DNV·GL

SHORT-TERM AGILITY, LONG-TERM RESILIENCE

The outlook for the oil and gas industry in 2017

SAFER, SMARTER, GREENER

ABOUT THE RESEARCH

Short-term agility, long-term resilience is an industry benchmark study on the outlook for the oil and gas industry in 2017. It is published by DNV GL, the technical advisor to the sector. Launched in 2011, and now in its seventh year, each edition of the survey builds on the findings of previous research.

The report provides an assessment of industry sentiment, confidence and priorities, in addition to expert analysis of the key pressures facing the industry in the year ahead.

It is based on a global survey that incorporates the views of 723 senior industry professionals and executives, along with 15 in-depth interviews with a range of experts, business leaders and analysts, conducted during October and November 2016.

The research was carried out on behalf of DNV GL by Longitude Research.

The companies surveyed vary in size: 39% had annual revenue of USD500milliion or less, while 18% had annual revenue in excess of USD5billion.

Respondents were drawn from across the oil and gas value chain, including publicly-listed companies and privately-held firms. They also represent a range of functions within the industry, from board-level executives to senior engineers.

The findings and views expressed in the report do not necessarily reflect the views of DNV GL.

We would like to extend our thanks to all participants and, in particular, to the following interviewees for sharing their time and insights with us (listed alphabetically, by surname):

Graham Bennett, vice president, DNV GL – Oil & Gas

Paul Doucette, global leader, public policy & external funding GE Oil & Gas

Kristin Færøvik, managing director, Lundin Norway

Christoph Frei, secretary general & chief executive officer, World Energy Council

Maria Moræus Hanssen, chief executive officer, exploration and production (E&P), ENGIE

Jan Arve Haugan, chief executive officer, Kværner

Liv Hovem, senior vice president, DNV GL – Oil & Gas

Ye Hua Huang, deputy director-general, China National Offshore Oil Corporation (CNOOC), Bohai Oilfield Bureau

Thore E Kristiansen, chief operating officer (E&P) & executive director, Galp Energia

Edward Morse, global head of commodities research, Citigroup

Graeme Pirie, vice president, DNV GL – Oil & Gas

Brian Sullivan, executive director, IPIECA

Rob Van Velden, finance director, Brunei Shell Petroleum

Eirik Wærness, senior vice president & chief economist, Statoil

Maarten Wetselaar, integrated gas & new energies director, Shell

723
Senior industry professionals were surveyed

66%
of respondents work for suppliers or services companies across the industry

39%
of companies surveyed had annual revenue of USD500m

26%
of respondents work for an operator

18%
of companies surveyed had annual revenue in excess of USD5bn

CONTENTS

01

INDUSTRY CONFIDENCE – STABLE FOR NOW

The oil and gas industry is in a period of significant change. Price dynamics, innovations, a diversifying energy mix and fragmenting competition are driving what economists call creative destruction, where new models and markets mutate or terminate the old. Meanwhile, annual business targets, and the world's energy needs, must continue to be met. The industry has never had more reason to contemplate the long term, but it is also under pressure to take swift, short-term actions to protect margins.

Finding normal

Like the oil price, industry confidence has stopped falling, but it remains dramatically lower than 2014 and the preceding years. Indeed, as in previous years, there remains a rigid correlation (0.975) between the oil price and industry confidence.

Our survey was fielded just before OPEC announced, on 30 November 2016, that a deal had been reached to cut production in January 2017. Prices have firmed in the wake of that announcement, but as we discuss in this report, confidence remains subdued about how much positive impact the new accord will have in the year ahead.

Just under one-third (32%) of the 723 senior oil and gas professionals surveyed for this study are confident of oil and gas industry growth in the year ahead, which is similar to the 30% we reported heading into 2016. "The industry is on a balance point," says Paul Doucette, global leader for public policy and external funding at GE Oil & Gas. "Companies are trying to decide where the new normal is."

Companies also need to figure out when that new normal begins: has the oil price now bottomed out, or is there more to come? While 27% believe the worst of the price falls are over, 42% disagree. This kind of divergence is indicative not just of market uncertainty, but also of the differences in how organizations have been coping with prolonged low oil prices.

Operators and larger companies are more optimistic

The effects of the price drop are not evenly spread. From Stavanger to Perth, the impact is extensive in cities where oil and gas dominates. Office space is discounted, cafes have closed, and many experienced staff simply leave for other cities or industries.[2]

Larger, more diversified cities have fared better. The same is true for larger companies and those with more diverse operations. They have had the means, and options available, to weather low oil prices better than many smaller companies, explorers, service providers and manufacturers.

This is evident in the outlook for 2017. For example, while half (52%) of respondents from operators are confident about their companies prospects for 2017, just 26% of manufacturers say the same. There is a similar gap in confidence between large companies (54%) and mid-size (41%) or smaller (40%) organizations.[3]

"It's certainly been true that since oil prices started to come down, our midstream and downstream operations have functioned as the hedges that we all believed they would be," says Maarten Wetselaar, integrated gas and new energies director at Shell. "Refining has had a strong run. When you look at Q1-Q3 2016, margins have held well, and having sizeable downstream and a strong brand has really helped the resilience of the business over the past few years."

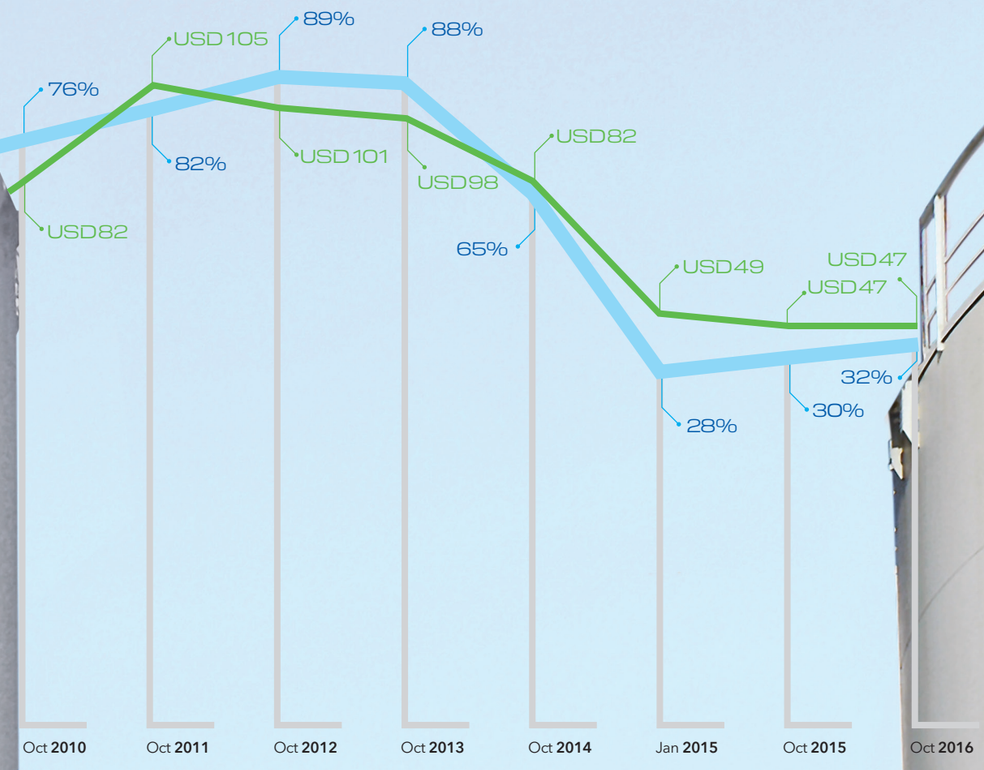
> "The industry is on a balance point, companies are trying to decide where the new normal is."
>
> **Paul Doucette**, global leader for public policy and external funding, GE Oil & Gas

Making the right adaptations

Some companies have simply adapted faster and have managed to insulate themselves, to some extent, from the low price. While a strategically better-positioned and more agile group is now able to achieve an operating profit at USD40 per barrel, others may continue to struggle for as long as oil prices remain low – whether that is for the year ahead, or forever, as many industry players now expect.

This is made clear when considering the differences between respondents' confidence in industry growth and their confidence in their own companies' profitability: only half (54%) of those who are confident of hitting their profit targets in 2017 are also confident of growth in the oil and gas sector as a whole. As we explore on pages 20–21 of this report, companies that are confident of meeting their profit targets for 2017 appear to be reorganizing themselves to thrive even if prices never rise to previous levels.

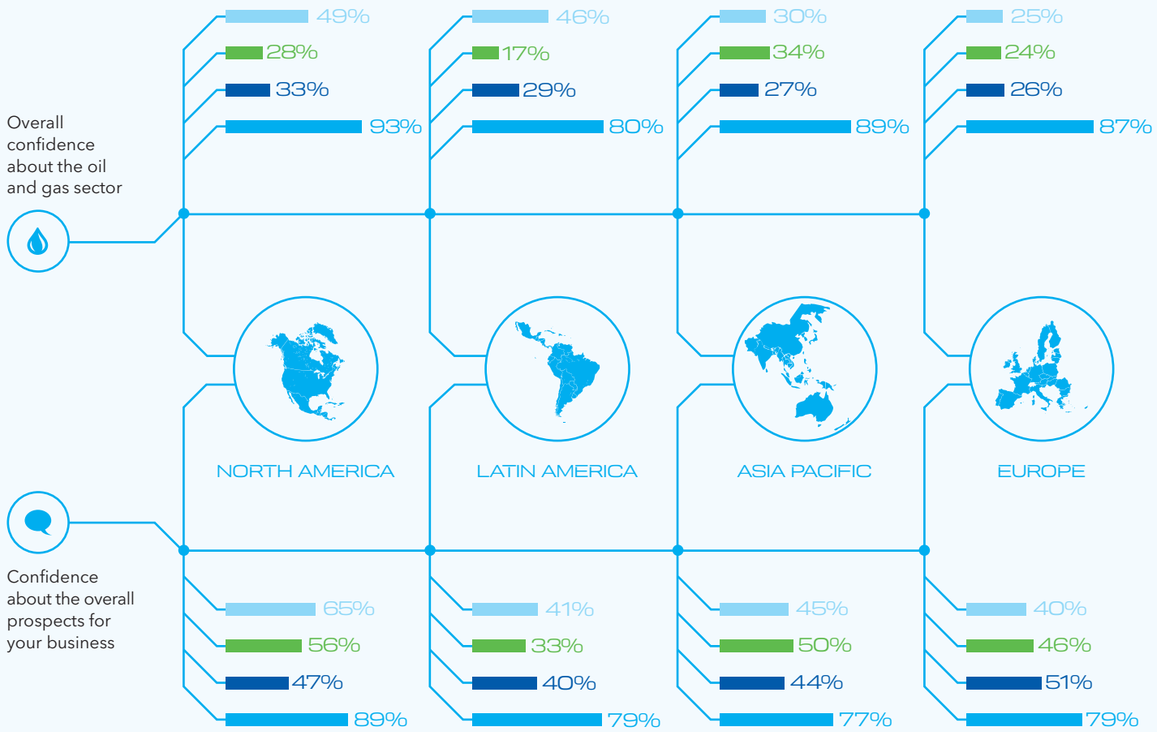
Oil price vs overall industry confidence



Oil price calculation: average oil price (WTI, Brent) during relevant fieldwork periods (Source: eia.gov)

1 www.econlib.org, Creative Destruction: The Concise Encyclopedia of Economics: http://bit.ly/2k4bjWg
2 www.outsourcingportal.eu, Oil: The Commodity We Love to Hate: http://bit.ly/2jCqtVR
3 For the purposes of this report, we have defined company sizes by annual revenue according to the following bands: small (USD500m or less), medium (USD500m to USD5bn) and large (USD5bn+)

Industry confidence by region



Declines and delays

Some industry players have fared well in the challenging market over recent years, but they now need to battle harder. For example, a number of engineering, procurement and construction (EPC) companies had long-term projects under way before capital expenditure (capex) spending was cut back. "We did not see a decline in our operations immediately," says Jan Arve Haugan, chief executive officer of EPC services company Kværner. "We had major contracts that we got back in 2012 and 2013. This, combined with some few additional contracts in 2014, 2015 and 2016 kept our order book strong through the first part of the downturn. However, the timing of potential new projects is now, of course, very uncertain."

This kind of delay is also evident in the downstream sector. "One of the characteristics of the last year is that, while refining margins were very high in 2015, these have been significantly reduced in 2016," says Thore E Kristiansen, chief operating officer (E&P) and executive director at Portuguese integrated energy company Galp Energia.

Downstream businesses will be looking at new ways to improve efficiencies in their refining operations in 2017 – particularly in Europe. "There is an oversupply in refining capacity in Europe," says Kristiansen. "So it is critical to be very competitive and have control of the cost side of the business."

Meanwhile, fresh opportunities have emerged in recent years for some parts of the industry. New production markets have seen strong demand created for pipelines and other transport infrastructure and services, for example. Douglas Westwood expects 309,000km of onshore pipeline to be installed globally between 2015 and 2019 – an increase of 11% over the previous five-year period.[4]

The price barrier

The oil price is once again expected to be the biggest impediment to the industry's growth prospects in 2017, with 64% of respondents citing it as a top three barrier. Only one third (34%) of respondents to our survey expect the oil price to rebound in 2017; 28% expect it will not, and 35% expect similar prices.

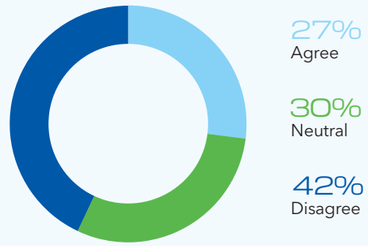
Oversupply remains a major concern. In fact, a larger share (61%) than in 2016 (55%) expects global oil and gas supply to continue to outpace demand in 2017. The unusual feature of this downturn is how long it is taking for low prices to materially affect supply. "The oil and gas supply losses from currently deferred and cancelled projects will rebalance the market over time, increasing prices," says Rob Van Velden, finance director, Brunei Shell Petroleum. "The question is when, and to what extent."

Of respondents to our survey, 92% expect crude to trade at USD50 per barrel or higher by the end of 2017, while 59% expect USD60 per barrel or higher. This is roughly in line with industry forecasts. In October 2016, just before our survey, the World Bank raised its 2017 forecast for crude oil prices from USD53 to USD55 per barrel, in anticipation of the OPEC deal[5] – a relatively modest adjustment. Similarly, the US Energy Information Agency's 2017 forecast only moved from USD51 to USD52 per barrel on either side of the announcement.[6&7]

As Ye Hua Huang, deputy director-general at the China National Offshore Oil Corporation (CNOOC) Bohai Oilfield Bureau, points out: "The actual amount of production cut will still depend on whether producers abide by what they have agreed on. The cut could also be overshadowed by any increase in production by non-OPEC members." Huang is doubtful that the cut will have a significant impact on the supply-demand imbalance.

> "One of the characteristics of the last year is that, while refining margins were very high in 2015, these have been significantly reduced in 2016."
>
> **Thore E Kristiansen**, chief operating officer (E&P) and executive director, Galp Energia

Is the worst of the industry downturn already over?



4 www.douglas-westwood.com, Operations and Maintenance Activity to Boost Spend: http://bit.ly/2k6WshZ

5 www.worldbank.org, World Bank Raises 2017 Oil Price Forecast: http://bit.ly/2jrLcK0
6 www.eia.gov, Short-Term Energy Outlook - U.S. Energy Information Administration: http://bit.ly/2jP8cm2
7 www.eia.gov, Short-Term Energy Outlook pdf: http://bit.ly/2jP8toQ

Sky-high stocks

Global inventories are also at record levels, which is likely to cushion supply for at least a year.[8] "There's so much supply in storage now that we could be in a situation where supply exceeds demand by a million barrels per day for the better part of one and a half to two years before storage levels are back to normal," says Eirik Wærness, senior vice president and chief economist at Statoil.

Moreover, with new fields coming online outside OPEC – in Brazil, Canada and Kazakhstan, for example – total global production could be higher in 2017 than it was in 2016.[9]

The market can also respond to higher prices more rapidly than in the past. "The industry is essentially able to react to positive signs much more quickly than has been the case in the past," says Doucette. "What that ultimately means is that, when prices rise, supply can surge which could push prices back down faster than before." Cycles may continue, but the peaks and troughs could be less severe.

The marginal barrel

A lot of that rapid response capacity has been built in the US shale sector, where vast reserves are close to the market and quickly accessible. Innovations in hydraulic fracturing and horizontal drilling allow them to use these technologies flexibly on existing wells to exploit the hundreds of wells already drilled, particularly in the Permian Basin.[10] Using this approach, production can be ramped up or down significantly within a matter of days in reaction to market changes, with minimal capex investment.

Over the past two years, the US industry has been more resilient than those in other regions, cutting costs rapidly to adapt to new conditions. There are now signs that investment and drilling are picking up. Wall Street provided more than USD20bn in funding to US oil companies in 2016.[12] And despite a year with 40% lower capex than 2015,[13] spending on drilling machinery went up in the third quarter of 2016 – the first time in two years – while the number of rigs in operation climbed by 50% between May and November 2016.[14]

Not surprisingly, then, respondents based in North America report significantly higher confidence in the outlook for 2017 than those in other regions. Almost two-thirds (65%) are confident of their company's overall prospects, compared with 45% in Asia Pacific, 49% in the Middle East & North Africa, and just 40% in both Europe and Latin America.

"In the US, confidence is still not where it really needs to be, but it is showing some signs of progress in the right direction," says Graeme Pirie, vice president at DNV GL. "A lot of our American customers are able to make money at USD25 per barrel for some areas of onshore development, but other sources are costlier. Once you get into fracking and unconventionals, it becomes a little bit more expensive: USD40 to USD50 is a more sustainable threshold there."

These numbers are more important than ever outside the US, with some analysts of the opinion that global oil prices are now set not by OPEC production but by the marginal cost of US shale production.[15] It is unclear whether that is a shorter- or longer-term phenomenon, but in 2017 the increase in activity in the US market could be a bigger factor than the OPEC accord.

> "There's so much supply in storage now that we could be in a situation where supply exceeds demand by a million barrels per day for the better part of one and a half to two years before storage levels are back to normal."
>
> **Eirik Waerness**, senior vice president & chief economist, Statoil

Capital investment

The last quarter of 2016 saw some major capex investments approved. Mexico's deepwater oil block auction was a resounding success,[16] BP approved the USD9bn Mad Dog 2 project,[17] and Total and China National Petroleum Corp signed a USD6bn agreement to develop Iran's South Pars gas field.[18] This follows Chevron's announcement, in the middle of the year, that its Kazakhstani joint venture, Tengizchevroil, will proceed with a USD36.8bn development to increase crude oil production at the Tengiz oil field by an estimated 260,000 barrels per day.[19]

In the midstream sector, Phillips 66 will invest USD1.5bn in transportation and its natural gas liquids businesses, including significant investments in terminals and pipelines in the southern parts of the US.[20] Further down the chain, meanwhile, three of India's state-owned oil companies (Indian Oil Corp, Bharat Petroleum and Hindustan Petroleum) announced plans to invest a collective USD20bn in refinery expansion by 2022.[21]

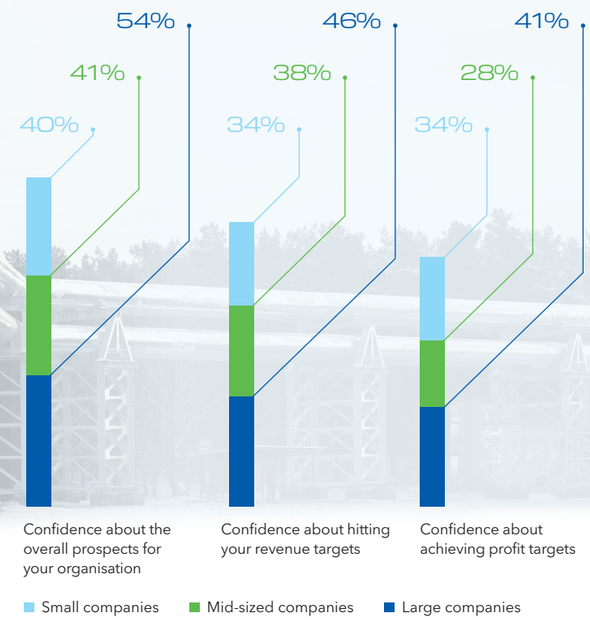
With an estimated 2,000 energy assets available globally,[22] is the industry prepared to invest its capital again? Not in 2017, according to our survey. Just 12% of respondents expect increases in capex this year, down from 17% in 2016. For comparison, 45% were expecting capex increases in 2014 – following a few years of oil at a relatively stable USD100 per barrel.

"Even though prices will start to increase, it may take time before we see large increases in capex," says Statoil's Wærness. "A lot of companies will use the opportunity to improve their balance sheets before they invest. We need to see a decent period of higher prices before capex picks up significantly."

In the meantime, 52% of respondents will favour investments in more agile projects (those that are producing within shorter timeframes) – up from 45% in 2016. "The idea of kicking off a mega-project that may take five years to produce a return is much less likely," says Graham Bennett, vice president at DNV GL.

This reflects the uncertainty pervading the oil and gas industry, which has reached new heights since the US presidential election and OPEC's announcement. Early indications are that the new US administration will be a net positive for the oil and gas industry there, potentially reducing taxes, building infrastructure and relaxing regulations. But policies that restrict international trade could have serious ramifications for highly globalized resource industries such as oil and gas.[23]

Confidence in oil and gas industry and respondents' own businesses



8 www.iea.org, oil market report: http://bit.ly/2k3Wc3j
9 www.ft.com: http://on.ft.com/2jZfxyD
10 www.reuters.com, U.S. shale's message for OPEC: http://reut.rs/2jZggjh
11 www.wsj.com, U.S. Shale Firms Are Ready to Pump More: http://on.wsj.com/2j8DiEf
12 www.economist.com, A tricky time for oil producers: http://econ.st/2iHREus
13 www.reuters.com, U.S. oil companies cut 2016 capex by $54 billion: http://reut.rs/2iHWWGk
14 www.wsj.com, Energy Firms Step Up Business Investment :http://on.wsj.com/2iADzUo
15 www.bloomberg.com, Oil and Gas M&A Seen Accelerating: http://bloom.bg/2jn8654
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17 www.ft.com: http://on.ft.com/2jyp5Uk
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19 www.chevron.com, Chevron Approves Next Major Tengiz Expansion Project: http://bit.ly/2k3UZsV
20 www.bizjournals.com, Phillips 66 reduces 2017 capital budget: http://bit.ly/2jwnwGB
21 www.reuters.com, India's $20 billion refinery expansion to cut fuel oil output: http://reut.rs/2iHZLXR
22 www.bloomberg.com, Oil and Gas M&A Seen Accelerating: http://bloom.bg/2jn8654
23 www.thenational.ae, Why globalised energy markets are worth defending: http://bit.ly/2jneCZw

02

DEEPER COST-EFFICIENCY EFFORTS ARE EXPECTED

Over the past two years, cost-cutting has become the oil and gas industry's best chance of improving profitability, which is reflected in this survey. In an identical result to 2016, one-third of respondents (34%) are confident that they will achieve their profit targets for 2017. The defining characteristic of this group? Close to nine out of 10 (87%) believe that their organization has successfully cut costs in 2016.

"There is great pride, and rightly so, about the massive progress that has been achieved in cost-cutting," says Christoph Frei, secretary general and CEO of the World Energy Council. "Across the board, the sector has managed to achieve amazing efficiency increases."

The focus on cost control looks set to continue in 2017, with 84% of respondents expecting it to increase or remain at current levels – a little lower than the 92% of 2016. Cost efficiency is also the top priority in 2017 for 34% of respondents; 51% have it as a high priority, while just two per cent will not focus on cost efficiency in 2017.

Naturally, with so much being done to reduce costs, few (11% of respondents) are expecting to increase operating expenditure (opex) in 2017 – down from 15% in 2016. Where spending is set to increase, the most popular areas are those connected to operational savings: spending on the efficiency of assets in operation is set to increase for 47% of respondents, while 41% will increase investment the standardization of operations and 39% will increase spending on extending the lifespan of assets.

The cost revolution

Cost inflation had been rising sharply for more than a decade prior to the drop in oil prices. In 2013, when WTI (West Texas Intermediate) oil averaged USD98 per barrel, corporate returns on average capital employed (ROACE) for energy companies was lower than in 2001, when oil prices averaged USD27.[24] This had previously been hidden by the high oil price, but it is now in full daylight. As the 'lower-for-longer' oil price reality continues, survival for many rests on rapid cost reductions and cutting complexity as margins erode.

Exploration and production companies (E&Ps) have been especially effective at achieving cost-efficiency targets, with 89% reporting success. "Depending on their size and where their portfolio is, some of the upstream-only companies have needed to be more short-termist in how they've looked at their organizations, and how they've reacted from a cost perspective," says Brian Sullivan, executive director of IPIECA, the global oil and gas industry association for environmental and social issues.

As a result, upstream-focused companies are now dramatically more cost efficient than they were just two years ago.

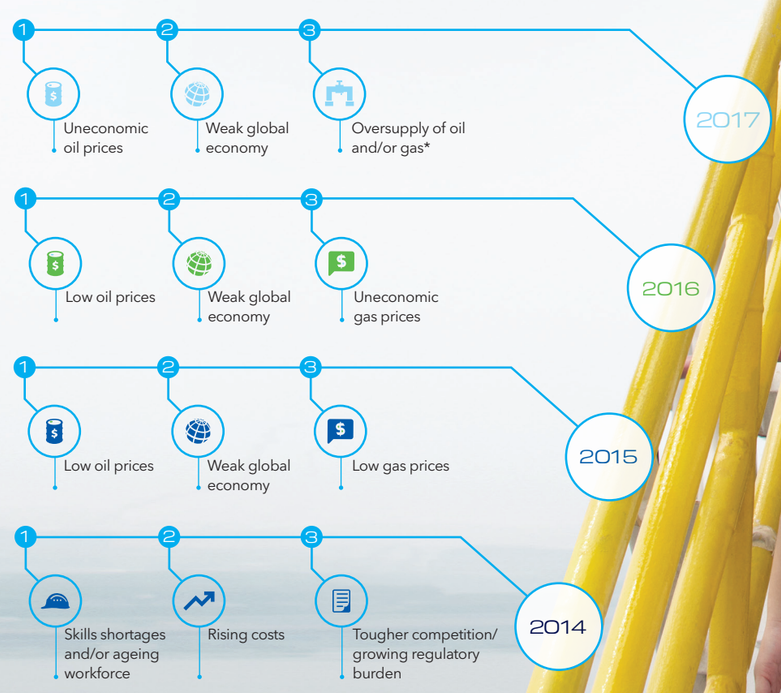
Priorities for cost cutting in 2017

"We've seen a drastic reduction in exploration drilling costs," says Kristin Færøvik, managing director of Lundin Norway, an operator that is primarily focused on the Norwegian shelf. "The rates have come down on almost everything."

Over the past 12 months, Galp Energia has cut by 25% its overall costs for drilling completion. "A year and a half ago, we were negotiating sixth-generation offshore rigs at USD600,000 to USD650,000 per day," says executive director, Thore E Kristiansen. "Now, you can get the same rigs for USD250,000 and even below."

BP's Mad Dog 2 is a dramatic example of how costs have changed. Estimated at USD20bn before the price falls, the project was given the green light at USD9bn in late 2016, thanks to a significant redesign and negotiating lower prices with suppliers. BP chief executive Bob Dudley told the *Financial Times* that the deal proves that big deepwater projects are still viable in current conditions, "if they are designed in a smart and cost-effective way".[25]

Top three barriers to growth, by year

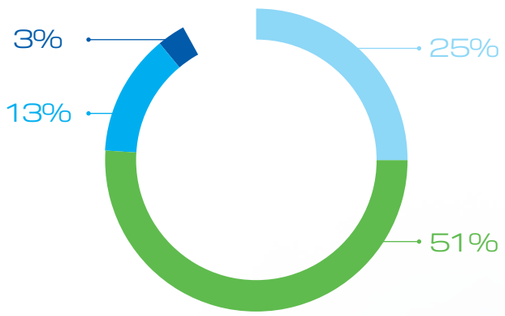


*Option introduced for the first time in 2017

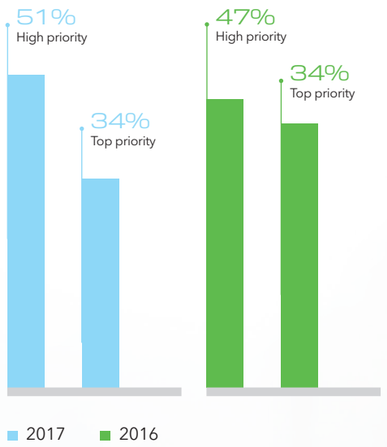
24 www.ogfj.com, HS: Escalating Costs Driving Diminishing Returns For Oil And Gas Companies Despite Stronger Oil Prices: http://bit.ly/2jPjXsH

25 www.ft.com, http://on.ft.com/2jyp5Uk

How successful have organizations been in achieving cost efficiency targets in 2016?



To what extent will cost efficiency be a priority in the year ahead?



Cost cutting only gets harder

The impressive cost gains to date have included the 'low-hanging fruit'. Unless prices rebound and the industry awakens, deeper and more substantial measures will be needed in 2017. "The 'easy' cost-cutting is done," says Brunei Shell Petroleum's Van Velden. "And much of it was done under the expectation that oil prices will rise again."

For 2017, a significant portion of the industry (38%) will pivot from capex efficiency drives to more challenging opex cuts. A lot of this is likely to come from the workforce, with 25% expecting to cut costs from the labour force in 2017.

"We now need to work on sustainable and more creative solutions to maintain competitive cost levels for the longer term," says Van Velden. "This will require more than renegotiating rates with contractors. Competitive scoping and tighter workflow management will be needed, along with different ways of working in partnership with our key suppliers to create win-wins for all."

Pain down the chain

Keeping the supply chain healthy in this way has not been the norm in recent years. This period has been so severe that, instead of reaching agreements to sustain critical partnerships, operators have squeezed the supply chain to the point where some face bankruptcy, find themselves forced into mergers, or transition to other industries.

We see evidence of this in this year's survey. Over half (55%) of respondents from smaller companies (those with annual revenue of less than USD500m) are likely to diversify into – or invest more in – opportunities outside the oil and gas sector in 2017.

"Since the downturn in the oil price, the supply chain has faced substantial pressure from the procurement desks of operators, who are renegotiating even quite recently agreed contracts," says DNV GL's Bennett. "This has strained many long-standing relationships between operators and their suppliers, and damaged trust within the supply chain."

Unfortunately, this is a trend that shows no signs of stopping in the year ahead: 27% of those we surveyed are looking to cut costs by pressuring suppliers to reduce their prices, compared with 27% going into 2016.

"While operators look at improved profits following a recent rise in the oil price, the suffering in the supply chain is likely to continue in 2017," says Maria Moræus Hanssen, chief executive officer for the E&P business of global energy supplier, ENGIE.

Safety and risk management blind spots

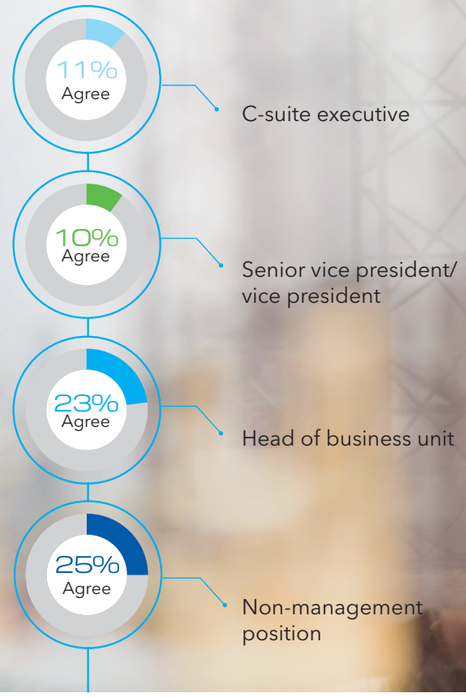
Further reductions in the labour force are likely in 2017, with 55% of respondents expecting headcount in their organization to decrease in 2017. One-third (33%) also expect cuts in spending on training and competence.

This raises a key question for all industry leaders in 2017: is the intense pressure on suppliers and staff creating a safety time bomb?

Only 10% of respondents to our survey expect health, safety and environment (HSE) spending to rise this year, down from 15% in 2016. CNOOC's Ye Hua Huang says that the industry has not been investing enough in safety. "Safety facilities and management are affected when you cut costs. Many use cheaper facilities and cheaper services. Will that lead to accidents this year? Maybe. We all need to be careful about safety all the time – no matter what the oil price is. It can never be compromised."

Our survey asked respondents whether cost-cutting initiatives in their organization are increasing health and safety risk. Only one in five (19%) said yes, but there is reason to believe that this underestimates the issue. "I think it is easy for the industry to say that safety has not been affected," says Bennett. "But if you look at some of the recent feedback from regulators, they are seeing signs of a deteriorating picture for safety." Unions are also concerned. In late 2016, the UK's Unite union reported that 58% of offshore workers (from a survey of 700) believed health and safety standards had dropped in the industry during the previous six months.[26]

To what extent are cost-cutting initiatives increasing health and safety risk?



One reason why the industry may have a blind spot in this area is the time lag between spending cuts and accidents. "Cutbacks in investment do not produce an immediate safety impact; their effects are felt in the medium term, so it is difficult for the industry to claim that safety has not been affected, as they do not yet have the operating data to support that statement," says Bennett. "But the lack of investment in inspection, maintenance, competency training and the physical fabric of installations will come back to bite hard if it continues into 2017."

A related issue is the distance between the boardroom of the budget-setters and the risks in the field. Senior management often have good sight of formal indicators (such as lost-time injuries or days away from work) but can sometimes be too far from operations to see things like corroding steel, failing pipework, structural problems or workforce overload.

In line with this picture, our survey finds that those in more senior positions are more confident about safety risk than lower-level employees. In our survey, just 11% of c-suite executives believe that safety risks have increased as a result of cost cutting, compared with 23% of those in non-management positions. Part of the problem, as Bennett says, is that "bad news doesn't travel upwards as fast or as far as good news. Lower-level employees may not be sharing issues with those higher up."

26 www.bbc.com, Offshore industry safety standards have fallen, says Unite union: http://bbc.in/2jGjRpq

03

LONG-TERM IMPROVEMENTS ARE BEING MADE

The harsh realities of the low prices are accompanied by some positive changes and opportunities that may leave many organizations in a better position to thrive in the decades ahead.

Several of these opportunities come through strongly in our survey. For example, 63% see most of their current cost-efficiency measures as a permanent shift towards a leaner way of working. "The key learning for us is that, should there be an increase in the oil price, we need to make sure that we maintain the strong cost focus so that expenses do not escalate again," says Galp Energia's Kristiansen.

Some have doubts about how long cost controls will last,[27] but it looks likely that a significant turnaround would be needed to convince the industry to relax them in the short-term. In the longer term, meanwhile, a significant, global energy transition – towards gas and renewable energy sources, coupled with increasing energy efficiency – might mean that the excesses of the past never return.

"After this period of volatility, our management is very aware that we must always be careful to invest cautiously, optimize costs, and improve efficiency," says CNOOC's Ye Hua Huang. "We can't abandon this cautious strategy when prices are high. We need to adopt a consistent approach."

In this sense, we may be at a point where the oil and gas industry finds a way to thrive in a future without the long, strong bull markets of the past.

Collaboration

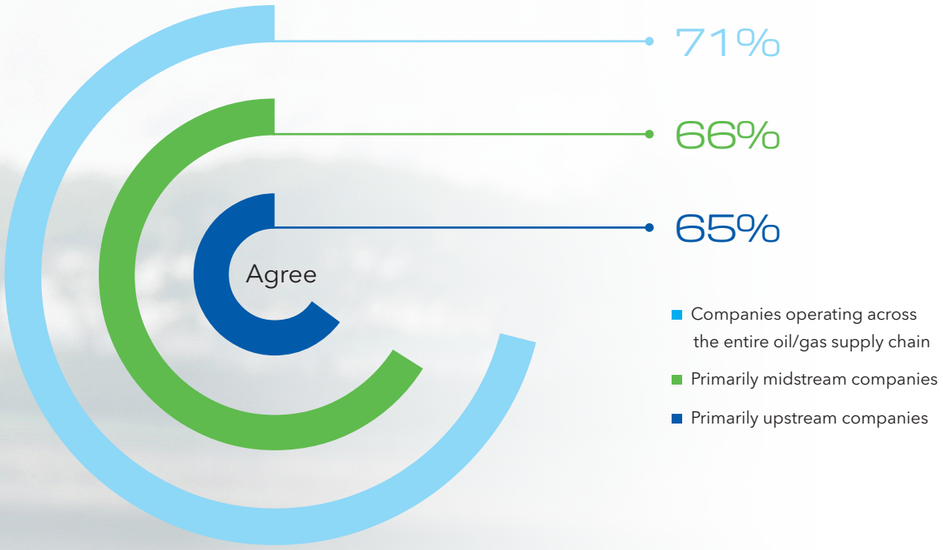
A more immediate positive effect of recent market challenges is that industry players are working together to a greater extent than ever before. Two-thirds (66%) of our survey respondents say that cost pressures are driving more industry collaboration.

The most-cited drivers behind the move to collaborate more are to make new projects financially viable (cited by 51% of respondents), to reduce risk/downside exposure (42%), and to access skills they do not have (33%). "Operators are starting to depend on smaller, more agile players, with the majors becoming financiers to a lot of projects, as opposed to implementing them," says DNV GL's Graeme Pirie. "It is to do with their cost structure. Independents and smaller companies are a lot nimbler, and majors are realizing that sometimes their work models prohibit them from being cost effective."

"After this period of volatility, our management is very aware that we must always be careful to invest cautiously, optimize costs, and improve efficiency."

Ye Hua Huang, deputy director-general, CNOOC Bohai Oilfield Bureau

Are cost pressures driving greater industry collaboration?



27 www.ft.com, http://on.ft.com/2iN0UNQ

Standardization and simplification

Collaboration is also increasing standardization efforts. "The sector is talking, in an unprecedented way, about working with competitors to use standardization to support joint efficiencies," says the World Energy Council's Christoph Frei. "That defines, to an extent, a new reality that the sector can be proud of."

Much of this has been enabled by joint industry projects (JIPs) to solve common technical challenges. For example, a cross-industry project led by DNV GL to halt the boom in unnecessary subsea documentation shows that implementing a standardized approach can significantly reduce engineering hours. According to a contractor in the JIP, subsea documentation increased by a factor of four between 2012 and 2015.[28]

A benchmarking exercise by one JIP participant showed that adoption of the recommended practice that resulted from the initiative could deliver a 42% potential reduction in engineering hours. The savings come from reduced reviews by reusing documents, having more standardized documents and avoiding unnecessary reviews of non-critical documents.

Seven in 10 (69%) respondents to our survey expect the industry to increase global standardization activities in 2017, up from 61% in 2016. Larger organizations are doing more to standardize tools and processes: 81% expect to achieve greater standardization in 2017, compared with 72% of medium-sized companies and 61% of smaller companies.

The industry is already seeing some of this much-needed simplification: 49% of our survey respondents agree that the industry downturn is helping to reduce the complexity of projects and operations.

It is increasingly clear that, despite conditions being varied across the industry's diverse operations, much can be done to simplify oil and gas operations. "But even when a platform is unique to a particular reservoir, if you break it down into the different pieces each piece might have a standard solution," says Kværner's Jan Haugan. "If you then industrialize the process of putting those pieces together, that still simplifies the process and reduces the costs."

66%

of respondents say cost pressures are driving them to collaborate more with industry partners

66%

say their organization will seek to achieve greater standardization of tools and processes during 2017

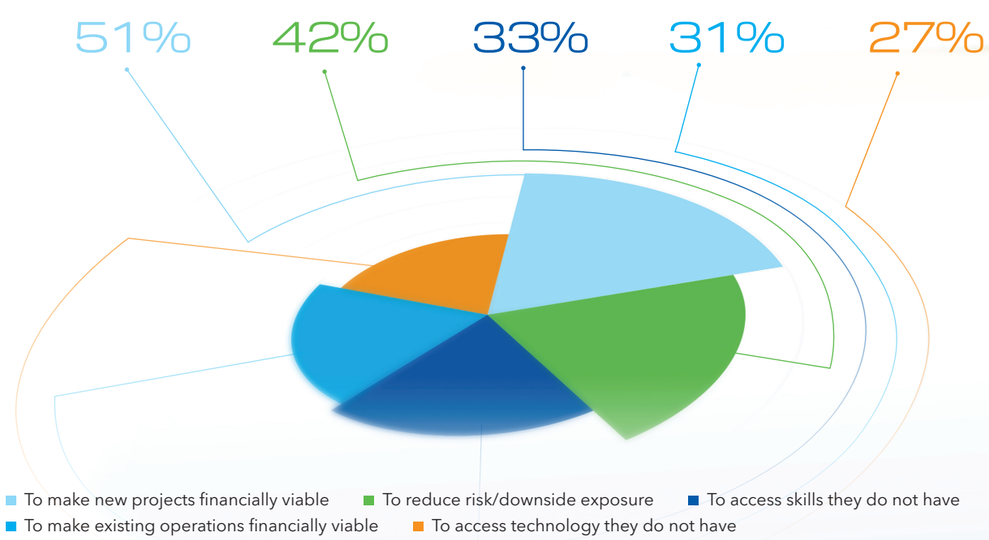
63%

say most of their cost efficiency measures are permanent changes

"The sector is talking, in an unprecedented way, about working with competitors to use standardization to support joint efficiencies."

Christoph Frei, secretary general, World Energy Council

Why are respondents increasingly collaborating with other industry players?



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04

THE OIL AND GAS INDUSTRY IS REORGANIZING FOR A NEW ERA

Another defining feature of today's energy market is the increasing speculation about the ultimate future of oil and gas. There is greater debate than ever – and more uncertainty – about when oil demand will peak. The International Energy Agency (IEA) suggests 2040[29] and OPEC says 2029,[30] while some believe it will be earlier, even as soon as 2021.[31]

Beyond cyclical patterns, there are signs that recent years could be the beginning of a new reality for oil and gas companies. So as we begin 2017, much of the industry is focused not just on surviving the low prices, but also on reorganizing for a new era. The key consideration though, is how rapidly we are moving into that new era.

Global energy supplier ENGIE, for example, is refocusing its business towards downstream services. Maria Moræus Hanssen, CEO of its exploration and production business, says that this fundamental shift in the company's strategy is driven by three Ds: decarbonization, decentralization and digitalization. "These three words describe mega trends, and they are what we are aiming to reposition ourselves towards," she says.

"There are definitely some deflationary trends in the energy industry that are new, such as renewables and shales," says Shell's Maarten Wetselaar, "but these are limited in the effect they can have in the near-term." Wetselaar cites the fact that renewables are restricted to applications that can be electrified, with electricity currently providing only 18% of the world's energy.[32] "While we see growth in electrification, it won't happen overnight. And the deflationary impact of shales, while significant, is also limited, given the size of overall oil and gas production," he says.

Focus on diversification

One of the most striking findings in this year's survey is that half (49%) of respondents say their organization is likely to diversify into (or invest more in) opportunities outside of oil and gas in 2017.

"Diversification is definitely something that every player in the industry is looking at," says Statoil's Eirik Wærness. "Whether it is to diversify across the value chain or into other energy sources, companies are trying to make future cash flow less dependent on variations in the oil and gas price."

Manufacturers report the strongest intentions in this regard, with 61% likely to invest outside oil and gas. Meanwhile, 57% of midstream companies are gearing up to cross industry boundaries. Even among primarily upstream companies – which arguably have the least transferrable capabilities – 40% are likely to invest or diversify away from oil and gas in 2017. These high numbers signal a major shift in long-term strategies in the industry.

The rise of renewables

Investing in renewable energy sources is an obvious choice for many companies. Particularly as prices have fallen to the extent where, in most cases, subsidies are no longer necessary for these energy sources to be profitable.[33] In our survey, 26% of respondents expect their renewable energy investment to increase in 2017, and 41% say that their organization has a good understanding of how to assess investments in renewable technologies.

"Companies across the spectrum are redesigning themselves as energy companies – not just as oil and gas companies," says the World Energy Council's Christoph Frei. "Many have started talking about their 'energy blend' – increasing the importance of renewables and electricity."

Total's 2016 investments in solar power and batteries reflect this widespread trend of operators and national oil companies increasingly directing funds into renewables.[34] In the short term, however, it is difficult to see renewables becoming a significant source of revenue for oil and gas companies. As DNV GL's Graham Bennett says, "We need to recognize that we're talking about small investments relative to a typical oil and gas project and the overall capex portfolio of the oil and gas operators."

The renewables trend is complicated by uncertainty around peak demand. When should an oil and gas company plant the seeds of a new renewables business if they want it to bear fruit at the right time? "Companies need to maintain a certain level of investment in renewables," says Ye Hua Huang of CNOOC. "If you don't, you lose the existing market and you lose the chance to be a major player in the future."

Beyond energy

Some companies are also looking to diversify into areas beyond the energy sector. For example, Viper Innovations, a UK engineering firm, is applying its expertise in electrical cable integrity technology in subsea control and distribution systems to other industries.[35]

In Norway, mechanical engineering specialist EnerMech has reacted to weaker oil and gas markets by securing a contract with the Norwegian Defence Estates Agency to maintain its fleet of cranes and other lifting equipment.[36] Malaysia's External Trade Development Corporation, meanwhile, recently reported that companies in Malaysia are diversifying into aerospace in response to reduced opportunities in oil and gas.[37]

Challenges and opportunities in consolidation

Companies are also looking at mergers and acquisitions (M&A) as a way of reorganizing for the future. Shell's USD54bn acquisition of BG Group was a prominent example of this, reflecting the company's expectation that growth prospects in gas are better than in oil, as well as its strategy of increasing the scope of its downstream business.[38]

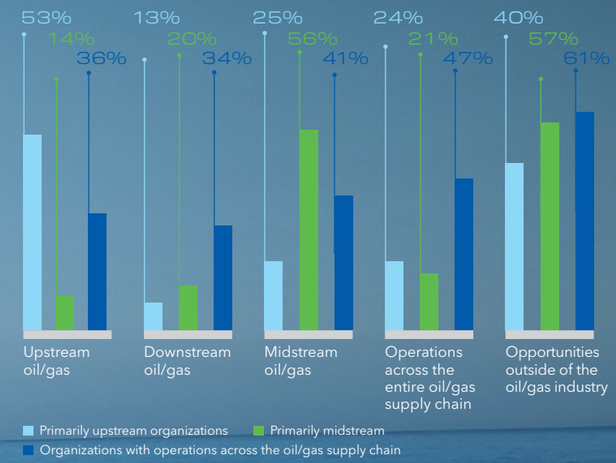
"But there has been no significant large-scale M&A activity, as was the case in the price slump of the early 1990s when we saw mega-companies growing, such as ExxonMobil and ConocoPhillips," says Edward Morse, Citigroup's global head of commodities research. "I think this is down to increasing questioning of the big oil model, and because of the valuations in the marketplace, with few synergies working out at these levels. There are similar issues for medium-sized companies in terms of the struggle to agree valuations."

One-third of our survey respondents (33%) expect their organizations to increase M&A activity in 2017 – a considerable jump from 2016's already significant 23%. Overall, 78% expect increased industry consolidation in the year ahead, which is a continuation of the trend from 2016, when 72% expected the same.

Analysts from Credit Suisse,[39] Wood Mackenzie[40] and Goldman Sachs[41] have also suggested that 2017 could see a significant increase in M&A activity in the industry. "Because there is such a pressure on margins, there will be continual opportunities for companies with strong balance sheets to look for opportunities," says Galp Energia's Thore E Kristiansen. "I see this trend continuing in 2017 – possibly with greater urgency because buyer and seller expectations are getting closer."

But as both Kristiansen and Morse suggest, success will depend on greater consensus around valuations. The past few years have played havoc with people's confidence in what assets are worth and how to calculate future earnings.[42] "It is difficult to negotiate deals that depend on future oil prices," says Eirik Wærness, "when nobody knows what the price is going to be, or how long the downturn will last."

In 2017, how likely are organizations to increase investment in, or diversify into, the following areas?



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05

DIGITALIZATION IS ON THE RISE

The digitalization of the oil and gas sector has been increasing steadily in 2016, with significant progress in digital technologies, including artificial intelligence, automation, predictive analytics and machine-to-machine communication. Among the 15 emerging technologies investigated in our survey, digitalization is the area in which companies are most likely to invest in 2017 – across R&D, trials and full-scale implementations – which indicates that the industry has recognized it as a path to improved profitability and reduced risk.

Among survey respondents, 39% expect their organization's spending on digitalization to increase in 2017. The same proportion report that the low oil and gas prices have increased their focus on digitalization, while 45% say that their focus has remained the same. Only six per cent have decreased their focus on digitalization following the downturn.

Lack of digital culture

Naturally, funding is a major barrier to digitalization for many companies: 30% of our respondents cite it as the joint top barrier. It shares the top spot with the presence of an old-fashioned organizational culture. These two obstacles are closely followed by a lack of awareness among senior management about digitalization and the potential benefits (26%), a lack of the required skills (23%) and bureaucratic/procedural obstacles (20%).

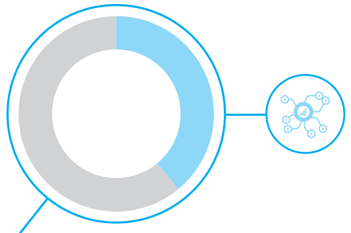
It is striking how, funding aside, these top barriers to digitalization all relate to people and culture. Technical obstacles – such as immature technologies (14%), reliability of data (14%) and access to required data (12%) – fall far down the list.

Also striking is how those in senior positions perceive the problem compared with those further down. Funding is, by some margin, the leading barrier among board members, directors, and c-suite executives. For the heads of business units, however, the top barrier is the lack of awareness among senior management. For managers further down, an old-fashioned culture is by far the greatest barrier.

The data scientists who will be required to bring the oil and gas industry through a digital transformation have different cultural expectations from work, according to ENGIE's Moræus Hanssen. "Data nerds don't show up at work in a suit and tie. They don't sit around tables discussing in long meetings like we do. We saw the need to set up a different type of work environment to reflect this, inviting people with crucial competences to come and interact with us more informally. We needed to change our culture," she said.

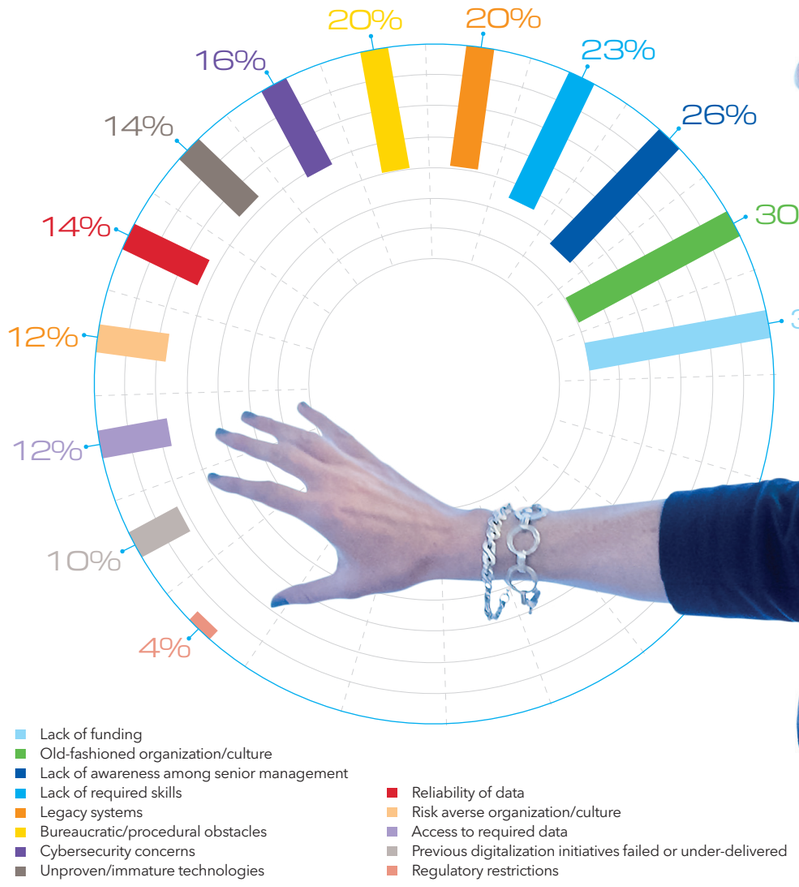
ENGIE has recently established separate digital unit of its business to foster creativity and new ways of thinking that is needed to take on the digital journey successfully.

Organizations expect to increase their spending on digitalization



39%
of organizations operating across the entire oil/gas supply chain

What are organizations' primary barriers to greater digitalization?



Data-driven production

Larger companies are leading the charge towards digitalization: 60% of respondents from large companies say their organization needs to embrace digitalization to increase profitability, compared with 56% of those from mid-sized companies and 45% of those from small companies. Correspondingly, 57% of large companies are expecting to increase spending on digitalization in 2017, compared with 42% of mid-sized and 30% of small companies.

"There's general acceptance of the idea that big data, in particular, is important to the future of oil and gas," says Doucette from GE Oil & Gas. "Many operators are working on how to go about harnessing it. The struggle is to make data meaningful and actionable fast enough to make a difference."

DNV GL estimates that the industry could become at least 20% more efficient by making full use of digitalization,[43] and examples of such transformation can be found throughout the value chain.

BP, for example, is working on digitalizing production platforms. A pilot project announced in November 2016 will use specialized software to gather and process data in real time to help reduce unexpected shutdowns. The operator believes that this initiative alone could improve operating efficiency by up to four per cent.[44]

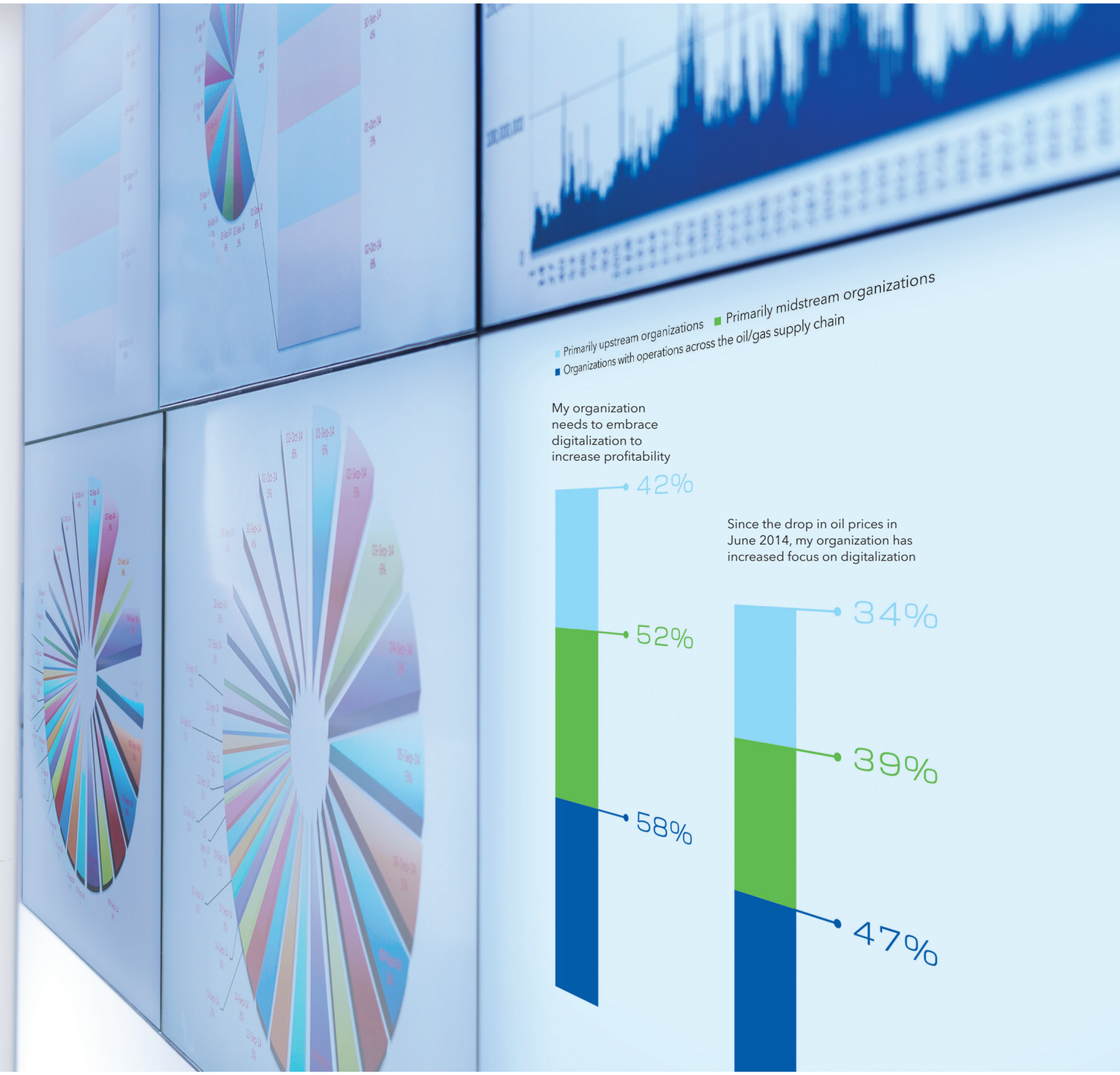
Galp Energia is also aiming to get more value from the massive amounts of geological and geophysical data it collects. Over the past two years, the company has been investing in an R&D project to try to use cognitive computing to make sense of this data more rapidly. "We are putting a lot of emphasis on this project," says Thore E Kristiansen. "We think, if successful, it will enable greater efficiency and more powerful data analysis."

Gasunie, the Dutch natural gas infrastructure and transportation company, has worked with DNV GL to use data analytics to try to match the occurrence and severity of external corrosion of onshore gas pipelines with data from pipelines and their surroundings. The patterns in the data allow Gasunie to estimate the probability of external corrosion occurring.[45] Similarly, SGN, the UK's second largest gas distribution network operator, is working with DNV GL on building real-time gas networks that will use flow and gas quality sensors to manage gas distribution more efficiently while helping to predict customer demand.[46]

> "There's general acceptance of the idea that big data, in particular, is important to the future of oil and gas. The struggle is to make data meaningful and actionable fast enough to make a difference."
>
> **Paul Doucette**, global leader for public policy and external funding, GE Oil & Gas

20%

DNV GL estimates that the industry could become at least 20% more efficient by making full use of digitalization



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IN-DEPTH

01

BALANCING R&D PRIORITIES

Weighing up short- and long-term priorities was a key challenge in 2016, as low prices forced tough decisions. This is particularly pertinent in the context of R&D programmes. So how are organizations striking the balance? How is the current environment affecting R&D strategy?

Only 14% of respondents to our survey expect R&D spending to rise in 2017, while 37% expect cuts in this area – a near identical result to 2016, when 15% and 36% held these views, respectively. Shell's Maarten Wetselaar thinks there has been a shift in the way companies are approaching R&D. "We've seen a few changes and they don't all go in the same direction," he explains. "We see a change in R&D expenditure being directed to near-term performance improvements, either lowering costs or increasing recovery factors, or both. The industry will put less emphasis on chasing 'firsts' in the oil and gas sector."

Statoil's Eirik Wærness thinks drops in R&D activities are quite likely across the industry in 2017. Like Wetselaar, he sees companies aiming to become much more focused than they have been. "The industry needs to concentrate on being able to deliver future projects, specific recovery rates and other key goals," he says. "There is likely to be less general, broad R&D activity."

CNOOC is taking this concentrated approach at its Bohai oil field, researching new technologies that can better tap very heavy oil and marginal oil fields to make them commercially viable. Ye Hua Huang, deputy director-general, says: "If you raise the amount of oil produced from an existing field, it can be like finding a new one." This is a smart strategy when new fields are off the agenda. Among those we surveyed, 10% will conduct research on enhanced oil recovery (EOR) in 2017.

Subsea and digitalization top the R&D agenda

Subsea technologies are the leading area for R&D in 2017, according to our survey, with 16% of senior oil and gas professionals expecting to drive innovation in this area. This may be related to the increasing appeal of subsea tiebacks, which provide a less capital-intensive way to access adjacent and marginal oil and gas fields.[47] For example, in mid-2016, Woodside Energy and Mitsui E&P Australia announced the development of the Greater Enfield area, off the coast of Western Australia, which was only possible through advances in tiebacks.[48]

Subsea processing is a relatively young and undeveloped field of technology, requiring operators to tailor solutions to field-specific requirements. DNV GL has started a JIP with Petrobras, Shell, Statoil and Woodside to deepen industry knowledge and encourage progress in this area by examining the potential for standardization in subsea processing – beginning with subsea pumping.[49]

Operators around the world are investing in ways to reduce maintenance, inspection, drilling and production costs for subsea oil and gas. Statoil, for example, has worked with Kongsberg Maritime, the Norwegian University of Science and Technology and Inventas to develop snake-like robots that can swim to the sea floor to conduct visual inspections, clean components and make basic adjustments to valves and chokes. Once rolled out, the robots are expected to save a significant slice of subsea costs.[50]

Robots are also set to transform other segments. In the UK, National Grid Gas Transmission has developed a robot called GRAID (Gas Robotic Agile Inspection Device), which can inspect the interiors of high-pressure gas pipelines.[51] The GRAIDs are expected to cut asset maintenance costs by reducing the need for excavations, while also providing data that can be used to extend the life of assets.

With 39% of our survey respondents having increased investments in digitalization, it is no surprise to see it as the second most popular area for R&D in 2017: 14% expect to invest in digitalization this year. At BP, for example, despite overall R&D budget cuts, digitalization R&D spending has increased.[52]

Much of the investment in digitalization is also related to efficiency. Indeed, for significant numbers of respondents in our survey, new technology (15%), smarter use of data (15%) and automation/IT modernization (12%) are ways in which their organization is looking to cut costs.

The importance of collaboration

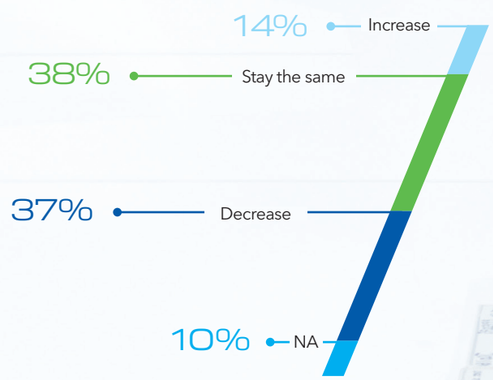
If 2017 is as tough as 2015 and 2016, R&D budgets will continue to be scrutinized at many organizations. But the drivers and the focus areas of industry R&D are also shifting. Parts of the services sector increasingly depend on being able to offer innovations that increase the cost efficiency of projects for their customers. "I think that the R&D has shifted significantly from oil companies of various sizes to the services sector," says Citigroup's Edward Morse, "There, I think technological change has not relented. In fact, I think that the price downturn has accelerated focus on a variety of pockets in the service sector, for example raising production rates with fracking technologies in oil sands."

The shift Morse refers to is partly down to the fact that R&D spending is difficult to maintain – particularly in house. "We have limited research capabilities," says Huang. "We can't afford to conduct all the R&D activities by ourselves through running our own laboratories while also keeping a huge staff, so we partially rely on the skills of local universities and specialized companies."

More collaboration will help support R&D in 2017. Our survey indicates that 22% of respondents are increasing collaboration to maintain their innovation agendas. But these relationships need reliable, continual funding, as well as mutual commitment from both sides. "Operators and research firms are under pressure – this gives us reasons to work together," explains Huang. "If we don't do more sharing, everyone will come to a dead end."

Top 10 priority areas for R&D in 2017

R&D and innovation spending intentions for 2017



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IN-DEPTH

02

THE TWO SIDES OF GAS

This was expected to be the 'golden age of gas',[53] but many are now not so sure about the role of gas in the future energy mix. Gas sits apart from coal and oil: it is the cleaner-burning alternative that can both meet energy demand and support climate change targets. However, fugitive methane emissions, flaring and the impact of production and pipeline roll-outs push its environmental credentials closer to its fossil fuel cousins than renewables. "The story is not as strong as it was, the belief is not as strong," says Liv Hovem, senior vice president at DNV GL. "Gas should be overtaking coal, but prices are not competitive enough."

Leap-frogging gas

Then there is long-term demand. Gas is expected to be the fastest-growing fossil fuel for a few decades, with demand rising at 1.5% per annum to 2040. By then, demand for gas will be 50% up from 2016, making up a quarter of global energy demand, according to the IEA.[54]

However, this trend depends on how quickly the world further adopts renewable energy sources. Five years ago, nobody would have believed that half a million solar panels would be installed every day around the world in 2015. Or that, in that year, China would install two wind turbines every hour – and account for 40% of all renewable capacity increases.[55] If this continues, will the world leap-frog gas and go directly from fossil fuels to renewable sources?

Not according to this year's survey respondents: 77% expect gas to become a more important component of the global energy mix over the next 10 years. Exactly half believe that the role of gas in longer-term energy transition makes it an increasingly attractive prospect for their businesses.

This even split is another indication of diverging perspectives around gas. "I see different strategies," says Hovem. "Some companies are very clearly divesting, especially in upstream gas production, while some are investing. There is a divide between those that want to leave the fossil fuel industry and invest in renewables, and those with strong optimism for the future of gas."

Shell is one company optimistic about gas, evidenced by the company's acquisition of BG Group in 2016, forming the world's largest liquefied natural gas business.[56] "We view gas, not only as a fuel that has an important role to play in the energy transition- as the cleanest of all traditional fuels-but also as a fuel with a firm place in the destination energy mix," says Maarten Wetselaar, integrated gas and new energies director at Shell. "There will be all kinds of pockets of demand that simply need the energy density of a hydrocarbon, from heavy transport to producing steel, as well as chemical applications in glass, plastics, fertilisers and many others."

Falling oil prices have made gas more attractive for 28% of survey respondents. This has prompted 31% to look for new gas projects, and 27% to look for new M&A opportunities in the gas sector. These numbers suggest that significant portions of the industry are looking to gas as a counterbalance to their exposure to oil. This is supported by the fact that many (45%) think gas prices will decouple from oil prices in the long term, meaning that exposure to both could help to smooth the peaks and troughs of energy cycles.

China's role in the future of gas

China's moratorium on coal-fired power generation from 2020 is a significant development for gas, which is seen by some as the most likely fuel to replace coal.[57]

Survey respondents from Asia Pacific are the most convinced about gas's increasing importance over the next 10 years, with 85% in agreement – higher than those in either Europe (72%) or North America (74%).

Coal still produces almost three-quarters of China's electricity, however, and efforts to reduce this still face significant headwinds.[58] "Natural gas has huge potential in China, but apart from a few highly developed cities, most of the country's population cannot afford it," says CNOOC`s Ye Hua Huang. He cites the fact that China does not produce enough gas domestically, so has to rely on expensive imports. "In the short run, if China's economy doesn't take off quickly, there won't be booming demand for gas," he says. "It will take at least another five years to rival oil and coal here."

Trumped by coal

Gas exports from the US have risen by more than 50% since 2010. In 2016, the country became a net exporter of natural gas for the first time in 60 years.[59] But, as in China, there is considerable uncertainty around longer-term demand. Much of this will depend on developments in both domestic and international policy. "The uncertainty about environmental regulations in the US calls into question the role gas will play versus coal," says GE Oil & Gas's Paul Doucette. The rise of shale gas may have seen the US's CO_2 emissions fall, but coal has one huge benefit: "At the end of the day, coal is really cheap," he adds. "If price becomes the only thing to think about, we will see more coal power generation."

> "We view gas, not only as a fuel that has an important role to play in the energy transition- as the cleanest of all traditional fuels-but also as a fuel with a firm place in the destination energy mix."
>
> **Maarten Wetselaar**, integrated gas & new energies director, Shell

Network effects

Considerable infrastructure development is also required to support gas expansion. The IEA estimates that USD9.4trillion will be needed to build a network to support secure and reliable global gas supply to 2040.

It isn't just a long-term challenge, either: 25% of our survey respondents think that demand for onshore pipelines will exceed supply in 2020. More than one third (35%) believe that this will drive an increase in onshore pipeline projects over the next three years.

Renewable synergies

On balance, says DNV GL group CEO and president Remi Eriksen, "Gas and renewables are likely to be 'frenemies' – healthy competitors and allies – for a while, since gas can provide baseload electricity to complement variable renewable power."

This will require greater collaboration between the sectors. For example, a power-to-gas value chain could be developed where surplus electricity from offshore wind is converted to hydrogen for use in traditional infrastructure. A JIP managed by DNV GL is already developing the technical guidelines to make sure this process is safe and cost effective.[60]

Examples like this, along with the considerable momentum of gas supply and demand, suggest that gas will still play a key role in shaping the long-term fortunes of companies throughout the global resources and energy industries.

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IN-DEPTH

03

A NEW ERA FOR SUSTAINABILITY

In such a cost-driven environment, it is encouraging to find that just three per cent of the senior oil and gas professionals we surveyed are scaling down their sustainability initiatives.

"I have to admit I'm not seeing any compromises being made in response to the low oil price," says IPIECA's Brian Sullivan. "Companies now view sustainability as part of their licence to operate – not as something that could be compromised." Sullivan also points out that 2016 saw the fastest growth in IPIECA's membership for five years.

The majority of survey respondents (57%) report that their organization has environmental performance targets in place – and 81% of those are meeting them. Midstream companies are leading the way in the application of environmental targets (71%), ahead of both upstream companies (53%) and those with operations across the whole supply chain (57%).

Beyond Paris

For many in the industry, the 2015 United Nations Climate Change Conference (COP21) agreement amplified existing long-term thinking about renewables and sustainability. It both solidified and accelerated plans for a global evolution towards cleaner forms of energy over the decades ahead.

> "When growth is a struggle, competitiveness becomes very sensitive. You can't afford to lose any advantage."
>
> **Christoph Frei**, secretary general, World Energy Council

"I think we can see a clear big-picture shift and, if anything, that shift has accelerated in the oil price downturn – moving us towards less CO_2-rich technologies, and adding a tremendous push to the innovation agenda," says the World Energy Council's Christoph Frei.

The agreement came into force in November 2016, so the post-COP21 era has only just begun. But already 21% of respondents report that their organizations have increased their sustainability efforts as a result of the 2015 agreement. Similarly, one-in-five have also increased sustainability efforts as a result of the UN's sustainable development goals, which were adopted in September 2015.

On the day COP21 came into force, several major operators – BP, Eni, Repsol, Saudi Aramco, Shell, Statoil and Total – announced a joint investment of USD1bn over the next 10 years to develop clean energy solutions, with carbon capture and storage (CCS) systems being the first area of focus.[61]

It is a significant step, but much more is needed to meet the 1.5°C limit in temperature increases favoured under COP21. Governments will need to employ "every known technological, societal and regulatory decarbonization option," as the IEA puts it.[62]

Business sense

Maria Moræus Hanssen, chief executive officer for ENGIE's E&P business, says that the transition to renewable energy is not only about decarbonization. "It is also a new competitive space where your customers suddenly become your competitors."

Ultimately, sustainability needs to make business sense. This is especially pertinent when prices are low. "When growth is a struggle, competitiveness becomes very sensitive," explains Frei. "You can't afford to lose any advantage."

CCS adoption is a case in point. It is one of the more expensive technologies for CO_2 reduction, and if countries and companies are not moving to CCS at the same rate, then those that move first may feel they are undermining their competitiveness. "That is obviously a big barrier to introducing CCS at scale," says Frei.

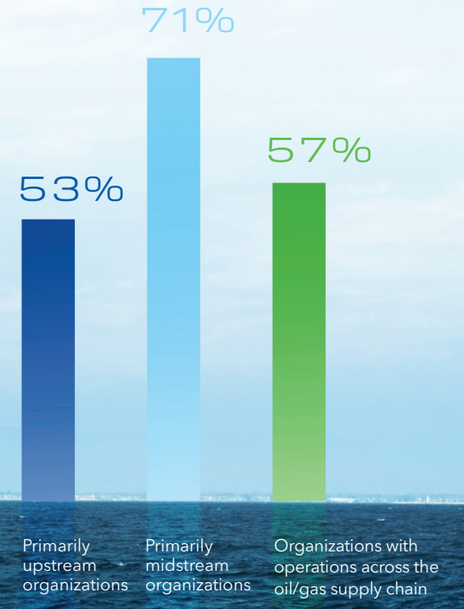
However, several technologies are available today that reduce carbon footprints without reducing profits.[63] For example, several energy efficiency strategies have the dual impact of reducing both emissions and costs, making them ideal candidates for implementation in the year ahead.

A DNV GL study of operations on the Norwegian Continental Shelf (NCS) identifies a number of cost-effective CO_2 abatement measures, such as process control and optimization, power management, performance monitoring, energy storage and flare management. The study demonstrates that these measures can support a 29% reduction in the current CO_2 emissions from offshore production on the NCS, while securing significant cost savings.[64]

Environmental performance targets

57%
of survey respondents have environmental performance targets in place

How successful are industry players in applying environmental targets?



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64 www.dnvgl.com, Oil and gas industry must do business differently to meet sustainability targets, says DNV GL:http://bit.ly/2iFcvDa

Profits drive decisions

This year's survey has revealed a divergence in relation to environmental performance between profit-optimists (those expecting to hit their profit targets in 2017) and profit-pessimists (those not expecting to hit their profit targets).

Profit-optimists are more likely than profit-pessimists to view transparency around environmental performance as a competitive advantage in 2017 (58% compared with 48%). They are also twice as likely to be spending on environmental impact reduction (25% compared with 10%) and emission controls (22% compared with 11%).

Profit-optimists are more likely than profit-pessimists to have environmental performance targets (65% compared with 50%) and to be meeting these (87% compared with 77%). What's more, they are less likely than profit-pessimists to have seen cost-cutting negatively affect their environmental performance (14% compared with 20%).

It seems that financially healthier companies are often greener companies.

Regulators and investors turn up the heat

GE's Paul Doucette believes that, on balance, that many in the industry are willing to support sustainability targets – but regulations will be crucial. "If regulatory drivers are absent," he says, "then the cost equations may not compelling enough, especially in the current environment."

Investors are also increasing the pressure on the industry. In the US, the Securities and Exchange Commission and the New York Attorney General's office are investigating ExxonMobil over how transparent the company has been about the impact of climate change mitigation policies on the company's reserves.[65] Shareholders want to know how oil companies will deliver future profits.

These developments have made investments in renewable energy more important, but more as a long-term strategy than an urgent priority. The industry is not showing signs of immediate concern about the competitive threat from renewables. "There's been a mild push to diversify into renewables," says Edward Morse of Citigroup. "I don't think it in any way reflects a fear in any of the large companies that they're in immediate jeopardy of the oil demand peaking any time soon."

Along with the IEA and other forecasters, 57% of survey respondents expect prices of renewable energy generation (wind, solar, etc.) to continue to fall in 2017. Tellingly, however, only seven per cent of respondents select renewables as a top three barrier to growth in 2017.

Organizations' environmental performance

65 www.economist.com, How to deal with worries about stranded assets: http://econ.st/2iWvEPF

CONCLUSION: SHORT-TERM AGILITY, LONG-TERM RESILIENCE

Our research this year reveals an industry in flux. It is still adapting to significant shifts in price dynamics, and is coping with considerable uncertainty around whether the current conditions set the tone for the future, or whether the cycle will swing up again as it has before.

"A year ago, we were all recognizing that we would have two consecutive years of very low investments in our industry," says Kristin Færøvik of Lundin Norway, "but the down cycle has lasted longer than most people anticipated."

As Graham Bennett of DNV GL points out, "It might not just be 'lower for longer', it could well be lower forever, and in the meantime, oil and gas companies need to rebuild their reserves. They need to start plans for developing new fields in 2018 and 2019 and beyond in order to retain shareholder value."

As a result, companies across the value chain must work carefully to ensure that they are set up to survive and thrive in the short term, while thinking in greater depth about the longer term and evolving their organizations to suit what could be a new reality.

In 2016, many larger operators have been successful in this pursuit, but our survey results suggest that smaller companies and specialists have not been as successful – for these companies, 2017 will be a critical year to get right.

Volatility ahead

Many are of the opinion that the industry faces more volatility. "It has taken longer than most people expected to balance supply and demand – particularly with the supply levels we are seeing, combined with a relatively moderate demand growth," says Eirik Wærness of Statoil.

> "It's too early to call an end to cyclicality. Maybe the extremes will be more moderate, but it is also still possible that if we test the system too much we will go back to the extremes."
>
> **Maarten Wetselaar**, integrated gas and new energies director, Shell

Shell's Maarten Wetselaar agrees. "My medium-term perspective is that we will need to see some firming of energy prices in order to trigger enough investment to keep the energy system in balance, but I see more volatility in the near-term," he says. "The focus will continue to need to be on resilience and lowering costs."

As to whether the industry has truly begun to change forever – breaking the boom-bust pattern for good – it may only become certain in a few years. "It's too early to call an end to cyclicality," says Wetselaar. "Maybe the extremes will be more moderate, but it is also still possible that if we test the system too much we will go back to the extremes."

Despite near-term uncertainty, creative destruction is happening in the oil and gas industry. But it cannot happen quickly. Unlike camera film, VHS and taxis, the world cannot switch away from oil and gas over the course of a few years. But a gradual process of major change in energy supply and demand – expected for a generation – has now begun in earnest. Oil and gas companies must now decide where, when and how to stake their claim in the energy markets of the future.

> "Oil and gas companies need to rebuild their reserves. They need to start plans for developing new fields in 2018 and 2019 and beyond in order to retain shareholder value."
>
> **Graham Bennett**, vice president, DNV GL – Oil & Gas

> "It has taken longer than most people expected to balance supply and demand – particularly with the supply levels we are seeing, combined with a relatively moderate demand growth."
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> **Eirik Wærness**, senior vice president & chief economist, Statoil

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Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. Operating in more than 100 countries, our professionals are dedicated to helping our customers in the maritime, oil & gas, energy and other industries to make the world safer, smarter and greener.

DNV GL is the technical advisor to the oil and gas industry. We bring a broader view to complex business and technology risks in global and local markets. Providing a neutral ground for industry cooperation, we create and share knowledge with our customers, setting standards for technology development and implementation. From project initiation to decommissioning, our independent experts enable companies to make the right choices for a safer, smarter and greener future.