Future Energy Scenarios Stakeholder workshop

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FES Framework

October 2017

What is the FES framework?

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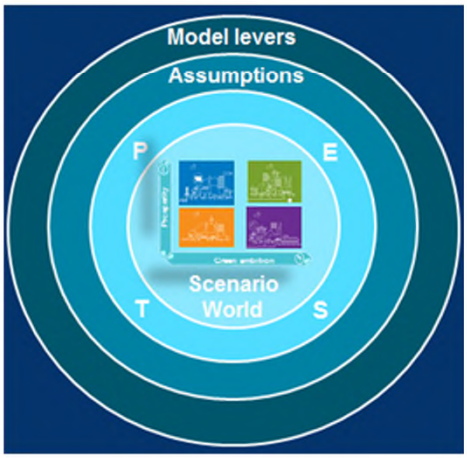
"A structured approach which provides a single reference for all inputs and assumptions that are used to build the Future Energy Scenarios"

The framework consists of several layers, each containing increasing levels of detail:

- **Scenario World**
- **Assumptions**
- **Model Levers**

We use the Political Economic Social & Technological (**PEST**) approach to structure the framework and narrative.



The FES framework is structured approach which provides a single reference for all inputs and assumptions that are used to build the Future Energy Scenarios.

The framework itself is made up of three layers, increasing in levels of detail:

Central to the scenario framework is the scenario world. This effectively captures the core elements which are fixed across the scenarios: the matrix, the axes and fixed rules, e.g. security of supply.

Sitting beneath the scenario world are all of the assumptions that feed into the scenarios. Each assumption broadly aligns to one of our models (e.g. onshore wind) and will be set generally at high, medium or low for each of the four scenarios.

The final layer of the framework is the specific model levers which are the detailed granular inputs into the analysis – these cover all inputs to all the models used to produce the FES.

To further structure the framework we use the widely accepted Political, Economic, Social and Technological (or PEST) approach. This also allows us to easily theme the modelling assumptions and narrative around the scenarios.

What is the FES framework – an example

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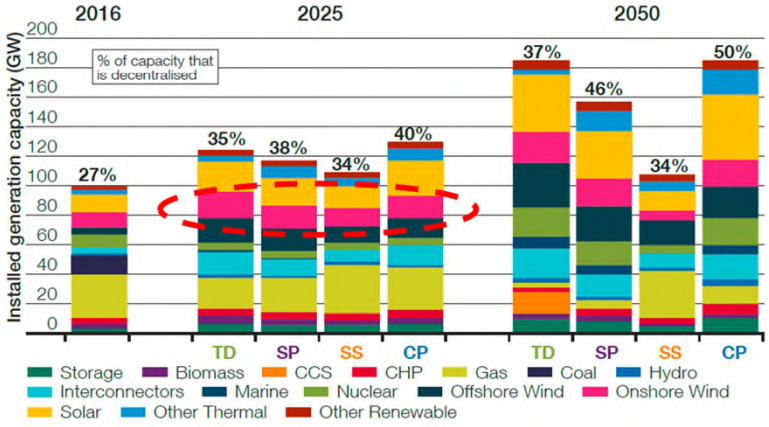
Let's consider how the framework approach used for FES 2017 lead to the following projections for Onshore Wind capacity in 2025:

Figure 4.2
Generation capacity by type and proportion of decentralised generation



Scenario	Capacity
Two Degrees	18 GW
Slow Progression	16 GW
Steady State	13 GW
Consumer Power	15 GW

To bring the Framework to life, lets consider an example of how the Framework created onshore wind installed capacities for FES 2017.

In 2025 we see between 13 GW and 18 GW of onshore wind, there is round 10 GW today.

These are the figures which came out of our final modelling outputs. How did the framework guide their creation?

What is the FES framework – an example

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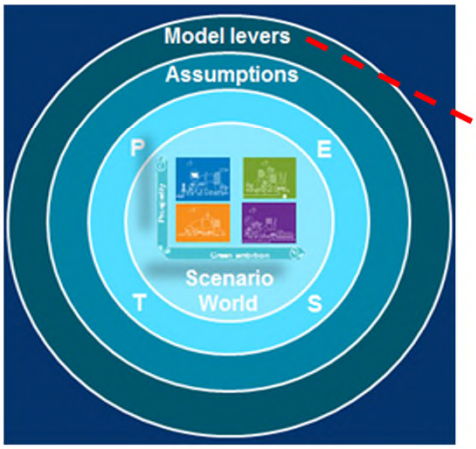
From a *narrative* point of view Onshore Wind is Technological under PEST:



Scenario	Example Levers
Two Degrees	No incentives required to build projects
Slow Progression	Only projects with consents or applied for are built
Steady State	Only projects with consents are built
Consumer Power	Slower commissioning times for projects

There are many levers for onshore wind, each has a different effect on the capacity

To get those modelled outputs, what inputs or "model levers" went into our onshore wind modelling?

Of course, there are many inputs into our models. The table shows are a few examples of them. Note that onshore wind is classified under the technical PEST from a narrative point of view.

What is the FES framework – an example

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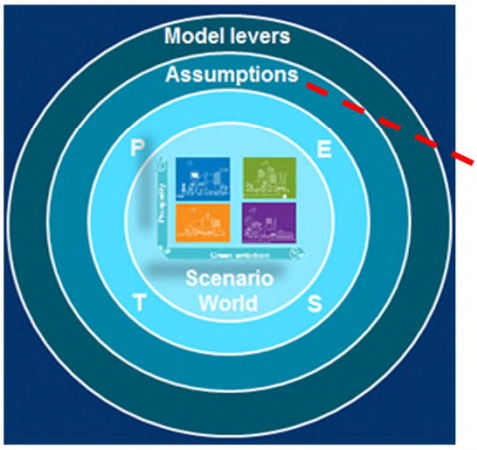
Where to set the model levers is governed by the assumption for "Level of installed capacity of onshore wind":



Scenario	Installed Onshore wind capacity
Two Degrees	High
Slow Progression	Medium
Steady State	Low
Consumer Power	Medium

Each assumption has a set level and a description – all available in our Scenario Framework workbook

Scenario Framework

In order to decide on which model levers to input to our model, there is an assumptions behind each lever.

In this case it is the assumption "Level of installed capacity of onshore wind" allows the model levers for each of the scenarios to be chosen in order to meet that assumption (see table).

Each assumption is set either High, Medium or Low. For transparency all of our assumptions, including a brief description, are published and available on our website at:

http://fes.nationalgrid.com/media/1247/fes-2017-scenario-framework-web-version.xlsx

What is the FES framework – an example

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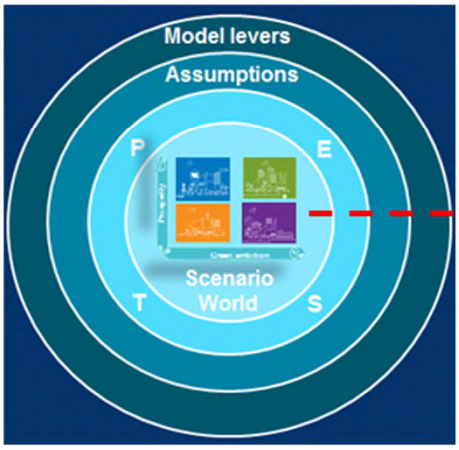
Assumption levels are determined by the Scenario World – currently Green Ambition (More or Less focus) and Prosperity (More or Less Money)



Scenario	Green Ambition	Prosperity
Two Degrees	More	More
Slow Progression	More	Less
Steady State	Less	Less
Consumer Power	Less	More

Ultimately it is the Scenario Worlds which guide the detail of the scenarios….

Where to set each assumption is determined by the scenario world , what each assumption should be given either More or Less Green Ambition or More or Less Prosperity (see table).

So, ultimately it is the scenario world which determines the assumptions and therefore the model levers and therefore the modelled outputs.

Why is the framework important? Why is it important to consider updating the framework?

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The framework ensures consistency across our gas and electricity modelling

The framework provides transparency for customers and stakeholders

The framework allows for a robust change control process, as changes can easily be tracked through

While there has been continued support from our customers and stakeholders for the framework approach, we need to ensure the scenarios continue to cover a plausible range of outcomes…

So that is how we use the framework, but why is it so important?

First: the framework ensures consistency across our gas and electricity modelling, as they use the same framework so no contradictory outputs are created, e.g. scenarios with both high levels of gas boilers and electrical heat pumps.

Second: the framework provides transparency for customers and stakeholders. As we said before, the framework is published and open for challenge from customers and stakeholders.

Thirdly: The framework allows for a robust change control process, as changes can easily be tracked through the end to end modelling process to determine the materiality of the change and what would be required to implement it

While there has been continued support from our customers and stakeholders for the framework approach, we need to ensure the scenarios continue to cover a plausible range of outcomes.

To ensure a plausible range of outcomes, we need to test the following points against the framework:

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- **Do the scenarios create a broad gas and electricity demand range?**
- **Should the scenarios have more of a focus on the 2050 decarbonisation target, including:**
  - **Allow for further pathways to reach the 2050 target**
  - **Meet the target with a no nuclear scenario**
  - **Meet the target with a no CCS scenario**
  - **Meet the target by decarbonising gas**
- **Should dependency on interconnection be reduced as a potential result of the UK leaving the European Union?**
- **Are the scenarios transparent around "coupling technologies" to avoid netting effects?**

From our engagement with customers and stakeholders to date, we believe the following need to be tested to ensure any framework will create a plausible range of outcomes:

Do the scenarios create a broad gas and electricity demand range?

Should the scenarios have more of a focus on the 2050 decarbonisation target, including:

- Allow for further pathways to reach the 2050 target
- Meet the target with a no nuclear scenario
- Meet the target with a no CCS scenario
- Meet the target by decarbonising gas

Should dependency on interconnection be reduced as a potential result of the UK leaving the European Union?

Are the scenarios transparent around "coupling technologies" to avoid netting effects?

What could the framework look like is shown on the following slides.

How could we address these points?

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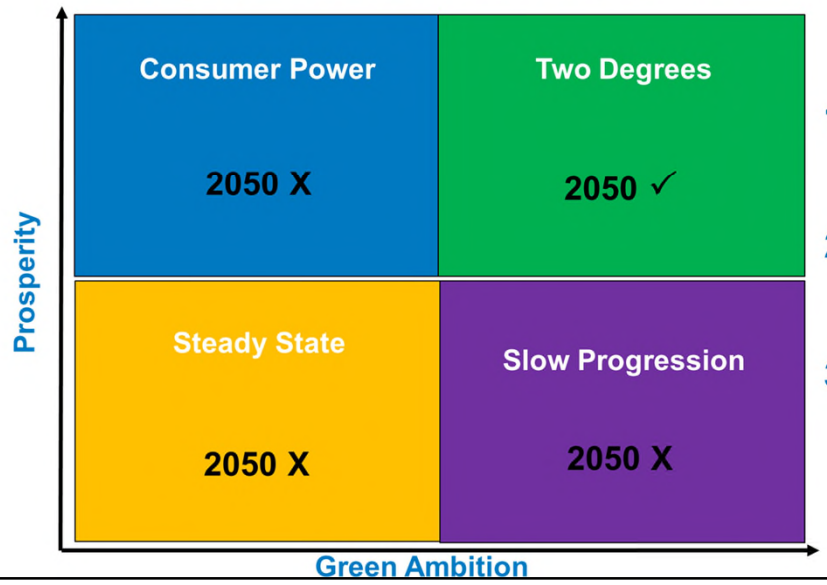
Some (very much non exhaustive!) options:



Option #1

1. Continue with current framework
2. Make our planned incremental changes
3. Still having one scenario which meets the 2050 target

We could keep the current framework, making the necessary incremental changes.

This would leave us with only one scenario which meets the 2050 target.

It is worth emphasising that these options are for debate and discussion and not a choice between them.

The scenarios shown are again examples of the type of scenario we could use in this framework.

How could we address these points?

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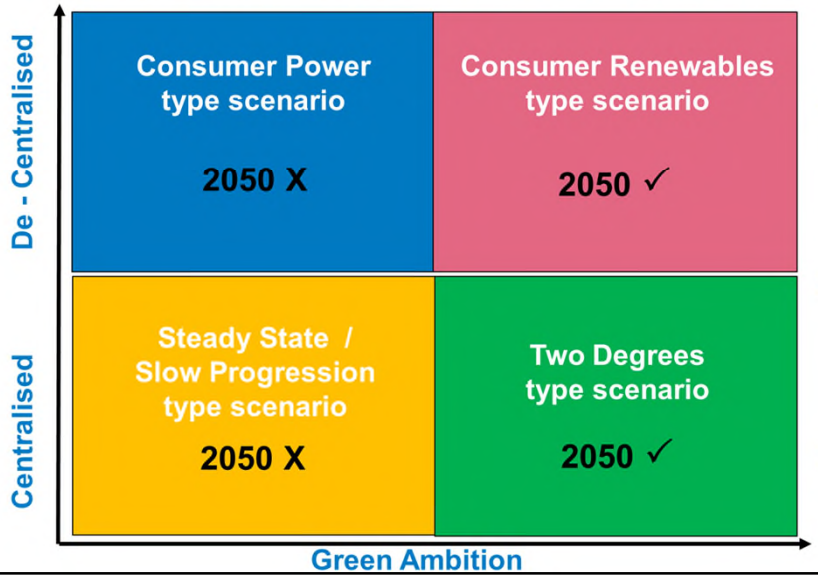
Some (very much non exhaustive!) options:



Option #2

1. Focus the x-axis on the "need", that is, Green Ambition
2. Focus the y-axis on "how" that need is met, either centralised or de-centralised
3. Allows for two scenarios to meet the 2050 target

We could "merge" prosperity into green ambition, as some say these are intrinsically linked.

This creates a "need" axis for green ambition and then an axis on how this need can be met – in this option by either a centralised or de-centralised energy system.

This would allow us to have two scenarios which meets the 2050 target.

It is worth emphasising that these options are for debate and discussion and not a choice between them. The scenarios shown are again examples of the type of scenario we could use in this framework. Consumer renewables was a sensitivity published as part of FES 2017 which looked at a scenario with a high level of decentralised renewable generation.

How could we address these points?

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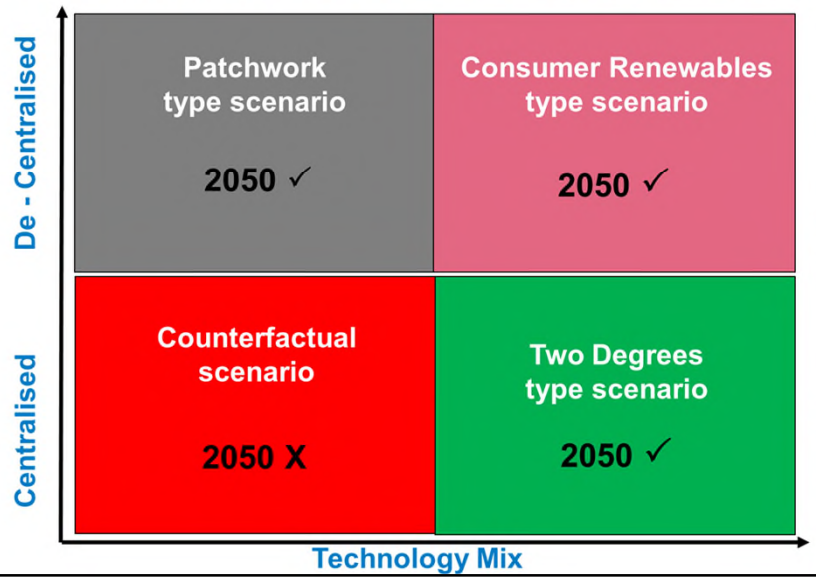
Some (very much non exhaustive!) options:



Option #3

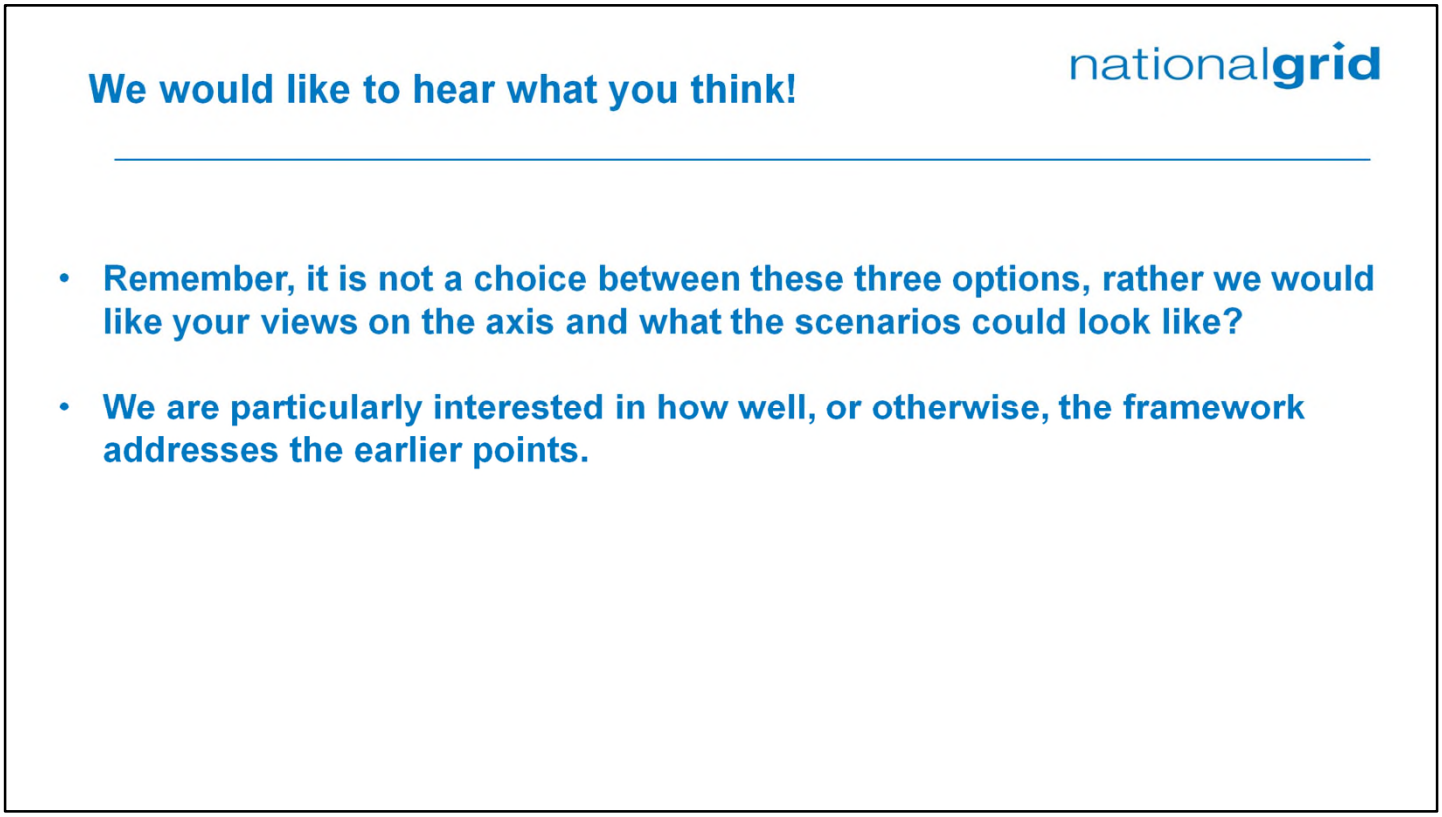
1. Assumes meeting 2050 targets in three scenarios
2. Focus the y-axis on how 2050 can happen, either centralised or de-centralised?
3. Focus the x-axis on how 2050 can happen, with which technology mix?

We could assume that meeting the 2050 target is "given" and consider two axes on how that is achieved.

In this option by either a centralised or de-centralised energy system and by changing the technology mix, for example through increased electrification of heat and transport.

This would allow us to have three (or four) scenarios which meet the 2050 target – we could have a counterfactual scenario to which would provide a comparison to today.

It is worth emphasising that these options are for debate and discussion and not a choice between them, the scenarios shown are again examples of the type of scenario we could use in this framework. Consumer Renewables was a sensitivity which looked at a scenario with a high level of decentralised renewable generation. Patchwork looks at a "patchwork" heating solution.



We would like to hear what you think!

Remember, it is not a choice between these three options, rather we would like your views on the axis and what the scenarios could look like?

We are particularly interested in how well, or otherwise, the framework addresses the earlier points, i.e.:

Do the scenarios create a broad gas and electricity demand range?

Should the scenarios have more of a focus on the 2050 decarbonisation target, including:

- Allow for further pathways to reach the 2050 target
- Meet the target with a no nuclear scenario
- Meet the target with a no CCS scenario
- Meet the target by decarbonising gas

Should dependency on interconnection be reduced as a potential result of the UK leaving the European Union?

Are the scenarios transparent around “coupling technologies” to avoid netting effects?

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Contact

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