

2016 STRATEGIC DIRECTIONS: NATURAL GAS INDUSTRY REPORT

Black & Veatch Insights Group



BLACK & VEATCH
Building a world of difference.®

ABOUT THIS REPORT

The fifth annual Black & Veatch *Strategic Directions: Natural Gas Industry Report* finds segments across the industry value chain continuing to adapt to a low price environment. Over the past year, we have seen each sector react and adapt to a mix of pricing and regulatory challenges while navigating familiar but pressing issues related to safety and reliability.

This year's report, as in years past, depicts a remarkably high-spirited industry in the face of a downturn in investment and segment restructurings. Overwhelming optimism for a rebound has not wavered as efficiency gains and lower production costs move the market towards equilibrium. Additional coal plant retirements and lower operating dispatch costs have moved natural gas to its position as a primary power generation source, while global economic growth and opportunities in the liquefied natural gas (LNG) trade feed this positive outlook.

Yet, this optimism may be masking some substantial warning signs, particularly for upstream and midstream players. Tight controls on capital investments, tied to the low margins inherent in today's pricing environment, have constrained new projects. Lower crude oil prices have revitalized petrochemical projects in the downstream sector, particularly in international markets, but investors still question long-term viability. This raises a key question for how organizations are, or are not, positioned to take advantage of an eventual pricing correction.

The *2016 Strategic Directions: Natural Gas Industry Report* examines how natural gas leaders are managing these challenges – both old and new – and evolving for future growth.

We welcome your questions and comments regarding this report and/or Black & Veatch services. You can reach us at MediaInfo@bv.com.

Sincerely,

JOHN CHEVRETTE | PRESIDENT

Black & Veatch management consulting

HOE WAI CHEONG | PRESIDENT

Black & Veatch's oil & gas business

Black & Veatch is a world leader in gas processing, sulfur, ammonia, syngas, fuels, and liquefied natural gas.







**TABLE
OF
CONTENTS**

ii	Table of Contents
02	Executive Summary
08	Managing the Low Price Market
08	Economic Growth in Emerging Markets Provides Opportunity in Low Price Gas Market
14	Market Conditions Forge New Focus on Diversification, Production Reliability
18	Convergence with the Electric Market
22	Technology Brings Opportunities and Challenges
22	Advanced Metering Provides Efficiencies for Utilities
26	Market Forces Raise Stakes for Efficient Project Delivery
30	Cyber Threats Prompt Fresh Attention to System Security
36	Regulations Shaping Operations and Planning
36	Emissions Reduction Goals Carry New Implications for Compliance
40	Expanding Federal Oversight on Horizon for Gas Storage Operators
44	Closing Commentary
44	Industry Optimism Reflects Divergent Market Trends
50	The Black & Veatch Analysis Team
54	2016 Report Background
58	List of Figures/Tables

EXECUTIVE SUMMARY

Varying Expectations for Upstream, Midstream and Downstream Sectors

By John Chevrette

The past year has seen an industry coming to grips with the reality that natural gas prices have yet to rebound. Steady price conditions have pushed industry players – and the markets they interact with – to find ways to adapt. Finding efficiencies to streamline production, investing in new technologies and capitalizing on downstream opportunities are just some of the approaches employed by industry leaders.

Increased coordination between oil producers, natural gas producers, pipeline operators, local distributors and other oil and gas industry providers has become integral. Consolidations have also transformed the market, making this interconnectivity more complex.

With another year of low natural gas prices on the books, the market anticipates a rebound with emerging economies leading the path to growing market demand. Survey responses in the *2016 Strategic Directions: Natural Gas Industry Report* reflect a convincingly positive outlook, with nearly 70 percent of all respondents indicating they were either “optimistic” or “very optimistic” for future growth in the global oil and gas economy between now and 2020. Local distribution companies (LDCs) and interstate and intrastate pipelines appear to be more confident in future growth, but oil and gas producers are surprisingly not far behind (Table 1). But what is feeding this overwhelming optimism? This year’s report details how the industry is tackling challenges both new and evergreen, while still striving for growth.

Finding efficiencies to streamline production, investing in new technologies and capitalizing on downstream opportunities are just some of the approaches employed by industry leaders.

Table 1

What is your general outlook on the future growth of the global oil and gas industry?
 (Please use the drop-down menus to select what you feel the outlook for the future growth of the industry will be Between Now and 2020 and then Between 2020 and 2030.)

	Combined “Very Optimistic” and “Optimistic” Ratings by Services Provided					
	Oil Producers	Pipeline Operators	Local Distribution Companies	Electricity Generators	Oil & Gas Industry Services	All Respondents
Outlook on the industry between now and 2020	71.1%	87.5%	89.3%	67.4%	60.6%	69.1%
Outlook on the industry between 2020 and 2030	65.1%	77.4%	67.5%	63.4%	60.9%	70.7%

■ The cells highlighted in blue indicate ratings that were notably higher or lower compared to the ratings of all the other groups combined.

Source: Black & Veatch

MARKET GROWTH ON HORIZON WITH EMERGING ECONOMIES, LNG TECHNOLOGY

Projected growth in emerging economies and increasing activity in the liquefied natural gas (LNG) trade present opportunities for gas providers. Underserved global markets, particularly in Asia, are capitalizing on low natural gas prices to spur economic development. With limited infrastructure to produce and distribute natural gas, these markets will rely on suppliers such as the United States and Australia, and will need to invest in additional pipeline infrastructure and transport projects.

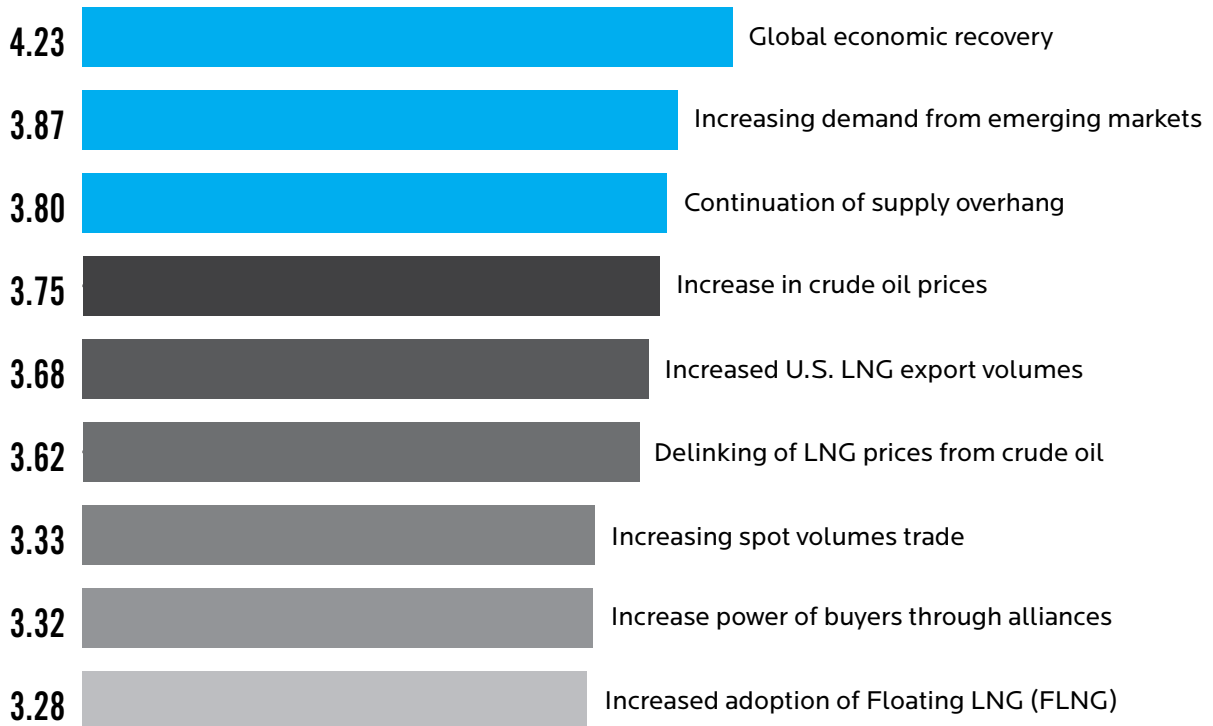
LNG technology is also expected to help meet global demand, especially in more isolated markets. Export

facilities, floating LNG and import terminal projects scheduled for completion in the coming years will not only support industrial projects but can also help stabilize the market. With infrastructure constraints a top concern in some Asian markets, increased LNG imports can help address worldwide natural gas oversupply (Figure 1).

India, in particular, is poised to capitalize on low oil prices to embark on new projects. Petrochemical sector developers are assessing the feasibility of new fertilizer and sulfur recovery plants. These downstream projects could result in high returns when the market rebounds, making them easily bankable to investors.

Figure 1

On a 5-point scale, where a rating of 5 means “Significant Impact” and a rating of 1 means “No Impact,” please rate the potential impact of the following factors on the global LNG market over the next 5 to 10 years? (Select one choice per row.)



Source: Black & Veatch

With ongoing aging infrastructure concerns looming and recent high-profile gas incidents gaining media attention, safety has become more pertinent as demand for gas-powered energy grows and new regulations arise.

SAFETY AND RELIABILITY LEAD TOP INDUSTRY CONCERNS

As in years past, safety remains the industry's top concern, with 70 percent of respondents ranking it as a "very important" long-term issue. With ongoing aging infrastructure concerns looming and recent high-profile gas incidents gaining media attention, safety has become more pertinent as demand for gas-powered energy grows and new regulations arise. Pipelines, among other elements, must undergo strenuous safety checks to maintain standard requirements, which can be costly. With many in the industry cutting capital spending, finding resources to fund mandatory assessments has become all the more challenging.

Safety's intersection with cybersecurity and physical security has forced organizations to reconsider processes as technology is increasingly used to maximize production, efficiency and sustainability. Innovative advancements, however, also generate new points of vulnerability. Breaches within LDCs can be particularly damaging, and many are managing risks by implementing new policies and procedures. Those who approach these frameworks holistically can better safeguard their pipeline and production systems.

EXTREME WEATHER CHALLENGES RELIABILITY

As natural gas's role in electricity generation increases, so do reliability challenges. Perennial reliability concerns have been revitalized as winter storms hindered power production and natural gas demand for home heating skyrocketed in early 2016. These extreme weather events further exacerbated the persistent reliability woes of the Northeast United States, which suffers from limited pipeline capacity. However, the operational challenges that have caused synchronization disconnect between the gas and power markets go beyond physical infrastructure constraints. Pipeline infrastructure investments, customer demand and regulation compliance will all play important roles in how the gas and power markets integrate.

Better coordination between the gas and electric markets could result in energy planning that ensures reliability by mitigating potential outages and supply interruptions, while keeping price rates reasonable for customers. However, nearly half of LDCs and related industry providers surveyed responded that they currently do not know how to best manage the gas and electric market disconnect. Transparency between the parties, detailed planning and analysis will help close planning gaps to ensure gas supplies meet future demand.

MAXIMIZING PRODUCTION IN THE DOWNTURN

Gas producers must also better manage productivity without sacrificing reliability. To maximize production from current assets, survey respondents listed implementing operations and maintenance improvements as the most common strategy (71 percent). Using new/innovative technology was ranked second, selected by 42 percent of respondents (Figure 2).

Technological advancements in data analytics, particularly in advanced metering, can create operational efficiencies for utilities. Program management services can also help organizations deliver more economical and cost-effective projects while mitigating risk. Organizations that invest in finding operational efficiencies now will be well-positioned to yield returns as the market rebounds.

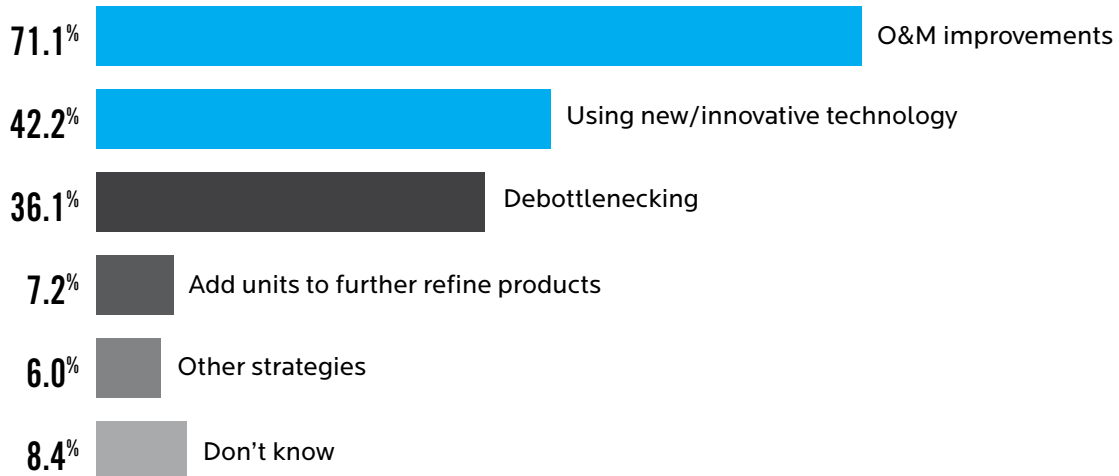
The prolonged pricing slump has done more than simply test the natural gas market's resilience. Perhaps today's

market strains have also kept industry leaders from falling into business complacency. We are seeing an industry that is now more prepared for the demand growth seemingly on the horizon. Where opportunities exist to streamline processes or utilize innovations, industry leaders are taking action and investing where practical. As the market continues to evolve, lessons learned in the downturn are already being applied in planning, coordination with interconnected markets and investment in infrastructure.

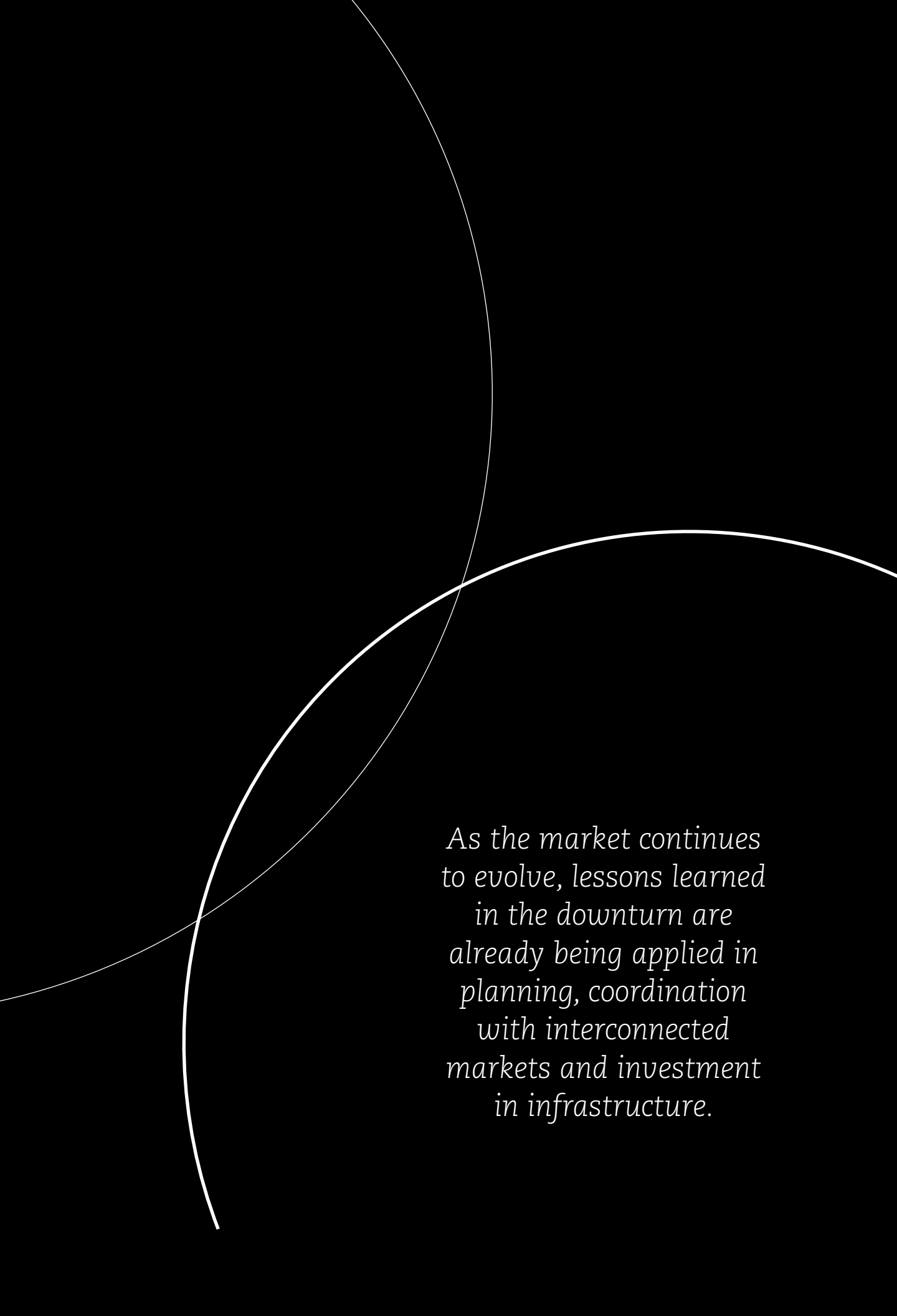
Since the inaugural *Strategic Directions: Natural Gas Industry Report* in 2012, survey responses have consistently suggested that the industry's future holds promise. A similar sentiment was reported then – of low prices and ample supply changing the energy landscape, with abundant opportunities for all elements of the value chain. But, have subsequent years shifted the advantages entirely to utilities? How has oil and gas trade affected the global outlook? This year's report examines the state of today's natural gas industry and how this optimistic outlook has transformed for all sectors of the market.

Figure 2

How is your organization planning to maximize the production from your assets? (Select all that apply.)



Source: Black & Veatch



*As the market continues
to evolve, lessons learned
in the downturn are
already being applied in
planning, coordination
with interconnected
markets and investment
in infrastructure.*

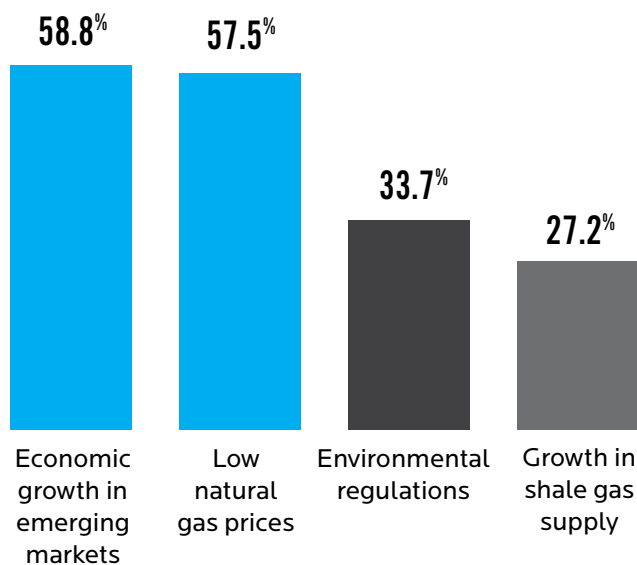
MANAGING THE LOW PRICE MARKET

Economic Growth in Emerging Markets Provides Opportunity in Low Price Gas Market

By Anand Pattani, Deepa Poduval, Javid Talib and Denny Yeung

Low natural gas prices have pushed natural gas industry participants to find innovative ways to meet rising demand while lowering production costs. Those hoping to persevere in the current “survival of the fittest” environment must capitalize on opportunities facilitated by lower crude oil and gas prices. Economic growth in emerging markets is a critical component driving global demand for natural gas (Figure 3).

Figure 3
Which factors do you expect to be the biggest drivers of global demand growth for natural gas? (Select top two choices.)



Source: Black & Veatch

Rapidly developing countries in Asia, particularly India and China as well as established markets like Japan, are increasingly seeking to benefit from low natural gas prices, which present a cost-effective alternative to oil to support economic growth. With relatively limited domestic resources and increasing infrastructure capacity to import and distribute natural gas, these markets are expected to rely on suppliers such as the United States and Australia to help meet their forecasted demand. This dependency is reflected in the *2016 Strategic Directions: Natural Gas Report's* results, with respondents who indicated their primary business region was outside the United States rating international market access as a top long-term issue (Table 2).

Table 2

On a 5-point scale, where a rating of 5 means “Very Important” and 1 means “Very Unimportant,” please rate the importance of each of the following long-term issues to the natural gas industry. (Select one choice per row.)

Natural Gas Industry Issues	Mean Importance Ratings by Primary Business Region									
	United States	Canada	Mexico	Central America	South America	Asia	Australia/Oceania	Europe	Middle East, including the GCC	Africa
Safety	4.62	4.51	4.55	4.39	4.44	4.59	4.48	4.55	4.56	4.65
Aging infrastructure	4.27	4.25	4.17	4.13	4.16	4.11	4.16	4.20	4.11	4.16
Gas supply reliability	4.24	4.03	3.98	3.89	4.07	4.14	3.95	4.06	4.06	4.00
Economic/demand growth	4.27	4.37	4.34	4.44	4.45	4.51	4.32	4.43	4.56	4.54
Environmental regulation	4.26	4.18	4.15	4.04	4.09	4.23	4.09	4.17	4.11	4.11
Available pipeline capacity	4.10	4.03	3.95	3.96	3.88	3.92	3.88	3.93	3.88	3.96
Regulations	4.12	4.03	3.98	3.91	3.87	4.02	3.92	4.03	3.94	3.98
Rate and regulatory certainty environmental	4.06	3.87	3.93	3.98	3.93	4.08	3.98	4.07	3.92	4.07
Physical security	3.98	3.80	3.83	3.93	3.85	4.05	3.73	3.99	3.97	4.02
Aging workforce	4.05	4.08	4.14	4.15	4.15	4.00	4.09	4.13	4.05	4.16
Gas price stability	4.02	3.86	3.91	3.85	4.00	4.13	3.91	3.99	4.00	3.96
Capital access and cost	3.91	3.97	4.00	4.07	4.06	4.26	3.92	4.11	4.23	4.25
Cybersecurity	3.89	3.74	3.75	3.80	3.67	3.83	3.66	3.86	3.86	3.80
Electric-gas interdependency	3.85	3.86	3.83	3.91	3.78	3.75	3.75	3.80	3.77	3.84
International market access	3.17	4.03	4.12	4.20	4.12	4.27	4.03	4.19	4.46	4.35

■ The cells highlighted in blue indicate ratings that were notably higher or lower compared to the ratings of all the other groups combined.

Source: Black & Veatch

LOW GAS PRICES STIMULATE DEVELOPMENT IN INDIA

Oil and gas importing nations see opportunities in the challenges facing North American supply markets. Factors such as low oil prices can incentivize or delay new projects such as liquefied natural gas (LNG) export terminals or petrochemical facilities. Developers in India, specifically in this latter category, are looking to capitalize on low oil and gas prices to embark on new projects in the LNG, refinery, petrochemical and fertilizer markets. Fertilizer projects, previously delayed or mothballed because of high gas input prices, are once again being considered for development by the Indian government.

Participants in India's broader oil and gas market also expect new regulations to be enforced in the near future that will further restrict sulfur emissions from oil refineries. The current Bharat Stage-IV (BS-IV) Norms require facilities to have units in place that remove 99 percent of sulfur from emissions. A new, more stringent set of regulations, BS-VI, are scheduled to be enacted between 2018 and 2020 and will require recovery units to remove 99.9 percent of sulfur. To maintain compliance, refineries will need to be upgraded or tail gas treating units will need to be added to existing sulfur recovery units. The costs associated with installing these units may impact the price to produce oil. And, as oil and gas become more interchangeable as energy sources in markets such as India's, natural gas demand could increase further.

LNG TECHNOLOGY TRANSFORMING NATURAL GAS INDUSTRY

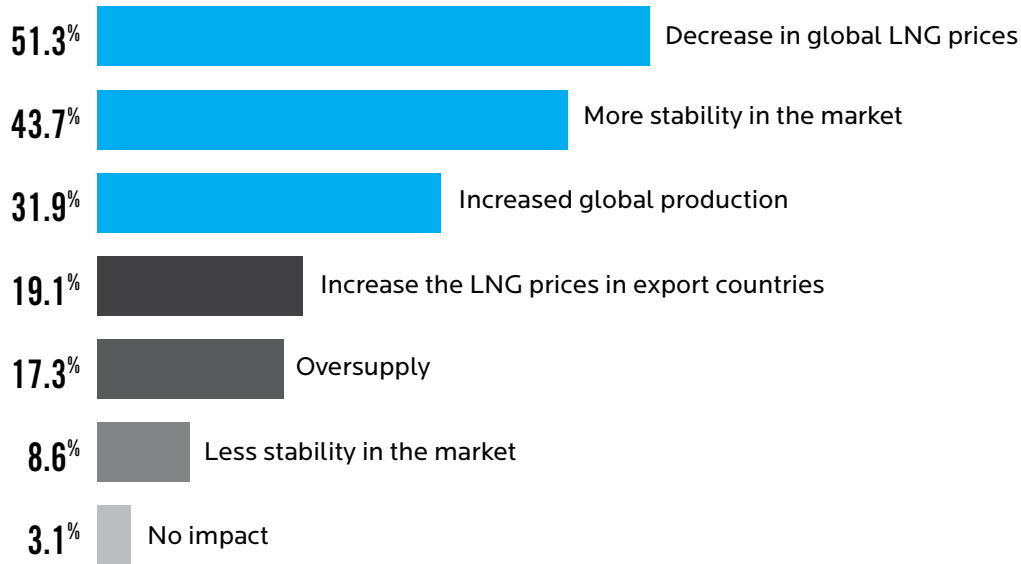
Producing countries utilize LNG technology to transport their excess natural gas supply to target demand regions that are not readily accessible to them through natural gas pipelines. To further support international trade in natural gas, additional LNG export facilities, floating liquefied natural gas (FLNG) facilities and LNG import terminals are expected to come online within the next few years. While large LNG export projects involve high capital expenditure (CAPEX), once operational, these projects generally yield predictable, long-term cash flows to project sponsors. Survey responses indicate that the industry expects a proliferation of new LNG facilities to drive down global prices, help stabilize the market and increase global production (Figure 4).

A desire to shift LNG contract structures is perhaps one of the most prominent trends emerging in the market. LNG has traditionally been sold under long-term contracts, with many involving terms as long as 20 years. LNG importers historically entered into long-term agreements to ensure a stable, uninterrupted supply with a relatively limited number of suppliers in the market. With more LNG supply coming online, contracts are increasingly being renegotiated to shorter terms. Due to production gains, the availability of uncommitted short-term supply has increased, and pricing structures are transforming to accommodate greater sourcing options. Thus, buyers are benefiting from more competition in the market and achieving lower costs for LNG.

A sustained, albeit modest, global economic recovery (by current United Nations forecasts) is expected to drive an increase in LNG demand and contribute to the recovery of the natural gas industry. Forty-three percent of all survey respondents indicated they expect the current global LNG supply overhang to be absorbed and a need for the next tranche of supply to emerge between 2021 and 2025. LDCs and utilities are more unsure than other sectors, with about 23 percent indicating they do not know (Table 3).

Figure 4

How will additional export facilities and FLNG facilities and import terminals coming online affect the market? (Select top two choices.)



Source: Black & Veatch

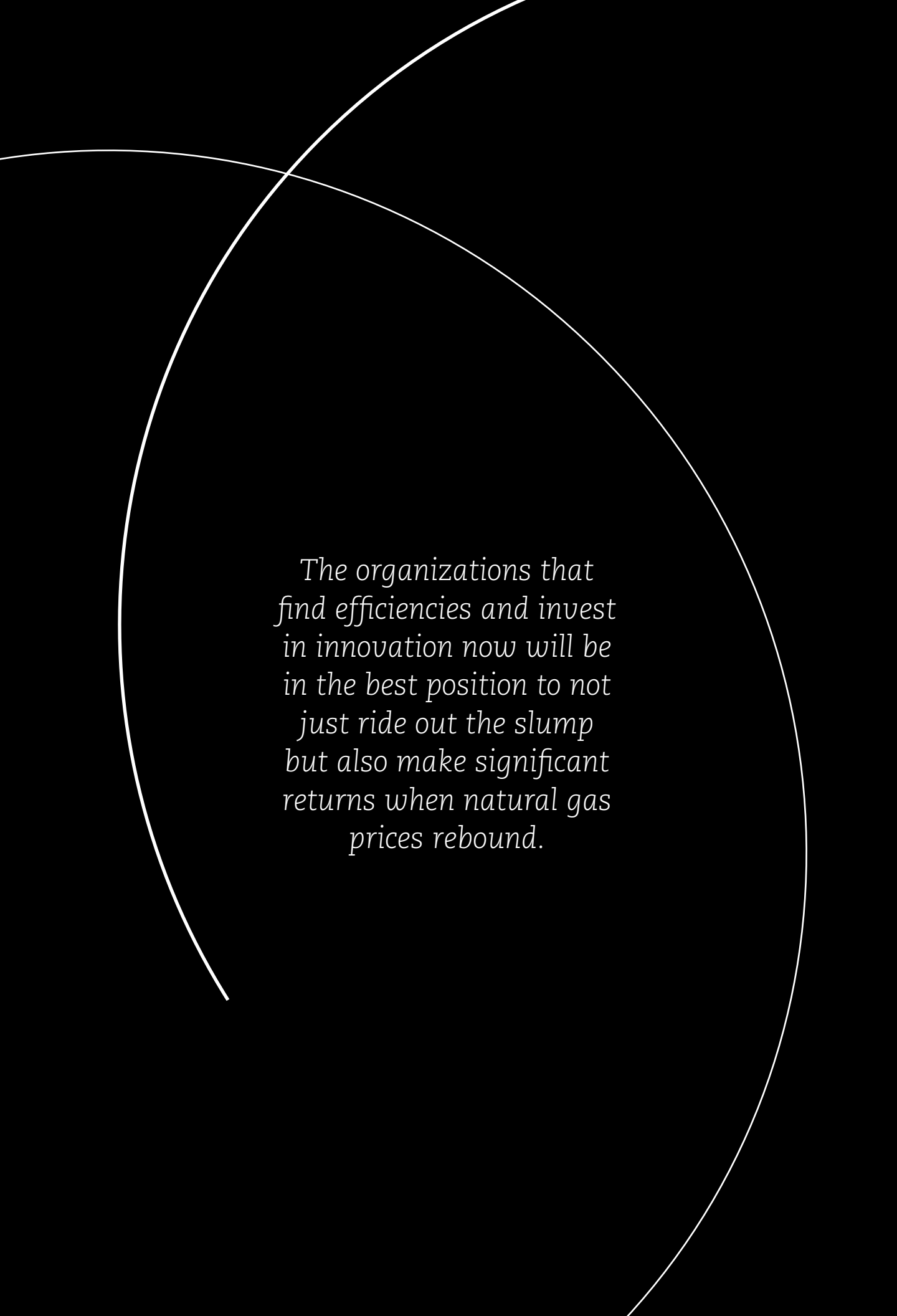
Table 3

When do you expect the current global LNG supply overhang to be absorbed and the need for the next tranche of LNG supply to arise? (Select one choice.)

	Combined “Very Optimistic” and “Optimistic” Ratings By Group				All Respondents
	Oil Producers	Pipeline Operators	Local Distribution Companies and Electricity Generators	Oil & Gas Industry Services	
Never or not in the foreseeable future	5.6%	5.6%	8.9%	7.7%	7.1%
2016-2020	26.4%	16.7%	8.9%	20.0%	16.5%
2021-2025	50.0%	45.4%	35.5%	46.2%	43.1%
2026-2030	6.9%	13.9%	16.1%	3.1%	11.4%
After 2030	2.8%	2.8%	7.3%	3.1%	4.3%
Don't know	8.3%	15.7%	23.4%	20.0%	17.6%

■ The cells highlighted in blue indicate ratings that were notably higher or lower compared to the ratings of all the other groups combined.

Source: Black & Veatch



*The organizations that
find efficiencies and invest
in innovation now will be
in the best position to not
just ride out the slump
but also make significant
returns when natural gas
prices rebound.*

The Black & Veatch 0.5MMTPA FLNG vessel is the world's first proven FLNG technology to achieve production on a floating facility.



RELIABILITY REMAINS KING

The past 36 months have seen the natural gas industry undergo a dramatic series of events from booming optimism to caution. Yet, one priority remains constant – the need for reliability across the sector to support rising demand. Natural gas demand is expected to rise due to a variety of factors. Coal plant retirements and support for additional renewable and distributed energy resources will further position natural gas as a critical contributor in a modern power portfolio. With this greater penetration of natural gas into the energy mix, reliability of gas supply is becoming increasingly critical.

While natural gas supplies have increased, the infrastructure needed for this supply to serve growing demand safely and reliably needs ongoing investment. In recent years, producers have made the investment needed to move their supply to market regions. Current market conditions and a subsequent need for upstream players to cut their capital costs create challenges for these investments to continue.

At the same time, as infrastructure continues to age and environmental regulations become more stringent, these investments will be all the more necessary. The Northeast

United States, for example, has seen relatively less investment due to various constraints but is in desperate need of additional infrastructure. Market mechanisms to facilitate the new beneficiaries from natural gas, such as power generators or electric utilities, to support natural gas infrastructure development and to recover a return on these investments remain nascent.

The market is relying heavily on growing gas demand for electric generation and demand from emerging markets to finally give the industry some reprieve from its current price slump. But, what if forecasts are wrong? Strategic planning that incorporates a robust spectrum of scenarios is critical given the uncertainty in the magnitude and timing of pricing changes.

The organizations that find efficiencies and invest in innovation now will be in the best position to not just ride out the slump but also make significant returns when natural gas prices rebound. How the industry participants take cautious but strategic steps could impact their survival and future for years to come.

MANAGING THE LOW PRICE MARKET

Market Conditions Forge New Focus on Diversification, Production Reliability

By Michael Goff
and Eddy Karmana

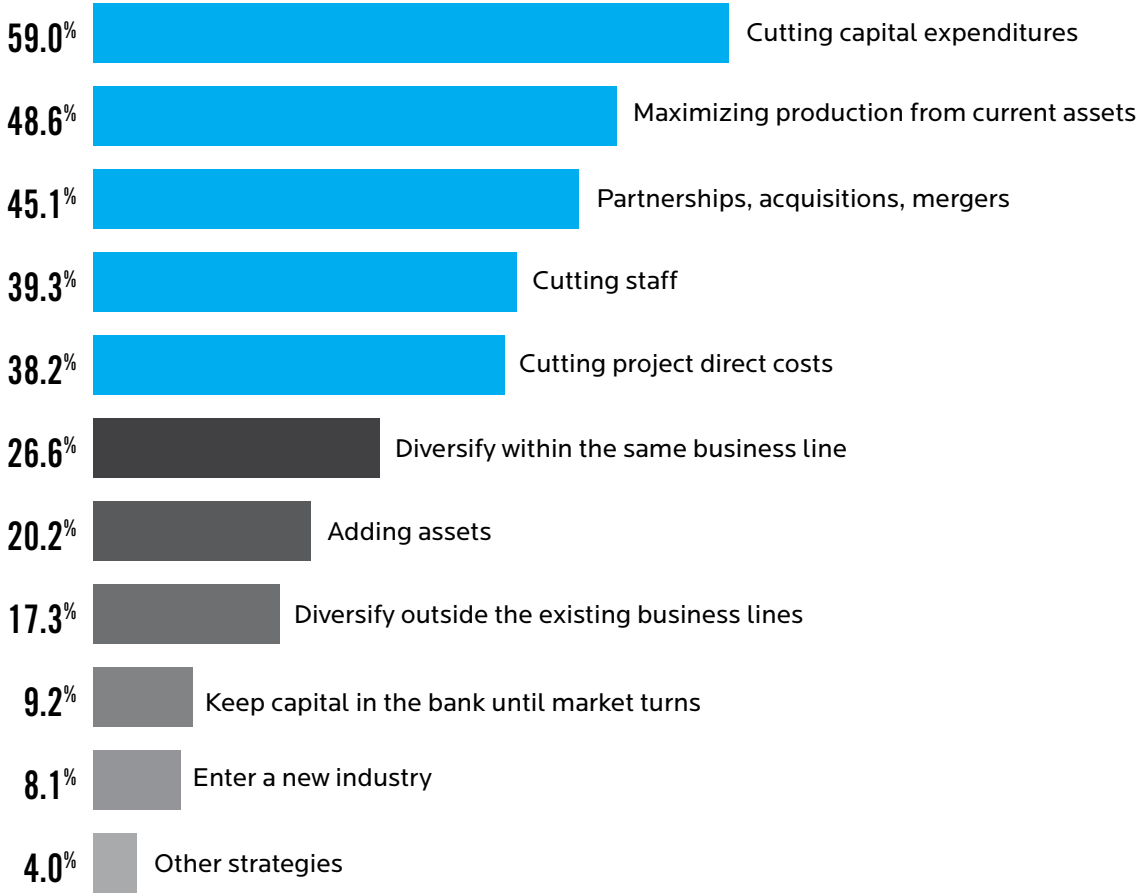
Diversification through mergers and acquisitions (M&A), as well as physical expansion into downstream markets such as natural gas conversion products, have emerged as tactics helping upstream and midstream organizations through the current price-challenged environment. Others, hoping to take advantage of expanding production capacity, are looking inward and rewriting capital investment plans, redirecting focus to efficiency and reliability to produce as much revenue as possible from a supply-heavy market.

Historically low crude oil prices and the subsequent oversupply of natural gas means that the heightened reliance on natural gas as a power generation source – often at the expense of coal – isn't expected to abate any time soon. These market pressures are forcing new focus on strategies for maintaining stable earnings and dividend growth as evidenced by respondents to this year's Black & Veatch *Strategic Directions: Natural Gas Industry Report* survey (Figure 5).

Historically low crude oil prices and the subsequent oversupply of natural gas means that the heightened reliance on natural gas as a power generation source – often at the expense of coal – isn't expected to abate any time soon.

Figure 5

What is your organization's current strategy to maintain stable earnings considering the current market situation while anticipating future oil price rebound? (Select all that apply.)



Source: Black & Veatch

Some of the strategies include:

Focus on efficiency and asset maintenance. Many organizations are understandably slowing their large capital expenditures and instead investing resources in reliability and maximizing efficiencies through operations and maintenance – a sort of asset-preservation safe harbor as producers await an upward market swing. Producers are also cutting back the scale and scope of projects that were underway before prices tumbled. Many companies are also investing in electrical maintenance and upgrades, replacing older, unreliable and inefficient equipment.

Organizational diversification. The *2016 Strategic Directions: Natural Gas Industry Report* comes as large pipeline operators are exploring how to gain footholds in crucial supply-heavy and supply-dependent markets. One example is the recently announced plan by Canada-based Enbridge Inc. to buy U.S.-based Spectra, a play aimed at, among other objectives, giving Enbridge access to critical North American East Coast markets.

A more subtle approach to M&A could prove beneficial in a down market. Considerations to augment capabilities with organizations that stretch beyond the acquiring firm's core competencies carry significant risks that are amplified when margins are as low as the current natural gas market supports. Considering adjacent sectors that complement fundamental strengths can deliver both the necessary diversification and expertise to handle new market territory.

Indonesia's Medco Energy made such a move in 2016, when it announced it had purchased a stake in the parent company of Newmont Mining. Though both deliver vastly different commodities – Medco, oil and gas; Newmont, minerals – the companies' shared exploration heritage and core competencies translate well and should help both organizations weather some of the tumultuous conditions facing both sectors.

Other opportunities for diversification are mini liquefied natural gas (LNG) or gas-to-liquids (GTL) projects. For instance, gas wells located significant distances from major gas pipelines can't support a large facility because of pricing challenges and infrastructure limitations, but could support a mini LNG or small-scale GTL facility. For such locations, smaller, more flexible LNG facilities – producing 5 to 20 million standard cubic feet per day as opposed to large plants – may be more economically viable.

Despite broad international trends toward retrenched capital investment plans, key emerging markets continue to build up LNG assets as part of larger goals to deliver reliable electricity to growing populations. India is planning to build two additional LNG terminals, while Indonesia pursues small-scale LNG terminals to provide fuel to power plants.

Diversification through conversion. The low price of natural gas has increased production of fertilizer, ammonia and methanol (Figure 6). In addition to the significant supply of methanol and ammonia that has come online since 2014, more supply is expected to begin production by the end of 2017. In China alone, methanol production has roughly doubled in recent years, contributing to a boom in global supply.

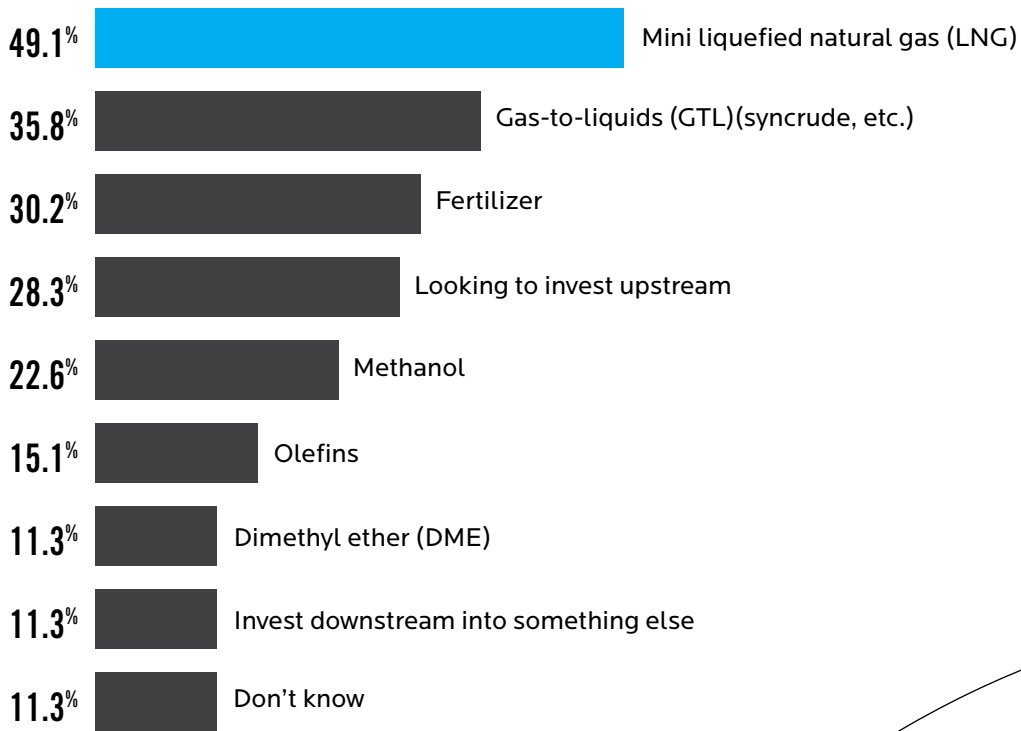
HEDGING AGAINST A TOUGH MARKET

While a few players are maximizing production to compensate for the reduced unit price of gas, for the most part global producers are doing little or nothing to expand capacity at the time. Instead there is an enduring focus on mechanical efficiency and reliability, and organizational and product diversification.

These approaches align well with the oil and gas industry's natural conservative tendencies and have strong merit. It is encouraging to see companies explore diversification models, particularly M&A activity, as a hedge against low prices cutting into the margins of their core business.

Figure 6

If you were to diversify your business into a downstream/petrochemical production facility, what three products or markets would be most attractive to your organization? (Select top three choices.)



Source: Black & Veatch

MANAGING THE LOW PRICE MARKET

Convergence with the Electric Market

By Judith McArdle, Lynn
Allen and Denny Yeung

As convergence between the electric and natural gas markets in North America grows, competition for gas supplies will continue to increase. Ensuring reliability will require access to sufficient pipeline infrastructure to meet competing demands for gas. However, the current operational challenges that have caused supply interruptions between the gas and power markets go beyond just physical infrastructure constraints. Careful collaboration and coordination between these markets will require detailed planning and analysis.

INCREASING PIPELINE CAPACITY

Extreme weather events, particularly in the Northeast region of the United States, have highlighted the need for more natural gas pipeline capacity to support power generation demand. As natural gas technology becomes a larger component of the electricity generation market, other gas consumers will likely also need to build out new infrastructure as demand increases.

To serve emerging demand, survey respondents indicated that interstate pipeline laterals and interstate pipeline mainline expansions should be top priorities. However, with additional infrastructure needs, investment must follow to fund these projects. With so many market participants exploring opportunities to serve new power generation demand, the question arises about who should bear the cost. More than 65 percent of respondents concluded that perhaps the costs should fall on electric consumers. While this sentiment has remained steady over the past several years, there has also been a growing trend in respondents who think regional transmission organizations (RTOs) and independent system operators (ISOs) should help absorb these costs – rising from 22 percent in 2014 to 33 percent in 2016 (Figure 7).

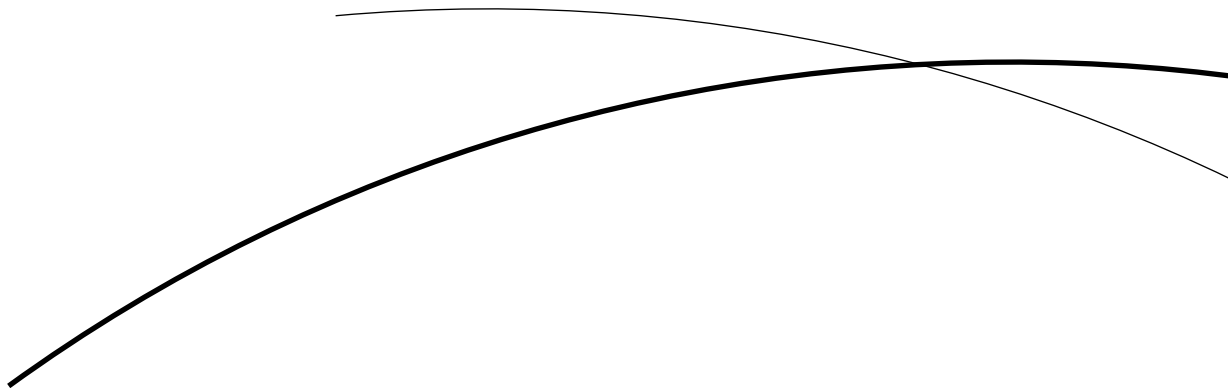
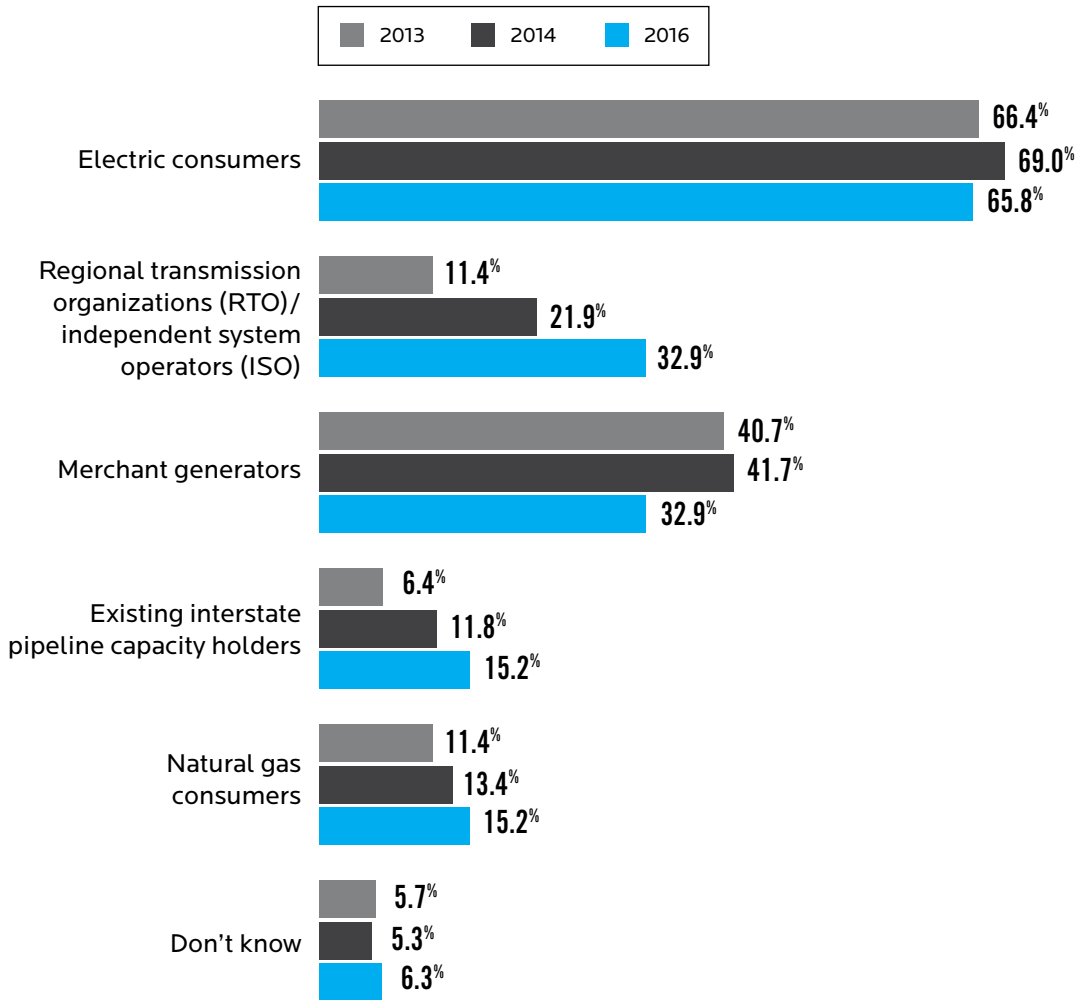


Figure 7

If additional natural gas infrastructure is needed to serve the growth in power generation demand, who should bear the costs? (Select all that apply.)



Source: Black & Veatch

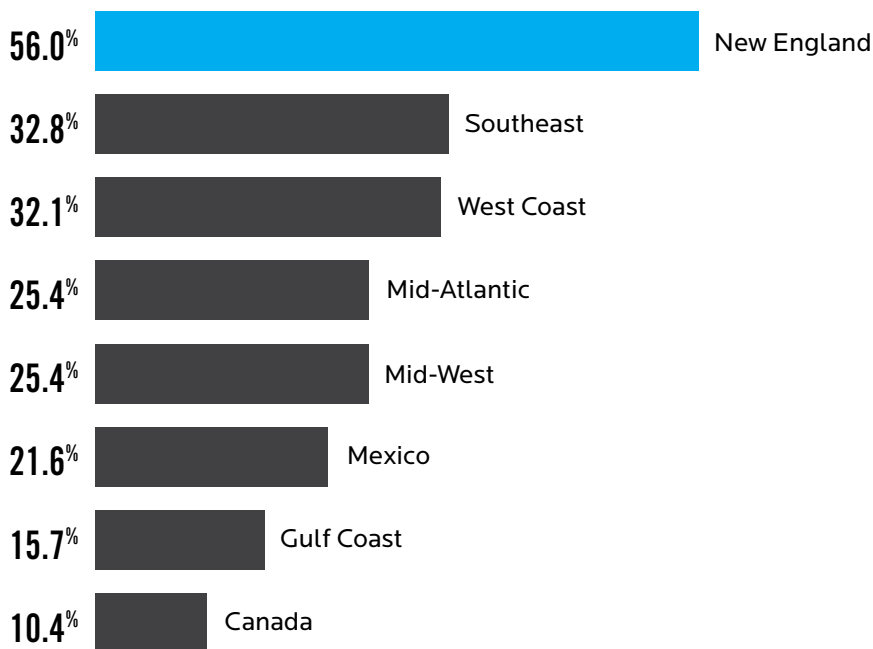
In August 2016, a decision by the Massachusetts' Supreme Judicial Court concerning the State's Department of Public Utilities' ability to approve gas pipeline capacity contracts may have temporarily delayed development progress in New England. Despite efforts to tie pipeline expansion funding to the benefits received by electric utility customers, the ruling prevented local utilities from charging these customers. Yet broadly, new incremental pipeline in this market will play an integral

role in serving power generation over the next five years, as reflected by 56 percent of North American survey respondents (Figure 8).

Nearly half of respondents also indicated that federal or state regulatory commission policies to establish new funding or cost mechanisms should be implemented to facilitate development of natural gas infrastructure (Figure 9).

Figure 8

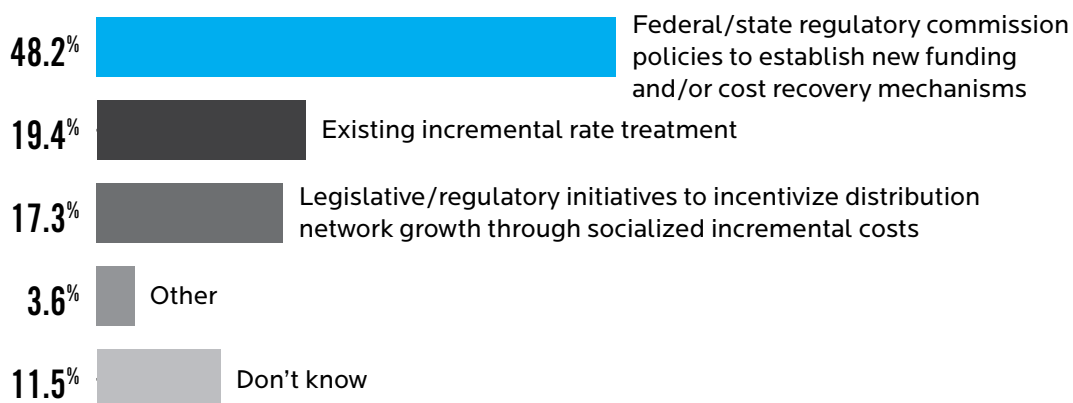
Which of the following North American markets will be in need of incremental natural gas pipeline capacity to serve power generation over the next 5 years? (Select all that apply.) [North American Respondents Only]



Source: Black & Veatch

Figure 9

Which of the following do you consider as the optimal strategy to facilitate incremental natural gas pipeline infrastructure? (Select one choice.)



Source: Black & Veatch

MANAGING THE GAS/POWER MARKET SYNCHRONIZATION DISCONNECT

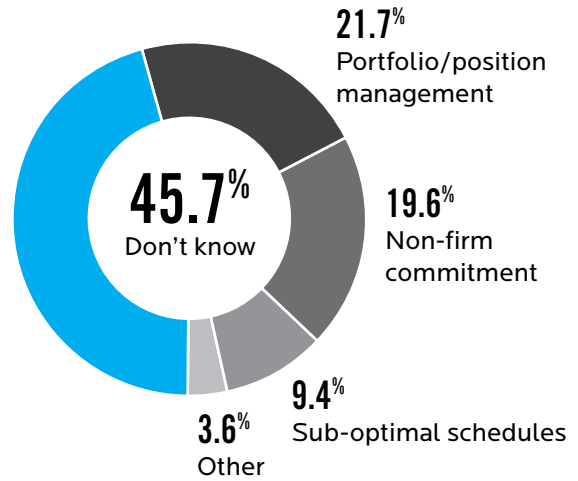
The gas/power market disconnect is becoming an increasingly complex issue, creating potential reliability risks for North American power grids. Coordination between the electric and gas industries is critical, yet nearly half of survey respondents still do not know how best to manage this issue or could be unaware this issue exists (Figure 10). Within the market framework, the appropriate scheduling resources must be allocated to enable planning for the increased use of natural gas to generate electricity.

Scheduling power with ISOs and RTOs takes careful planning and coordination. Planning should take into account incremental rate treatment recommendations, transmission distribution, power generation services and the increased use of renewable energy sources.

Better synchronization between the natural gas and electric markets could lead to more market transparency and enhanced reliability. During periods when gas supply and/or pipeline capacity is limited, wholesale market prices typically rise, leading to higher retail electric prices for regional consumers. Collective collaboration can help mitigate potential outages and supply interruptions.

It is imperative that these industries coordinate energy planning to ensure reliability and meet forecasted demand growth. Regulations, customer demand and pipeline infrastructure will play important roles in how these markets integrate but strategic planning should start now to ensure adequate gas pipeline capacity and access to low-cost gas supplies. Alternative financing and cost recovery mechanisms can help bolster these large capital investments, but careful consideration should be made regarding which types of pipeline expansions should be made to serve various seasonal load shapes.

Figure 10
How is your organization managing the gas/power market synchronization disconnect? (Select one choice.)



Source: Black & Veatch

TECHNOLOGY BRINGS OPPORTUNITIES AND CHALLENGES

Advanced Metering Provides Efficiencies for Utilities

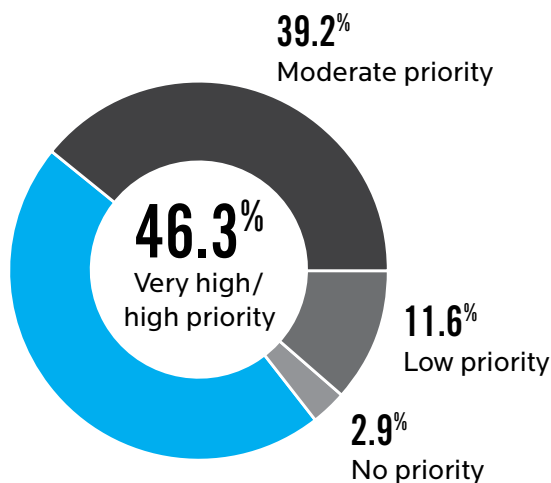
By Jeremy Klingel and Jeff Buxton

Natural gas utilities have historically enjoyed a simple and predictable relationship with their customers. The strategy to ensure positive, stable ratings is based on two easily articulated goals: deliver timely, informative and accurate bills and avoid high-profile infrastructure failures.

In other words, keeping your head down and focusing on consistent delivery with few billing surprises has long been a winning formula. The more a gas utility is unobtrusive, some even to the point of invisibility, the happier customers typically are.

That makes it remarkable and encouraging that gas utilities are nonetheless keenly aware of the growing importance of improving the experience for an increasingly discerning customer population. In the *2016 Strategic Directions: Natural Gas Industry Report* survey, more than 45 percent of utilities responded that they place a high or very high priority on improving customer experience and satisfaction with new technologies. Only 15 percent ranked experience and satisfaction as a low or non-priority (Figure 11).

Figure 11
What priority does your organization place on investing in new technologies that utilize real-time data to improve customer experience and customer satisfaction? (Select one choice.)



Source: Black & Veatch

IS METHANE *SNEAKING PAST YOU?*

Many have already upgraded to one-way fixed network AMI:

- Restored customer confidence
- Advance meter-to-cash operational efficiencies
- Leak and corrosion detection
- Increased equipment efficiency
- Operational disruption prevention

Advanced metering can help.

AMR TO AMI – UTILITIES BENEFIT FROM TECHNOLOGICAL ADVANCES

Advanced metering infrastructure (AMI) can be an ideal investment for utilities looking to achieve both traditional and modern customer experience-driven objectives. Although its predecessor technologies, such as automatic meter reading (AMR), offer some overlapping benefits, AMI architectures deliver more comprehensive, up-to-date billing that reflects detailed actual usage. AMI also allows utilities to better monitor and maintain assets and infrastructure.

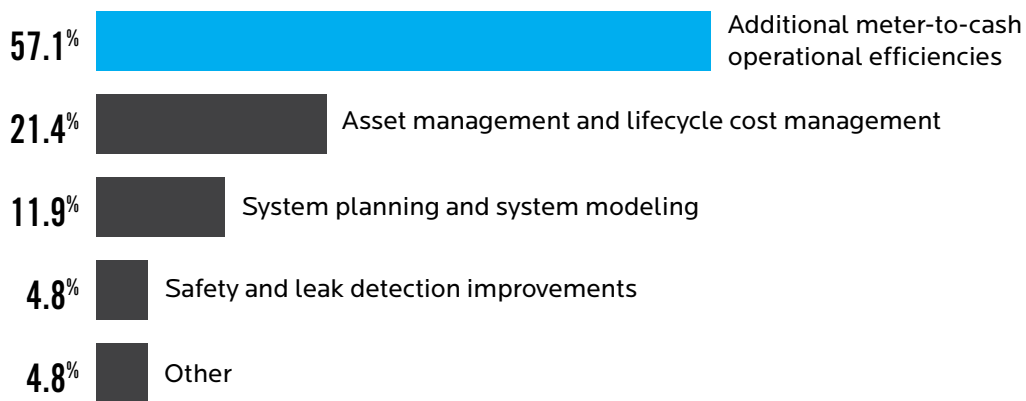
The survey revealed that 35 percent of natural gas utilities have already upgraded to AMI, and another quarter of the utilities are considering upgrading from AMR to the newer technology. Gas utilities that are considering or have already adopted AMI overwhelmingly cited meter-to-cash opportunities as their most compelling advantage (57 percent) (Figure 12).

Early adopters of one-way AMR enjoyed significant advantages in meter reading – cutting incremental costs and reducing the need for estimated billing. AMI reduces additional cost and time from the meter-to-cash process and includes the added feature of remote disconnect, which is only in the early stages of adoption by utilities.

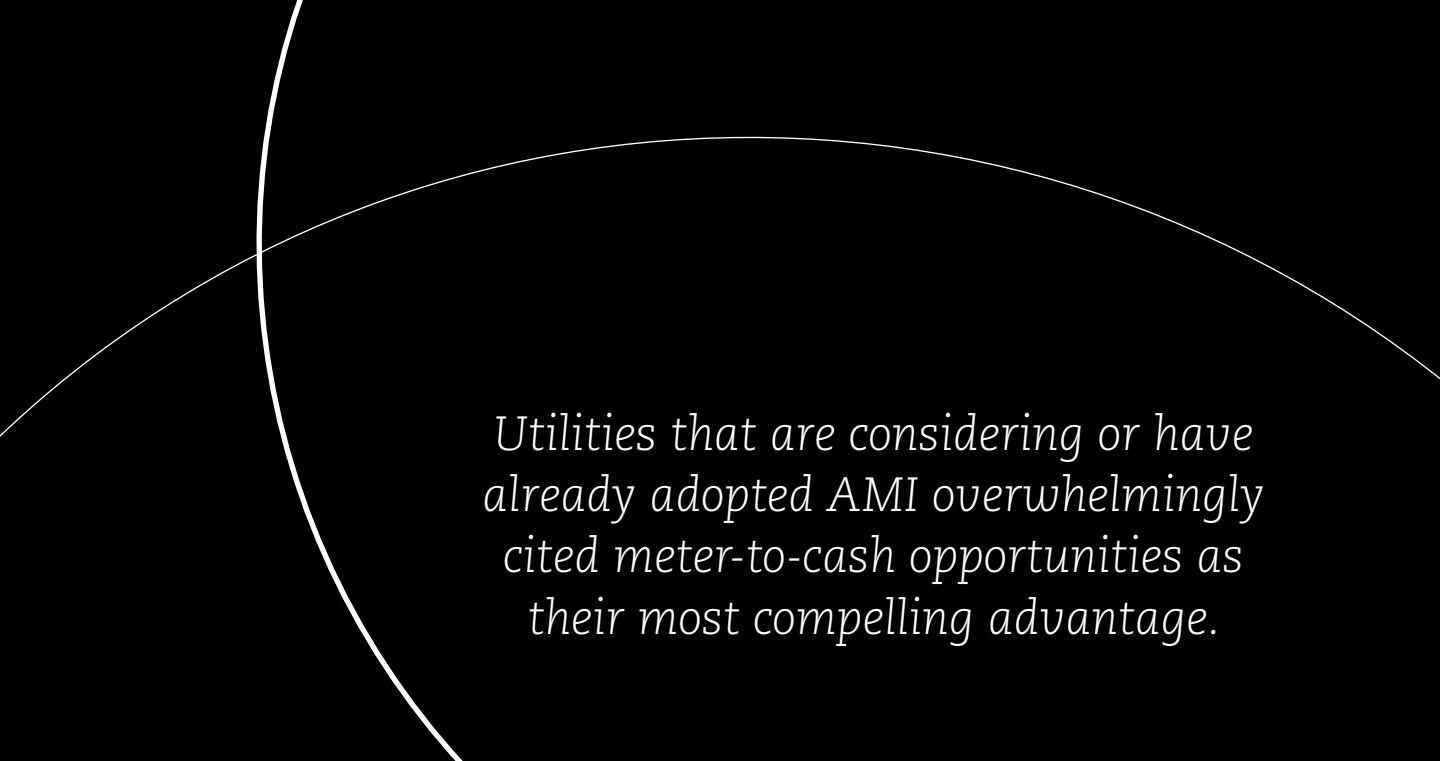
Although remote “reconnect” is not feasible due to safety considerations, remote disconnect takes fleet labor and costs out of the end stage, but because disconnect is less common, the associated cost savings are more subtle. While the meter-to-cash benefit should not be discounted, natural gas utilities are just beginning to capitalize on the safety and asset management benefits from cathodic protection and methane detection, which could be more beneficial long-term. Opportunities also exist in asset management and lifecycle cost management, which only 21 percent cited as their primary motivation for AMR/AMI development or implementation.

Figure 12

What is the primary reason your organization is considering or has already upgraded to one-way or two-way fixed network AMI? (Select one choice.)



Source: Black & Veatch



Utilities that are considering or have already adopted AMI overwhelmingly cited meter-to-cash opportunities as their most compelling advantage.

INTELLIGENCE-BASED DECISION-MAKING

In 2016, regulators demonstrated that they have prioritized methane detection and are making concerted efforts to clamp down on emissions throughout the delivery chain. High-profile natural gas storage leaks put the challenges of methane control in the public eye and raised concern within customer communities. Fully realized AMI can utilize integrated methane sensors that provide near real-time communication and notification should an issue arise. These sensor systems can substantially increase chances for early detection and potential remediation of natural gas leaks that may otherwise go undetected.

Cathodic protection sensors can also provide a more reliable framework for predictive maintenance, identifying likely sources of impending corrosion and loss before an actual incident occurs. Maximizing the life span of equipment in the field without compromising safety provides a significant asset management advantage that in most cases also leads to long-term cost savings.

KEEPING DISTRIBUTION SYSTEMS IN PROPER WORKING ORDER

To put the case another way – AMR alone already solves many low-hanging, high-cost meter-to-cash challenges. Utilities should look at AMI not simply as another way to further improve the meter-to-cash process but to obtain real-time insights and analysis on the entire distribution network, which can reveal significant, costly flaws.

Tamper detection was listed as the top factor for considering AMI implementation, which demonstrates an understandable focus on protecting the integrity of the meter-to-cash process by providing accurate and timely billing for actual usage. Utilities can capitalize on opportunities to improve visibility, reliability and cost structures by seeing more opportunity in data analytics as well as corrosion and leak detection.

The technical aspects of leak detection and cathodic monitoring are more difficult to explain to the end customer, but the overall goals of increased safety, reduced waste and lower costs are easy to communicate. Regulators, in turn, want to see a balanced commitment to safety. The detailed data available through AMI architecture powers insights that help serve these top priorities.

TECHNOLOGY BRINGS OPPORTUNITIES AND CHALLENGES

Market Forces Raise Stakes for Efficient Project Delivery

By John George
and Dave Hile

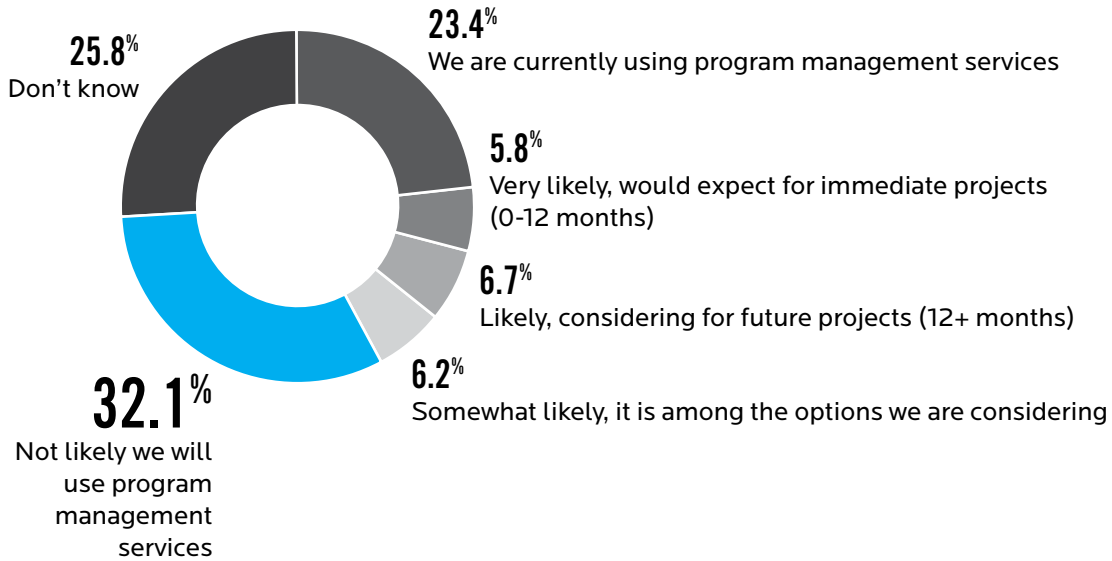
Financial pressures are forcing many organizations across the oil and gas industry to seek new efficiencies or reconsider capital expenditures. One potential strategy to drive cost savings lies in the use of program and construction management services, which can help organizations sustain key projects, rather than retrench, while still performing on budget and schedule.

Too often, highly complex capital projects are undertaken by ownership groups that lack the in-house skill or staff resources necessary to closely monitor all details, especially for large-scale endeavors. But it is these details that often are the differences that make or break projects. In today's environment, the delivery of complex capital programs often requires collaboration, efficiency, transparency and accountability – often in an integrated setting with multiple stakeholders.



Figure 13

What is the likelihood that your organization would consider using program management (including program management office, program management training or program management consulting services)? (Select one choice.)



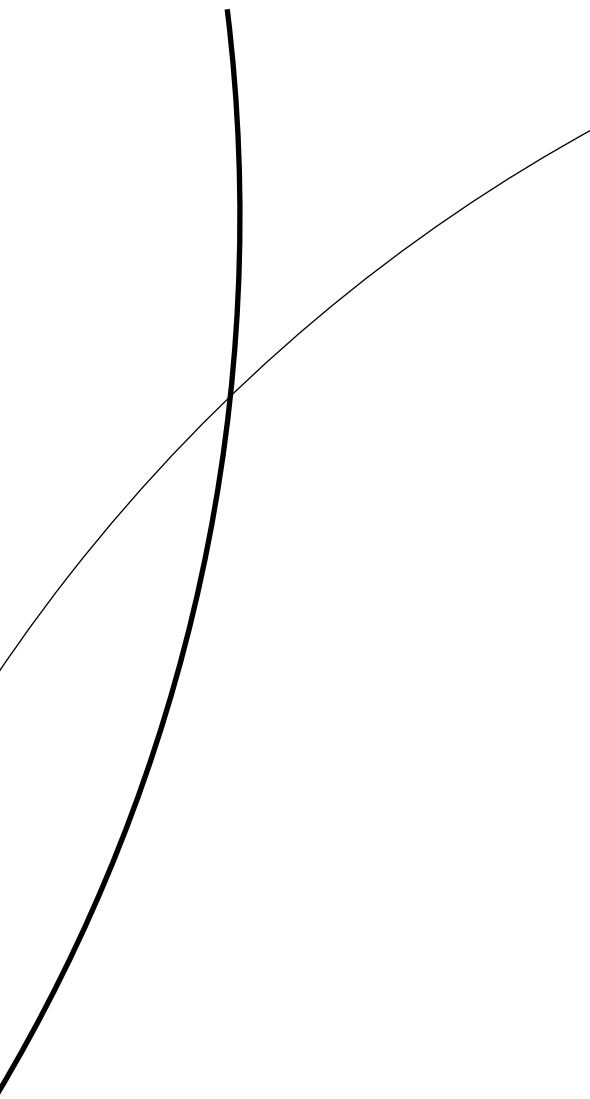
Source: Black & Veatch

In the hands of experienced program and construction management teams, projects are delivered in a repeatable, standardized and consistent manner across the entire program lifecycle. More than 40 percent of respondents to Black & Veatch's *2016 Strategic Directions: Natural Gas Industry Report* survey indicated varying degrees of willingness to consider program management to achieve these aims (Figure 13). Nearly a quarter of respondents were already employing program management services, while about 20 percent said they were at least somewhat likely, likely or very likely to consider or use program management to bring a project online.

Market conditions, along with increasingly sophisticated technologies and complex projects, are forcing tighter schedules – and stricter budgets – on capital spending programs. Successful program management models resolve these issues by accounting for estimating, modeling and planning and controlling risk, resources and schedules.

Not all organizations with sizable capital plans are ready to bring their projects online without external support and expertise. Today's changing workforce environment may create additional hurdles in project execution. Increased retirements, energized by improving economic conditions, are expected to exacerbate the industry's perceived shortage of technical workers needed to plan, manage and execute large-scale projects.

The benefits of outside program management services can be numerous, but perhaps no outcomes are as primary to organizations as cost savings and predictability.



Although it ranked No. 10 among industry issues in 2016, 75 percent of natural gas industry respondents considered the aging workforce to be an important or very important concern – an increase of 10 percent since 2012 (Table 4). It suggests some companies may eventually lack the resources, from a staffing and expertise perspective, to see complex projects to completion.

The benefits of outside program management services can be numerous, but perhaps no outcomes are as primary to organizations as cost savings and predictability. These two factors were the top drivers for seeking program management services among survey respondents, followed by schedule certainty, risk and change management and the prospects for higher overall quality project outcomes (Figure 14). The responses are not surprising, as project managers understand that without proper oversight, project expenses can frequently balloon to two times or more of the initial budget cost before production begins.

Change management cannot be underestimated in a program management approach. Project costs that rise well beyond initial estimates and agreements can often be tied to change orders or other decisions that extend a project past its initial aims. Black & Veatch professionals recently advised a Midwestern client on a major project, in part, by framing the project budget as a bank account that carried strict controls on how withdrawals were made and how the money was spent.

Often, program managers who can act as objective stewards of a project's assets, resources and finances can take a big-picture approach and account for issues or obstacles that a client's internal management team cannot see because of separate demands on their time and attention. A program manager's independent advocacy – steeped in the cost and scheduling objectives laid out in the project's initial phases – can pay off substantially for clients eager to wring as much revenue as possible from a price-restrictive market.

Table 4

On a 5-point scale, where a rating of 5 means “Very Important” and 1 means “Not Important at All,” please rate the importance of each of the following long-term issues to the natural gas industry. (Select one choice per row.)

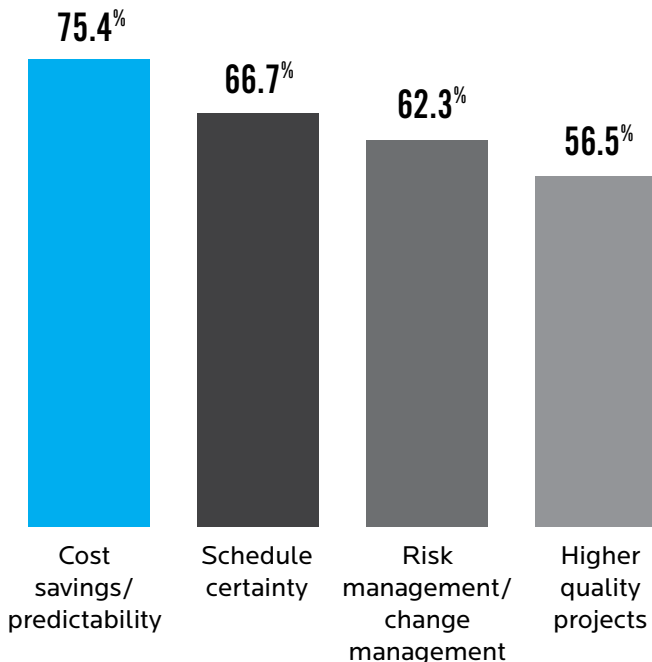
Natural Gas Industry Issues	Percentage of “Very Important” and “Important” Ratings Among the Natural Gas Industry by Year				
	2012	2013	2014	2015	2016
Safety	91.6%	94.0%	92.8%	84.4%	93.5%
Gas supply reliability	85.5%	85.1%	88.4%	77.7%	87.0%
Economic/Demand growth	89.4%	89.9%	90.2%	85.6%	86.6%
Environmental regulation	65.9%	85.7%	87.0%	86.3%	85.3%
Aging infrastructure	78.4%	82.1%	82.8%	88.8%	85.0%
Rate and regulatory certainty	83.9%	91.1%	86.6%	77.2%	83.3%
Available pipeline capacity	Not Asked	Not Asked	Not Asked	84.9%	80.4%
Regulations (other than environmental)	Not Asked	Not Asked	Not Asked	Not Asked	79.8%
Gas price stability	79.7%	81.5%	79.4%	74.5%	78.2%
Aging workforce	65.0%	68.2%	70.7%	70.7%	75.2%
Physical security	Not Asked	79.5%	76.1%	59.8%	75.2%
Cybersecurity	Not Asked	79.2%	79.2%	66.7%	69.1%
Capital access and cost	84.6%	83.6%	83.0%	67.0%	69.0%
Electric-gas interdependency	75.6%	78.3%	73.2%	75.6%	68.6%
International market access	Not Asked	Not Asked	Not Asked	Not Asked	40.8%

■ The cells highlighted in blue indicate ratings that were notably higher or lower compared to the ratings of all the other groups combined.

Source: Black & Veatch

Figure 14

How will (or do) your customers benefit from project management services? (Select all that apply.)



Source: Black & Veatch

TECHNOLOGY BRINGS OPPORTUNITIES AND CHALLENGES

Cyber Threats Prompt Fresh Attention to System Security

By David Mayers

Results from the *2016 Strategic Directions: Natural Gas Industry Report* survey show that safety is the No. 1 concern for almost three-quarters of this year's respondents. This reflects a dramatic departure from merely 10 years ago when security, as a whole, barely ranked in our report's Top 10 issues ranking, and focused more on terrorism and natural disasters. With safety now playing so heavily on the industry's collective mind, in what forms are the threats and risks to safety?

Two such forms are gaining significant mindshare: physical security and cybersecurity. The physical risks are fairly obvious: someone breaks into a facility with the intention of causing damage and disrupting production. But, as the industry's bold steps toward efficiency and sustainability have increased its reliance on sophisticated technology, this evolution has naturally produced more entry points for mischief within networks.

HOW IS THE ENERGY SECTOR KEEPING HACKERS AT BAY?



10 YEARS AGO

*CYBERSECURITY AND PHYSICAL
SECURITY WAS HARDLY ON
the industry's radar.*

NOW

*cybersecurity
IS A MAJOR CONCERN AMONG
68 PERCENT OF RESPONDENTS.*

*Enterprise-wide policies and procedures
for all global locations can help mitigate risks.*

To keep a site physically safe it is necessary to keep it cyber safe, and vice versa.

That explains why cybersecurity is a growing concern; the survey revealed that for oil and gas executives and managers, cybersecurity is starting to register as something that needs to be addressed, with 68 percent of all respondents rating it as “important” or “very important.” How important it ranks is also dependent on the services provided within the industry (Table 5).

The energy sector is a frequent target for hackers, with 46 incidents within the sector reported to the U.S. Department of Homeland Security (DHS) by asset owners and industrial organizations in fiscal year 2015. This highlights concerns that the Internet of Things (IoT) is expanding the risks posed to both system safety and reliability as well as corporate intellectual property (IP) assets such as drilling and refining processes.

Those on the frontline of providing gas to utilities and to end consumers represent the subsectors of the industry that are the most concerned, and rightly so, as the impacts of a breach at their end of the value chain are going to be felt long before a similar event at the extraction and production stage. Physical safety and cyber safety are equally important and go hand in hand. Both production facilities and corporate offices are protected by cameras and security systems that are controlled by computers connected to networks that control all the elements of an organization’s activities. Computer systems are susceptible to hackers, and one way of trying to hack into a network more easily is to gain physical access to a site. To keep a site physically safe it is necessary to keep it cyber safe, and vice versa.

Table 5

On a 5-point scale, where a rating of 5 means “Very Important” and 1 means “Very Unimportant,” please rate the importance of each of the following long-term issues to the natural gas industry. (Select one choice per row.)

Natural Gas Industry Issues	“Very Important” and “Important” Ratings By Services Provided					All Respondents
	Oil Producers	Pipeline Operators	Local Distribution Companies	Electricity Generators	Oil & Gas Industry Providers	
Safety	91.1%	100.0%	100.0%	90.9%	88.1%	92.4%
Gas supply reliability	77.8%	97.1%	91.8%	93.2%	77.6%	85.8%
Economic/demand growth	93.3%	91.2%	91.8%	84.1%	83.3%	87.4%
Environmental regulation	82.2%	91.2%	81.2%	90.9%	80.6%	85.8%
Aging infrastructure	80.0%	88.2%	92.9%	86.0%	86.6%	83.9%
Rate and regulatory certainty	75.6%	88.2%	91.7%	95.5%	71.6%	81.8%
Available pipeline capacity	66.7%	91.2%	85.9%	84.1%	76.1%	78.6%
Regulations (other than environmental)	75.6%	85.3%	90.6%	81.8%	71.6%	79.7%
Gas price stability	81.8%	61.8%	84.7%	84.1%	76.1%	78.7%
Aging workforce	75.6%	79.4%	88.2%	65.9%	77.6%	76.5%
Physical security	75.6%	88.2%	84.5%	84.1%	61.2%	74.8%
Cybersecurity	62.2%	91.2%	81.9%	79.5%	54.5%	68.1%
Capital access and cost	72.7%	85.3%	59.0%	65.1%	59.7%	70.5%
Electric-gas interdependency	64.4%	79.4%	53.6%	90.9%	68.7%	68.8%
International market access	86.7%	41.2%	7.5%	24.4%	68.7%	49.2%

■ The cells highlighted in blue indicate ratings that were notably higher or lower compared to the ratings of all the other groups combined.

Source: Black & Veatch

If natural gas is to fulfill the role of helping the global energy generation industry improve sustainability, Black & Veatch expects security issues will continue to gain the attention of industry leaders in order to keep pipeline and production systems safe.

With this in mind, it is important to consider what steps are being taken to address these increased cyber risks, which bring with them increased physical safety risks. Many organizations have enterprise-wide policies and procedures that are rolled out and well-established in all locations they operate in around the world. While these procedures may be implemented differently in the United States than in Asia, for example, they will have the same risk management outcomes and have a manager dedicated to ensuring that regulations are adhered to.

For years this approach was enough to mitigate most risks, but as cybersecurity risks have grown, as have the need for more resources dedicated to managing them. Many organizations (50 percent) are now creating centralized security operations centers that control cyber safety for all of their global locations. An integral part of creating these centralized security facilities is a systems architecture that can holistically manage the policies for all locations.

With 7 percent of organizations outsourcing this element of safety management, a new layer of risk is added. In these cases, a strong due diligence process must be completed to ensure that all parties are aware of

acceptable levels of risk and how they must be managed. It is also becoming apparent that in order to focus efforts on security, industry participants are increasingly hiring professionals that have experience beyond traditional IT backgrounds who can work with operational technology systems, such as supervisory control and data acquisition (SCADA).

A recent report from the World Energy Council, *Deciding the Future: Energy Policy Scenarios to 2050*, identifies natural gas as having an increasingly important role in cutting power generation's greenhouse gas emissions from 2020 onward. This ties in with the industry's outlook for the future growth of the natural gas industry, which many are viewing with optimism, as indicated throughout this Black & Veatch report.

If natural gas is to fulfill the role of helping the global energy generation industry improve sustainability, Black & Veatch expects security issues – chiefly the role of cybersecurity for increasingly connected infrastructure – will continue to gain the attention of industry leaders in order to keep pipeline and production systems safe.



50.3%

*Planning to manage cybersecurity
across multiple facilities, centralized
operations center staffed with
their employees*

REGULATIONS SHAPING OPERATIONS AND PLANNING

Emissions Reduction Goals Carry New Implications for Compliance

By Andy Byers,
Russell Feingold
and H. Edwin Overcast

The Environmental Protection Agency's (EPA's) recent release of its final rules aimed at reducing methane emissions as part of the Clean Air Act and Clean Power Plan has created specific regulations that will transform the U.S. natural gas sector.

Included in the regulations are specific rules for shale gas producers to follow as well as regulatory and ratemaking activities for the downstream market. In addition, new activities focused on the integration of distributed energy resources (DERs) to electricity markets, as well as the corresponding new services and pricing, will undoubtedly have an impact on natural gas distribution utilities.

To position themselves for this evolving market, industry players will likely need to tweak operations and maintenance plans to comply with the maze of current and upcoming regulations. How these regulations affect the gas industry in the near- and long-term and how the industry adjusts to comply, remain areas to watch.

International goals and policies to address climate change are adding significant pressure and influence to fuel markets. Combined with market and regulatory forces, natural gas is experiencing a worldwide surge in both production and consumption. Last year, natural gas-fired power generation in the United States increased 19 percent and is forecasted to exceed coal generation on an annual basis by the end of this year. But as growth in natural gas generation continues to surpass coal, so will its energy-associated carbon dioxide (CO₂) and methane greenhouse gas emissions; these emissions are drawing increasing attention from environmental interest groups and regulatory agencies (Figure 15).

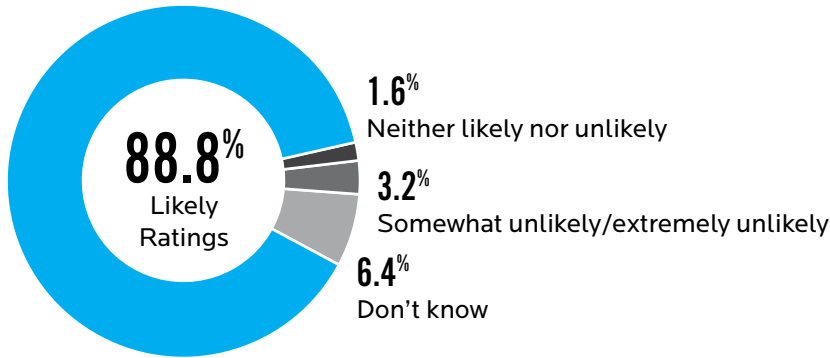
The conflicting sentiments this creates for the natural gas industry are reflected in the survey responses. While the boom in gas consumption in the power and industrial sectors is being at least partially driven by climate change and regulatory concerns, these same concerns are drawing attention to greenhouse gas emissions across the entire spectrum of natural gas systems (Figure 16). In line with initiatives on the international level, such as the United Nations Climate Change Agreement reached in Paris in late 2015 and the more recent clean energy and climate collaboration announcement by Canada, the United States and Mexico are bolstering CO₂ and methane reduction initiatives. The EPA is already regulating methane emissions from new sources in the oil and gas industry and soon will be applying reduction requirements to existing infrastructure in the sector.

While this may impose more requirements on production, processing and pipeline activities, it also serves to drive market expansion. Similarly, market opportunities for liquefied natural gas (LNG) as a cleaner fuel alternative

are even spreading into such new areas as heavy transportation, while at the same time its global export is being scrutinized for propagating increased greenhouse gas emissions from fossil fuel access and utilization.

Figure 15

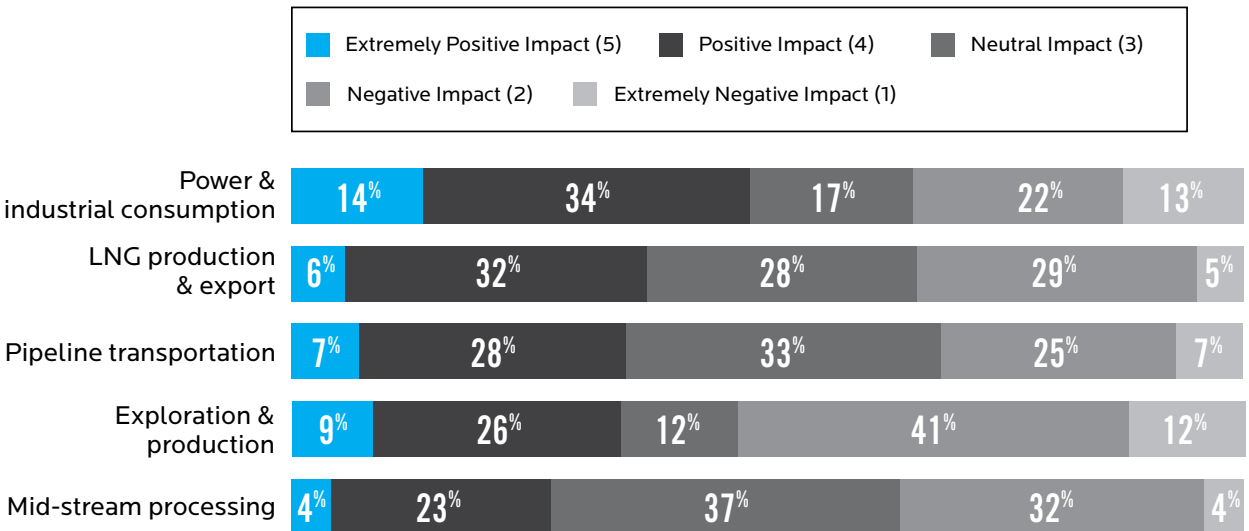
How likely is it that the EPA or other Government Agency will regulate methane emissions from existing sources in the oil and gas sector? (Select one choice.)



Source: Black & Veatch

Figure 16

What type of overall, long-term economic impact will global climate change and environmental programs have on the following aspects of the natural gas industry? (Select one choice per row.)



Source: Black & Veatch

Market participants across a wide range of applications are expressing a clear preference for natural gas as a primary fuel source, including electric generation, combined heat and power, natural gas vehicles and LNG for truck transportation.

DISTRIBUTED ENERGY RESOURCES BRINGS NEW PURSUIT OF REGULATORY ACTIVITIES

At the same time, the environmental benefits of DERs are being recognized by state utility regulators across the United States through their pursuit of transformational regulatory activities related to the integration of these energy resources in the electric utility grid. These activities are also having a meaningful impact on the natural gas distribution utility industry in a number of visible ways.

Survey respondents clearly indicated that these types of regulatory mandates are creating opportunities to provide natural gas as a fuel source to new market participants. Market participants across a wide range of applications are expressing a clear preference for natural gas as a primary fuel source, including electric generation, combined heat and power, natural gas vehicles and LNG for truck transportation. In addition, the variability of DERs such as solar power and wind power can significantly impact the electric grid. An increasing penetration of renewables such as wind and solar actually requires an increase in the amount of natural gas-fired backup to be able to accommodate the faster up and down ramping requirements of electric generation caused by DERs. These fuel source applications all provide incremental load opportunities for natural gas distribution utilities (Figure 17).

As regulatory conditions evolve in response to environmental concerns, utility regulators are also beginning to mandate the adoption of new regulatory models to ensure electric utilities will properly integrate DERs into their grid operations. These models will establish new service offerings and revenue streams for electric utilities to address the needs of the DER market and to serve as an offset to the expected decline in utility revenues as DER providers invest in generation and grid infrastructure rather than the utilities.

More broadly, some utility regulators are considering the adoption of performance-based regulation (PBR) to replace traditional cost of service regulation. Under this model, the utility's revenues would not be based on

the total costs of providing utility service. PBR instead provides a utility with a stronger incentive to control costs, and the resulting prices charged to its customers, than under traditional cost of service regulation.

PBR plans fundamentally change the rate-setting process from a singular focus on cost recovery to one focused on financial and operational incentives. As such, the utility has a strong motivation to better manage costs because it can retain some level of financial benefits associated with improving the efficiency of its operations and because it has a reduced ability to pass on cost increases typically allowed under cost of service regulation.

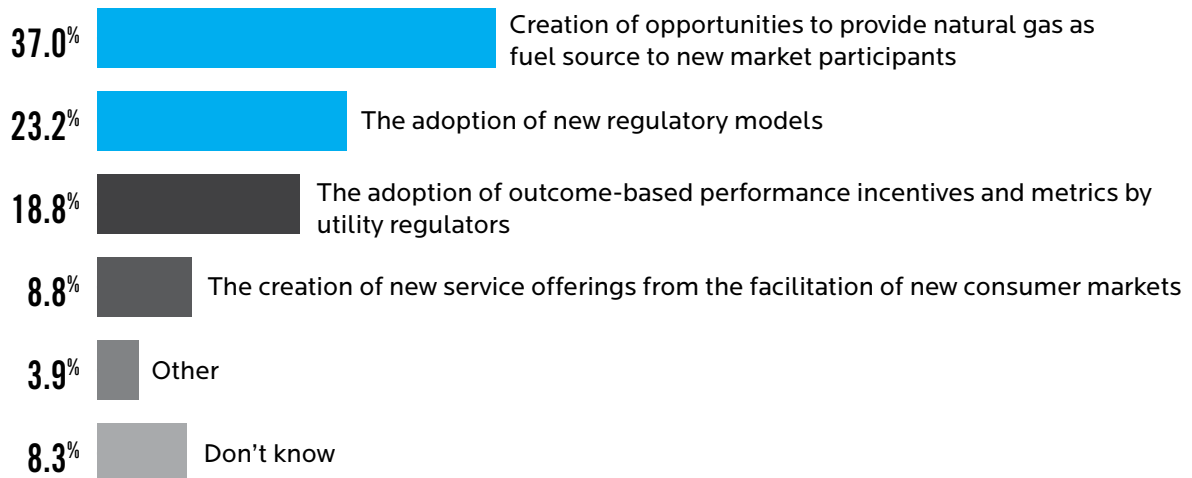
While, initially, such regulatory models will be applied to electric utilities to address the impact DERs are having on the electric utility business, it is expected that over time these regulatory models will also be considered for adoption by natural gas distribution utilities because the conceptual underpinnings of PBR are equally applicable to electric and natural gas distribution utilities.

Finally, survey respondents expect that utility regulators will adopt outcome-based performance incentives and metrics (e.g., reliability, safety, customer service and billing, call center operations) in conjunction with the types of regulatory initiatives just discussed. Under PBR plans or other types of rate stabilization mechanisms (used under traditional cost of service regulation), the outcomes achieved by utilities will be the standard by which their performance will be judged rather than the focus on cost recovery.

As long as the outcomes are structured to meet the needs of the energy marketplace, utility management should be given greater latitude to decide the right levels of investment and specific business activities to best align the interests of its shareholders and customers. Once again, it is expected that as regulators adopt PBR plans for electric utilities, eventually these regulatory concepts will also be applied to natural gas distribution utilities.

Figure 17

Which one of the following activities will have the greatest impact on the natural gas distribution utility industry over the next five years? (Select one choice.)



Source: Black & Veatch

REGULATIONS SHAPING OPERATIONS AND PLANNING

Expanding Federal Oversight on Horizon for Gas Storage Operators

By James Gooding

Underground natural gas storage operators are facing historic regulatory challenges as the federal government expands its oversight for the more than 400 active storage facilities in the United States. These operations represent a combined capacity of 4.8 trillion cubic feet of marketable gas. As an energy equivalent, this would meet the gas needs of all U.S. residential customers for a year, including winter heating.

Historically, federal oversight of underground gas storage has focused on initial environmental impact reviews and on ensuring that the storage operations do not wield excessive market power or create inequitable financial impacts on gas ratepayers. Day-to-day operations and maintenance reviews of gas storage facilities have more often been the purview of state agencies. However, in 2016, there was a major regulatory shift when the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) was granted oversight authority for these gas storage operations following highly publicized gas leak incidents, particularly the 2015 leak at the Aliso Canyon storage facility in California.

Several key risk factors drive the increasing federal role for underground gas storage regulation. Many storage operations are aging, with facilities in excess of 30 years or more. This can result in potential equipment corrosion and mechanical degradation of casings and wellheads, critical components in maintaining system integrity. In addition, when most underground gas storage facilities were constructed they were located in remote areas. Over time, population growth has resulted in the development of communities in close proximity to facilities, which creates additional risks if gas leak incidents occur.

The motivation for new federal oversight of underground gas operations is also partly the result of the U.S. EPA's proposed new rules for greenhouse gas emissions. Methane, a primary constituent of natural gas, is considered by the EPA to be a greenhouse gas 25 times more potent than carbon dioxide. In March 2016, the EPA announced that it planned to expand regulations to existing wells, including those used in gas storage.

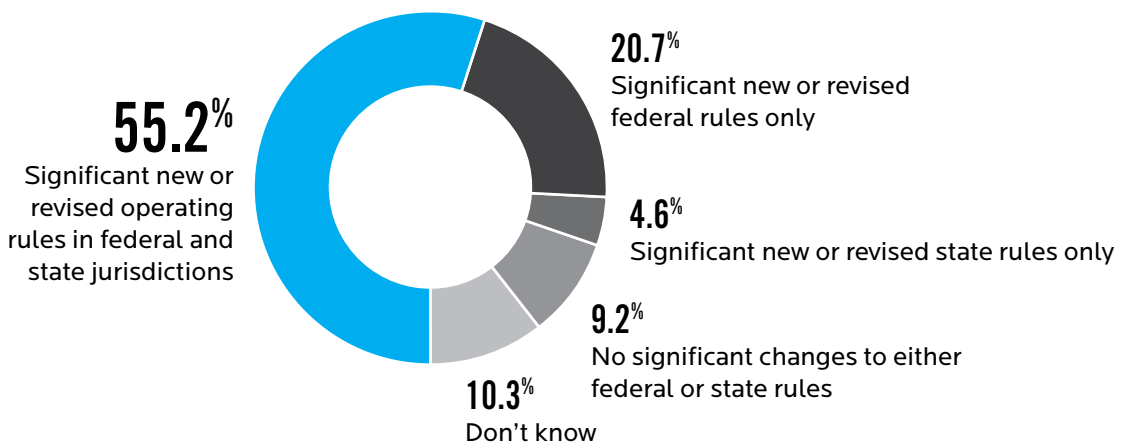
The *2016 Strategic Directions: Natural Gas Industry Report* shows that although the full scope of new federal

regulations has not yet been determined, 76 percent of respondents view increasing federal oversight as a significant new reality (Figure 18). Those respondents who do not view these new federal regulations as impactful may be counting on litigation on the rules to slow actual implementation, as is the case with the Clean Power Plan.

The report further shows that nearly three-quarters of respondents see the new underground storage regulations complicating business operations, with one in five saying the regulations are going to degrade service or business reliability (Figure 19). This points to a growing need for gas storage operators to engage the services of independent engineers and design consultants, or in-house resources, to help upgrade operational plans that can mitigate the regulatory impacts on their operations.

For example, Black & Veatch recently conducted an independent engineering analysis for a Midwestern client with significant gas transmission and storage assets to identify any potential gaps between operations and maintenance practices under federal and state regulatory requirements.

Figure 18
Based on incidents such as the Aliso Canyon, California, gas leak of 2015-2016, what types of regulatory changes do you expect to see for underground gas storage facilities? (Select one choice.)



80.5% Expect regulatory changes to occur at the state and/or federal level

Source: Black & Veatch

Operators of these storage facilities should begin planning for increasing levels of regulatory oversight of their operations including such areas as maintenance and testing of wells, pipelines and supporting equipment.

Operators of these storage facilities should begin planning for increasing levels of regulatory oversight of their operations including such areas as maintenance and testing of wells, pipelines and supporting equipment. Actions also should include an overview on the sufficiency of reservoir and well integrity plans, verifying and validating installation, testing and remediation work and preparing testimony as needed in regulatory filings. Other key areas to address are validating equipment integrity plans and the facility's provisions for physical security and cybersecurity.

Those remaining respondents who did not identify significant regulatory effects to their business are likely not as heavily dependent on the gas storage business or may have contracted with a third-party storage service and, therefore, are not immediately concerned about regulatory ramifications at this time.

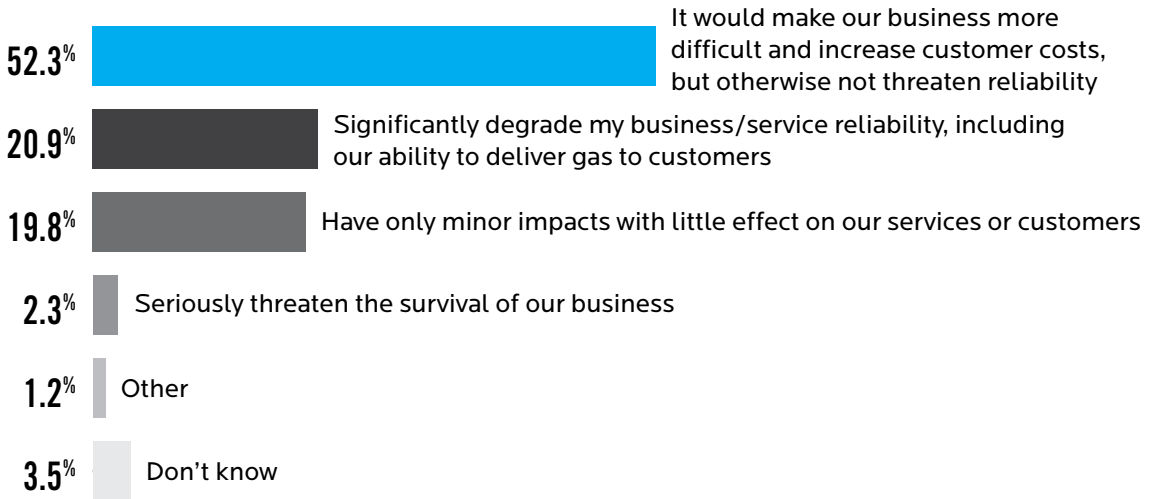
To capture the most recent market sentiment, the survey informing this report was taken after President Obama signed the authorization for PHMSA to deliver new rules for underground natural gas storage facilities. As a result, the survey respondents presumably were aware of the new PHMSA regulatory authority and the significant impact it would have on their gas storage operations. In this vein, it would have been expected that even more respondents would have chosen two years; however, more felt the new rules would impact their storage operations within the next three to five years (Figure 20). This may indicate that the industry might be pushing off preparing to comply with new regulations and is still unsure of the definitive impact on their businesses.

PHMSA has until June 2018 to deliver new rules for underground gas storage operations and currently has authority for emergency rule creation, including recommendations based on the findings of the federal task force investigating the Aliso Canyon incident. The task force issued its report on October 18, 2016, with 44 recommendations across three main areas: well integrity, facility reliability and health and environment. At least some of those recommendations are expected to be adopted in the interim rules for gas storage to be issued by PHMSA by December 2016 – as prescribed by the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2016. Most notably, stricter requirements are anticipated for well design and testing, and an overall stronger emphasis on risk management planning and documentation. Based on these recommendations, storage operators can, and should, begin business planning accordingly.

It may be that respondents seeing a longer time frame for taking action on regulatory changes again believe that legal roadblocks in the court system may delay implementation. However, the fact remains that laws are in effect now that require new regulations from PHMSA within two years. Waiting to address business planning to meet the various regulatory actions will inevitably cost operators additional money to achieve compliance. Operators should, at minimum, initiate preliminary planning to address these expansive regulations that are going to exert a major impact on the industry in the near future.

Figure 19

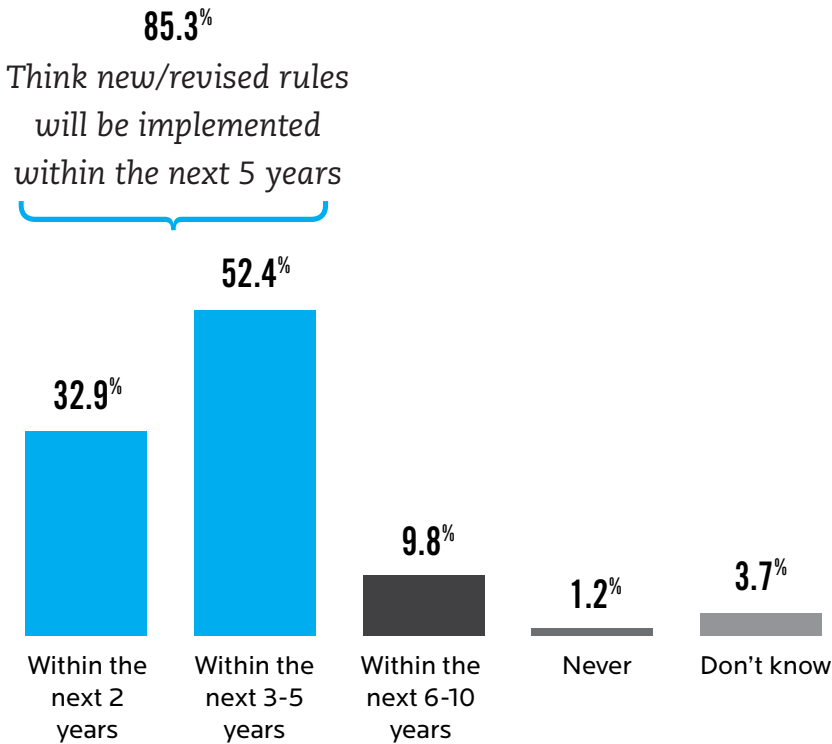
If new regulations restricted or impaired the use of underground natural gas storage beyond current practices, how would this rule tightening affect your business? (Select one choice.)



Source: Black & Veatch

Figure 20

If new or revised operating rules for underground natural gas storage are implemented, how soon do you think the updated rules would affect your business planning? (Select one choice.)



Source: Black & Veatch

CLOSING COMMENTARY

Industry Optimism Reflects Divergent Market Trends

By Hoe Wai Cheong

Factors stoking optimism for segments of the natural gas industry are plentiful. In North America, local distribution companies are awash in low-cost supplies that are helping to expand natural gas's use as a source for power generation. Gas is replacing many legacy coal units while also supporting the future promise of renewable power generation and emerging battery storage technology.

Yet, for the upstream and midstream segments across the globe, the positive outlook flattens and, in some cases, reflects outright pessimism. Thinning revenue streams and diminished appetites for capital investment have left many producers with abundant supplies but increasingly few places to send it profitably.

With this backdrop, today's market orthodoxy may be hiding an opportunity. All markets correct themselves, and how stakeholders across the natural gas industry address the current correction will go far in determining natural gas's full potential as world governments step closer to fulfilling agreements related to climate change.

All markets correct themselves, and how stakeholders across the natural gas industry address the current correction will go far in determining natural gas's full potential as world governments step closer to fulfilling agreements related to climate change.

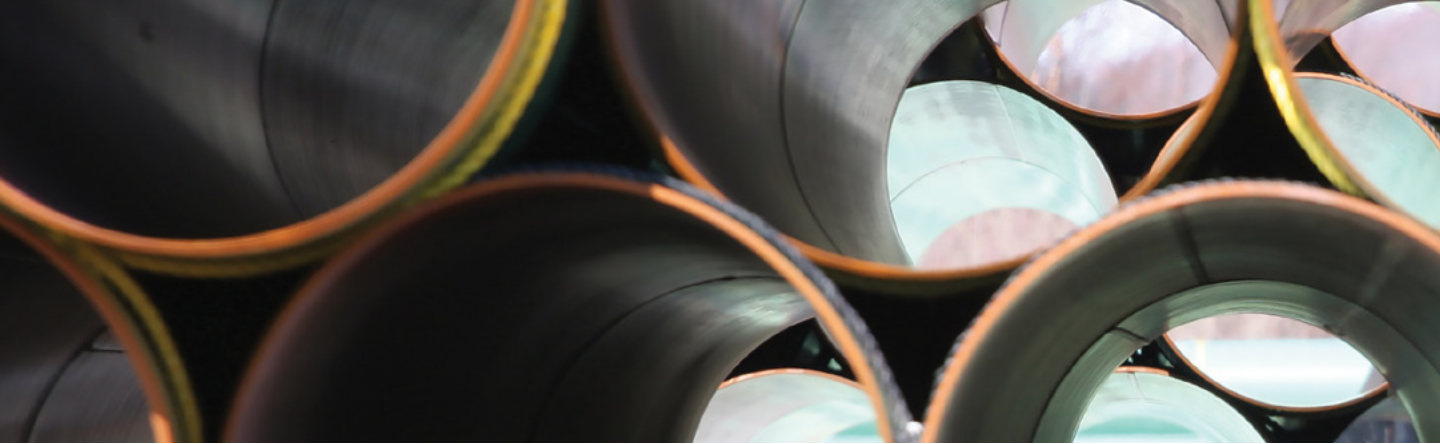


ARE YOU
READY FOR A
MARKET
CORRECTION?

70% of respondents are optimistic
about industry prospects.

**INDUSTRY EXPERTS BELIEVE TODAY'S
LOW GAS PRICES WILL EVENTUALLY RISE.**

Today's investment will drive tomorrow's success.



COAL RETIREMENTS AND EMISSIONS TARGETS DRIVE NATURAL GAS IN THE UNITED STATES

There is little doubt that, in the United States, the profile of natural gas in domestic power generation is on the rise. Baseload demand remains flat, but in 2016, annual generation from natural gas is expected to surpass generation produced with coal and maintain a strong position for the foreseeable future. Natural gas stocks are plentiful, and affordable, efficient, combined cycle technologies are more environmentally focused and easier to permit. As long as renewables such as solar and wind remain intermittent suppliers of power, gas will be seen as a much more reliable alternative that also satisfies growing regulatory mandates tied to greenhouse gas emissions, such as the COP21 climate agreement forged in Paris in 2015.

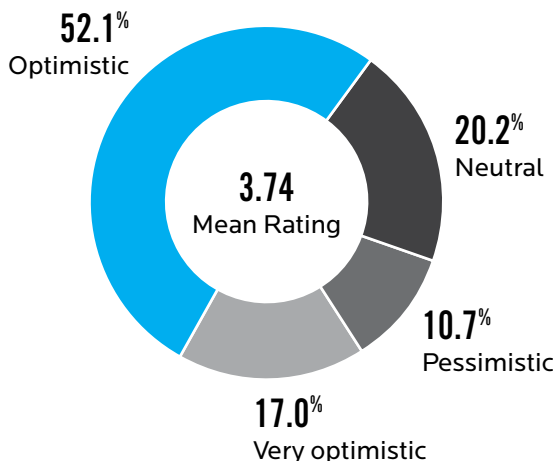
Respondents to Black & Veatch's 2016 survey convey an optimism that in many respects could be considered encouraging, with more than 70 percent of respondents expressing positivity about industry prospects between 2020 and 2030. We believe this outlook is tied to aspirations for demand growth in international markets and the continuing march away from coal in the United States (Figure 21).

Simply put, the historic price volatility of natural gas has given way to expectations for consistently low prices, driven by continuing efficiency gains from shale plays across North America and a new leadership role in power generation. It seems there may be little on the near-term horizon, at least in the United States, to shake that positive outlook.

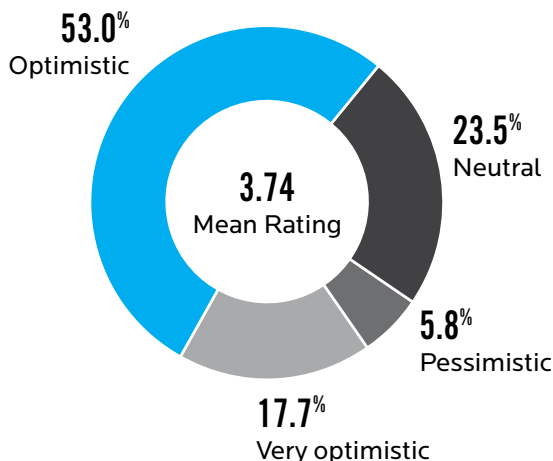
Figure 21

What is your general outlook on the future growth of the global oil and gas industry? (Please use the drop down menus to select what you feel the outlook for the future growth of the industry will be Between Now and 2020 and then Between 2020 and 2030.)

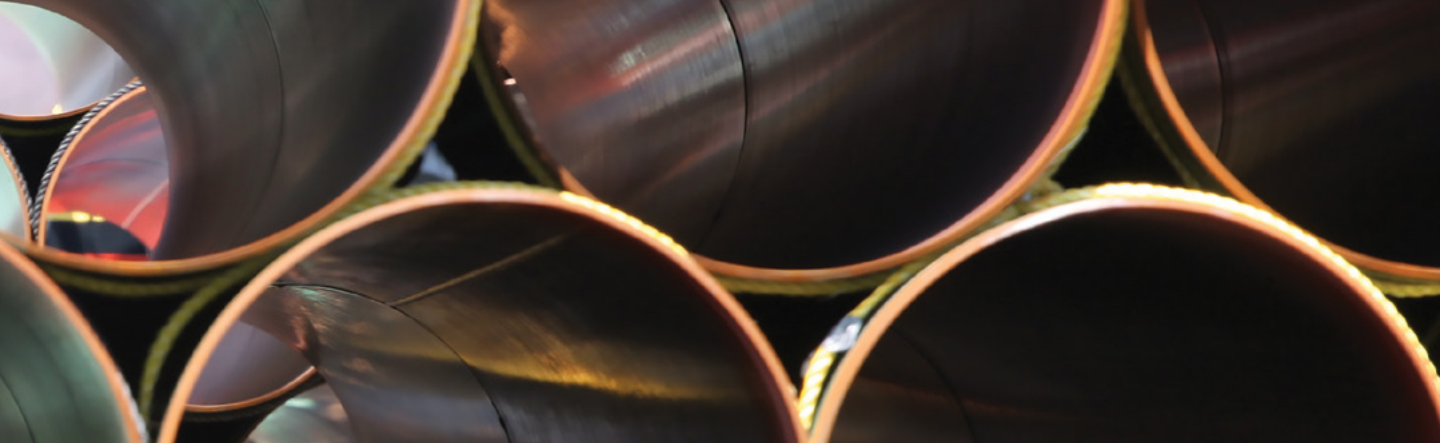
Between Now and 2020



Between 2020 and 2030



Source: Black & Veatch



GLOBALLY, POTENTIAL FOR DISRUPTION WEIGHS ON INDUSTRY INVESTMENT

But natural gas's ascendancy is a U.S. story, not necessarily shared globally.

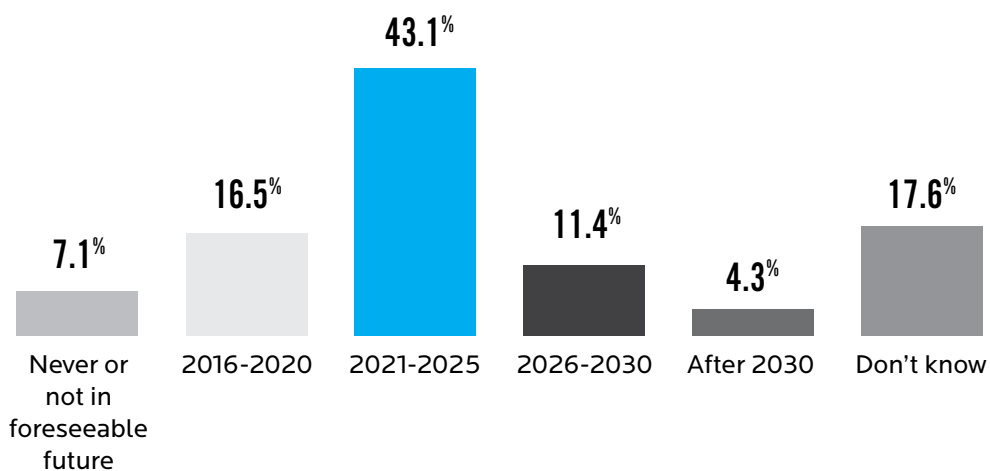
Demand for natural gas in Asia – specifically the key markets of China, Japan and South Korea – has slowed. Those countries are responsible for a large share of the world's global LNG import volume, but slower economic growth (particularly in China) and the restart of additional nuclear units in Japan may limit future demand. Abundant supply continues to flow from markets such as Australia and Qatar, but more diverse import markets that could theoretically benefit from that output lack the necessary LNG port, terminal and distribution infrastructure (or the assets that would fund those systems) to accommodate it.

And as long as market prices remain where they are in late 2016, there is little to no incentive for organizations to invest significantly because of natural gas's low margins and return on investment – even in a competitive pricing environment for capital projects. Indonesia, Vietnam, parts of Africa and a great portion of the developing world cannot afford natural gas and are forced to rely on coal even as their governments signed on to the 2015 Paris climate agreement.

Respondents to the Black & Veatch survey reflected an interesting optimism about when the low price market will correct itself. More than 40 percent think the current overhang will reverse between 2021 and 2025, with another 16 percent predicting a correction sometime after 2026 (Figure 22).

Figure 22

When do you expect the current global LNG supply overhang to be absorbed and the need for the next tranche of LNG supply to arise? (Select one choice.)



Source: Black & Veatch

Certainly, the Organization of Petroleum Exporting Countries (OPEC) curbs on production can affect natural gas price, and thus bear watching (Figure 23). Others within the industry, for good reason, believe the potential for geopolitical flash points hangs over this market and could bring a correction sooner than these results suggest. If one considers the history of the oil markets, every price recovery can be tied to conflict that constricts supply. However, continuing gains in North American production and the potential adoption of shale technology globally could keep a cap on potential price increases.

The reticence of upstream and midstream organizations to invest is understandable. Prices are not high enough to support capital expenditures. But Black & Veatch believes the potential for abrupt disruptions should be considered today.

For investors in a down market, such as the current one, perhaps the best time to invest is now, when capital costs are lower. The significant shakeup impacting higher cost producers has driven numerous smaller players out of the market, and new investors are negotiating more favorable production and service contracts. Further, a crucial consideration when pondering large-scale projects is their development time. From studies and design through to procurement and construction, projects have as many as five to 10 years to production. It will be important for organizational planning to consider investment options now and get the competitive advantage that will likely evaporate in a demand-driven market.

Investors may need to make strategic, albeit daunting, moves now while these advantages are in place. For the industry's optimistic view of the future to come to fruition, it should consider what can be done today.

The Shepard Energy Centre, located in Calgary, Alberta, is a 800 megawatt (MW) natural gas-fired combined cycle facility, uses the most advanced natural gas technologies available in the marketplace today.

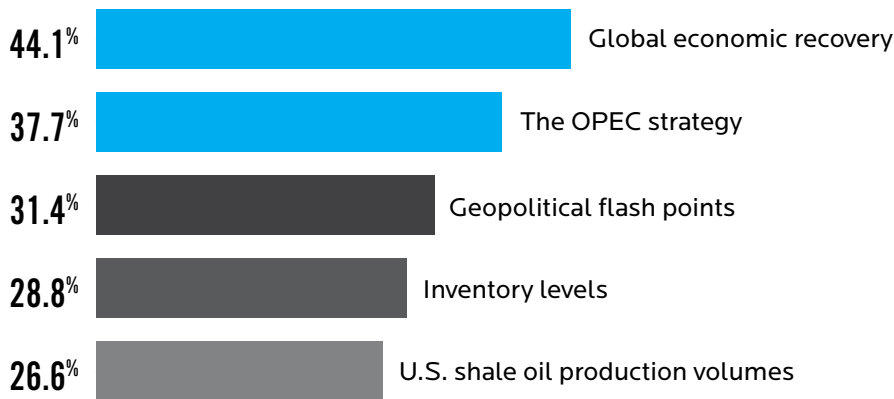


Investors may need to make strategic, albeit daunting, moves now while these advantages are in place.

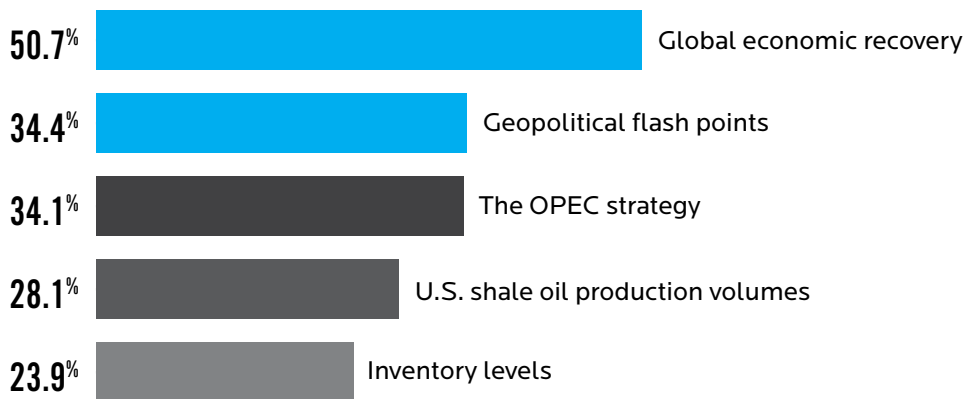
Figure 23

Which of the following will have the greatest impact on oil prices between now and 2018? Which of the following will have the greatest impact on oil prices between 2018 and 2025? (Select top two choices.)

Between Now and 2018



Between 2018 and 2025



Source: Black & Veatch

THE BLACK & VEATCH ANALYSIS TEAM

EXECUTIVE SUMMARY

John Chevrette is President of Black & Veatch management consulting and works closely with clients to address key challenges affecting today's electric, water and gas utilities. Chevrette has more than 20 years of industry consulting experience and has worked with domestic and international clients in the electric utility, energy technology, gas pipeline, telecommunications and water industries.

MANAGING THE LOW PRICE MARKET

Lynn Allen is Managing Director of the Planning Service Offering for Black & Veatch management consulting. He has more than 18 years of power sector experience spanning a broad range of initiatives, including resource planning, energy management, supply procurement, trading and risk management, commodity structuring and transactions, business development, mergers and acquisitions, deal origination, portfolio management, financing and economic evaluations.

Michael Goff is a Technology Manager in Black & Veatch's oil & gas business. His responsibilities include ensuring appropriate technologies are applied to projects to provide commercial advantages to clients. This includes the supervision of all lead process engineers working in a specific technology area. His expertise includes gasification, syngas processing, ammonia, gas-to-liquids, process modelling and alternative energy resources.

Eddy Karmana is an Operation Manager for oil & gas within Black & Veatch's energy business in the Jakarta Office and Regional Engineering Manager for the Asia region. He has nearly 20 years of project and engineering experience in the oil and gas, refinery, and petrochemical industries. Karmana has been involved in all phases of developing offshore topside facilities and onshore facilities, and is focused on business development support and project execution in the area of LNG, regasification, gas processing and coal gasification.

Judith McArdle is Senior Managing Director of the Advisory and Planning Service Offering in Black & Veatch management consulting. Advisory and Planning Service comprises the rates and regulatory practice for electric, gas and water rate studies, market analysis and integrated resource planning practice, and independent engineering for all types of electric generating technologies. Her energy-related experience includes project management for independent engineering assessments for lenders, owners, bidders and developers, as well as construction project management and engineering system design and review.

Anand Pattani is Country Manager and Managing Director of Black & Veatch Private Limited (BVPL), India. Based in Mumbai, he is responsible for developing client relationships, directing bids and proposals, negotiating contracts and executing projects using global teams. Pattani's experience of more than 17 years includes planning, development, engineering, designing and implementation of nearly 25,000 megawatts of coal, gas and renewable power plant facilities for utilities, developers, EPC (engineering, procurement and construction) contractors and financial institutions. He is a U.S.-licensed professional engineer and has a bachelor's degree in chemical engineering from the University of Mumbai, India, and a master's degree in chemical engineering from the University of Missouri-Columbia, USA.

Deepa Poduval is a Senior Managing Director with Black & Veatch management consulting and is responsible for business strategy and project management. Her client engagements focus on strategic analytical services supporting portfolio optimization, asset acquisition, risk management and business strategy development. Poduval's expertise includes the valuation of energy industry assets, analysis of oil and gas marketing strategies and commercial agreements, performance and risk measurement and analysis, and utilization of natural gas industry structural models.

Javid Talib is a Vice President within Black & Veatch's oil & gas business and is Director of Floating Technology Applications. His responsibilities include advancing technology enhancements for floating liquefied natural gas (FLNG) solutions. His more than 40 years of industry experience includes significant project management responsibilities including engineering design, procurement, construction, commissioning and startup, as well as strategic global business development for onshore and offshore oil and gas projects.

Denny Yeung is a Principal at Black & Veatch with expertise in natural gas fundamental market analysis, asset valuation and financial analysis. He has led numerous engagements in market assessments of natural gas markets and due diligence review of midstream assets. As the interstate pipeline market lead, he has led the detailed modeling of fundamentals factors in the North American natural gas market and assessing of the impact on price and basis on proposed natural gas infrastructure. He has accumulated extensive knowledge on market fundamentals, strategy development and natural gas infrastructure optimization in his experience with Black & Veatch.

TECHNOLOGY BRINGS OPPORTUNITIES AND CHALLENGES

Jeff Buxton is a Managing Director and Executive Consultant in Black & Veatch management consulting, specializing in utility operational technology strategy, implementation and operation. He supports electric, gas and water utilities in strategic planning, business case development, solution selection, program management, organizational planning and operations management of transformational smart grid programs and has supported large utilities in developing advanced metering infrastructure and system modernization programs.

John George is Vice President and Managing Director of Black & Veatch's oil & gas business. He has more than 30 years of project and operations understanding from both the contractor and client perspective in order to develop business-centric technical solutions for clients. His experience includes operational leadership on large-scale oil and gas business operations, strategic growth programs, administrative and organizational management, project management, fiscal controls, contracts and direct construction management.

Dave Hile directs client program management for Black & Veatch's oil & gas business. He is responsible for client engagement and management, finding creative solutions for clients and tracking project and client feedback during project execution.

Jeremy Klingel is a Managing Director leading the distribution modernization and customer experience offerings within Black & Veatch management consulting. He specializes in end-to-end smart grid technology initiatives for utilities and assists with business and technical issues related to the implementation and migration of advanced metering infrastructure. Klingel also focuses on the operational and regulatory strategies necessary to support the design of customer programs that enable maximum return on investment for the utility and its customers.

David Mayers is a Senior Managing Director at Black & Veatch and leads the Security, Risk & Resilience team. He has 26 years of management consulting experience, including 12 years in the banking industry and 14 years in the energy industry.

REGULATIONS SHAPING OPERATIONS AND PLANNING

Andy Byers is an Associate Vice President and Director of Environmental Services in the Black & Veatch power business. He currently serves as the Environmental Regulatory and Legislative Policy Advisor, responsible for tracking developments and advising on risks and opportunities arising from key federal legislative, regulatory and judicial initiatives.

Russell Feingold is a Vice President in Black & Veatch management consulting, where he leads the Rate and Regulatory Consulting group. He has more than 39 years of experience serving electric and gas utilities on a broad range of utility ratemaking and regulatory related projects. Feingold has prepared and presented expert testimony submitted to the Federal Energy Regulatory Commission and the National Energy Board of Canada, as well as several state and provincial regulatory commissions dealing with the cost, pricing and marketing of electric and gas utility services.

James Gooding is a Manager in Black & Veatch management consulting. As a subject matter specialist in oil, natural gas and mining, he is responsible for developing and delivering services in planning, process improvements, independent engineering and risk management for clients in energy- and water-related businesses, including gas storage facilities. His knowledge and experience includes geotechnical research, construction and auditing of forecast models, and development of compliance plans required by quality and regulatory standards. Gooding has 37 years of professional experience in government and industry, including a wide range of technical and commercial enterprises. He is a licensed Professional Geoscientist and also is credentialed by the American Society for Quality as a Certified Manager of Quality/Organizational Excellence.

H. Edwin Overcast is a Director in Black & Veatch management consulting specializing in finance and markets. Overcast has more than 40 years of experience at investor-owned utilities, government-owned electric and gas utilities and as a consultant practicing in the rates, regulatory and strategic planning areas. During his career, he has held various management- and officer-level positions.

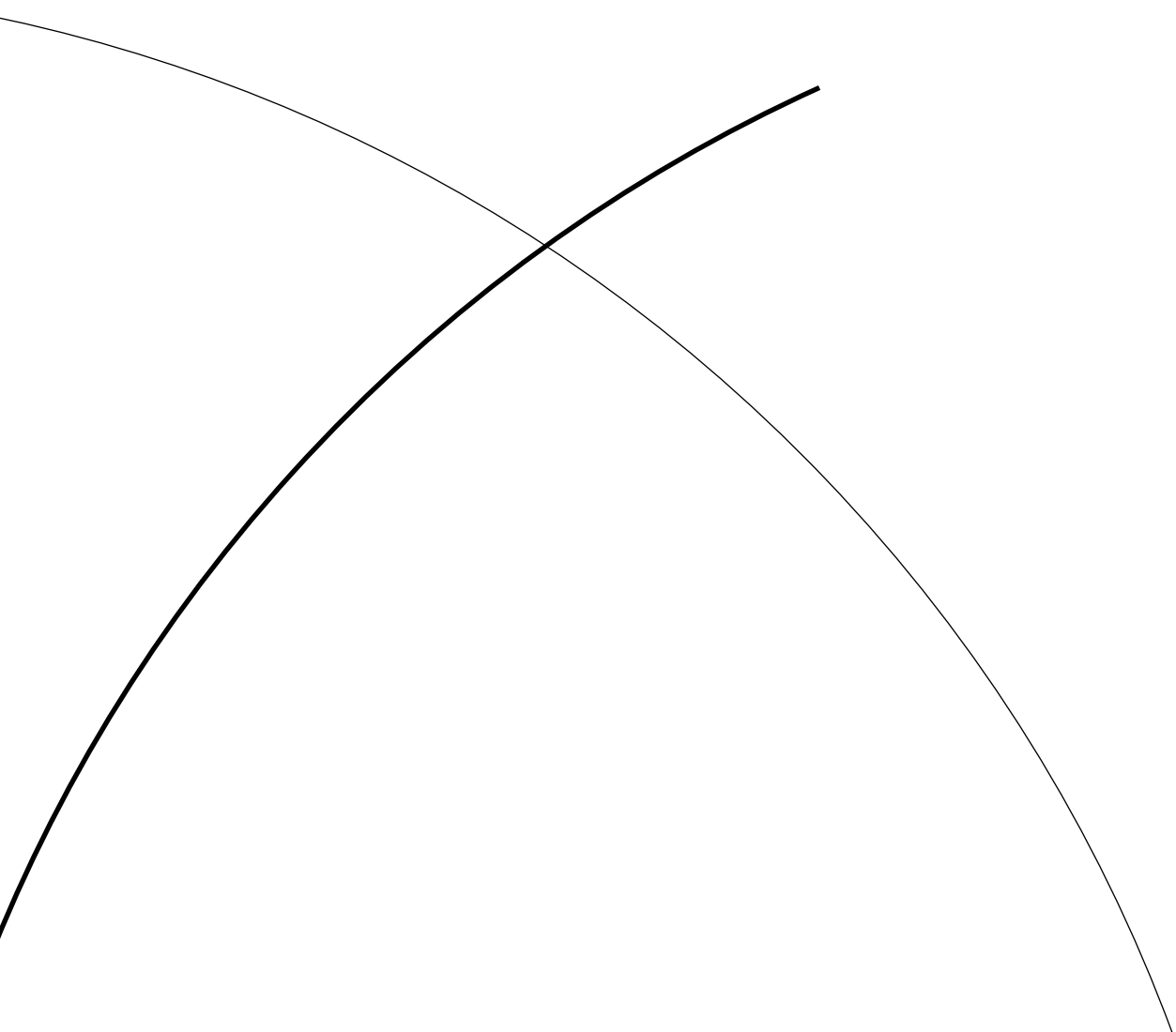
CLOSING COMMENTARY

Hoe Wai Cheong is President of Black & Veatch's oil & gas business. He is responsible for global strategy, business development, and project acquisition and execution. Cheong holds a bachelor's degree and doctorate in chemical engineering from the University of Aston in Birmingham, UK. Cheong is based in Singapore.

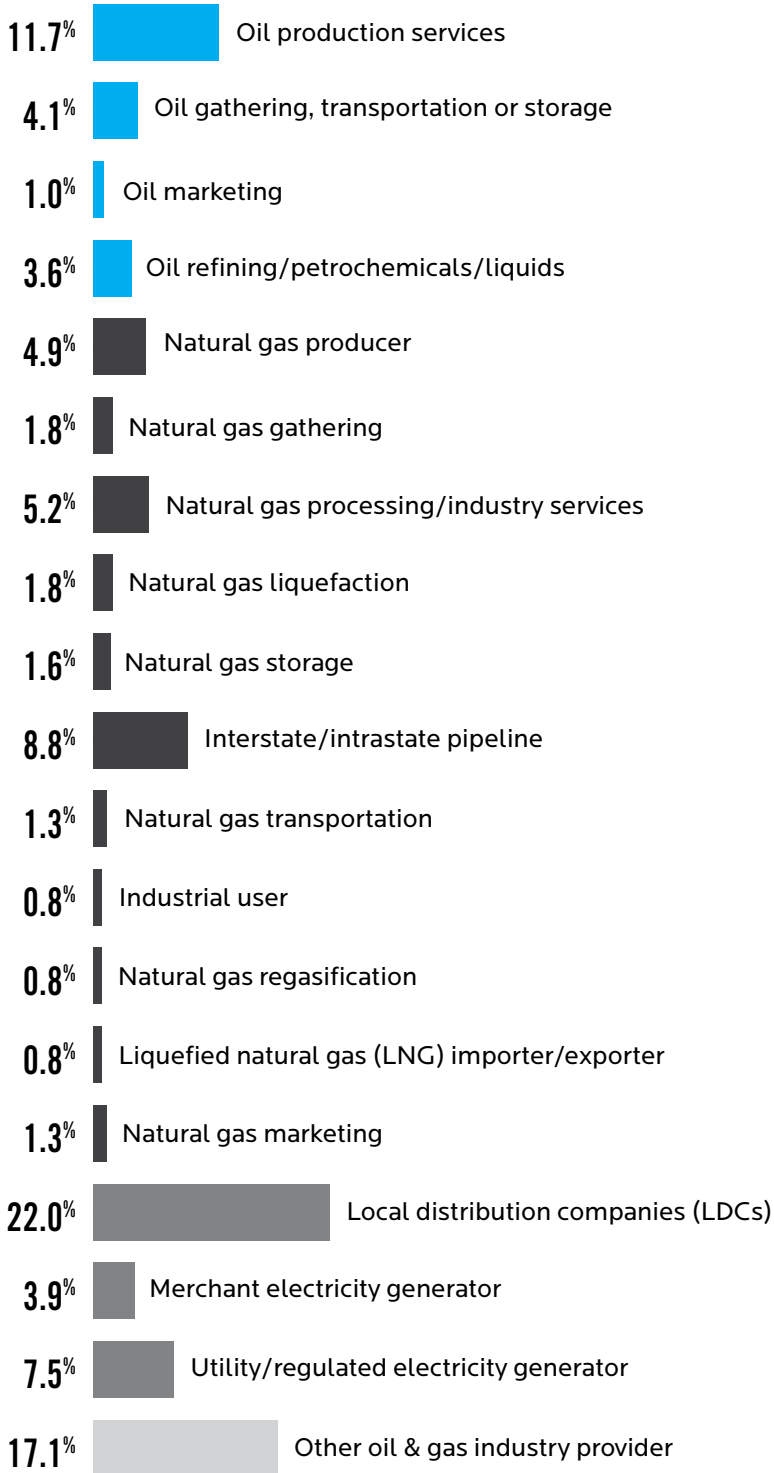
2016 REPORT BACKGROUND

The fifth annual Black & Veatch *Strategic Directions: Natural Gas Industry Report* is a compilation of quantitative and qualitative data and analysis from industrywide surveys. This year's online survey was conducted from 15 July through 5 August 2016 and reflects the input of 386 oil and gas producers, utilities and other oil and gas industry providers.

The following figures provide additional detail on the respondents in this year's online survey. The results of the 386 survey responses have a precision of at least +/- 5.0 percent at the 95 percent confidence level.

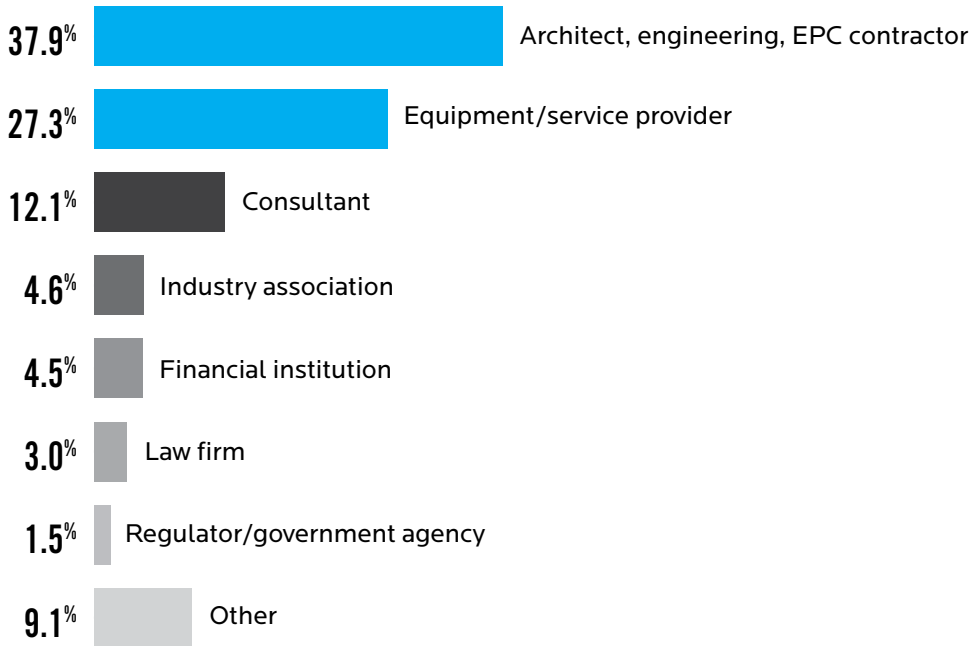


Oil and Gas Services Provided



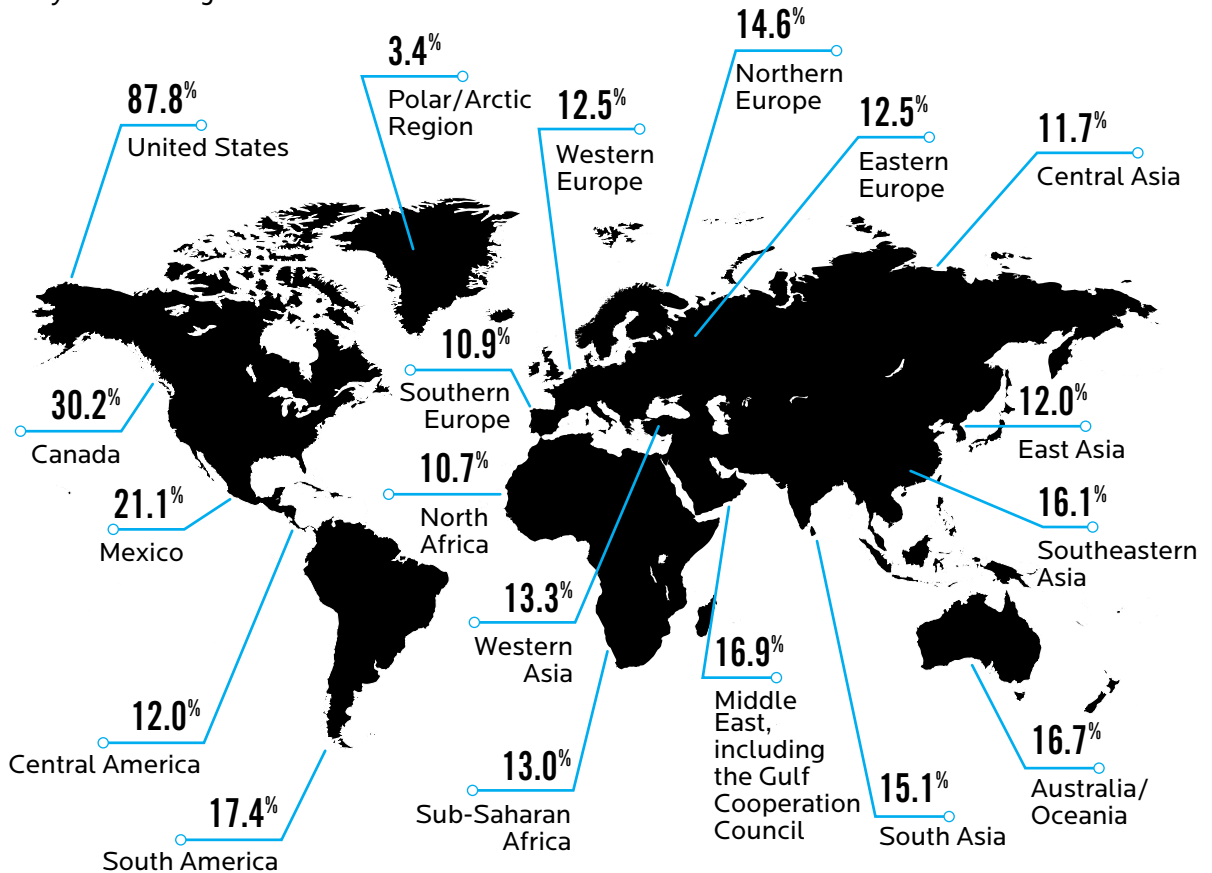
Source: Black & Veatch

Other Oil and Gas Industry Provider Types



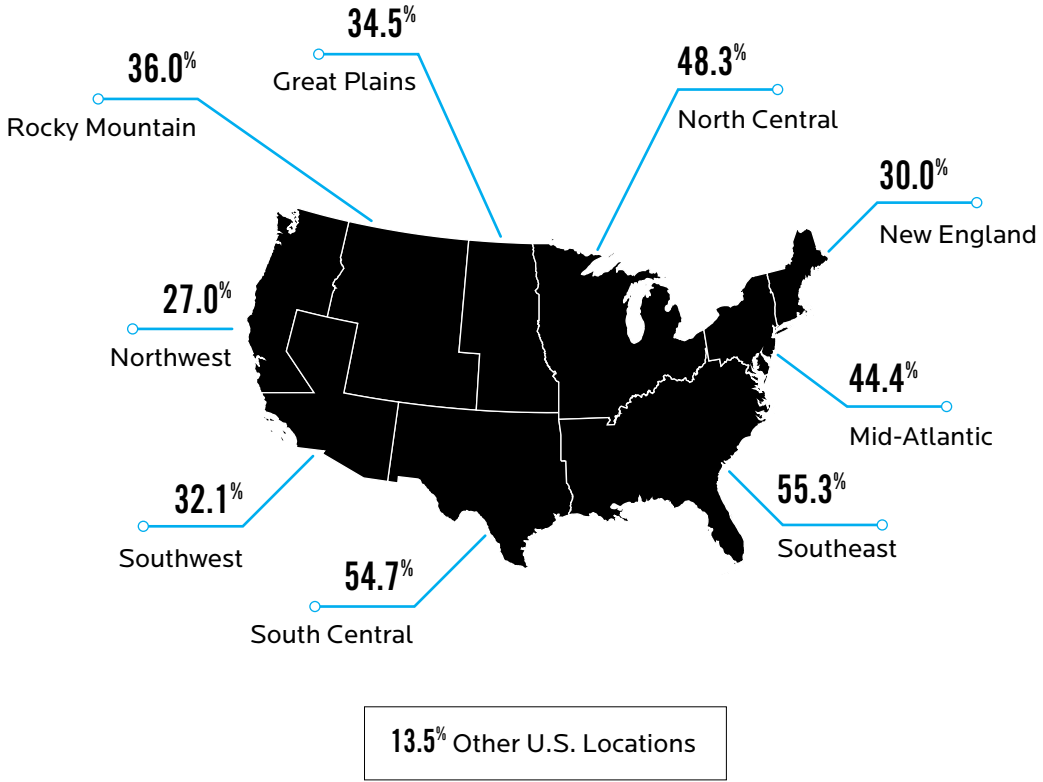
Source: Black & Veatch

Primary Business Region



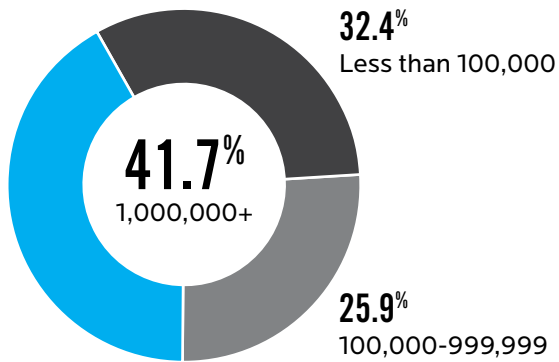
Source: Black & Veatch

Primary U.S. Business Region



Source: Black & Veatch

Utility Providers – Population Served



Source: Black & Veatch

LIST OF FIGURES

- 4** Figure 1
On a 5-point scale, where a rating of 5 means “Significant Impact” and a rating of 1 means “No Impact,” please rate the potential impact of the following factors on the global LNG market over the next 5 to 10 years? (Select one choice per row.)
- 6** Figure 2
How is your organization planning to maximize the production from your assets? (Select all that apply.)
- 8** Figure 3
Which factors do you expect to be the biggest drivers of global demand growth for natural gas? (Select top two choices.)
- 11** Figure 4
How will additional export facilities and FLNG facilities and import terminals coming online affect the market? (Select top two choices.)
- 15** Figure 5
What is your organization’s current strategy to maintain stable earnings considering the current market situation while anticipating future oil price rebound? (Select all that apply.)
- 17** Figure 6
If you were to diversify your business into a downstream/petrochemical production facility, what three products or markets would be most attractive to your organization? (Select top three choices.)
- 19** Figure 7
If additional natural gas infrastructure is needed to serve the growth in power generation demand, who should bear the costs? (Select all that apply.)
- 20** Figure 8
Which of the following North American markets will be in need of incremental natural gas pipeline capacity to serve power generation over the next 5 years? (Select all that apply.) [North American Respondents Only]
- 20** Figure 9
Which of the following do you consider as the optimal strategy to facilitate incremental natural gas pipeline infrastructure? (Select one choice.)
- 21** Figure 10
How is your organization managing the gas/power market synchronization disconnect? (Select one choice.)
- 22** Figure 11
What priority does your organization place on investing in new technologies that utilize real-time data to improve customer experience and customer satisfaction? (Select one choice.)
- 24** Figure 12
What is the primary reason your organization is considering or has already upgraded to one-way or two-way fixed network AMI? (Select one choice.)
- 27** Figure 13
What is the likelihood that your organization would consider using program management (including program management office, program management training or program management consulting services)? (Select one choice.)
- 29** Figure 14
How will (or do) your customers benefit from project management services? (Select all that apply.)
- 37** Figure 15
How likely is it that the EPA or other Government Agency will regulate methane emissions from existing sources in the oil and gas sector? (Select one choice.)
- 37** Figure 16
What type of overall, long-term economic impact will global climate change and environmental programs have on the following aspects of the natural gas industry? (Select one choice per row.)
- 39** Figure 17
Which one of the following activities will have the greatest impact on the natural gas distribution utility industry over the next five years? (Select one choice.)
- 41** Figure 18
Based on incidents such as the Aliso Canyon, California, gas leak of 2015-2016, what types of regulatory changes do you expect to see for underground gas storage facilities? (Select one choice.)

LIST OF FIGURES

- 43 Figure 19
If new regulations restricted or impaired the use of underground natural gas storage beyond current practices, how would this rule tightening affect your business? (Select one choice.)
- 43 Figure 20
If new or revised operating rules for underground natural gas storage are implemented, how soon do you think the updated rules would affect your business planning? (Select one choice.)
- 46 Figure 21
What is your general outlook on the future growth of the global oil and gas industry? (Please use the drop down menus to select what you feel the outlook for the future growth of the industry will be Between Now and 2020 and then Between 2020 and 2030.)
- 47 Figure 22
When do you expect the current global LNG supply overhang to be absorbed and the need for the next tranche of LNG supply to arise? (Select one choice.)
- 49 Figure 23
Which of the following will have the greatest impact on oil prices between now and 2018? Which of the following will have the greatest impact on oil prices between 2018 and 2025? (Select top two choices.)
- 3 Table 1
What is your general outlook on the future growth of the global oil and gas industry? (Please use the drop-down menus to select what you feel the outlook for the future growth of the industry will be Between Now and 2020 and then Between 2020 and 2030.)

LIST OF TABLES

- 9 Table 2
On a 5-point scale, where a rating of 5 means “Very Important” and 1 means “Very Unimportant,” please rate the importance of each of the following long-term issues to the natural gas industry. (Select one choice per row.)
- 71 Table 3
When do you expect the current global LNG supply overhang to be absorbed and the need for the next tranche of LNG supply to arise? (Select one choice.)
- 29 Table 4
On a 5-point scale, where a rating of 5 means “Very Important” and 1 means “Not Important at All,” please rate the importance of each of the following long-term issues to the natural gas industry. (Select one choice per row.)
- 33 Table 5
On a 5-point scale, where a rating of 5 means “Very Important” and 1 means “Very Unimportant,” please rate the importance of each of the following long-term issues to the natural gas industry. (Select one choice per row.)

BUILDING A WORLD OF DIFFERENCE®

Black & Veatch is an employee-owned, global leader in building critical human infrastructure in Power, Oil & Gas, Water, Telecommunications and Government Services. Since 1915, we have helped our clients improve the lives of people in over 100 countries through consulting, engineering, construction, operations and program management. Our revenues in 2015 were US \$3 billion. Follow us on www.bv.com and in social media.

LEGAL NOTICE

Please be advised, this report was compiled primarily based on information Black & Veatch received from third parties, and Black & Veatch was not requested to independently verify any of this information. Thus, Black & Veatch's reports' accuracy solely depends upon the accuracy of the information provided to us and is subject to change at any time. As such, it is merely provided as an additional reference tool, in combination with other due diligence inquiries and resources of user. Black & Veatch assumes no legal liability or responsibility for the accuracy, completeness, or usefulness of any information, or process disclosed, nor does Black & Veatch represent that its use would not infringe on any privately owned rights. This Survey may include facts, views, opinions and recommendations of individuals and organizations deemed of interest and assumes the reader is sophisticated in this industry. User waives any rights it might have in respect of this Survey under any doctrine of third-party beneficiary, including the Contracts (Rights of Third Parties) Act 1999. Use of this Survey is at users sole risk, and no reliance should be placed upon any other oral or written agreement, representation or warranty relating to the information herein.

THIS REPORT IS PROVIDED ON AN "AS-IS" BASIS. BLACK & VEATCH DISCLAIMS ALL WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT. BLACK & VEATCH, NOR ITS PARENT COMPANY, MEMBERS, SUBSIDIARIES, AFFILIATES, SERVICE PROVIDERS, LICENSORS, OFFICERS, DIRECTORS OR EMPLOYEES SHALL BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR RELATING TO THIS REPORT OR RESULTING FROM THE USE OF THIS REPORT, INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOSS OF PROFITS, USE, DATA OR OTHER INTANGIBLE DAMAGES, EVEN IF SUCH PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

In addition, user should place no reliance on the summaries contained in the Surveys, which are not intended to be exhaustive of the material provisions of any document or circumstances. If any point is of particular significance, reference should be made to the underlying documentation and not to this Survey. This Survey (and the content and information included therein) is copyrighted and is owned or licensed by Black & Veatch. Black & Veatch may restrict your access to this Survey, or any portion thereof, at any time without cause. User shall abide by all copyright notices, information, or restrictions contained in any content or information accessed through this Survey. User shall not reproduce, retransmit, disseminate, sell, distribute, perform, display, publish, broadcast, circulate, create new works from, or commercially exploit this Survey (including the content and information made available through this Survey), in whole or in part, in any manner, without the written consent of Black & Veatch, nor use the content or information made available through this Survey for any unlawful or unintended purpose.

BLACK & VEATCH

11401 Lamar Avenue, Overland Park, KS 66211

P +1 913-458-2000 | E MediaInfo@bv.com | W bv.com

© Black & Veatch Corporation, 2016.

All Rights Reserved. The Black & Veatch name and logo are registered trademarks of Black & Veatch Holding Company.

REV 2016-10

