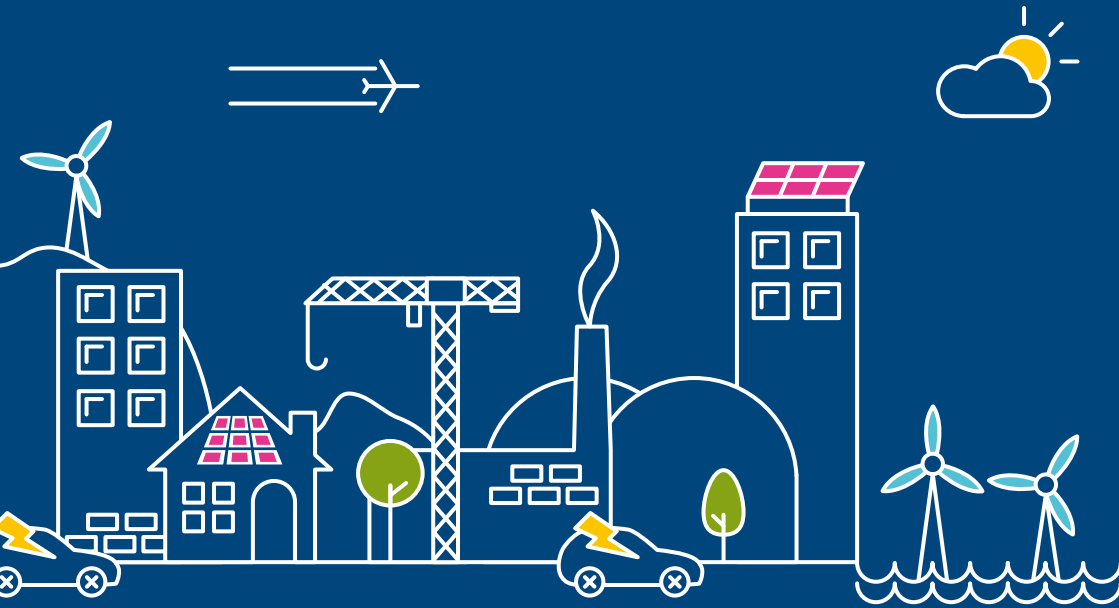
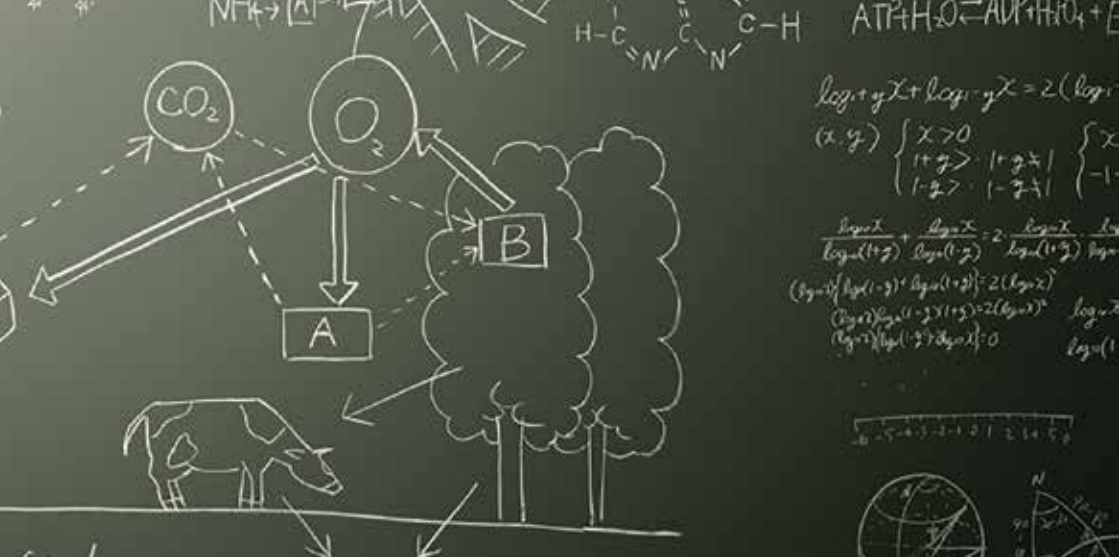
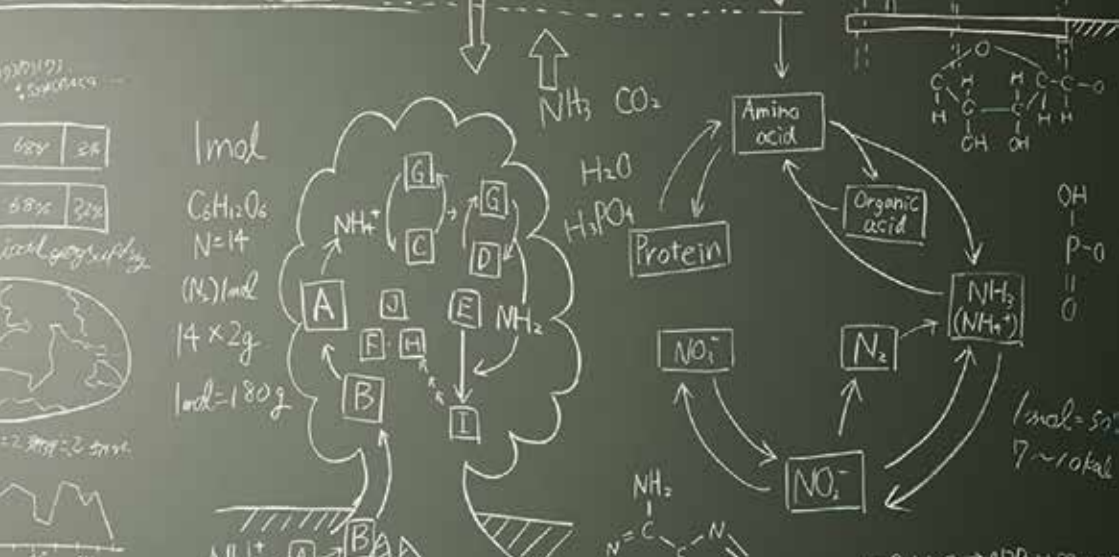


Future Energy Scenarios

UK gas and electricity transmission





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.

The main text is divided into sections by subheadings.

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

Heading and icon introduce the main topic on the page.

Key pieces of information are highlighted in boxes.

Future Energy Scenarios July 2015 29

Residential demand

4.4.1.2 New builds

Stakeholders have raised that the pace of change to building regulations in our 2015 analysis was too fast. In response, we have adjusted our assumptions to progress towards the Zero Carbon Home standard less rapidly to the more stringent 'realistic' standard. We assume that historic trends continue and adopted every four years creating a step change. We have held the average demand for hot water constant at 2.3kWh per year as per feedback from stakeholders.

The date by which new homes are built to the Zero Carbon Home standard differs between the scenarios, as seen in Figure 6. In **One Green**, homes meet the target in 2020 as there is both the policy and government drive to encourage this. In **Slow Progression** and **Consumer Power** changes to assess, meeting the standard is 2025. **Net Progression** has the slowest rate of change, meeting the standard in 2040. With an average build rate of 12,000 domestic homes per year, building to the Zero Carbon Home standard is equivalent to building an average new property every 500,000 of thermal energy demand per year. The overall rise in demand is being met by increasing this standard in 2020 rather than 2040 is over 127MWh/year.

Figure 21 Heat demand for an average new home

Footnotes are used for citations and further commentary.

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Our 2015 One Green scenario has a 2014 GHG of 0.22t compared to 2006-08 compared to 110GW of Fossil 2014 **One Green**.

6.1.3.3. Marine
Our **One Green** scenario recognises the potential which OSE has of harnessing the power of the sea and converting it to renewable energy, due to the focus on the decarbonisation agenda. The scenario also acknowledges the uncertainty of how specific projects may develop in the future. The proposed tidal lagoon projects located in Wales along with the marine projects up in the Portland Firth, Orkney and all the locations of generating potential, by 2020-26, the installed capacity for marine technology reaches 4500 based on the new tidal lagoon projects processes and recent grid connection limitations for the Orkney projects.

2020's
The first new nuclear power station, since the 1950s, will be operational by the mid 2020s.

Key data is emphasised with an image.

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

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Chapter two



Scenarios



Scenarios

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.

In a **Gone Green** world there are high levels of prosperity; consumers are able to buy new appliances and technologies, industrial and commercial users have investment capital available and the government has more money available for incentives. There is a high level of green ambition across all sectors of the economy, with new policies introduced to reduce emissions. This green ambition extends across Europe, with harmonisation and long-term environmental energy policy certainty.

Power generation is focused on decarbonisation due to policy drivers introduced by the government. With moderate economic growth, generation build rates are at their highest in this scenario. There are high levels of renewable generation and new technologies such as marine and Carbon Capture and Storage (CCS) generation.

Decarbonisation of the power supply is required to meet the 2020 and 2050 targets, especially in response to the increasing demand for power in this scenario. Power demand is higher as electricity is used to meet a significant proportion of heat and transport demand.

To manage the impact of increased demands at peak times, there is a significant uptake of time of use tariffs (TOUTs) and the smart metering deployment is delivered on time by 2020.

In response to popular green sentiment regulations are introduced which make shale gas development uneconomic. Money is instead invested in innovative green technologies, which are supported by government policy; biomethane production is high.

3.2GW

Amount of additional onshore wind, installed by 2018

10GW

Amount of additional wind generation, installed by 2020

27M

Amount of smart meters installed by 2020

900,000+

Number of heat pumps installed by 2020

500,000

Number of electric vehicles by 2020

10%

The level of interconnection reaches the EU capacity target of 10% by 2020

Residential users

With one in six cars being an electric vehicle (EV) by 2035, you or someone in your close family will be driving an electric vehicle in this world. You may choose to substitute some car trips by taking a natural gas powered bus.

When buying a new home you will see more energy efficient homes on the market; and if you buy a new one after 2020 you will purchase a Zero Carbon Home. If you are not moving home you will invest in as much insulation as your house needs to improve its energy efficiency rating. You will have greater control over your energy use, and a greater desire to reduce your demand, facilitated by smart meters and home energy management systems like smart thermostats. Your TOUTs will enable you to save money and energy by shifting your energy use away from peak times, such as turning on appliances overnight. You will have abandoned the use of halogen lighting in favour of the more efficient light emitting diode bulbs (LEDs).

Low carbon heating technologies are appealing due to their green credentials and so you invest in a heat pump in your home. The new estate nearby is heated by a district heat network where the heat is generated centrally, most likely by a biomass combined heat and power (CHP) unit. It's likely you or a neighbour choose to invest in micro-generation, investing some of your higher disposable income in solar photovoltaic (PV) panels for your roof.

Industrial and commercial users

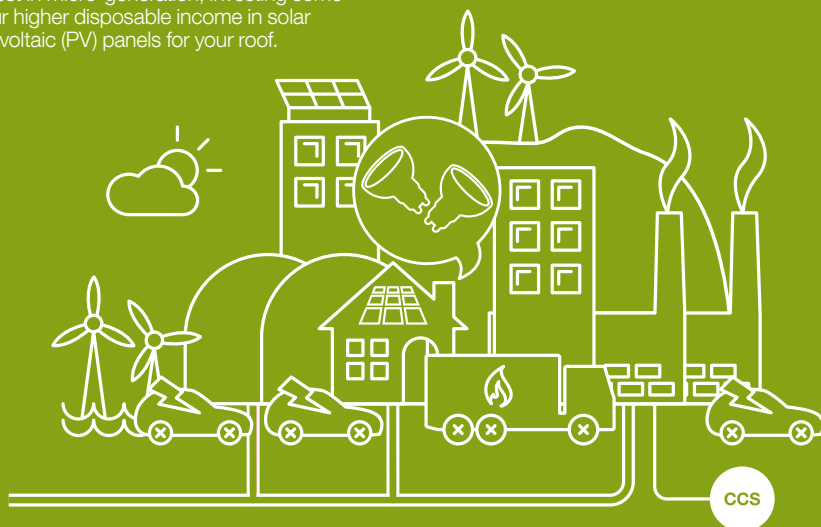
Your HGV fleet progresses towards natural gas and later towards hydrogen fuelled vehicles, as this is the most economic and environmentally friendly option for your business. You replace your existing light bulbs with highly-efficient LED bulbs to reduce your emissions and electricity bills. You consider installing a biomass fuelled CHP unit to generate your own clean electricity.

2030

The investment climate and pilot project outcomes support the commercial rollout of carbon capture and storage (CCS) by 2030

2050

Date when almost all power generation is decarbonised





Scenarios

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.

Slow Progression is a world where residential, industrial and commercial users and the government are all striving towards a **Gone Green** world, but the lower economic growth slows progress. There is harmonisation at a European level, with a focus on low cost environmental energy policies. The limited innovation money available is spent on renewable and low carbon technologies, as there is limited government money to support development.

Policies support renewable and low carbon generation, however build rates are hampered by the lower economic growth in this world. Expensive technologies such as marine receive less investment, whilst wind and solar generation reach medium levels. Thermal generation is still a major part of power generation, with gas and nuclear favoured over coal.

UK continental shelf (UKCS) development is limited due to taxes, and new regulation makes shale gas uneconomic. The limited investment is focused instead on innovative green technology. Regulation does support biomethane production and some innovation money is invested in new production techniques.

Consumers, in an effort to reduce energy use in order to save money and reduce emissions, invest where they can in efficient products. Smart appliances are a focus area of spending and many people take up TOUTs. Micro-generation is introduced where possible, but the high gas price focuses installations away from gas CHP units. Building regulations are tightened to reach the Zero Carbon Homes target by 2020 and cost-effective insulation rates are high.

8.4GW

The level which electricity interconnection increases to by 2020

9GW

Amount of wind generation installed by 2020 – a year behind Gone Green

1.9%

Average annual economic growth

Residential users

You want to reduce your impact on the environment and reduce your energy bill but have less money to purchase expensive technologies. You are willing to invest in solar PV when possible. You seek out cost effective ways to manage your energy use and consider TOUTs and home energy management systems where you can afford them.

Any new appliances that you buy are more efficient, as this has become the only option following policy and regulation. You do all you can to ensure your home is energy efficient, insulating your loft and cavity walls.

You would like to buy an electric car but may not be able to afford it; hybrid vehicles offer a cheaper solution. The decarbonisation of public transportation is a government priority and receives support, and you often choose to take the bus instead of drive.

Your heating system is likely to remain gas or electric until 2030; there has been less innovation in low carbon heating technologies which leaves heat pumps and micro-CHP too expensive.

Industrial and commercial users

Environmental policies and the green focus of consumers drive you towards improving your energy efficiency and investing in green technologies where possible. The slower economic growth restricts you from investing in expensive technologies with long pay-back periods so you opt for smaller projects such as insulating buildings and purchasing LED light bulbs.

You are slowly transitioning your HGV fleet to natural gas vehicles, it is more economical but the required upfront capital to purchase new vehicles or convert your current stock remains a barrier. You may also consider saving to invest in a biomass CHP plant to reduce your energy usage if the payback period is economical.

300,000+

Vehicles are electric by 2020

3,000

Approximate number of micro-CHP units in homes/properties in 2020





Scenarios

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, with little innovation affecting how we use energy.

No Progression is a world of low economic growth and inconsistent political signals with a lack of focus on environmental policies. Society is cost conscious and focused on the here and now.

Power generation is focused on achieving security of supply at the lowest possible cost. As such, there is minimal innovation and traditional generation remains high; with gas prevailing over low carbon and renewable technologies.

Today's level of support for UKCS and biomethane continues into the future but is not sufficient to drive significant growth with medium market prices. The limited innovation is focused on technology with high production rates, hindering biomethane production and holding shale gas and UKCS developments at a medium to low level.

Consumers choose to spend their money to receive immediate and direct benefits, and are not driven to reduce their energy usage. The lack of innovation in the energy industry also affects consumer choice when making purchases. This leads to a low uptake of micro-generation, electric vehicles and smart appliances.

The makeup of the heat and transport sectors does not differ significantly from today. Heat is dominated by traditional gas appliances as there is limited growth in both low carbon technologies and heat networks. Petrol and diesel vehicles dominate in the public, private and business use sectors as the cheapest option.

1M

**Consumers are engaged
TOUT users in 2020**

<200,000

Vehicles are electric in 2020

1.9%

**There is an average annual
economic growth of 1.9%**

Residential users

In a **No Progression** world your primary driver is cost. You don't have the money or the inclination to spend time and money on green technologies. Due to a lack of policy support, you do not see many renewable or energy efficient products on sale and choose to continue with the products that you know and trust.

For most products that you own, you would rather keep them than replace them. You don't replace your car or appliances unless they break and you are not engaged with smart meters or TOUTs. If you are looking for a new home you do not seek out improved energy efficiency ratings or low carbon heating technologies.

Industrial and commercial users

The slow economic growth and inconsistent government policy do not drive you to make many significant changes from today's rate of progress. The lack of political support and incentive schemes cause you to maintain your current activities rather than invest in new technologies. You have no inclination to switch to low carbon or renewable sources of energy, and the lack of innovation in these sectors causes prices to remain high and uneconomical for many.

You have not changed your vehicle fleet, choosing not to invest in gas or electric vehicles.

Electricity prices are low and, without environmental taxation, there are fewer incentives to reduce your energy usage. As such you see no reason to replace your light bulbs with LEDs. Nor would you feel inclined to take advantage of demand side response activities, even if it is available.

2040

Residential houses don't reach the Zero Carbon Homes target for energy efficiency until 2040

6M

Smart meters installed by 2020

35%

Gas is the dominant fuel source for generation, making up around 35% of installed capacity in 2020





Scenarios

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.

Consumerism and quality of life drive decisions in this scenario. There is a more relaxed ambition to renewable targets, with government policy focusing instead on indigenous security of supply and low carbon technologies. The moderate level of economic growth ensures that there is money available for the government, consumers and industrial and commercial users to spend and invest. As a result innovation is high and research and development continues at a fast pace.

The primary fuel for both large and small scale generation is gas, due to the relatively low gas prices. This economic driver results in localised generation becoming prominent, including micro-CHP units. While there is a push towards low carbon generation this materialises in high levels of solar and gas CHP.

In response to the high demands for gas for power generation, increased gas supplies are required. Despite the low gas prices, regulatory support makes investment in gas sources economical. With this support, and a focus on innovation and investment capital, shale production levels are highest in this scenario. Additionally, low taxation helps to drive further development in UKCS.

Energy demand is driven by consumer preferences, and the market responds by focusing on innovating to attract customers to new products. Although some technologies do reduce energy usage, such as home energy management systems, smart appliances and electric vehicles, this is a by-product rather

than the main selling point. This is the only scenario to see a high level of demand for air-conditioning as consumers value higher quality of living over reducing emissions. Manufacturers invest in continued development into electric vehicles and they are desired by consumers as a luxury item, regardless of the lower green ambition. Public transport does not see the same level of investment in electric or gas vehicles, due to the low environmental concerns. There is only a medium amount of decarbonisation achieved in order to improve air quality for consumers.

Heat demand, in the residential, industrial and commercial sectors is dominated by gas. This is comprised of traditional gas boilers, micro-CHP units and larger CHP plants.

120,000

Micro-CHP units installed in homes in 2020

18GW

Solar PV installed by 2020

100

Shale sites developed by 2030

Residential users

As a consumer in this world you spend your money on your family and yourself, enjoying the relatively prosperous economic growth. You choose to invest in some smart appliances and a new electric vehicle, because they are new and luxurious and make everyday life easier for you.

If you have money available to invest, the low gas prices make installing a micro-CHP unit in your home an economical decision, replacing your gas boiler. You consider solar PV as a source of income, taking advantage of affordable panel prices.

Industrial and commercial users

As in **Gone Green**, your HGV fleet is comprised of natural gas vehicles as they are by far the most economical. You install a CHP unit to take advantage of the discrepancy between gas and electricity prices and reduce your electricity demand and switch from power to gas for heating and hot water needs. You also consider purchasing LED lighting when your old bulbs need replacing.

2.4%

Average annual economic growth

33.3%

Small scale generation accounts for a third of power generation capacity by 2020

3%

Of HGV fleet are gas vehicles by 2020





Chapter eight



Government policy



Meet the team



Glossary

Appendix 1

Government policy

CRC Energy Efficiency Scheme (CRC)

The Carbon Reduction Commitment (CRC) Energy Efficiency Scheme¹ 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 Reform² includes the introduction of new long-term contracts: Contracts for Difference (CfDs) for new low carbon generation projects, a Carbon Price Floor³ (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 450gCO₂/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 Floor³).

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 scheme⁴ 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 Deal⁵ replaces the Carbon Emissions Reduction Target⁶ (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 Deal⁷. 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 installations⁸.

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 Directive⁹ 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 Directive¹⁰ 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 Framework¹¹ 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 Incentive¹² 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-levy-funded-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 Obligation¹³ (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 ESOS¹⁴ 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-o>

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 our interconnector 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

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Energy Security Analyst

Caroline Kluyver
Content Officer

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Content Officer

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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

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Marcus Stewart

Energy Supply Manager

Nigel Fox

Strategy
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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.
CWW	Composite weather variable	A measure of weather incorporating the effects of both temperature and wind speed. We have adopted the new industry wide CWW 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 100MW in NGET transmission area, 30MW in Scottish Power (SP) transmission area and 10MW 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.
HHDl	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: <ul style="list-style-type: none"> – 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-Ing/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 or 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.

Disclaimer

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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/

You can write to us at:
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