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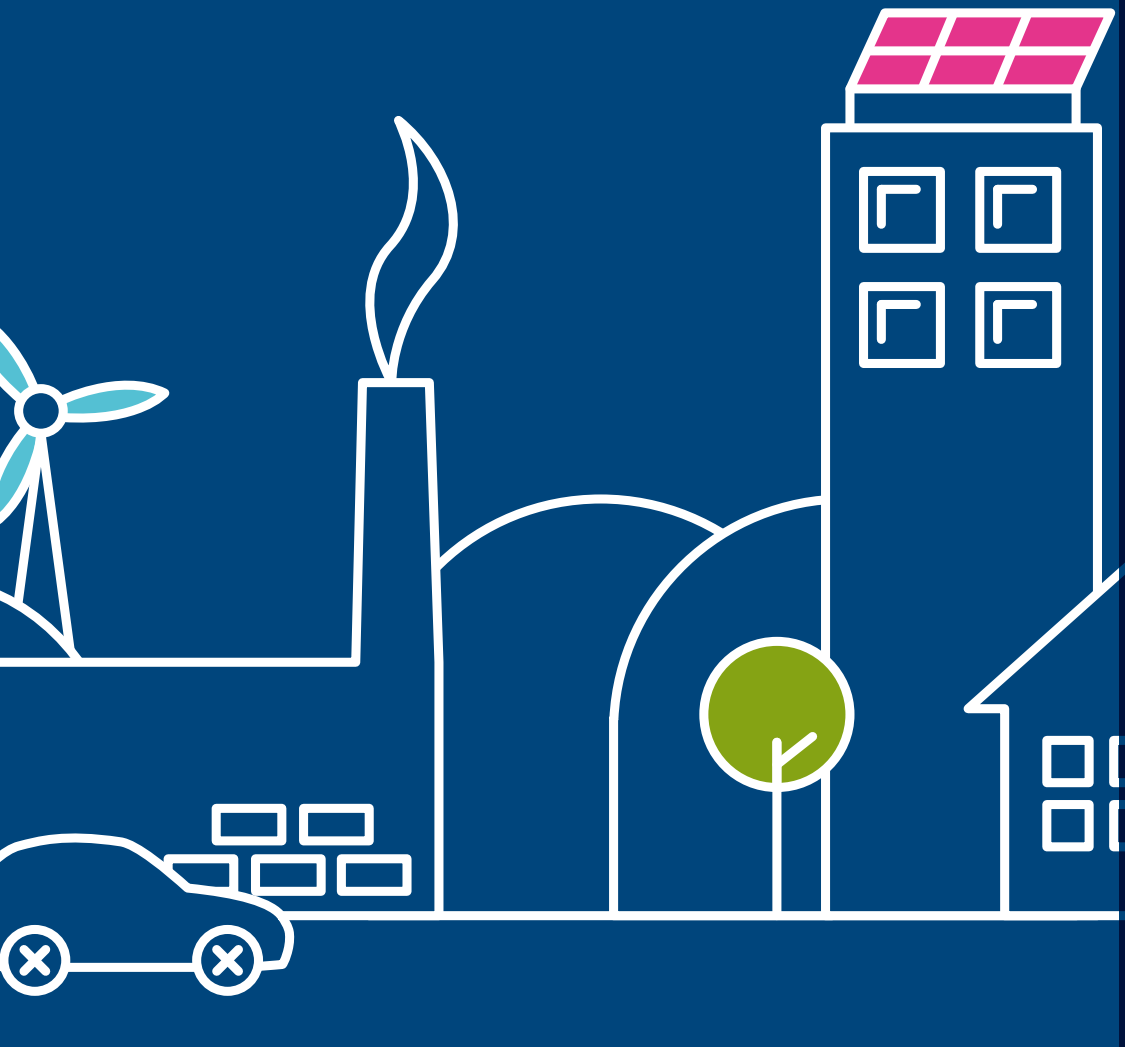
Future Energy Scenarios in five minutes



Key messages from Future Energy Scenarios (FES) 2015

Great Britain remains a net importer of electricity in three out of our four scenarios.

- The investment climate for interconnectors has improved; there is increased investment certainty, aspirational interconnector targets and a strengthening need case due to high levels of intermittent generation.
- Gone Green is the only scenario showing exports by mid 2030s. This highlights the benefit interconnectors provide for nuclear and renewable generation, with low carbon generation able to reach a wider customer base across Europe.
- To account for this change we have increased interconnector capacities for FES 2015, with the highest being Gone Green at 17.7 GW by 2030. The lowest level of interconnection is in No Progression at 9.8 GW by 2030.

The scenarios highlight the increasing operability challenges the electricity industry faces.

- Future summers will see periods of low transmission demands due to the increasing amounts of small scale generation.
- Consumer Power is our scenario with the highest levels of small scale solar generation. By 2020, demand seen on the transmission system will be as low as 16.7 GW on some days. With the output from low carbon generation at such a level, we will face system balancing challenges. Minimum demand could fall below 5 GW by 2030, which is below the expected level of inflexible generation.
- Innovative solutions will be required to address these challenges. For example, greater flexibility from existing sources of generation and demand, greater use of interconnection, the development of energy storage, more demand side response, and new balancing products.

Key messages from Future Energy Scenarios (FES) 2015

Sufficient gas supplies are available in all scenarios with significant uncertainty on the source.

- In all scenarios there is sufficient gas supply to meet demand, both on an annual and peak basis.
- The major variation between scenarios is the source of supply, be it indigenous or imported gas.
- Consumer Power sees our highest case for GB production from shale gas, with 32 bcm per year by 2030. This significant growth in shale gas from the mid-2020s reduces the need for gas imports.
- In contrast Slow Progression sees our lowest level of GB production. This results in an increasing requirement for gas imports with a 90% dependency by 2035. This could be provided either from continental Europe or buying liquefied natural gas (LNG). The precise mix of these sources will be determined by the prevailing market conditions at the time.

Gone Green is the only scenario to achieve all renewable and carbon targets on time.

- Renewable technologies contribute 34% of electricity supplied by 2020. Wind power contributes the vast majority of output to achieve the 2020 renewables target, at 18% of total output.
- Beyond 2020, low carbon electricity, from a mix of renewables and nuclear, underpins the electrification of heat and transport. Heat pumps and electric vehicles provide an increasing contribution towards meeting the targets over time.
- In order to meet the challenges of long-term decarbonisation targets the heat sector requires a move away from gas towards electric heating.
- Whilst heat pumps become the largest provider of heat in 2050, there is still an essential role for gas to provide top-up heat.
- In the three other scenarios environmental targets are not met on time due to lower prosperity and less green ambition.

Margins, whilst narrow, continue to be manageable until 2018/19 when the capacity market delivers new sources of capacity and margin pressures ease.

- Our analysis shows the importance of putting in place products to access additional capacity, to support management of winters with tight margins until the Capacity Mechanism is implemented. We are contracting with demand side balancing reserve (DSBR) and supplemental balancing reserve (SBR) providers to address this for winter 2015/16. This is shown in our security of supply case study in Chapter 7.
- In the longer term, security of supply improves with the contribution to capacity as a result of the Capacity Market included in all four scenarios from 2018/19.

16.7 GW

By 2020, demand on the transmission system will be as low as 16.7 GW on some days.

32 bcm

Consumer Power sees our highest case for GB production from shale gas, with 32 bcm per year by 2030.

34%

Renewable technologies contribute 34% of electricity supplied by 2020.

We had a positive response to our 2014 scenarios with suggested improvements being evolutionary, rather than revolutionary.

- We have kept our scenarios based on the energy trilemma.
- We reworked the Low Carbon Life scenario into Consumer Power.
- We replaced our “axioms” with a clearer set of five high level primary assumptions, which underpin the ranges of our modelling inputs.

Consumer Power is a world of relative wealth, fast paced research and development and spending. Innovation is focused on meeting the needs of consumers, who focus on improving their quality of life.

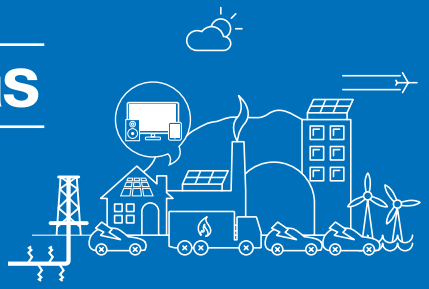
500MWe
Additional installations of gas CHP in commercial properties reaches 500MWe in 2018.

458M
CFL bulbs will peak in 2022 with 458 million units.

40%
By 2035/36 small scale generation will account for 40% of the power supply capacity.

Solar
By 2020/21, solar PV installed capacity nearly quadruples to 18GW.

Shale gas
Commercial production of shale gas starts in 2020.



Gone Green is a world where green ambition is not restrained by financial limitations. New technologies are introduced and embraced by society, enabling all carbon and renewable targets to be met on time.

LEDs
LEDs will be the only viable option for light bulbs by 2030.

300,000
Annual sales of air source heat pumps exceed 300,000 by 2020.

2025/26
By 2025/26, output from renewable sources of electricity generation will be comparable to that of conventional power stations.

400
Over 400 new biomethane connections will be required by the end of 2025.

10%
Electricity interconnection reaches the EU supply capacity target of 10% by 2020.

No Progression is a world focused on achieving security of supply at the lowest possible cost. With low economic growth, traditional sources of gas and electricity dominate, and little innovation affecting how we use energy.

130,000
Cavity wall installations don’t exceed 130,000 per annum.

50%
DSR contribution will only be up 50%, from today’s value, by 2030.

Smart
13.6 million smart meters will be rolled out by 2025.

Solar
By 2035/36 the output from solar will match that of coal.

89%
By 2035/36, for electricity generation, gas output will increase by 15% whilst coal output drops by 89%.

Slow Progression is a world where slower economic growth restricts market conditions. Money that is available is spent focusing on low cost long-term solutions to achieve decarbonisation, albeit later than the target dates.

50,000
Annual sales of hybrid electric vehicles exceed 50,000 by 2019.

Offshore
Offshore wind capacity doubles every five years until 2025/26.

8.4GW
Electricity interconnection increases to 8.4GW by 2020.

Case studies this year

Power balancing challenges

Future summers will see periods of low transmission demands due to the increasing amounts of generation embedded within the distribution networks; in particular solar photovoltaic (PV). These increases, without action, will create balancing challenges for the system operator (SO). This case study considers these challenges for a typical summer Sunday in 2020, using the Consumer Power scenario.

The analysis shows that with average solar output, transmission demand is being suppressed across a large part of the day, dropping to a minimum of 16.7 GW in 2020. There will still be a need to hold generation at part load to cater for unforeseen events on the system. Therefore total generation is likely to exceed demand.

19 GW

11 August 2014, minimum demand fell to 19 GW, which led to 13 consecutive ½ hour periods of negative generation prices.

Future of Heat

Energy used in heating demand is currently very carbon intensive and accounts for a significant proportion of GB's carbon emissions. If the carbon targets are to be met, there must be a step change in how our homes and businesses are heated. There are many solutions coming to market that aim to facilitate this change. We see a need for a combination of these solutions, with enabling technologies, to decarbonise heat at the most efficient cost to consumers and we see gas continuing to have a key role.

Key statistics

- Almost half (46%) of the final energy consumed in GB is used to provide heat, around 700 TWh/year
- Around 80% of heat demand is currently met with natural gas
- Heat is responsible for around a third of GB's greenhouse gas emissions.[6]

Heat is responsible for around a third of GB's greenhouse gas emissions1

[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48574/4805-future-heating-strategic-framework.pdf

Security of supply

This case study looks at the outlook for security of supply for the coming winter. Margins, whilst narrow, continue to be manageable until 2018/19 when the capacity market delivers new sources of capacity and margin pressures ease.

The purpose of this section is to look at the immediate outlook for security of supply and describe the solutions that are in place to ensure adequate generation and Demand Side Response is available to meet the security of supply standard.

Electricity storage

Electricity storage could be significant for the future balancing toolkit. It has the potential to offer valuable services to the SO, broader industry, and ultimately the end consumer. Using a traffic light system, this case study explores the developments that could improve the commercial viability of electricity storage in GB. The findings will inform how electricity storage is captured in future years of the FES using an evidenced based approach.

We have considered four areas where progress would be beneficial:

- policy and regulatory developments
- system needs
- commercial developments
- technological developments.

For each area, we explore the current status for GB (red, amber, green). We explain what progress, or 'green', may look like for GB and consider international examples. Issue resolution, or a 'green' status, is not necessary for all four areas for storage to be commercially viable; a change in just one or two areas could unlock the potential.

1 **Policy and regulatory developments is red**

3 **Commercial developments is amber**

2 **System need is amber**

4 **Technological developments is amber**

Key statistics in 2030

	Gone Green	Slow Progression	No Progression	Consumer Power
Power				
Annual demand, TWh	362	332	333	342
Peak demand, GW	66.1	59.4	60.8	62.6
Total installed capacity, GW	136	117	101	125
Low carbon capacity, GW	98	74	48	76
Interconnector capacity, GW	17.7	14.2	9.8	10.8
Gas				
Residential gas demand, TWh	200	274	308	292
Annual gas demand, TWh	602	702	819	851
Gas imports, %	68	88	61	34
Shale gas production, bcm	0	0	1	32
Decarbonisation				
Renewable energy, %	30	22	11	19
Reduction of GHG emissions, %	64	60	52	57

Continuing the conversation

Get involved in the debate on the future of energy on Twitter at #FES2015 and join our LinkedIn group 'Future of Energy by National Grid.'

Email us with your views on FES or any of our future of energy documents at: transmission.ukfes@nationalgrid.com **and one of our experts will get in touch.**

Access our current and past FES documents, data and multimedia at: http://fes.nationalgrid.com

Keep up to date on key issues relating to National Grid via our Connecting website: www.nationalgridconnecting.com/

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