underway as three simultaneous and parallel challenges – the industrialization of processes, the monetization of interconnected analytics and the mass customization of customer solutions through partnerships – have a greater chance of succeeding in this undertaking.

1. Industrializing processes. One of the biggest challenges for commodity traders is that the pace at which they have amassed global portfolios of commodities and logistics and retail operations in recent years has outpaced the investment in processes that are needed to monetize their potential effectively. This is especially true for independent traders that have historically had an appetite for more complex deals, which require extensive oversight by their own staff and as a result cannot be easily integrated into a standardized trading workflow.

   Consequently, the more commodity traders attempt to be all things to all clients, the more their costs rise – often faster than their revenues. Commodity traders are trading a much broader range of commodities with more numerous counterparties, handling more complex logistics chains, managing more multifaceted financial and operational risks and delivering commodities to wholesale and retail customers in smaller lot sizes around the world.

To avoid this outcome, major energy companies have been refining their ability to incorporate their longstanding operational expertise into their trading divisions' cultures. They are standardizing, automating and outsourcing processes. They are breaking down barriers between logistics operations and their supply and trading divisions in order to improve operational stability and efficiency. At the same time, they are standardizing and outsourcing finance, risk reporting and post-trade handling matters.

Taken together as a whole, these efforts are having a significant impact. One leading asset-backed player, for example, was able to reduce the ratio of costs to trading income by more than 10 percentage points simply by standardizing and outsourcing more work.

2. Monetizing interconnected analytics.
Leading asset-backed traders are also developing a competitive edge in terms of automating the collection and analysis of their market intelligence in order to optimize the value captured from existing strategies and to develop entirely new opportunities. Traditionally, commodity traders have gathered market intelligence from personal networks of buyers, sellers, shippers and agents with little formalized assessment and tracking. Centrally controlled fundamental market analytics have been critical, but these have often struggled to support fast-paced day-to-day front-office decisions.

But that's beginning to change.
Leading traders are breaking down their organization's heavy dependence on a handful of key individuals for critical decision making across global systems based on market intelligence.

They are strengthening their market, weather and competitive intelligence-gathering capabilities by upgrading their systems to process the Big Data that exists across their

massive operations. They are adopting remote-sensing technologies such as satellites and ground-based sensors to gather quasi-real-time market intelligence on waterborne vessels and pipeline flows, as well as the state of refineries, stockpiles and tank farms worldwide.

By connecting their proprietary intelligence on flows, the condition of their assets and competitor behavior with new technology-backed market and competitor intelligence, leading traders are able to improve the precision of their trading strategies, as well as identify new opportunities. To be sure, intelligence gathered by individuals will always be hugely important to the commodity trading industry. But the new front line for competition between commodity traders is shifting toward inferring meaningful intelligence in a timely manner from a combination of proprietary intelligence and ground or remote sensing data from other sources. This can be achieved with so-called "smart machine" algorithms that learn to derive signals to trade by identifying patterns and anomalies.

3. Developing equity-based opportunities.
   Top asset-backed traders are also beginning to play catch-up with leading independent commodity traders by successfully building out their business development and origination capabilities. In the past, top asset-backed traders have been slower than independent traders such as Vitol and Trafigura to strike capital-efficient partnerships in order to expand their capabilities and market access. That's in large part because they didn't have to. Most oil majors and other large commodity producers were already operating in most of the key markets and were able to mobilize resources globally more easily because of their vast global production and processing networks.

But recently, asset-backed players have been entering partnerships in new markets to exploit profitable niches and emerging markets, especially in the Eastern Hemisphere. For example, Shell has been involved in a number of successful collaborations with logistics-services provider Royal Vopak N.V. related to infrastructure investments. BP is joining forces with Sinopec to gain access to the Chinese bunker fuel market. European utility traders are also considering Asian partnerships in order to expand and better optimize their global fuel and freight books.

Other traders are also entering deals backed by third-party master agreements with banking, logistics, project development and engineering partners. They have discovered that these partnerships serve a dual purpose. They help their companies to avoid becoming slow and rigid in their quest for stability. At the same time, traders pick up clear guidance on complementary commodity classes, potential acquisition targets and preferable deal structures.

BREAKING FROM THE PACK

The commodity-trading industry began as a fragmented band of individuals stepping in to smooth out global supply and demand imbalances and information asymmetries. But that's not where it will end. To remain front-runners, commodity traders must industrialize in order to become nimble, global one-stop shops for multiple commodities, in addition to providing for their financing, risk management and logistics.

To do so, in the next five years, commodity traders will morph into organizations with all of the benefits and challenges of other mature industries. Like automakers, manufacturers and financial-services firms before them, as commodity traders' business models become increasingly homogeneous, they will be under even more intense pressure to distinguish themselves from the pack.

This is a tall order for an industry made up of creative and nimble customers and key trading talent unaccustomed to more institutionalized cultures. Sluggish commodity markets and slipping trading margins could threaten traditional compensation structures and levels.

Nevertheless, leading independent traders must learn from asset-backed traders in order to grow and become more resilient. If the past is an indicator for the future, independent players will find nimble and swift ways to adapt and lead again. Conversely, asset-backed traders will need to continue to push the envelope in professionalizing the industry and strive to be more agile by exploring new, innovative ways to inexpensively optimize all of the options available in their massive global operations. No one can afford to sit still.

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THE MEXICAN RETAIL FUELS REVOLUTION

OIL DEREGULATION OPENS DOOR FOR NEW FUELS MARKETERS AND RETAILERS IN 2016 AND BEYOND

Bob Orr • Karina Swette

As Mexico deregulates its oil industry, it is opening its doors to the largest fuels marketing and retail prospect on the horizon.

For the first time, foreign companies will be allowed to own and operate fuel assets, and companies will be able to import and sell fuel that is branded and sold by suppliers other than Pemex, Mexico's state-owned petroleum company. New fuel marketers and retail offerings will change the market landscape and shake up the legacy industry.

A highly attractive market, Mexico is the sixth-largest consumer of motor gasoline and diesel, with consumption forecasted to grow by around 3 percent annually, roughly double global demand. Mexican fuel site throughput, the average amount of fuel sold per retail location, is 30 percent higher than other, mature markets. Average fuel prices in Mexico are currently almost 50 percent higher than in the United States. And only about half of Mexican fuel stations have convenience stores, compared with 80 percent in other countries.

Most deregulation talk focuses on oil exploration and production, but as the Mexican market opens, investors who are willing to work through the challenges of the evolving market will discover enormous opportunities downstream. (See Exhibit 1.)

ATTRACTIVE MARKET DYNAMICS

Mexico is one of the last developing markets to deregulate. Its size, current pricing arbitrage, high site throughputs, fragmentation and limited customer offerings make it attractive for incumbents and new competitors who invest in new retail fuel offerings.

Mexicans consume more than 750,000 barrels of gasoline per day, and demand is expected to grow twice as fast as global demand and at a higher rate than the top five fuel consuming nations. Such demand growth will likely lead to an increasing reliance on

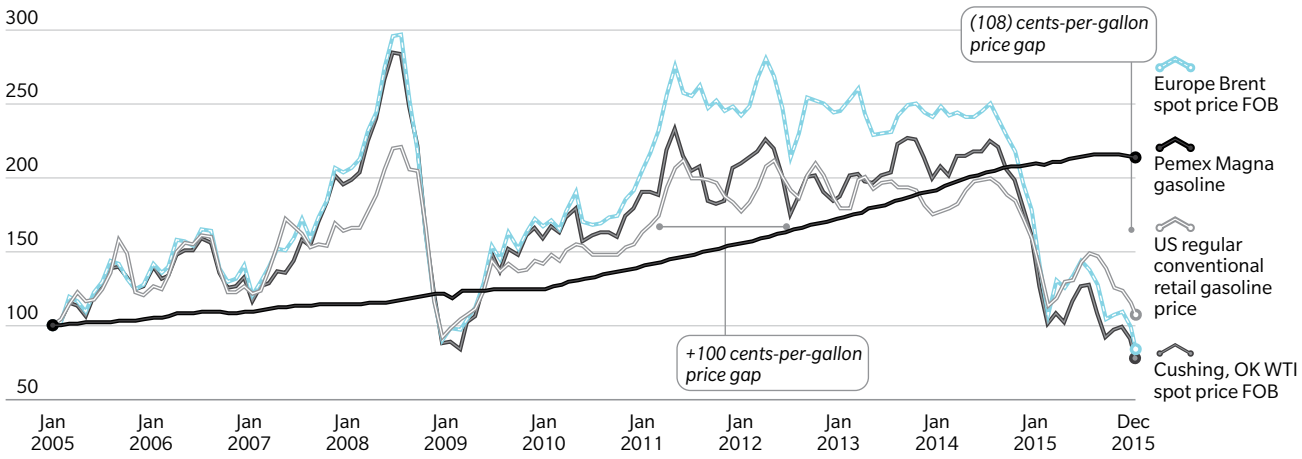
EXHIBIT 1: MEXICO REFUELS

Mexico's deregulation of its oil and gas industry is creating huge fuels marketing and retail prospects for foreign investors that could fundamentally change the way Mexicans buy gasoline and diesel

MEXICO FUEL PRICE GAP

The regulated Mexican gasoline price has created a wide profit margin for foreign suppliers...

INDEXED, 2005–2015 (2005 = 100)

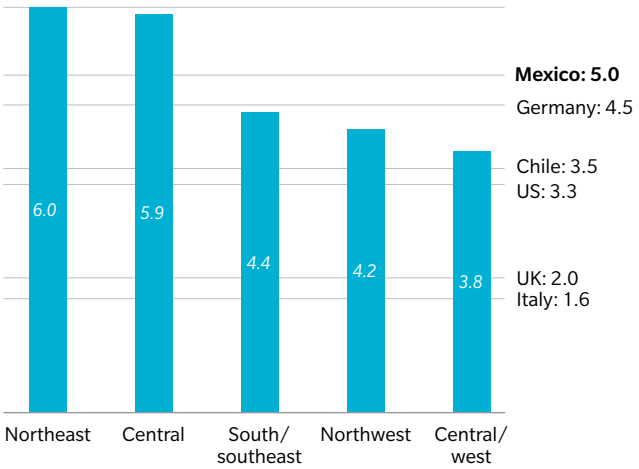


Source: Pemex Magna unleaded (regular), Energy Information Administration; Oliver Wyman analysis

HIGH SALES VS. OTHER COUNTRIES

...plus, Mexican service stations sell more fuel per station than those in other countries...

AVERAGE ANNUAL CONSUMPTION PER REGION OF MEXICO AND THROUGHPUT
(MILLIONS OF LITERS, 2013, INCLUDES GASOLINE AND DIESEL)

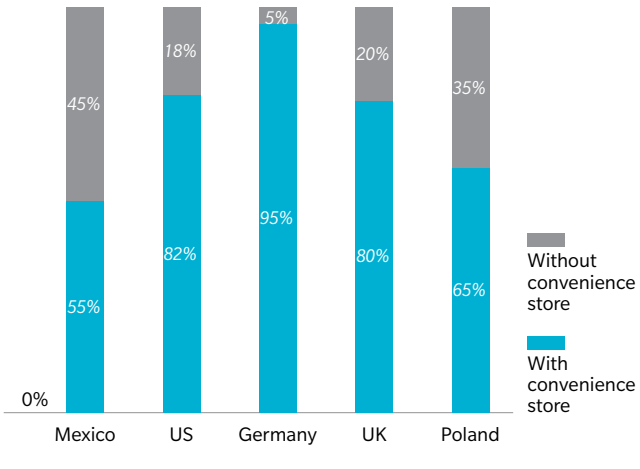


Note: UK excludes supermarkets in average
Source: Country government reports, Oliver Wyman analysis

FEWER CONVENIENCE STORES

...and there is a lower percentage of gasoline stations with convenience stores

CONVENIENCE STORES PENETRATION IN GAS STATIONS
(PERCENTAGE OF STATIONS WITH CONVENIENCE STORES)



Source: CBRE – Market View European Petroleum Retail Sector, US Census Bureau; Oliver Wyman analysis

imports. With oil prices in the US dropping, US refiners that have access to cheap crude will continue to increase fuels exports, and Mexico is their closest and largest import market. Imports already account for 48 percent of Mexican fuel consumption and are projected by Oliver Wyman to reach up to 60 percent of total consumption in 2020.

The Mexican government sets fuel prices and has steadily increased prices over time. Historically, this meant the Mexican government was subsidizing fuel prices. Throughout 2008, 2011 and 2012, the equivalent gallon of Pemex Magna in Mexico was often $0.75 to $1.25 cheaper, as US prices exceeded $3.50 a gallon. But with the recent drop in global crude prices, the price per gallon in the US has declined to $2.00, on average, while the steadily increasing price in Mexico now exceeds $3.00 per gallon. That's 50 percent higher and creates significant arbitrage opportunities.

The number of retail fuel stations in Mexico is controlled by the government and stands at just over 10,000 sites. As demand has increased without a parallel growth in the number of stations, Mexico now has one of the highest average volume throughputs per station in the region and globally, at 5 million liters per station. The average throughputs in larger Mexican markets, including Mexico City, are more than 6 million liters per station, 50 percent higher than average neighboring US regions, creating attractive site-level economics. In addition, several of these Mexican regional markets use exclusively imported fuel products, compounding the tension in supply-demand dynamics and driving a potential structural change.

With only Pemex branded fuel and stations allowed in Mexico until this year (2016), the competition and investment has been much more limited than in other markets. Additionally, Mexico is a highly fragmented market with more than 5,000 franchisees operating only one or two sites, making organic improvement in offerings challenging. This has left the consumer offering relatively limited. There are fewer non-fuel services than in similar markets (only half the sites have convenience stores), and many facilities lack the cleanliness and security desired by consumers. Even the largest franchisees operate fewer than 300 stations, making scale operations a challenge.

50

The percentage by which Mexican pump prices exceed those in the United States

But that has not restricted the development of grass-roots efforts to meet consumer demand. The largest franchisees have developed their own offerings (including loyalty programs, fleet cards and fresh food,) proof that the Mexican consumer is looking for expanded choices.

REGULATORY CHANGES

Deregulation laws passed in 2013 and 2014, and Mexican regulators are implementing plans to relax control of the market in the next few years, impacting all areas of energy. The regulatory changes are occurring in phases.

40

The expected percentage increase in the number of fuel sites in Mexico over the next several years

Permits to transport, store and distribute fuels were offered in 2015. The government plans to offer permits to own and operate retail stations in 2016, with fuel import and export permits to follow in 2017. By 2018, retail prices open and the market fully deregulates. (See Exhibit 2.)

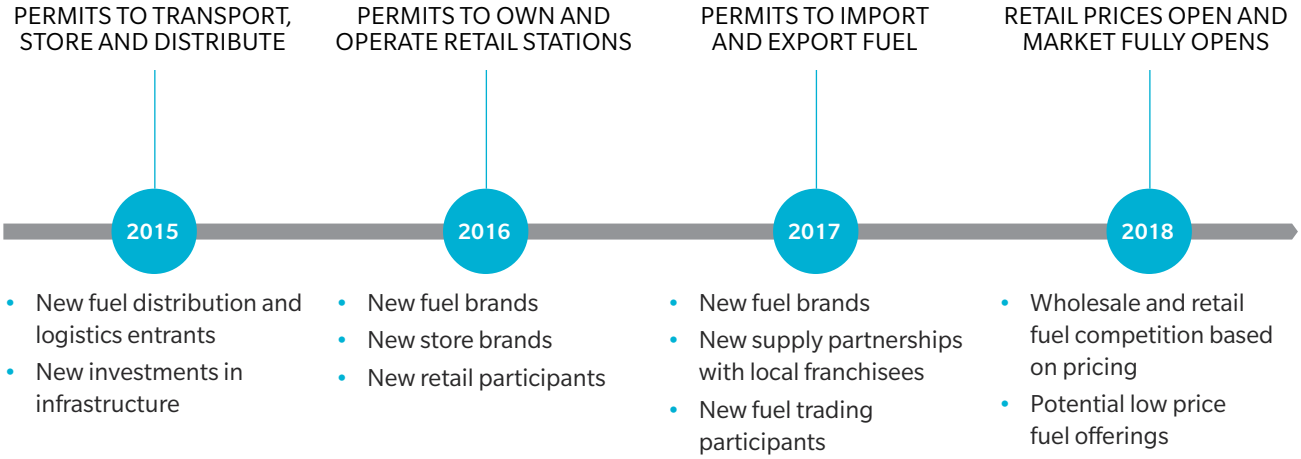
Investing in the Mexican fuels market, however, comes with risk. Several details about the regulations are not clear, such as exactly how and when permits will be awarded, if foreign companies will be allowed to buy existing assets and how the number of retail stores will be regulated. Further, it is not clear how regulators will determine fuel prices during the transition period or how prices will change. It is essential for participants and investors to monitor the changes closely and develop flexible strategies.

EVOLVING DYNAMICS

Market dynamics will continue to evolve, with consolidation of current players and new sites and concepts from market entrants. Existing local fuels and convenience retailers will continue to grow and consolidate, with larger companies speeding up the pace of buying smaller operators. New entrants and local participants will build new fuel sites and probably test hypermarket and grocery

EXHIBIT 2: MEXICAN DEREGULATION TIMELINE

Foreign investors are in a strong position as Mexico follows a plan to full deregulation



Source: Pemex and Oliver Wyman analysis

fueling offers. In this fertile environment, the number of fuel sites could grow in the next few years by more than 40 percent.

A range of foreign refiners, midstream operators, fuel distributors, marketers and retailers will build, buy and form partnerships, bringing new value propositions and offerings in fuel and convenience. A large, attractive market lacking in customer choice, Mexico is about to undergo a deregulation revolution that will fundamentally change the way consumers get their fuels.

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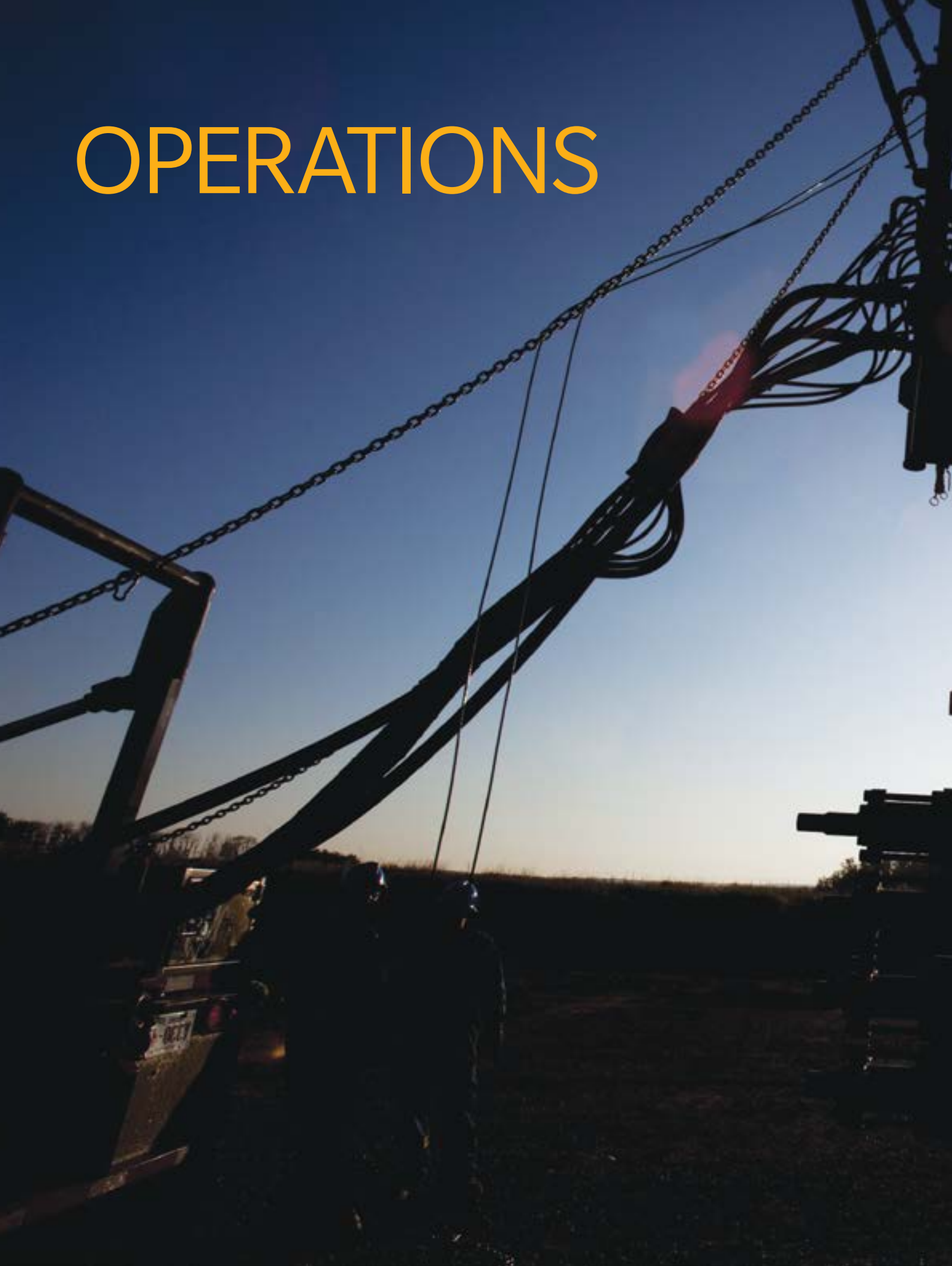
OPERATIONS



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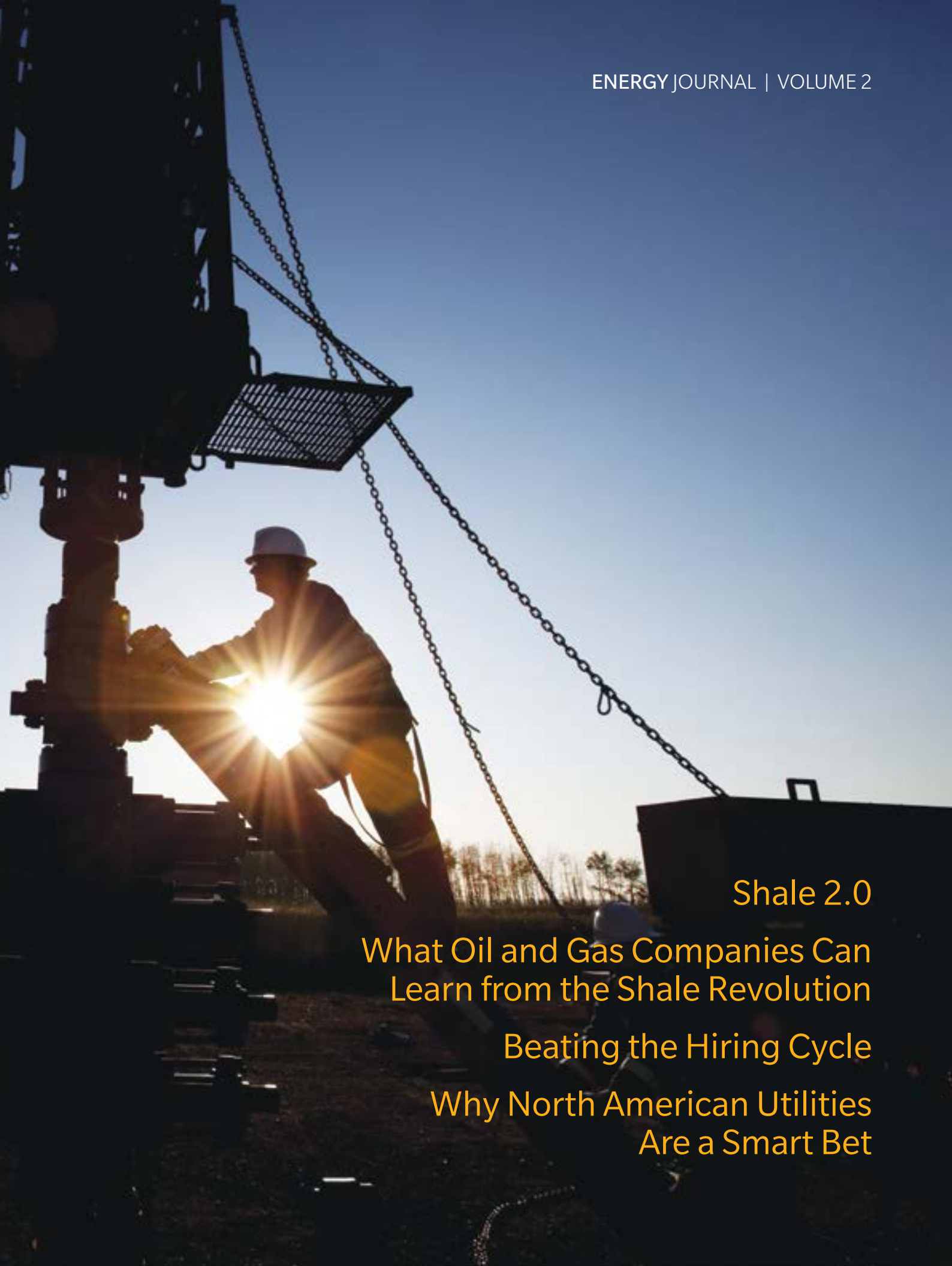


Shale 2.0

What Oil and Gas Companies Can Learn from the Shale Revolution

Beating the Hiring Cycle

Why North American Utilities Are a Smart Bet

SHALE 2.0

WHY NORTH AMERICAN SHALE DRILLERS ARE ABOUT TO BECOME EVEN MORE COMPETITIVE

Irfan Bidwala • Ryan Early • Robert Peterson • Tim Thompson

In the first phase of the shale revolution, North American shale drillers catapulted the United States to one of the top oil producing positions in the world, upsetting a global balance of power in oil that had prevailed for decades. (See "The New Balance of Power in Oil" on page 13.) But by the end of 2015, most were struggling to make ends meet. Falling oil prices left North American shale producers burdened by an estimated $32 billion operating cash shortfall in the first half of 2015 and a gap of about $20 per barrel in "life cycle" cash flows, after tallying up total investments involving land acquisition, field development and production operations. (See Exhibit 1.)

So is the shale revolution over? No. Instead, shale drillers are entering a second phase that will make many even more competitive and resilient. Although some drillers are merely slashing costs to survive hardships, the more savvy ones are redesigning their operations to thrive in a future of highly volatile, low oil prices. Industry leaders such as EOG Resources, Hess and Encana are challenging conventional practices regarding technology integration, organizational decision making, management of complex operations and infrastructure ownership to achieve significant improvements in efficiencies. We estimate that by differentiating their operations even more from those of conventional oil and gas companies, these players will reduce their life cycle costs by as much as 25 percent, or $15 per barrel.

To remain at the forefront of this next major turning point in the evolution of shale drilling, producers will need to revamp their operations on four fronts. First, leading shale producers must develop focused technology strategies that enable the rapid application of new technology in the next well, not in the next year's drilling program. At the same time, they have to create more agile organizations and utilize predictive analytics to better optimize a highly complex set of daily operations supporting thousands of wells. Finally, they must restructure partnerships to lower their cost base and to enable more efficient use of investment capital.

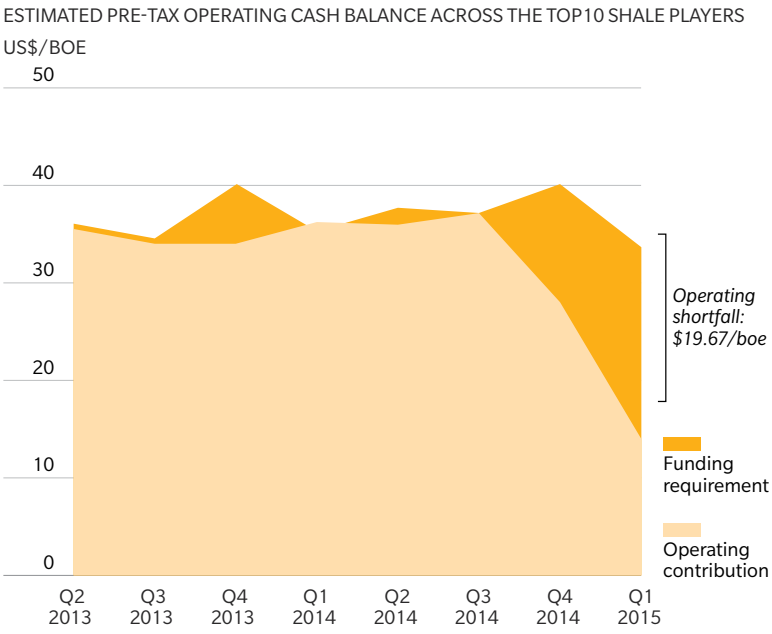
FOCUSED TECHNOLOGY

Until now, successful shale operators have followed one of two key technology strategies: They either rapidly integrated off-the-shelf proven technologies into existing and future operations or developed a differentiated core competency internally. Niche operator Trilogy, for example, has achieved tremendous success by efficiently deploying proven technologies across its operations faster and more effectively than its competitors. At the other end of the spectrum, EOG Resources is the industry's leader in efficient well designs because of its ability to develop incremental innovations that are difficult for other firms to comprehend, much less replicate. EOG Resources' production rates now equal their peers' for about 20 percent less investment per well.

But neither of these approaches will continue to suffice on their own. To run profitably in a lower price environment, shale drillers must make a quantum jump in operational efficiency. Despite recent advances, 80 percent of a shale field's production is still delivered from only about 30 percent of the wells drilled, at extremely low recovery rates of 4 to 7 percent. The contrast with conventional reservoirs is striking: Conventional reservoirs produce 30 to 40 percent of the oil in place, with the majority of wells being economic. In order to close this gap and improve shale economics, shale drillers must accelerate the pace of technological innovation. Systems made up of new technologies must be tested, deployed and upgraded rapidly in the span of months – not years, as is currently the practice. At the same time, drillers must "reinvent geophysics" and improve fracking efficiency to better understand rock characteristics and to significantly increase the recovery of the trapped hydrocarbons.

EXHIBIT 1: SHALE FUNDING SHORTFALLS

North American shale producers are struggling to close operating cash shortfalls



Source: Oliver Wyman analysis, company reports

AGILE ORGANIZATIONS

Today's shale organizations struggle with finding the optimal balance between centralization and local control. Operators with more centralized organizations are some of the industry's worst performers. Plagued by bureaucracy, many of them are slow moving. On the other hand, operators with decentralized organizations have been among some of the best performers, thanks to their ability to make quick decisions. However, decentralized operators have discovered that regional silos inhibit knowledge sharing of best practices. This leads to inconsistent operational practices in areas such as safety and limits the ability of the organization to efficiently scale resources across multiple shale basins.

The most agile producers will adopt a balanced approach toward centralized control and local decision making: decision rights will be decentralized, but there will be accountability through transparent performance metrics to

senior operations and corporate management. This will allow for communal visibility and the self-policing of unhelpful organizational silos, making them easier to correct.

DYNAMIC OPERATIONS

To deliver higher returns, shale operators will need to be more disciplined about high-grading their drilling portfolio to respond in real-time to operations and market volatility. To achieve discipline, they must incorporate predictive analytics into daily operations to anticipate and maximize well and reservoir performance. Operators must stand ready to reconstitute drilling and completion programs on the fly, based on real-time market-adjusted profitability of individual wells and the associated logistical costs. Drilling plans and completion designs must be flexible to incorporate knowledge based on experience gained from prior wells.

By applying these techniques, operators like Hess could more than double oil and gas recovery factors, from 4 to 8 percent, and improve the 'hit' rate of economic wells to over 60 percent, up from the current rate of 30 percent or less.

RESTRUCTURE PARTNERSHIPS

Finally, savvy shale operators are taking advantage of the industry's distress by exploring and implementing lower cost business models. For example, as shale basins have matured and ownership of infrastructure has become less strategic, operators such as Devon and Shell have 'dropped down' pipeline systems into separate, arms-length companies, thus lowering the rent they now pay for these services. Further drop-downs of other infrastructure such as oil and gas processing, water management and field power systems are now under consideration. What was once strategic is now considered a commodity.

Others are reconfiguring existing partnerships with suppliers, beyond just simple across-the-board reductions of service costs. For example, two of the biggest oil field services companies, Schlumberger and Halliburton, have recently announced they will now partner with customers to finance upfront fracking costs in exchange for a percentage of revenue. (See "The Big Squeeze in Oil Field Services" on page 87.)

At the same time, many shale operators are forging new connections and partnerships with midstream and refining customers to gain direct and reliable access to the final crude sales market. By doing so, these drillers will not only increase their sales volume, but also maintain some price protection during the supply glut.

A NEW PHASE

A new phase of the shale revolution is rapidly forming behind the scenes of shale producers' current distress. In the next several years, leading drillers will drive down their life cycle costs significantly by revamping their operations along the four foundational pillars: focused technology; agile organizations; dynamic and flexible processes; and restructured, lower-cost business models. These players will not just pioneer but establish a platform for sustained profitability in the more volatile and uncertain world of Shale 2.0.

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WHAT OIL AND GAS COMPANIES CAN LEARN FROM THE SHALE REVOLUTION

FOUR LESSONS FOR DEEP-WATER OPERATIONS

Bill Heath • Robert Peterson • Susie Scott

Shale drillers are forging new operating models that will continue to challenge the conventional practices of the oil and gas business in a number of key areas. (See "Shale 2.0" on page 55.) At first glance, these operating tactics may appear more relevant for managing a Silicon Valley startup than for running an oil and gas company. Like many high-tech startups, shale drillers manage a rapidly changing set of daily activities and must continuously improve technologies across widely dispersed assets and supply chains to remain competitive.

There are four key lessons from the next phase of the shale revolution that deep-water operations can benefit from:

1. Integrate technology and operations more closely. In shale, the winners rapidly deploy the best new technology into the next well by holding local business leaders (asset leaders) fully accountable for technology pilots. They do not have separate technology and operations budgets, with years-long cycle times. Team performance metrics are simple and directly reward all contributors for producing profitable barrels or enhancing ultimate recovery. Technology portfolios are focused on innovating in one or two key areas, while at the same time remaining on top of a broader set of best practices used by competitors.

   Like shale drillers, conventional oil and gas players should focus on improving the productivity of their sites, instead of accepting the status quo. To do so, oil and gas companies should concentrate their resources on those improvement programs that will affect fundamental business metrics, such as well and reservoir productivity. At the same time, they should re-evaluate how they filter ideas from other facilities and operators to implement innovations more quickly.

Shale drillers will continue to challenge the conventional practices of the oil and gas business

2. Become more agile. Shale drillers have learned that the best decisions are made by fully empowered and integrated teams that are not divided by functional lines. Business, technical and safety managers work side-by-side, wherever possible. A very small corporate center serves as the knowledge facilitation hub. The team is bound together by a culture of continuous improvement in which it is okay to fail, and where failure does not mean the end to one's career.

   It's time for conventional operators to finally elevate continuous improvement practices to a new level of effectiveness by eliminating organizational barriers to swift decision making and rapid implementation of new innovations. They should also strengthen the facility manager's role to that of integrator and operations manager, running closely integrated teams to realize excellent operations.

3. Make better use of data analytics. Leading shale operators are implementing factory pull models. They work backward from the new drilling and maintenance drilling inventory requirements to guard against operational disruptions and to ensure that the best technology will be applied as fast as possible. Systems are implemented to provide an integrated team with comprehensive cost and performance data for each well, supported by more sophisticated predictive analytics to find and exploit well performance and supply chain opportunities.

   Most conventional oil and gas companies have significant data that is often unexploited. This data can be mined deeper to provide insights for better performance. Digital oil field management systems and other such initiatives have not delivered the value originally promised because they have become overly complex and misaligned with business objectives. Oil and gas companies can streamline these systems and improve their performance by re-examining the biggest opportunities to exploit the operational data to develop higher impact, predictive analytics.

4. Re-engineer financial structures. Shale operators are structurally altering their cost base in order to thrive in a more volatile and uncertain price environment. At one end of the spectrum, some are considering acquiring critical assets such as pressure pumping equipment and water infrastructure systems at cents on the dollar, and then leasing them back through an arm's length third party. At the other end of the spectrum, many are considering transferring non-strategic infrastructure into master limited partnerships, with much lower expected rates of return.

   Conventional oil and gas companies should also begin to re-examine which assets still make sense to own, and which ones can be dropped down and leased back under more favorable terms. For example, it might make sense for some operators to consider leasing certain topside components, such as compressors, pumps or entire topside facilities, from new industry entrants such as private-equity-backed specialist firms.

MORE SUSTAINABLE OPERATIONS

Shale producers may be struggling with challenging business conditions like everyone else in the industry, but they have already changed people's ideas of what is possible. The improvements that many are putting in place now portend an even more competitive new wave of shale drilling. For those deep-water operators willing to consider these innovations, shale drillers' improvements to their operations can also be the starting point for more profitable and sustainable conventional oil and gas companies.

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BEATING THE HIRING CYCLE

OIL AND GAS COMPANIES NEED TO REDESIGN THEIR HUMAN RESOURCES PROCESSES

Jay Doherty • John Koob • Keric Morris

In the past 12 months, oil and gas companies have been forced to do an about-face and shift from preparing for a shortage of experienced employees to shrinking their abundant workforces.

The turnabout illustrates the long-term staffing challenge for the oil and gas industry. (See Exhibit 1.) Many organizations handled worker shortages in recent years by developing forward-looking human resource strategies and investing in programs such as strategic workforce planning. But the drop in energy prices is both sharper and more pronounced than the prior upward trend. (See Exhibit 2.) The last downturn saw a considerable amount of knowledge and talent leave the industry, which ultimately slowed the recovery.

Smart energy executives are stepping off the roller coaster by developing robust human resource processes to manage the contraction in a way that preserves organizational strength and capabilities for the future. They are pulling data and resources from across the energy industry to create databases that can predict and respond to hiring cycles. Those organizations that can forge a staffing approach that weathers the ups and downs will be the first to recover and best positioned to take advantage of future growth.

EMPOWER HUMAN RESOURCES

To stop the frenzied hiring-and-layoff cycle, top energy companies are empowering their human resources departments to influence decision making and giving them new processes, tools, skills and positioning to work effectively. They are creating an end-to-end, data-based approach to staffing to allow a proportionate response to the most recent market drop. This includes a deep understanding of the economic outlook and trends facing the industry, their likely impact on the organization and a strategic view of how to manage those issues and constraints from a human resource perspective.

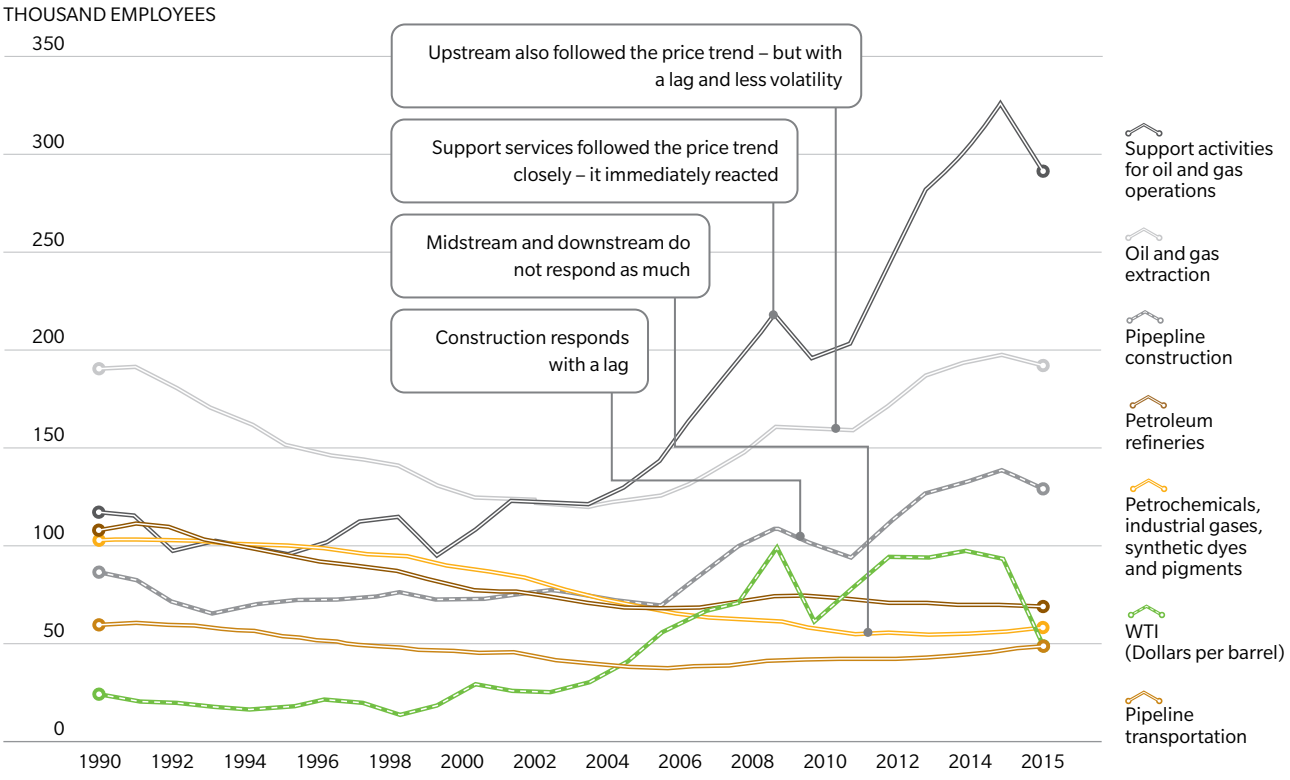
The start of that journey is giving human resources a greater role in cost management and in recruiting and retaining talent. Using human resources to simply enact strategic decisions (helping business units reduce costs) can lead to long-term problems retaining the knowledge and capability critical for future performance. It could also miss some creative opportunities to manage costs more effectively, thereby reducing the need for staff cuts, which pose high risks.

Driving robust and effective core talent decisions requires a change in process. Human resources should be elevated to the level of board investment (project portfolio management) and take part in corporate and operating decision forums. Robust talent data is critical, including numbers, capabilities, workforce drivers, capability gaps and supply and demand forecasts, as well as alternative options, such as contractors, joint ventures or acquisitions, so the team can challenge and support decisions on strategy.

CONDUCT PREDICTIVE ANALYSIS

Today's issues also demand more predictive analysis. Typically, a company receives demand data and creates the right supply of key skills in the business. Instead, oil and gas companies should establish current skills maps to assess locations, job families, capabilities and other information. Then they should benchmark

EXHIBIT 1: MARKET-LED EMPLOYMENT IN THE OIL AND GAS SECTOR
Employment has changed dramatically in some sectors as oil prices have moved



Source: BLS, EIA and Mercer

the map against best practices to highlight gaps and opportunities. Future workforce requirements should reflect the varying expected productivity gains by skills group due to technology advancement. With this in hand, oil and gas companies can test different demand scenarios to understand vulnerabilities in workforce composition under extreme market movements. Then, they should define the range of options, including levers other than changing staffing levels, such as redesigning benefits or using alternative workforce configurations.

As top oil and gas companies shift to this data-driven approach, they are taking a more holistic approach to talent management to resolve other, long-standing staffing issues. For example, they are using the market downturn as a catalyst to support the great crew change as Baby Boomers retire. They're drawing on different models for contract workers or early retirement while building accelerated knowledge transfer approaches.

Oil and gas companies can use the market disruption to target, recruit and upgrade specific skills previously in short supply. Already, many are considering more radical approaches to using and managing contractors, such as bringing capabilities back

To stop the frenzied hiring-and-layoff cycle, top energy companies are empowering their human resources departments

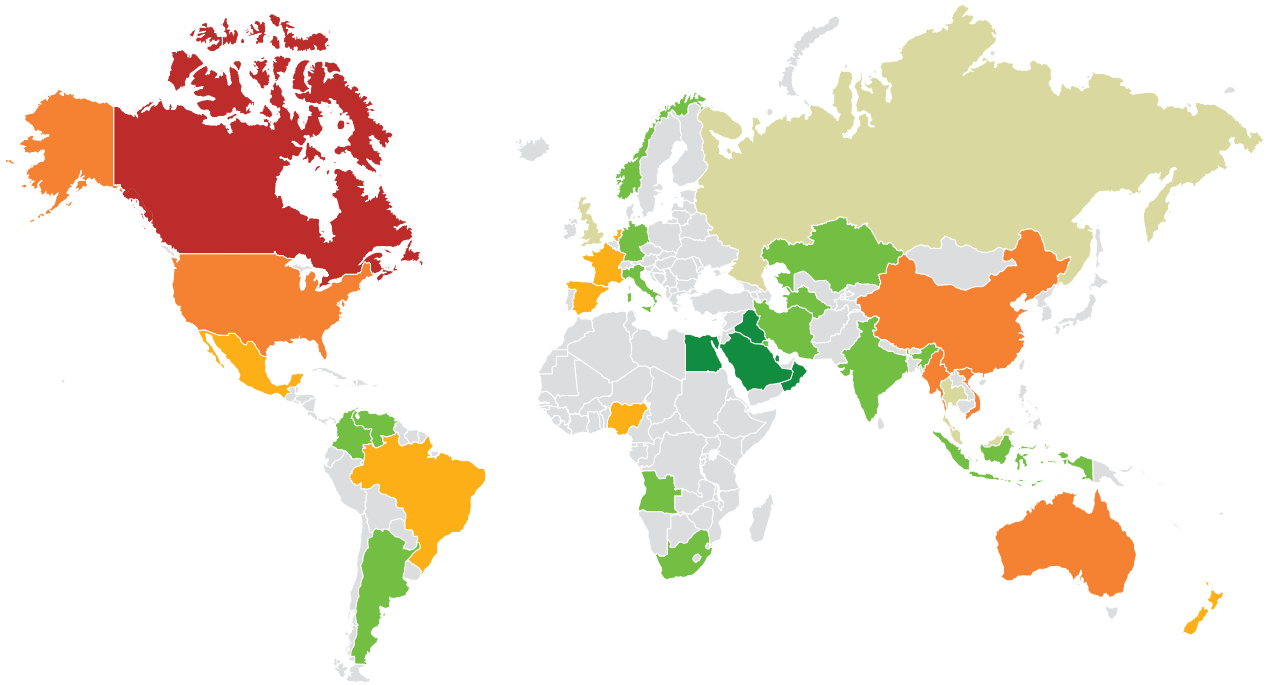
in-house. In addition, they can work with other market players to develop talent-based joint ventures and key resource sharing schemes, including with contractors.

It's important to embed sustainable change with robust processes that build talent management into investment decisions and redesign the management approach regarding business unit demands. This will require experimenting with processes and approaches, from pure analytical modeling to changing the way resources are managed in the business.

For example, it may mean rebalancing the needs of the business or project with the need to develop staff and create a better employment proposition. One approach may

EXHIBIT 2: IMPACT OF LOWER OIL PRICES ON WORKFORCE IN 2015-2016

The steep decline in oil prices will result in workforce reductions in some regions, but some countries are still hiring



Sharp cuts in workforce
- Canada

Workforce reductions
- Australia
- China
- Myanmar
- United States
- Vietnam

Sector reductions and wage freezes
- Brazil
- France
- Mexico
- Netherlands
- New Zealand
- Nigeria
- Spain

Selective reductions by some
- Great Britain
- Malaysia
- Russia
- Thailand

Stable
- Angola
- Argentina
- Colombia
- Germany
- India
- Indonesia
- Iran
- Italy
- Kazakhstan
- Kuwait
- Norway
- South Africa
- Turkmenistan
- Venezuela

Workforce growth
- Egypt
- Iraq
- Oman
- Qatar
- Saudi Arabia

Recruiting opportunities for experienced talent

Source: Mercer analysis

be to create teams with blended skills, rather than putting the A team on the biggest projects and the rest on what is left. Think about professional development and career paths, rather than project outcomes.

A MORE MARKET-LED APPROACH

The overall dynamics in oil and gas are changing to a more market-led approach. While the drop in oil prices won't likely last forever, the return of oil prices to mid-2014 levels is at best some way off. Operating models must change to reflect this, and talent management must change, too.

Driving a radical redesign of human resource processes and positioning will do much more than address the immediate need to cut costs. It will permit companies to reflect market conditions while keeping an eye on the future, enabling businesses to recover more quickly as hydrocarbon demand increases.

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WHY NORTH AMERICAN UTILITIES ARE A SMART BET

EIGHT STEPS UTILITIES CAN TAKE TO CONTINUE SOLID EARNINGS GROWTH

Alan Feibelman • Arun Mani • Curt Underwood • Gerry Yurkevicz

As utilities in the United States face new competitive threats brought on by the evolving electric grid, an Oliver Wyman analysis shows the industry still has a solid foundation for earnings growth.

With the new smart grid, consumers will have more control and more choices. Consumers can monitor, analyze and adjust behavior based on the large information flow at their disposal. They can choose a range of distributed generation resources (not just solar) enabled by innovative battery storage technologies.

Excitement about the technology is giving way to rhetoric from new market entrants about the power of the new grid to fundamentally change the industry, with dire consequences for utilities. These doomsday predictions, however, are more hype than reality. No doubt, the high-tech grid is unleashing a wave of innovation. But the old grid and centralized resources will still be around as new technologies proliferate.

STEADY UTILITY EARNINGS GROWTH

Rather than shrink, we estimate that utility earnings will grow 3 percent to 4 percent annually during the next 15 years for the next decade-and-a-half thanks to requirements for infrastructure investment. While investment in electric transmission may taper off, investment in electric distribution will remain significant and will increase as aging infrastructure is being replaced and a network to accommodate distributed resources is being built. Utilities will continue to invest in power generation in states where they are allowed to do so – both central and distributed resources. And utilities with natural gas businesses are likely to see a doubling of their spending on gas distribution and transmission to enable ample price-competitive gas to reach end-users, including power

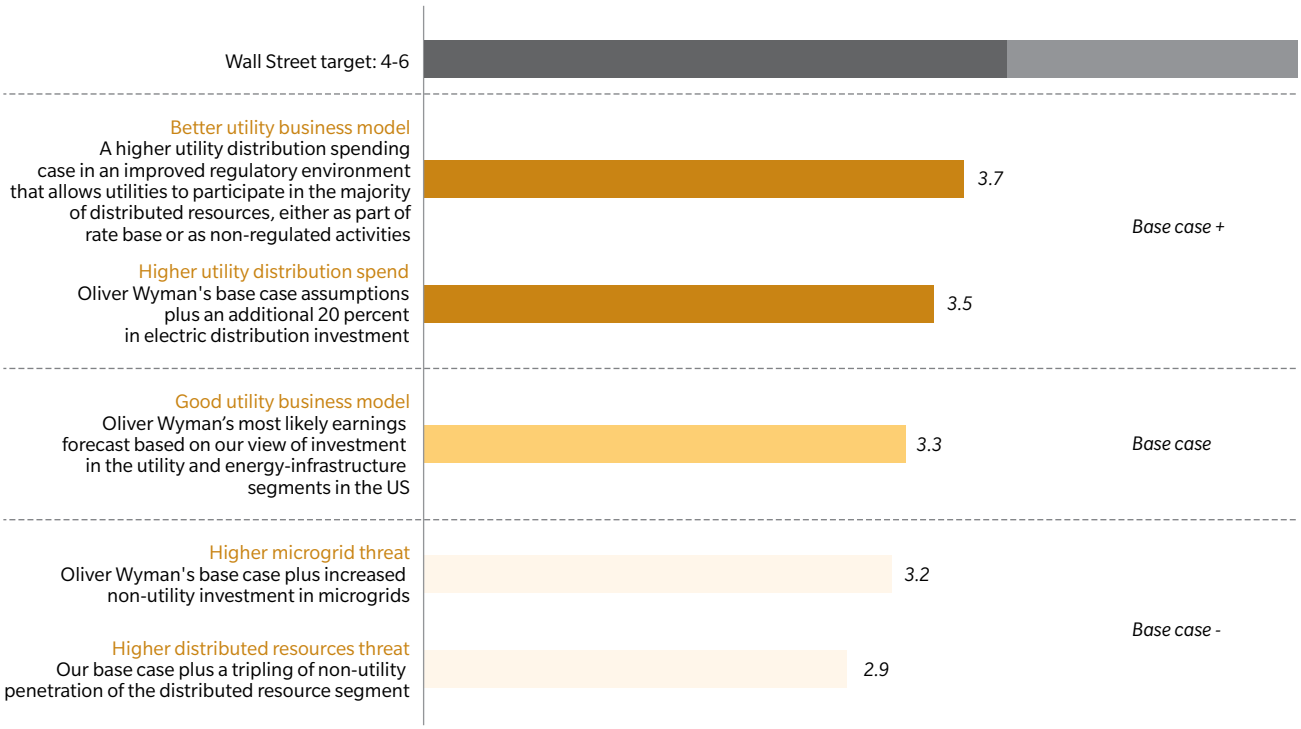
The industry can expect a steady, 3 percent to 4 percent base of growth for the next decade-and-a-half

generation. That's lower than the 4 percent to 6 percent earnings growth that some utilities are forecasting, but we expect utilities could earn even more by making wise changes. (See Exhibit 1.)

With low electricity prices and high performance by most utilities, the majority of customers aren't motivated to seek out something to cut or replace dependence on the local power and light company. The traditional centralized grid will remain relevant, but decentralized energy resources, as their economics improve, will be the new building blocks of future energy resources.

EXHIBIT 1: NORTH AMERICAN UTILITIES EARNINGS GROWTH FORECAST

North American utilities will continue to grow steadily, even if they don't meet Wall Street's current expectations



Source: Oliver Wyman analysis. Base case assumes significant and increasing investment in electric distribution, tapering but steady investment in electric transmission and continuing utility investment in a portfolio of generation resources where it is allowed by regulation, offset by a significant increase in non-utility distributed resources and a doubling of gas distribution and transmission capital spending.

With the bountiful supplies of energy in North America and efficiency measures already in place, we expect electric bills to remain flat during the next 15 years. Average but not improving overall customer satisfaction ratings for utilities are a warning to executives as innovation in the industry heats up, but at a lower decibel.

UNPROFITABLE NEW ENTRANTS

North America has a plethora of new companies involved in residential solar, distributed generation, battery storage, energy services of various shapes and natural gas vehicles, as well as startups in wind, biofuels, ocean energy and other fuel sources. These represent real competition for utilities, but most new entrants aren't profitable.

More than 30 new companies that focus on North America covered by the investment research company Value Line collectively generated about $20 billion in sales in both 2013 and 2014. The median after-tax income margin for these companies was negative 1.3 percent in 2013, and worsened to negative 5.5 percent in 2014. Half had negative cash flows. In contrast, in 2014, the average utility after-tax operating margin 7.5 percent, and every utility was profitable.

Of course, the new 1,000-pound gorilla could emerge from the pack, but who that might be may not be clear until much later, say 2040 or beyond. Google represents a strong future competitor, but its acquisition of Nest thermostat technology may be more about developing the connected home rather than the energy market. If Google should figure it out and focus on the energy space, it could present an ominous competitive threat even for utilities.

The utilities' most important stakeholders, regulators, will make some adjustments to accommodate new grid technology, but they will almost assuredly keep the utility framework intact. Certainly public utility commissions and other governmental stakeholders will guide, shape and drive change in the utility market in their attempts to ensure reliable, safe and reasonably priced utility service. But fundamental change to the utility operating model is doubtful.

The old grid and centralized resources will still be around as new technologies proliferate

EIGHT MANAGEMENT LEVERS

The industry can expect a steady, 3 percent to 4 percent base of growth for the next decade-and-a-half thanks to requirements for infrastructure investment. To do better, utilities must pull eight management levers to improve their performance:

1. Undertake solid business planning now.
   To build a business plan robust enough to capture the opportunities created by all of the challenges utilities face, companies need to design operating and profit models that focus on the new grid, distributed resources, micro-grids, energy storage and

other initiatives. Good planning may still be followed by bad outcomes, so a clear focus and commitment in strategic planning to implementation and communication will help set the stage for earnings growth.

Pulling the right management levers smartly should lead to outstanding financial performance

2. Become customer-centric. Our research suggests utilities that deliver exemplary customer focus earn 50 to 100 basis points more than those with less customer focus. Happy customers lead to more responsive and flexible regulators, which lead to greater opportunities to achieve higher levels of earnings. The days of putting the company first, speaking from a script and talking at customers are over. Customers want to buy from companies that show empathy, have conversations with them and make eye contact. Consumers will be open to leaving the utility if new entrants are able to show they are truly customer-centric.

3. Use natural gas expansion to focus on customers. The US will be awash in natural gas for a good while. Many utilities also have a natural gas distribution business. What better time to make it easy for utility customers to convert or expand their use of natural gas?

4. Position for increased electric transmission and distribution investment. The infrastructure is more than aging, and could use more investment than is planned. Utilities must set the customer and regulatory stage to accelerate investment in the future, including capturing the value from distributed resources.

5. Expand participation by taking the regulatory initiative. Utilities have delivered big time to both their customers and regulators. They need to tell their story. Be a leader with the state executive branch, the legislature and big-city mayors to infrastructure investment in innovative ways.

6. Develop a fresh approach to non-regulated activities and business models. The last round of energy retail and wholesale deregulation went down in flames, capped by the Enron fiasco. If non-regulated earnings growth is needed, do not repeat those mistakes. Avoid embracing non-regulated initiatives if you do not have a snowball's chance to execute effectively and sustain profitability.

7. Focus on cost management to earn allowed returns. The average utility does not earn its allowed return on equity. To earn their allowed returns, utilities would need to reduce non-fuel operating and maintenance expenses by about 10 percent annually. For many utilities, trying to hold expenses flat represents a good first step. The future business environment may require more.

8. Reconsider mergers and acquisitions, especially small acquisitions. Go after the big utilities if you can make it work. But remember, there are still more than 200 small utilities with a $30 billion rate base and $1.3 billion in annual earnings that could fit nicely into growth strategies.

A SMART BET

Utilities are still a smart bet for the new grid. Though it will be challenging, pulling the right management levers smartly should lead to outstanding financial performance. Good utility management working well together provides the best chance to change and succeed.

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RISK

ENERGY JOURNAL | VOLUME 2

Cyber-Risk Management

Liquidity Risk

The Big Squeeze in Oil Field Services

Defusing the Decommissioning Time Bomb

Electricity Storage Technology

CYBER-RISK MANAGEMENT

WILL HACKERS CAUSE THE NEXT ENERGY CRISIS?

Sandro Melis • Angelo Rosiello • Silvio Sperzani

Energy companies are suffering from an increasing and unprecedented number of cyberattacks. The most alarming example so far: a malware attack in 2014 that compromised the operations of more than 1,000 energy companies in 84 countries, including the United States, Spain, France, Italy, Germany, Turkey and Poland. This cyber campaign, reportedly waged as a means of industrial espionage, gave hackers the ability to cripple wind turbines, gas pipelines and power plants at the click of a mouse.

For many years, the world has benefited from information technology advances that have improved the productivity of almost every sector of the energy industry – drilling, pipelines, power generation and transmission. But we continue to underestimate the dark side of this equation: Greater dependence on information technology also increases energy companies' risks. A recent *Global Risks* report by the World Economic Forum and its partners (including Oliver Wyman) ranks cyberattacks as one of the top 10 risks most likely to cause a global crisis. The World Energy Council, a forum for energy ministers and utilities, considers cyber threats as one of the top five risks to the world's energy infrastructure.

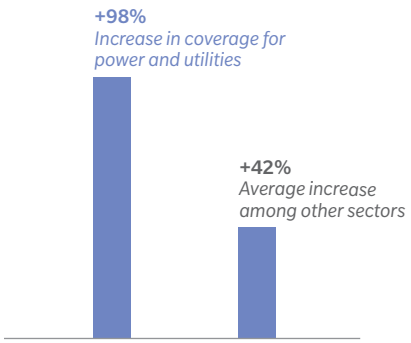
In response, more than 30 countries – including Germany, Italy, France, the United Kingdom, the United States, Japan and Canada – have unveiled cybersecurity strategies. And on June 29, 2015, the Latvian Presidency of the Council of the European Union reached an understanding with the European Parliament on the main principles of what could become a unified directive for the European Union to protect critical infrastructure.

But the searing reality is that both the growing strategic relevance of data and the potential impact of data breaches are outpacing these initiatives. Former chief of the United States' National Security Agency, General Keith Alexander, has commented that countries need something like an integrated air-defense system for the energy sector to keep up with mounting cyber risks. Recent clashes between the White House and Republicans over the establishment of a new Cyber Threat Intelligence Integration Center, however, show that marshaling the resources required to protect energy companies more broadly will take time.

EXHIBIT 1: RISING CYBER RISKS

Power and utilities companies are spending more on cyber-risk insurance to protect themselves from an increasing number of cyberattacks

PERCENT INCREASE IN INSURANCE COVERAGE



CHANGE IN COVERAGE BY TYPE

Security and privacy coverage	+0%
Media coverage	+14%
Regulatory defense coverage	+0%
Business interruption coverage	+3%
Information asset coverage	+14%
Cyber extortion coverage	+14%

Note: Percentage increase in spending by companies with more than $1 billion in revenues on cyber-risk insurance from 2012 through 2014
Source: Marsh Global Analytics

Meanwhile, cyber risks to the energy industry are becoming more serious and the implications more far-reaching than is commonly recognized. One reason is that the industrial control systems that support energy companies are no longer as sealed off from external threats. Electric utilities depend on automated controls to run their grids, which are managed through interconnected network systems. Oil and gas companies depend on data networks to manage facilities and to interpret seismic developments. Refiners, too, rely on data networks to manage meters and to analyze their customers' needs.

So what can be done? So far, many energy companies have tried to mitigate cybersecurity threats by increasing their spending on information technology solutions, implementing new IT procedures and buying more insurance. Since 2012, energy companies with revenues of more than $1 billion have increased their cyber insurance coverage worldwide by 98 percent, according to Marsh Global Analytics estimates. Marsh, like Oliver Wyman, is a division of Marsh & McLennan Companies. (See Exhibit 1.)

While these initiatives are understandable and laudable first steps, much more needs to be done. Above all, energy companies should treat cyber risks as permanent risks to their entire enterprise and not as isolated "information technology" events. Unlike

98

The percentage increase in cyber insurance coverage by power and utilities firms in the past two years

strategic, operational, and financial risks, cyber risks are often mistakenly treated as lower priorities and relegated to information communications and technology departments. Consider: Computer systems that remotely monitor and control plants and equipment of oil and gas companies and electric utilities are often outside the responsibility of most chief information security officers. Even managers in charge of guaranteeing that these systems are compliant with a company's policies often don't understand their technical specifications.

As a result, the true cyber risk exposure of energy companies often goes unnoticed by top management and boards of directors, leaving the companies at higher risk than necessary. Cyber risks are rarely quantified or linked with their potential impact on companies' financials, making it almost impossible to conduct cost-benefit analyses or to make strategic choices. Information technology departments introduce new technical solutions with minimal top-level direction. Companies adopt case-by-case reactive measures instead of a balanced portfolio of initiatives that involve their entire organization and align with their overall appetite for risk.

As with other operational risks, companies should set a target level of cybersecurity for all of its software, hardware and people based on their importance to the firm's overall appetite for risk. The company should then ensure that controls and processes address gaps that are accordingly prioritized, starting with those that are mission critical. For example, a company might first safeguard its billing and customer relationship management systems since they could put its revenues and reputation at serious risk if corrupted before addressing risks to video-conferencing tools or internal community portals.

At the same time, top managers in the energy industry need to develop a cyber risk management culture to the point that it becomes as second nature to employees as handling high hazard equipment. Cyber risk management goals should be baked into performance targets, incentives, regular reporting and key executive discussions. When executives evaluate their tolerance for breaches that could impact their company's reputation or violate health, safety and environment standards, cyber incidents involving their industrial control systems should be front and center.

Otherwise, like other slow-building risks that people take for granted, ignoring the threat of increasing cyberattacks could drop unprepared energy companies into the middle of a full-blown energy crisis. This isn't a threat that is going away. Energy companies need to do the math and start making cybersecurity a top priority.

1,000

The estimated number of energy firms that hackers compromised in a global malware attack in 2014

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This story first appeared on BRINK.

LIQUIDITY RISK

UNCOVERING THE HIDDEN CAUSE OF CORPORATE SHOCKS

Alexander Franke • Ernst Frankl • Adam Perkins

International conflicts, an uncertain global economy and volatile stock prices are prompting management teams to examine whether they would fare better in a liquidity crunch today than they did when the financial crisis struck in 2008. Unfortunately, the answer to that question is unclear. On the positive side, banks and non-financial companies have both been shoring up capital reserves, partly in response to new regulations.

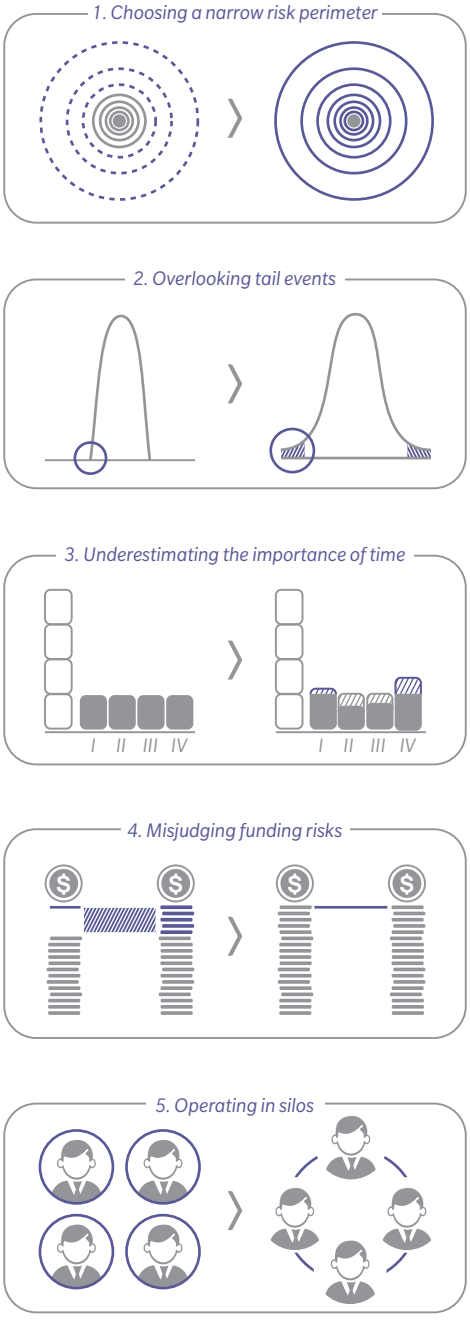
But unlike banks, which have been forced by regulators to make strengthening their liquidity risk management capabilities a top priority, many businesses have not improved their ability to analyze and mitigate funding shortfalls. A study by the United Kingdom's Financial Conduct Authority released in September found that most commodity traders do "not include stress testing and scenario analysis in their assessments of liquidity risk." This could result "in large financial pressures and liquidity risks in the event of stressed market conditions," according to the report. Our research shows that liquidity-risk management may be an even lower priority for many non-financial services companies. In our view: too low.

In a recent Oliver Wyman survey, we asked commodity-driven industrial conglomerates and asset-backed traders about four critical liquidity-risk-management best practices: comprehensive assessments of sources and uses of liquidity; robust risk and reserve calculations; thorough stress testing; and integrated risk and finance evaluations. We found that only some players are following best practices in terms of liquidity-risk assessment and provision planning, such as taking a wide range of risk factors into consideration and conducting extensive stress testing. But even then, these practices are only being applied in isolated cases. Not one company is consistently following best practices for liquidity-risk management across all four dimensions.

Instead, most respondents report that they have only basic liquidity-risk management practices in place. For example, many companies just examine how market price movements will force them to seek more funding. Or they fail to seek the views of both their treasury and risk divisions when stress testing their potential access to funding. (See Exhibit 1.)

EXHIBIT 1: THE FIVE COMMON MISTAKES IN LIQUIDITY RISK MANAGEMENT

Practices that should be avoided to prevent a funding shortfall



Source: Oliver Wyman analysis

There is more work to be done: One of the main reasons that liquidity risk remains a low priority for many organizations is that they do not have a robust enough understanding of how much their organization is at risk of a funding shortfall – or they underestimate the steps required to close the gap. The financial crisis has taught us that liquidity risks are the greatest risks of all in terms of bankrupting a company. But they are difficult to foresee without careful forethought and preparation. That's because they usually occur when risks correlate, overlap or combine to result in a full-blown crisis. To meet this challenge, liquidity-risk management must be a comprehensive attempt to predict the impact of a perfect storm.

FIVE COMMON MISTAKES

To take advantage of all that we have learned from the financial crisis and avoid repeating history, companies will need to avoid the five most common mistakes in liquidity risk management:

1. Choosing a narrow risk perimeter. As we learned from the financial crisis, companies can suffer from a shortfall of financial resources when a risk event suddenly creates an unexpected need for funding or when external sources for funding suddenly become unavailable, or both. Generally, companies must be prepared for three types of risk events – market, credit and operational – which could happen simultaneously. Examining all three types of risks also can help organizations to avoid double counting available reserves.

   Unfortunately, most businesses tend to focus solely on market risks that could cause their cost of funding to spike or trigger margin calls from derivative contracts. Few companies regularly evaluate the potential

impact of credit risks produced by delays in payments or cancelled deliveries of products that have already been paid for. Or they fail to examine the potential impact of operational interruptions that could require funds or harm a company's ability to generate cash.

2. Overlooking tail events. The second most common mistake is that companies rarely analyze what could happen if a risk event occurs that is outside of their regularly considered range of possibilities. Most businesses examine if they have sufficient financial strength to weather an event that has somewhere between a 1 percent to 5 percent chance of occurring. But few conduct stress tests and scenario analyses to understand the potential impact of so-called "tail" events that are outside a company's regularly considered risk purview.

   Or they analyze tail events in a mechanical way. They don't bring into consideration the views of external experts or even tap all of the business intelligence that may exist within their own organization's four walls.

3. Underestimating the importance of time. Another frequent error is that companies fail to consider how their exposures change over time. Most calculate their potential liquidity shortage over one quarter and then apply those requirements over a year's time. Or they ignore this step entirely. As a result, they fail to take into account how much their liquidity requirements could rise when their company pays dividends, for example. Or conversely, businesses may be unaware that they will need fewer reserves at other points in the year.

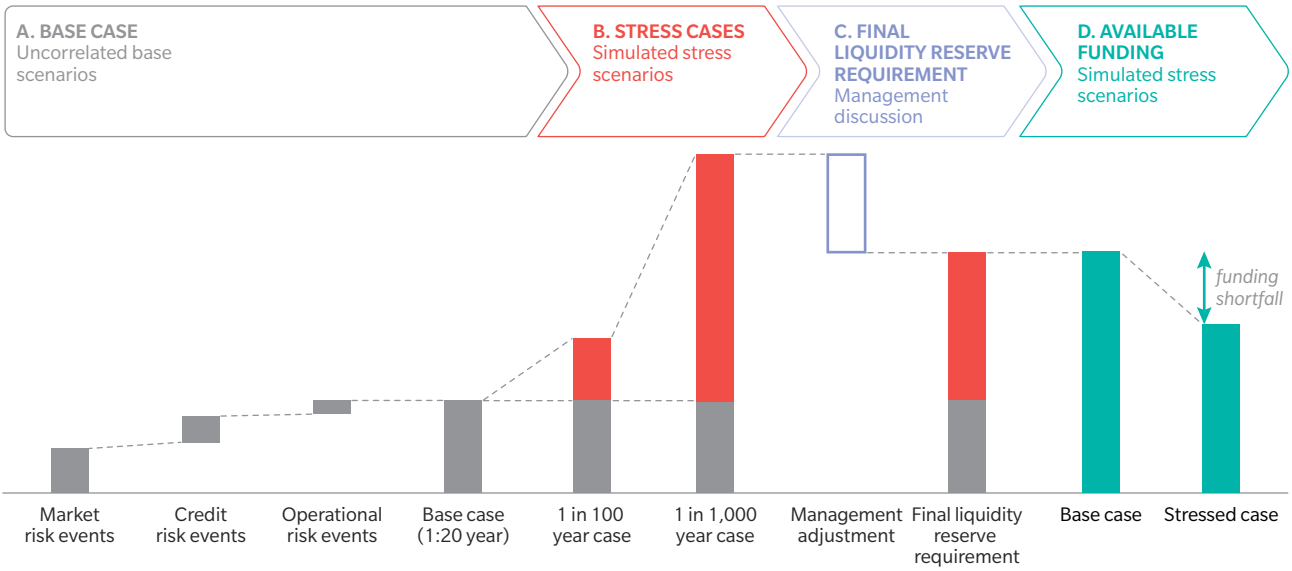
   For example, the European Union voted in January 2013 against a plan to support the European Trading Scheme (ETS) for carbon and auction off yet more carbon credits. If the announcement had come several weeks later, it could have resulted in a full-blown liquidity crisis for many traders. As it was, after the announcement, carbon prices went into free-fall, dropping by 40 percent, and triggering hundreds of millions of dollars in margin calls on hedges. Traders were only able to meet their commitments by borrowing in the short term from their dividend reserves. Had the dividends already been paid and those reserves been depleted, many traders would not have been able to weather the shift as easily.

Businesses do not have an accurate understanding of the extent to which their organizations remain at risk of funding shortfalls

4. Misjudging funding risks. Trying to understand the risks associated with the uses of liquidity is a common process for risk managers. But issues such as the availability of funding and the associated risks come less easily to them. As a result, few companies regularly assess the potential funding and liquidity problems that could result if lenders shut down credit facilities or if corporate treasuries cut funding for subsidiaries.

EXHIBIT 2: FORECASTING FUNDING SHORTFALLS

Companies must adopt a multidisciplinary approach to identify the full extent of their funding shortfall



Source: Oliver Wyman Analysis

But paying greater attention to potential funding shortfalls caused by unexpected moves by counterparties is becoming critical. Banks and investors are increasingly worried about high debt levels and weak earnings in the current uncertain economic environment. In fact, some prominent independent traders have already begun to report that counterparties are starting to trim their credit lines.

5. Operating in silos. Intuitively, it may seem obvious that liquidity risk is too interconnected, complex and potentially fatal to be analyzed by a single division. Yet even after the lesson of the financial crisis, many companies still assign the responsibility of monitoring liquidity risk either to the risk division, since it is closely tied to market and credit risk, or to their treasury, since liquidity risk relates to working-capital management and funding. Firms often assign tasks such as calculating liquidity risks, setting liquidity reserve requirements, and determining funding requirements and provisions to a single division or spread out the work across segregated teams in silos that don't communicate with each other.

This failure to collaborate causes significant gaps in companies' liquidity-risk analyses. Perspectives from a company's treasury department are critical to determining cash allocation and funding. But these insights fall short of identifying a firm's actual liquidity risk without the risk division's view on potential fluctuations in cash inflows and outflows and the financial planning division's assessment of the firm's future minimum liquidity requirements.

A MULTIDISCIPLINARY APPROACH

So what can be done? Ultimately, companies' chief financial officers and chief risk officers need to work together to ensure that their risk, treasury and financial planning divisions are interacting with each other to assess the company's liquidity requirements, potentially as part of their annual planning and budgeting process. By taking advantage of the expertise that exists across the company, they can be sure they are considering all potential risks to funding.

Leaders in this area include in their multidisciplinary analyses improbable and unforeseen events. They compile an exhaustive risk register across divisions, which include assessments of different types of liquidity risks, and then assess their likelihood, impact and potential interplay with other risks. (See Exhibit 2.) Then they evaluate what the company's liquidity requirement will be when major liquidity risk events occur that could happen once in 20 years, once in 100 years or once in 1,000 years. These individual reserves are then aggregated to give the total base and stressed liquidity requirement.

The company's top management team can then adjust the company's final reserve requirement based on the company's risk appetite and its willingness to pay for cash reserves or unused credit lines. By matching the requirements for "business as usual" against a stressed funding scenario, the management team can gain a more accurate picture of how large a funding shortfall should be addressed.

ADDRESSING FUNDING SHORTFALLS

Once companies grasp the full extent of their potential funding gap, they can create a strategy for changing the way they address potential shortfalls in financial resources and incorporate these shifts into their overall strategy for managing risks. But developing such an integrated approach can only happen if companies attempt to bring the limits associated with their reserve calculations in line with their changing appetite for risk and overall funding plans.

Companies must examine a wide range of scenarios to determine both the cost of different sources of funding and the likelihood of their access to financial resources. For example, companies should be prepared for separate divisions to draw down on reserves at the same time and examine how internal transfer prices and competition for funding could affect funding availability.

Finally, a company's chief risk officer must work with its chief financial officer to calculate and monitor the firm's financial resources. They must form teams responsible for liquidity risks in their risk, financial planning and treasury divisions. Otherwise, corporations will not just remain vulnerable to the next financial virus, they may even exacerbate it, fulfilling the words of Spanish-born philosopher George Santayana that "those who do not remember the past are condemned to repeat it."

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THE BIG SQUEEZE IN OIL FIELD SERVICES

THREE STRATEGIES TO SURVIVE THE CURRENT OIL PRICE DOWNTURN

Bill Heath • Adam Perkins

Since the collapse of global oil prices, oil field activity (both ongoing and planned) has decreased dramatically: Global exploration spending has contracted by almost 25 percent, the equivalent of $120 billion, due to delayed or cancelled projects. Additionally, global rig count – the key indicator of level of future exploration activity – has shrunk by 43 percent over the past 12 months.

Oil field services companies are being squeezed on almost every front, given falling oil prices. Their total revenues are expected to have declined by 20 percent through the end of 2015, based on third-quarter results. If oil prices remain at current levels, we estimate that oil field services firms' revenues could decline by another 28 percent over the next four years, and we expect steep, long-run declines in spend across the industry, with drilling companies being hit almost twice as hard. (See Exhibit 1.)

In response, these firms, which provide national and international oil companies with everything from seismic surveys and drilling technology to production maintenance services, likely will have to lay off a considerable number of people: The top 37 companies alone are expected to reduce their workforce by 170,000 – this in addition to the more than 120,000 who lost their jobs in 2015. To regain profitability, Schlumberger, Halliburton and Baker Hughes (the industry's three largest firms, accounting for about one-fifth of the market) will likely have to eliminate another 10,000 positions on top of the 64,000 they lost in 2015 and have announced for 2016. The 34 firms that represent the middle tier of the industry will need to cut the deepest, with the remaining 160,000 jobs in jeopardy. And the industry's bottom third tier in terms of revenues, which is made up of more than 300 small firms with limited cash reserves, will struggle to survive without further drastic cuts.

While it's true that cost cutting can enable a strategy, it cannot take the place of one. Leading oil field services firms are not just aiming for bottom-line targets. Medium-size players are looking to take steps to emerge on top once the oil and gas industry's

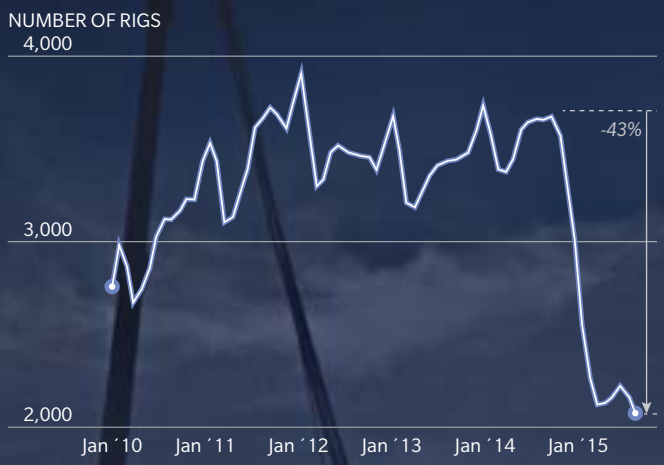
EXHIBIT 1: THE BIG SQUEEZE

Oil and gas companies are delaying projects and withdrawing rigs resulting in an expected 48 percent decline in revenues for oil field services companies

PROJECTS HAVE BEEN DELAYED OR AXED

Source: *Financial Times*; Rystad Energy; Morgan Stanley; Oliver Wyman analysis, from December 2014 through December, 2015

THE ACTIVE RIG COUNT HAS DROPPED



Source: Baker Hughes Worldwide Rig Count; Oliver Wyman analysis

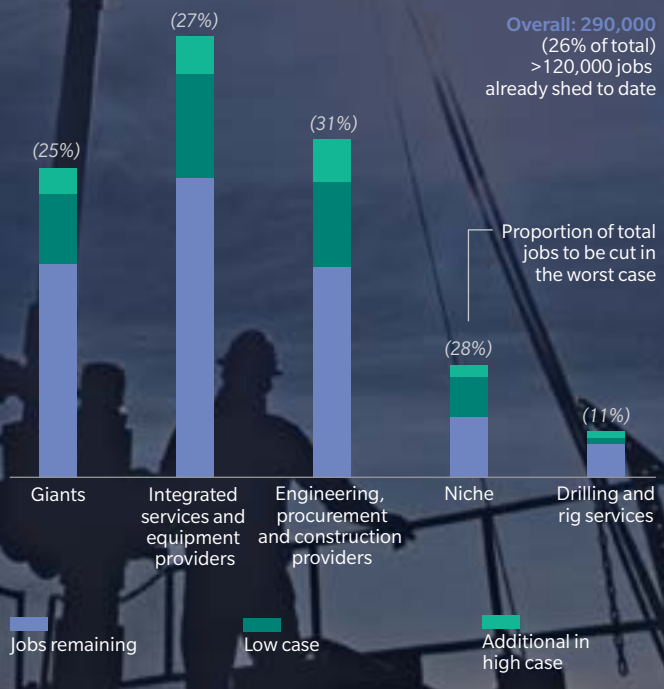
REVENUES HAVE DECLINED

$BILLION *REVENUES OF TOP 350 OIL FIELD SERVICES FIRMS

*Assumes oil prices remain at 2015 levels
Source: Capital IQ (2015 estimate based on 2015 data through December); Oliver Wyman analysis

NEARLY 170,000 MORE JOBS CUT

EXPECTED JOB LOSS IN GIANT AND MID-TIER OIL FIELD SERVICES FIRMS* 2000 FTE, 2016 - LONG-RUN EXPECTATIONS



* Top 34 mid-tier oil field service firms by revenues and three giants
Source: Capital IQ and company announcements; Oliver Wyman analysis

economic cycle turns. What follows is a "top three" list of potential approaches that mid-tier oil field services firms should be considering. These strategies are about to reshape, and perhaps significantly strengthen the oil field services industry, and their impact will be felt long after the present big squeeze.

BECOME A NICHE PLAYER

Giant and mid-tier oil field services businesses have already laid off nearly 10 percent of their workforce to shrink their operations to suit current demand, with the assumption that when oil and gas prospects brighten, they can ramp up once more. But it's more likely that these firms will need to cut even more positions should they continue to follow the same strategy. Many will ultimately become much smaller players or else be forced to shut down if oil prices fluctuate between $45 and $70 for an extended period.

Shrinking is a long-term solution only for those firms that are willing to become niche players, since the elements necessary for growth may be out of reach after the cycle turns. Take strong customer relationships and long-term contracts, for example, which many mid-tier firms are relying on to get them through the current hard times. The margins associated with these contracts are likely to shrink and not return to their current levels any time soon. Already, international oil companies and national oil companies are in the process of renegotiating the terms of their contracts with oil field services companies that will remain in place for three to five years.

Once the decision has been made to downsize, the people and technology required to gain a competitive edge when the cycle turns may also prove to be unobtainable. Oil field services talent is highly mobile, quick to move between geographies and firms. Competitors that do not downsize in the interim will likely have hired away key talent and implemented today's cutting-edge technologies – or may be moving toward adopting even more advanced tools and knowhow.

28

The expected percentage decline in oil field services revenue by 2019 if current oil prices hold

CONSOLIDATE

Another option is to consolidate, as demonstrated by Halliburton's pending acquisition of Baker Hughes and Schlumberger's recent purchase of Cameron International (the oil field services industry's eighth-largest player). If this $50 billion total of mergers is completed, there will be only two major oil field service companies with a global footprint. These giants will raise the bar for the entire oil field services industry in terms of size and scale of operations.

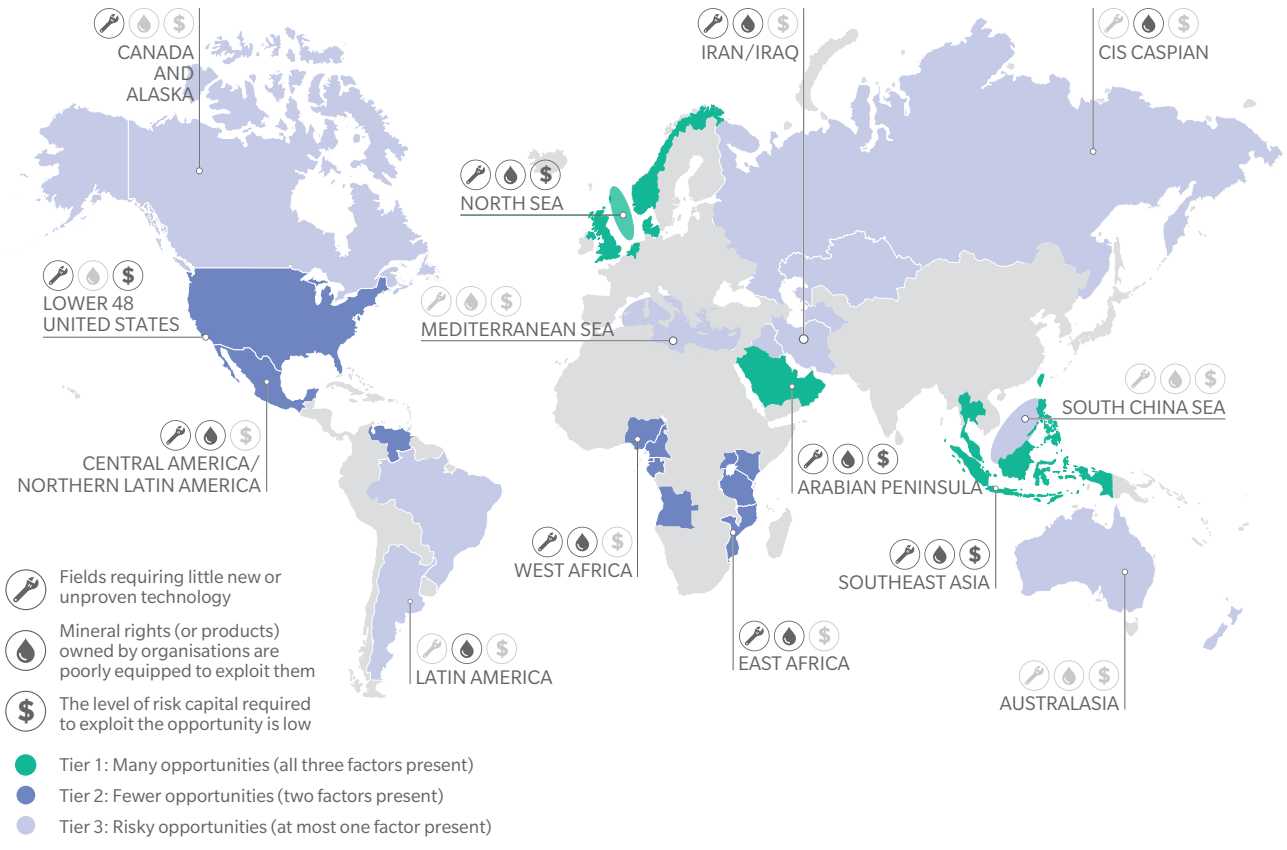
An oil field services firm could improve its bargaining power by following a similar strategy of bulking up by acquiring smaller companies. There is room for a third oil field services giant to satisfy those customers concerned that the industry is becoming too concentrated. Moreover, the underlying structure of the market that oil field services firms serve remains the same.

But to compete with the other top two players, such an entrant would have to be able to support new projects and production everywhere, from Australia to Iraq to the United States. It also would have to deliver innovative approaches and technologies to supplying services ranging across sub-surface management, engineering design, construction and production services.

Creating a third oil field services company with revenues between $25 billion and $30 billion would require $12 billion to $30 billion in investment. That might sound like a tall order but is not impossible to imagine. A large conglomerate such as General Electric could develop a larger, more competitive oil field services presence by acquiring businesses. Or an ambitious oil field services business with a strong brand and footprint could partner with a private equity firm.

EXHIBIT 2: NEW OIL FIELD SERVICES INDUSTRY OPPORTUNITIES

Mid-tier oil field services firms may attempt to compete with international oil companies in regions where there are low maintenance oil fields, underdeveloped mineral rights and less capital-intensive projects



Source: Oliver Wyman analysis

CHANGE THE RULES

Major oil field services firms must walk a difficult line between serving international oil companies and competing with them, especially for contracts that do not demand high levels of risk capital. This tension will grow as 'difficult oil' remains unprofitable and onshore or shallow water resources are exploited. These resources are now well understood and in the more politically stable countries require little in the way of risk capital. That means there is less need for international oil companies to be involved.

Larger oil field services firms are unlikely to challenge the status quo. But mid-tier firms with less to lose and under greater pressure to survive may attempt to change the rules by providing expertise and technology competitively and directly to national oil companies or other potentially unsophisticated mineral owners, especially to OPEC countries interested in achieving greater returns from their resources. Petrofac, for instance, already has a number of operations where it provides such services (and has an equity stake).

With the backing of a private equity firm or pressure from an expanding rival, mid-tier oil field services companies will most likely pursue three types of opportunities: those that involve oil fields requiring little new or unproven technology, such as mature fields that only need closer management or new fields in a benign environment; contracts or partnerships that involve mineral rights (or products) owned by organizations such as national oil companies that are poorly equipped to exploit them; and projects that don't require a great deal of capital, specifically risk capital.

Many opportunities exist for oil field services companies to not just survive the present downturn, but to change the rules, by creating synthetic international oil companies through partnerships with national oil companies or investors. Such partnerships are especially likely to succeed in major oil producing regions such as the North Sea, Southeast Asia and the Arabian Peninsula, where there are low maintenance oil fields, underdeveloped mineral rights and less capital-intensive projects. (See Exhibit 2.)

Most leaders know that when their backs are up against the wall, it is a sign that their industry is at an inflection point that can lead to potentially greater opportunities. Although it may not feel like it, oil field services companies do indeed have a choice. To survive current low oil prices, they can aggressively downsize. But an alternative course may be much better over the long run: They can make a bold move to rewrite the rules.

170,000

The number of additional jobs that giant and mid-tier oil field services companies will need to cut if current oil prices hold

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DEFUSING THE DECOMMISSIONING TIME BOMB

OIL AND GAS COMPANIES MUST COLLABORATE TO CONTAIN THE POTENTIALLY CRIPPLING COSTS OF REMOVING OFFSHORE FACILITIES

Thorsten Querfurt • Nic Singleton

Oil and gas companies have installed thousands of structures offshore in the earth's oceans, and the time is quickly approaching for those wells, pipelines and other pieces of equipment to begin coming out.

Already in some basins, such as the United Kingdom's continental shelf, low production, falling efficiency, aging assets and rising decommissioning liabilities are making production less attractive. Now, persistently low oil prices are putting pressure on producers to consider the costly and irreversible decision to decommission those structures.

Operators must dispose of the equipment properly to meet regulations and to avoid spills that could damage the environment. Decommissioning this equipment will cost hundreds of billions of dollars and represents new operational risks for most companies. The costs have started to impact company balance sheets through provisions, and depending on the jurisdiction, much of the burden will be borne by governments. (See Exhibit 1.)

POOLING EFFORTS

If each oil and gas company forms its own decommissioning operation, the total cost may balloon. Each company will have to undergo a learning curve of developing the capabilities and of gaining the necessary experience, and inconsistencies could impact the resulting work. Pooling the efforts would be more efficient and, according to an Oliver Wyman analysis, could reduce costs by more than 25 percent through the combined benefits of: increased purchasing power in the supply chain; improved learning and knowledge sharing; better information for central planning and coordination; reduction in duplicated decommissioning skills; and improved financial control and transparency.

Independent producers and companies with a small number of structures could benefit the most, establishing decommissioning syndicates that could harness and realize the benefits from pooling efforts. To a lesser degree, increased collaboration among international oil companies, which focuses on sharing data and services and improving financial control, could cut the cost of decommissioning by up to 15 percent. Syndicated independents and larger oil companies alike could significantly improve their balance sheets by spinning off the unprofitable assets into a separate decommissioning company, similar to a bad bank.

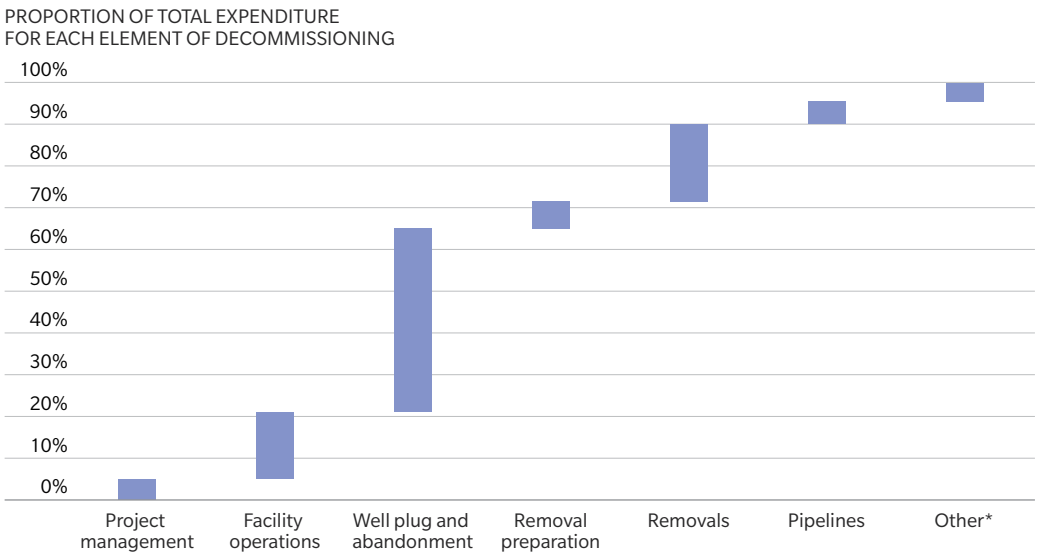
The UK continental shelf, one of the most mature offshore oil and gas producing regions, will be an immediate test case. Most of the platforms are more than 30 years old, and only around 7 percent of the assets have been removed, according to the UK Department of Energy and Climate Change. But that amount will soon rise. The offshore industry association Oil & Gas UK believes that more than 2,300 kilometers of pipeline, infrastructure from 74 fields, over 70 subsea projects and more than 130 installations are scheduled for decommissioning in the North Sea during the next decade.

BALLOONING COSTS

The equipment removal that has already taken place in the basin was carried out sporadically, with little communication among operators. This strategy has resulted in projects being delivered, on average, 40 percent over budget, according to the UK's Department of Energy and Climate Change. Operators assign their limited resources to an activity that creates no value. They have little leverage on supply chain costs, and with the limited number and long lead time of projects, it's difficult for individual companies to retain knowledge and talent for future work. There's also a risk of stranded and untapped reserves due to early or poorly synchronized decommissioning across the region.

EXHIBIT 1: DECONSTRUCTING DECOMMISSIONING

A breakdown of decommissioning costs



*Other includes site remediation, onshore recycling and monitoring

Source: Oil & Gas UK; Oliver Wyman analysis

Average annual spending on decommissioning in the region is forecast by Oil & Gas UK to rise to more than $3 billion by 2018, from $2.25 billion in 2014. Relief from UK's petroleum revenue tax is meant to pay for the majority of decommissioning, but the decommissioning cost will rise significantly just as production declines. If tax receipts continue to plunge as they have in recent years (receipts were just $7 billion in 2013-2014 compared with $17 billion in 2011-2012), the government will need to look outside of oil and gas production to pay for decommissioning.

SEPARATING NONPERFORMING ASSETS

As part of the collaboration, operators should consider forming a separate company that owns the physical end-of-life assets and performs the removals. We estimate the potential members of such a syndicate in the UK continental shelf, independent producers and those with few assets, could save as much as $7.5 billion. This strategy is similar to what happened in the financial world with the creation of so-called "bad banks," a strategy that, according to news reports, ultimately resulted in major benefits.

Separating nonperforming assets into a new company focuses investors and counterparties on the bank's healthy, core activities. This boosts investor confidence through a clear investment thesis, improving the bank's share price and ability to raise capital. The goal is not to make the bad bank into a profitable company, but to manage risk and avoid asset fire sales. Most importantly, the bad banks create strategic options. They can work with many different buyers or consolidation partners, and make use of alternative forms of capital or risk transfer.

An oil and gas decommissioning company could see similar benefits. The assets would shift to a separate company that is run and partly funded by operators, with financing from institutional investors seeking yield from long-term debt. The new decommissioning company can explore the best approach to unwind its holdings, develop true world-class decommissioning capabilities, create economies of scale from resources, equipment and technology, and influence the supply chain, regulators and governments.

A NEW MODEL

This radical, industry-shaping change won't be easy. A key group of operators must commit to collaborate. Roadblocks may exist for funding, governance, data sharing and tax liabilities. Operators must agree on allocation methodologies, roles and processes, and secure systems for data, among other issues. Governments must amend laws and tax structures.

The issues facing the fledgling decommissioning industry are certainly challenging, particularly as work shifts from the relatively easier shallow waters to deep-water facilities. But if the UK continental shelf operators can collaborate on decommissioning these initial shallow-basin structures, they will then be able to lay the groundwork for the technical and financial models that will be needed to tackle the more complex deep-water structures. The time to begin the grand collaborative effort is now.

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ELECTRICITY STORAGE TECHNOLOGY

A WAKE-UP CALL FOR UTILITIES TO INTEGRATE NEW TECHNOLOGIES

Dan Darcy • Arun Mani

Although solar power has been ballyhooed as the reigning threat to the traditional utility revenue model, there is a stealth disruptor lurking in the wings: electricity storage. New and more economically priced technology can store enough electricity to power a home or business for a few hours. That's long enough to disrupt the peak demand charges business model many utilities rely on for their cash flows.

Alarm bells should be going off for traditional utilities. This is not just about a few wealthy homeowners making better use of their solar panels. This is about a fundamental change to the way electricity is generated, sold and used as customers use batteries to reduce their peak demand and the hefty demand charges that go along with it. This is about power plants potentially sitting idle, power lines moving less electricity and commercial customers, big and small, gaining a powerful tool to cut their electricity bills.

So what should utilities do? Rather than resist new technology, forward-thinking utility executives are drawing on their traditional strengths. They are using long-standing customer relationships to understand power requirements and system operations to integrate new technologies in a way that benefits both the customer and the utility. Failing to do so could potentially put billions of dollars of annual revenue at risk for the utility sector.

DEMAND CHARGES

Many commercial customers pay a significant fee, called a demand charge, based on the amount of electricity they draw from the grid during their time of peak usage. Demand charges can represent as much as 80 percent of a commercial customer's monthly bill.

For example, if a manufacturer runs all of its equipment, air conditioners and lights during the afternoon, that peak usage period determines the demand charge for the month. That's because utilities must keep adequate power generation and power line capacity available on reserve to meet the potential surge in demand.

Some utilities charge a flat fee, others charge based on the time of day and season of the year that the customer uses electricity, while some utilities have a tiered system, with higher demand fees for customers with higher usage.

Lowering consumption during peak usage times can significantly reduce the demand charge for small commercial and industrial customers, even if they use the same total amount of electricity. This is where battery storage could offer a compelling business case for a customer. By using an electricity storage solution to switch to battery power during the peak usage hours, a customer can considerably reduce, or even eliminate, demand charges.

As an example, we studied the potential impact of electricity storage technology on the peak demand of a hypothetical office building over the course of a year. (See Exhibit 1.)

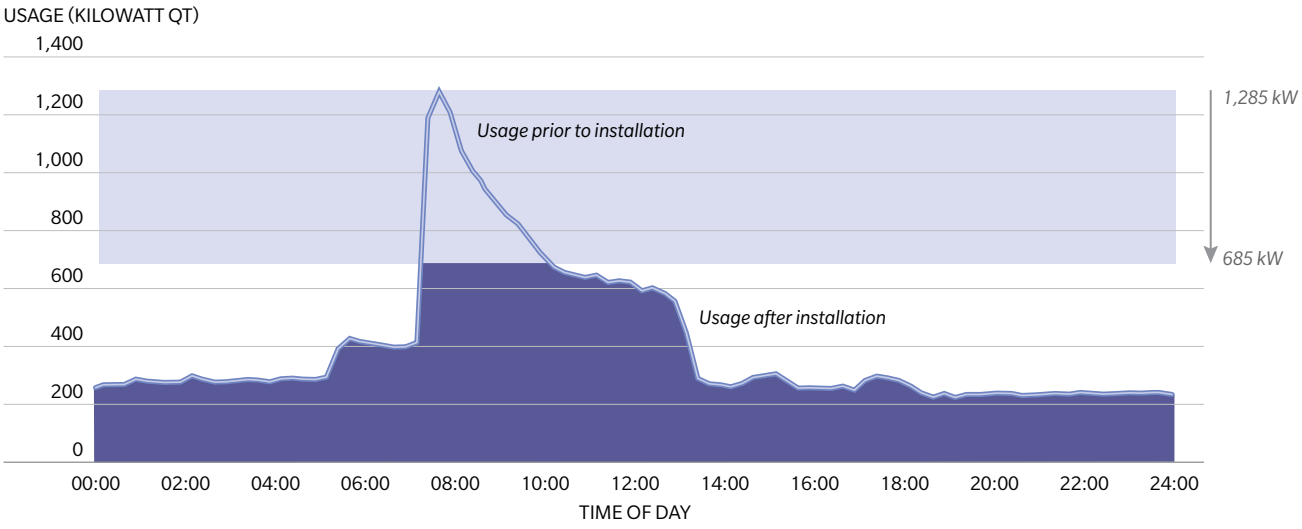
We assumed the customer is located in a large Southern California utility's service territory and falls under the utility's time of use rate class, since its annual peak of 1,285 kilowatts is greater than 500 kilowatts. Assuming a 50 kilovolt or greater power factor, the facility would be charged a $6.56-per-kilowatt monthly demand charge. Different utilities may employ slightly different methods for calculating demand, but a review of several utility tariffs shows that this demand charge appears to be within the normal range.

Based on the monthly load profile in our example, the customer would pay between $6,000 and $8,500 per month in demand charges. A further examination of the facility's peak day for the period identifies the underlying energy usage that drove the demand charge payment for the month of January 2014.

EXHIBIT 1: SHAVING PEAKS WITH ENERGY STORAGE TECHNOLOGY

Emerging energy storage technologies can enable building owners to reduce their daily peak demand and significantly cut their electric bills

OFFICE BUILDING DAILY LOAD PROFILE BEFORE AND AFTER INSTALLING ELECTRICITY STORAGE



Sources: Innowatts, Oliver Wyman analysis

SWITCHING TO STORED ENERGY

If this customer were to install electricity storage technology at this facility, the facility could meet its peak demand with stored energy as opposed to power from the grid. Assuming a relatively consistent day-to-day usage profile, any peak usage reductions would directly result in lower demand charges.

According to the U.S. Energy Information Administration, there are 18,000 similarly-sized buildings in the Pacific region. The utility selected for our analysis covers a quarter of that region, so let's assume it serves 4,500 such buildings. The state of California is considered to have progressive jurisdiction in terms of energy storage legislation, so even a small number of customer storage installations could have serious revenue implications for the utility. If one in five of these facilities installs battery storage and is able to cut demand charges by one half, based on the annual savings illustrated in the example above, the utility could see its revenue decline by $45 million a year.

This analysis only represents one utility's service territory and one building size within that territory, with potential opportunities for peak demand reduction varying greatly depending on each individual facility's load profile. If battery storage becomes more popular and more effective, the potential loss to utility companies could balloon, just through lower demand charges. Apply the above methodology to the 190,000 similar-sized buildings nationwide and the annual revenue loss for the utility industry could approach $2 billion.

Of course, regulators vary by state. Some public utility commissions would allow utilities to recoup their costs by boosting demand charges for those customers who still incur them or by finding alternative recovery mechanisms. In that case, the utility's shareholders would see a temporary dip in revenue, until rates could be adjusted to cover the total costs for a utility to manage peak demand.

However, the regulatory changes would result in higher rates for the remaining demand charge customers, incentivizing them to cut their peak demand and improving the economic viability of alternative solutions. In the long-term, this could result in more customer installation of electricity storage technology and could increase customer defection from the grid.

A WAKE-UP CALL

At the beginning of 2015, 43 companies offered battery storage systems. Since then, big names such as Tesla have entered the industry, drawing attention to the sector. This should serve as a wake-up call for utilities. As some utilities wrestle with regulators over investment in utility-grade battery arrays and pass the cost along to customers, advances in technology are allowing customers to make their own decisions and undermine the utility's traditional rate-setting process.

Utilities still have advantages over upstart technology companies. The old power-and-light companies possess financial and operational skills, and they've built relationships with their customers over the years. Now they have the opportunity to draw on those skills and strengths to transform themselves into utilities of the future.

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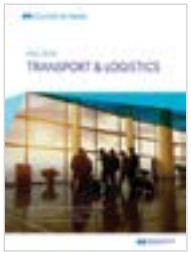

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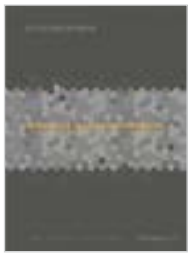

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