



The future of gas

The role of natural gas in the
future global energy system

February 2018

Introduction from our President

There's an elephant in the room of the global energy system and it's called natural gas... For it to fulfil its potential long-term role in the future low carbon world, more must be done to clean up how it is produced and how it is burned.



Malcolm Brinded
CBE FEI FREng

There's an elephant in the room of the global energy system and it's called natural gas. It looks like a golden age for gas in many ways, with unconventional production soaring and global LNG trade forecast to more than double by 2040 (International Energy Agency [IEA] 2017). But at the same time the world has committed to keeping global temperature increases within 2°C, requiring net zero emissions in the second half of this century.

Even natural gas's cleaner-than-coal and friend-to-renewables advantages will not be enough to square this circle. For it to fulfil its potential long-term role in the future low carbon world, more must be done to clean up how it is produced and how it is burned.

At last year's International Petroleum Week in London, the UNFCCC's Patricia Espinosa applauded action to tackle greenhouse gas emissions by some in the oil and gas industry, but called for it to enter the DNA of all.

The IEA, in its World Energy Outlook 2017, has since assessed that much more could technically be done during production and distribution to reduce leakage of methane, a greenhouse gas 28–36 times more potent than CO₂ over 100 years, to a large extent at net zero cost. Further, it suggests that one of the reasons why this potential exists is lack of awareness.

So the Energy Institute, which works closely with its members and partners to ensure energy is produced safely and securely, decided to gauge this awareness by surveying the views of professionals working in oil and gas around the world.

Could it possibly be the case that awareness and behavioural – not just technological – issues are holding back progress towards a viable, long term role for natural gas in the future low carbon energy system?

Most respondents are bullish about the role of natural gas through to 2050. They expect it to still play a major role across the heat, industrial and power sectors, but also in transport, where it currently plays only a minor role. Such growth is expected to be partly due to conversion to hydrogen – and inevitably will come at the expense of oil. Much of this use of natural gas is expected to be abated, particularly in the electricity sector. While this is an encouraging assessment, a gap still exists to achieve the ambition set out in the Paris Agreement (Energy, Climate Change & Environment report, IEA 2016).

Oil and gas professionals take a largely positive view of the potential to tackle carbon emissions from combustion. Those surveyed believe carbon capture and storage (CCS) has the greatest potential of any technology to reduce emissions in the natural gas lifecycle. Of those working in potentially relevant organisations, just over half report that their organisations are active in advancing the CCS case. It is likely that moving from a few demonstration projects to full-scale implementation will require much more widespread policy support. However, nine out of ten respondents believe that industry has a primary role to play in developing and implementing CCS, with half of these emphasising the need for government-industry cooperation.

But on methane leakage during production, our findings are

less encouraging. Too many professionals underestimate the significance of fugitive emissions, and the possibilities for reducing it cost effectively. Two thirds of respondents expressed surprise at the extent of the problem and these possibilities.

This lack of awareness around methane suggests a significant opportunity may be being missed by the industry within its own operations – an opportunity that is likely to be very cost-effective compared with other greenhouse gas reduction measures.

The Energy Institute, as the sector's independent professional body, is here to help address the realities of the energy system. In most scenarios gas has a significant and positive role to play for decades into the future. Similarly, the evidence around climate change, and the need to avert its worst impacts, are beyond doubt. The solution to this particular elephant will be technological, but must also be behavioural.

This report's findings are a call for action across the industry to make 'the best' 'the normal'. Just as health, safety and environmental protection are now embedded in our operating cultures, tackling climate change in all ways needs to become equally – and profoundly – part of our business-as-usual. It is central to our future licence to operate; it must enter all our DNA.

Malcolm Brinded
CBE FEI FREng
President, Energy Institute

25%

Global energy demand to be satisfied by natural gas in 2040

80%

Share of gas demand growth to 2040 driven by developing economies

75%

Avoidable methane emissions in current natural gas supply chain

What will the future of gas look like?



“It’s hard to imagine a pathway to a lower emissions future that does not include natural gas, something this report highlights. Gas has a significant role to play in fulfilling the energy needed to ensure development for all countries, complementing renewables, and delivering a clear climate and clean air benefit, especially when compared to coal. In combination with carbon capture use and storage (CCUS), it can become a very low emissions fuel for electricity production and industrial use.

These two elements are well identified by the report, and reflect two key focus areas for the Oil and Gas Climate Initiative (OGCI) working to enable CCUS development for gas and aiming towards near zero methane emissions in the gas value chain. The more cleanly gas is produced, processed and transported, the bigger the benefit in tackling climate change.”

Gérard Moutet,
Executive Committee
Chairman, OGCI

Global oil and gas professionals believe gas will play a major role across sectors through to 2050. Transport is particularly notable; over half of respondents expect gas to provide a significant proportion of primary transport energy, contrasted with the relatively minor role it plays today. While the majority of respondents believe natural gas will be phased out or abated in some way, the level of unabated use they expect is not in line with achieving the Paris 2°C commitment (IEA 2016). This is particularly the case for the heat sector, where nearly half of respondents expect its unabated use to persist.

Over 80% of the surveyed oil and gas professionals see continued gas use in the heat, power and industrial sectors. There is agreement among many respondents that decarbonised natural gas will retain a significant long-term role in the global electricity (56%) and industrial (48%) supply mix, assuming availability of carbon capture and storage (CCS) technologies. However, a considerable proportion of respondents predict continued use of unabated natural gas through to 2050, specifically in the heat sector (47%) and to a lesser degree in the industrial (40%), electricity (31%) and transport (30%) sectors.

Only a small proportion (<4%) of respondents expect natural gas to have been phased out entirely globally by 2050. A slightly higher proportion predict that natural gas will have been

replaced by alternatives such as biomethane or hydrogen, or reduced through demand-side response (DSR) methods, most strongly in the heat sector (16%).

Almost a third of the respondents anticipate that unabated natural gas will continue to play only a minor role, mainly in a form of LNG in shipping or CNG in road transport. A quarter of respondents believe that natural gas has potential to become a significant, long-term transport fuel source if it ties its future with hydrogen.

Natural gas’ role in the 2050 energy mix will be driven by a combination of market, policy and technology factors, primarily: climate policy, air quality concerns, and price relative to other fuels.

These three factors were ranked equally highly by respondents, though their impacts are likely to vary temporally and geographically. Though climate and price as key issues are perhaps unsurprising, the prominence of air quality as a global driver of natural gas use is of note. The next most significant drivers are increased use of natural gas in transportation (as LNG, CNG or feedstock to hydrogen), followed by the extent of industry support and leadership in gas network decarbonisation, and non-climate policies and regulations. Public sentiment is also expected to influence the future role of natural gas, but to a lesser extent than other factors.



Through to 2050, what primary (highest volume) role will natural gas play in the global energy mix for each of the following sectors?

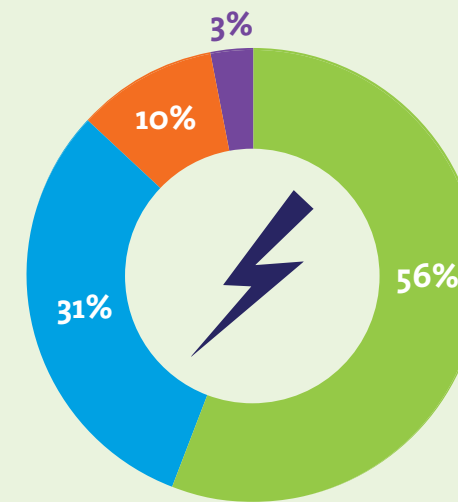
Electricity N=175 (number of respondents);

Industry and Transport N=181;

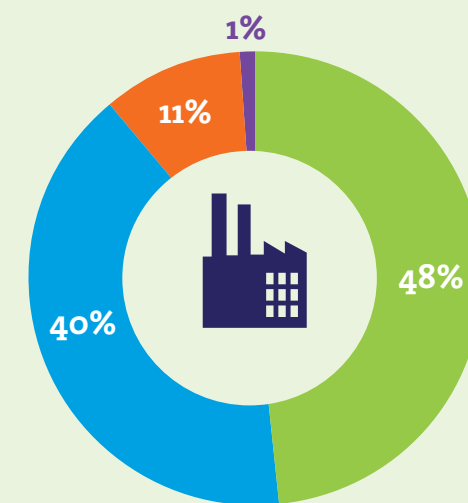
Heat N=177;

‘Other’ responses not shown on these charts.

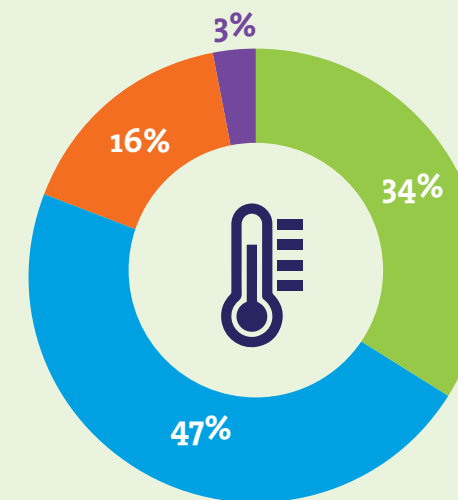
Reported as percentage of respondents.



ELECTRICITY

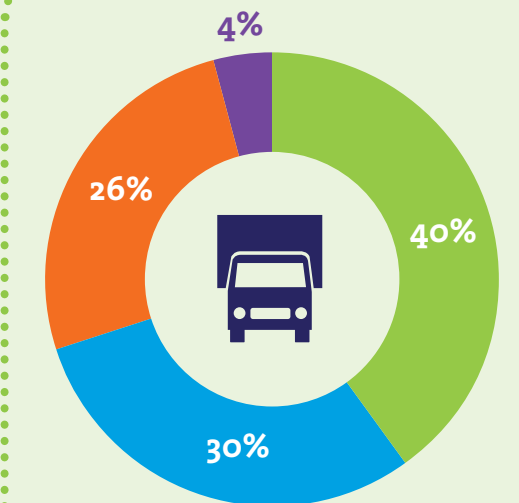


INDUSTRY



HEAT

- A long-term decarbonised energy source, assuming availability of CCS technology
- Continue with unabated use
- Phased out and replaced by alternatives, eg biomethane or DSR
- Phased out entirely



TRANSPORT

- Continue to play a minor role (ie, for LNG in ships or CNG in road transport)
- Provides a significant proportion of transport fuel, unabated
- Provides a significant proportion of transport fuel, as source for hydrogen
- Phased out entirely

What are the best measures for decarbonisation?

Global oil and gas professionals see carbon capture and storage (CCS) as essential to decarbonising natural gas, and believe their own industry has a primary role to play in its development.

Respondents ranked large-scale CCS deployed at point of combustion as the most effective technological measure to reduce natural gas emissions. When asked who should lead on developing CCS, industry does not shy away from its role. 46% of respondents believe that their industry should take the lead in developing the technology and pilot plants without relying on government support, while 42% think that CCS should be developed and implemented through close cooperation between industry and government. Only 7% responded that CCS should primarily be the responsibility of governments to either mandate or sufficiently incentivise.

Of those respondents whose organisations could have some involvement with CCS (those who did not select 'N/A'), just over half report that their organisations are active in advancing CCS.

Of the respondents in organisations that could be involved with CCS, 27% support early stage CCS R&D, 24% are involved in some large-scale CCS pilots and projects, 22% try to mobilise government support for an appropriate policy framework to support CCS development and 15% work in some way to make CCS a more investable proposition. In total, just over half of respondents (55%) indicated that their organisation was involved in one or more of these efforts to advance CCS. 42% of organisations have opted not to undertake any activity towards its development.



“The high proportions of respondents replying that industry should lead in developing CCS, and whose organisations were already involved in CCS in some way, indicates that there is interest and activity relating to CCS in these sectors.

However, scaling CCS technologies up to full scale demonstrations is not straightforward, and 42% of respondents felt that the development of CCS requires ‘close cooperation between industry and government’. It is now crucial for governments to work with industry to understand what such a ‘close cooperation’ could look like, and what each party’s most effective role could be in relation to CCS development.”

Dr Nick Hughes,
UCL Institute for Sustainable Resources



“Using natural gas – the cleanest-burning hydrocarbon – is already helping countries reduce carbon dioxide and improve air quality where it replaces coal and diesel. To realise greater greenhouse gas emissions benefits, the gas industry must increase its focus on reducing emissions of methane across the value chain – from production to the final consumer. Every company in the industry must take control of this issue. Measure emissions accurately. Report them in a transparent way. And continually reduce emissions to maximise the full greenhouse gas advantages of natural gas.”

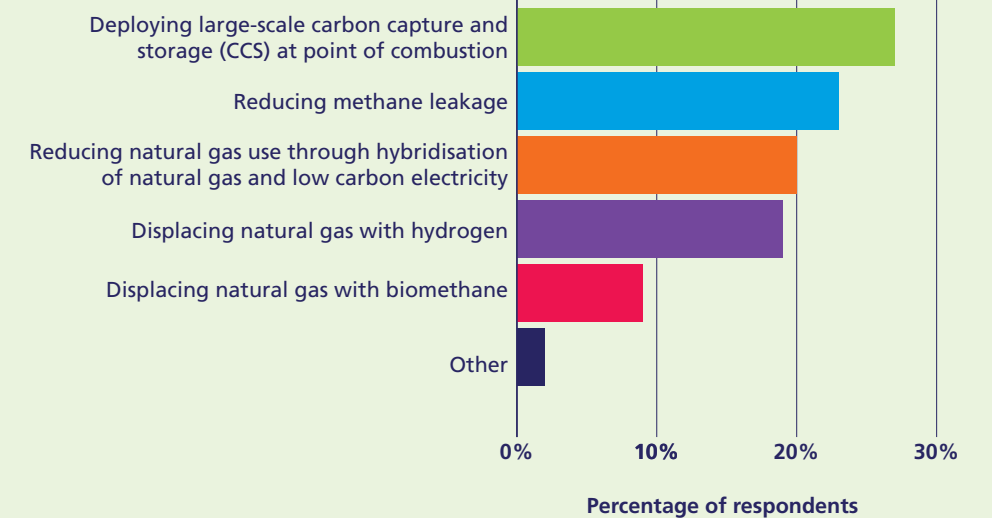
Maarten Wetselaar,
Integrated Gas and New Energies Director,
Royal Dutch Shell



What would be the most effective technological measure to reduce emissions from production and consumption of natural gas?

N=188

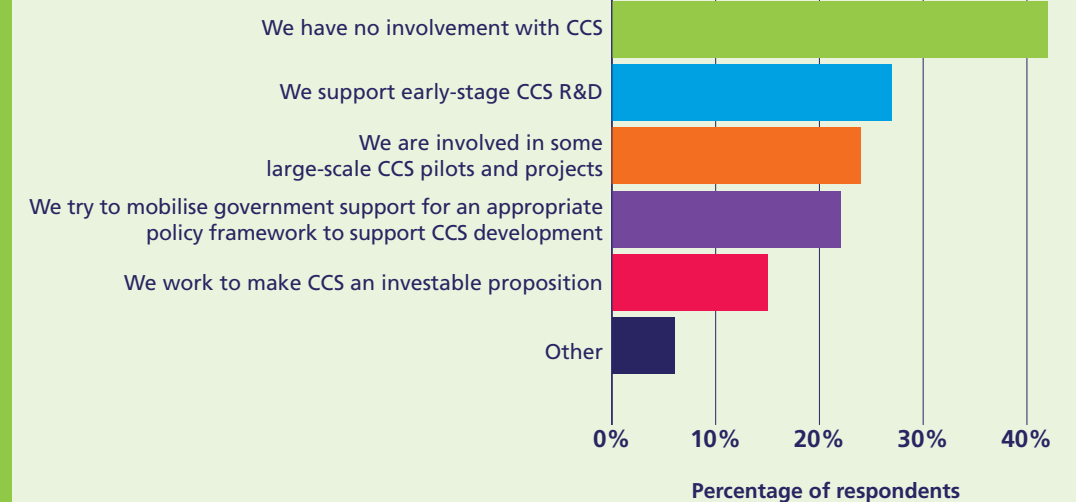
Results ordered by weighted rank.



Which of the following statements describes the level of activity around CCS within your organisation?

N=121 ('N/A' responses [n=68] not shown on this chart).

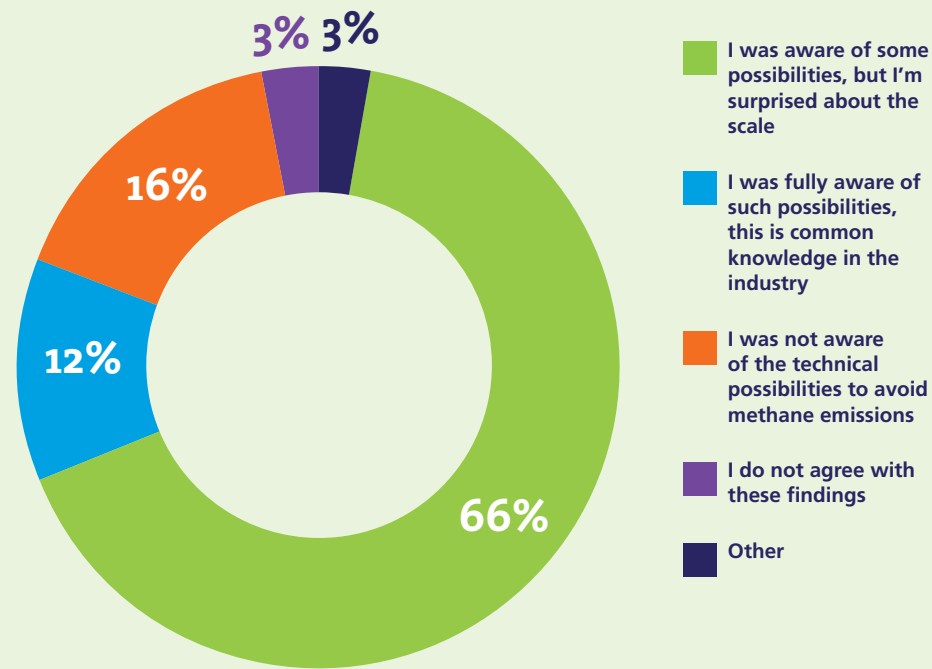
Respondents could choose more than one response.





The IEA's World Energy Outlook 2017 finds that it is possible to avoid 75% of current methane emissions in the natural gas supply chain, and that 40–50% of these emissions could be avoided at no net cost. Which of the following statements most accurately describes your response to these findings?

N=189
Reported as percentage of respondents.



After CCS, respondents ranked 'reducing methane leakage' as the second most important technological measure to reduce emissions from natural gas. However, the majority of respondents had underestimated the significance of methane leakage for lifecycle emissions associated with natural gas, particularly the possibilities for reducing them.

Oil and gas professionals were asked about their familiarity with the IEA's recent World Energy Outlook 2017 findings, which demonstrated that it is possible to avoid 75% of current methane emissions in the natural gas supply chain, of which 40–50% could be avoided at net negative cost because of the value of the methane saved. Overall, a significant majority (66%) revealed that despite being aware of some technological options, they are surprised about the scale of possibilities to combat methane leakage. 12% of the surveyed professionals state that these figures are regarded

as common knowledge in the industry, while a greater portion of respondents (16%) admit a lack of awareness of this subject.

Of those respondents from organisations directly responsible for fugitive methane emissions, 49% are proactive about their reduction, with 34% of these putting systems in place to manage them and 15% benchmarking rigorously and aspiring to industry leadership. Meanwhile, a considerable proportion (44%) try to reduce fugitive emissions only where there is little additional cost or effort (25%), or only do what is legally required (19%).

The lack of awareness about the scale of possibilities, paired with relatively high proportions of organisations that show little effort to reduce fugitive emissions, suggests a significant opportunity is being missed in the industry. Overall, respondents are more aware of the potential of CCS, and had not realised the potential of reducing methane emissions.



"We welcome the findings from this EI report into the role of natural gas in the future energy system. Gas has many advantages as a source of energy – demand for gas continues to grow, it is abundant, resilient and flexible – but much of this is conditional on 'getting gas right'. As the report shows, this means detecting and reducing methane emissions and acting on the need for abated gas in all demand sectors in the medium- and long-term. Policy advocacy and working with our customers and governments will be key, but we should not wait for this – our industry holds the keys to driving this forward and making gas a destination fuel for the energy transition."

Dominic Emery,
VP, Group Strategic Planning, BP



"There are multiple technologies and measures available today that can be used to reduce methane emissions from oil and gas operations. Implementing just those measures that pay for themselves, by monetising the captured methane, would have the same long-term impact on mitigating climate change as immediately shutting all existing coal-fired power plants in China.

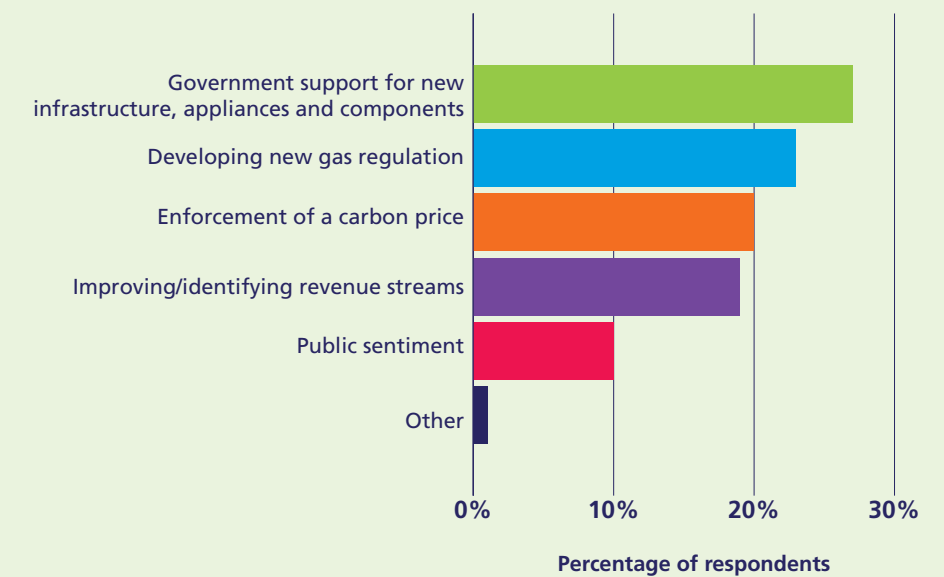
To tackle the issue, policy-makers and industry need ultimately to accomplish two goals: measure and abate. Measurement is critical to assess the efficacy of policy actions and to assure the public of effective implementation. Abatement is critical to reduce emission levels."

Christophe McGlade,
Oil and Gas Analyst –
World Energy Outlook, IEA



What would be the most effective non-technological measure to reduce emissions from production and consumption of natural gas?

N=188
Results ordered by weighted rank.



Oil and gas professionals highlight the importance of a strong policy and regulatory framework to reduce emissions from production and consumption of natural gas.

Government support for new infrastructure, appliances and components, and new gas regulation, are ranked as the most preferred non-technological measures to reduce emissions from production and consumption of natural gas. To a lesser, but still significant extent, oil and gas professionals believe the enforcement of a carbon price and the identification and improvement of revenue streams, e.g. from selling captured methane into the gas grid (IEA 2017), can effectively reduce emissions.

It is notable that policy and regulatory measures are ranked more highly than improving or identifying revenue streams; this perhaps further reflects respondents' surprise at the IEA's findings about the possibilities for reducing fugitive methane emissions. Meanwhile, these findings provide a counterpoint to the leading role that the industry

sees for itself on CCS. While respondents were in favour of the industry taking the lead on development of CCS technologies, government support is identified as the top non-technological measure needed to reduce emissions. Alongside industry leadership, global oil and gas professionals see a role for governments to provide a framework within which industry can deliver on environmental goals.

Method

The Energy Institute (EI) presents EI Views: The future of gas – the first in a series of subject-specific survey-based reports conducted by the EI. The survey was sent to 1350 professionals working in the oil and gas sector, including attendees of IP Week 2017. These professionals were divided roughly equally between the UK and the rest of the world, representing 40 countries. The report reflects the views of these energy professionals on the future of gas in a low carbon economy.

The survey focuses on the role of natural gas in the future energy system. It encompasses a wide range of topics including growth projections, technological and regulatory measures for decarbonisation, the case for carbon capture and

storage, and industry attitudes toward fugitive methane emissions. The questions in the survey were developed by the EI Knowledge Service, under the guidance of industry experts. The views contained in the report text are those of the survey respondents, not of the commentators or the EI. The views contained in the commentary are those of the commentators.

A total of 189 professionals from the oil and gas sector completed the survey online in January 2018. The survey included nine multiple choice questions as well as one free response question. In the report, responses to the questions are presented as percentages of respondents, unless stated otherwise. In the case of questions where

respondents could choose more than one option, percentages add up to more than 100%. The responses were analysed by the EI Knowledge Service to identify key findings and assess major trends within the sector.

The questions

- 1: Through to 2050, what primary (highest volume) role will natural gas play in the global energy mix for each of the following sectors? Choose one for each sector.
- 2: Through to 2050, what primary (highest volume) role will natural gas play in the global energy mix for the transport sector? Choose one.
- 3: What will be the strongest driver of the extent to which natural gas will be part of the global energy mix in 2050? Rank at least 3 by order of importance.
- 4: What would be the most effective technological measure to reduce emissions from production and consumption of natural gas? Rank at least 3 by order of importance.
- 5: What would be the most effective non-technological measure to reduce emissions from production and consumption of natural gas? Rank at least 3 by order of importance.
- 6: The IEA's World Energy Outlook 2017 finds that it is possible to avoid 75% of current methane emissions in the natural gas supply chain, and that 40–50% of these emissions could be avoided at no net cost. Which of the following statements most accurately describes your response to these findings? Choose one.
- 7: Which of the following statements most accurately describes attitudes toward fugitive methane emissions within your organisation? Choose one.
- 8: Which of the following statements describes the level of activity around CCS within your organisation. Choose all that apply.
- 9: What is the most appropriate role for oil and gas companies in developing and implementing CCS? Choose one.
- 10: Do you have any other comments on the role of natural gas in a decarbonised energy system? Free response.

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Kamila Piotrowska, Oil and Gas Producers Association

Nicola Pitts, National Grid

Dr Jamie Speirs, Sustainable Gas Institute, Imperial College London

Philip Swanson, Climate & Clean Air Coalition

Dr Luke Warren FEI, Carbon Capture & Storage Association

Maarten Wetselaar, Royal Dutch Shell



"As the survey shows, addressing methane emissions is unfortunately still new territory for many in the sector, despite the fact that it is 'low hanging fruit' and other stakeholders are increasingly aware of the issue. The Climate and Clean Air Coalition (hosted by UN Environment) created the Oil & Gas Methane Partnership to help oil and gas companies identify the most cost-effective mitigation options. The public-private partnership helps member companies take a systematic approach to managing their methane emissions and provides opportunities for member companies to learn from each other and to publicly report efforts and results."

Philip Swanson,
Administrator, CCAC Oil & Gas
Methane Partnership

“Much has been said about gas as a ‘transition fuel’, with a number of oil companies shifting their hydrocarbon portfolios towards gas. However this report shows that industry professionals tend to underestimate the need to decarbonise gas if the Paris climate commitments are to be met.

The significant finding that energy professionals underestimate both the significance of methane leakage, and the opportunities for reduction, points to the need for wider conversation about ways to reduce the environmental impact of gas. I hope this report can contribute to that debate.”

**Vivienne Cox CBE FEI, Vice President,
Energy Institute**

#FutureofGas

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