



Views from UK energy professionals



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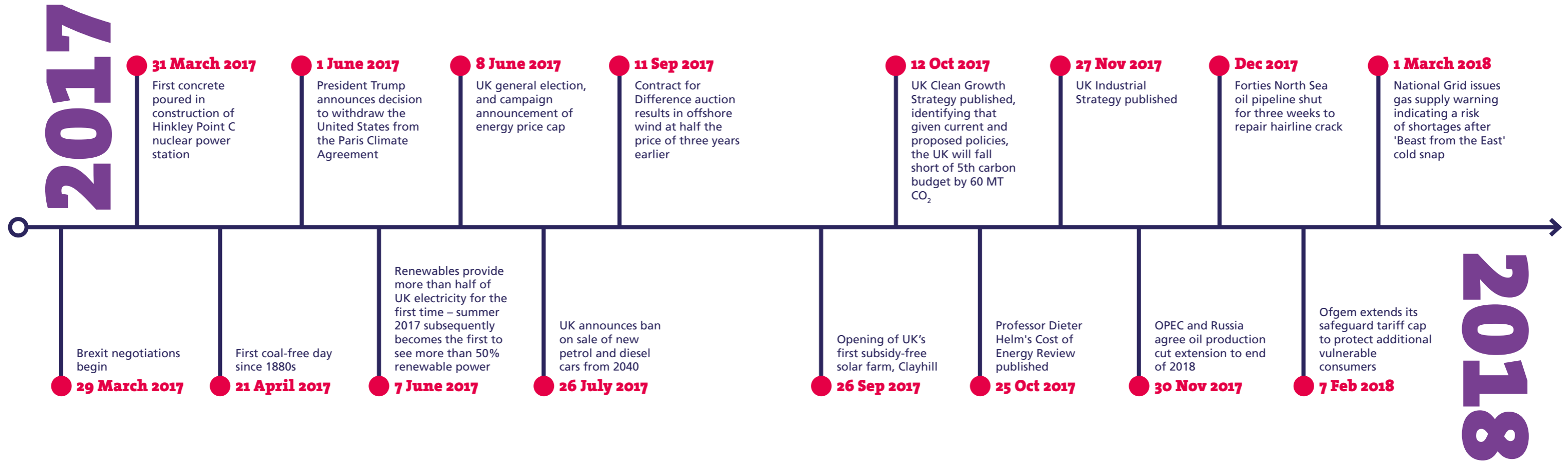
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A year in the life of UK energy

The year since the last Energy Barometer was conducted has seen notable change across the energy world. These developments provide context against which to interpret the findings of this new 2018 survey.



Presidential overview



Malcolm Brinded,
CBE FREng FEI

The past year highlighted the accelerating pace of change in the UK energy system. In particular, the radical shift under way in our electricity system is now happening at a pace most forecasters would have hesitated to predict. A series of ‘firsts’ have seen coal-fired generation all-but eliminated at certain times. Over 2017 as a whole, low carbon made up the majority share of the power mix, thanks to bulk quantities of renewable electrons meeting our needs. Wind and solar – increasingly allied with storage – are challenging the old guard on price and creating a new dynamic at the grid edge, where consumers are waking up to the revenue-generating opportunities.

But I am unable to conclude, based on the findings of this year’s Energy Barometer, that we have shaken off past uncertainties. While the shift to low carbon in the power sector looks to be a consistent trend, the trajectory and pace of the transition in other sectors is still very uncertain.



The challenges the energy industry faces are diverse, but it is **policy uncertainty** that continues to raise the greatest unease among professionals. While UK energy policy is seen to have had a positive impact in some areas – on renewable electricity, low carbon transport and innovation – it is seen as volatile and short-term focused, and especially ineffective in tackling fuel poverty and simplifying energy taxation: both critical inputs for a thriving economy and fairer society.



Although the UK is expected to outdo the **carbon reductions** required during the first fifteen years of the Climate Change Act, the forward picture is much less rosy. The Barometer finds energy professionals now less confident than they were a year ago that the UK will deliver on its targets through to 2032, despite the Government having brought forward its Clean Growth Strategy designed to do so. Indeed 5 times as many Barometer respondents expect us to fall short of the target than expect us to meet it. A third of respondents don’t appear to be aware of the content of the Clean Growth or Industrial Strategies, reflecting the fact that further work is needed to bring them to fruition and communicate them.

Policy shortcomings are exacerbated by unprecedented political risk, notably in the form of Brexit, which has risen from fifth to second in Barometer respondents’ top concerns since last year. Despite ministers being a year further into negotiations with Brussels, the fog of uncertainty around skilled workforce availability and around our future relationship with the EU’s single energy market has not lifted.



This all translates to high perceived levels of **investment risk** – especially felt in the more capital intensive and often less well-proven sectors (such as carbon capture, tidal power, hydrogen and nuclear), which could still play a key role in our future energy mix given the right enabling policies and technology development.

But amid these concerns, the Barometer also finds opportunities for the taking. Lower investment risk is perceived in offshore wind and solar, signalling that economic rewards are still seen in the power sector.

The lowest investment risk and greatest decarbonisation potential, however, is still seen to lie in energy efficiency. For the fourth year in a row, the Barometer identifies energy efficiency as the first port of call for meeting our carbon targets and capitalising on the economic benefits of doing so. This is not a novel view, it’s shared by the

Committee on Climate Change and the Royal Academy of Engineering. But, with UK productivity 18% below the OECD average, it is welcome to see ministers pursuing initiatives aimed at improving the efficiency of our homes, commercial properties and heavy industries – and clear encouragement for even more focus in these areas.

Improved energy efficiency will be especially valuable if Barometer respondents’ views on longer term oil prices are as prescient as their short-term predictions: having correctly called the price increase experienced in 2018, will their \$80–120 average prediction for 2030 come true?



The Barometer also looks to the **UK’s place in the world** energy market. The ability post-Brexit to negotiate new trade agreements with non-EU countries and gain greater financing freedom is seen by some as potentially bringing opportunity in our sector. Within the global context, exportable competitive advantage is especially identified in the UK’s energy-related legal and financial services, smart grid and renewables integration know-how.



The Barometer finds energy professionals confident that major changes in **transport** are closer than many have suggested. They expect half of vehicles on the road to be

low carbon, even before the Government’s proposed 2040 ban on new petrol and diesel engines takes effect. Breaking with a century of automotive convention, electricity, hydrogen and biofuels will, they believe, take over as the majority share of the fuel mix. This complements last year’s Barometer finding, that the UK’s heat mix will also see a rebalancing away from natural gas to alternative sources.

We must not be complacent. It is precisely because the stakes for our economic prosperity and social wellbeing are so high, and because energy professionals are best qualified to understand the complexities and trade-offs involved, that we should heed the picture painted by the Barometer.



But I would highlight one final caveat – the insight we gain from the Barometer College could be even greater if our sector better reflected the talents of our whole society. A gender **diversity** cloud continues to cast a shadow over the potential capability of the energy sector.

This year’s Barometer finds a growing appreciation, especially among younger professionals, of the benefits of diversity to sector productivity, and the value of measures such as flexible working to help bring this about. But a full third of respondents overall say they don’t perceive

the existence of any barriers to diversity. Encouraging? Or rose-tinted? The POWERful Women initiative just last month found that women account for only 13% of boards in the top 80 UK energy companies – and half of those boardrooms contain no women at all. This evidence suggests that there are real barriers, and that much work needs to be done to build awareness of the necessity for change and to make those changes.

Credit for the work involved in producing this report is due to the hard work of the Energy Institute’s Knowledge Service, and the wisdom of its Energy Advisory Panel, chaired by Dr Joanne Wade OBE FEI. Above all, thank you to all the members of the College who generously spared their time to complete this year’s survey. Without them this insightful tool for those shaping the UK’s energy future would not be possible.

Malcolm Brinded CBE FREng FEI
President, Energy Institute

Top three challenges facing energy professionals

Policy concerns persist as Brexit worry worsens

EI members were asked to identify the biggest challenge facing the energy industry in 2018. Three challenges emerged as clear first, second and third most common responses, followed by seven others of relatively equal importance.



Energy policy

EI members contrast current energy policy, which they see as lacking in focus and forward-looking measures, with the need for a transparent policy framework which is informed by evidence, enables clear policy goals and avoids unintended consequences. These policy concerns have emerged as paramount for the fourth consecutive year. They would like ambitious, long-term policies that are well-explained; the Industrial and Clean Growth Strategies were not often cited. Many reference election cycles, Brexit and price caps as potentially interfering with essential policy goals such as decarbonisation and mitigating energy poverty.

Most frequently mentioned with: Brexit



Brexit

There is evident disquiet about Brexit among EI members, even though negotiations have continued over the year. This is now more of a concern than it was last year. EI members cite two main factors: uncertainty around the process and its outcomes, and its diversion of attention away from energy policy and decision making. Potential impacts of Brexit which are seen as particularly challenging are risks to investment, availability of skilled workers, security of supply, access to the single market and UK influence on regulations.

Most frequently mentioned with: Energy policy



Investment and cost

In addition to investment risk from Brexit and policy uncertainty, oil price volatility is expected to impact the flow of finance in 2018. Funding is needed both for projects with long lead times or unproven technologies and also to maintain ageing infrastructure, including fossil fuel assets, during the transition to a low carbon world. EI members cite the need to keep costs down, in particular for low carbon technologies.

Most frequently mentioned with: Energy policy

“Getting government focus, as all are distracted by Brexit. Tough, clear, long-term regulations need to be introduced, so the policy trajectory is known.”

“Meeting climate change targets at minimum cost. Also increasing political and regulatory transparency in order to encourage investment.”

“Preparing for the impact of Brexit and the implications on foreign investment and security of supply.”

“Brexit is so consuming it is preventing energy issues from being discussed properly or fully.”

Other challenges facing energy professionals

"Communication about energy issues to the person on the street. We need to change behaviours, similar to the way plastic waste is currently foremost in people's minds."

"Building public and stakeholder trust in innovative market offerings that will help to deliver the transition to a low carbon, flexible, equitable system."

"Delivering resilient, smart electricity grid infrastructure and policy to enable and encourage increased connection of renewables and storage."

Energy demand and efficiency

EI members would like to see efficiency improved across all sectors and demand reduced and managed where possible. Both are seen as a key part of the UK's decarbonisation pathway, keeping down costs and assuring security of supply. Efficiency is commonly linked to the built environment, and demand management is often referred to in relation to changes in demand, such as demand growth or electrification of transport.

Most frequently mentioned with:
Energy policy

Grid and infrastructure

Changes in the dynamics of supply and demand pose a challenge for the UK's grid and energy infrastructure. Constraints on supply such as ageing infrastructure, decentralisation and a shift to more intermittent sources could be exacerbated by growth in demand (in particular from electrification of transport). EI members expect to see modernisation of infrastructure, new supply sources and electricity storage, and a smart grid that will enable flexibility.

Most frequently mentioned with:
Supply security

Low carbon energy

EI members acknowledge the challenge to decarbonise the UK's economy, including electricity, heat and the energy system as a whole. Specific elements include transitioning away from fossil fuels, keeping costs down (particularly in light of 2017's relatively low fossil fuel prices) and maintaining security of supply.

Most frequently mentioned with:
Energy policy

People and skills

A qualified, experienced and adequately skilled workforce will need to be attracted and retained to meet many of the challenges facing the UK energy system. The main threats to supply of skilled labour are retirement of experienced staff (particularly in the oil and gas sector) and loss of access to EU migrants resulting from Brexit.

Most frequently mentioned with: Brexit

Public engagement

EI members see a need for their industry to engage consumers and other audiences on new technologies, business models and their own energy use. Barriers to this engagement include the negative image of the industry (especially of the fossil fuel and nuclear sectors), influence of the media and a lack of responsibility being taken by consumers. Such improved engagement is seen as a route to potentially increase acceptance of certain activities and to stimulate greater attitude change and action on the part of consumers.

Most frequently mentioned with:
Energy policy

Security of supply

Adequate primary energy and generation capacity are needed in the face of increasing demand. EI members cite several challenges to meeting demand, including dependence on imports, reliance on less diverse, lower carbon and more intermittent supply sources, and geopolitical factors including, but not limited to, Brexit. Cyber security is also a concern in the increasingly smart, more connected energy system.

Most frequently mentioned with:
Grid and infrastructure

Sustainability and climate change

While most responses focus on meeting carbon targets, this challenge also includes wider environmental concerns such as air quality. EI members urge additional action by policy makers and investors to advance technology and bring the heat and transport sectors up to speed. The impacts of climate change itself on the economy and energy system are also acknowledged.

Most frequently mentioned with:
Energy policy

"Attracting sufficient skills to ensure future energy industries thrive. Comprehensive skills mapping and training programmes are required in anticipation of Brexit impact."

"Realising that demand management is the most cost-effective way of reducing costs and emissions. The massive gulf between the rhetoric around 2°C or even 1.5°C and the reality of what is happening in actual choices being made globally."

"Trying to address long-term supply and environmental issues amid current short-termism and governmental chaos."



Energy policy

UK energy policy effects

For the fourth consecutive year, EI members express mixed views about the effects of UK policy on a range of energy topics.

The respondents highlighted 'developing low carbon transport' as the area where energy policy exerted the biggest positive impact during the last year. Moreover, policies in this sphere enjoyed the biggest boost in positive perception: a 12% increase in comparison to last year's Barometer survey. This opinion may reflect several recent decisions on decarbonisation of transport, for example the July 2017 announcement of the 2040 ban on the sale of new petrol and diesel cars, or the October 2017 introduction of the T-charge aimed at cutting car pollution in London.

Policies supporting emerging technology research and innovation were also acknowledged for their effectiveness. Indeed, the last 12 months witnessed multiple initiatives aimed at advancing new technologies in the energy sector. The Faraday Challenge fund for the development of new battery technologies, or actions included in the Government's July 2017 Smart Systems and Flexibility Plan to improve access to energy markets for new technologies, could both have contributed to positive perception of policies in this area.

Positive recognition was also given to policies supporting renewable electricity.

This coincides with 2017 seeing a successful auction for low carbon electricity contracts as well as being the first year in which more than 50% of electricity in the UK was generated from low carbon sources (read more on p. 22).

Progress on clean energy but fuel poverty languishes

Nevertheless, across most other energy areas, over half of the respondents think that policy has had no effect or a negative effect.

The energy policies least positively viewed by EI members are reducing fuel poverty, simplifying energy taxation and securing energy supplies. Notably, the attitudes towards policy effectiveness in each of these areas haven't changed much since the question was asked a year ago, despite announcements and introductions of relevant new policies such as plans for a market-wide domestic energy price cap, or plans to streamline energy and carbon reporting.



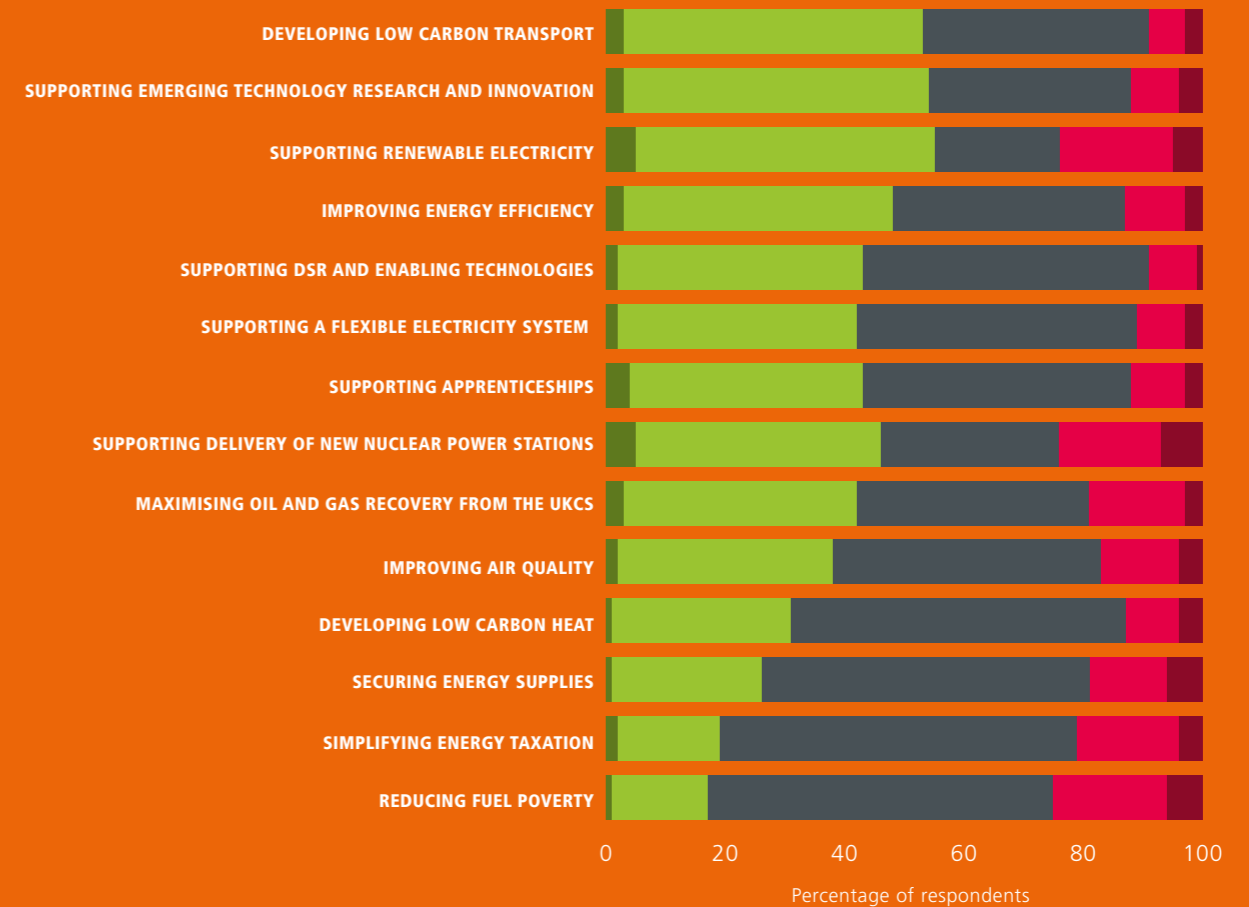
Dr Joanne Wade
OBE FEI
CEO, Association for the Conservation of Energy

“The Energy Company Obligation alone will not solve the problem of fuel poverty. To close the investment gap, the Government needs to take robust action to ensure that Minimum Energy Efficiency Standards for the Private Rented Sector are enforced, strengthened, and complemented by strong incentives for action in other housing sectors.”

UK energy policy effects

? What effect do you think UK energy policy has had on each of the following areas in the last 12 months? "Not sure" answers are not shown on this chart. Results ordered by weighted net score.

- Very positive effect
- Positive effect
- No effect
- Negative effect
- Very negative effect





Industrial and Clean Growth Strategies

The end of 2017 was marked by the publication of two long-awaited government papers: the Industrial Strategy and the Clean Growth Strategy. These comprise the Government's proposed approach to achieving a clean, smart, efficient and productive energy system, and one that contributes to economic prosperity.

To gauge the perceived value and suitability of the Strategies, EI members were asked to what extent the Strategies meet the needs of the energy system. Half of the respondents believe that the strategies address *some* of the most important current energy issues. Only 4% believe that the strategies address the *most* important energy issues.

Jury is out on flagship government strategies

One in ten EI members express their concerns that the strategies do not address the most pressing energy issues. Professionals working in the heat and power generation sector stand out as the most sceptical about the scopes of the Industrial and Clean Growth Strategies, with 20% of them reporting that the strategies do not address the most important energy issues.

Notably, a full third of respondents are not aware of what the strategies include. The relatively high proportion of professionals not familiar with the content of the Strategies may indicate a need for the Government to develop and implement their proposals as well as lead a more effective communication and engagement campaign.

Looking ahead, EI members were asked to identify indicators of success for the Industrial Strategy. 47% of respondents believe that the Strategy will be successful if energy infrastructure is modernised, including heat networks, transport networks or power generation. This position may reflect energy professionals' awareness of the UK's ageing infrastructure and the need to adapt to changing demand and supply patterns.

Increased energy efficiency is identified as another important determinant of a successful Industrial Strategy. Considering the impacts of improved energy efficiency on limiting carbon emissions, energy wastage and energy cost, the recognition given to efficiency as a decisive factor for future economic prosperity seems well-placed. Another area seen as an indicator of Industrial Strategy success is facilitation of low carbon economic growth. Indeed, such conviction further endorses alignment of the Industrial Strategy with the Clean Growth Strategy.

When it comes to the most important policy instruments related to energy and environment in the new government strategies, EI members place greatest importance on developing local smart energy systems and on the 2050 Industrial Decarbonisation and Energy Efficiency Roadmap Action Plans agreed between the government and seven energy-intensive sectors. The preference for these two policy instruments aligns with respondents' indicators of a successful Industrial Strategy.

Efficiency must be energy system's first port of call

Across strategic policy areas, EI members prioritise improving energy efficiency fairly consistently over other policies.

They not only believe that the Government Strategies should to a large extent be built around improving energy efficiency, but they also identify efficiency as the highest priority measure for the Government to meet the 5th carbon budget (p. 26). Furthermore, EI members firmly acknowledge efficiency's role in reducing transport emissions (pp. 28–31), as well as its comparatively low investment risk (pp. 22–23).

When asked where the Government should focus to most effectively improve building energy efficiency, EI members point to building regulations (33.5%) and funding or incentives for building owners (26.4%).

EI members believe that all areas targeted by the Clean Growth Strategy regarding home energy efficiency are important: insulation, heating, lighting, and location (urban and rural). This likely reflects their view that energy efficiency is a key, highly cost-effective opportunity, and so potentially merits even more funding.



Measuring success of the Industrial Strategy

The UK's Industrial Strategy will be successful if it:
Respondents were allowed to choose more than one response



Modernises energy infrastructure

47%



Increases energy efficiency

41%

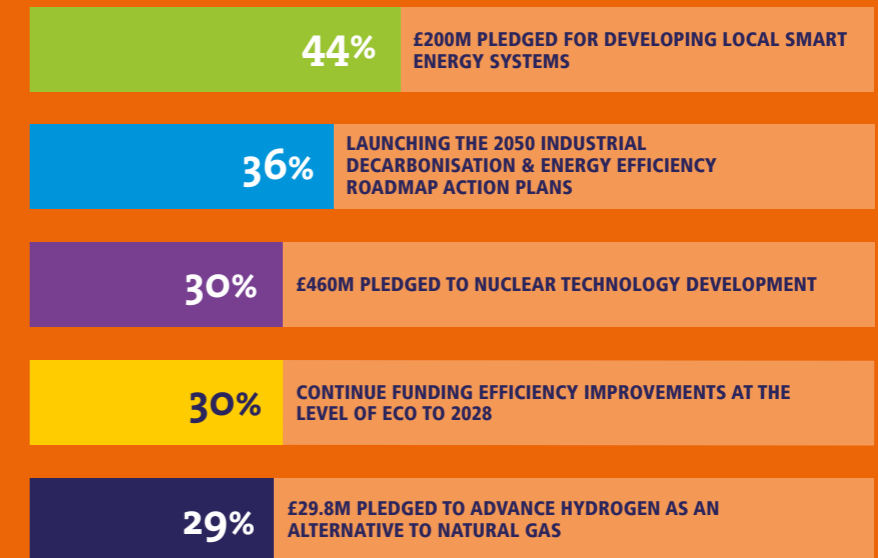


Facilitates low carbon growth of the UK economy

39%

Most important energy and environmental measures

Which measures related to energy and environment listed in the Industrial Strategy, Clean Growth Strategy and Autumn Budget 2017 do you think are most important?
Respondents were allowed to choose more than one response



Percentage of respondents



Low carbon technology

Minimising the cost of low carbon energy has been identified as important for a successful UK Industrial Strategy (National Infrastructure Commission, 2017). EI members point to a range of measures that should be prioritised to ensure low carbon electricity is delivered at least cost. Chief among these are lowering barriers to market entry for smaller generators and establishing and maintaining clear process for incremental reduction of subsidies over time.

This prioritisation of an innovative market structure, friendly to new smaller generators, to deliver least cost decarbonised electricity reflects a significant development in an industry still dominated by nine power producers. Indeed, between 2012 and 2015, the share of generation capacity of smaller generators only increased by 4% (BEIS 2016).

Clean generators seek friendly, predictable market

The goal of affordable low carbon energy is reflected in the recognition of the need for a reduction in subsidies over time. This is not surprising in an era of continuing falling costs of solar and wind, prompting talk of near-subsidy free renewables. An overarching message from the results is the need for increased predictability in the trajectory of such subsidies over time.

These top two measures are closely followed by leaving the market to open and fair competition, and setting a sufficiently high, universal carbon price.

The Clean Growth Strategy supports Carbon Capture, Usage and Storage (CCUS) as a technology that might help to deliver a low carbon energy system and meet the 5th carbon budget. Acknowledging the current risk of investing in the technology due to its high cost and lack of significant revenue stream, the Strategy unveils plans to invest up to £100 million in CCUS innovation and to establish a new CCUS Council which will facilitate partnership with the industry. It also pledges to deliver a plan to reduce the cost of deploying the technology, review the investment models for CCUS and analyse how the barriers to deployment can be reduced.

CCUS in need of further support

The Barometer's findings also indicate that more actions are needed in this area. Although the UK's policy effects on supporting emerging technology research and innovation have been rather positively evaluated by EI members (pp.12-13), investment risk due to policy uncertainty is still perceived as high in CCUS and other immature low-carbon technologies (pp.22-23).

The Barometer survey asked EI members about the most cost-effective way for the UK to progress towards deploying CCUS at significant scale.

Respondents prioritised providing a stable policy framework (23%), providing government funding for demonstration projects (21%) and setting sufficiently high carbon price and allowing market to bring

it forward (18%). Approximately 5% of respondents expressed their doubt whether CCUS is a viable solution. These responses account for nearly 60% of comments provided for 'Other'.



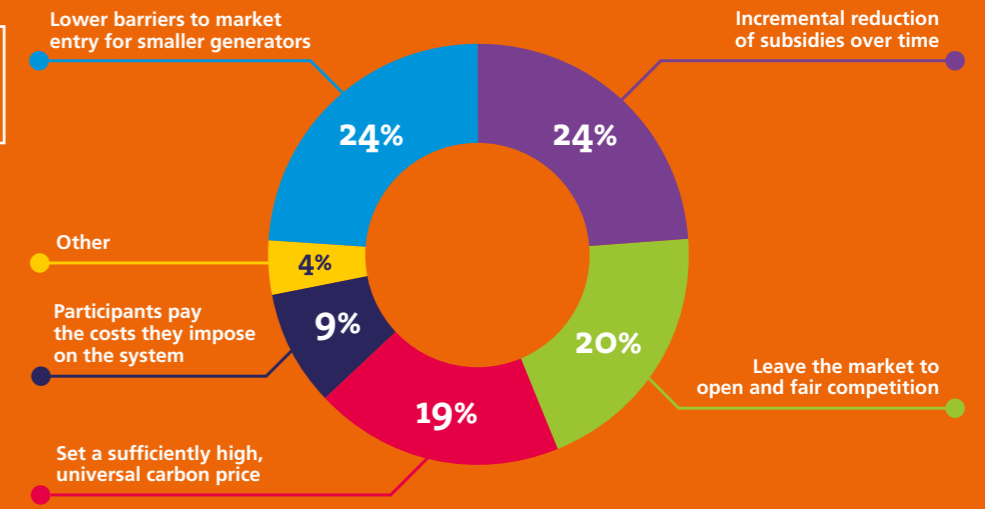
Keith Anderson
HonFEI
Chief Executive,
ScottishPower

“ This report demonstrates the success of clean energy in the UK. We need to keep up that momentum. Now is the time for the Government to back more onshore wind where communities want it, and sustain affordable decarbonisation that backs British industry and creates jobs. ”



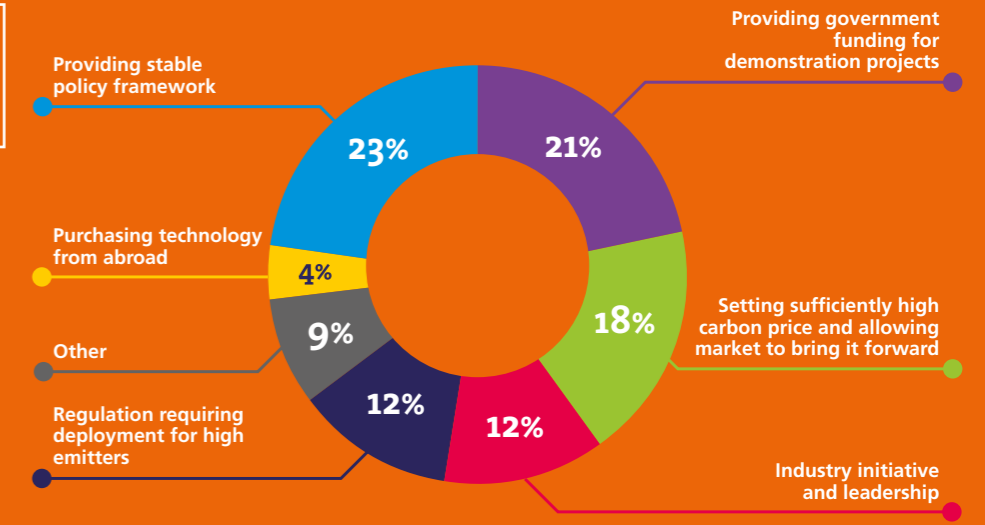
Delivery of low carbon, low cost electricity

? Which of the following should be prioritised to ensure low carbon electricity is delivered at least cost?



Deploying carbon capture, usage and storage

? What would be the most cost-effective way for the UK to progress towards deploying carbon capture and storage at significant scale?





The UK's place in the world

In the 2017 Energy Barometer, EI members were asked about the most significant expected impacts of Brexit on the energy industry. They identified unpredictable policies and regulations, high or volatile costs, decreased security of supply, uncertain investment climate and shortage of skilled labour as the top impacts. They also indicated that they did not want the UK's existing relationship with the EU to alter greatly after Brexit, with the exception of two areas: state aid rules and the EU emissions trading system (ETS).

Brexit cloud remains – but opportunities emerge

This year, EI members were asked about potential beneficial opportunities for the UK energy sector arising from Brexit. The ability to negotiate new trade agreements with non-EU countries was indicated as the biggest opportunity by 47% of respondents. This was followed by flexibility to finance new electricity generating capacity (39%), flexibility to support new renewable heat and transport (36%) and greater control over UK carbon pricing policy (36%).

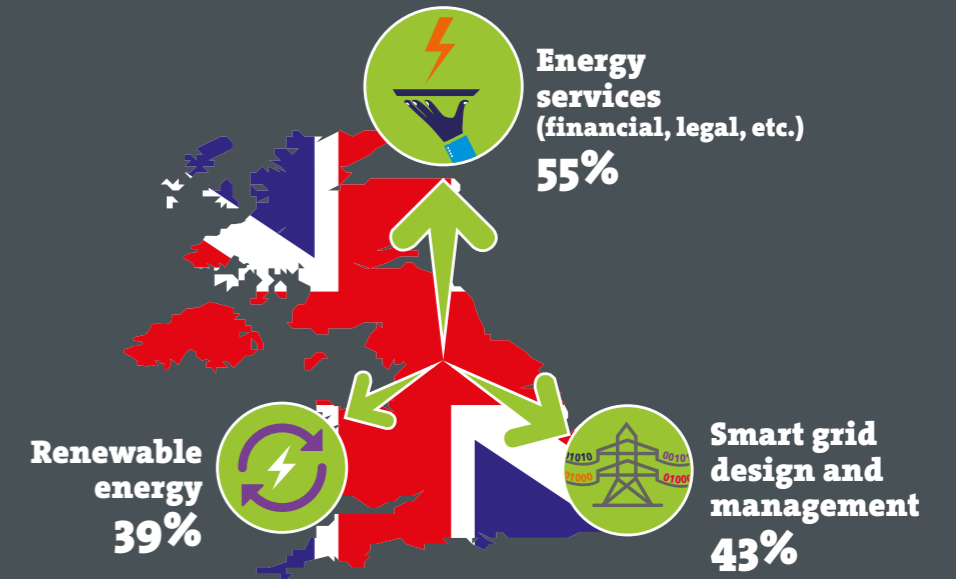
10% of respondents believe no opportunities and benefits are likely to arise from Brexit (these responses account for around two thirds of comments provided for 'Other').

EI members believe that amongst various post-Brexit export opportunities for energy industry products and services, the UK has the best potential to export its financial, legal and other services. This is followed by smart grid design and management and renewable energy.

Respondents working in heat and power generation are most enthusiastic about potential of energy services export (63%). Respondents working in natural gas and oil are more optimistic than other sectors about potential of UK exports related to oil and gas, for instance services and technology (47% vs ~25% on average).

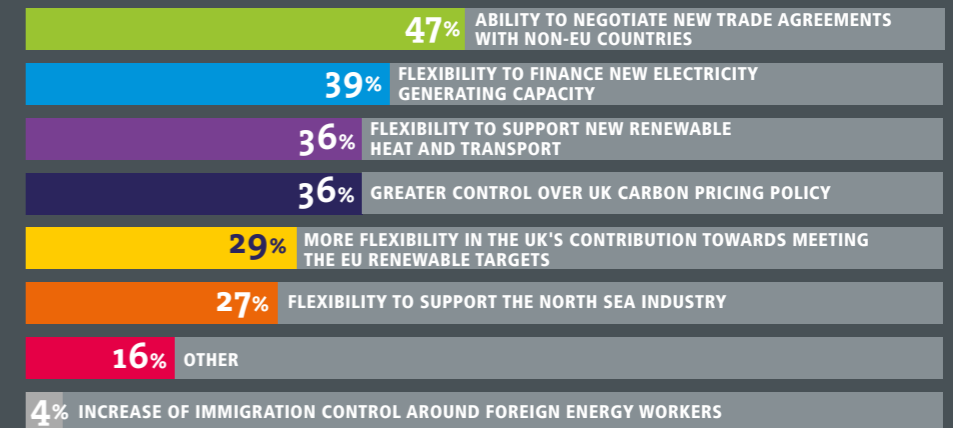
The UK's energy export opportunities

? In which of the following areas will the UK have the best potential to export products, services, and intellectual property through to 2030? Respondents were allowed to choose more than one response



Brexit opportunities for UK energy

? In your opinion, what could be the most beneficial opportunities for the UK energy sector arising from Brexit? Respondents were allowed to choose more than one response



Percentage of respondents



Given the Government's focus on innovation and batteries in particular, battery technology is poised to be a key pillar in the UK's Industrial Strategy. As part of the Industrial Strategy Challenge Fund, the Faraday Battery Challenge grants £246 million for the development of innovative technologies in this area. In the words of Business and Energy Secretary Greg Clark, "government investment into battery technology is to ensure the UK builds on its strengths and leads the world..."

EI members were asked where the UK can best contribute to the global battery supply chain. EI members see the biggest potential to lead international development efforts in research, followed by design and financing. The finding draws attention to the focus on expertise, technology and services rather than on manufacturing products.

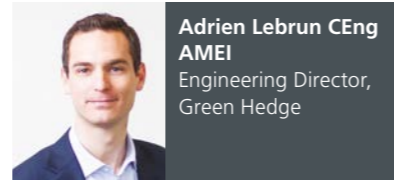
Potential in the global battery market, but more support needed to commercialise low carbon research

Despite the UK's position as a global leader in research, many ideas do not make it through the 'valley of death' to realise their commercial value in UK and international markets.

To retain the value of UK research, EI members think that establishing stable (long-term) financial incentives for early start-ups such as grant funding, tax breaks, and encouraging patient capital (investment with relatively long time horizons) are the best measures for the Government to take.

Other measures favoured by EI members are stimulating market demand for low carbon technologies (e.g. eco-labelling, consumer tax breaks), facilitating collaboration between start-ups and investors and between academic researchers and start-ups, and spending a higher proportion of GDP on development of energy research.

For more on the outlook of UK energy investment in 5 years' time, see pages 22-23.



Adrien Lebrun CEng AMEI
Engineering Director,
Green Hedge

“The UK has a real opportunity to be a hotspot in the world electricity storage market across multiple sectors. This will require consistent policy from the Government, forward looking regulation by the grid operators as well as ambition from academia and innovative companies.



The UK's competitive advantage in batteries

? In what area(s) of the battery supply chain does the UK have the biggest potential to lead global development efforts?



Research
32%



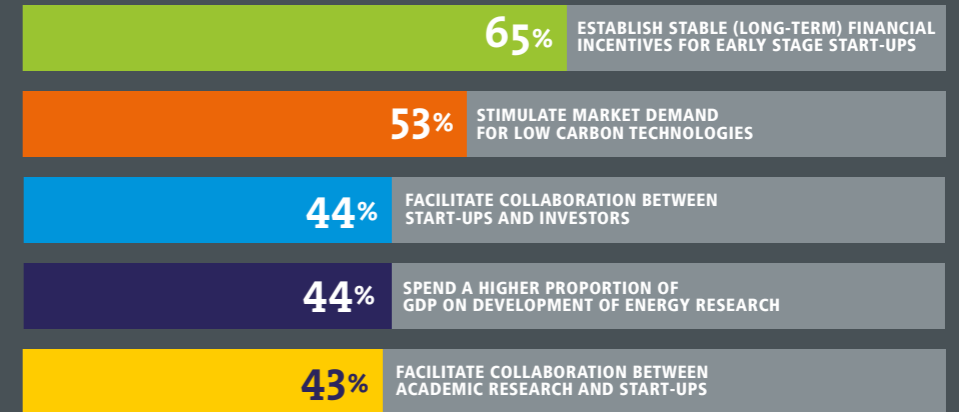
Design
21%



Finance
18%

Commercialisation of UK research

? There are currently a significant number of low carbon energy research projects taking place in the UK. How could the Government help ensure that commercialisation of this research occurs in the UK? Respondents were allowed to choose more than one response



Percentage of respondents



Investment and prices

Investment risk

For a fourth consecutive year, a lack of policy transparency is identified as the biggest challenge facing the energy industry. Despite the direction provided by the Government in the Clean Growth and Industrial Strategies, EI members perceive many areas of the energy system as risky for investors due to policy uncertainty.

Big ticket clean tech seen as risky business

Indeed in carbon capture, usage and storage (CCUS), marine, hydrogen and nuclear, two to five times as many EI members see high or very high investment risks due to policy uncertainty as those who see low or very low risks. CCUS continues to be seen as the most precarious field, reflecting the need for a transparent and stable policy framework. Tidal and wave technologies, and hydrogen are ranked as the second and third riskiest investments this year. A commonality for all three technologies is their high capital cost and longer return on investment, which may require particular government support.

The level of investment risk in low carbon transport and energy storage remain largely unchanged, maintaining a perception of moderate risk.

Among the areas considered lowest risk due to policy uncertainty are building

energy efficiency, solar and offshore wind. Investment in the latter area is seen in stark contrast to the perceived risk of onshore wind. The results may reflect the Government's stronger, sustained support for offshore wind compared to a withdrawal of subsidies for onshore wind and exclusion from Contract for Difference auctions. This contrast has not gone unnoticed by the wider industry, with recent calls from wind developers for the government to reverse its decision around onshore wind and stimulate the sector. The lower risk perceived around offshore wind perhaps reflects a wider confidence in falling costs. In 2017, the strike price of offshore wind dropped to £57.50/MWh, half of its cost in 2015. In comparison, the figure is significantly lower than the strike price allocated to the new Hinkley Point C nuclear power plant in Somerset (£92.50/MWh).

When asked about the attractiveness of the UK as a place to invest and do business in 5 years' time, EI members show mixed sentiment relative to today. A third of the respondents predict a steady state for their sectors. A further 38% are sceptical and believe that for their sector the UK will become less attractive – particularly those in oil and gas, renewables, academia and research – while 28% are optimistic that the UK will become more attractive. Those working in the buildings sector are most positive.

The results are more positive than a recent CBI survey on sector attractiveness post-Brexit, which indicated a decreased attractiveness of the UK as a place to invest and do business alongside increased uncertainty and a concern for the access to labour supply.



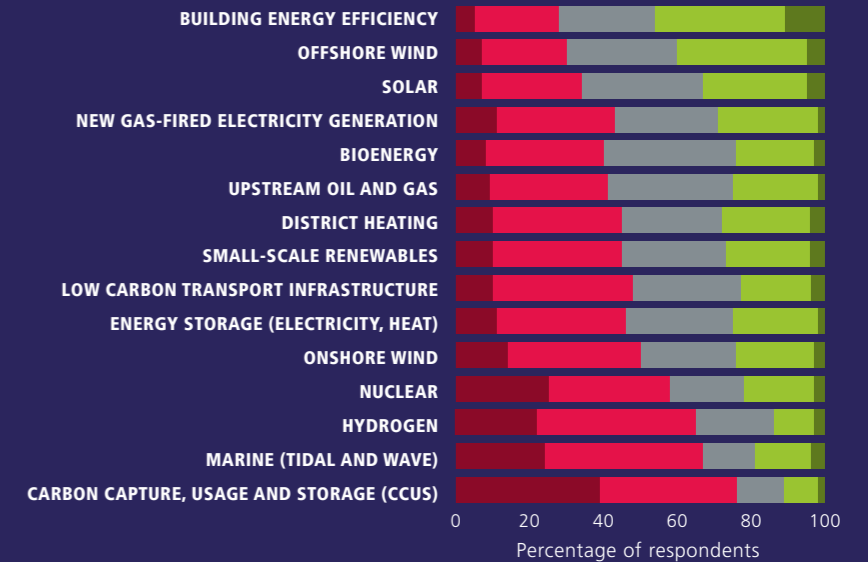
Sara Vaughan FEI
Political & Regulatory
Affairs Director,
E.ON UK

“The Barometer results highlight yet again the impact of policy uncertainty on investment confidence, suggesting that the Government still needs to do more to allay investor concerns. Looking to the future, whilst some respondents are optimistic, the picture is mixed, with most respondents seeing an unchanged or less attractive outlook.”

UK investment risk due to policy uncertainty

? In the UK, what in your view is the level of investment risk due to policy uncertainty in each of the following areas? Not sure" answers are not shown on this chart. Results ordered by weighted net score.

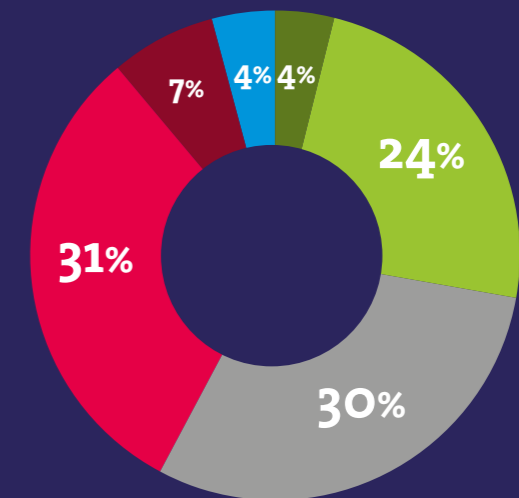
- Very high
- High
- Neither low nor high
- Low
- Very low



Investment attractiveness of UK energy

? Thinking of your own sector, relative to today how attractive will the UK be as a place to invest and do business in 5 years' time?

- Much more attractive
- More attractive
- About the same
- Less attractive
- Much less attractive
- Other



Price drivers

After years of turbulence in the oil markets, EI members expect crude oil prices to increase by 10–15%, from \$65 per barrel at the time of the survey to \$70–\$75 per barrel by the end of the year. The actions and policies of oil producing nations continue to be seen as the biggest driver of crude oil prices, followed by geopolitical instability and demand levels in developing countries. According to the International Energy Agency (IEA, 2017), two thirds of global energy growth will stem from developing countries in Asia.

Upward oil price widely foreseen

The crude oil price hike is forecast to be even greater in the future, with the majority of respondents anticipating \$80–\$120 per barrel in 2030.

Transport fuel prices are expected to continue to be heavily dependent on crude oil prices. For the first time in 2018, EI members also expect actions due to climate change and environmental concerns to have an impact on transport fuel prices.

Most respondents expect natural gas prices to increase moderately within the next 12 months and more significantly by 2030. Although the greatest driver of price changes in the next 12 months is again expected to be UK and European natural gas demand, this year's responses indicate a shift. Whereas supplier costs were seen as the second greatest driver in 2017, this year they have been replaced by global natural gas demand, drawing attention once again to

growing industrialisation in the developing world and the increased global connectivity of the gas market.

UK energy policies have dropped to third place as a driver of natural gas prices. Among all measures, the energy price cap and sustainability measures are expected to have the least impact on natural gas prices. For further insight into factors impacting the role of natural gas, see the EI's 2018 [The future of gas report](#).

When asked about the greatest drivers of electricity prices in 2018, EI members have clearly identified UK energy policies in the lead, followed by the cost of primary fuel and UK electricity demand. The expected impact of electricity demand on prices aligns with recent projections from BEIS indicating a rise in the demand for electricity across the UK through to 2033, coinciding with a decline in demand for petroleum products.



Bernard J Bulkin
OBE FEI
Vice President, Energy Institute

“Predicting oil and gas prices is a nearly impossible task. Of great value here are the perceived drivers of future prices – geopolitical events for oil, increased demand for gas, and government policies on electricity – pushing supply considerations deep into the background.”

Factors influencing energy prices

? Which of the following factors will have the GREATEST impact on crude oil, transport fuel, natural gas and electricity prices through the end of 2018?





Climate change targets

Even given the introduction of the Clean Growth Strategy, EI members have become slightly more sceptical this year compared to 2017 about the UK's ability to meet its fifth carbon budget (2028 to 2032) commitment to reduce greenhouse gas (GHG) emissions by 57% from 1990 levels. While the share of respondents who anticipate emissions reductions will fall significantly short of the target has remained around one third, the share of members who think the UK will fall marginally short of the target has grown by 5%, and now accounts for nearly half of the respondents. The proportion of members who believe the UK will meet the target has seen a corresponding decrease from 19% to 12%.

EI members also feel sceptical about the UK's ability, given current policies, to meet the 2050 climate change target, which requires 80% reduction of GHG emissions compared to 1990 levels. The largest segment of respondents (42%) believe the UK will fall significantly short of the target. More than a third think the UK will fall marginally short of the target, while 14% of respondents believe the target will be met.

Meeting targets seen as less likely but emissions banking is not the solution

In addition, EI members were asked whether the government should introduce emissions banking to help meet the GHG emissions reduction targets. Emissions banking

involves the application of a previous surplus in emissions reductions, such as a surplus achieved during an economic downturn, to future carbon budgets. The largest segment of EI members (41%) do not think this mechanism should be used. This echoes the view of the Committee on Climate Change (CCC), which believes the mechanism is counterproductive to the Climate Change Act (CCA) and might negatively impact decarbonisation efforts. The strongest aversion comes from professionals working in heat and power generation or in buildings. Only a quarter of the respondents agree with the use of this mechanism, while a further third of the respondents are not sure.

Efficiency the key to meeting carbon targets

When asked to rank the top government measures to reach emissions reduction targets at least cost, EI members across all sectors single out energy efficiency as the best bet, in line with previous years' results. Efficiency is followed by support for renewables, also a runner-up in last year's Barometer. However, the third most important measure has changed from supporting nuclear energy last year to decarbonising transport this year, with the former dropping to fifth place. This fall in the perceived priority of nuclear energy in meeting the fifth carbon budget corresponds with the year-on-year declining perception of the effect UK policy has had on supporting new nuclear (pp. 12–13). Among the

measures with least support are emissions banking and altering agricultural practices.

EI members identify wider environmental concerns such as air quality, land use and water scarcity, followed by falling low carbon technology costs and citizen pressure as the top three additional factors driving the transition to a low carbon economy. This result may reflect growing public awareness of environmental challenges, with more businesses responding to their customers' concerns.

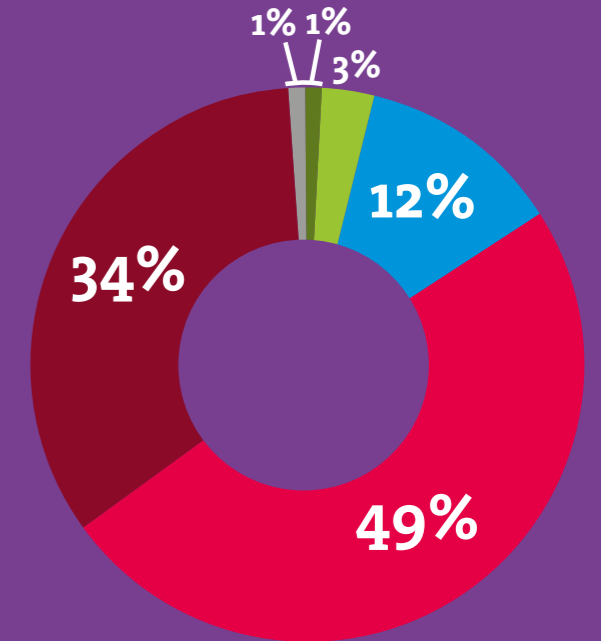
In addition to emission targets, what other factors are driving the transition to a low carbon economy? Respondents were allowed to choose more than one response

	Measures	% of respondents
1	Wider environmental concerns (e.g. air quality, land use change, water scarcity)	69
2	Falling low carbon technology costs	57
3	Consumer, citizen pressure	50
4	Rising energy costs driving efficiency improvements	46

UK fifth carbon budget

? The fifth carbon budget (2028–2032) requires greenhouse gas (GHG) emissions to fall by 57% (from 1990 levels). By 2032, given current UK emission reduction policies, do you expect emissions reductions to:

- Significantly exceed the target (62% or larger reduction)
- Exceed the target (59–61% reduction)
- Meet the target (56–58% reduction)
- Fall short of the target (53–55% reduction)
- Fall significantly short of the target (52% or smaller reduction)
- Not sure



Meeting the fifth carbon budget

? What measures should the UK Government prioritise to fill the shortfall in meeting the fifth carbon budget at least cost? Respondents were allowed to choose more than one response



Supporting energy efficiency
49%



Supporting renewable electricity
32%



Decarbonising transport
31%



Decarbonising transport

This year EI members were asked to take a closer look at the challenge of decarbonising transport. Transport accounted for 26% of the UK's GHG emissions in 2016 (BEIS, 2017), making it the highest emitting sector in the UK and overtaking energy generation for the first time. Transport is also the biggest source of air pollution in the UK, causing an estimated 9,500 premature deaths each year in London alone (KCL, 2015).

Mix of cleaner fuels to end dominance of petroleum well before 2040

EI members expect electricity to drastically increase its portion of the future fuel mix in 2040, rising to about 34%. Hydrogen and bioliquids are also set for an increase, rising to 11% and 9% respectively in the next two decades, from their current very minor contributions. Members believe that petroleum will play a significantly smaller role than today, accounting for less than half of the fuel supply.

A majority of EI members believe that a transition to electric passenger vehicles is the most effective way to reduce emissions from passenger transport. This view is shared among professionals across all sectors, including oil and gas, and renewable energy. Also cited are a modal shift away from cars and setting and enforcing vehicle emissions limits.

When asked about the barriers to deploying charging points for electric vehicles, a third of respondents point to the lack of capacity of the electricity grid to support additional demand as the main challenge. Lack of incentives to install charging points outside cities was cited by just under a quarter of respondents.

EI members believe the failure by councils to take advantage of government funding schemes has also played an important role in the under-deployment of charging points. At the beginning of the year, only five UK councils had made use of the available government funding for the deployment of charging points, leaving £4.5 million unclaimed (Department for Transport, 2018).

What do you believe is the most effective way to reduce emissions from passenger road transport?
Respondents were allowed to choose more than one response

	Measures	% of respondents
1	Transition to electric passenger vehicles	63
2	Modal shift	54
3	Setting and enforcing vehicle emissions limits	40
4	Improve efficiency of internal combustion engines	33
5	Transition to hydrogen or CNG powered passenger vehicles	31
6	Improve lifecycle emissions of EVs	25

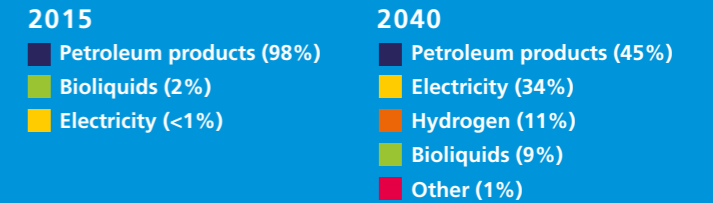
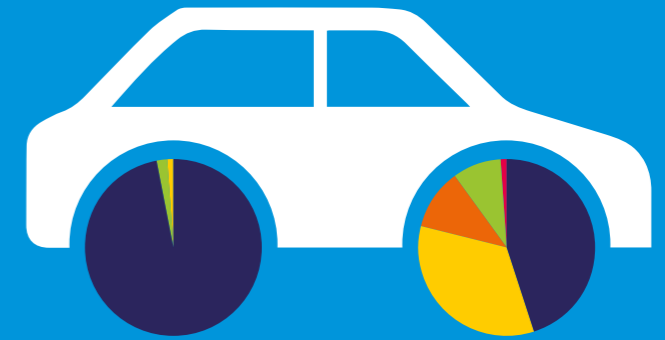


Simon Virley CB FEI
Partner and Head of Energy & Natural Resources, KPMG UK LLP

“The survey results suggest that the stranglehold of petrol and diesel for road transport will be broken over the next two decades, as we move to a more plural fuel mix. But there are still major challenges to overcome, including the grid charging infrastructure needed to cope with the rapid take-up of electric vehicles.”

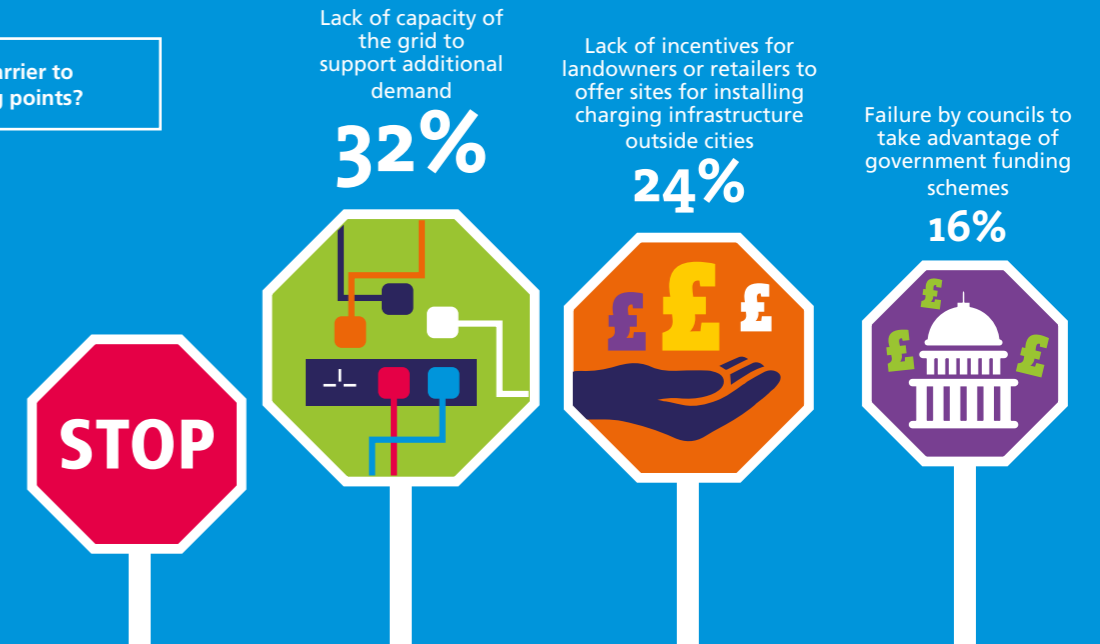
UK transport energy mix

What do you expect the UK fuel mix for road transport to be in 2040?



Barriers to deploying EV charging points

What is the biggest barrier to deploying EV charging points?





Freight transport also plays a crucial role in transport's share of GHG emissions, with heavy goods vehicles (HGVs) estimated to account for around 17% of UK's emissions from road transport in 2017 (BEIS, 2017). On an international level, the International Energy Agency (2017) projects that if no measures for the decarbonisation of HGVs are taken, they will contribute to an increase in carbon dioxide emissions of nearly 900 million tonnes by 2050. This is equivalent to the predicted growth in CO₂ emissions caused by coal use in the energy and industrial sectors.

When asked about the best measures to reduce freight-related emissions, more than half of EI members prioritise the shift of more freight from road to rail. Considering the current capacity constraints of the rail network and the prioritisation of passenger trains, this seems unlikely without significant additional investment. This suggests the need for even more focus on the other priority measures EI members identified, including setting and enforcing vehicle emissions limits, and transitioning HGVs to hydrogen, CNG, or electric drivetrains.

In terms of infrastructure investment needed to decarbonise transport at least cost, more than half of EI members prioritise rail above all other modes of transport. This result, coupled with the call for a shift of more freight to rail, demonstrates the potential benefits of further evaluating different decarbonisation options as well as the strong sentiment among EI professionals that rail should play an important part in decarbonising the UK's transport system.

Rail is priority for surface freight, while shipping and aviation chart a course for efficiency

The shipping industry accounts for 2.3% of global CO₂ emissions (International Maritime Organization, 2015). The top measure chosen by the majority of EI members (62%) as the most effective way to reduce emissions from the sector is improving shipping efficiency. This is closely followed by implementing emissions policies for shipping, use of LNG and use of wind assistance technology. The application of a sufficiently high carbon price is seen as relatively unimportant for shipping.

Emissions from the aviation sector accounted for 6% of UK's total GHG emissions in 2014 (CCC, 2016). Further highlighting the importance of energy efficiency, 66% of the respondents have chosen improving aviation efficiency as the most effective measure in reducing emissions from the sector.

This is closely followed by a shift of more air freight to other modes of transport and reduction in passenger travel through behaviour change. The latter might prove to be particularly challenging, considering CCC's forecasts for a 60% increase in aviation passenger demand up to 2050. Measures such as the electrification of aircraft and the use of solar hybrid technology are seen as least effective at this point in time. Offsetting emissions from other sectors has the lowest rank for reducing both shipping and aviation emissions.



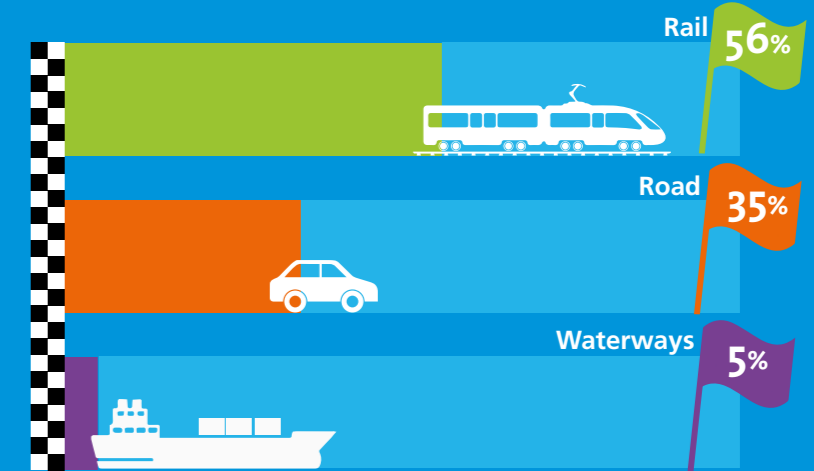
Sophie Punte
Executive Director,
Smart Freight Centre

“The solutions to decarbonize freight are known. It is now time for business and government to act as leaders by turning ideas into action. Businesses can adopt cleaner fuels and technologies and optimize freight movement. Governments can support them with smart policies, infrastructure and access to information and initiatives that can help. The good news for both is that more efficient freight goes hand in hand with greater competitiveness and sustainability.”



Investing in low carbon transport infrastructure

? In order to decarbonise transport at least cost, which of the following areas would you prioritise for infrastructure investment?



Reducing emissions from freight road transport

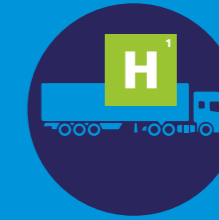
? What do you believe is the most effective way to reduce emissions from freight road transport? Respondents were allowed to choose more than one response



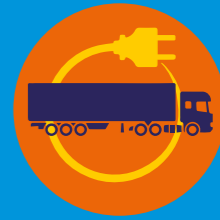
Shift more freight to rail
56%



Setting and enforcing vehicle emissions limits
43%



Transition to hydrogen or CNG powered HGVs
41%



Transition to electric heavy goods vehicles (HGVs)
36%



Diversity in the energy workforce

The energy sector struggles to recruit and retain a diverse workforce. Ethnic and gender diversity are consistently shown to be positively correlated with financial returns (McKinsey 2018), as well as safety and productivity (BHP 2017). EI members were asked for their perceptions of the challenges and opportunities of diversity, drawing on the questions used in the CBI's Employment Trends survey (CBI 2016).

The majority of EI respondents (65%) believe a diverse workforce is very or somewhat important for their company or sector's future success. Nevertheless, 16% of respondents think that diversity is neither important or unimportant, whilst 10% think it's somewhat or completely unimportant. A higher proportion of Associate Members (AMEIs), who are in the first 5 years of their career, see diversity as very important or somewhat important (77%), compared to more senior members (62%). This may indicate the energy sector will move towards ensuring that diversity becomes an integral part of its operation.

A report by McKinsey (2018) suggests where companies 'commit to diverse leadership' they are successful and better equipped to win 'top talent.' This aligns with EI members' top three benefits of diversity to business in their sector. Nearly half (48%) responded that diversity leads to an increase in skills and capabilities, closely followed by the ability to retain and keep staff (44%) and introducing a wider perspective (42%). AMEIs more than other grades think that diversity introduces wider

perspective (58% vs. 40% of more seasoned members).

Benefits of diverse workforce understood but 30% perceive no barriers

EI members were asked to indicate the main obstacles to diversity faced by their company or sector. Workforce and management culture are among the top obstacles to diversity, each pointed to by a quarter of respondents, but a significant number (30%) also indicated there were no obstacles for their company or sector. This could be interpreted as an optimistic response (as a sign of an inclusive environment), or as an indication that barriers are not fully recognised by those in the industry.

The POWERful Women initiative explores one particular aspect of diversity: gender equality. They recently reported that 50% of the top 80 UK energy companies have all-male boards of directors. The gap is particularly stark in the global oil and gas industry, with women accounting for only 25% and 17% of middle management and senior leadership roles, respectively (Boston Consulting Group, 2017).

We asked about the steps that have been taken by companies or the sector to increase diversity over the past five years. A common practice among respondents' companies was the introduction or extension of flexible working opportunities. The introduction or improvement of family friendly policies and

a review of recruitment policies were also popular measures taken, each identified by more than a quarter of respondents.

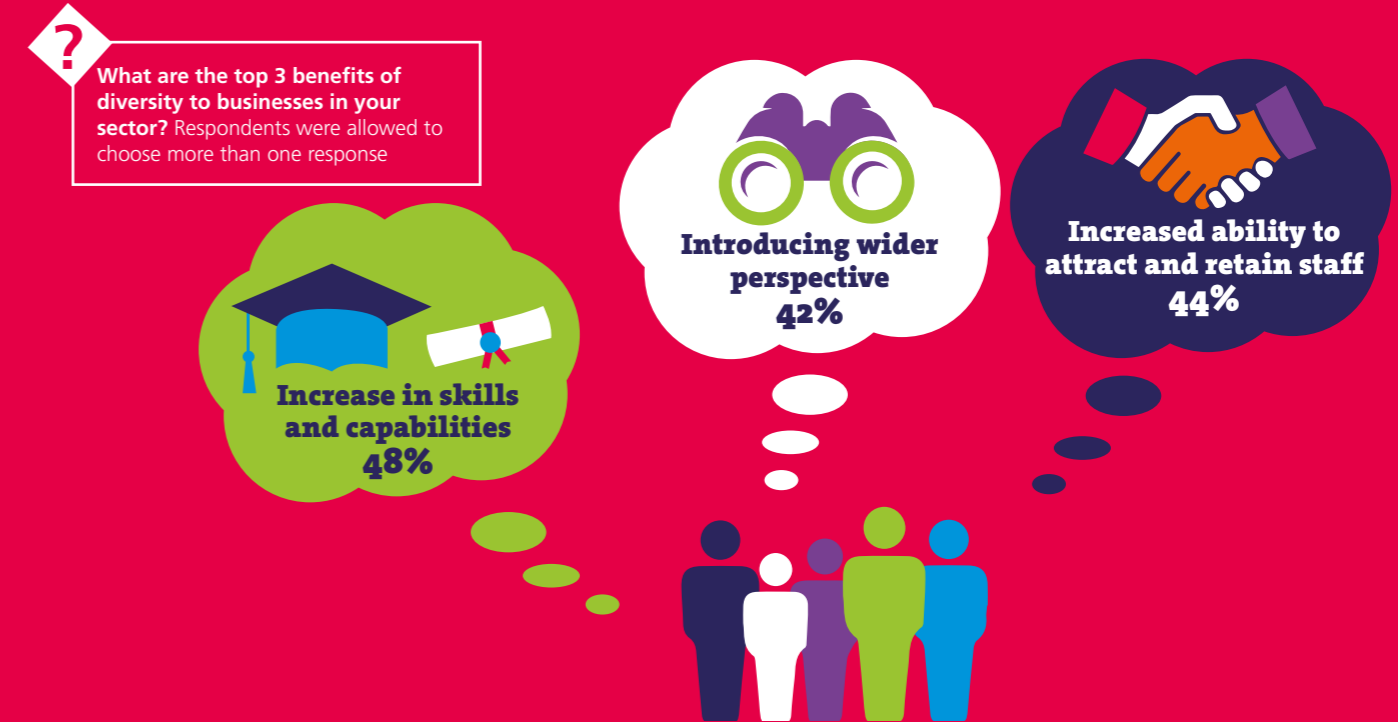
People and skills is identified as one of the ten biggest challenges facing the UK energy industry in 2018 (p.10). It is important for the industry to retain and attract a skilled workforce, both because of the existing and potential Brexit-exacerbated skills shortages in the industry as well as the rapid changes it is going through in the transition to a low-carbon economy.



Baroness Verma
Member of House of Lords and co-founder, POWERful Women

“When you look at the top 3 benefits of improving diversity, coupled with the transformational journey our energy sector is on, it's the companies that embrace sustained change towards inclusive cultures who will prevail, while others will be left behind. The talented people that we need will make the obvious choice.”

Benefits of workforce diversity



Steps to increase workforce diversity



The role of the EI

Message from the CEO



Louise Kingham
OBE FEI

Energy defines modern life. It lights, heats and cools our businesses and homes, it gets us from A to B, and it is increasingly safe, sustainable, reliable and affordable. But the story of energy is only part told. Shifting to low carbon at the same time as opening up access for the world's growing population is one of the most pressing challenges facing humanity. Ingenious people – innovators, entrepreneurs, scientists and engineers – make all of this possible.

The Energy Institute (EI) is the professional membership body bringing global energy expertise together. We're a unique network with insight built over a century and spanning the world of energy, from conventional oil and gas to the most innovative low carbon and energy efficient technologies.

Our mission is to gather and share essential knowledge about energy, the skills that are helping us use it more wisely, and the good practice that keeps it safe and secure.

We firmly believe that a path towards the future secure, innovative and sustainable energy system depends on a capable and motivated workforce as well as on informed and engaged energy consumers. That's why so much of our work focusses on professionalism and skills, making sure knowledge is transferred between generations and sectors, and recognising excellence.

The Energy Barometer is one of our channels to articulate the voice of energy experts and take the know-how of around 20,000 members from 120 countries to the heart of the public debate. With the report, we share these professionals' inside knowledge about the current energy milieu and their suggested path towards a clean, responsible and effective energy future.

We are not hesitant in pointing out where things could be better. In this report we examine barriers to recruiting and retaining a diverse energy workforce. This sensitive and crucial issue has been in the spotlight of our cooperation with POWERfulWomen, which strives to enable more women to reach senior-level roles.

Our advancement of views from UK energy professionals is by no means limited to this report. We carry our members' suggestions, concerns and questions while responding to policy consultations and engaging with policy and industry decision makers. It is our ambition to provide a reliable and balanced resource to the Government to inform energy strategy and policy decisions. By sharing their views, our members make this important work possible.

It is our firm belief that the future of the energy system is tied closely to simple, impartial and public communication between all involved stakeholders. We are an independent, not-for-profit, safe space for evidence-based collaboration, an honest broker between industry, academia and policy makers.

I would like to profoundly thank all members of the EI College for sharing your views through the Barometer survey. We truly value the opinion you have provided and see in it not only a guide to our charitable aims but also towards a better energy system.

Louise Kingham OBE FEI
Chief Executive, Energy Institute

Method

The 2018 Energy Barometer is the fourth in a series of annual surveys of the EI College, a group of EI professional and pre-professional members. The College includes three EI member grades: Fellow (FEI, N = 178), Member (MEI, N = 276) and Associate Members (AMEI, N = 178). This process was designed to ensure that a diverse range of sectors, disciplines, and seniority levels were included in the sample.

The survey questions were designed by the EI Knowledge Service (EIKS), under the guidance of the EI's Energy Advisory Panel and industry experts. Some questions are repeated annually to track trends over time; others cover topical subjects that change year-to-year.

The survey focuses on the UK energy system, and encompasses a wide range of topics including UK energy policy effects, the Industrial and Clean Growth Strategies, UK's place in the world, investment and prices, climate change targets, decarbonisation of transport and diversity in the energy workforce. The questions were refined with the help of Dr Dimitrios Xenias at Cardiff University.

The survey was sent to the 632 College members. A total of 406 College members fully completed the survey online in February 2018. The responses were analysed by EIKS to assess key findings and identify themes from the results. The survey included multiple choice as well as free response questions. The answers to free response questions were coded and mentions of codes were counted across responses. In the report, responses to both types of questions are presented as percentages of respondents,

unless stated otherwise. This can lead to percentages adding up to more than 100%, in the case of multiple choice questions where respondents were allowed to choose more than one option, or in the case of a free text question where a single response may have been assigned more than one code.

The findings represent the views of the EI's members. Where there were prominent differences across sectors, disciplines or member grades, these have been singled out in the report. While naturally there are topics where opinions differ among subgroups, a surprising feature of the survey was a high degree of consensus on most energy issues. This report constitutes a step towards creating an informative, useful account of the energy sector based on the views of those working within it.

The complete set of data used in this report is available online at knowledge.energyinst.org/barometer. Data for questions not included in the report is also available upon request.

	Top respondent sectors (members may be in more than one sector)	% of respondents
1	Natural gas and oil	35
2	Renewable technology	25
3	Heat and power generation	20
4	Academia and research	20
5	Buildings	18

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