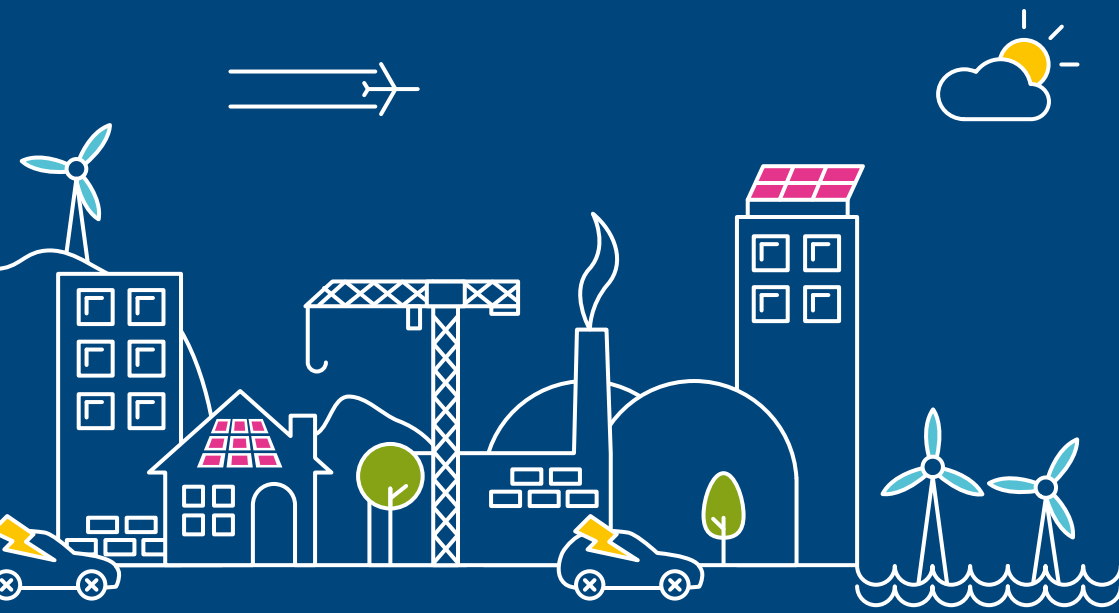
nationalgrid

Chapter one

Future Energy Scenarios

UK gas and electricity transmission



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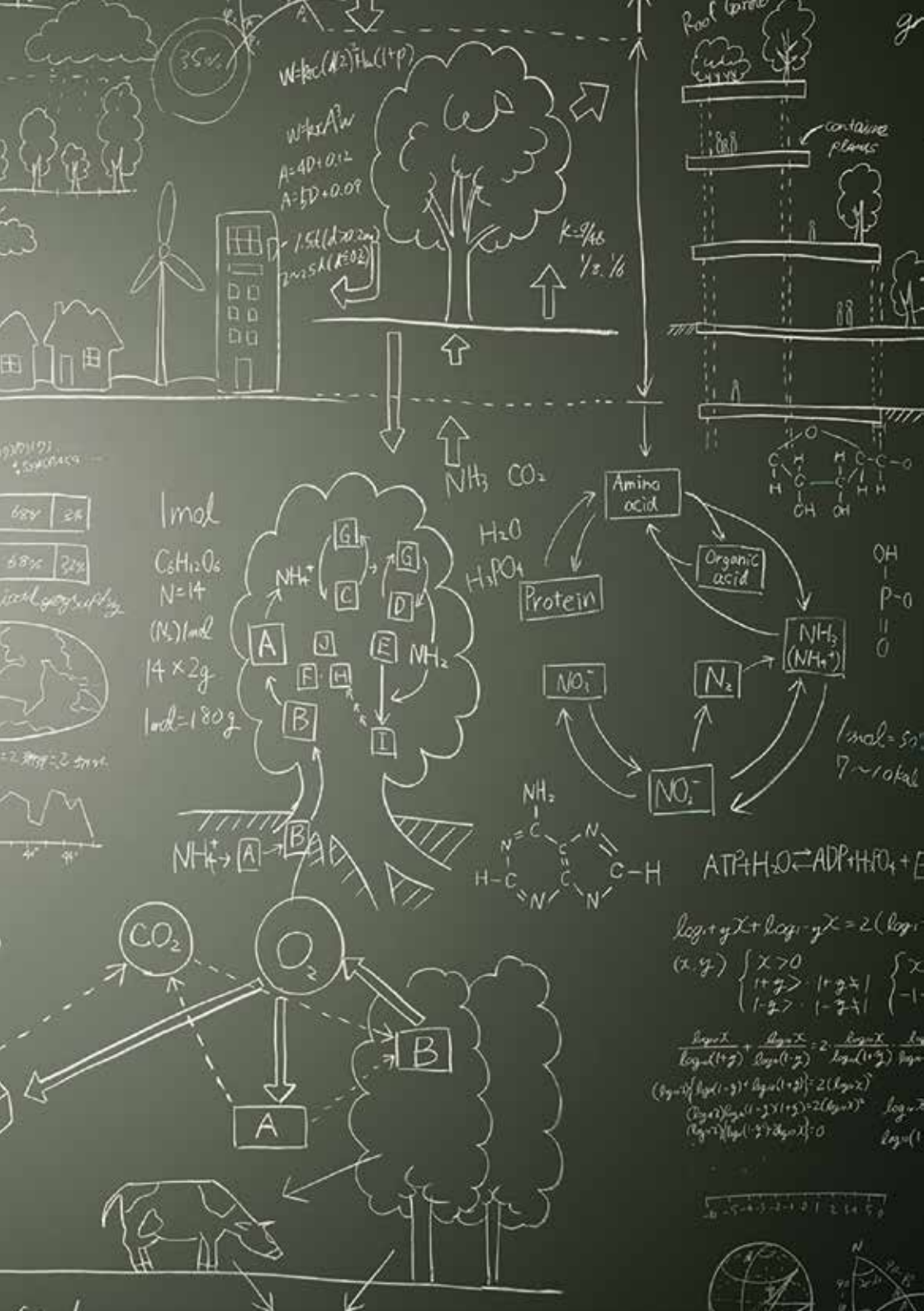
Amino acid
Organic acid
Protein
NH_3 CO_2
H_2O
H_3PO_4
NH_3 (NH_4^+)
NO_3^-
N_2
NO_2^-
1mol
$C_6H_{12}O_6$
N=14
180g
CO_2
O_2
A
B
ATP+H₂O⇌ADP+H₃PO₄
container plants

Ensuring that Great Britain has secure, sustainable and affordable sources of energy to fuel the future is one of the biggest challenges facing our nation.

Through our 2015 Future Energy Scenarios (FES) we explore how this complex energy landscape is changing and analyse how the future might play out.

We are only able to produce a set of credible future energy scenarios through the involvement of stakeholders from right across the energy sector. By participating in bilateral sessions and workshops or responding to questionnaires and providing comments you have really helped to shape our thinking.

We've also listened and acted on your feedback from FES 2014. This year we have introduced five high-level assumptions to simplify the presentation of our analysis. There is also a new scenario called **Consumer Power**, replacing the **Low Carbon Life** scenario, which you told us lacked the necessary clarity.

So, now that the detailed analysis is complete and we can take a step back to look at the overall picture for the energy environment, what does it tell us?

Two things strike me. The first is that uncertainty is here to stay. An uncertain economic, technological and consumer landscape provided the backdrop to our 2014 scenarios and we can expect more of the same in the coming years. The growth in small scale generation in GB offers one practical example, because we now have more locally generated and distributed electricity than ever before. As a large proportion of this never enters our transmission network, this means we see changing demand patterns on our network.

The second point is the increasingly global nature of the energy market. Great Britain is an island, yet it is true to say that our energy future will be driven not only by decisions taken at home, but by factors in Europe and elsewhere in a world that is becoming ever more interconnected. Over the last 12 months we have seen this play out in the GB gas sector with an increasing diversity of supplies, as well as fluidity in the liquefied natural gas (LNG) market. Similarly the electricity sector has seen an increase in planned interconnectors, responding to more price certainty from Ofgem's cap and floor announcements.

Without question there are some significant challenges ahead, including plenty to be positive about. By sharing insight, collaborating and taking action together, we can help the UK to meet its 2020 and 2050 energy targets, whilst at the same time ensuring security of supply for both electricity and gas. It is really important to me that consumers are at the heart of this debate to ensure they continue to enjoy secure, sustainable and cost effective energy.

I hope that you find this document useful as a catalyst for the wider energy debate that remains high on the agenda for all of us. We're keen to hear your views and you can get involved via our new website fes.nationalgrid.com, via our dedicated LinkedIn group page, Future of Energy by National Grid, and on Twitter via @nationalgriduk and #fes2015.

Roisin Quinn,
Head of Energy Strategy and Policy

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Chapter one

Executive Summary

Executive Summary

Great Britain's energy landscape continues to change at an unprecedented rate. Diversity of supply has increased and globalisation has accelerated, from the international shipping of new sources of gas supplies to the cross border transfer of electricity in Europe. Managing these and other changes to the energy mix results in opportunities both for energy consumers and for future grid operation. This includes scope for significant innovation as we explore new tools to balance the network through changes in supply and demand and seasonal operability challenges.

Security of supply is achieved in all scenarios. The sources of power and gas supply flex across the scenarios as political, economic, technological and societal assumptions affect market conditions. Gas supply scenarios include a wide range of possible supply patterns. Import dependency increases in three of our four scenarios and the gas market is expected to provide enough gas from international markets to make up the difference between indigenous supply and demand.

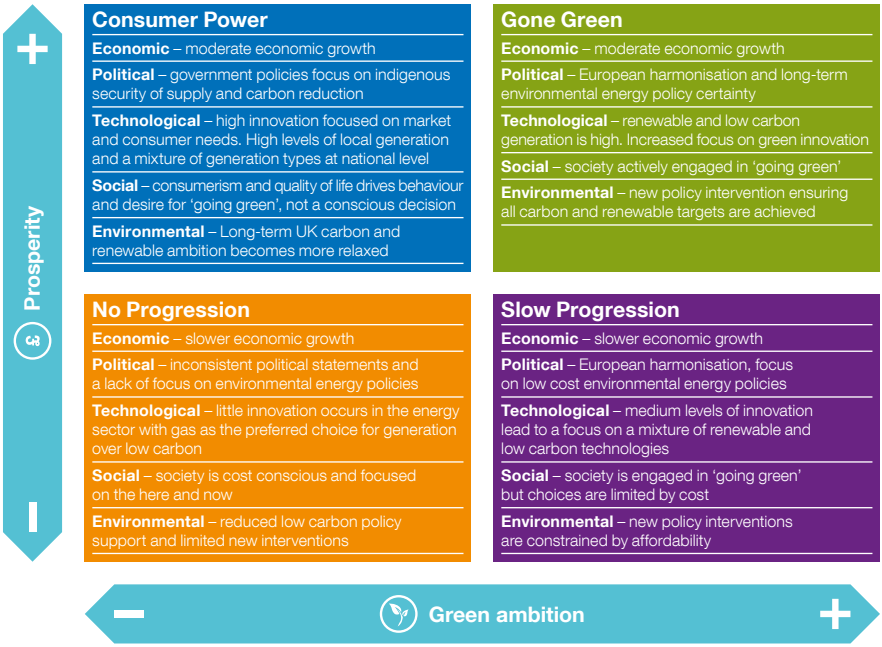
Power demand decreases in the short term across all four scenarios, before increasing to beyond today's level at different points in the future. In terms of gas demand two scenarios show an increase with two showing a decrease. Whilst the overall demands are similar between some of the scenarios there are different factors driving individual sectors.

1.1
An evolutionary approach to our Future Energy Scenarios for 2015

We have listened to your feedback and created a credible set of scenarios that has been approved by our regulator, Ofgem. This is in accordance with the recent modification of National Grid's Electricity Transmission Licence (ETL), requiring submission of our proposed scenarios to Ofgem each year.

Stakeholders were positive about our 2014 scenarios and suggested evolutionary, rather than revolutionary, improvements. In response to the feedback, we kept our scenarios based on the energy trilemma. We reworked the **Low Carbon Life** scenario into **Consumer Power** and replaced our "axioms" with a clearer set of five high level primary assumptions, which underpin the ranges of our modelling inputs.

Figure 1
Here are the political, economic, social, technological and environmental factors accounted for in our four 2015 Future Energy Scenarios



Executive Summary

- **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.
- **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 it later than the target dates.
- **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 there is limited innovation changing how we use energy.
- **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.

1.2
We have identified important themes emerging from our analysis on the future of energy

GB 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 being 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.

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; this is shown in all four scenarios from 2018/19.

90%
dependency on gas imports by 2035

Executive Summary

1.3 Key statistics

Consumer Power	2014	2020	2030
Power			
Annual demand, TWh	339	334	342
Peak demand, GW	60.4	60.7	62.6
Total installed capacity, GW	87	104	125
Low carbon capacity, GW	31	56	76
Interconnector capacity, GW	3.8	6.0	10.8
Gas			
Residential gas demand, TWh	321	302	292
Annual gas demand, TWh	818	859	851
Gas imports, %	58	55	34
Shale gas production, bcm	0	1	32
Decarbonisation			
Renewable energy, %	~7	~12	~19
Reduction of GHG emissions, %	30	52	57

No Progression	2014	2020	2030
Power			
Annual demand, TWh	339	335	333
Peak demand, GW	60.4	60.5	60.8
Total installed capacity, GW	87	93	101
Low carbon capacity, GW	31	43	48
Interconnector capacity, GW	3.8	6.0	9.8
Gas			
Residential gas demand, TWh	321	308	300
Annual gas demand, TWh	815	819	839
Gas imports, %	58	61	64
Shale gas production, bcm	0	1	16
Decarbonisation			
Renewable energy, %	~7	~10	~11
Reduction of GHG emissions, %	30	49	52

Gone Green	2014	2020	2030
Power			
Annual demand, TWh	339	329	362
Peak demand, GW	60.4	59.3	66.1
Total installed capacity, GW	87	96	136
Low carbon capacity, GW	31	53	98
Interconnector capacity, GW	3.8	10.8	17.7
Gas			
Residential gas demand, TWh	321	284	200
Annual gas demand, TWh	811	710	602
Gas imports, %	58	52	68
Shale gas production, bcm	0	0	0
Decarbonisation			
Renewable energy, %	~7	~15	~30
Reduction of GHG emissions, %	30	54	64

Slow Progression	2014	2020	2030
Power			
Annual demand, TWh	339	335	332
Peak demand, GW	60.4	60.3	59.4
Total installed capacity, GW	87	96	117
Low carbon capacity, GW	31	48	74
Interconnector capacity, GW	3.8	8.4	14.2
Gas			
Residential gas demand, TWh	321	294	274
Annual gas demand, TWh	814	756	702
Gas imports, %	58	66	88
Shale gas production, bcm	0	0	0
Decarbonisation			
Renewable energy, %	~7	~13	~22
Reduction of GHG emissions, %	30	51	60

Executive Summary

1.4 The role of stakeholders

Stakeholders are fundamental in the development of our Future Energy Scenarios, driving the range, content and advancement of our analysis. As important users of the outputs of the FES process, our stakeholders create and deliver the component parts needed to deliver the energy systems of the future.

We value the opinions and contributions from across the sector and the wider community to ensure we have a complete and rounded understanding of current and future market activity. We actively seek out industry experts to bring knowledge and new thinking to our analysis. Equally important is the wider debate and discussions we use to challenge and review our market assessment.

Many stakeholders are impacted by our business and influence our decisions at every stage of our operation; from identifying the energy mix of the future, through to building new pipes, overhead lines and cables and operating this new infrastructure. It is therefore essential that our stakeholders have the opportunity to understand and debate the scenarios in detail to evolve and improve the outputs each year.

The publication of this document each summer represents the beginning of a new cycle of engagement. Over the last few years we have significantly increased the involvement of our stakeholders in the development of our scenarios. We interact with a diverse range of stakeholders with a wide set of interests.

In the last 12 months we have engaged with over 350 people from 233 organisations including industry, the government, regulators, professional and special interest groups, customers and consumers. Last autumn we hosted three large-scale conferences to discuss the scenarios and gather feedback from the previous year's report. We engage our stakeholders using a mixture of one-to-one meetings, topic-specific discussions with small groups of experts from one or more companies, and sector-specific workshops involving a larger number of organisations. Working closely with interest groups and trade associations, we proactively seek a diverse range of views to maximise the depth and diversity of the inputs to our scenarios and analysis.

1.5 Responding to your feedback

This year's stakeholder views were positive about FES 2014 in terms of scope, content, process and delivery. We were told that no radical changes were required, so we have adopted an evolutionary approach to FES 2015.

The most noticeable change has been to our **Low Carbon Life** scenario. Stakeholders told us it was difficult to understand as there were underlying inconsistencies in the rationale which made the results unclear. For 2015 we have re-worked this scenario, renaming it **Consumer Power**.

The energy trilemma is used as the foundation for our scenarios. Many stakeholders found this very useful to provide a common narrative across the energy industry so it continues to be the basis of our analysis in 2015.

Stakeholders told us the axioms we used in our analysis and modelling can help them to better understand the scenarios. However it was clear from the 2014 feedback that there were too many axioms and having no hierarchy was confusing. Based on this feedback, we have replaced the axioms with five high-level primary assumptions which drive the ranges of all the modelling inputs to the four scenarios.

We presented our scenarios in a 2x2 matrix, and this approach received strong positive feedback. In 2014, sustainability and affordability were used as the axes descriptions for the matrices and some stakeholders felt these were unclear. For 2015, the axes have been revised to prosperity and green ambition.

Our FES Stakeholder Feedback Document summarises our stakeholder engagement each year. This publication gives more information to understand how we have engaged, what our stakeholders have been telling us, and how we intend to act on the feedback.

Executive Summary

1.6 What FES is…

A range of credible futures.

An output of an annual stakeholder consultation process regarding the future of the energy landscape.

A document covering the model inputs to the scenario analysis, new technologies, social and economic developments, government policies and progress against targets.

A set of scenarios which can be used to frame discussions and perform stress tests.

A set of scenarios that are projected out from the present to 2050.

Scenarios which form the starting point for all transmission network and investment planning. They are also used in analysis to identify future operability challenges and potential solutions to meet those challenges.

A document covering developments in electricity generation and demand, and gas supply and demand.

What FES isn't…

The document does not cover potential network developments: these are addressed in the gas and electricity ten year statements.

Costs are not applied to the scenarios. There is too much uncertainty for any numbers to be credible.

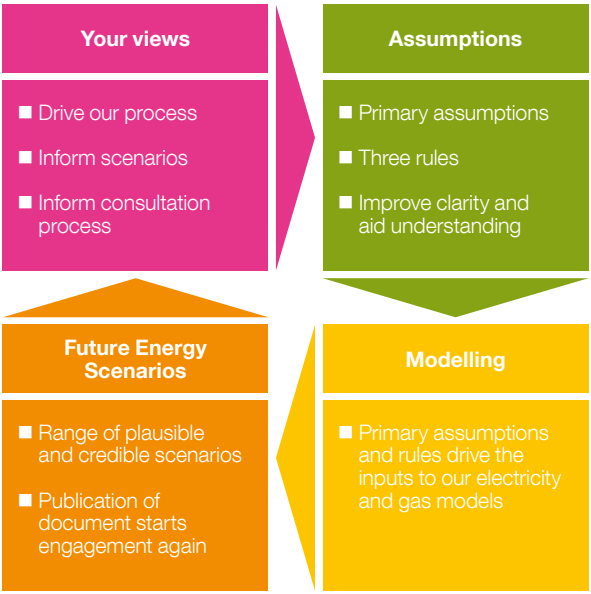
The document does not provide a forecast of the future. Scenario planning does not predict the future; rather it considers a scope of potential drivers that may have an impact.

There is no probability analysis undertaken and not one of our scenarios is deemed more likely than another.

Executive Summary

1.7 Improving stakeholder involvement

We are never complacent and recognise that there are always ways that our stakeholder engagement could be improved. For 2015, we are planning to make our engagement broader, deeper and smarter with improvements to the value added to the outputs.



By targeting, co-ordinating and listening more actively, we believe our engagement will be significantly smarter. A 'one-size-fits-all' approach is not appropriate for our diverse range of stakeholders. We will explore a wider range of engagement methods. The new dedicated FES website is just one of a number of developments we are making to provide a more open and transparent source of engagement opportunities.

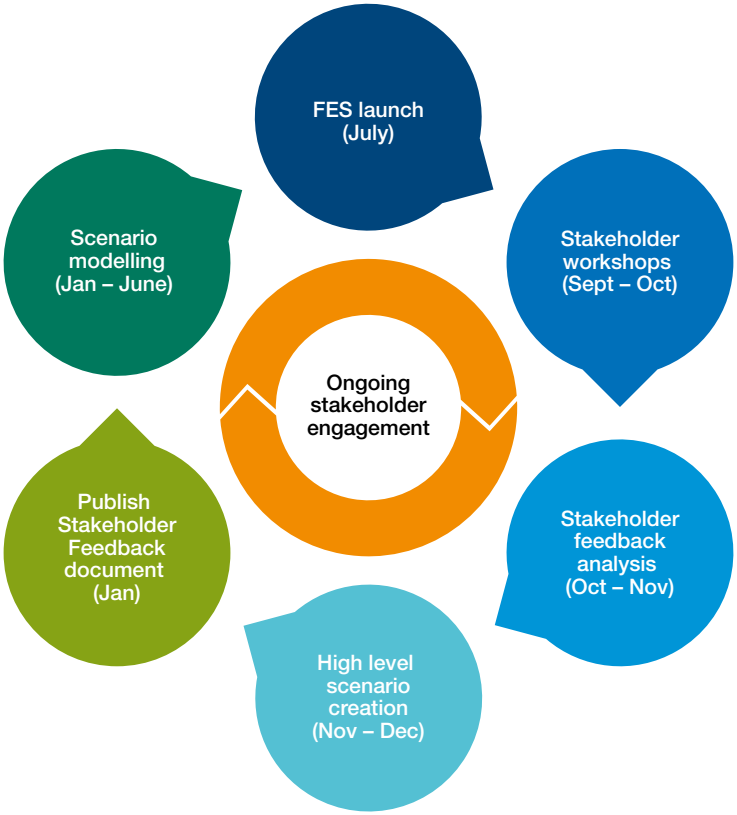
Deeper engagement will concentrate on understanding how our scenarios are used by stakeholders. We will explore opportunities for more collaborative engagement to aid the development of primary assumptions and modelling inputs to give richer, better outputs.

Broader engagement with new stakeholders is important to develop more robust scenarios. For example, we work with a range of UK and European organisations to identify best practice in scenario development and stakeholder engagement. We will build on these relationships, adding new organisations where appropriate.

1.8
Scenario development

Feedback is fundamental to the development of our FES. With an improved understanding of all our stakeholders' views on the future of energy, we can develop a rich suite of energy scenarios that will enable us to address the long-term strategic challenges facing the development of the gas and electricity transmission networks in GB.

Our stakeholders' views are at the heart of the scenario creation process, from developing the primary assumptions and model inputs, through to the scope and content of our FES.



Executive Summary

1.9
How to use this document

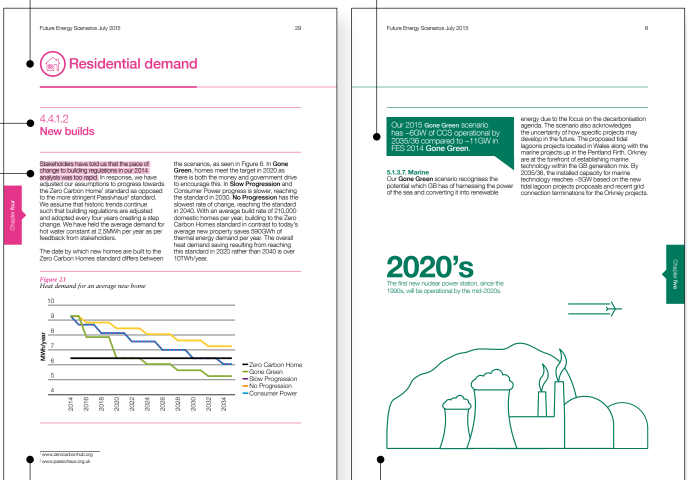
This document has been designed to present information in easily digestible sections, with the subject matter clearly defined in colour-coded chapters.

Heading and icon introduce the main topic on the page.

Key pieces of information are highlighted in boxes.

The main text is divided into sections by subheadings.

We have highlighted specific areas where we have responded to stakeholder feedback.



Footnotes are used for citations and further commentary.

Key data is emphasised with an image.

Chapters are tabbed and colour coded to help you find the section you are looking for.

Chapter eight


Government policy


Meet the team


Glossary

Appendix 1 Government policy

CRC Energy Efficiency Scheme (CRC)

The Carbon Reduction Commitment (CRC) Energy Efficiency Scheme[1] is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organisations. The scheme features a range of reputational, behavioural and financial drivers, which aim to encourage organisations to develop energy management strategies that promote a better understanding and more efficient use of energy.

Electricity Market Reform (EMR)

Electricity Market Reform[2] includes the introduction of new long-term contracts: Contracts for Difference (CfDs) for new low carbon generation projects, a Carbon Price Floor[3] (in place since April 2013) and a Capacity Market, to include demand response, interconnectors and generation. EMR also includes an Emissions Performance Standard (EPS), set at 450gCO_2/kWh, to reinforce the requirement that no new coal-fired power stations are built without carbon capture and storage (CCS) and to ensure necessary investment in gas can take place. The Energy Act of 2013 gave the Secretary of State for Energy and Climate Change the power to introduce these elements of EMR (to work alongside the Carbon Price Floor[1]).

National Grid as the National Electricity Transmission System Operator (NETSO) has been appointed as the Delivery Body for EMR. This involves administering the Capacity Market and CfDs on behalf of DECC, as well as providing key analysis to inform decision making.

Our analysis of EMR is ongoing. We have taken account of the main themes in deriving our power supply backgrounds, shown in chapter 5. We assume that the mechanisms will play a part in maintaining adequate plant margins and will ensure that there is sufficient renewable and low carbon generation to meet the renewable and carbon targets in the **Gone Green** scenario.

Feed-In Tariffs scheme (FIT)

The Feed-In Tariffs scheme[4] aims to encourage small scale renewable and low carbon electricity generation by paying users for each unit of electricity generated, as well as a payment for each unit exported to the grid. The scheme is applicable to a number of technologies (solar PV, wind, hydro, and anaerobic digestion) up to a maximum capacity of 5MW of total installed capacity (TIC). Micro combined heat and power (mCHP) plants are also eligible up to 2kW.

Green Deal Energy Company Obligation (ECO)

Green Deal[5] replaces the Carbon Emissions Reduction Target[6] (CERT). It allows individuals and businesses to make energy efficiency improvements to their buildings at no upfront cost through access to the finance needed for the improvements with repayment, in instalments, attached to the electricity bill. Research conducted by GfK NOP showed that in November 2013, 23% of consumers were aware of the Green Deal[7]. It is estimated that 26 million homes could be eligible for Green Deal financing. By the end of March 2015, over 530,000 Green Deal assessments had been carried out, 184 authorised Green Deal providers had been registered and 2,258 organisations were signed up to carry out installations[8].

[1] https://www.gov.uk/crc-energy-efficiency-scheme-qualification-and-registration#overview

[2] https://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform

[3] The carbon price floor was legislated for in the 2011 Finance Act

[4] https://www.gov.uk/feed-in-tariffs

[5] https://www.gov.uk/green-deal-energy-saving-measures

[6] http://webarchive.nationalarchives.gov.uk/20121217150421/www.decc.gov.uk/en/content/cms/funding/funding_ops/cert/cert.aspx

[7] https://www.gov.uk/government/publications/green-deal-household-tracker-wave-3

[8] https://www.gov.uk/government/collections/green-deal-and-energy-company-obligation-eco-statistics

Energy Company Obligation (ECO)

The Energy Company Obligation (ECO) commenced in 2013 and will operate until March 2017. It places a legal obligation on energy suppliers to satisfy energy efficiency and fuel saving targets to households. ECO is primarily focused on households unable to achieve significant energy savings from Green Deal without an additional or different measure of support. ECO is directed towards vulnerable and low-income households, community schemes, and those living in harder to treat properties, such as those with solid walls.

Industrial Emissions Directive (IED)

The Industrial Emissions Directive[9] is a European Union directive which commits member states to control and reduce the impact of industrial emissions on the environment post-2015 when the Large Combustion Plant Directive (LCPD) expires.

Under the terms of the IED, affected plant can:

- Opt out and continue running under previous (LCPD) emission limits.
- Opt in under the Transitional National Plan (TNP), which will impose a cap on annual mass nitrogen oxide emissions and a decreasing cap on annual mass sulphur dioxide emissions on all plants operating under a country's TNP until mid-2020. At that point they will have to decide whether to fit appropriate emission-reducing equipment to comply with the directive, be limited to run a maximum of 1,500 hours a year or close.
- Opt in and comply fully from 1 January 2016. This will mean fitting selective catalytic reduction equipment or additional flue-gas de-sulphurisation technology for some plants.

Large Combustion Plant Directive (LCPD)

The Large Combustion Plant Directive[10] is a European Union directive which introduced measures to control the emissions of sulphur dioxide, oxides of nitrogen and dust from large combustion plant. Large power stations (installed capacity greater than 50MW) in the UK must comply with the LCPD. Plants that 'opt out' of meeting the new standards must close by 2015 or after 20,000 hours of operation.

Levy Control Framework (LCF)

The Levy Control Framework[11] caps the annual amount of money that can be levied on bills to support UK low carbon generation at £2.35bn in 2012/13, rising to £7.6bn in 2020/21. This covers Feed-in Tariffs (FITs), Renewables Obligation (RO) and Contracts for Difference.

Renewable Heat Incentive (RHI)

The Renewable Heat Incentive[12] scheme provides payments for heat generated from renewable technologies including biomass boilers, solar thermal and heat pumps. There are three distinct phases of financial support:

- RHI Phase 1 – for commercial, industrial, public, not-for-profit and community generators of renewable heat
- RHI Phase 2 – a renewable heat premium payment (RHPP) to householders who have no access to the gas network and who generate renewable heat. Under RHPP householders receive a single payment for the installation of renewable heat technology
- RHI Phase 3 – for householders generating renewable heat. Householders will receive regular annual or quarterly payments for heat generated.

[9] http://www.official-documents.gov.uk/document/hc1012/hc16/1604/1604.pdf (page 12)

[10] https://www.gov.uk/government/publications/environmental-permitting-guidance-the-large-combustion-plants-directive

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48244/3290-control-fwork-decc-levyfunded-spending.pdf

[12] https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/renewable-heat-incentive-rhi

Appendix 1 Government policy

Renewables Obligation (RO)
The Renewables Obligation[13] (RO) is the main support mechanism for renewable electricity projects in the UK. Smaller scale generation is mainly supported through the Feed-in Tariff scheme (FITs).

The RO came into effect in 2002 in England and Wales, and Scotland, followed by Northern Ireland in 2005. It places an obligation on UK electricity suppliers to source an increasing proportion of the electricity they supply from renewable sources.

Renewables Obligation Certificates (ROCs) are green certificates issued to operators of accredited renewable generating stations for the eligible renewable electricity they generate. Operators can trade ROCs with other parties. ROCs are ultimately used by suppliers to demonstrate that they have met their obligation.

Where suppliers do not present a sufficient number of ROCs to meet their obligation, they must pay an equivalent amount into a buy-out fund. The administration cost of the scheme is recovered from the fund and the rest is distributed back to suppliers in proportion to the number of ROCs they produced in respect of their individual obligation.

Energy Saving Opportunities Scheme (ESOS)
The government established ESOS[14] to implement Article 8 (4-6) of the EU Energy Efficiency Directive (2012/27/EU). The ESOS Regulations 2014 give effect to the scheme.

ESOS is a mandatory energy assessment scheme for organisations in the UK that meet the qualification criteria. The Environment Agency is the UK scheme administrator.

Organisations that qualify for ESOS must carry out ESOS assessments every 4 years. These assessments are audits of the energy used by their buildings, industrial processes and transport to identify cost-effective energy saving measures.

Organisations must notify the Environment Agency by a set deadline that they have complied with their ESOS obligations, the first of which is 5 December 2014.

[13] https://www.ofgem.gov.uk/environmental-programmes/renewables-obligation-ro

[14] https://www.gov.uk/energy-savings-opportunity-scheme-esos

Appendix 2 – Meet the Energy, Strategy & Policy team

Balancing and Markets
We explore the future electricity balancing challenges and opportunities relating to changing generation and demand. We consider the role that technologies such as interconnectors, electricity storage, demand side response and other innovative solutions may play in the future balancing toolkit. Engagement with stakeholders is vital to the development of ourinterconnector scenarios and through industry groups and bilateral meetings we ensure all perspectives are taken into consideration. We welcome your views on balancing the electricity system over coming decades.

Emma Carr
Balancing and Markets Manager

Dave Wagstaff
EMR Network Cost Analyst

Iain Ashworth
Balancing Analyst

Matthew Speedy
Balancing Analyst

Rhiannon Grey
Balancing Analyst

EMR Modelling
Our team was set up to fulfil part of National Grid's obligations as Electricity Market Reform (EMR) Delivery Body. Our responsibilities include analysis used to recommend the capacity to procure in the Capacity Market that is published annually in our Electricity Capacity Reports and modelling to inform the setting of strike prices for Contracts for Difference (CfDs) as illustrated by our report for the EMR Delivery Plan. We also carry out related modelling work outside of our EMR responsibilities, for example to inform the volume of the new balancing services (SBR and DSBR) required in the mid-decade years.

Duncan Rimmer
EMR Modelling Manager

Ajay Pandey
EMR Senior Data Officer

Gareth Lloyd
EMR Analytical Manager

Simon Geen
EMR Analytical Manager

Gas Demand
As the gas demand team we project the usage of gas for both the Industrial and Commercial markets and the residential sector. We utilise various modelling tools and techniques to support our analysis alongside taking part in several industry discussion groups to balance our statistical analysis with innovative thinking on the future of gas. Heat forms a significant part of our analysis as this is currently dependent on gas in addition to transport which has the potential to become more reliant on gas. Amongst our stakeholders, we engage with gas providers and distribution networks to ensure we're using the most up to date information. If you can share any views on gas demand, please get in touch.

Iain Shepherd
Energy Demand Analyst

Phil Clough
Gas Demand Analyst

Rob Nickerson
Senior Gas Demand Analyst

Appendix 2 – Meet the Energy, Strategy & Policy team

Gas Supply
We take gas demand projections from our colleagues in the Gas Demand team and work out how much gas will have to come from different sources to meet the demand. Our work depends very much on detailed industry knowledge rather than complicated mathematical modelling, and is helped by the 70 years of industry experience that we have between us. During the year we talk to major industry players, producers, terminal operators, other network operators and potential developers. We also attend industry discussions, all to make sure that we are working with the best possible information when we come to make our supply to demand match. If you have anything that you think we should know about possible gas supplies we'd be very interested to hear from you.

Simon Durk
Gas Supply Manager

Nigel Bradbury
Primary Energy Analyst

Chris Thompson
Senior Gas Supply Analyst

Christian Parsons
Gas Supply Analyst

Market Outlook
We bring together expert thinking, market data, industry experts, stakeholder feedback and indepth analysis to create a rounded view of the future of energy. Our publications cover the short, medium and longer-term including the Winter and Summer Outlook Reports, the Winter Consultation, the Safety Monitors Report and, of course, the Future Energy Scenarios (FES). Our role is to extract the key messages from the inputs and analysis to give a clear direction to National Grid and the industry on energy trends, landscapes and the future energy challenges. We also produce the Stakeholder Feedback document that summarises views from interested parties on the FES document and provides a commentary of how these responses have been used to develop and progress the scenarios. We welcome your views on the content of all these documents.

Catherine Lange
Market Outlook Manager

Andy Dobbie
Energy Security Analyst

Caroline Kluyver
Content Officer

Chris Thackeray
Content Officer

Duncan Sluce
Energy Security Analyst

Faye Relton
Strategy Analyst

Power Demand
We spend much of our time striving to understand electricity usage once it's been generated. Our models are concerned with what people do with electricity in their day-to-day lives, from the home to the office and beyond, from an annual basis right down to an understanding of within day usage profiles. This considers the future landscape for transport, heating and lighting. To understand potential electricity usage, we engage with members of Britain's society, including homeowners, business people, academics and journalists. We also regularly attend a wide range of industry events and conferences along with reading a wide range of publications and annual reports. Please let us know your thoughts and opinions on power demand and how this may change into the future.

Russell Fowler
Power Demand Manager

Huw Thomas
Power Demand Analyst

Kein-Arn Ong
Senior Power Demand Analyst

Orlando Elmhirst
Senior Power Demand Analyst

Power Supply
We consider the sources of generation that will be used to meet power demand now and in the future. We consider all sources of generation (both established and emerging technologies) irrespective of where and how they are connected. We consider how the political ambition, environmental legislation, the economic climate, technological advancements and social engagement influence electricity generation. We look forward to discussing with you our power supply scenarios and will be delighted to hear from you if you have any information on power supply which could be included in our analysis.

Lilian MacLeod
Power Supply Manager

Dr Giuliano Bordignon
Senior Power Economics Analyst

Greg Hunt
Senior Power Supply Analyst

Janet Coley
Senior Power Supply Analyst

Luke Cutler
Power Supply Analyst

Mark Perry
Senior Power Supply Analyst

Secondments

Liana Cipcigan
Seconded from Cardiff University

Leadership team

Roisin Quinn
Head of Energy, Strategy and Policy

Janet Mather
Demand and Supply Manager

Kirsty Martin
PA to Head of Energy, Strategy and Policy

Marcus Stewart
Energy Supply Manager

Nigel Fox
Strategy Development Manager

Appendix 3 Glossary

Acronym	Word	Description
ACT	Advanced conversion technology	Gasification, pyrolysis or anaerobic digestion, or any combination of those.
ASHP	Air source heat pump	Air source heat pumps absorb heat from the outside air. This heat can then be used to produce hot water or space heating.
ARA	Amsterdam Rotterdam and Antwerp (Coal Price)	The cost of coal in the major NW Europe coal importing ports of Amsterdam/ Rotterdam/Antwerp (ARA). http://www.worldcoal.org/resources/coal-statistics/shipping-terms-glossary/
AD	Anaerobic digestion	Bacterial fermentation of organic material in the absence of free oxygen.
	Ancillary services	Services procured by a system operator to balance demand and supply and to ensure the security and quality of electricity supply across the transmission system. These services include reserve, frequency control and voltage control. In GB these are known as balancing services and each service has different parameters that a provider must meet.
	Annual power demand	The electrical power demand in any one fiscal year. Different definitions of annual demand are used for different purposes.
ACS	Average cold spell	Average cold spell: defined as a particular combination of weather elements which gives rise to a level of winter peak demand which has a 50% chance of being exceeded as a result of weather variation alone. There are different definitions of ACS peak demand for different purposes.
BBL	Balgzand Bacton Line	A gas pipeline between Balgzand in the Netherlands and Bacton in the UK. http://www.bblcompany.com
	Baseload electricity price	The cost of wholesale electricity paid for baseload power.
bcm	billion cubic metres	Unit or measurement of volume, used in the gas industry. 1 bcm = 1,000,000,000 cubic metres
	Biogas	Biogas is a naturally occurring gas that is produced from organic material and has similar characteristics to natural gas.
	Biomethane	We use the term biomethane specifically for biogas that is of a suitable quality to be injected into distribution or transmission networks. http://www.biomethane.org.uk/
	Boil-off	A small amount of gas which continually boils off from LNG storage tanks. This helps to keep the tanks cold.
CM	Capacity Market	The Capacity Market is designed to ensure security of electricity supply. This is achieved by providing a payment for reliable sources of capacity, alongside their electricity revenues, ensuring they deliver energy when needed.
CCS	Carbon capture and storage	Carbon (CO_2) Capture and Storage (CCS) is a process by which the CO_2 produced in the combustion of fossil fuels is captured, transported to a storage location and isolated from the atmosphere. Capture of CO_2 can be applied to large emission sources like power plants used for electricity generation and industrial processes. The CO_2 is then compressed and transported for long-term storage in geological formations or for use in industrial processes.
CO_2	Carbon dioxide	Carbon dioxide (CO_2) is the main greenhouse gas and the vast majority of CO_2 emissions come from the burning of fossil fuels (coal, natural gas and oil).
CPF	Carbon price floor	A price paid by UK generators and large carbon intensive industries for CO_2 emissions.
CPS	Carbon price support	A price paid by UK generators and large carbon intensive industries in addition to the EU ETS to guarantee a minimum floor price for CO_2 emissions.
CRC	Carbon Reduction Commitment	See appendix on government policy. The Carbon Reduction Commitment is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public sector and large private sector organisations.
	Cash out	Prices that are used to settle the difference between contracted generation or consumption and the amount that was actually generated or consumed in each half hour trading period

Acronym	Word	Description
	Climate change targets	Targets for share of energy use sourced from renewable sources. The 2020 UK targets are defined in the Directive 2009/28/EC of the European Parliament and of the Council of the European Union, see http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0028&from=EN#ntc1-L_2009140EN.01004601-E0001
CBM	Coal bed methane	Coal bed methane is methane that is extracted from un-mined coal seams by drilling wells directly into the seams to release the gas. http://www.worldcoal.org/coal/coal-seam-methane/coal-bed-methane/
COP	Coefficient of performance	The ratio of heating (or cooling) provided per electrical energy consumed.
CCGT	Combined cycle gas turbine	Gas turbine that uses the combustion of natural gas or diesel to drive a gas turbine generator to generate electricity. The residual heat from this process is used to produce steam in a heat recovery boiler which in turn, drives a steam turbine generator to generate more electricity.
CHP	Combined heat and power	A system whereby both heat and electricity are generated simultaneously as part of one process. Covers a range of technologies that achieve this.
CFL	Compact fluorescent light	A lighting technology introduced to replace traditional incandescent bulbs. Commonly referred to as energy saving bulbs.
CWV	Composite weather variable	A measure of weather incorporating the effects of both temperature and wind speed. We have adopted the new industry wide CWV equations that take effect on 1 October 2015.
CNG	Compressed natural gas	Compressed natural gas is made by compressing natural gas to less than 1 percent of the volume it occupies at standard atmospheric pressure.
CfD	Contract for Difference	See appendix on government policy. Contract between the Low Carbon Contracts Company (LCCC) and a low carbon electricity generator designed to reduce its exposure to volatile wholesale prices.
DBSR	Demand side balancing reserve	Demand side balancing reserve (DSBR) is a balancing service that has been developed to support National Grid in balancing the system during the mid-decade period when capacity margins are expected to be tight. DSBR is targeted at large energy users who volunteer to reduce their demand during winter week-day evenings between 4 and 8pm in return for a payment. Along with supplemental balancing reserve (SBR), this service will act as a safety net to protect consumers, only to be deployed in the event of there being insufficient capacity available in the market to meet demand.
DSR	Demand side response	A deliberate change to an industrial and commercial user's natural pattern of metered electricity or gas consumption, brought about by a signal from another party.
DECC	Department of Energy and Climate Change	A UK government department: The Department of Energy & Climate Change (DECC) works to make sure the UK has secure, clean, affordable energy supplies and promote international action to mitigate climate change.
	Deterministic	A modelling approach that produces a single view or outcome. This approach has no random elements as all outcomes and inputs are completely determined.
DUKES	Digest of UK Energy Statistics	A DECC publication which contains historic information on energy in the UK.
	Dispatch (aka economic dispatch)	The operation of generation facilities to produce energy at the lowest cost to reliably serve consumers, recognizing any operational limits of generation and transmission facilities.
	Distributed generation	Generation connected to the distributed networks which is equal or greater than 1 MW in size, up to onshore transmission areas' mandatory connection thresholds. The thresholds are 100 MW in NGET transmission area, 30 MW in Scottish Power (SP) transmission area and 10 MW in Scottish Hydro-Electric Transmission (SHET) transmission area.
	Distribution losses	Power losses that are caused by the electrical resistance of the distribution system.
DNO	Distribution network operator	Distribution network operators own and operate gas or electricity distribution networks.

Appendix 3 Glossary

Acronym	Word	Description
EV	Electric vehicle	An electric vehicle has an electric motor to drive the vehicle. It can either be driven solely off a battery, as part of a hybrid system or have a generator that can recharge the battery but does not drive the wheels. We only consider EVs that can be plugged in to charge in this report.
EMR	Electricity Market Reform	See appendix on government policy. A government policy to incentivise investment in secure, low-carbon electricity, improve the security of Great Britain's electricity supply, and improve affordability for consumers.
ELSI	Electricity scenario illustrator	ELSI is a National Grid tool used to model network constraint costs and interconnector flows.
	Electricity storage technologies	Mechanical (for example, pumped hydro and compressed air), thermal (for example, molten salt), electrical (for example, supercapacitors), electrochemical (various battery types), chemical (for example, hydrogen). Each technology has different characteristics, such as speed and duration of response, scale and maturity status.
ETYS	Electricity Ten Year Statement	The ETYS illustrates the potential future development of the National Electricity Transmission System (NETS) over a ten year (minimum) period and is published on an annual basis.
ETL	Electricity Transmission Licence	A permit which allows transmission companies to own and operate electricity transmission assets. Conditions within the licence place rules on how holders can operate within their licence.
	Embedded generation	Power generating stations/units that don't have a contractual agreement with the National Electricity Transmission System Operator (NETSO). They reduce electricity demand on the National Electricity Transmission System.
ECO	Energy Company Obligation	See appendix on government policy. The scheme places a legal obligation on energy suppliers to help households meet energy efficiency and fuel savings targets.
ECUK	Energy Consumption in the UK	A UK government publication which reviews historic energy consumption and changes in efficiency, intensity and output since the 1970s.
ENA	Energy Networks Association	The Energy Networks Association is an industry association funded by gas or transmission and distribution licence holders.
ESOS	Energy Savings Opportunity Scheme	See appendix on government policy. The Energy Savings Opportunity Scheme is a mandatory energy assessment scheme for qualifying organisations in the UK.
	Error correcting model	A model with the characteristics that the deviation of the current state from its long-run relationship will be fed into its short-run dynamics.
EU ETS	EU Emissions Trading Scheme (EU ETS)	A European Union trading scheme that allows participants to buy and sell carbon emissions allowances. https://www.gov.uk/eu-ets-carbon-markets
ENTSO-E	European Network of Transmission System Operators – Electricity	ENTSO-E is an association of European electricity TSOs. ENTSO-E was established and given legal mandates by the EU's Third Legislative Package for the Internal Energy Market in 2009, which aims at further liberalising electricity markets in the EU.
EU	European Union	A political and economic union of 28 member states that are located primarily in Europe.
FiT	Feed-in Tariffs	See appendix on government policy. Government programme designed to promote the uptake of a range of small-scale renewable and low-carbon electricity generation technologies
FIDER	Final Investment Decision Enabling for Renewables	Scheme to help developers of low carbon electricity projects make final investment decisions ahead of the Contract for Difference regime.
FFR	Firm Frequency Response	Firm Frequency Response (FFR) is the firm provision of Dynamic or Non-Dynamic Response to changes in Frequency. http://www2.nationalgrid.com/uk/services/balancing-services/frequency-response/firm-frequency-response/
	Foot room	The ability for a generation plant to allow output to decrease without going below its minimum output level and disconnecting from the system.

Acronym	Word	Description
	Frequency controlled demand management	Frequency control demand management (FCDM) provides frequency response through interruption of demand customers. The electricity demand is automatically interrupted when the system frequency transgresses the low frequency relay setting on site. http://www2.nationalgrid.com/uk/services/balancing-services/frequency-response/frequency-control-by-demand-management/
	Frequency response	An ancillary service procured by National Grid as system operator to help ensure system frequency is kept as close to 50Hz as possible. Also known as frequency control or frequency regulation.
FES	Future Energy Scenarios	The FES is a range of credible futures which has been developed in conjunction with the energy industry. They are a set of scenarios covering the period from now to 2050, and are used to frame discussions and perform stress tests. They form the starting point for all transmission network and investment planning, and are used to identify future operability challenges and potential solutions.
GTYS	Gas Ten Year Statement	The GTYS illustrates the potential future development of the (gas) National Transmission System (NTS) over a ten year period and is published on an annual basis.
GW	Gigawatt	1,000,000,000 watts, a measure of power
GWh	Gigawatt hour	1,000,000,000 watt hours, a unit of energy
gCO_2/kWh	Gram of carbon dioxide per kilowatt hour	Measurement of CO_2 equivalent emissions per kWh of energy used or produced
GB	Great Britain	A geographical, social and economic grouping of countries that contains England, Scotland and Wales.
	Green Deal	See appendix on government policy. A scheme that allows individuals and businesses to make energy efficiency improvements to their buildings.
GDHIF	Green Deal Home Improvement Fund	See appendix on government policy. A scheme that allows individuals to get financial support for qualifying energy efficiency improvements to homes.
GHG	Green house gases	A gas in the atmosphere that absorbs and emits radiation within the thermal infrared range.
GDP	Gross Domestic Product	An aggregate measure of production equal to the sum of the gross values added of all resident, institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs).
GVA	Gross Value Added	The value of goods and services produced in a sector of the economy
GSHP	Ground source heat pump	Ground source heat pumps absorb heat from the ground. This heat can then be used to produce hot water or space heating.
	Head Room	The operation of generation plant below its minimum output levels to allow output to increase at times of need.
	Heat pump	A heat pump is a device that provides heat energy from a source of heat to a destination called a “heat sink”.
HGV	Heavy goods vehicle	A truck weighing over 3,500 kg.
HHDI	Household disposable income	Household income minus tax.
IED	Industrial Emissions Directive	See appendix on government policy. The Industrial Emissions Directive is a European Union directive which commits member states to control and reduce the impact of industrial emissions on the environment post-2015 when the Large Combustion Plant Directive (LCPD) expires.
ITPR	Integrated Transmission Planning and Regulation	Ofgem’s Integrated Transmission Planning and Regulation (ITPR) project examined the arrangements for planning and delivering the onshore, offshore and cross-border electricity transmission networks. Ofgem published the final conclusions in March 2015.
IUK	Interconnector (UK)	A bi-directional gas pipeline between Bacton in the UK and Zeebrugge Belgium. http://www.interconnector.com

Appendix 3 Glossary

Acronym	Word	Description
	interconnector, gas	Gas interconnectors connect gas transmission systems from other countries to the National Transmission System (NTS) in England, Scotland and Wales. There are currently three gas interconnectors which connect to the NTS. These are: – IUK interconnector to Belgium – BBL to the Netherlands – Moffat to the Republic of Ireland, Northern Ireland and the Isle of Man.
	interconnector, power	Electricity interconnectors are transmission assets that connect the GB market to Europe and allow suppliers to trade electricity between markets.
IRR	Internal Rate of Return	The annualised rate of return, independent of inflation, for the net present value of an investment of zero in a given time frame.
IEA	International Energy Agency	The International Energy Agency is an intergovernmental organisation that acts as an energy policy advisor to member states.
LCPD	Large Combustion Plant Directive	See appendix on government policy. The Large Combustion Plant Directive is a European Union Directive which introduced measures to control the emissions of sulphur dioxide, oxides of nitrogen and dust from large combustion plant.
LCF	Levy Control Framework	See appendix on government policy. The Levy Control Framework caps the annual amount of money that can be levied on bills to support UK low carbon generation at £2.35bn in 2012/13, rising to £7.6bn in 2020/21. This covers Feed-in Tariffs (FITs), Renewables Obligation (RO) and Contracts for Difference.
LED	Light emitting diode	An energy efficient electronic lighting technology which is increasingly being adopted in UK homes and businesses.
LNG	Liquefied natural gas	LNG is formed by chilling gas to -161˚C so that it occupies 600 times less space than in its gaseous form. www2.nationalgrid.com/uk/Services/Grain-lng/what-is-lng/
	Load Factor	the average power output divided by the peak power output over a period of time.
LDZ	Local Distribution Zone	A gas distribution zone connecting end users to the (gas) National Transmission System.
LOLE	Loss of load expectation	LOLE is used to describe electricity security of supply. It is an approach based on probability and is measured in hours/year. It measures the risk, across the whole winter, of demand exceeding supply under normal operation. This does not mean there will be loss of supply for X hours/year. It gives an indication of the amount of time, across the whole winter, which the system operator (SO) will need to call on balancing tools such as voltage reduction, maximum generation or emergency assistance from interconnectors. In most cases, loss of load would be managed without significant impact on end consumers.
LCCC	Low Carbon Contracts Company	Private company owned by the Department of Energy and Climate Change (DECC) that manages the Contracts for Difference (CFD) scheme introduced by government as part of the EMR programme.
LCHT	Low carbon heating technology	A heating technology that has a lower carbon intensity for heating homes than an A rated condensing gas boiler
LCNF	Low Carbon Network Fund	A fund established by Ofgem to support projects sponsored by the distribution network operators (DNOs) to try out new technology, operating and commercial arrangements.
	Marine technologies	Tidal streams, tidal lagoons and energy from wave technologies (see http://www.emec.org.uk/)
	Medium range storage	These commercially operated sites have shorter injection/withdrawal times so can react more quickly to demand, injecting when demand or prices are lower and withdrawing when higher. http://www2.nationalgrid.com/UK/Our-company/Gas/Gas-Storage/
MWe	Megawatt (electrical)	1,000,000 Watts, a measure of power.
MWh	Megawatt hour	1,000,000 Watt hours, a measure of power usage or consumption in 1 hour.
	Merit Order	An ordered list of generators, sorted by the marginal cost of generation.
mCHP	Micro-Combined Heat and Power	A subset of CHP, designed for domestic use.

Acronym	Word	Description
	Micro generation	Defined within this document as generation units with an installed capacity of less than 1 MW.
mcm	Million cubic meters	Unit or measurement of volume, used in the gas industry. 1 mcm = 1,000,000 cubic metres.
Mte CO_2	Million tonnes of CO_2 equivalent	Carbon dioxide equivalency is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO_2 that would have the same global warming potential (GWP), when measured over a specified timescale (generally, 100 years).
	N-1	Refers to the European Commission security of supply test, where total supply minus the largest single loss is assessed against total peak demand. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:295:0001:0022:EN:PDF
NBP	National balancing point	The wholesale gas market in Britain has one price for gas irrespective of where the gas comes from. This is called the national balancing point (NBP) price of gas and is usually quoted in pence per therm of gas.
	National balancing point (NBP) gas price	Britain's wholesale NBP Gas price is derived from the buying and selling of natural gas in Britain after it has arrived from offshore production facilities. https://www.ofgem.gov.uk/gas/wholesale-market/gb-gas-wholesale-market
NETS	National Electricity Transmission System	It transmits high-voltage electricity from where it is produced to where it is needed throughout the country. The system is made up of high voltage electricity wires that extend across Britain and nearby offshore waters. It is owned and maintained by regional transmission companies, while the system as a whole is operated by a single system operator (SO).
NTS	National Transmission System	A high-pressure gas transportation system consisting of compressor stations, pipelines, multijunction sites and offtakes. NTS pipelines transport gas from terminals to NTS offtakes and are designed to operate up to pressures of 94 barg.
NGV	Natural gas vehicle	A vehicle which uses compressed or liquefied natural gas as an alternative to petrol of diesel.
NOx	Nitrous oxide	A group of chemical compounds, some of which are contributors to pollution, acid rain or are classified as green house gases.
OFGEM	Office of Gas and Electricity Markets	The UK's independent National Regulatory Authority, a non-ministerial government department. Their principal objective is to protect the interests of existing and future electricity and gas consumers.
	Oil & Gas UK	Oil & Gas UK is a representative body for the UK offshore oil and gas industry. It is a not-for-profit organisation, established in April 2007. http://www.oilandgasuk.co.uk
OCGT	Open Cycle Gas Turbine	Gas turbines in which air is first compressed in the compressor element before fuel is injected and burned in the combustor.
	Passivhaus	A Passivhaus is a building, for which thermal comfort can be achieved solely by post-heating or post-cooling of the fresh air mass, which is required to achieve sufficient indoor air quality conditions – without the need for additional recirculation of air.
	Peak demand, electricity	The maximum power demand in any one fiscal year: Peak demand typically occurs at around 5:30pm on a week-day between December and February. Different definitions of peak demand are used for different purposes.
	Peak demand, gas	The 1-in-20 peak day demand is the level of demand that, in a long series of winters, with connected load held at levels appropriate to the winter in question, would be exceeded in one out of 20 winters, with each winter counted only once.
pa	Per annum	per year.
PV	Photovoltaic	A method of converting solar energy into direct current electricity using semi-conducting materials.
PHEV	Plug-in hybrid electric vehicle	Has a battery which can be charged by plugging it in as well as a regular engine.
	Power supply background (aka Generation background)	The sources of generation across Great Britain to meet the power demand.

Appendix 3 Glossary

Acronym	Word	Description
	Pumping demand	The power required by hydro-electric units to pump water into the reservoirs.
PEV	Pure electric vehicle	Has only a battery for energy storage.
RHI	Renewable Heat Incentive	See appendix on government policy. A payment incentive owned by Ofgem which pays owners of certain, renewable heating technologies per unit of heat produced. There is a domestic and a non-domestic version.
ROC	Renewable Obligation Certificate	See appendix on government policy. Green certificates issued to operators of accredited renewable generating stations for the eligible renewable electricity they generate. ROCs are ultimately used by suppliers to demonstrate that they have met their obligation.
RO	Renewables Obligation	See appendix on government policy. Main support mechanism for renewable electricity projects in the UK. It places an obligation on UK electricity suppliers to source an increasing proportion of the electricity they supply from renewable sources.
R&D	Research and development	A general term for activities which involve improvements to goods or processes, or research into new goods or processes.
	Seasonal storage or long-range storage	There is one long-range storage site on the national transmission system: Rough, situated off the Yorkshire coast. Rough is owned by Centrica and mainly puts gas into storage (called 'injection') in the summer and takes gas out of storage in the winter. http://www2.nationalgrid.com/UK/Our-company/Gas/Gas-Storage/
	Self-consumption	Where an end user consumes the electricity they generate, commonly from solar generation. This reduces the need to import electricity from grid but does not necessarily mean an end user is self-sufficient.
	Shale gas	Shale gas is natural gas that is found in shale rock. It is extracted by injecting water, sand and chemicals into the shale rock to create cracks or fractures so that the shale gas can be extracted. https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking
SRMC	Short run marginal cost	The instantaneous variable cost for a power plant to provide an additional unit of electricity. The short run marginal cost (SRMC) is derived from the cost of fuel, the cost of CO_2 emissions, the share of operating and maintenance (O&M) costs that varies with the plant electricity output and any income from incentives and the provision of heat associated to the plant electricity output.
STOR	Short term operating reserve	Short term operating reserve (STOR) is a service for the provision of additional active power from generation and/or demand reduction.
	Smart appliances	Residential power consuming goods which are able to reduce their power demand at defined times of the day either by reacting to a signal or by being programmed.
	Smart meter	New generation gas and electricity meters which have the ability to broadcast secure usage information to customers and energy suppliers, potentially facilitating energy efficiency savings and more accurate bills.
	Station demand	The onsite power station requirement, for example for systems or start up.
	Summer minimum	The minimum power demand off the transmission network in any one fiscal year: Minimum demand typically occurs at around 06:00am on a Sunday between May and September.
SBR	Supplemental balancing reserve	Supplemental balancing reserve (SBR) is a balancing service that has been developed to support National Grid in balancing the system during the mid-decade period when capacity margins are expected to be tight. SBR is targeted at keeping power stations in reserve that would otherwise be closed or mothballed. Along with demand side balancing reserve (DSBR), this service will act as a safety net to protect consumers, only to be deployed in the event of there being insufficient capacity available in the market to meet demand.
	System inertia	The property of the system that resists changes. This is provided largely by the rotating synchronous generator inertia that is a function of the rotor mass, diameter and speed of rotation. Low system inertia increases the risk of rapid system changes.
	System operability	The ability to maintain system stability and all of the asset ratings and operational parameters within pre-defined limits safely, economically and sustainably.

Acronym	Word	Description
SO	System operator	An entity entrusted with transporting energy in the form of natural gas or power on a regional or national level, using fixed infrastructure. Unlike a TSO, the SO may not necessarily own the assets concerned. For example, National Grid operates the electricity transmission system in Scotland, which is owned by Scottish Hydro Electricity Transmission and Scottish Power.
TWh	Terawatt hour	1,000,000,000,000 watt hours, a unit of energy
TOUT	Time Of Use Tariff	A charging system that is established in order to incentivise residential consumers to alter their consumption behaviour – usually away from high power demand times.
tCO^2	Tonne of carbon dioxide	A fixed unit of measurement commonly used when discussing carbon dioxide emissions.
TEC	Transmission entry capacity	The maximum amount of active power deliverable by a power station at its grid entry point (which can be either onshore or offshore). This will be the maximum power deliverable by all of the generating units within the power station, minus any auxiliary loads.
	Transmission losses	Power losses that are caused by the electrical resistance of the transmission system.
TSO	Transmission system operators	An entity entrusted with transporting energy in the form of natural gas or power on a regional or national level, using fixed infrastructure.
	Triad	Triad demand is measured as the average demand on the system over three half hours between November and February (inclusive) in a financial year. These three half hours comprise the half hour of system demand peak and the two other half hours of highest system demand which are separated from system demand peak and each other by at least ten days.
UKCS	UK Continental Shelf	The UK Continental Shelf (UKCS) comprises those areas of the sea bed and subsoil beyond the territorial sea over which the UK exercises sovereign rights of exploration and exploitation of natural resources.
UK	United Kingdom of Great Britain and Northern Ireland	A geographical, social and economic grouping of countries that contains England, Scotland, Wales and Northern Ireland.
UCL	University College London	A UK university based in London.
	Weather corrected	The actual demand figure that has been adjusted to take account of the difference between the actual weather and the seasonal normal weather.

Annual data in FES

Where a single year is referred to in FES, e.g. 2020, we are referring to that calendar year.

Where data is across split years, e.g. 2020/21, we are referring to power years. These run from 1 April to 31 March. For example, 2020/21 refers to 1 April 2020 to 31 March 2021.

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