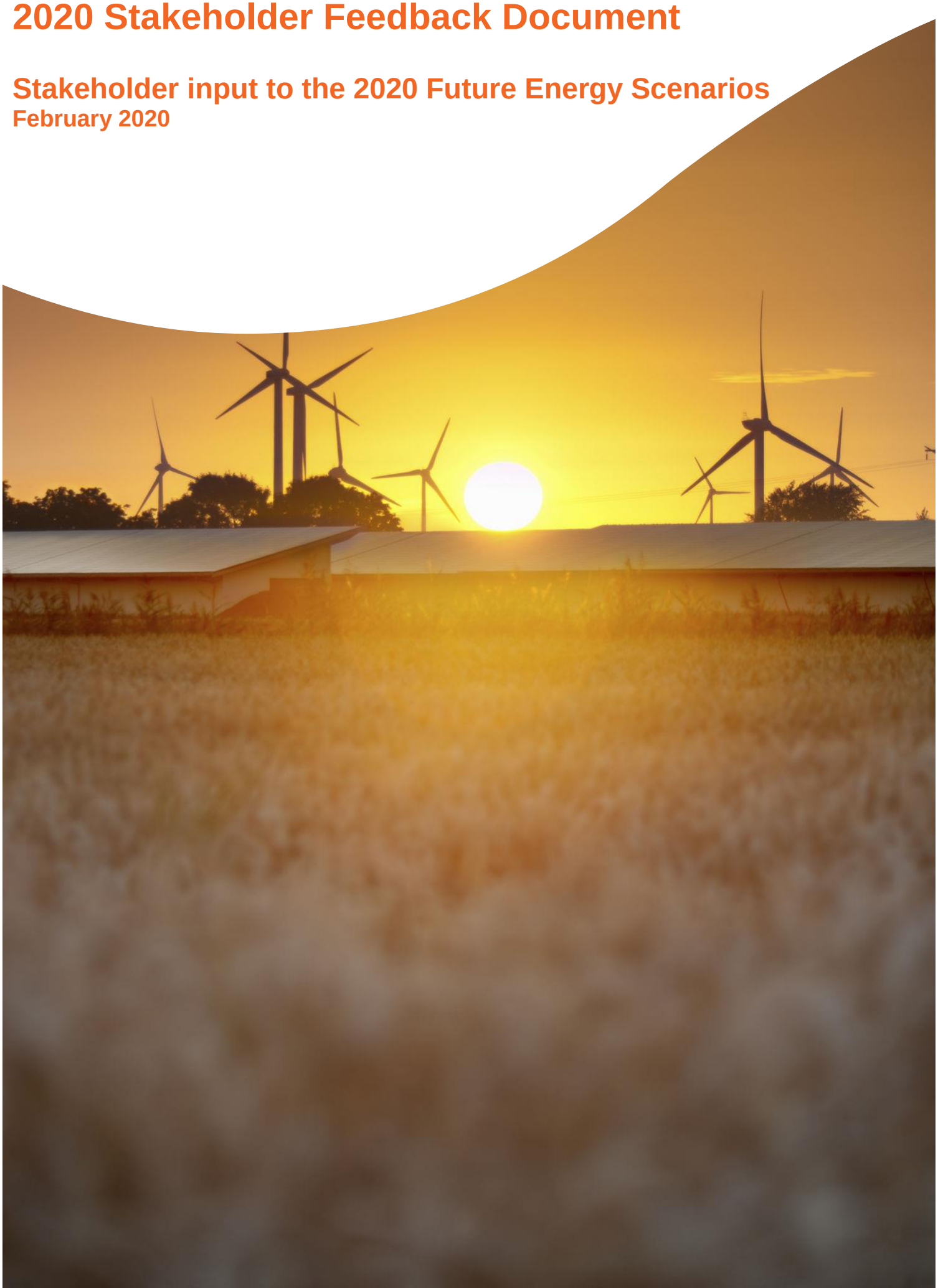
nationalgridESO

2020 Stakeholder Feedback Document

Stakeholder input to the 2020 Future Energy Scenarios

February 2020



Contents

1. Overview

Introduction

This Stakeholder Feedback Document is a key milestone in the annual *Future Energy Scenarios* (FES) process as it summarises the stakeholder input which underpins the scenarios. The document explains how and why we have come up with the Scenario Framework and Scenarios and sets out what stakeholder feedback we have received through engagement that will shape *FES 2020*. We also provide an update on the actions we said we would be undertaking for *FES 2019*.

Working with our stakeholders to develop *FES 2020*

The future of the energy landscape holds many uncertainties. Broad engagement across industry allows us to capture the full range of this uncertainty through understanding many different perspectives. Deep engagement with experts across specific technologies and sectors allows us to understand and analyse the interaction across the whole energy system, allowing us to build credible pathways in our scenarios.

We work with stakeholders to gather information and test our thinking, as well as to share the conclusions of our analysis. During the year of 2019 we have engaged widely with our stakeholders to listen and discuss with them, calling on their expertise. We have reached out to 463 individual stakeholders representing 224 unique organisations from nine main different stakeholder categories like 'energy industry', 'innovators' and 'regulators'. Across all our activities we have engaged with 590 stakeholders. During 2019 we have engaged with 109 new organisations compared to 2018.

Our *Shaping FES 2020* call for evidence was shared with the breadth of our stakeholder community of nearly 6,500 people providing the opportunity for all to provide us evidence and insight on specific subjects. We thank all those that took the time to take part in the consultation.

Our bilateral engagement has been a key focus for *FES 2020* and will continue through to the spring. For this year's scenarios, we have reached out to 67 different organisations and spoken to a range of new organisations and those wider than the GB energy industry like RTE, the electricity transmission system operator of France. The experience and insight gathered from these meetings is an integral part of our engagement programme.

We have held several collaborative engagement events with stakeholders for *FES 2020* as part of the autumn engagement programme, specifically to focus on the Scenario Framework and Scenarios. This engagement provided early input into our thinking and was definitive in shaping the new framework. We also commenced the *FES: Bridging the Gap to net zero* programme during autumn and held the first workshop focusing on the use of bioresources in the context of a net zero emissions target.

We thank everyone for their time and effort in engaging with the *Future Energy Scenarios*, whether attending the launch event, attending a bilateral or taking part in our consultations or workshops. We look forward to continued engagement throughout 2020.

The Scenario Framework and Scenarios for *FES 2020*

Following stakeholder engagement and our own review of the Scenario Framework and Scenarios we are making significant changes for *FES 2020*. From our own evaluation and engagement there is a clear agreement for change. Stakeholders have told us that consistency is valuable, but the 2019 Scenario Framework is no longer suitable as:

- The UK's decarbonisation target is now net zero and
- Decentralisation is no longer the most useful variable to flex to explore uncertainty

In summary, for *FES 2020*, we are:

  - Retaining four scenarios on two axes
  - Introducing a new vertical axis of "Level of Societal Change" (replacing "Level of Decentralisation")
  - Retaining "Speed of Decarbonisation" as the horizontal axis which continued to have broad support from stakeholders as a key uncertainty
  - Having one scenario which doesn't meet the 2050 net zero target.
  - Security of supply standards for both gas and electricity to be achieved across all four scenarios.

Improving how we engage and work for *FES 2020*

- We will continue to look for and make improvements to the way we engage with stakeholders.
- We will ask for input before making key decisions on our approach.
- We will consider holding two events for the launch of *FES 2020* to meet stakeholder needs and publishing the suite of documents a week before the main conference.
- We will provide adequate time during events for discussion, networking and Q&A.
- We will continue to increase the level of transparency around our assumptions and a provide a clear comparison from *FES 2019* to *FES 2020*.
- We will continue to share our engagement plans, inform on early modelling insight and ask for views and feedback via our FES newsletter and provide updates on the FES website.

We look forward to sharing the final *FES 2020* with stakeholders and industry in July. If you would like to find out more about our ongoing FES work and have early sight of some of our results, please sign up to our newsletter, visit the FES website or contact the team by email on: FES@Nationalgrideso.com

2. How we engage with stakeholders

Engagement with our stakeholders for FES is an annual cycle which starts and finishes with the launch and publication during July.

The development process of FES includes several stages, including stakeholder engagement, data and intelligence gathering, followed by high level scenario creation and our own detailed modelling and analysis. At each stage in the development process we apply our expertise and judgement to ensure plausible and credible scenarios are delivered.

Stakeholder engagement plays a fundamental role in the development and production of the scenarios every year. The broad engagement that takes place across the energy industry and wider allows us to capture the full range of uncertainties by listening to a range of different perspectives. The deep engagement that we host with experts across specific technologies and sectors allows us to recognise the complexity and interaction across the whole energy system.

Figure 1

We use a variety of engagement methods to ensure we gather the best evidence and input for our analysis, and then to share the outputs in ways that are accessible to our stakeholders.

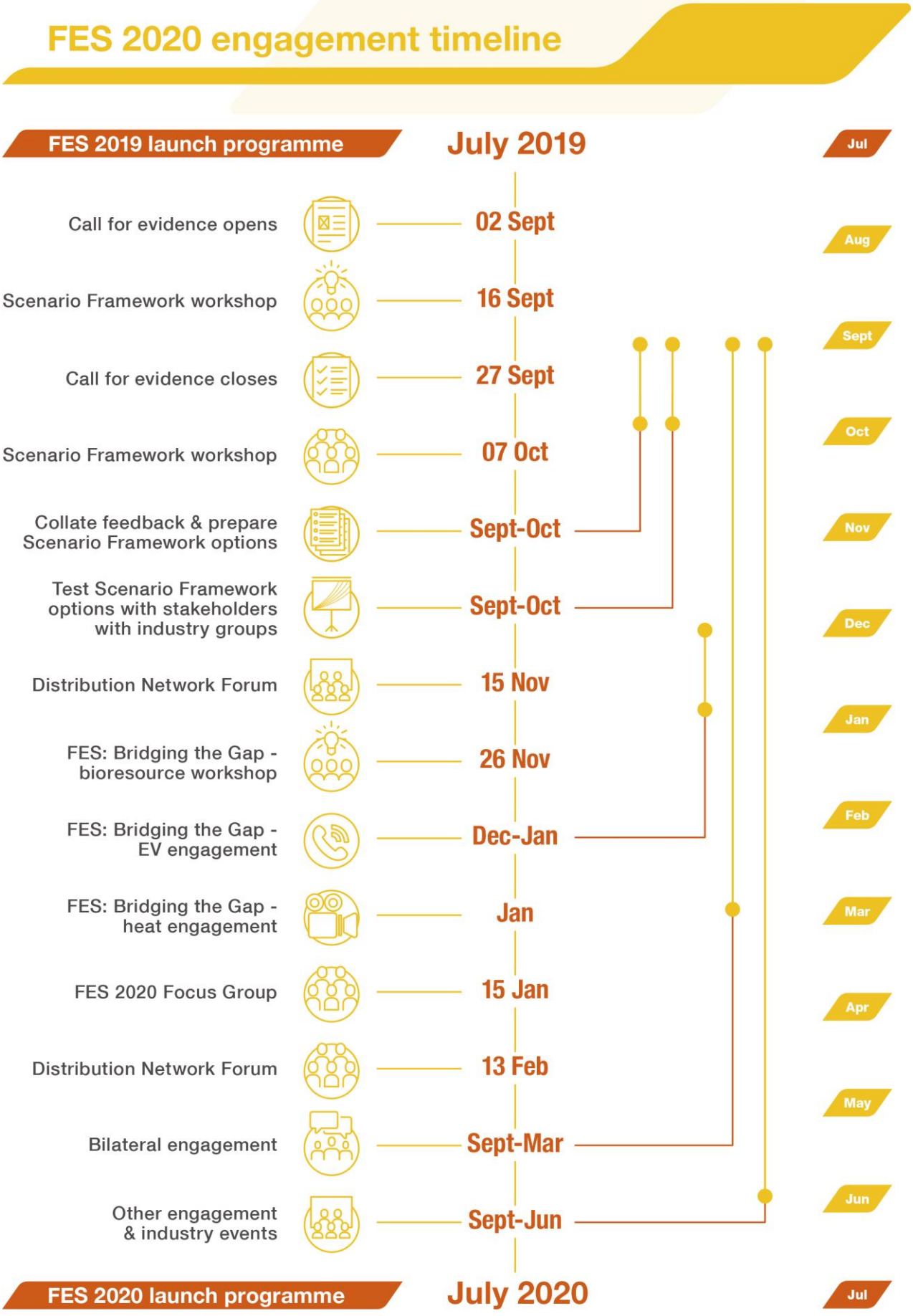
As the energy industry continues to evolve and its participants change, we review our stakeholder lists to ensure we are reaching out to a full cross section of current and new stakeholders. This provides the breadth and depth to the debate and conversation for each significant event.

A. Summary of stakeholder engagement since July 2019

A timeline of the engagement that has taken place since the *FES 2019* launch is shown overleaf. A summary of the engagement shown in the timeline together with an overview of our communication activity can be found in the appendices on page 34.

Figure 2

Timeline showing key engagement during 2019



Stakeholder feedback last year highlighted that stakeholders wanted us to collaborate with them more and we have sought to address this in the following ways.

We have taken a different approach to our engagement, tailoring it to our stakeholders needs and providing more bespoke sessions. This included a change in our events for the *FES 2019* launch programme. We undertook a briefing for Ofgem and BEIS (Department for Business, Energy and Industrial Strategy) to discuss our analysis and key messages prior to the publication. On the day of FES publication, we hosted a morning briefing where we shared the *FES 2019* key messages and spoke with industry leaders about their views of the *Future Energy Scenarios*.

Our conference was then held a week after publication which enabled attendees to fully review the document beforehand. This meant that discussion was more focussed on the data and analysis of the document, providing much more meaningful engagement for us and for our stakeholders.

In our autumn engagement, we sought a broad range of industry opinion in using our *Shaping FES 2020* Call for Evidence and FES newsletter. This has been done alongside a renewed focus on who we are engaging with and why, to ensure we get the necessary expert opinion whilst also considering a broader range of stakeholders.

We have tailored further engagement to seek collaborative opportunities to engage with industry experts on specific topics, including the revised Scenario Framework, and the use of bioresources as part of the *FES: Bridging the gap to net zero* programme. This engagement has enabled us to deepen our understanding and provide challenge to our early FES design and Scenario Framework.

With the new legally separate Electricity System Operator (ESO) we have been using the ESO channels on social media and LinkedIn; these channels have an audience reach that is smaller than the previous National Grid channels but allows us to be more targeted in our communications for those with a closer interest in the subject.

We produced five videos looking specifically at *FES 2019*, including the four key messages:

- An overview of *FES 2019*
- Reaching net zero carbon emissions by 2050 is achievable.
- Electric vehicles can help decarbonise both transport and electricity supply for Great Britain.
- Heat decarbonisation pathways are uncertain and vary by region
- A whole system view across electricity, gas, heat and transport underpins a sustainable energy transformation.

These were shared on our YouTube channel, LinkedIn and on Twitter. We also shared on the day content from our conference via video and this is an area we will seek to increase throughout the year.

We have had additional sessions with stakeholders about our process for compiling FES, focused on our Scenario Framework and are sharing a higher level of information with Ofgem and BEIS to help with ongoing discussions.

We have worked closely with the gas and electricity distribution network companies to understand the impact of our work on them specifically and will work in a collaborative way going forward.

Scenario costing webinar

In March 2019 we ran a webinar to share with stakeholders the results of a piece of work we conducted looking at the cost of the 2018 scenarios. We had over 50 stakeholders join us for the webinar where we explained our approach to the work, explored the key scenario differences, and look at some of the sectors of most relevance to electricity and gas demand, for example the electricity supply and transportation sectors. We also incorporated time into the session for questions and answers. The slides and recording of the webinar were made available on the FES

website shortly after. As there was little change to the Scenario Framework from FES 2018 this exercise was not repeated for FES 2019.

***FES: Bridging the Gap to net zero* programme**

During summer 2019 we highlighted that we would be going further than in previous years to explore the 'so what' of our FES analysis. *FES: Bridging the gap to net zero* programme was launched during November 2019 focusing on themes from our *FES 2019* key messages to look more closely at what steps need to be taken to reach the UK's 2050 net zero target. These three topics (bioresource, electric vehicles and heat) are considered to be the areas of greatest importance and/or uncertainty which required further investigation.

While the main output from this programme is a report which is not part of our FES analysis, it also provides a strong feedback loop into *FES 2020* by clarifying areas of uncertainty and gathering detailed evidence for *FES 2020* analysis. It is designed and timed to provide valuable input and evidence to *FES 2020*, like many of our other stakeholder engagements.

This programme is a pilot and is co-designed with stakeholders as it progresses. It is trialling both the content questions being researched, and different types of stakeholder engagement tailored to the relevant stakeholder groups for each topic. We are working with Laura Sandys CBE on this programme, who will be acting as an event chair and guest editor for the programme.

The first piece of work in this programme was a focused workshop on 26 November to look at the role of bioenergy in a net zero world. The workshop looked deep into areas of uncertainty and consensus for bioenergy across different energy areas, and how this might be represented in our *FES 2020* scenarios. We discussed where there might be clear areas for action in the area of bio-resource, to help GB meet our net zero goal. This theme picks up on two of our *FES 2019* key messages, exploring net zero and whole system thinking.

The second topic in our *FES: Bridging the gap to net zero* programme focussed on the future role of electric vehicles (EVs) in the energy system. In *FES 2019*, one of our key messages was around the ability of EVs to facilitate greater growth of renewable generation - primarily via their ability to absorb renewable power for use at other times. We undertook bilateral calls with eight organisations working in the EV arena, including charge point providers, suppliers, technology companies and consultants. The focus of these calls was to understand more about:

- the size of the electricity flexibility market opportunity for electric vehicles
- likely development pathways for smart charging and vehicle to grid
- types of markets where EVs could play a greater or lesser role in addressing system problems

We also asked organisations for their views on any current barriers to the maximising the 'double decarbonisation' effect of electric vehicles, and any next steps that could be taken now to address these.

The final piece of work is considering how the management of peak electric heat demand could help meet decarbonisation targets. We recorded a short series of videos, featuring *FES 2019* heat analysts looking at:

- why electric heat demand, and particularly electric heat demand at peak, is important from a system point of view
- how we modelled peak electric heat demand in *FES 2019*
- a number of questions on areas where we would like to hear people's views, information and thoughts on next steps. These are heat storage, insulation and its impact on peak heat, and consumer and heat pump behaviour in very cold weather.

These videos featured in online engagement forums in late January 2020 to gather views from a wide range of stakeholders in this area.

FES 2020 document focus group

In our December newsletter we asked stakeholders to get in touch with us if they would like to take part in a focus group on the structure of *FES 2020* document. The focus group took place in January via Webex to enable attendance across a wider geographic area. It prompted valuable discussions about the impact of our proposed changes and how that would affect varied audiences for *FES*. The participants endorsed our recommended approach and their feedback will help our development of the *FES 2020* document.

Engagement with Ofgem and BEIS

We hold regular and ongoing engagement with Ofgem and BEIS to ensure that they are kept informed of the development of *FES 2020* and how stakeholder input continues to inform the scenarios. Both organisations were involved in the development of the new Scenario Framework.

International engagement

We have continued to engage with those further afield than the UK. Subscribers to our newsletter reach out as far as Japan, India and Romania enabling them to be kept informed about FES, our engagement and the opportunity to be involved.

At the *FES 2019* launch event on the 18 July in Birmingham we had many stakeholders from other countries, including: Netherlands, United States, Denmark and Finland. This international representation provides fresh insight and a different perspective, promoting richer discussion.

Other engagement

As well as the collaborative engagement described above, we have also attended approximately 50 other events; to both share our knowledge and insight as well as bring feedback and evidence to include with our analysis. These include engagement with consumer groups, energy industry consultants, trade bodies and those representing renewable energy organisations.

By doing this we are meeting with those stakeholders who may not have the time to attend our engagement events, providing the opportunity to talk to us and gain a greater understanding about FES.

We also engaged specifically with flexibility providers and small generators across the industry to gain insight into their subject matter. This included a Flexibility Forum event run by Cornwall Insight where we presented FES and engaged with those stakeholders' present. Our bilateral engagement has also incorporated storage and flexibility organisations like the Association for Decentralised Energy.

During the autumn time, we spent time talking to existing stakeholders over the telephone for our own evaluation and external engagement, to discuss their feedback, queries and to build relationships with new stakeholders, as well as identifying other areas of the energy industry and beyond to engage with.

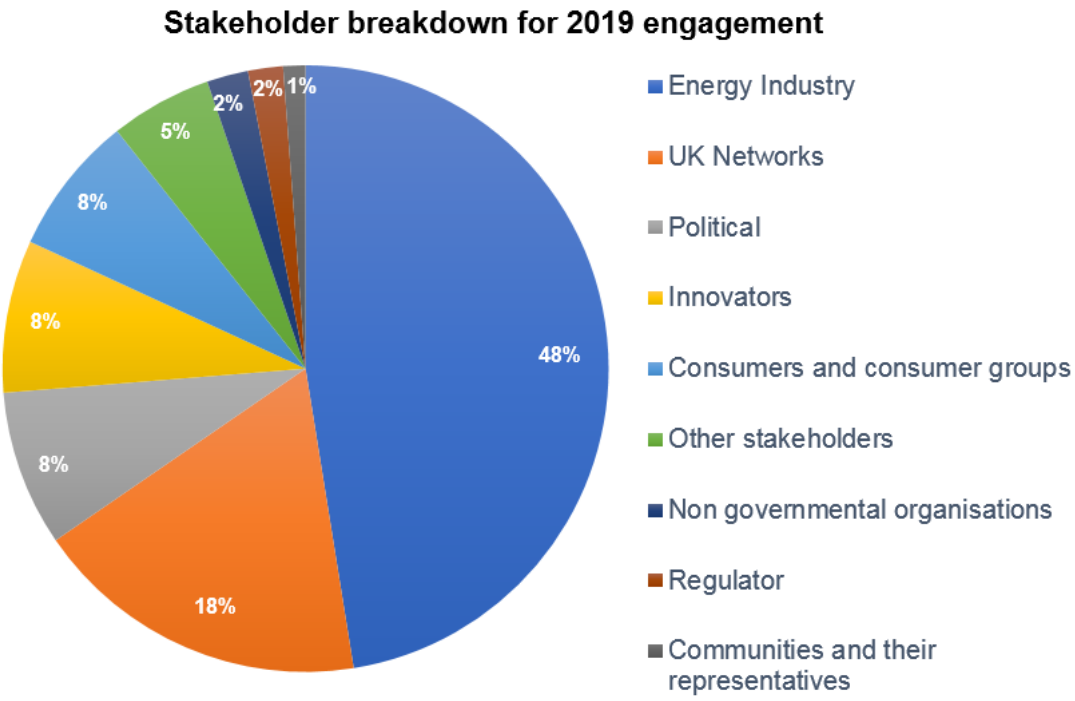
The team has also been involved in the Spatial GB Clean Heat Pathway Model project – an NIA funded collaboration between National Grid Gas and National Grid ESO, delivered by Element Energy. The project aims to provide a coherent modelling framework for regional energy demand and supply mapping that captures competition between low carbon technologies and the impact that consumers, communities, distribution networks, and regional and national bodies will have on the national heat decarbonisation strategy.

Stakeholder groups engaged during 2019

The graphic below shows the nine different stakeholder categories we have engaged with during 2019

Figure 3

Stakeholder breakdown for engagement during 2019



Measuring engagement satisfaction and improvements for *FES 2020* and beyond

During all our significant engagement events, we measure the level of stakeholder satisfaction by using the Net Promotor Score (NPS) on our feedback cards used on the day. For all our recent engagements events included the FES 2019 launch the NPS score is currently +39.

NPS is an index ranging from -100 to +100 that measures the willingness of customers to recommend a company's products or services to others. It is widely recognised as a means of measuring levels of satisfaction. A “positive” score above 0 is considered “good”, +50 is “excellent,” and above 70 is considered “world class.”

In the summary tables in the appendix on page 34 we have detailed the individual score for each of our collaborative engagements together with feedback received.

B. Engagement and communication actions and improvements

Based on the feedback that we have received from our events and activities since July 2019, below are the actions and improvements we are considering for our engagement and publications.

Engagement and Communication		
You said:	**We will:**	**Where was the feedback gathered?**
You prefer the locations of London, Birmingham and Manchester for our engagement events.	Consider the top three favourable locations for our launch venues for 2020 and further events during our autumn engagement programme.	Call for evidence
You prefer communicating by email with ESO & FES websites being favourable with social media and LinkedIn having less importance.	Continue to publish bi-monthly or more regular newsletters to inform stakeholders as well as asking for feedback on key decisions we are making. Make enhancements to the FES site to ensure it remains fit for purpose and meets stakeholder needs. We will continue to use social media as a means of engagement but not be fully reliant on this for getting our messages out.	Call for evidence
You like having a week to read and digest the suite of FES documents before attending the main launch event; this is adequate time and is a positive change from last year.	Publish the suite of FES documents at least a week before holding the main FES launch conference.	Call for evidence
You would prefer if we continue with a similar format for the *FES 2020* launch events that allows adequate time for Q&A, discussion and networking and with senior ESO leaders.	Hold two events to meet the needs of our wide stakeholder base for our launch programme of events for *FES 2020*. During each event, we will ensure that delegates have plenty of opportunity for networking and Q&A time with the ESO leaders and our team of analysts.	On the day satisfaction cards at FES 2019 launch event
You would like us to be clear in the scope and purpose of each launch event through the invitation and introduction.	Be explicit in the scope, purpose and aim of the differing launch events as part of the invitation process for the launch events.	
You believe we should ensure diversity in presenters at engagement events.	Ensure that our presenters and representatives at events represent a range of diversity.	
You think we need to be clearer on the use of Slido.	Provide clear instructions on how to use Slido as part of the pre-read material and also during the event introduction.	
You would like better planning & allocation of delegates to individual topics sessions during the conference.	Look at the options available for planning and allocation of delegates for attending any smaller specific sessions that we may host during the main conference for *FES 2020*.	
You value the full range of publications that make up FES. You especially appreciate having a concise summary,	Continue to provide the full suite of FES documents, including FES-in-5, and ensure	Call for evidence

in the form of FES-in-5 alongside the main FES document and data workbook. You would like the documentation to be as comprehensive as possible.	they meet our stakeholder's needs by considering a range of perspectives.	On the day satisfaction cards at FES 2019 launch event
You strongly supported our proposal to discontinue the printed copies of the full FES document, and move towards the interactive online style used in our Market Outlook publications.	Continue to provide printed copies of FES-in-5. However, based on your support for reducing our carbon footprint, we no longer intend to print the main FES document.	Call for evidence
You would like the document to be more concise.	Aim to make the online document more accessible and concise to read via the introduction of interactive features.	Call for evidence
You would appreciate greater transparency of the assumptions made within the scenarios.	Explore ways of bringing key assumptions into the core narrative so that they are clearer and more transparent when developing the main FES document. Continue to provide the full details of our scenario assumptions in the associated Scenario Framework document. Look to share the key assumptions in the presentations that we give during *FES 2020* launch programme and subsequently share online.	On the day satisfaction cards at FES 2019 launch event Call for evidence
You would like us to provide more visible comparisons to the previous year's FES.	Look to provide comparison information that will enable stakeholders to compare & contrast with the *FES 2019* scenario range as the scenarios will not be directly comparable since the framework and scenarios will be changing for *FES 2020*.	On the day satisfaction cards at FES 2019 launch event Call for evidence
You have asked for increased granularity of data at a consistent level across the outputs, and for more sensitivity work to be included in the publication.	Publish as much of our data and assumptions as possible, to ensure that they can be externally ratified via challenge and review. We expand on the data set we provide in our Data Workbook every year as we develop our analysis and receive requests for additional data. We will publish the data related to the building blocks agreed with the DNOs. Continue to do this, and extend the data sets where possible, however there are certain areas where we must aggregate data items for confidentiality reasons.	Call for evidence
You would like more information relating to relative costs and consumer benefits across the scenarios.	Endeavour to include more qualitative information in the main narrative to improve comparison of scenarios based on cost where relevant. Look to analyse the scenario costs in a similar way to our scenario costing in *FES 2018*, and publish these as a standalone document.	Call for evidence

3. FES 2020 Scenario Framework and Scenarios

We use our *Future Energy Scenarios* to help us plan for an uncertain future. It would be unhelpful to forecast a single pathway for our energy future over the long term, a view also held by our stakeholders. Instead, we develop scenarios to help us explore a range of credible futures and to better understand the uncertainties facing the energy industry. It is important that we regularly check that our scenarios properly reflect our views of the future, and we strive to improve our process continually. As a result, this year we have changed the Scenario Framework to take into account recent developments in the energy world.

In this section, we explain the choices we have made in developing the scenario framework and the stakeholder feedback we have used to inform those choices.

The scenarios for *FES 2020*

Taking account of the engagement feedback and our own analysis, we will have four scenarios structured in a 2x2 diamond matrix against axes of speed of decarbonisation and level of societal change.

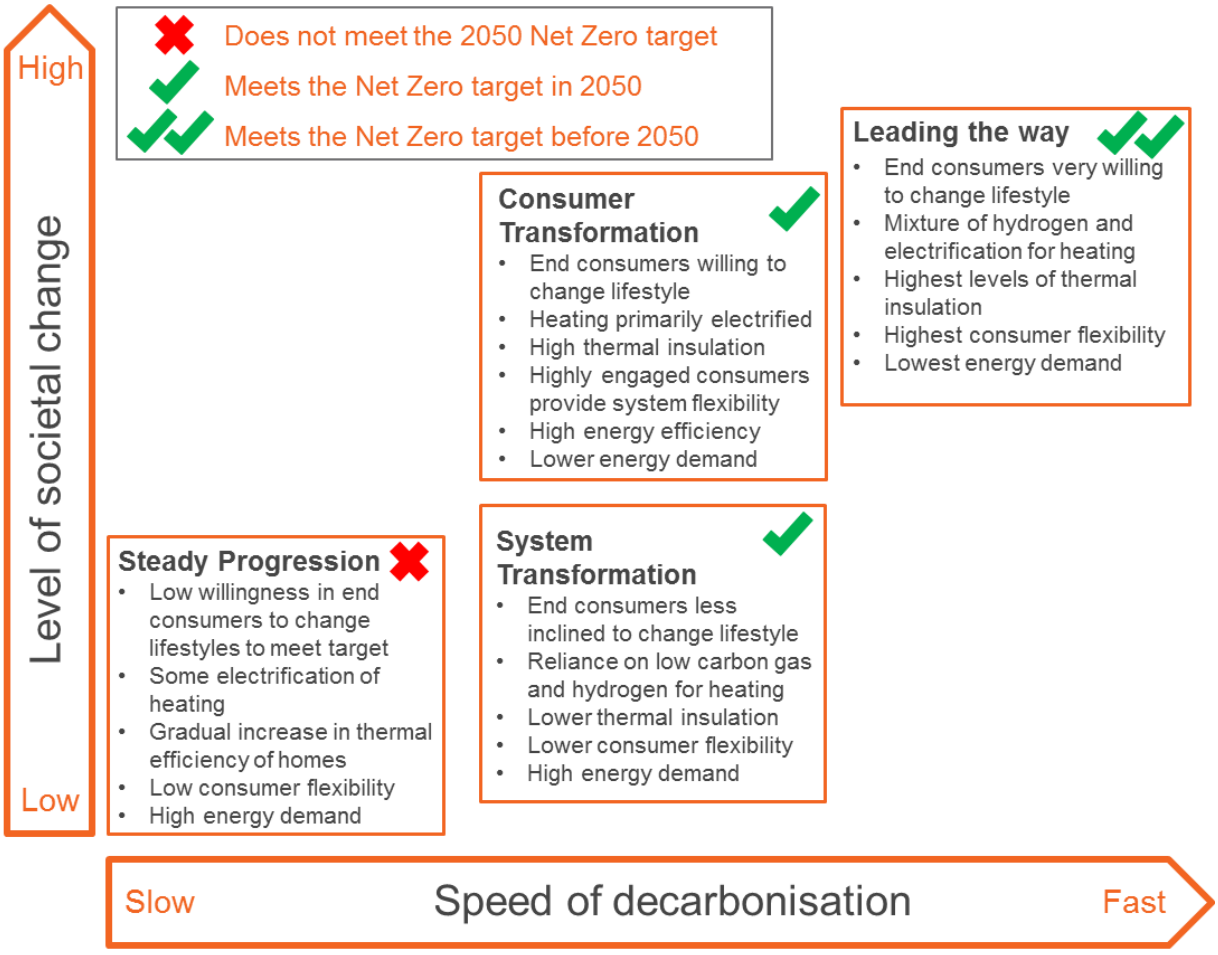


Figure 4: FES 2020 Framework

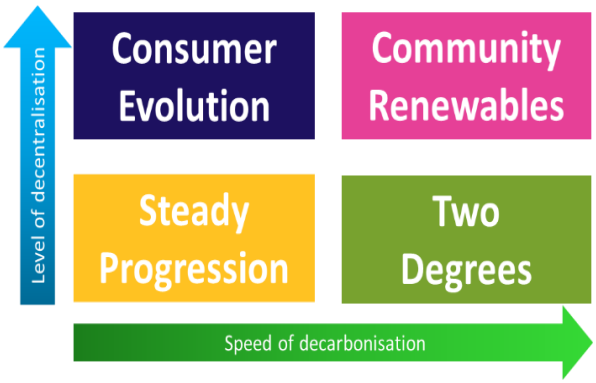
Creating the Scenario Framework

In *FES 2020* we have kept a 2-axis structure but changed the alignment and the nature of the scenarios modelled. The 2019 and 2020 scenario frameworks are presented below, showing the changes made.

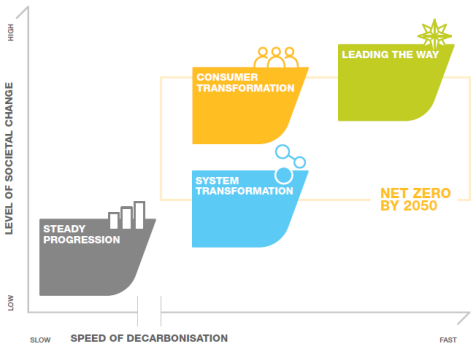
Figure 5

FES 2019 and FES 2020 scenario matrix

FES 2019 scenario matrix



FES 2020 scenario matrix

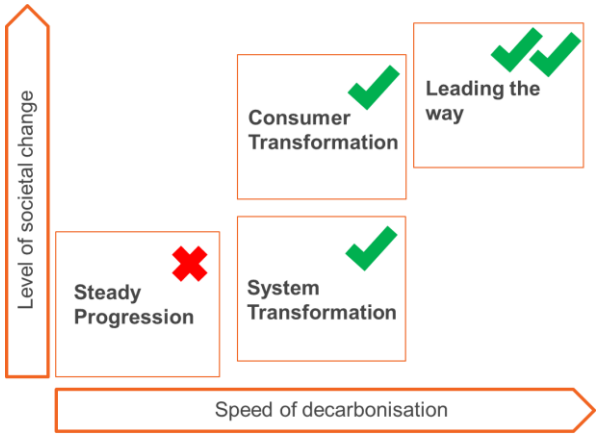


When we develop our scenarios, we have traditionally used a structured approach that we call the Scenario Framework, shown in figure 4. This ensures that our scenarios are internally consistent while also exploring the credible range of uncertainty as a set of scenarios. Figure 6 shows the stages in creating scenarios, starting with the Scenario Matrix, where we decide how many scenarios there will be, and how they will be differentiated at the highest level. There are then stages with increasing levels of detail, culminating in the Levers, which describe how we choose the inputs into our detailed models.

Increasing level of detail

Scenario matrix

In FES 2020 there are two axes; consumer change and speed of decarbonisation. There are three different levels of decarbonisation and four different levels of consumer change, creating a 2x2 diamond matrix and four scenarios



Common assumptions

Assumptions which are the same across all four scenarios in the matrix

Example:

- Population
- Exchange rates

Driver levels

A set of parameters that drive where the scenarios sit on the two axes

Drivers can be set at several different levels. For example, each scenario will have the driver for onshore wind set to high, medium or low.

Levers

The mechanisms and assumptions which help quantify the driver levels

Example for onshore wind:

- Low: only projects with consents are built
- Medium: decisions based on intelligence gathered from stakeholders
- High: no incentives required to build projects

Figure 6: How we create the scenario framework

Engaging across industry

We aim to reflect the breadth of stakeholder input and uncertainty in designing the framework. Where we haven't received clear input or direction from stakeholders on a topic, we draw on other sources of information to support our decisions. In making these decisions, we consider: the purpose of FES in network investment both today and in the future; industry publications, conferences and discussion; the direction of government policies; and the questions which we are asked by industry, government and the regulator on a day-to-day basis.

Our engagement for the *FES 2020* framework started with our *Shaping FES 2020* call for evidence circulated to nearly 7,000 stakeholders and promoted through multiple channels. The numbers of stakeholders who provided significant input on the framework are summarised in the below.

Stakeholder category	Call for Evidence	Presentations	Workshops	Total
Consumers and consumer groups	6			**6**
Energy industry	23	19	20	**62**
Innovators	2			**2**
Non-governmental organisations			1	**1**
Other stakeholders	1		1	**2**
Political	1		6	**7**
Regulators			2	**2**
UK Networks	9	14	15	**38**
Total	**42**	**33**	**45**	**120**

Feedback from stakeholders

Stakeholders confirmed that a two-dimensional framework is a useful tool to articulate the scenarios and how they are differentiated. The first element of the framework we then tested was how uncertainty is explored through the axes of the framework.

Axes of uncertainty

In order to understand stakeholder attitudes towards the existing framework and the appetite for change we tested support for the existing axes we have used against a range of other potential axes we could use for the scenario framework.

The axes tested were:

- **Speed of decarbonisation** - an existing axis. To explore extent to which target is met early or missed.
- **Degree of electrification** - this would explore the balance between electrification and use of low carbon gas.
- **Green ambition** - the extent to which public sentiment and policy prioritises decarbonisation (an axis used in FES 2017).
- **Level of decentralisation** - an existing axis. To explore how close supply is to demand.
- **Economic prosperity** - the rate of economic growth (an axis used in FES 2017).
- **Level of consumer engagement** - the extent to which consumers are engaged with their energy use (e.g. respond to price signals to modify demand).
- **Supply-led vs Demand-led** - seeks to address whether a supply side solution is favoured over a demand side solution.

- **Level of devolution** - similar to “decentralisation” but looks at extent to which a more regional approach could be taken to decarbonisation e.g. clean heat.
- **Level of energy efficiency** - would attempt to stretch the range of energy demand levels (e.g. thermal efficiency of buildings).

In the call for evidence respondents were asked to rate the importance of each potential axis on a three-point scale from ‘very important’ to ‘not important’. Figure 7 summarises this feedback.

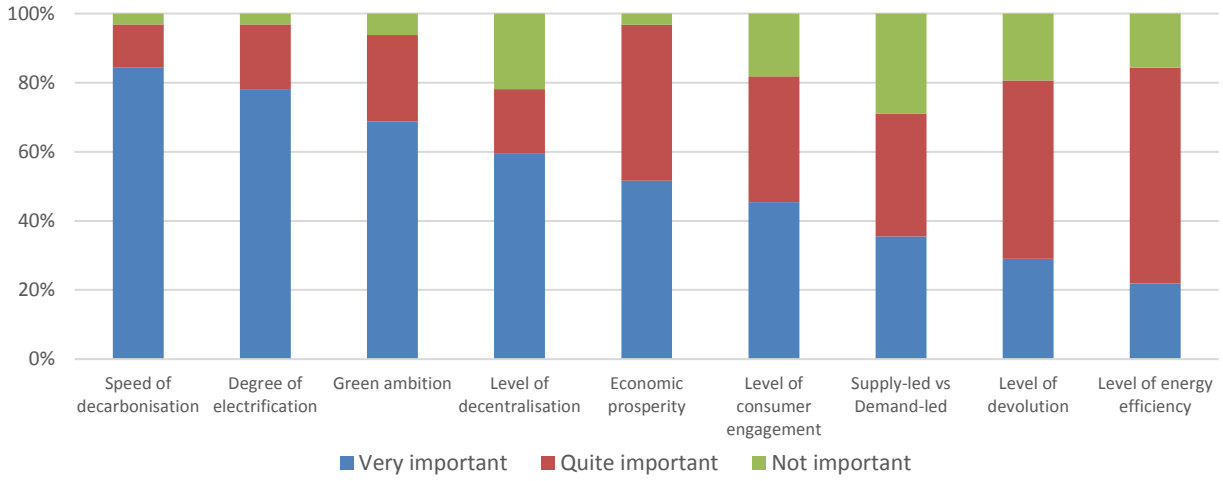


Figure 7: Levels of support for different framework axes

Views were mixed from the 34 respondents to the framework section of the call for evidence. Only four of the options gained over 50% of ‘very important’ votes.

From this and qualitative feedback we concluded that there are many factors driving energy developments. As such it is difficult to choose one over another, further exacerbated by different factors affecting different aspects of energy to different levels. As the diversity of the energy industry grows this effect is increased. There will also be different factors at force over the timescale we cover. We have therefore tried to select a broad axis which can demonstrate a breadth of factors and impacts on the scenarios.

‘Speed of decarbonisation’ retained

The results show that ‘**speed of decarbonisation**’ has good support as a key uncertainty and will therefore be used as an axis in *FES 2020.*

‘**Green ambition**’ and ‘**economic prosperity**’ were also ranked highly. These two uncertainties were combined into the ‘Speed of Decarbonisation’ axis in FES 2018, and we wanted to test whether this treatment should continue. The logic supporting the combination of the two uncertainties was that the relationship between the two variables has changed; for example, the costs of some renewable technologies have reduced significantly. Following discussions with stakeholders, it is clear that this logic continues to hold, and so retaining the ‘Speed of Decarbonisation’ axis would enable both of these uncertainties to be captured.

‘Level of decentralisation’ removed

There was significantly less support for ‘**level of decentralisation**’, which was used in both 2018 and 2019. This axis was ranked as only the 4th most important by number of supportive responses and received the second highest number of responses ranking it as ‘not important’. This combined with feedback through workshops and bilaterals, to inform that a ‘step change in policy means that we can’t keep existing assumptions and scenarios’. This has led us to conclude that the ‘level of decentralisation’ is no longer one of the key uncertainties and we have removed this as an axis in the framework.

‘Level of societal change introduced’

This axis explores the degree to which the behaviour or lifestyle of end consumers of energy (including domestic, industrial and commercial) can be assumed to change. It does not represent whether the nature of this change is voluntary or mandatory – just how disruptive the change will be. Behaviour here includes both day-to-day actions and one-off decisions and investments, such as building improvements or technology choices. Varying this axis will allow us to explore different levels of consumer engagement and flexibility, levels of energy efficiency and levels of electrification of heating.

In a world where there is a low level of societal change there is more reliance on low carbon gas (e.g. hydrogen) to meet heat demand, whereas in a world with high levels of societal change with higher flexibility and where consumers see higher levels of change in building insulation and heating technology, heat is primarily electrified. By explicitly flexing the level of societal change it will be possible to further understand the potential impact of consumer-provided flexibility in facilitating the decarbonisation of energy.

While ‘Degree of Electrification’ was the axis with the most respondents marking it as ‘very important’ outside of ‘Speed of Decarbonisation’, the level of support for other axes as well as qualitative feedback questioning the suitability for this as an axis, both in the call for evidence and workshops we held, meant we felt it was necessary to consult further on the appropriate vertical axis to use.

One repeated discussion point was on the uncertainties about the pathways for the future decarbonisation of heat and there was clear feedback that, as the largest area of uncertainty, the Y axis should explore a range of outcomes here. Credible scenarios could range from a world that is dominated by low-carbon gas and hydrogen use compared to a world with high use of electrification. Most stakeholders within workshop discussions felt that both of these worlds should be explored within our scenarios. This is the reason why ‘Degree of Electrification’ was initially popular as an axis.

During external workshop discussions, we asked stakeholders to explore why they thought particular variables were important, and whether there was another category that could be used to encompass them. There were suggestions that an explicit electrification axis may be too specific and neglect other important areas of uncertainty, and that worlds that are either more low-carbon-gas dominant or electricity dominant could be explored using axes other than ‘Degree of Electrification.’

Using ‘level of societal change’ as an axis can show changes in many areas, including fuel type (e.g. electrification), levels of thermal insulation / energy efficiency, levels of consumer engagement in flexibility services and level of policy support. This approach is also supported by workshop discussions where stakeholders felt that a key driver of decision-making will be ‘public acceptability of disruption’, a concept which is central to the ‘Societal Change’ axis.

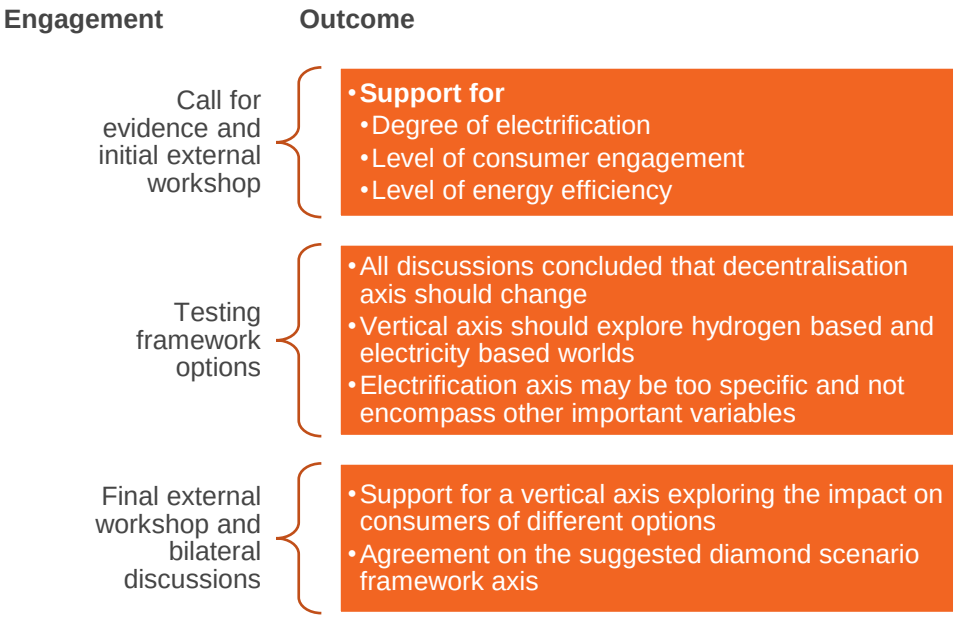


Figure 8: Vertical axis options testing

Other areas of feedback

We also consulted on changes to the framework in other areas. One important area of engagement was around the net zero emissions target. In *FES 2019* two of the scenarios met the 80% carbon reduction target with two non-compliant scenarios. We engaged with stakeholders to understand their views on:

- How many scenarios should meet new net zero 2050 target
- Whether there should be any scenarios which did not comply with the net zero target
- Whether there should be any scenarios which met the target earlier than 2050

Stakeholders were broadly supportive of the inclusion of one or more non-compliant scenarios and for the Steady Progression scenario to represent the credible least amount of progress towards the 2050 target. Stakeholders also agreed that there should be more than one net-zero compliant scenario.

Respondents to the call for evidence were more evenly split on whether there should be a scenario that meets the net zero target earlier than 2050, with 35% supportive and 29% against and we received a range of feedback on this issue. We have also considered our experience with regards to the net zero target. In early stakeholder engagement for *FES 2019* there was no broad support for inclusion of net zero as a core scenario within our modelling, however we received feedback suggesting that *FES 2019* had not represented the full envelope of credible outcomes by not including a net zero scenario after the government's net zero commitment in May 2019. Combining past experience with current context and the split stakeholder opinion we received on this issue, we see significant consumer benefit in including a core scenario that meets net zero earlier than 2050 to ensure that we can produce a credible range of scenario outcomes.

We also consulted on potential disruptors that could emerge within the next 12 months to affect our choice of framework. Of these the main areas raised were the potential for political change, the uncertainty caused by Brexit and potential game changing developments in battery storage. We feel our framework allows enough flexibility for our scenarios to fully represent uncertainty in these areas.

We also asked stakeholders whether we should continue to include a balanced mix of technologies within each scenario such that each scenario remains credible or stretch the envelope of possibilities by focusing more on one technology than another in different scenarios. Stakeholders were supportive of the balanced approach for each scenario, however wanted us to ensure that within net zero scenarios the range of uncertainty for provision of heat between electrification and hydrogen was adequately represented.

Stakeholder feedback summary

- There is a mandate for change. Consistency is valuable, but the 2019 framework is no longer suitable as:
    - The UK's decarbonisation target is now net zero in 2050
    - Decentralisation is no longer the most useful variable to flex to explore uncertainty
- The 2-axis framework is useful to structure and articulate the scenarios, making the content more accessible
- Decarbonisation of heat is the biggest challenge in reaching net zero emissions.
- A combination of 2050-compliant scenarios and non-compliant scenarios will maintain credibility
- The best variables to flex using the 2-axis framework are:
    - 'Speed of decarbonisation' (widely agreed to be the biggest uncertainty)
    - 'Level of societal change' (combines the area of uncertainty most supported by stakeholders, 'degree of electrification' with other important variables such as 'level of consumer engagement', 'public acceptability of disruption' and 'level of energy efficiency').

The **speed of decarbonisation** axis combines policy, economics and consumer attitudes. All scenarios will show progress towards decarbonisation from today, with the scenarios in the centre of the matrix meeting the 2050 net zero target and those on the right and left representing the credible range of decarbonisation progress by meeting the target earlier and missing the target respectively.

The **level of societal change** axis allows us to explore different solutions for decarbonisation of heat (e.g. electrification vs low carbon gas) alongside changes in consumer engagement, levels of energy efficiency and a 'supply-led vs demand-led' approach. Scenarios close to the bottom of the axis involve lower levels of energy efficiency improvements, less change of heating technology (incl. continued use of the gas network) and lower levels of consumer engagement in flexibility services. Scenarios closer to the top of the axis involve greater impact on consumers, with greater changes in heating systems and insulation and more consumer appetite for participation in provision of flexibility to help manage peak demand and intermittent generation.

Continuing with four core scenarios and a two-axis structure retains some elements of the previous format to aid comparison. As in previous years, security of supply standards for both gas and electricity will be achieved across all the scenarios.

Summary of stakeholder feedback for the Scenario Framework and Scenarios

Scenario Framework and Scenarios		
You said:	**We will:**	**Evidence:**
You value year on year continuity and support continued use of a two-axis framework. You consider that having four scenarios allows us to show an appropriate range of future pathways.	Continue to produce four scenarios and use a two-axis framework to allow users to understand how the scenarios relate to each other. We will also maintain the same horizontal axis, '*speed of decarbonisation'*. Due to the significant legislative changes over the past year with the net zero amendment to the Climate Change Act change is necessary so we **won't** keep the framework the same as last year.	Call for Evidence Scenario workshop UK Networks
You have suggested that decentralisation may not be the most useful axis to explore future uncertainty in the energy sector.	Change the vertical axis to better explore future uncertainty in energy provision.	Call for Evidence Scenario workshop Range of stakeholders
You see the potential for the use of hydrogen or electrification to decarbonise heat as a major area of uncertainty.	Change the vertical axis to allow us to explore the impact on consumers of different choices and the consumer appetite for flexibility. This will also allow us to capture variation in levels of deployment of hydrogen-based or electrified heating systems as they represent differing levels of impact on consumers. However, we **won't** include the level of electrification directly as an axis, as we are able to reflect the uncertainty in this area through the variation in our chosen vertical axis '*level of societal change'*.	Call for Evidence Scenario workshop UK Networks Energy Industry
You would like us to explore more than one way of meeting net zero in our scenarios to avoid giving the impression there is only one way to meet net zero.	Include at least two scenarios which both meet the net zero target in 2050 using different pathways to explore the uncertainty in this area.	Call for Evidence Scenario workshop On the day satisfaction cards at FES 2019 launch event Energy Industry
You would like us to continue to include at least one scenario that does not meet the 2050 net zero target as a counterfactual and to ensure that a credible broad range of outcomes and uncertainties are represented.	Include a scenario that does not meet the 2050 net zero target, representing the lowest credible level of decarbonisation, to allow comparison between this and the highly decarbonised worlds that do meet the target.	Call for Evidence Scenario workshop UK Networks Energy Industry
You have expressed a range of views about whether any of the scenarios should meet net zero before 2050.	Include a scenario that meets the net zero target early in order to produce scenarios that cover a credible range of outcomes.	Call for Evidence Scenario workshop Energy Industry NGOs UK Networks Consumer groups
You would like us to continue to include a balanced mix of technologies within each scenario such that each scenario remains credible in its own right.	Ensure that each scenario is individually credible with a balanced mix of technologies. These will still cover as wide a range of uncertainty as possible.	Call for Evidence UK Networks Energy Industry Consumer Groups

4. Stakeholder input to date for FES 2020

Below we have provided a summary of the insights and evidence gathered from stakeholders during our autumn engagement, together with other input and analysis that will inform *FES 2020*. We have detailed the feedback received, the action we will take based on this or, where we will take a different approach, the reasons why.

Summaries of the specific feedback from *Shaping FES 2020* call for evidence, are available on our website at: Call for Evidence

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Electricity market modelling **Storage**	Storage is expected to see short term growth followed by a period of stability. Growth will pick up again when more renewables have been deployed and wholesale prices are spikier.	Continue to assess the need for storage within our analysis and will track the build out of projects via our engagement with the network companies and via registers such as the Capacity Market register.	The impact by scenario will be determined through our analysis and the FES levers.	Bilateral meeting Storage and flexibility
Electricity market modelling **Hydrogen**	Under certain circumstances (e.g. lower cost of offshore wind) hydrogen from electrolysis may be price comparable to hydrogen from stream methane reforming (SMR). This may result in additional growth in offshore wind.	Assess the need for hydrogen and the different production options as part of our whole system analysis. If hydrogen from electrolysis is included, we will ensure that the required power generation is included within the scenarios to meet this.	If we include hydrogen production from large scale electrolysis, it is likely that we include this in a limited number of scenarios. There is still much uncertainty as to how hydrogen will be produced (electrolysis, methane reformation or imports). We will aim to explore this uncertainty across the scenarios.	Bilateral meeting UK Government bodies

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Electricity market modelling **Charges**	The Targeted Charging Review and review of network charging are policies which may shift the balance between growth of distributed generation and growth of transmission connected generation. Some distributed generation sites may start to close before end of life following changes to the embedded benefits and as a result of emissions regulations.	Update our analysis to include the November 2019 decision Ofgem published on the targeted Charging Review. Monitor the case for earlier closure of these sites whilst we undertake our analysis and through further stakeholder engagement. Based on early results we are minded to include earlier closures than in *FES 2019*.	Although we have removed the decentralisation axis from the FES Framework, it is likely that the scenarios with higher degrees of societal change will see the higher levels of distributed generation. Earlier closure of unabated thermal generation typically occurs in the scenario that decarbonise quickest.	Call for evidence Bilateral meeting Energy industry
Electricity market modelling **Interconnectors**	We are likely to have significantly more than 20GW of interconnection by 2050. In *FES 2019* interconnection flatlines after the 2020s. You should consider interconnector connections outside of current listed projects.	Investigate the option of adding addition post 2030 projects within the scenarios. We will examine the consumer benefit off additional interconnectors to other countries.	The level of interconnection is likely to vary in line with the amount of renewable generation.	Bilateral meeting Energy industry

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Electricity market modelling **Technology**	We should consider higher ranges for several technologies, in particular: thermal, Carbon Capture, Utilization & Storage (CCUS), wind and nuclear.	Assess the need for all types of generation in light on the new net zero targets. This may result in higher ranges than in previous *FES*.	The amount of installed generation will depend on the total demand for electricity. In case where hydrogen is produced by electrolysis it is likely that we will see higher capacities than in previous *FES*.	Call for evidence Consultancy Electricity Transmission Company Individuals Energy suppliers UK Networks
Electricity market modelling **Renewable generation**	You generally expressed a very weak outlook for small scale wind (sites of less than 1MW total capacity) due to high capex costs and planning restrictions. Respondents were more positive around solar Photovoltaic (PV), with typical ranges being within the 20 – 65 GW bracket for a net zero compliant scenario.	Reflect the weak outlook for the smallest scale wind turbines within our scenarios particularly in light of the removal of the decentralisation axis.	The highest level of small-scale wind was previously within the Community Renewables scenario. For *FES 2020* we will align this to the level of societal change.	Call for evidence Individuals Local Authorities Electricity Transmission Company Generator Consultancy
Gas supply **LNG**	There is general oversupply in the Liquefied Natural Gas (LNG) market at present but demand, particularly from developing countries, will continue to increase.	Maintain relatively high levels of LNG in the short term as we expect prices to stay relatively low.	Keeping LNG in the scenario that is non-compliant with net zero. Reviewing the appropriateness and acceptable volume of LNG imports in the decarbonised scenarios.	Call for evidence Consultancy Electricity Transmission Company Industry Body

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Gas supply **Shale**	Environmental and public concerns, on top of regulatory tightness is, or could be, holding back development on shale gas and as such opposing views were received on whether shale gas should be developed further. Some believe it should be supported fully to achieve security of supply, and at least one net zero scenario in *FES 2020* should include UK shale.	Continue to monitor closely the environmental and political developments surrounding shale gas and incorporate these into our modelling.	The uncertainty around UK shale gas production will be captured by providing a range of plausible outcomes across the scenarios.	Call for evidence Consultancy Electricity Transmission Company Industry Body Individuals
Gas supply **Storage**	A support mechanism would be required for new storage to be viable.	Consider storage when modelling flows at times of peak demand. There will be many aspects of our scenarios that will require or benefit from support or legislation. We aim to make these assumptions clear in the document. However, we will not model in detail future storage capacity in the scenarios because from a gas supply perspective, storage essentially nets off to zero.	Where there is existing storage or a new facility comes on-line, this will be taken into account in the modelling, but we do not make assumptions regarding future projects.	Call for evidence Consultancy Electricity Transmission Company Industry Body Individuals Gas Distribution Networks

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Whole system **Hydrogen**	You would like to see hydrogen in power generation included in one of the scenarios.	Consider including H2 in the power generation mix	H2 power generation will be considered in our modelling and the volume will be determined by the economic case.	FES email account Consultancy Electricity Transmission Company Industry Body Individuals Energy suppliers
Whole system **Hydrogen**	There is some but little support for hydrogen imports.	Consider hydrogen imports but only in one of our scenarios as hydrogen imports could change the scenario significantly.	Some level of hydrogen import will be used to meet demand in one of the scenarios	Call for evidence Consultancy Electricity Transmission Company Industry Body Individual Suppliers
Whole system **Net zero**	You would like to see the trajectory of the net zero pathway to 2050	Include the trajectory of the net zero pathway to 2050	This will be reflected in all our net zero scenarios	FES launch conference FES email account Consultancy
Energy Demand **Industrial & Commercial (I&C)**	In a low carbon environment, there will be a mix of electricity for low temperature processes and hydrogen for high temperatures.	Include a wide range of lower carbon technologies in the scenarios – to reflect the uncertainty of technologies, fuel use and regional variations where possible.	Different combinations of pathways in the scenarios	Call for Evidence Other reports Industry associations Energy suppliers

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Energy Demand **I&C**	Energy efficiency or Zero Carbon in this sector is difficult and requires policy or incentivisation	Consider the impact that current and new policy would have on our scenarios. This will be captured as part of our assumptions needed to ensure we meet net zero across a range of scenarios. Reflect a range of I&C efficiency assumptions in the scenarios, based on the spring 2019 BEIS consultation on I&C energy efficiency	Reflect a range of I&C efficiency assumptions in the scenarios	Call for Evidence Industry bodies Energy suppliers
Energy Demand **Residential efficiency**	The existing government targets for energy efficiency are already challenging and the UK has missed every target it has set to date.	Assume a continuation (or reduction) of past performance in this area for Steady Progression scenario. The other scenarios specifically consider what is necessary to achieve the net zero target and so will necessarily be more optimistic.	Reflect a range of assumptions in the scenarios	Bilateral Call for Evidence Suppliers UK Network
Energy Demand **Heat**	You would like to see more granular data on the number and type of heating appliances in the *FES* data workbook (storage/resistive heaters; oil/wood/lpg boilers; etc.)	Include more disaggregated data on building level technologies and expand the sourcing of primary data in our analysis.	Range in uptake rate of low carbon technologies.	Bilateral Energy industry Trade bodies
Energy Demand **Heat**	You would like to see more evidence of how seasonal variation in heat pump performance has been used in modelling of peak demand.	Update the heat pump performance curves in our heat pump modelling and ensure seasonal impacts are captured in calculation of winter peak demand.	Range of electricity demand for heating at peak.	FES 2019 launch Energy industry

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Energy Demand **Heat**	You would like to see clearer definition of regional approach to heat decarbonisation.	Continue to reflect the regional segmentation of heat decarbonisation, especially around hydrogen and district heating where appropriate. We have started an NIA innovation project to build a platform for assessing the regional drivers of heat decarbonisation and how that might impact technology uptake. The project is not going to be completed until September 2020 and would therefore be too late to make it into *FES 2020*.	Range in fuel consumption across regions.	Call for Evidence UK Networks Trade bodies Local authorities UK Government bodies
Energy Demand **Heat**	You would like to see clearer mapping of technologies to building types based on connection to the gas grid or whether they're in new or existing stock.	Provide future projections of heating technology uptake that are grouped according to whether the buildings are new builds or existing stock on the gas grid or not.	Range in energy consumption by fuel type; better scenario narratives	FES Network Forum Gas Futures Group Gas distribution networks
Energy Demand **Heat**	You would like to see clear indication of the level of decentralisation in scenarios now that the decentralisation axis has been replaced	Explore, through sector-specific assumptions and the document narrative, how level of decentralisation can be best manifested in the scenarios	Range in heat technology uptake in scenarios e.g. more decentralised scenarios will show higher levels of district heating	Bilateral Trade association
Energy Demand **Transport**	The deployment of Vehicle-to-grid (V2G) could start to happen anywhere from imminently to within the next 10 years.	Not be modelling any significant engagement in V2G before 2025. Currently the most popular charging standard for European manufacturers, Combined Charging System (CCS), is not due to offer V2G capability until 2025 on their product roadmap. Given this and other barriers which still exist, we don't think any earlier would credible at this stage.	Different V2G adoption rates in the scenarios.	Call for Evidence Individuals Consultancies Small Renewables Energy industry UK Networks Trade bodies

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Energy Demand **Transport**	The capacity of V2G available in 2050 in a Net-zero world could be anywhere from 0-20GW, but on average you expect the capacity available to be lower than that modelled for *FES 2019*. You also expect this capacity to be lower in a scenario where we do not meet net-zero.	Include a wide range of V2G assumptions to reflect this uncertainty and we will make these assumptions clear in the scenarios. The Steady Progression scenario will likely have a very low use of V2G, whereas a higher rate of V2G, may be necessary to achieve net zero.	Different V2G adoption rates in the scenarios.	Call for Evidence Bilateral Individual Consultancies Energy industry UK networks Trade bodies UK Networks
Energy Demand **Transport**	To see significant uptake, V2G needs a strong commercial offering to domestic users. One key barrier to this is the increased cost of the V2G charger, and this may or may not come down substantially in price.	Include a wide range of V2G assumptions to reflect this uncertainty and we will make these assumptions clear in the scenarios. In Steady Progression, for instance, we may consider the uptake of domestic solar or other similar technologies with a similar payback period.	Different V2G adoption rates in the scenarios.	Call for Evidence Bilateral Individuals Small Renewables UK Networks Consultancies Innovators Energy supplier Academics
Energy Demand **Transport**	You expect to see a significant number of biofuel heavy goods vehicles (HGVs) on the road from the early 2020s - 2035, 5-10 years before we see a significant number of hydrogen HGVs on the road.	Be unable to model considerable uptake of biogas road transport in net-zero scenarios without first modelling the other sectors to better understand the resources available. The range of uptake dates suggested broadly align with the results of our *FES 2019* modelling. In *FES 2019* we had different technologies in different scenarios.	Different gas and hydrogen adoption rates in the scenarios	Call for Evidence Bilateral Individual Consultancies Small Renewables UK Networks Trade bodies

Theme	You said:	We will:	Shown in scenario through:	Evidence and stakeholder group
Energy Demand **Transport**	You think our smart charging engagement levels in *FES 2019* could be too optimistic (e.g. when considering historic consumer engagement in economy 7) or could be more optimistic.	Review the evidence base for smart charging engagement and consider whether its credible to widen this range of engagement across scenarios.	Different smarty charging adoption rates in the scenarios	Bilateral UK Networks Energy suppliers Academics
Energy Demand **Transport**	You think as different consumer segments adopt electric vehicles, the charging profile will change and so we should account for this when using our historic charging profile from our NIA study to model peak demand.	Consider scoping a further study to investigate whether and how this profile could change over time. However, we do not intend to change our methodology this year as we do not currently have the evidence base to do so.	N/A - The charging profile is used across all scenarios	Bilateral UK Networks
Energy Demand **Transport**	You think when we're modelling autonomous vehicles, that we're missing the energy demand from the external infrastructure and communications equipment required.	Continue to explore this with stakeholders with expertise in this area to understand how we could take account of this	N/A - This is a comment on methodology	Wider interest
Energy Demand **Transport**	Low and zero carbon technologies will become available for maritime and aviation in the period 2030 - 2050, using electricity, hydrogen, biofuel and hybrids.	We do not currently model these in our bottom up forecasting and don't currently have sufficient evidence base to do so. We will therefore use other published figures in *FES 2020*. We will continue engaging with industry and exploring the potential to flex these across scenarios in future years	Assumptions on aviation and maritime fuel usage will remain fixed across all scenarios	Call for Evidence Energy industry Other reports

5. Next steps and continuing the conversation

We will continue the detailed modelling and analysis to publish *FES 2020* in July. During February we held the second distribution network forum where we shared some early analysis for our energy demand data. Following this, we will be conducting challenge and review sessions with internal and external stakeholders on other parts of the analysis.

During springtime, we will be planning our launch programme of events and will share this information with stakeholders through our newsletters. We will also be asking for stakeholders' input on some of the key decisions we make during the FES process.

We will provide early insight and updates into some of the modelling data and results through the early part of 2020 using a variety of communication methods.

We will continue to seek feedback and opinion on the way we engage and communicate to ensure we are meeting or exceeding the expectations and needs of our wide stakeholder community. This continual feedback helps us move forward and improve what we do and how we do it.

During springtime, we will be considering the engagement and communication options available to us for the beginning of the *FES 2021* engagement cycle. This will include broad and deep engagement and will take into account the feedback received to make improvements.

Annual FES process

The image below shows the main steps in the FES annual process.

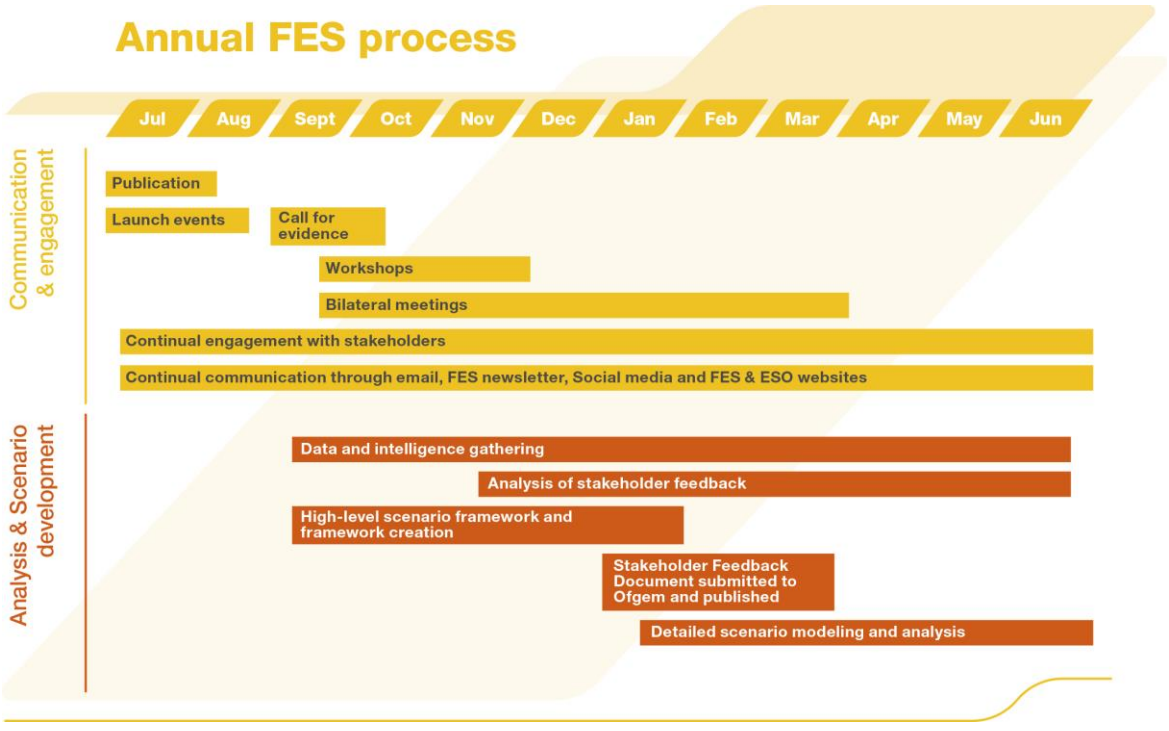


Figure 9

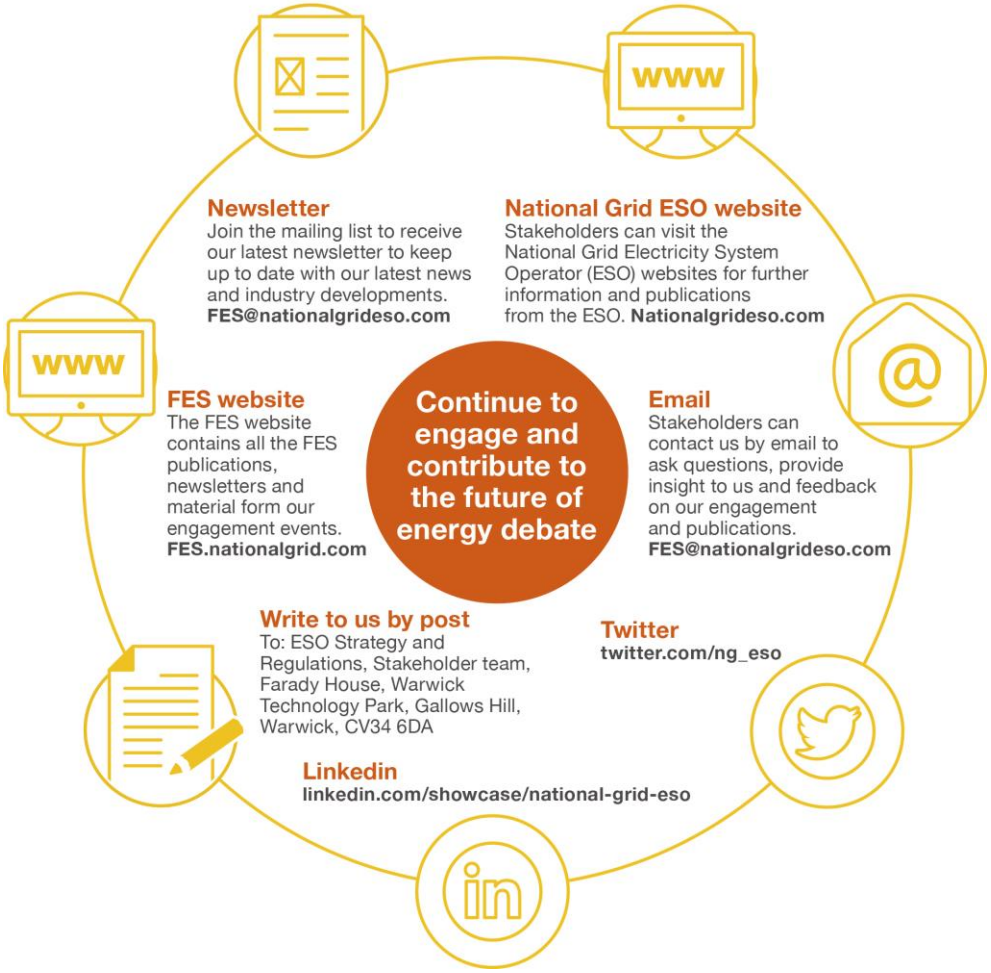
Annual FES process

Continue the conversation

We welcome your thoughts and feedback all year round and encourage everyone to contribute to the debate on the future of energy via these ESO channels.

Figure 10

Methods to continue the conversation



6. Appendix

- A. Overview of engagement events and communication activity
- B. Stakeholder groups we have engaged with during 2019
- C. Comparison of engagement and stakeholders - 2018 to 2019
- D. Review of engagement actions and improvements for FES 2019
- E. Review of our commitments for FES 2019

A. Overview of engagement events and communication activity

FES 2019 launch executive briefing – Thursday 11 July 2018
County Hall, London, 52 delegates

On-the-day satisfaction cards (24 responses)

- NPS: (net promoter score) +42.
- Average score out of 10: 8.5
- 100%: format of the briefing meet expectations
- 96%: content of the briefing meet expectations

Formal satisfaction survey (17 responses)

- Overall score: 7.0

Positive feedback:

- The breakfast briefing was a good early opportunity to hear the FES messages before the main event – this was a good process development
- The Q&A session with the ESO leaders was good
- FES 2019 overview and key messages provided at a high level was positive
- Networking opportunities were welcomed

Improvements for consideration:

- Longer time is needed, and more detail would be beneficial
- More visual slides would help during the briefing
- Less chit-chat
- A comparison from last years' FES to the current year would be beneficial

Summary of feedback for *FES 2020*

All feedback received was relating to the event itself rather than insight that could be taken forward for *FES 2020*.

Stakeholder feedback:

• **"The change to this year's structure is having the launch first then conference a week later. Having a week in between to think about it all is a good idea." – Energy Industry Trade Association.**

• **"I think it's the access to documents early. Now there is a two-stage process which I support fully. Also, the briefing was extremely good and pitched at the right level" – Gas Distribution Network.**

• "Their interaction within the industry with ourselves, they reach out with everyone which is fantastic. I feel like they listen to my point of views and they are also reacting to what's going on from a regular basis." – Renewable energy company.

• "They listened to all of our views and the one to one engagements with them have been positive throughout the organisation." – Gas Distribution Network owner.

FES 2019 launch conference – Thursday 18 July 2018
NEC, Birmingham, 188 delegates

On-the-day satisfaction cards (104 responses)

- NPS: (net promoter score) +41.
- Average score out of 10 is 8.4
- 93%: format of the conference meet expectations
- 94%: content of the conference meet expectations

During the conference we used Sli.do, the online mobile app to allow stakeholders to post questions during the event. We used the app during five of the sessions at the conference; received a total of 103 questions and 122 'likes' to the questions that had been raised. All the questions received were captured and replied to via the FES 2019 Questions and Answers document that was published on the FES website during August.

Positive feedback:

- The format of the day worked well
- The availability of team and opportunity to ask questions was a positive
- There was opportunity for networking and meeting others
- The event was well organised, friendly, informal with an enthusiastic team
- Including net zero as a topic
- Including more detail at the right level, more transparency, informative was helpful
- Holding the event a week after publication was a process improvement

Improvements for consideration:

- Better use of Sli.do would help the event run better
- More comparison from FES18 to FES19 would be beneficial
- A session on modelling methods and more clarity on how the models work is needed

Summary of feedback for *FES 2020*

- A full net zero scenario is needed
- Review the reliance on hybrid pumps
- Suggest NetZero forms the target for 2 scenarios - replaces 80% as currently
- Scenario costing would be beneficial

All other feedback received related to the event itself rather than insight that could be taken forward for *FES 2020.*

	• Allocation of delegates to the topic session or single sessions for all is required next time • More deep-dive round table discussions • More diversity at the event is needed – all presenters were white males • London venue and London format (from FES 2018) would be preferred
Stakeholder feedback: • **(FES 2019) "The most 'listening' and 'open to ideas' that I've ever seen" – anonymous** • **"Very thorough and rigorous analysis" – anonymous** • **"Timed allowed for Q&A for good discussions to develop" – anonymous** • **"Networking and discussion. Opportunities to discuss with NG FES analysts" – anonymous** • **"Printing the conference slides and putting them in the arrival hall for discussion was a great idea – anonymous**	

***Shaping FES 2020* Call for Evidence** **September 2019 - Online**	
• **The online *Shaping FES 2020* Call for Evidence ran throughout September and was shared with the breadth of our stakeholders.** • We received over 50 responses providing feedback from a cross-section of our stakeholder audience – you can see how we have combined this feedback with other insight during the autumn engagement and taken it forward for *FES 2020* on page 22 onwards. • Our approach for 2019 was very similar to that of 2018. We produced the online survey in sections to allow stakeholders to view and answer only those questions that reflected their area of expertise. • We took time to ensure that the survey was directed to those stakeholders who we believed to be experts in specific areas after the original publication through our newsletter. • To increase transparency for stakeholders, we shared summaries of the feedback we received on the FES website during November and through the newsletter.	**Summary of feedback for *FES 2020*** • The Targeted Charging Review and review of network charging are policies which may shift the balance between growth of distributed generation and growth of transmission connected generation. • We should consider higher ranges for several technologies, in particular, thermal, CCUS, wind and nuclear. • Stakeholders generally expressed a very weak outlook for small scale wind (sites of less than 1MW total capacity) due to high capex costs and planning restrictions. Respondents were more positive around solar PV, with typical ranges being within the 20 – 65 GW bracket for a net zero compliant scenario. • There is general oversupply in the LNG market at present but demand, particularly from developing countries, will continue to increase. • We received opposing views from respondents on whether shale gas should be developed further. Environmental and public concerns, on top of regulatory tightness is, or could be, holding back development. Some stakeholders believe it should be supported fully to achieve security of supply, and at least one net zero scenario in *FES 2020* should include UK shale. • A support mechanism would be required for new gas storage to be viable. • There is some but little support for hydrogen imports. • Energy efficiency or Zero Carbon in this sector is difficult and requires policy or incentivisation. • You would like to see clearer definition of regional approach to heat decarbonisation • The deployment of V2G could start to happen anywhere from imminently to within the next 10 years • The capacity of V2G available in 2050 in a net-zero world could be anywhere from 0-20GW, but on average you expect the capacity available to be lower than that modelled for FES 2019. You also expect this capacity to be lower in a scenario where we do not meet net-zero. • To see significant uptake, V2G needs a strong commercial offering to domestic users. One key barrier to this is the increased cost of the V2G charger, and this may or may not come down substantially in price. • Expect to see a significant number of biofuel heavy goods vehicles (HGVs) on the road from the early 2020s - 2035, 5-10 years before we see a significant number of hydrogen HGVs on the road. • Low and zero carbon technologies will become available for maritime and aviation in the period 2030 -2050, using electricity, hydrogen, biofuel and hybrids.

***FES 2020* Scenario Framework collaborative workshop - Monday 16th September Faraday House, Warwick, 30 delegates**		
• NPS score of +41 • Average score out of 10 is 8.6 • Response rate of 56% • 94%: agreed that the format of the workshop met expectations • 94%: agreed that the content of the workshop met expectations More detailed information regarding these workshops and how feedback has influenced the Scenario Framework can be found on page 17	**Positive feedback:** • Genuine openness and seeking views • Interaction, discussion and debate • Ability to discuss in detail • Breakout sessions **Improvements for consideration:** • The session could be less complex • More time for table sessions would be beneficial • There is a need to develop on a global basis and not just UK • Net zero should be included • The current framework is too narrow • Organisations (BEIS, Ofgem) should not be allowed to plan/invest in any non-compliant scenarios/technologies to reduce the cost of compliance and increase the cost of non-compliance	**Summary of feedback for *FES 2020*** • Support for having a framework and a 2x2 structure • Decentralisation didn't bring out the actual drivers of the scenarios • Support for axis choices of either degree of electrification or consumer willingness to change • Should include at least two Net Zero compliant scenarios • Support for a scenario that meets the Net zero target early • Need to retain a wide range of outcomes so retain the Steady Progression scenario

***FES 2020* Scenario Framework workshop - Monday 7th October ENA, London, 21 delegates**		
• NPS score of +61 • Response rate of 23% • Average score out of 10: 8.6 • 100%: agreed that the format of the workshop meet expectations • 100%: agreed that the content of the workshop meet expectations More detailed information regarding these workshops and how feedback has influenced the Scenario Framework can be found on page 17.	**Positive feedback:** • Interactive, visual aids, pre-read guidance on chapter 1&2 of FES report • Outline of the variations in scenario framework and scenarios themselves • Just enough detail on the slides to stir up conversation • Very good (excellent) facilitation to allow a wide range of views as well as depth of discussion when necessary • Early view of new scenarios was welcomed • Good to have insight into high level process for 2020	**Summary of feedback for *FES 2020*** • Decentralisation may not be important enough to be an axis • Speed of decarbonisation is still the biggest uncertainty • Step change in policy (net zero) means we can't keep existing assumptions and scenarios • Level of inconvenience of willingness of consumers to change as an axis would be good • It is important to explore the uncertainty in levels of electrification • Not including a counterfactual would make *FES* a document about what needs to be done to meet net zero, not what the full range of future possibilities are • Exceeding the 2050 target should be a sensitivity rather than a scenario

FES Network Forum - Friday 11th October Faraday House, Warwick, 17 delegates		
▪ NPS score of 0 ▪ Response rate of 53% ▪ Average score out of 10: 7.7 ▪ 88%: agreed that the format of the workshop meet expectations ▪ 100%: agreed that the content of the workshop meet expectations	**Positive feedback:** • The presenters were well prepared • It was a good opportunity to understand triggers and think about the impacts • The session provided early insight into the *FES 2020* framework • Everyone had the opportunity to input & open discussion encouraged **Improvements for consideration:** • It was good to have an overview but potentially lacking in detail and focus. Maybe this is just a timing issue. • Some of the questions were in areas in which no one was likely to have any expertise (e.g. shipping) • A lot of topics covered in short timing. Maybe break up into two shorter meetings • May be useful to do smaller events aimed as gas/elec separately. Maybe quantify risk associated with scenarios • There is a need to make sure it can be shown that we have influenced 2020 • The WebEx element of the day did not work as well as they could not see/when to interject • It seems like there is limited chance to influence the final version.	**Summary of feedback for FES 2020** • The group were appreciative of the earlier insight into the *FES 2020* framework. • On heating there is still a need to include a range of options and also consider hydrogen hybrid heat pumps in *FES 2020*. • Hydrogen can be produced and deployed via various methods. *FES 2020* should include a range of these. • Would like more information on scenario whole system costs. • There were also some questions about how the move from two scenarios which do meet the target and two that don't, to three that do and one that doesn't would impact the downstream processes. This was followed up as part of the ETYS and NOA publications.

***FES: Bridging the gap*: bioresource engagement - Tuesday 26th November The Conduit, London, 20 delegates**		
▪ NPS score of +30 ▪ Response rate of 50% ▪ Average score out of 10: 8.4 ▪ 100%: agreed the format of the workshop meet expectations ▪ 100%: agreed the content of the workshop meet expectations	**Positive feedback:** • The participating approach and the facilitation ensured everyone in the room had an opportunity to contribute to the discussion. • The event was interactive, good discussion and moderation • There was a nice introductory session to set up the session and it was well structured **Improvements for consideration:** • A short presentation of FES assumptions would have been useful • There were a lot of different views to capture – a breakout sessions may have captured more	**Summary of feedback for *FES 2020*** Key uncertainty in bioresource supply is whether a global import market will develop. Consider middle case of bioresource supply for two net zero scenarios, and potential greater supply (perhaps import driven) in early net zero scenario. The final report for *FES: Bridging the gap* will be published during March.

***FES: Bridging the gap*: electric vehicles - December/January**		
Range of bilateral research calls held with nine key electric vehicle stakeholders during December and January	**Positive feedback:** Stakeholders welcomed the opportunity to be involved	**Summary of feedback for *FES 2020*** Range of stakeholder views on likely levels and development pathways for smart charging and V2G. The final report for *FES: Bridging the gap* will be published during March.

***FES 2020* focus group** **15th January** **Webex**		
Five stakeholders attended the Webex focus group Feedback was gathered by informal email and shown in the next column.	**Positive feedback:** • The session was interesting, the right length with good discussion • It's good to be involved while things take shape • Well thought through options to discuss rather than starting with a blank sheet • The event provided what was needed and using Webex saved travel time, carbon and cost • Would recommend such events to others **Improvements for consideration:** • Sending questions in advance would allow audience can be better prepared to answer. • Events could be recorded for later viewing by others unable to attend. • Better management of some practicalities of Webex call (audio feedback and levels)	**Summary of feedback for *FES 2020*** • Support for proposed Scenario Framework • Valuable feedback on scenario names and understanding of intent. • Encouraged more storytelling and visualisation to help increase understanding, (e.g. accessibility for general public) • Important not to dumb down content, as it is needed by technical experts. However, group recognised the value of making narrative more concise. • Supported the use of interactivity within document to enable readers to have more targeted access to relevant details.

Bilateral meetings (involving NGESO and one other organisation) for *FES 2020*
Sept 2019 to date.
Face-to-face or phone/Webex

- 67 bilateral meetings held either face-to- face or via telephone/Webex
- Further eight meetings planned
- Bilateral engagement will continue into the spring
- Current formal satisfaction score is 8.00 from 41 responses

Positive feedback:
Formal satisfaction feedback

- Good at taking people's views into account. Their modelling is sound, and they have a good understating of the industry.
- FES is a broad and speculative problem by its very nature. By asking the question of what the desired end point is (or end points) then working backwards; one can establish a range of credible scenarios that add up.
- Good at communicating complex material in a concise format. The material was clear, concise and suitable for external consumption while remaining on point. This is not a small achievement.
- They share where they were and always updated us on assumption they were making. They were keeping up us to date.

Improvements for consideration:
Formal satisfaction feedback

- A bit more transparency around the feedback they receive from the industry. They could improve the process by sharing the feedback they get from all parties.
- They could have been better with timing. They ran through quite a lot in parts they were talking about which meant they compressed some other parts.
- The future scenarios team is very GB specific and they reach out to regional trends instead. That regional piece needs to be more relevant.

Summary of feedback for *FES 2020*

- Net zero is the right thing to aim for but it is going to be extremely challenging for all aspects of our society.
- Clear, early, stable and long-term government policy/support/public messaging for decarbonisation is crucial to meet targets and support technologies such as CCS, low carbon heat and hydrogen.
- Companies and people are beginning to understand a “net zero rethink” is required, particularly for electricity generation, industry, home heat and all forms of transport
- The Targeted Charging Review and review of network charging are policies which may shift the balance between growth of distributed generation, growth of transmission connected generation and TRIAD response.
- Storage is expected to see short term growth followed by a period of stability. Growth will pick up again when more renewables have been deployed and wholesale prices are spikier.
- We are likely to have significantly more than 20GW of interconnection by 2050.
- Higher growth in offshore wind is expected following the 2030 sector deal and election manifestos.

FES 2019 online communication	
▪ **Website** Between 1/02/2019 to 20/01/2020, the FES website received over 57k unique pages views with a total of c73k page views. The most visiting individual page was the FES document receiving nearly 28k visits during this period with a peak on 11th July 2019. The other additional spike in views was during March 2019 when we published the 2019 Stakeholder Feedback Document with more than 3,500 users during the month. ▪ **Newsletter** We currently have 6,321 (@23/01/20) subscribers to the FES newsletter, as far afield as Japan, India, Saudi Arabia and USA. We have published nine editions of the newsletter since March 2019. ▪ **Email queries (01.02.19 to 17.01.20)** During this period, we received 339 queries from a wide range of organisations representing customers, educational interests, consultants and energy industry. We aim to respond to all queries within five working days; however, some complex queries require additional time involving teams working across National Grid. In addition to these queries received via email we also responded to 118 in our FES 2019 Questions & answer document published during August 2019. ▪ **Social media** • **LinkedIn**: viewed 37 times, liked 270 times • **Twitter**: viewed 4,524 videos and a further 504 retweets, link clicks or likes.	**Positive feedback:** • Email is the preferred method of communication with stakeholders • The FES website is a useful site to access the full suite of documents • The ESO website is a useful place for accessing ESO publications **Improvements for consideration:** • Having downloadable infographics to use in presentations would be useful • It would be helpful if meeting invites could be detailed separately to the newsletter

B. Stakeholder groups we have engaged with during 2019

New revised stakeholder categories

We have recently reviewed and revised our categorisation of stakeholders from the list used in the 2019 and previous Stakeholder Feedback Documents. Please see the table below for the revised categorisation. We will be using this as we move forward with our engagement in 2020 and beyond. These amendments will provide clearer guidance for us and other interested parties of which sectors across the industry and wider we are engaging with.

Stakeholder category	Subcategory
Communities and their representatives	Impacted Local Communities and Residents Parish Councils Local Campaign Groups
Consumers and consumer groups	General public/individual responses Consumer groups
Energy industry	Energy Suppliers European Networks European TSO Generators (including Big 6) Industry bodies & experts including Consultancies, Trade bodies Interconnectors Offshore Gas Companies Offshore Transmission Owners Operating Margin Providers National Grid ESO Shippers Small Generators Small Renewables Storage and Flexibility Terminal Operators Transmission directly connected demand
Innovators	Environmentalists Manufacturers and Technologists Infrastructure providers
Non-governmental organisations	Environmental Groups Other non-governmental organisations
Other stakeholders	Academics, Universities and Schools Finance and investment community Small businesses Other
Political	Devolved Administrations European Administration Members of European Parliament Members of Parliament Local Authorities UK Government Bodies
Regulators	Regulatory bodies
UK Networks	Distribution Network Operators Gas and Electricity Transmission Companies Gas Distribution Networks

Below is a breakdown of stakeholder groups and organisations engaged with during the year of 2019 based on revised stakeholder groups noted in the table above.

Stakeholder breakdown for all engagement activities during 2019

Stakeholder category	Total
Communities and their representatives	7
Consumers and consumer groups	44
Energy Industry	280
Innovators	48
Non-governmental organisations	13
Other stakeholders	32
Political	49
Regulator	11
UK Networks	106
TOTAL **590**	

Below is a breakdown of the subcategories of stakeholders to provide further transparency of those stakeholders we have engaged with.

Main category	Subcategory	Count
Communities and their representatives	Advocacy groups	3
	Campaign groups	4
Consumers and consumer groups	Consumer groups	2
	General public/individual responses	42
Energy Industry	Energy suppliers	46
	European networks	2
	European TSO	8
	Generators	49
	Industry bodies and experts	4
	Industry bodies and experts - consultancies	58
	Industry bodies and experts - trade bodies	54
	Interconnector	9
	International	3
	National Grid	17
	Offshore gas companies	2
	Shippers	3
	Small generators	1
	Small renewables	6
	Storage and Flexibility	17
	Transmission directly connected demand	1
Innovators	Environmentalists	4
	Industry bodies and experts - consultancies	1
	Infrastructure provider	10
	Manufacturers and Technologists	33
Non-governmental organisations	Environmental groups	3
	Non-governmental organisation	6
	Other non-governmental organisations	4
Other stakeholders	Academics, universities and schools	17
	Finance and investment community	7
	Other	1
	Other - lobbyist	1
	Other - media	3
	Skills provider	1
	Small businesses	2
Political	Devolved administrations	5
	Local authorities	2

	Members of Parliament	1
	UK Government bodies	41
Regulator	Regulatory bodies	11
UK Networks	Distribution Network Operators	36
	Gas and Electricity Transmission Companies	40
	Gas distribution networks	30
	TOTAL	**590**

Below is a breakdown of stakeholder groups for each engagement event

Stakeholder breakdown for costing webinar (March 2019)

Stakeholder category	Total
Consumers and consumer groups	10
Energy Industry	33
Innovators	3
Non-governmental organisations	1
Other stakeholders	4
Political	1
Regulator	2
UK Networks	2
TOTAL **56**	

Stakeholder breakdown for all FES 2019 launch events

Stakeholder category	Total
Communities and their representatives	4
Consumers and consumer groups	13
Energy Industry	128
Innovators	20
Non-governmental organisations	3
Other stakeholders	17
Political	30
Regulator	5
UK Networks	28
TOTAL **248**	

Stakeholder breakdown for *Shaping FES 2020* Call for Evidence

Stakeholder category	Total
Communities and their representatives	1
Consumers and consumer groups	19
Energy Industry	20
Innovators	2
UK Networks	10
TOTAL **52**	

Stakeholder breakdown for Scenario Framework workshops (16.09.19 and 07.10.19)

Stakeholder category	Total
Communities and their representatives	1
Energy Industry	20
Innovators	4
Other stakeholders	3
Political	5
Regulator	2
UK Networks	16
TOTAL **51**	

Stakeholder breakdown for Network Forum

Stakeholder category	Total
UK Networks	15
TOTAL **15**	

Stakeholder breakdown for *FES: Bridging the gap* bioresource workshop

Stakeholder category	Total
Communities and their representatives	1
Energy Industry	12
Innovators	2
Other stakeholders	2
Political	3
TOTAL **20**	

Stakeholder breakdown for *FES: Bridging the gap* electric vehicle bilateral calls

Stakeholder category	Total
Energy Industry	7
Innovators	1
Other stakeholders	1
TOTAL **9**	

Stakeholder breakdown for *FES 2020* focus group

Stakeholder category	Total
Consumer	1
Energy industry	2
Innovator	1
Regulator	1
TOTAL **5**	

Stakeholder breakdown for bilateral meetings

Stakeholder category	Total
Consumers and consumer groups	1
Energy Industry	57
Innovators	15
Non-governmental organisations	9
Other stakeholders	5
Political	5
UK Networks	36
TOTAL **128**	

C. Comparison of engagement and stakeholders - 2018 to 2019

	2019	2018
Total number of stakeholders	463 unique stakeholders 590 stakeholders across all activities	632 unique stakeholders 829 stakeholders across all events
Total number of organisations	224 unique organisations 548 organisations across all activities 109 new organisations for 2019	415 unique organisations 235 new organisations for 2018
FES launch events	248 stakeholders	331 stakeholders
Call for evidence	52 responses 28 organisations 19 as individuals	73 responses 70 organisations
Workshops	86 stakeholders 73 organisations	189 stakeholders 128 organisations
Bilateral meetings	67 organisations 128 stakeholders	62 organisations

Stakeholder breakdown using categories from the 2019 Stakeholder Feedback Document

2019 SFD categories:	2019 engagement	2018 engagement
Energy Industry	149	415
Customers	211	221
Small businesses (inc individual)	57	66
Innovators	55	10
Supply Chain	5	28
Educational Interest	19	9
Investors	7	18
Political	51	12
Non-Government Organisations	17	14
Media	4	20
Communities and their representatives	4	10
Consumer groups	n/a	3
Regulators	9	3
TOTAL	**590**	**829**

D. Review of engagement for FES 2019

Below we have provided a review of the actions that we said we would deliver for *FES 2019* (as set out in the 2019 Stakeholder Feedback Document), together with an update on how we have delivered against those actions or, where we have not taken forward an action, the reason why.

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
***FES* documents**	You would like to have early sight on the *FES* documents prior to the launch to be able to prepare for the event.	For 2019, we **will** review when and how we share the suite of *FES* documents with stakeholders to maximise the value they get from our launch events.	**We did.** For FES 2019 we published the suite of FES documents in the FES website on the 11th July. We then held our working level launch conference a week later on the 18th July. Feedback on the day showed this allowed adequate time for delegates to digest and attend the event prepared with questions. **Positive feedback means we will continue with this approach**
	You would like the Data Workbook to be easier to use, with the ability to drill down to the data and to use it to create your own analysis.	We **will** make enhancements to the data workbook to make it more user friendly.	**We did.** We made improvements to the data book by - we rationalised demand data into fewer tables (ED1-ED5) and included more data. **We continue to receive feedback each year on our data workbook and will continue to develop this to meet customer needs.**
***FES* engagement and communication**	You would like earlier pre-read before engagement events.	We **will** ensure that delegate pre-read for our engagement is sent to attendees more than one week in advance of the event.	**We did.** We continued to send all pre-read material for our events at least one week in advance on the event. **We will ensure we carry on with this during 2020.**
	You would like more frequent and regular updates throughout the year on the insight we receive and early views of our modelling.	We **will** continue to share updates on our modelling together with early insight into our analysis through our communication channels. We have already started to address this by publishing summaries of feedback from our *Call for Evidence* and the autumn workshops.	**We did.** Following the autumn engagement during 2018 we published summaries of all the feedback we received on the FES website. Following the Call for Evidence in September we published a summary of all the feedback gathered for each section and shared this through our newsletter. During early 2020 we will share some early insights into our *FES 2020* modelling. **Our newsletters and *FES: Bridging the Gap* will support this request on an enduring basis.**
Webinars	Although the overall format and content of the launch webinars was good, more needs to be done to make the log-in process smoother and to improve the technical aspects of the webinars.	We **will** comprehensively test the webinar function before we host the next webinars to ensure a better experience for our stakeholders.	**We did.** We hosted a costing webinar in March 2019. Prior to this we tested the technology. The webinar received positive feedback with minimal technology issues encountered

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
***FES* conference**	It would be beneficial to hold more deep-dive sessions with a workshop style format, giving stakeholders the flexibility to choose subjects of interest for the afternoon.	We **will** explore different approaches to the launch for 2019 to reflect the varying needs and interests of our audience. We will consider holding a smaller briefing event for executives and senior leaders. This will be followed by a more detailed session for those that want more detail which will be held once stakeholders have had time to digest the *FES* information.	**We did.** We held two launch events for FES 2019 to address the different needs of our stakeholders. The short breakfast briefing on the 11th July provided the key messages and synopsis of the analysis whilst the conference provided the next level of data into the analysis and opportunity for discussion and networking. During the conference, we held a Q&A session during the main briefing, further Q&A time during the topic sessions and networking and discussion time in the communal area of the venue. **There has been other feedback on the breakout sessions and so we will try and improve the organisation of these for 2020 whilst retaining the ability to have discussions and Q&A at a more specific topic level.**
	You would like more time during the conference for interaction, questions and work with the *FES* team as well as networking with other delegates.		
***FES* narrative**	You would like more detail on the modelling and assumptions around *FES*.	We **will** look to provide more details on the assumptions and modelling by improving our data workbook and providing a detailed analyst session.	**We did.** We made enhancements to the data workbook as noted above. In the detailed topic presentations given during the launch conference we shared the key assumptions made for the modelling. We then recorded these presentations and shared with the slides the FES website. **We have received similar feedback again and hence we are looking at how we can make our assumptions clearer in our FES document.**
	You would like to see the changes to the scenarios from the previous year.	As we did for the FES 2018 scenarios, we **will** provide a high-level summary of the changes from the 2018 to the 2019 scenarios at the time of *FES 2019* launch.	**We did.** In the detailed topic presentations given during the launch conference we shared the key differences from *FES 2019* to *FES 2020*. We shared the slides and the presentation recordings on the FES website. **We have received the same feedback again this year and so we need to consider how we can do this especially under a changing scenario framework where direct comparison of scenarios cannot be achieved.**

E. Review of our commitments for *FES 2019*

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Scenario Framework and Scenarios	You continue to support the approach of using a 2x2 scenario matrix, which is felt to be an easily understandable way of navigating future uncertainty. You consider that having four scenarios allows us to show an appropriate range of future pathways. You would like to see consistency across our analysis from year-to-year, noting that you would prefer *the FES 2019* scenario matrix to remain unchanged from *FES 2018*.	Considering stakeholder feedback, our own internal review and the value of consistency, we **will** keep the scenario framework unchanged for 2019.	**We did.** We kept the framework unchanged for FES 2019. **More recent feedback has reflected that Net Zero will require a change in framework and hence there is a change for *FES 2020*.**
	You have expressed a range of views as to how many scenarios should meet the UK's target to reduce greenhouse gas emissions by 80 per cent by 2050 compared to 1990 levels.	We **will** continue to have two scenarios that meet the 2050 target. This reflects the current obligations on GB to meet this goal, whilst also acknowledging and highlighting the potential challenges. It also allows the exploration of distinct pathways to achieve the target.	We kept the *FES 2019* framework design unchanged, and evolved the scenarios on the basis of new information, feedback or analysis
	You believe we should consider the possibility of achieving net zero carbon emissions by 2050.	To reflect our own research and input from stakeholders, *in FES 2019* we **will** explore how net zero carbon emissions could be achieved by 2050 using sensitivity analysis.	**We did.** We published a net zero sensitivity in Chapter 6 of *FES 2019*. **This now features as core scenarios for *FES 2020*.**
	You would like to see costing information for our scenarios.	Further to the information on scenario costings presented in *FES 2018*, we **will** publish our costing analysis for the 2018 scenarios in early 2019.	**We did** share the costing for the *FES 2018* scenarios in early 2019 once it was completed. As the scenario framework remained unchanged for 2019, we did not re-run the scenario costings for 2019. Instead we focussed our resources on producing additional sensitivities on how net zero carbon emissions could be achieved. **We are now investigating what costing work is achievable for the *FES 2020* scenarios.**
	You agree that scenarios are an appropriate way to deal with uncertainty over the longer term, but you would also like a shorter-term view.	We **will** produce a five-year forecast as part of *FES 2019* to provide a shorter-term view, in addition to our four longer-term scenarios.	**We did.** We published our "Five Year View" in the FES data workbook. **We will continue to do this.**

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Industrial and Commercial (I&C) energy demand	You consider that decarbonisation efforts in the I&C sector are more likely to be implemented/ mandated than in the domestic sector.	We **will** review our modelling to see whether greater focus on mandating decarbonisation within I&C for our two faster decarbonisation scenarios (**Community Renewables** and **Two Degrees**) improves our current modelling.	**We did.** Our consultation and analysis indicate 80% decarbonisation is not possible without engaging with all consumers. Therefore, we included residential decarbonisation in our 80% scenarios.
	You do not think it is clear what decentralisation means for demand and you consider that we should state more clearly in *FES* how the decentralisation axis has been treated. There was general agreement that arbitrary differentiation in demand across scenarios (i.e. not linked to the two axes) should be avoided.	Decentralisation reflects where the energy comes from. Where we differentiate demand across that axis, we **will** clearly explain this.	**We did.** In *FES 2019* we flexed demand components across the "level of decentralisation" axis more than in *FES 2018*. Where we did this (e.g. in relation to charging of EVs) we explained how this was aligned to the axes (e.g. in TD more EVs are charged centrally than in CR). Decentralisation was a popular axis for *FES 2019*. However, this is less relevant in *FES 2020* and hence is being changed following recent stakeholder engagement.
	You believe there are likely to be different routes for decarbonisation in different parts of the UK. *FES* should reflect that this may occur.	Our existing scenarios are already a patchwork of different technologies, as we recognise that different solutions will work better in different parts of the UK and that it is not likely that a single solution will be used. Where relevant, we **will** articulate more clearly how we treat regional policy developments and projects (e.g. use of hydrogen in heating). We have been considering moving *FES* onto more of a regional basis. We are conscious that this would involve a significant amount of additional work and engagement (e.g. with distribution companies and the ENA Open Networks project). We **will** continue to explore this further.	**We did.** A patchwork of different decarbonisation routes were articulated in *FES 2018* and *FES 2019* e.g. electrification, hydrogen, biofuel, hybrid heat pumps etc. Whilst we were not explicit on the locations of particular projects (as that would imply certainty), our technology choices in the scenarios reflected possible regionalisation.

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Demand Side Response (DSR) & SMART	You think that the I&C DSR landscape has changed significantly in the last 12 months. Those changes may lead to higher DSR potential in the short term.	We **will** review our assumptions and continue ongoing discussions with key stakeholders throughout the year to make sure that latest feedback is considered in our analysis.	**We did.** The result of our research and engagement in *FES 2019* was a wider range of DSR possibilities. **This area will remain under review.**
	You believe new technologies and software are being developed or already available for the residential market. In addition, there are opportunities to include electric vehicle (EV) charging and electric heating (both direct electric and heat pumps) in residential DSR.	Although we have already considered DSR potential from EVs and heat pumps in *FES*, we **will** review our approach this year and update it where necessary. In addition, we **will** keep up to date with any new technologies/ software and market developments and inform our analysis accordingly.	**We did.** We have reviewed our approaches in this area. With EV there remain a broad range of views, so the analysis remained unchanged. We did widen our assumptions on residential DSR and revised our heat storage assumptions. **This area will remain under review.**
DSR	You consider that the load response potential needs to be revised. In addition, FES needs to clarify the DSR definition that is used and how it compares with other National Grid Electricity System Operator (ESO) documents and processes (e.g. Power Responsive).	We will look for new sources of information and continue ongoing discussions with key stakeholders that have useful insights into the market. In addition, we will include a clear definition of DSR and load response and refer to other ESO documents where necessary to remove any potential confusion.	**We did.** The result of our research and engagement in *FES 2019* was a wider range of DSR possibilities. This area will remain under review. **We did.** In *FES 2019* we defined our view of Demand Side Response on page 59. In the Winter Outlook we did not refer to DSR but referred to TRIAD which was defined in the glossary.
Energy efficiency	You said there are concerns as to whether the EU target of 32 per cent energy efficiency by 2030 will be met.	We **will** continue to assume levels of energy efficiency improvement which are aligned to EU energy efficiency targets in the faster decarbonising scenarios.	**We did.** We assumed efficiency improvement aligned to EU targets in the 80% compliant scenarios and net zero sensitivity, as this would make the UK's decarbonisation targets harder to achieve.
	You believe that energy efficiency could go further than the EU energy efficiency targets, particularly if the 2050 decarbonisation target or net zero emissions are to be achieved.	We **will** review the possibility of having higher or lower improvement rates in the scenarios to illustrate different potential outcomes. Analysis of government data strongly suggests that 30 per cent energy efficiency improvement in all demand sectors is possible, given the right policies and frameworks.	**We did.** In the absence of evidence or political talks at time of FES creation, the EU targets were retained in *FES 2019.* **Since May 2020 talks have restarted on energy efficiency so we will reflect more possibilities in *FES 2020*.**

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Domestic heat and gas demand	You think that *FES* should not just be guided by aspirations in the Clean Growth Strategy (CGS) but should take a harder look at the 'how'. You consider that some of the energy efficiency trajectories applied in *FES 2018* and based on the CGS may be too aggressive and would require strong backing from government and willingness of consumers to invest, none of which you consider are evident now.	We **will** continue to build on our home energy efficiency model which assumes a broad range of outcomes and review our alignment with the CGS approach, especially for the first 10 years. Where appropriate, we **will** continue to align our projections to policy targets as well as statutory obligations.	**We did.** A high case of 26% improvement in building fabric and heat efficiencies by 2050 is assumed based on analysis of recent reports evaluating the technical potential levels of improvements vs costs. A low case of 9% in building fabric efficiency improvement is assumed by 2050. **We continue to develop our thinking on heat and our innovation project will deliver further insight for *FES 2021***
	You think that we should take a more regional approach to *FES*; *FES* should give more consideration to the broader impacts of heat decarbonisation (GDP, jobs, disposable income, trade, etc.), with the cost and estimate of scenario probability reported.	We **will** continue to reflect the regional segmentation of heat decarbonisation, especially around hydrogen and district heating where appropriate. We **will** continue to improve model benchmarking to ensure the scenarios are appropriately tied to underlying drivers of change.	We consider regional perspectives within *FES,* based on stakeholder information. We also have a live project to model regional variations which will be included in our modelling for FES as soon as possible.
	You believe that *FES* should take full advantage of the potential of hybrid heat pumps to reduce electricity demand for heating in the **Community Renewables** scenario.	We **will** look closely at the share of hybrid heat pumps in the **Community Renewables** scenario to reflect their improved cost outlook (when installed as retrofits) as compared to standalone heat pumps and conventional gas boilers.	**We did.** The uptake projections for hybrid heat pumps in the **Community Renewables** has more than doubled compared to *FES 2018*. This is as a result of their improved cost outlook and consideration of their benefits to the whole energy system
	You think the growth of peaking plants to complement renewables (as well as transport demand) is breaking the relationship between peak and annual gas demand.	We **will** review our peak demand modelling process to make sure that peak gas demand estimates take account of the unique operating characteristics of new technologies such as hybrid heat pumps and peaking plants.	**We did.** We have reviewed and updated our peak gas demand modelling process in close consultation with our stakeholders. Flexible plant annual and peak demands will now be published as separate line items
	You consider that *FES 2018* missed hydrogen blending for heating and that we should consider regional segmentation of the level of hydrogen use for heating.	We **will** explore the use of hydrogen blended with natural gas in the gas networks.	**We did.** We now have hydrogen blending of up to 20% by volume in the Steady Progression scenario by 2050

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Transport	You think vehicles with different duty cycles (light and heavy duty/mileage) will use different zero carbon fuel sources, i.e. heavier duty/mileage vehicles are likely to use hydrogen rather than electricity.	We **will** differentiate electricity and hydrogen use within the transport sector more clearly (e.g. with the heavier duty/mileage vehicles using hydrogen).	**We did.** In our FES data workbook for 2019, we published the following data. Total number of vehicles on the road and total energy demand, each broken down by vehicle type (Car, LGV, HGV, Bus and Motorcycles) and fuel source (Electric, hydrogen, Petrol/diesel and natural gas). **We continue to gather stakeholder feedback and evidence at this disaggregate level.**
	You believe that some commercial users may still charge at peak times, at modest levels at least.	We **will** check with current electric vehicle commercial users and gauge attitudes and reasons behind why they would/wouldn't peak charge.	We developed a new methodology for calculating peak demand based on our innovation charging study profile. As a result, the demand at peak is considered from all vehicle types (including LGVs, HGVs and Buses) across residential, workplace and public charge points. This does include some commercial users charging at peak – it is assumed this is to meet specific operational requirements.
	You think material scarcity for battery manufacturing (i.e. Cobalt) needs to be considered.	We **will** investigate multiple battery chemistries and draw out any supply-side constraints and opportunities.	We investigated the chemistries currently manufactured, and through engagement with experts in this field, we found that scarce resources (such as Colbalt) are being used less and less and thus will not materially affect our assumptions.
	You believe that vehicle-to-grid (V2G) from commercial or industrial users was a natural progression from smart charging and that the managers of fleet vehicles are more economically rational and likely to engage in V2G if there was economic benefit.	We **will** continue to explore the options around V2G for our scenarios modelling for 2019.	**We did.** We engaged with fleet managers and a common theme emerged that, at this time, they are concerned about how V2G will affect battery life. As a result, we did not include any commercial vehicles in our modelling of V2G at peak for *FES 2019*. **We will continue to investigate this area.**
	You believe that longer range vehicles will change charging habits to charge less often.	We **will** investigate differentiation between scenarios with short- and longer-range private vehicles and impact on charging profiles.	**We did.** We ran a NIA innovation project in which we identified that there is already a differential in charging behaviour between users, i.e. not all vehicles charged every day, and some vehicles charged only once a week. This was included as part of the profiles within the FES outputs.

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Whole energy system	You suggested that a mixture of hydrogen production methods should be included, with both electrolysis and steam methane reforming (SMR) in the same scenario. You would like the costs of electrolysis to be considered.	We **will** consider including both electrolysis and SMR in one of our 2050 compliant scenarios and in the net zero sensitivity. We **will** consider the cost of electrolysis when we examine using hydrogen.	**We did.** Both electrolysis and SMR + CCUS are included in FES19 TD scenario; Various reports with electrolysis costs are used as benchmarking information such as H21 project, IHS report, Bloomberg report etc. **These assumptions will be brought out in more detail in *FES 2020* as we have more Net zero scenarios to consider.**
	Regarding bio-energy and bio resource, you would like to see the split between domestic source and imported source in our scenarios. You also commented that sustainability of the feedstock needs to be addressed. In addition, you would like to see a clearer split of the volume of bio resources going to each sector (electricity generation, I&C, green gas production). You would like to see bio-energy with carbon capture and storage (BECCS) included in at least one scenario.	We **will** consider how our assumptions on bio energy feedstocks are represented in *FES 2019*. We **will** continue to review the evidence around the development of BECCS.	**We did. BECCS** is covered in our net zero sensitivity in FES19 as the main negative greenhouse technology to offset carbon from other sectors. We also covered which sectors the bio resource would be going to in our sensitivity. We continue to focus our work in this area as it is critical to our understanding and modelling of Net zero for *FES 2020*. The FES: Bridging the Gap programme specifically looks into the bioresource supply chain and modelling assumptions for different sectors.
	You would like to see the role of “energy from waste” and “waste energy” in decarbonisation.	Two of our scenarios in *FES 2018* included BioSNG, which uses domestic waste as part of its feedstock. Our modelling of electricity generation also includes energy from waste. We **will** consider including this in our reporting of bio resources in *FES 2019*.	**We did.** We continued to look at BioSNG with a specific call out on an explanation of potential sources of raw material including waste.
	You would like to see district heat to be projected at a larger scale in some scenario.	We **will** continue to review developments in district heat potential.	**We did.** We have increased the top range of district heating uptake (in the Community Renewables scenario) in view of recent developments around the heat networks investment scheme and communities taking independent actions to decarbonise

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Electricity market modelling	You broadly support higher levels of renewable generation in *FES 2018.* However, some of you challenged whether the levels of onshore wind and solar photovoltaic (PV) were above feasible levels in **Community Renewables**.	**Community Renewables** was intended to be extreme in this respect. We **will** review the high levels of renewable generation and continue to benchmark our analysis with other sources, wherever possible.	**We did.** We undertook a review of the level of onshore wind and solar PV required to meet the carbon targets. This was done through stakeholder engagement and as part of our analysis. Results indicated that the maximum level of onshore wind and solar PV could be reduced whilst still achieving the carbon reduction required. We updated our scenarios to reflect this.
	You believe we should analyse and publish regional variations for electricity generation in *FES*. This should reflect any local concerns and any targets that have been set by devolved governments in Great Britain.	While *FES* assesses the future energy trends for GB, we fully acknowledge that regional variations for electricity generation can have a significant impact on the System Operator's network development and operability studies. *FES* already reflects these aspects, but we **will** be more transparent and explicit on how this is done in *FES 2019*. Regional information is also published in the System Operator's *Electricity Ten Year Statement.*	**We did.** We have set out more detail related to the regional aspects of electricity generation. For example, our assessment of transmission generation is based on known projects and we have described the process within the Method Document. For distributed generation, we publish capacities by grid supply point within the Regional Breakdown of FES. This year this was published on the same day as *FES*. The data is used with the *ETYS* process. We used regional stakeholder feedback, including from the Welsh and Scottish Governments to enhance our understanding and analysis. **We continue to develop this for more detailed analysis in the ETYS.**
	You think that higher levels of flexibility, including cross-vector technologies such as hydrogen, can be used to reduce the curtailment of renewable generation that we reported in *FES 2018*. You expressed different views on how you would expect the market to respond to excess renewable generation. This included demand turn up (e.g. hydrogen production), incentivising deployment of more storage or curtailment.	This is an area of our modelling that we **will** continue to develop. We **will** review our modelling for *FES 2019* and be clearer on our assumptions.	**We did.** There was mixed response from our Call for Evidence with some stakeholders proposing options to reduce curtailment whilst others noted that a certain level of curtailment might be appropriate in an efficient system. Through our analysis, we were able to reduce the level of curtailment compared to *FES 2018*. The remaining curtailment is highly spikey so is difficult to further reduce within current business models. We presented an example profile at the *FES* event and continue to seek feedback. **We welcome further feedback in this area.**

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Electricity market modelling	You think we should include the impact of network and operability constraints (e.g. the need for black start capabilities) in *FES 2019.*	*FES* is the starting point for several System Operator activities. As such, *FES* considers an unconstrained network. However, where we have intelligence that specific projects or types of generation would not come to market due to network or operability constraints, then we can reflect this in *FES* – in fact, we already do. We **will** seek to provide greater clarity on our assumptions in *FES 2019* and how it supports other System Operator activities.	As noted in the 2019 Stakeholder Feedback Document we have not included the impact of network and operability constraints in *FES 2019* as this would duplicate the work contained in other System Operator publications. We did provide clarity on how *FES* supports these publications (such as our *Ten-Year Statements* on gas and electricity, the *Network Options Assessment* and the gas and electricity operability work), within Figure 1.1 of *FES 2019*.
	You think we should include carbon emissions from interconnector imports based on what is generating in Europe.	At the moment, the accepted way to calculate carbon emissions means that emissions from interconnector imports are assumed to be zero. This is because carbon emissions are calculated based on where the emissions are produced. In turn, this means that carbon emissions from generation in Great Britain that is exported to Europe count towards Great Britain's carbon emissions. We **will** continue with this convention in *FES 2019*.	In *FES 2019*, we have continued to calculate emissions based on those produced domestically within a country as this is the current, accepted way of doing this. This means that interconnector imports are considered as zero carbon. However, any interconnector exports from thermal generation would be included in Great Britain's emissions.
	You would like us to publish electricity prices in our Data Workbook.	We used to publish electricity wholesale prices in *FES* because this was an input assumption for our electricity dispatch modelling. However, we have since developed our electricity market modelling and we now use a model called BID3. Based on this, electricity prices are now an output of our modelling. This means that we no longer use the electricity prices as an input and so we have stopped publishing this data. However, as we develop our experience using BID3, we **will** continue to review which data, including electricity prices, we publish in future.	**We did not.** As noted, we no longer use the electricity prices as an input. Our BID3 model includes several assumptions (e.g. perfect foresight, unconstrained network) which impact the wholesale price results. Real world results will be notably different and as such we have chosen not to publish this data.

Theme	Stakeholders said for FES 2019:	We said we would for FES 2019:	Updated: What we did for FES 2019:
Gas supply	You think that the current evidence does not support the development rates of shale in **Consumer Evolution** and **Steady Progression**. In addition, we have had a mixed response as to whether shale gas should be considered in the faster decarbonising scenarios.	We will review our shale modelling processes to consider the evidence around the big influencers on development.	The introduction of shale in CE and SP has been delayed in *FES 2019*, with no significant production before 2027 in both scenarios. This contrasts with the start of shale production in 2023 and 2024 respectively in FES 2018. There is a lot of uncertainty surrounding shale gas production at present and to reflect this and keep the scenarios credible and plausible, shale gas has only been included in the two non-2050 compliant scenarios as it was in *FES 2018*.
Gas supply	You said that liquefied natural gas (LNG) continues to be an area of known uncertainty, believing it will be 3 to 10 years before we see high LNG levels.	The recent influx of LNG cargos to Europe and GB show how difficult it is to reflect likely LNG volumes when there are market options. We **will** continue with the same approach at present and monitor the LNG market.	This has been considered in our analysis in previous years so there will not be big changes in *FES 2019.*
	You generally support our Green Gas approach, with a minority not supporting it.	We are not proposing to fundamentally change our green gas approach. We **will**, however, review the levels of Green Gas for *FES 2019*.	**No action required.** As we appear to be capturing the consensus with our current approach, our intention is to resist making any significant changes to it unless there is a major disruptor in this sector which means that it is no longer the most appropriate.

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