State of the energy market

2017
REPORT

ofgem

Making a positive difference
for energy consumers

Foreword

The energy sector is changing rapidly, with significant potential benefits for consumers.

- In **generation**, new technologies, encouraged by regulation and financial support, mean that pollution is falling rapidly. Renewable power sources now provide around a quarter of total electricity generation, compared to 5% in 2006.
- In **retail markets**, the number of accounts, not including prepayment, on poor-value standard variable tariffs has fallen from 15 million in April 2016 to 14 million only 12 months later (which we estimate to be around 12 million households). This is because of near-record switching rates in 2017 so far.

These changes are exciting, but looking at the state of energy markets, we have three concerns about how they currently work for consumers:

- **First, the market works well for those who engage. But some are being left behind.** The retail energy market features two distinct tiers. Consumers that actively look for cheap prices have made large savings. But more than half of consumers are still on default tariffs, paying higher prices. For the typical household, a standard variable tariff costs about £300 more each year than the cheapest tariff available.
- **Second, consumers paying the highest prices are often those least able to afford them.** Many markets charge different prices to different consumers. But in the energy market, consumers with low incomes are much less likely to switch to the cheapest prices. Support schemes such as the Warm Home Discount help some vulnerable consumers, particularly pensioners. But identification of and support for other vulnerable groups are not yet good enough.
- **Third, the dramatic progress to ensure clean and secure electricity supplies has sometimes come at a higher cost to consumers than necessary.** On average, consumers currently pay about £90 each year towards environmental policies. This will rise as low-carbon generation increases. Rapid falls in the costs of wind and solar generation show the scope for competition and innovation to limit future cost increases. But consumers will lose out if there isn't effective competition for low-carbon support schemes and for measures to help the energy system to work effectively.

There are two major challenges to ensure that a transformed energy market works for all consumers.

- **Vulnerable consumers must be protected, and able to engage in the market more effectively.** We are consulting on extending our safeguard tariff to a further 1 million vulnerable consumers this winter. We are also working to make the switching process quicker and easier, so that retail markets work better for everyone. We are assessing the case for more use of collective switching, which could enable less engaged consumers to reap the benefits of competition.
- **Innovation must be harnessed in ways that bring benefits to all consumers.** Many consumers already generate their own electricity, and can monitor and control their consumption using smart meters. In future, the traditional 'supplier hub' model, whereby suppliers manage most interactions with consumers and the wider market, may break down. Peer-to-peer energy trading and greater customer ownership of their data should allow different ways of engaging with the energy system.

Meeting these challenges will be tough. But our ambition is clear – collectively, we need to build a transformed energy sector that provides secure and clean energy to consumers – at a cost that consumers recognise as fair.

Ofgem will continue to monitor energy markets to ensure that we act quickly to address problems. Where the market is not working well, we are taking action to protect consumers, both by reducing the harm that results, and by tackling the root causes. But this report makes clear that solving these issues needs continued action on our part, and on the part of companies and government.

We would like to thank all of those organisations and individuals who helped us to produce this report, including the Department for Business, Energy and Industrial Strategy, the Committee on Climate Change, Which? and Citizens Advice. The report draws on the work of many people across Ofgem. Following the Competition and Markets Authority's recommendations, it was led by Ofgem's Office of the Chief Economist, separately from Ofgem policy teams.

We are happy to hear from you. If you have any questions or comments about this report, please contact **chief.economist@ofgem.gov.uk**.

Contents

Executive Summary

Energy is an essential service, key to every aspect of modern life. We use gas and electricity to heat our homes and workplaces, power the phones we hold in our hands, the appliances we cannot live or work without and, increasingly, our cars. British households spend around £30 billion on gas and electricity each year, an average of around £1,123. Businesses, charities and public bodies spend an extra £20 billion each year.

Energy markets are rapidly transforming to meet our need for clean, secure and affordable energy and to accommodate changes in the way we consume energy. The pace and scale of changes to generation, networks, retail supply and consumption are unlike anything we've ever seen in the sector. The transformation is being helped by major investment in generation, networks and energy efficiency. But the benefits of these investments will only flow to consumers if energy markets work well.

Ofgem regulates Great Britain's gas and electricity markets, to protect the interests of current and future consumers. Through our regulation, we aim to deliver five outcomes for consumers:

- Lower bills than would otherwise have been the case
- Reduced environmental damage both now and in the future
- Improved reliability and safety
- Better quality of service, appropriate for an essential service
- Benefits for society as a whole, including support for those struggling to pay their bills

In this report, we assess how well energy markets are working based on these consumer outcomes. The report is our first comprehensive annual assessment of the state of energy markets in Great Britain. It covers the period since the Competition and Markets Authority (CMA) concluded its investigation into the energy sector in 2016, and sets a baseline for future reports.

Retail markets – where homes and businesses buy energy

Competition continues to benefit consumers who are able and willing to shop around, meaning they can usually get a good deal. As of June 2017, there were 60 suppliers offering electricity and or gas, 16 more than a year earlier. Since 2012, new suppliers have intensified competition, shrinking the six largest energy suppliers' share of the market from nearly all consumers to just over 80% of them. Switching and engagement are increasing. Annual household switching rates reached almost 17% in June 2017, the highest since August 2011.

But competition isn't working well for consumers who are less active. More than half of consumers (58%) have never switched supplier or have switched only once. 60% of consumers are on a default variable tariff, which can be around £300 more expensive each year than the cheapest fixed-term deals. Despite losing consumers to competitors since 2012, the six largest suppliers have maintained a healthy combined profit margin of between 3.9% and 4.5%. Price differences between variable tariffs and fixed tariffs have widened over this period, suggesting suppliers can offer low-price fixed tariffs to attract active consumers and cover direct costs, but rely on the higher prices charged to less active consumers to cover operating costs and maintain profits.

Retail markets typically work well for larger businesses, but small and microbusinesses pay much more on average. Larger business consumers can often negotiate good deals with suppliers, but smaller ones tend to pay more for their energy, and switch infrequently. Average business electricity prices are around 50% higher for very small firms than for large or very large consumers, while non-domestic gas prices can be twice as high (some of this is driven by cost differences). More than a quarter of businesses (27%) believe it is too complex or time-consuming to find a new tariff or supplier.

The CMA remedies, intended to improve competition and outcomes for consumers, are being implemented and are starting to show results. From April 2017, we implemented a cap on prepayment meter (PPM) tariffs. Prices fell by around £60 for a typical dual fuel PPM consumer, though some of the cheapest tariffs are no longer available. We are also trialling measures to improve consumer engagement, for instance by communicating cheaper offers to disengaged customers.

Wholesale markets – where gas and electricity are bought and sold

Competition in wholesale markets, in particular gas, is working reasonably well. Wholesale gas markets are diversified, market power isn't concentrated in one or a few firms, and there is significant liquidity and market entry and exit. There are fewer firms involved in generating electricity, and wholesale electricity prices are higher in Great Britain than in much of the rest of Europe. But we find that this is mainly because of policy factors such as higher carbon taxes and the allocation of network charges, rather than weak competition.

Affordability and vulnerability – managing price and consumption

In 2016, the average dual fuel bill for a customer of the six largest suppliers was £1,123, 16% lower than its peak in 2013 in real terms.[1] However, in 2017, all of the six largest suppliers increased prices. Changes in energy bills – up and down – affect consumers on low incomes the most. Households with the lowest incomes spend 10% of their expenditure on energy – over three times more than the proportion spent by households with highest incomes.

Many consumers still worry about the cost of their energy bills, although the situation is improving. In March 2017, 30% of consumers reported being worried about paying their energy bills; half the proportion who were worried in March 2013 (59%). In England, households with children have the highest rate of fuel poverty, while pensioners are now the least likely consumers to live in fuel poverty. The proportion of energy consumers in debt to their supplier is at its lowest level since we started collecting data in 2006, but some still face very high debts.

Households use 20% less energy than 10 years ago, which has helped reduce their bills. Improvements in energy efficiency play an important role in driving down consumption. Under the government's Energy Company Obligation (Affordable Warmth) scheme, 516,000 low-income households improved their energy efficiency between January 2013 and March 2017. Most consumers received replacement boilers and heating controls, which we estimate reduced their bills by £48 to £189 per year. However, we are concerned that some of the reduction in average consumption is because consumers who are less able to make energy efficiency improvements have self-rationed their gas consumption in response to price increases.

The two-tier energy market means that some groups of vulnerable consumers lose out. Nearly half of consumers who are unemployed, or have intermittent, semi- or low-skilled work, have never switched supplier, compared to under a third of other consumers. This means that they are more likely to be on expensive standard variable tariffs, despite being less able to afford them. In July 2017, we announced our plans to help improve outcomes for vulnerable consumers, and in October we published our proposal to extend a safeguard tariff to 1 million people receiving Warm Home Discount this winter.

Decarbonisation of energy – moving to a low carbon economy

Since the Climate Change Act 2008, over half the reduction in the UK's greenhouse gas emissions came from cleaner electricity. However, there has been limited progress in reducing emissions from heat and transport. According to the Committee on Climate Change (CCC), the UK is on course to achieve overall emissions targets up to 2022, but its projections suggest that further policies are needed to achieve subsequent targets.

[1] This bill reflects the average electricity bill and gas bill for customers of the six largest suppliers. It is calculated using the suppliers' Consolidated Segmental Statements, based on average (mean) consumption levels. Calculations using 'typical' or constant consumption levels, or calculated from other sources, will differ.

So far, reducing carbon emissions from electricity has relied on carbon prices and financial support. Carbon prices now make coal unprofitable, which has been crucial to its recent decline in the generation mix. Renewables produced 25% of all electricity in 2016, supported by subsidies. In 2016, the gross cost of low-carbon polices was £7.4 billion (equivalent to around £90 for the typical household). Both the Department for Business, Energy and Industrial Strategy (BEIS) and the CCC emphasise that this cost has been offset by energy efficiency savings.

The need for more low-carbon generation makes it even more important that consumers get the best deal. Renewable technology is getting cheaper. In 2022-23 new offshore wind turbines will cost £57.50 per MWh (in 2012 prices) including the wholesale price, less than half the cost of new offshore wind turbines in 2017-18. However, many contracts for support have been issued with limited or no competition, increasing costs to consumers. The Competition and Markets Authority estimated that consumers are paying about £250-310 million more per year than necessary because of lack of competition in the first allocation of Contracts for Difference. Similarly, support for the Hinkley Point C power station was allocated without competition, because it was the only viable nuclear power project in 2012.

Intermittent generators increase the need for flexibility in the UK's power system. In 2016, wind and solar generated 15% of our electricity on average, but its contribution in any given period normally varied between 5% and 25%. The UK Energy Research Centre (UKERC) estimates that the cost of integrating these sources of power remains relatively modest (between £5 and £10 per MWh), but could increase if we fail to adapt the grid. In July 2017, we published our joint strategy with BEIS to encourage greater flexibility.

Security of supply – keeping the lights and heating on

Gas supplies are diverse and resilient to disruption. In recent decades, Great Britain has not had a serious gas supply shortage. Although it has been announced that Rough – the country's largest storage facility – is closing, National Grid's analysis suggests that reserves for the coming winter will be enough to cope with all but the most extreme circumstances.

Secure electricity supplies have been maintained without substantial intervention to balance supply and demand.[2] This continues a period since 2005 where the level of intervention has been significantly below that implied by the government's 2013 reliability standard. National Grid expects to deploy fewer than 40 seconds of such measures for winter 2017/18. This could suggest that consumers have on average paid more to maintain security of supply than necessary.

The Capacity Market should provide adequate capacity, but close monitoring is needed to balance cost and security for consumers. The government assessed that, without intervention, the wholesale market would not sufficiently reward generation, and introduced a Capacity Market to improve security of supply. In theory, the Capacity Market should secure supplies at least cost. In practice, the cost to consumers will depend on a number of factors including the quality of forecasting. National Grid's one-year ahead forecasts of winter demand on the transmission system have been consistently about 1 to 2 GW higher than actual demand since 2011-12. Ofgem has placed incentives and obligations on National Grid to improve its forecasts.

National Grid's costs of balancing the electricity system increased by around £250 million in 2016-17, to over £1.1 billion. While pressure on cost is likely to increase as the system adjusts to more electricity produced by inflexible generators, the Capacity Market should, if it is effective, make such major jumps in costs less likely.

[2] Here we refer to whether National Grid deployed 'out-of-market' measures to balance supply and demand. Separately, there have been large policy interventions, such as introducing the Capacity Market.

Key facts on Competition

There is a two-tier retail market, offering a good deal to consumers able and willing to shop around, but not for less active consumers

£300 The approximate amount consumers on a Standard Variable Tariff could save by switching to the cheapest tariff in the market

60% Of consumers on a variable tariff, not including prepayments

17% The proportion of consumers switching supplier between July 2016 and June 2017

58% The proportion of consumers that have never switched, or have only switched once.

£60 Average reduction in dual fuel bills for prepayment customers after the introduction of the safeguard tariff (price cap) in April 2017

Key facts on Affordability and vulnerable customers

Many consumers still worry about the cost of their energy bills

£1,123 The average dual fuel bill for a customer of the six largest suppliers in 2016

16% The reduction, in real terms, of the average household bill since 2013, when it last peaked: a £214 fall

10% The proportion of their total expenditure low-income households spend on energy

20% Less energy used by consumers than 10 years ago, reducing their bills

30% The percentage of consumers concerned about affording their energy bills in March 2017, half the proportion in March 2013

17% The rate of fuel poverty for households with children, in England (the group of consumers with the highest rate of fuel poverty)

Key facts on
Decarbonisation of energy

The need for more low-carbon generation makes it more important consumers get the best deal

£90 The approximate gross cost of low-carbon policies for the typical household in 2016

64% Reduction in greenhouse gas emissions from electricity compared to 1990

45% Proportion of electricity from low-carbon sources in 2016: 25% renewable and 20% nuclear.

£57.50 The amount paid to new offshore wind turbines in 2022-23 per MWh (in 2012 prices) including the wholesale price, less than half the cost of new turbines in 2017-18

Key facts on
Security of supply

Secure supplies maintained without out-of-market intervention, but consumers may, on average, have paid more than necessary

0 The number of times gas deficit emergency measures have been deployed this century

1 The average number of hours a year, since 2005, that out-of-market measures have been used to maintain electricity supplies.

3 The number of hours government considers it cost effective to use out-of-market measures on average over a number of years

1.4 National Grid's average over-estimate of winter peak demand on the transmission system since 2010-11 (in GW)

£150m The estimated reduction in wholesale market costs from the introduction of the Capacity Market in 2017-18

£250m The increase in National Grid system balancing costs in 2016-17 compared with the previous year, an increase of almost a third

Chapter 1: About the energy system and Ofgem

How the energy system works

The energy system is critical to the UK economy. It supplies electricity and gas to practically all households and commercial premises in the country.

There are three elements to supplying energy to homes and businesses in Britain (Figure 1.1):

- generating electricity and producing gas (wholesale markets);
- transporting them through the 272,000km of gas infrastructure and 818,000km of electricity infrastructure (networks); and
- selling them to homes and businesses (retail markets).

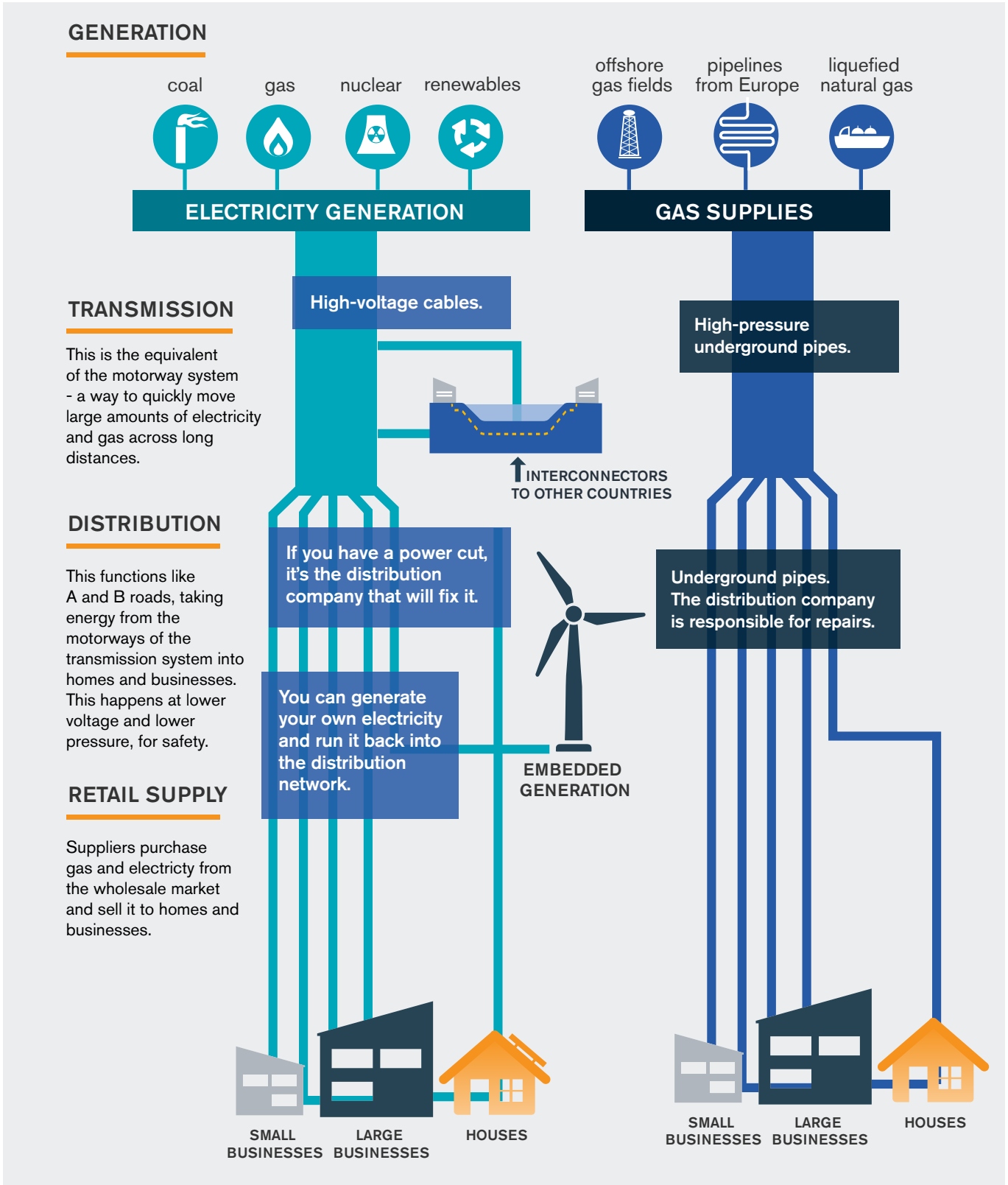
Ofgem regulates all of these elements.

Energy companies can operate in any of these areas, and some have a presence across the three. The six largest firms in GB energy markets are Centrica, EDF Energy, E.ON UK, RWE npower, SSE, and ScottishPower.[3] They are the former monopoly suppliers of gas and electricity to GB consumers. Each of them generates electricity and retails both electricity and gas. Centrica is also involved in gas production.

[3] This excludes those firms whose main business is in transmission or distribution networks, such as National Grid.

Figure 1.1 Britain's energy network

How Britain's energy network powers homes and businesses



The regulatory and policy framework

The government privatised previously nationalised gas and electricity companies through the Gas Act 1986 and the Electricity Act 1989. This was followed by gradual market liberalisation. Supply markets were fully opened to competition from 1998 and price controls for ordinary consumers were removed in 2002.

Until 2000, two separate regulators were responsible for overseeing the gas and electricity markets – the Office of Electricity Regulation (OFFER) and the Office of Gas Supply (Ofgas). They were merged by the Utilities Act 2000 to form Ofgem, which was given powers to regulate both markets, including the network monopolies. Ofgem's principal objective was, as it is now, to protect the interests of existing and future consumers. Ofgem must have regard to the interests of individuals who are disabled or chronically sick, of pensionable age, with low incomes, or residing in rural areas.

Ofgem protects the interests of consumers in a variety of ways, including:

- promoting value for money;
- promoting security of supply and sustainability, for present and future generations of consumers, domestic and industrial users;
- supervising and developing markets and competition;
- regulating the delivery of government schemes.

Ofgem is independent of government, but carries out its duties within the policy framework established by the UK government and the European Union (EU).[4] The Department for Business, Energy and Industrial Strategy (BEIS) is responsible for setting and developing energy policy. Energy policy as a whole is reserved to the UK government, but the Welsh and Scottish governments play important roles in several areas, such as energy efficiency and fuel poverty. EU law also has a significant impact on the UK energy sector. The European Commission publishes annual reports on the state of the European energy union.[5]

In the Climate Change Act 2008, the UK committed to reduce its greenhouse gas emissions to 20% of 1990 levels by 2050. To deliver on this commitment, the government sets five-yearly carbon budgets that run up to 2032. There is a legal duty to meet the restrictions on the quantity of greenhouse gases the UK can emit in a five-year period. The government published its Clean Growth Strategy in October 2017, outlining how it plans to achieve the 2032 carbon budget.[6] The independent Committee on Climate Change monitors progress in reducing emissions, and reports annually to Parliament.

The Energy Act 2013 established the two main mechanisms through which the government aims to ensure secure, affordable and clean electricity supplies:

- Contracts for Difference incentivise investment in low-carbon electricity generation; and
- the Capacity Market aims to encourage the availability of sufficient reliable electricity generating capacity.

[4] Ofgem regulates the energy sector in Great Britain. The Northern Ireland Utility Regulator regulates the energy sector in Northern Ireland.

[5] European Commission, 2nd report on the state of the energy union, 2017.

[6] HM Government, The Clean Growth Strategy, 2017.

Distinct features of the energy market

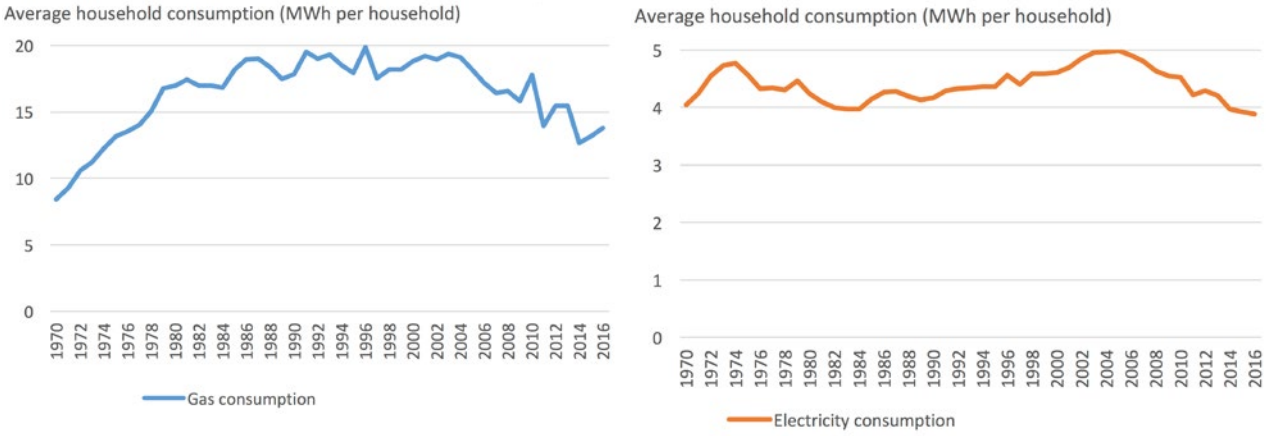
There are elements of the energy system that make it different from most other markets. On the supply side, energy generation requires large financial commitments with long timescales of investment and return. Gas and electricity networks are natural monopolies, meaning that it is typically not economic to build competing networks. In the electricity market, energy is currently expensive to store and it is costly to balance demand and supply. Gas and electricity generation and supply have the potential to produce high amounts of pollution, such as carbon emissions, which can badly affect our environment.

On the retail side, energy is essential to our way of life, meaning that society aims to minimise the risks of disconnection or disruption of supply.

For most consumers, there are no reasonable alternatives to gas and electricity to meet their energy needs. Energy is also a homogenous commodity, unlike most consumer goods: the electricity provided by one supplier is identical in its use to that provided by any other. Energy supply is continuous, meaning that there is no discrete point at which consumers need to engage with the market in order to continue receiving a service.

This combination of features means that energy markets display monopoly power, externalities and risks of poor outcomes due to limited consumer engagement or regulatory or government failures. This does not mean that market mechanisms are inevitably ineffective – but it does mean that close attention is required to ensure good outcomes for consumers.

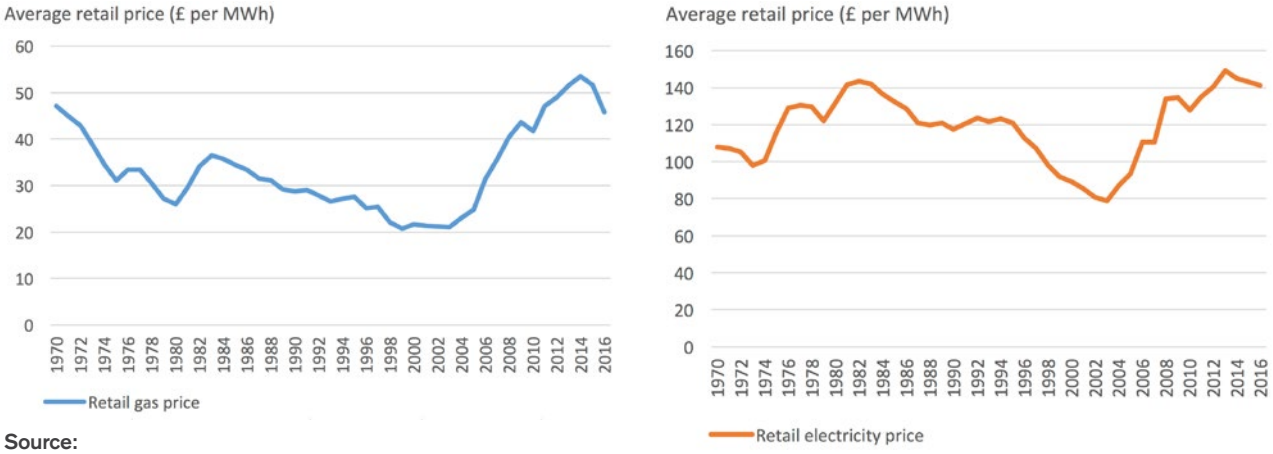
Figure 1.2 Energy consumption: 1970 to 2016



Source:

BEIS, Energy Consumption statistics in the UK (1970 to 2016).

Figure 1.3 Average retail energy prices: 1970 to 2016



Source:

BEIS, Annual domestic energy bills data, 2017.

How much we pay to consume energy

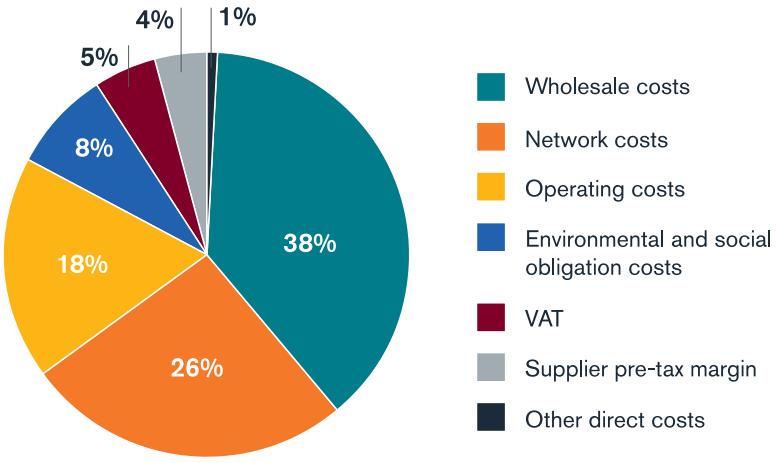
In Great Britain, domestic and non-domestic consumers spend around £50 billion on gas and electricity each year. The amount consumers pay individually depends on the amount they consume and the tariff they are on. Over the 10 years from 2006, average annual energy consumption fell by about 20%, from 4.9 MWh to 3.9 MWh for electricity and from 17.2 MWh to 13.8 MWh for gas (Figure 1.2).

However, retail prices also increased between 2006 and 2016. For gas, prices increased by 46%, from £31 to £46 per MWh and for electricity by 28%, from £110 to £141 per MWh. This has meant that despite the fall in consumption, bills are overall higher than before (£1,123 compared to £1,081 - looking at average bills for the six largest suppliers).

The main components of consumer energy bills are:[7]

- **Wholesale costs –** the amounts suppliers pay to buy gas and electricity;
- **Network costs –** costs of building, maintaining, and operating the transmission and distribution networks that transport energy to consumers;
- **Environmental and social costs –** costs of government policies that aim to meet environmental and social objectives;[8]
- **Other direct costs –** costs relating to general participation in the market such as administration and brokers' costs;
- **Operating costs –** costs of running a retail energy business, including sales, metering, and billing;
- **Profits –** for generators, network companies and suppliers;

Figure 1.4 The costs that make up an average 2016 domestic dual fuel bill



Note:

The profits made by companies operating in wholesale markets or networks are not shown separately. They are incorporated into wholesale costs and network charges.

Source:

Ofgem data based on the Consolidated Segmental Statements (CSS) for the six largest suppliers

Retail energy markets are characterised by wide price dispersion – some consumers pay much more for a given amount of energy than others. In particular, for a typical consumer, standard variable tariffs are typically around £300 more expensive each year than the cheapest fixed-term tariffs. We explore the reasons for and effects of these price differences in Chapter 2.

[7] For more information, see https://www.ofgem.gov.uk/consumers/household-gas-and-electricity-guide/understand-your-gas-and-electricity-bills

[8] Environmental and social costs do not include the cost of carbon (eg, EU Emissions Trading System and Carbon Price Support). This is captured in the wholesale cost.

The changing energy system

The energy system is changing rapidly. There are fundamental transformations in how energy is being generated and consumed.

Some changes are driven by the need to meet carbon reduction targets. Renewable energy sources now account for around a quarter of GB electricity generation. This has implications for our energy system, since low-carbon generation tends to be either largely inflexible (such as nuclear) or intermittent (such as wind and solar), compared to fossil fuel generation.

Other technological innovations and new business models are also starting to have an effect. Smart meters, electric vehicles and new types of storage are already affecting how consumers manage their energy, and allowing more innovative approaches to managing supply and demand.

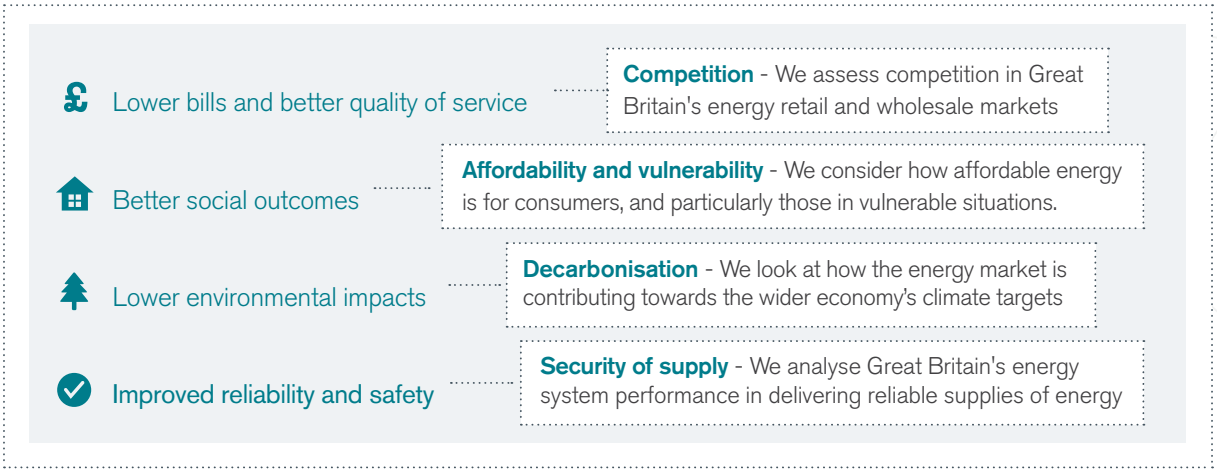
Although significant, the changes we have seen so far have had less effect on consumers than the changes we are likely to see in the coming decades. In particular, the decarbonisation of heating and transport is likely to have profound effects on the energy system, requiring consumer behaviour changes as well as major adaptations to gas and electricity supply.

The way Ofgem regulates is evolving to address the likely needs of the future energy system. We explore some of the possible changes in our approach in our Future Insights programme.[9] But we also need to ensure that the market works as effectively as possible today. Where there are problems, Ofgem will continue to take action to improve outcomes for consumers, particularly those in vulnerable situations.

State of the Energy Market Report 2017

In March 2014, Ofgem referred the energy market to the Competition and Markets Authority (CMA), because we assessed that it was not working as well as it could. This State of the Market Report is Ofgem's first annual assessment of Great Britain's energy markets since the CMA concluded its investigation in June 2016.

The report follows on from our previous Wholesale Energy Market and Retail Energy Market monitoring reports. It brings together analysis published by us and others, and includes new analysis that provides further insights on some of the key issues. The report focuses on energy markets and does not assess the state of energy networks.[10] It has four chapters, which cover the outcomes that Ofgem expects the market to deliver:



At the end of each chapter, we describe some of the actions we are taking to improve how markets work for consumers.

[9] See https://www.ofgem.gov.uk/tomorrows-energy-and-future-consumer/discussion-papers.

[10] We examine networks in our annual reports on distribution and transmission networks. See, for instance, https://www.ofgem.gov.uk/publications-and-updates/riio-electricity-transmission-annual-report-2015-16.

Aim of this report

We want this report to help anyone with an interest in gas and electricity markets to understand how well they are currently working. We provide an evidence-based assessment of the issues affecting the GB energy system, and help inform those who make decisions and those who contribute to regulatory debates.

We expect the focus of this report to evolve over time.

This year, we provide a baseline for future analysis, setting the context of energy market developments over the last decade. In future reports, we expect to focus more on current market issues and debates, including how effective interventions have been in improving the functioning of energy markets.

Chapter 2: Competition in energy markets

Summary of findings

- Competition continues to benefit consumers who are able and willing to shop around, meaning they can usually get a good deal.
- But competition isn't working well for consumers who are less active. More than half of consumers (58%) have never switched supplier or have switched only once.
- Non-domestic retail markets typically work well for larger businesses, but small and microbusinesses pay much more on average.
- Competition in wholesale markets, in particular gas, is working reasonably well. Wholesale gas markets are diversified, market power isn't concentrated in one or a few firms, and there is significant liquidity and market entry and exit.
- Wholesale electricity prices are relatively high in GB compared to the rest of the EU, mainly because of policy factors such as higher carbon taxes and the allocation of network charges.
- Following the CMA's investigation into energy markets, we are taking several actions to strengthen competition.

Ofgem and competition

Effective competition is central to ensuring that energy markets work in the interest of current and future consumers. Competition benefits consumers by incentivising firms to be more efficient and find new and better ways of providing the services consumers want at a low price. We aim to create and maintain a clear, predictable framework of rules to allow participants to compete effectively.

Competition is not static. To deliver good outcomes for energy consumers, market conditions should allow for the dynamic process of competition to work. A competitive energy market should be easy to enter and exit, and incentivise sustained rivalry between firms as they compete to supply innovative products and services.

Energy users should be able to access, assess and act on offers in the market. Firms who can best meet consumer needs should be rewarded with a bigger market share.

Here we look at how well competition is working in the energy markets, focusing in particular on developments since the CMA's energy market investigation. We consider whether the energy sector displays the structural features and outcomes we would expect to find in a well-functioning market (Figure 2.1).

By themselves, competitive markets cannot provide all of the outcomes that energy users care about, such as sustainable energy supplies and the protection of vulnerable consumers. We consider these issues in later chapters.

Figure 2.1 Structural features and outcomes of a well-functioning market[11]

Market structure		Market outcomes	
Wholesale	**Retail**	**Wholesale**	**Retail**
▪ Many market participants and ease of entry/exit	▪ Many market participants and ease of entry/exit	▪ Prices and profits reflect input costs and market conditions	▪ Low bills
▪ Low market concentration	▪ Low market concentration	▪ Technologies used in order of relative costs to meet demand (in merit order)	▪ High quality of service
▪ Limited opportunities for generators/producers to be pivotal to meeting demand	▪ Low barriers to switching suppliers	▪ Liquid markets (can trade quickly and without changing the market price significantly)	▪ Innovation and new business models
▪ No or limited scope for vertically integrated firms to foreclose the market	▪ High consumer engagement		▪ High consumer trust
Ofgem consumer outcomes: Lower bills, quality of service, benefits for society			

[11] These are based on the criteria we and the Competition and Markets Authority used in our joint 2014 State of the Market Assessment.

Retail energy markets

Retail energy markets are where households and businesses buy the energy they need from suppliers. The nature of competition in retail energy markets helps to determine consumer prices and service quality.

In its investigation into the energy market, the CMA found adverse effects on competition relating to consumer engagement, prepayment meters, the settlement process, and our Retail Market Review policies. In this section, we assess the structure of retail energy markets and the outcomes they achieve.

Domestic retail energy market structure

Substantial new entry and falling concentration

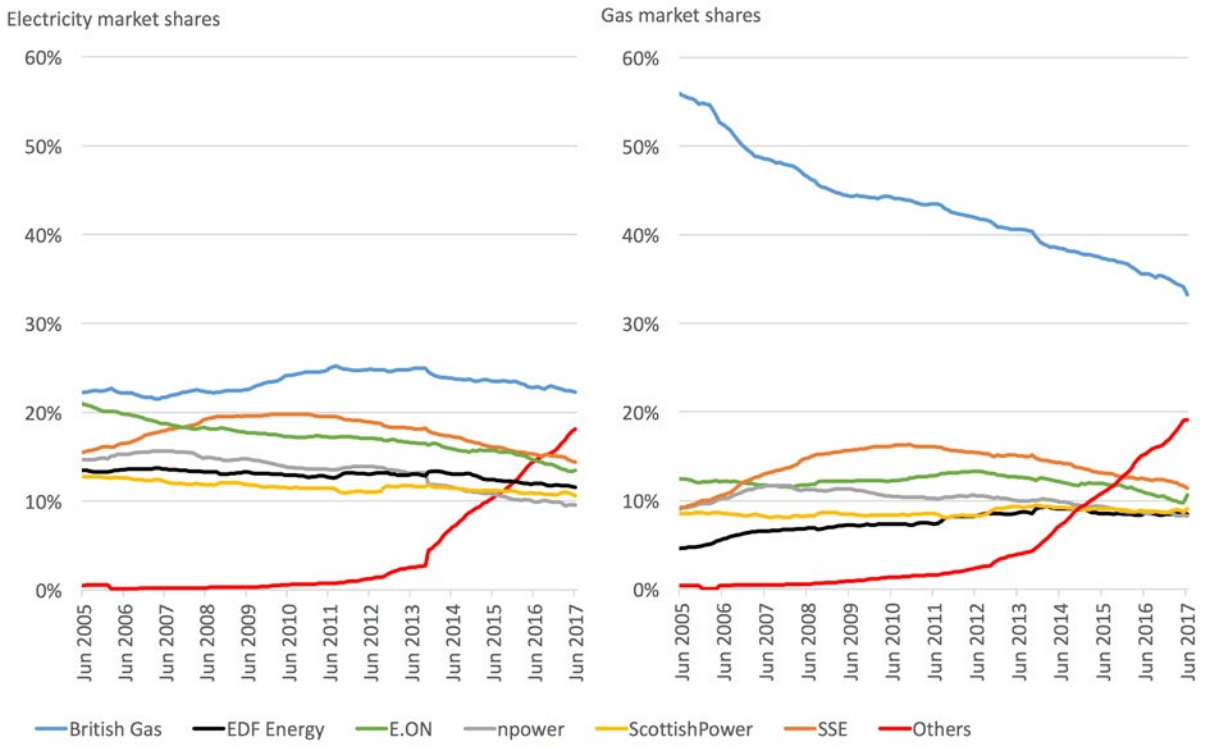
Retail energy markets have seen substantial new entry in recent years, supported by falling wholesale prices and increased liquidity in wholesale markets. In June 2017, there were 49 suppliers offering both electricity and gas in the domestic retail market plus seven gas-only and four electricity-only suppliers. Since June 2016, this is a net increase of 11 gas and electricity suppliers (12 new entrants and one exit (GB Energy)) and a net increase of two gas- and three electricity-only suppliers. GB Energy's exit happened without discernibly affecting the market or supply to consumers, mainly because it was small, and we successfully operated our Supplier of Last Resort arrangements.

The six largest suppliers still account for around four-fifths of domestic retail supply (81% and 82% in gas and electricity respectively). But they have lost almost four percentage points of market share in the last year in both fuels (Figure 2.2). Since June 2012, the large firms have lost 2.1 million and 4.3 million meter points in gas and electricity respectively, reducing their market share by around 17% for both fuels. British Gas is the largest supplier of both gas and electricity, with 33% of the gas market and 22% of electricity.

Despite substantial new entry, domestic retail energy markets are still concentrated, though concentration levels have fallen in the last year. The Herfindahl–Hirschman Index (HHI), which is the typical rule of thumb used by the CMA to measure concentration, was 1,793 for gas in June 2016 and 1,599 in June 2017. Figures for electricity were 1,353 and 1,247 respectively. The CMA typically regards markets with HHI below 1000 as unconcentrated, markets with HHI between 1000 and 2000 as concentrated, and markets with HHI above 2000 as highly concentrated.[12]

[12] The Herfindahl–Hirschman Index (HHI) measures market concentration by summing the squares of the market share of each player. It provides insights into how competitive a market is. The closer a market is to being a monopoly, the higher will be the measure of concentration (see CMA market investigation guidelines, p.87).

Figure 2.2 Electricity and gas market share evolution



Note:
Data correct as of June 2017.

Source:
Ofgem analysis of Distribution Network Operators and Xoserve data.

More reliable switching is needed to support competition

Making it easy and quick to switch suppliers is vital to increasing competition. In launching our Switching Programme in 2015, we stated that "the current switching arrangements, developed in the late 1990s, are complex for suppliers and can lead to delays, errors and costs, which are often borne by consumers."[13]

Despite some progress, consumers still experience significant difficulties when switching suppliers. Between April 2014 and June 2017, 26 million switch requests were submitted to the network operators, but only 22.6 million switches actually took place. Some of the 3.4 million extra requested switches may have been resubmitted as new requests, with no or only minor delays in switching. But others could represent substantial delays or switches that did not happen at all.

Our data suggests that suppliers' objections are responsible for about half of the gap between the number of switching requests and the number of switches that take place – about 1.7 million switching requests over this time period – and customer cancellations for nearly another fifth of these requests.

Objections can occur for a range of reasons, such as customer debts to their existing supplier. While such objections are understandable, they could have the impact of severely restricting competition for indebted consumers. Consumers with debts below £500 can apply to switch supplier, but in 2016, only 5% of those consumers that applied to switch succeeded.

Consumers that do switch can experience delays. In 2017, 27% of respondents to our consumer survey said they believe the switching process takes too long. We do not have consistent data on total switching times, but do gather data from network operators on the number of calendar days it takes from when a supplier submits a switching request to the transfer taking place.[14]

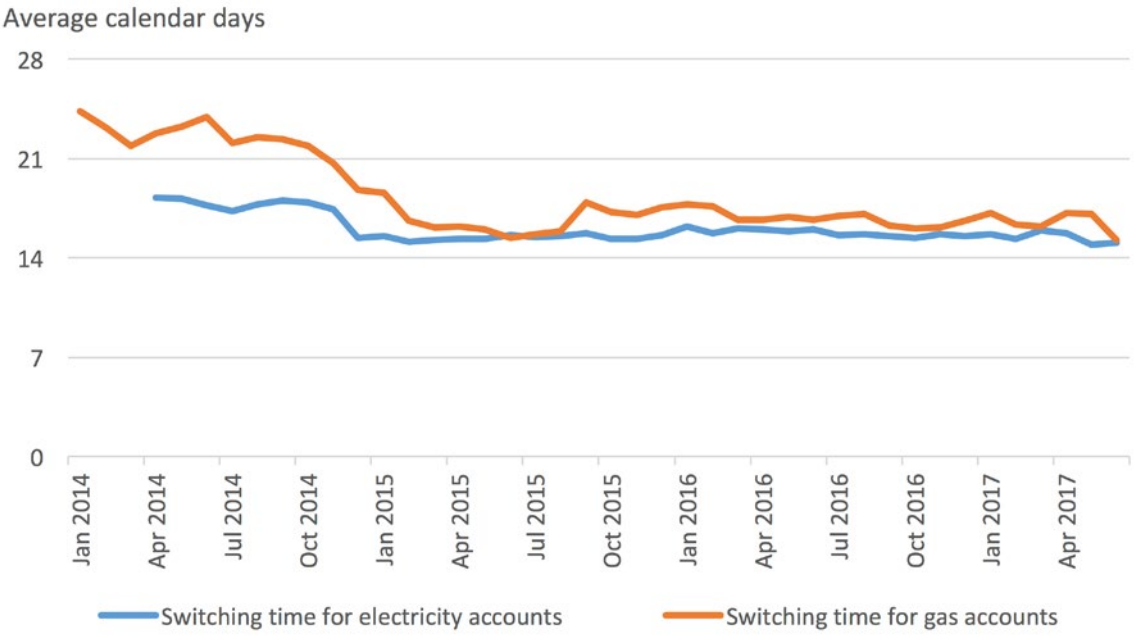
These figures show that, following an Ofgem-supported industry initiative to cut switching times in 2014, average switching times for domestic consumers fell from 18 days for electricity and 23 days for gas in May 2014 to around 16 days from 2015 onwards (Figure 2.3). We require licensed suppliers to take all reasonable steps to complete a transfer within 21 days from the end of the 14 day cooling-off period. For comparison, Bacs reports that more than 99% of current account switches are completed within 7 working days.[15]

[13] Ofgem, Moving to reliable next-day switching, 2014.

[14] This does not include the time taken by the supplier to submit a switching request, nor the additional time to process the contract with the customer.

[15] Bacs, Current account switch service statistics. The Financial Conduct Authority expects switches to be completed within 10 working days for current accounts and 15 working days for cash ISAs.

Figure 2.3 Average switching time for domestic consumers



Note:

Switching times reflect the time between a switching request and the transfer taking place, and include all switches, including those with a legitimate cause for delay.

Source:

Ofgem analysis of network operator data.

There are also significant numbers of erroneous transfers, whereby consumers are switched to suppliers against their wishes. These can happen for a variety of reasons, including inaccurate switching data, mis-selling, or fraud. Among the six largest suppliers, erroneous transfers accounted for around 0.6% of switches as of June 2017.[16] The proportion of erroneous transfers has stayed broadly stable since 2014, despite our introduction in that year of new licence obligations to prevent erroneous transfers.[17]

Despite barriers, switching is increasing

Consumer engagement and switching are key to achieving good outcomes in the market as a whole. Engaged consumers can strengthen price and quality competition. The CMA found that lack of consumer engagement gave suppliers a position of unilateral market power over their inactive customer base.[18]

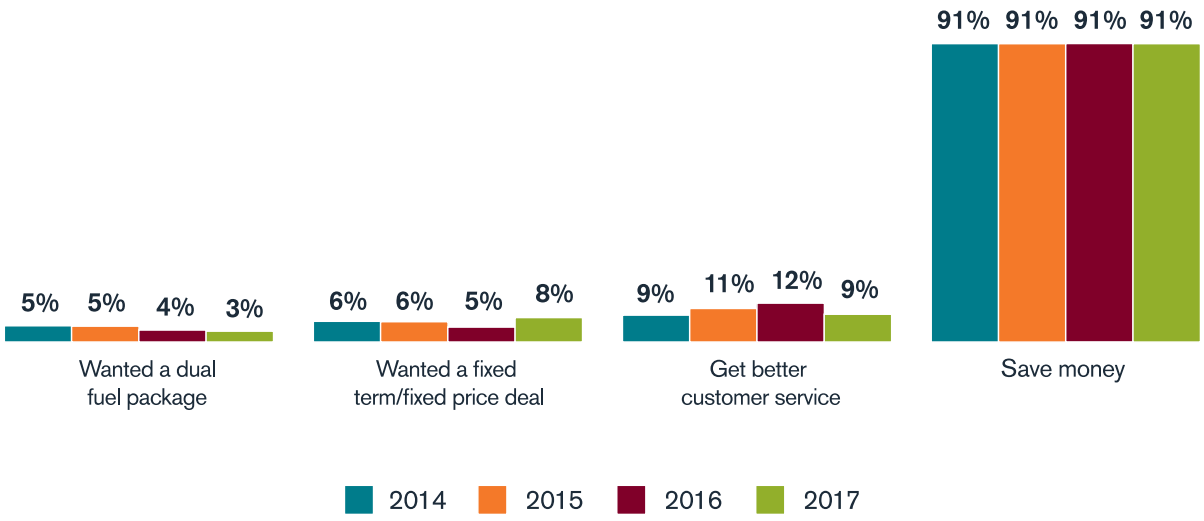
As in previous years, saving money is by far the main reason for switching supplier or tariff, with 91% of consumers who switched mentioning it as a motive in our consumer survey. Better consumer service was the next most common reason (9% of consumers) (Figure 2.4).

[16] Between July 2016 and June 2017, there were around 10,700 erroneous gas transfers and 16,100 erroneous electricity transfers.

[17] Ofgem, Statutory consultation on enforcing three week switching, 2014.

[18] Market power exists where an individual firm has the ability to raise prices profitably above competitive levels (or reduce the value of its offer to consumers in other ways) independently of the behaviour of rival firms.

Figure 2.4 Motivations for switching

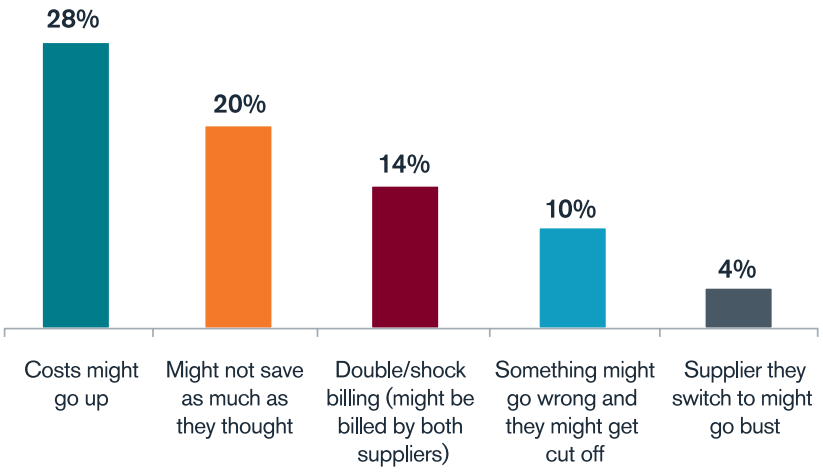


Source:

Ofgem, Consumer engagement survey 2017.

Consumers' concerns about switching also show how important savings are to engagement. Around two-thirds of consumers consider that switching may entail some risk. Figure 2.5 shows that the top three risks those consumers indicate relate to the extra costs they might incur or the savings they might not make. Despite the importance of making savings, a substantial minority (42%) of consumers in 2017 agreed that it was too hard to work out whether they would save money or not if they switched, up from 39% in 2016.[19]

Figure 2.5 Top five perceived risks with switching



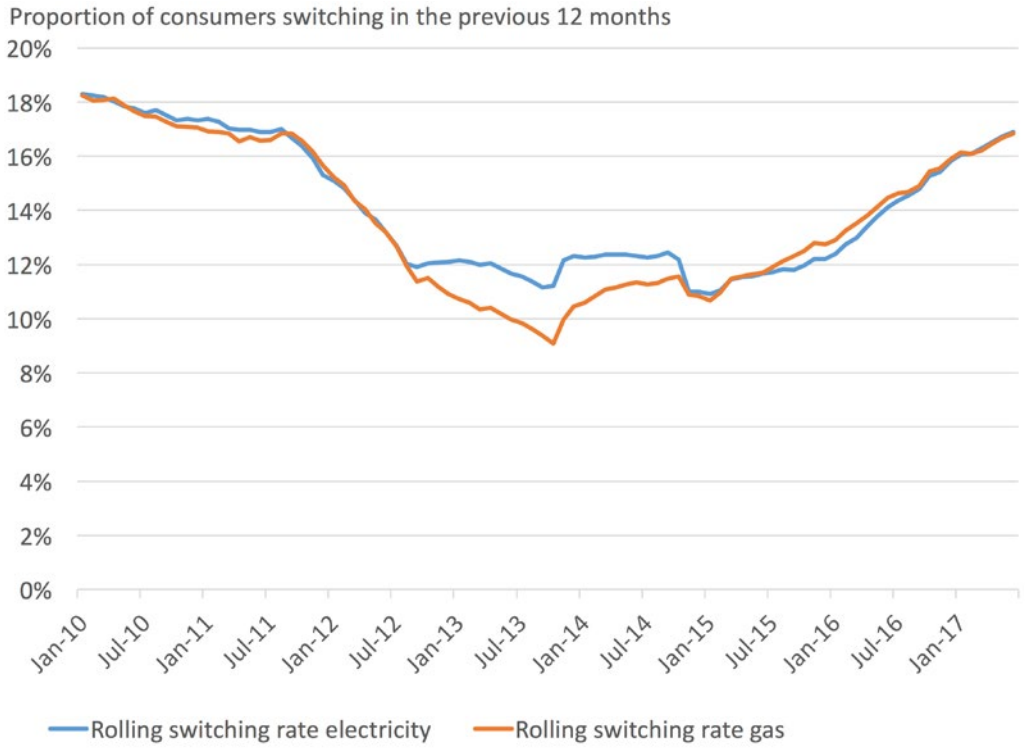
Source:

Ofgem, Consumer engagement survey 2017.

[19] Ofgem, Consumer engagement survey 2017

Rates of switching between suppliers increased substantially in 2016, with 16%[20] of gas and electricity accounts changing suppliers (over 3 million gas switches and 4 million electricity switches) (Figure 2.6). Switching has increased further in 2017 so far, with rolling annual switching rates reaching almost 17% in June 2017, the highest since August 2011. For comparison, a 2015 survey commissioned by the CMA found that rates of energy supplier switching were substantially higher than mortgage or personal current account switching, but lower than switching in motor insurance markets.[21]

Figure 2.6 Rolling annual switching rates



Note:

Rolling annual switching rates in a particular month are given by the ratio between the total number of switches and the average number of consumers in the 12 months before.

Source:

Ofgem's analysis of Distribution Network operator data and Xoserve data

[20] This is the annual switching rate from January 2016 to December 2016 (based on a rolling average) for both gas and electricity.

[21] GfK, Personal current account investigation: a report for the CMA, Figure 31. 31% of survey respondents reported that they had switched energy supplier in the last 3 years, while only 8% had switched personal current account, and 45% had switched motor insurer.

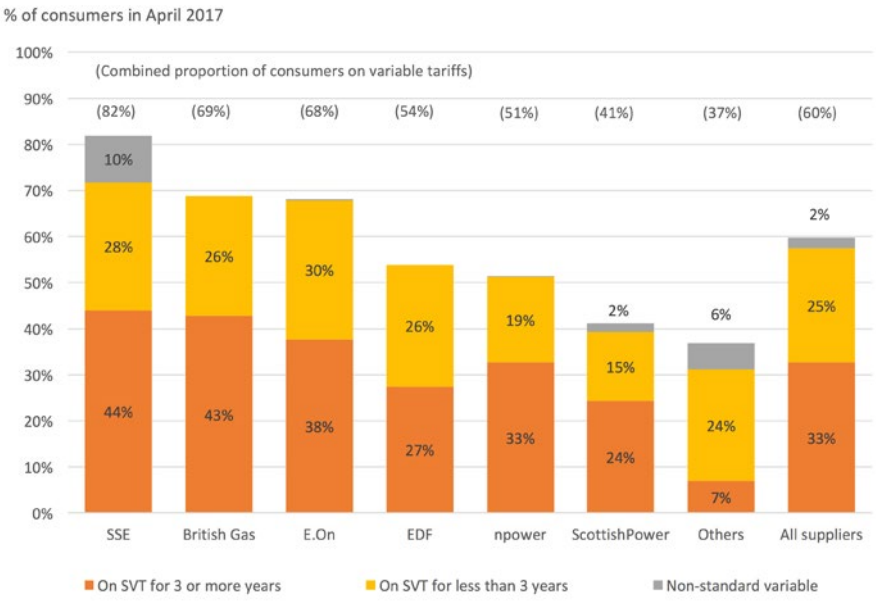
The internet is a key facilitator for engagement in the energy market and switching. In our survey, 49% of consumers who had engaged with the energy market found out about deals using a price comparison website, compared with 15% who rang a supplier. Two-fifths of those who switched supplier said they did so using a third party service, mainly price comparison websites. The CMA's recent market study on digital comparison tools found that 22% of internet users had used energy price comparison sites in the last year. This was around half of reported usage of motor insurance price comparison sites, but higher than in travel insurance, broadband or credit cards.[22]

A two-tier market of engaged and less-engaged consumers

Despite increasing engagement, a large proportion of consumers remain unengaged. Of those who responded to our survey, 35% told us that they have never switched supplier, while 23% said they had done so only once (58% in total). The main reasons consumers give for not switching are: satisfaction with existing arrangements, switching being a hassle, and believing that they are not likely to make significant savings by switching.

Less engaged consumers are on standard variable tariffs by default. As of April 2017, three-fifths of consumer accounts were on variable tariffs (60% vs 64% in April 2016). This varies across suppliers – SSE has the highest proportion at 82% (compared with 89% in 2016), ScottishPower the lowest at 41% (compared with 47% in 2016) – and indicates that there are significant differences in engagement with consumers (Figure 2.7).

Figure 2.7 Proportion on consumers with variable tariffs in April 2017



Note:

Non-standard variable tariffs refer to consumers on bundled or reward tariffs no longer available on the market. The chart includes all suppliers with over 100,000 customers. They supplied 99% of consumers in April 2017. The chart excludes prepayment meter consumers. It also excludes consumers with 'mixed tariffs' (a variable tariff for one fuel type, and a fixed tariff for the other type). In April 2017, 299,000 consumers had mixed tariffs (1.2% of the market).

Source:

Ofgem's analysis of accounts data.

[22] CMA, Digital comparison tools market study, Figure 3.4.

The proportion of consumers on standard variable tariffs (SVTs) is concerning. SVTs are generally more expensive than fixed tariffs and our analysis of price sensitivity suggests that consumers on SVTs are less likely to respond to opportunities to save money than consumers who are already on cheaper fixed tariffs.

Some consumers' lack of price sensitivity may indicate explicit customer loyalty. Between July 2016 and June 2017, 27% of consumers switched tariff but stayed with their existing supplier (known as 'internal' switches). This was substantially higher than the rate of external switches (17% of consumers switched suppliers). Figure 2.8 shows that, on average, consumers on SVTs could save £180 by switching tariffs without switching their supplier. While this may suggest that some engaged consumers are willing to make lower savings in order to stay with the same supplier, the high proportion of SVT consumers that neither switch tariff nor supplier suggests that many more are not engaged in the market.

Figure 2.8 Savings available to SVT consumers by switching between July and September 2017

Supplier	Average annual bill on standard variable tariff (£)	Supplier's cheapest fixed tariff (£)	Saving from an internal switch (within supplier) (£)	Range of savings from external switch (from SVT to another supplier's fixed tariff) (£)
British Gas	1,072	1,036	36	55 to 227
Coop	1,158	859	299	121 to 313
E.On	1,133	941	192	97 to 288
EDF	1,142	971	170	105 to 297
First Utility	1,132	927	204	95 to 287
Npower	1,166	935	231	130 to 321
OVO	1,097	942	155	61 to 252
ScottishPower	1,147	973	174	111 to 302
SSE	1,121	872	248	84 to 276
Utility Warehouse	1,098	1,017	81	62 to 253
Average	1,126	947	179	92 to 311

Note:

The range of savings from external switching shows saving from switching to the cheapest fixed tariff in the market, and the most expensive fixed tariff offered by one of the ten suppliers in the table.

This chart shows average prices in the last quarter for each of the 10 largest suppliers in the non-prepayment segment. These include suppliers' standard variable and cheapest tariffs, which are compared with the average price of the market cheapest tariff in the 3 month period. We base the figures on a typical domestic dual fuel customer paying by direct debit.

Source:

Ofgem's analysis of Energyhelpline data.

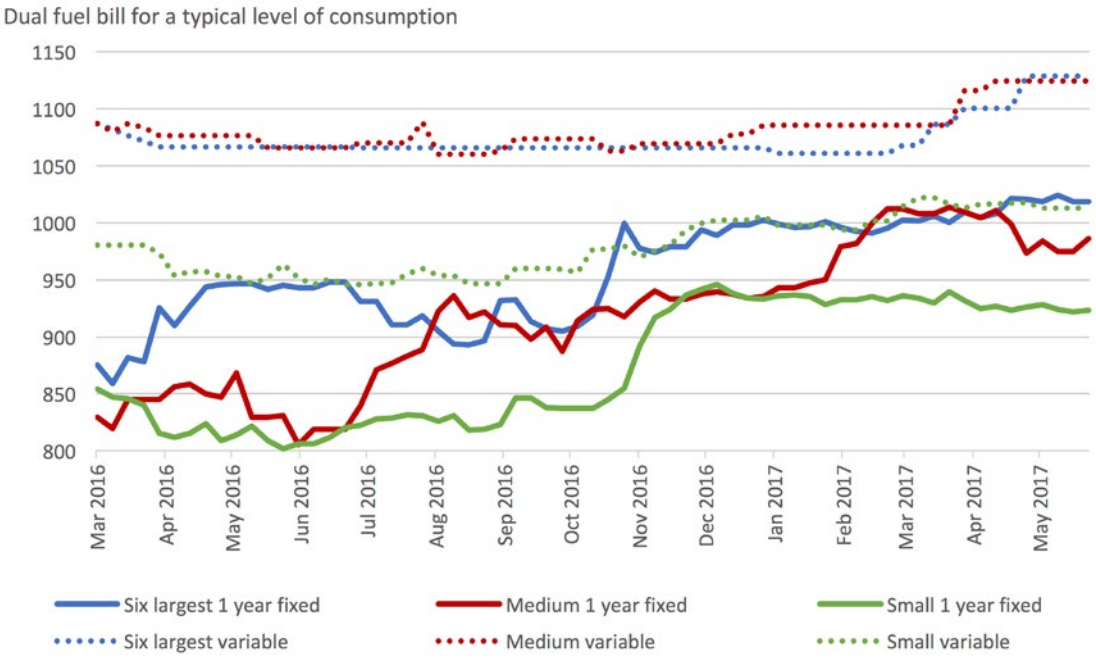
Domestic retail energy market outcomes

Higher bills for less engaged consumers

There is strong evidence that price is the single most important driver of switching. In a well-functioning competitive market, there should be downward pressure on prices as suppliers compete aggressively to attract consumers. Downward pressure does not necessarily mean lower prices, since prices could rise because of increases in costs such as the global price of gas, or to cover service quality improvements which consumers value.

Less-engaged consumers typically pay more than consumers that shop around for a fixed tariff. Figure 2.9 shows that between April 2016 and May 2017 the large and medium-sized suppliers charged consumers on SVTs a similar amount (£1,074 and £1,082 respectively). Over the same period, on average, consumers on fixed tariffs were charged £116 less by the six large suppliers, and £165 less by medium-sized suppliers (figure 2.9).

Figure 2.9 Average tariff prices over time split by supplier size groups from 2016-17



Note:

The chart depicts average prices for standard variable tariffs and fixed tariffs, paid by direct debit. Prices are calculated using the Typical Domestic Consumption Values before those values were updated in October 2017.

Source:

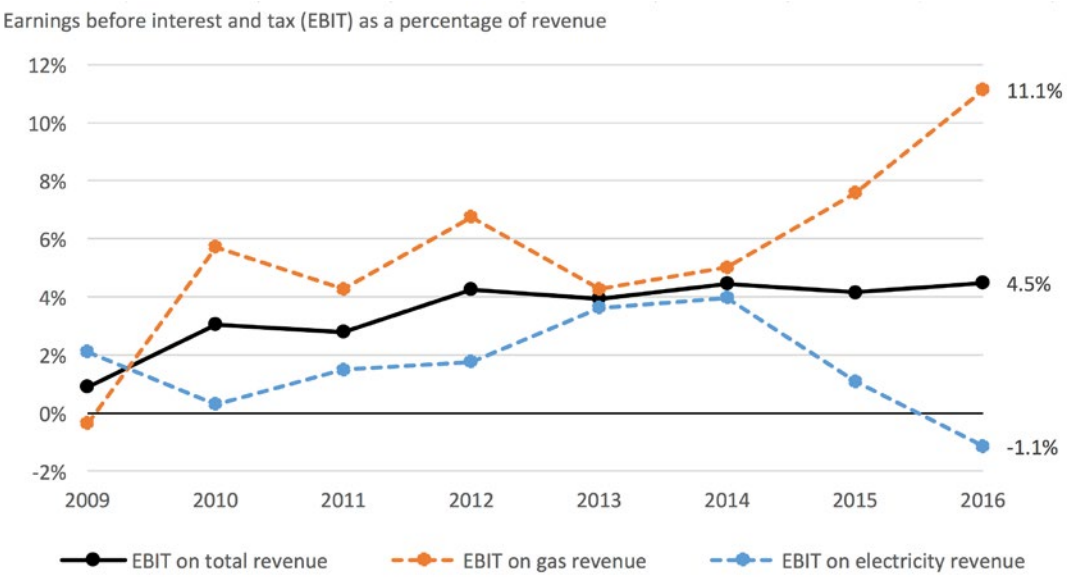
Ofgem's analysis of Energylinx data.

Stable profit margins and operating costs of six largest suppliers – but falling customer numbers

Because price changes alone cannot give the full story, a principal way of assessing whether price competition is intense enough is to consider company profit margins and costs.[23] With intense competition, and in the absence of innovation in services, we would expect profit margins and costs to be pushed towards their efficient level.

In 2016, the six largest suppliers made £1 billion profit before tax and interest (4.5% of their revenue from household consumers). Total profits have fallen from their peak (£1.2 billion in 2012), as the large suppliers have lost customers to smaller competitors.[24] However, Figure 2.10 shows that the profit margin (profit as a percentage of total revenue) has been relatively stable since 2012. Last year, the six largest suppliers made all of their profits on gas sales, whereas they made a loss on electricity sales. This divergence continues a two-year trend in gas and electricity profits, as reductions in gas costs have outpaced reductions in electricity costs.

Figure 2.10 Profits of the six largest suppliers before interest and tax as a percentage of sales, 2009-2016



Source:

Ofgem analysis of Consolidated Segmental Statements.

The six largest suppliers were not equally profitable in 2016. British Gas, E.ON, SSE, and ScottishPower made similar and significant profits (7.2%, 7.0%, 6.9% and 5.2% respectively), but EDF and npower made losses (-0.9% and -6.3%) (Figure 2.11).

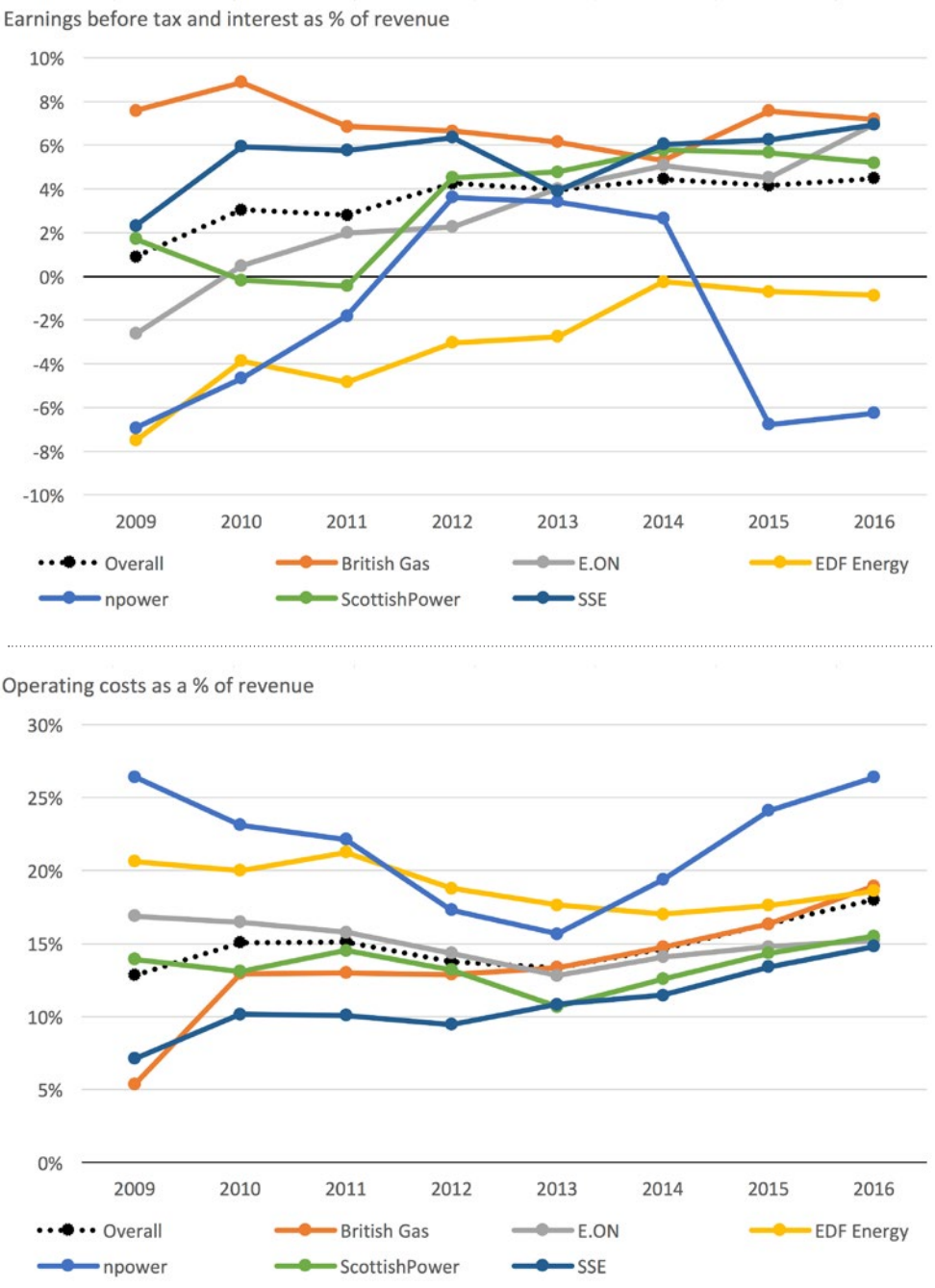
One reason for the difference in profit margins is the variance in suppliers' operating costs and the extent to which they are passed onto consumers.

Each of the six large suppliers made broadly similar average revenues per dual fuel customer (between £1,017 and £1,089). Figure 2.11 shows that the two suppliers with the highest operating costs have consistently made the least profits, suggesting some constraint on suppliers' ability or willingness to pass on high costs to consumers. Although operating costs have on average increased since 2009, they have largely converged across the suppliers.

[23] See, for instance, the CMA's latest market investigation guidelines. The OFT had previously commissioned a paper on Assessing profitability in competition policy analysis.

[24] We do not have consistent data on the profitability of smaller suppliers.

Figure 2.11 EBIT and operating costs as % of sales



Source:

Ofgem analysis of Consolidated Segmental Statements.

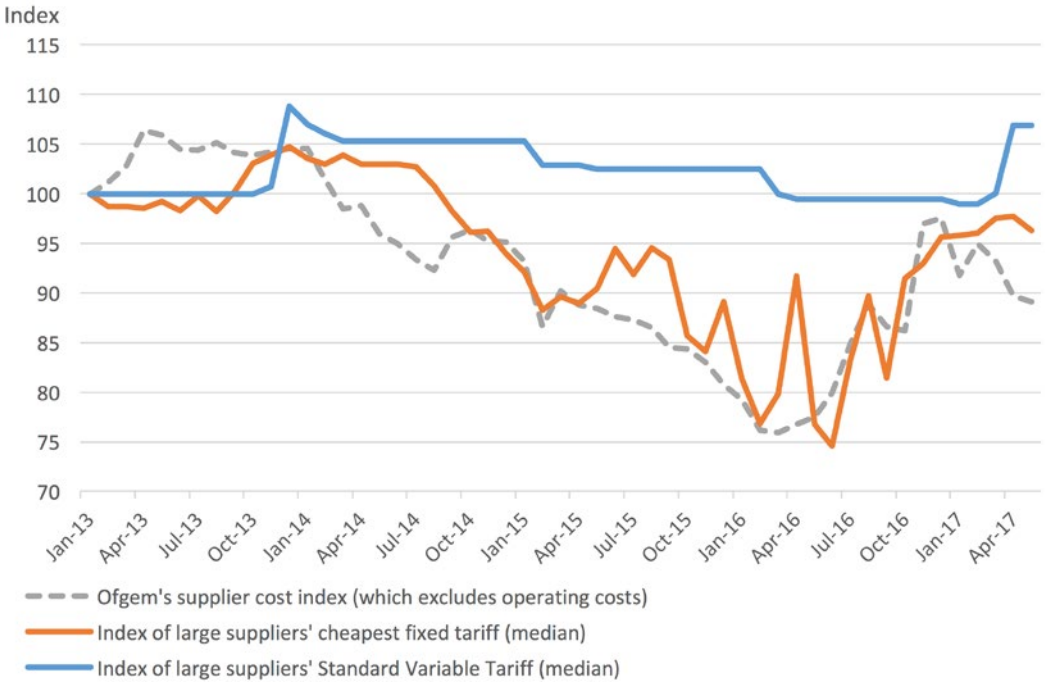
Higher profits from SVT customers

Beyond average prices and profits, it is important to understand the relationship between the two tiers of prices most consumers experience. The six largest suppliers, on average, made £54 of profit per dual fuel customer in 2016.[25] But, on average, prices offered to the typical SVT consumer are now around £180 more than those offered to the typical fixed-tariff consumer (see figure 2.8, above).

To help examine that relationship, we analysed the earnings suppliers make after they have deducted the direct costs of fuel, networks, and policies, but before they deduct operating costs (known as 'gross profit', which should not be confused with the EBIT profits we analyse above). Both fixed tariffs and SVTs cover their direct costs and contribute to the £5.1 billion gross profit made by the six largest suppliers. However, after deducting direct costs, a higher proportion of SVT revenue (26%) than fixed tariff revenue (14%) was left to cover the suppliers' £4.1 billion operating costs. We estimate that if SVT prices were reduced so that they provided the same gross profit margin as fixed tariffs, then suppliers would have made a 6% loss, unless suppliers could significantly reduce their operating costs.[26]

This relationship suggests that vigorous competition for engaged consumers has kept competitive pressure on fixed tariff prices so that they track marginal costs more closely (Figure 2.12). Less engaged consumers appear to allow suppliers to offer very competitive prices to engaged consumers and still make a profit after deducting their operating costs.

Figure 2.12 Changes in prices for standard variable tariffs and fixed term tariffs compared to direct costs



Note:

Direct costs include the costs of fuel, networks, and government policy for social and environmental purposes. The six largest suppliers spent £17.8 billion on direct costs in 2016. Direct costs do not include suppliers' operating costs, which for the six largest suppliers totalled £4.1 billion in 2016. We base the figures on a typical domestic dual fuel customer paying by direct debit. The indexes use nominal prices.

Source:

Ofgem analysis of Supplier cost index and Energylinx data

[25] Profit per dual fuel customer is calculated by combining the average profit for an electricity meter (a £6 loss in 2016) and the average profit for a gas meter (£60 in 2016). The six largest suppliers have 23.6 million electricity customers and 19.5 million gas customers.

[26] Ofgem analysis of supplier data provided in a request for information. In our analysis, we do not alter the costs to serve customers, either direct costs or operating costs.

Impact of safeguard tariff for PPM prices

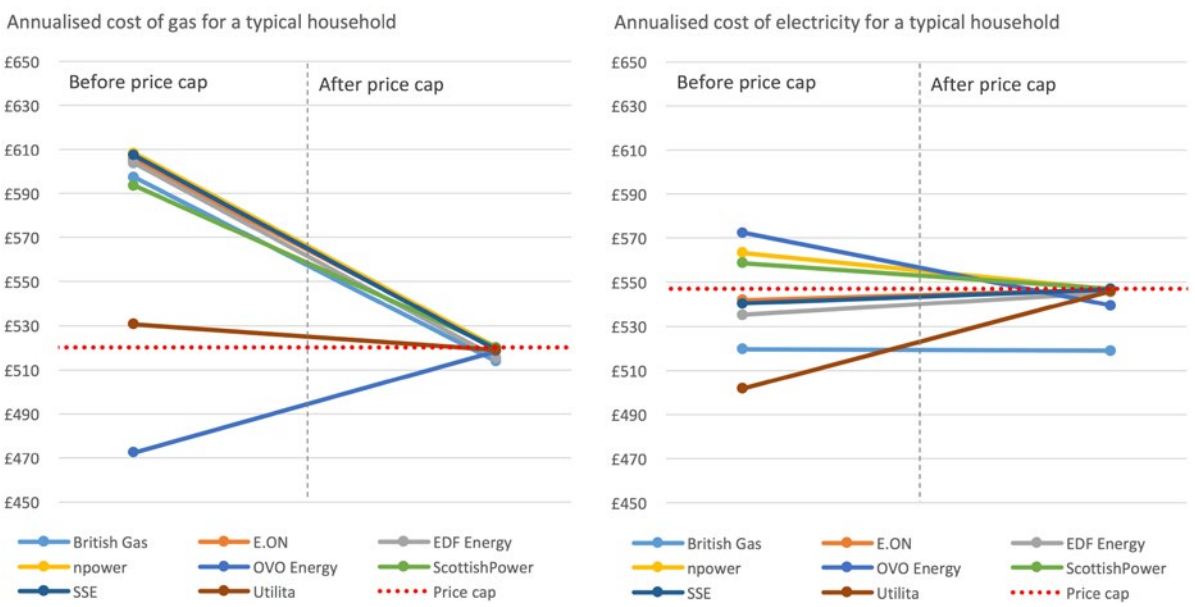
Competition has not worked well for consumers on prepayment meters (PPMs). For instance, switching rates are much lower for prepayment consumers, and they have fewer tariffs to choose from; price comparison websites offered 33 prepayment tariffs in June 2017, compared with 122 tariffs for consumers paying by direct debit.[27] Following a recommendation by the CMA, we implemented a safeguard tariff on PPM tariffs from April 2017. We have carried out an initial assessment of the impact of our safeguard tariff on the prices that prepayment meter consumers face.

As a result of the introduction of the safeguard tariff, the market average price for a dual fuel prepayment customer fell by around £60 in April 2017 (based on a typical level of annual consumption). This reduction, combined with the price increases we have seen for customers using other payment methods in the first half of 2017, means that prepayment customers now pay less for a given amount of energy than most of those on SVTs paying by direct debit (£57 less for a typical consumer), reversing a long-term trend.

Prepayment tariffs remain more expensive than the typical fixed-term tariff, paid by direct debit. However, there are still some examples of suppliers pricing beneath the safeguard tariff.[28]

Figure 2.13 shows the most common tariffs for the eight largest PPM suppliers before and after the cap. Most of these suppliers' gas consumers saw their prices fall (around 3 million accounts), and nearly a third of their electricity consumers saw their prices fall (around 1 million accounts). Reductions largely focused on unit rates for gas and Economy 7.

Figure 2.13 Prepayment tariffs before and after the price cap



Note:

The chart shows each supplier's standard variable prepayment tariff only. These suppliers serve 90% of consumers using prepayment meters.

Source:

Ofgem's analysis of Energylinx data

[27] Ofgem analysis of Energy linx data. These figures only look at single rate meters with dual fuel tariffs. The main exclusions are single fuel tariffs and economy 7.

[28] Ofgem analysis of Energylinx data.

Although the safeguard tariff required all the large suppliers to make significant reductions to their tariffs, several of the mid-tier suppliers in the prepayment market were already offering prices below the safeguard tariff. Many of these suppliers chose to increase their tariffs where they were able to do so, bringing them close to the level of the safeguard tariff, and increasing convergence in prices.

We have also seen the withdrawal of some zero-standing charge tariffs. Before the cap was introduced, four suppliers offered tariffs with no standing charge (to around 34,000 electricity or Economy 7 consumers, and 14,000 gas consumers). After the cap, only two suppliers offered zero-standing charge tariffs. As a result, some low-use electricity prepayment customers are likely to have seen their bills increase from April, and the alternatives available to this group have fallen.

Innovation in tariff offerings

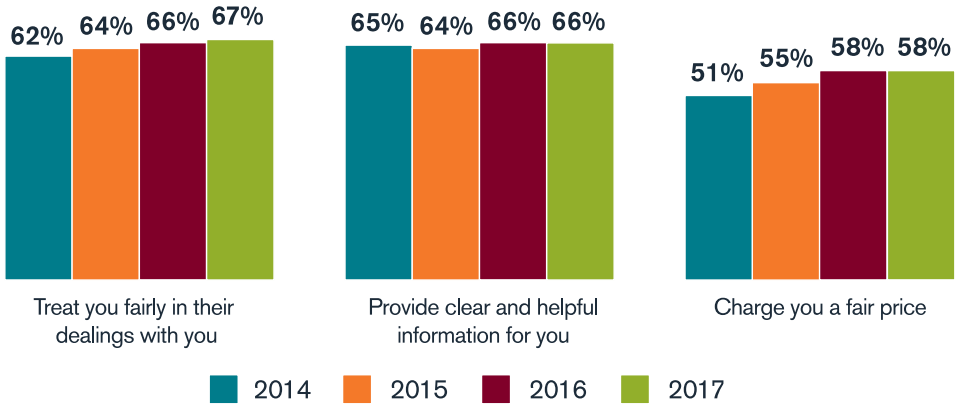
The increase in the choice of suppliers has been accompanied by greater diversity in tariff offerings and hence more opportunities for consumers to get the deal that best suits them. After we lifted our Retail Market Review tariff restrictions in the second half of 2016, the total number of core tariffs[30] in the market rose from around 90 to around 120 in the non-PPM segment. The increase is mostly explained by the entry of new suppliers rather than by tariff proliferation (on average, each supplier typically offers two or three core tariffs).

In addition, there has recently been an increase in tariffs that track wholesale price changes, and in tariffs that allow energy to be purchased in bundles. Suppliers are also offering tariffs that include non-energy services. However, our consumer perceptions survey found that consumers would value more choice than is currently available: only 46% of consumers feel they have the right amount of choice of energy tariffs.

Consumer trust increasing, but still too low

We would expect effective competition to lead to outcomes where consumers are confident engaging in the market, and choose suppliers that they trust to treat them well. But trust is generally low in the energy sector, and compared to other sectors the major energy firms are rated towards the bottom of Which?'s annual satisfaction survey.[31] Trust has increased slightly since 2014 (Figure 2.14).

Figure 2.14 Trust in the energy sector



Source:

Ofgem, Consumer engagement survey 2017

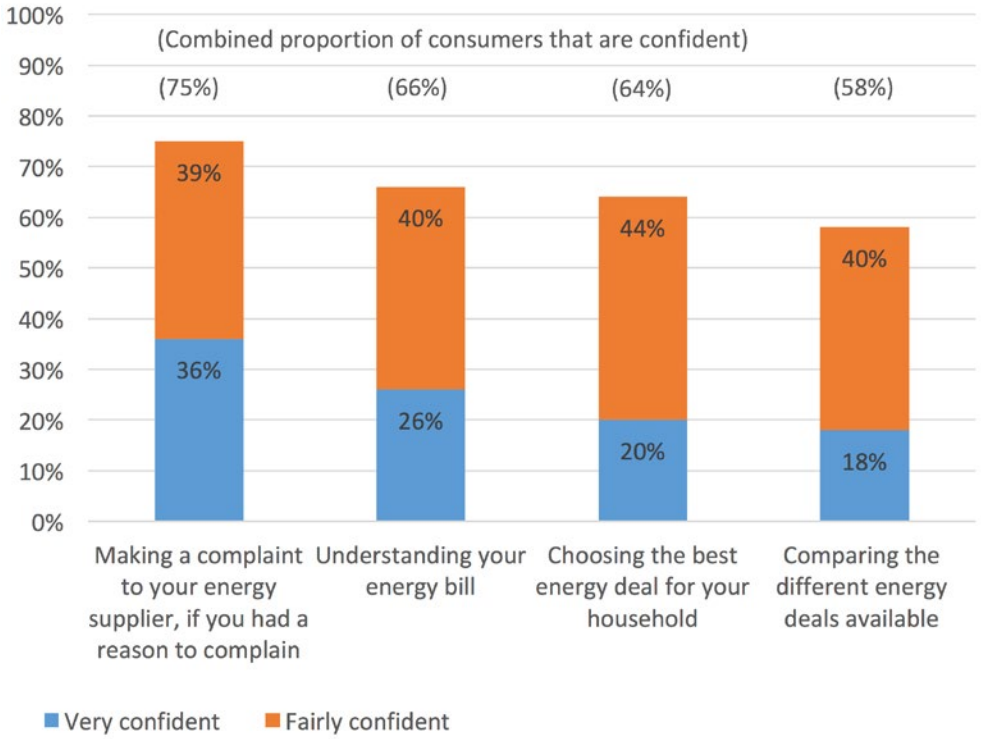
[30] A core tariff covers the charges for supply of electricity/gas combined with all other terms and conditions that apply, or are in any way linked, to a particular type of contract for the supply of gas/electricity. It excludes certain matters such as dual fuel discounts, variations in charges relating to payment method, appropriate surcharges and optional additional services.

[31] In its 2017 customer service survey, Which? ranked 100 of the UK's biggest brands. British Gas and EDF came joint 60th in the rankings, E.ON joint 80th, SSE 90th, Scottish Power 93rd, and npower joint 94th.

Survey data indicates that most consumers are at least fairly confident engaging with their energy supplier. Confidence is highest for complaining (Figure 2.15).

Quality of service is the main reason why consumers stay with their supplier and the second most popular reason they leave. Our survey shows that satisfaction with the service received from suppliers has increased slightly (53% in 2016 compared to 50% in in 2014).[32]

Figure 2.15 Confidence engaging with the market



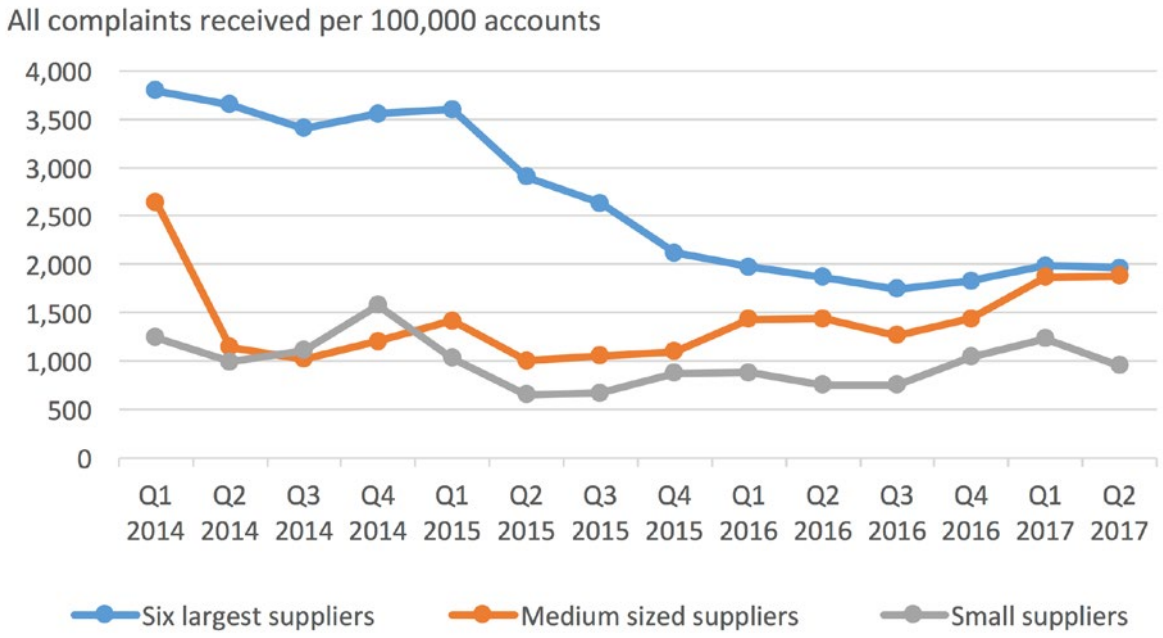
Source:
Ofgem, Consumer engagement survey 2017.

Overall customer complaints across suppliers as of June 2017 had slightly increased year-on-year from 1,800 complaints per 100,000 customers to around 1,900 (Figure 2.16). This aggregate figure hides differences among suppliers, with the six largest suppliers and medium suppliers experiencing around twice as many complaints per 100,000 accounts as small suppliers. This figure must be interpreted with caution, since higher complaints could reflect more engaged consumers or easier complaints procedures, rather than poorer service quality.

Looking at an alternative measure of quality of service, complaints handling, our data shows that resolution has remained stable on aggregate over the last year. Comparing the first quarter of 2017 to the same quarter of 2016, the average proportion of complaints resolved within eight weeks has remained almost unchanged at 93% for large suppliers and 94% for medium suppliers. Small suppliers improved substantially from 87% to 94%. Between suppliers, performance varies slightly; between January and June 2017, each large or medium supplier resolved between 89% and 98% of their complaints within 8 weeks.

[32] Ofgem, Consumer engagement survey 2017

Figure 2.16 Complaints received each quarter per 100,000 customer accounts (GB)



Source:
Ofgem's analysis of suppliers' complaint data.

Non-domestic retail energy market structure

As of June 2017, businesses had 2.5 million electricity meter points and 860,000 gas meter points, compared to 28.0 million electricity meter points and 23.1 million gas meter points for household meter points. But business consumers account for nearly 40% of total demand, spending around £20 billion each year.

Consumers in the non-domestic sector are diverse, covering a range of different sectors and energy needs. Businesses can be broadly categorised as Industrial and Commercial (I&C), small and medium enterprises and microbusinesses (business consumers with up to 49 employees). In this section, we assess how well the market is working for these customers by looking at the market's structural features and outcomes.

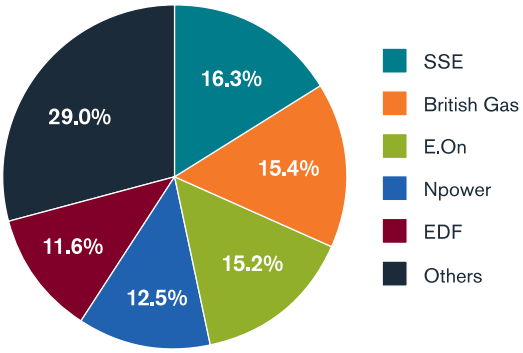
Our main finding is that non-domestic retail markets typically work well for larger businesses, but engagement among small and microbusinesses remains limited.

Large number of suppliers and moderate concentration

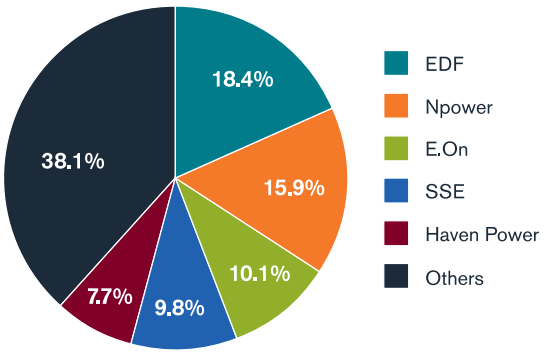
The non-domestic market is more fragmented than the domestic market, with a greater presence of suppliers besides the six largest suppliers. Figure 2.17 shows the market shares of the largest non-domestic suppliers in June 2017 for different groups of business customers.[33] The number of suppliers has increased over the last year (there were 79 in June 2016, compared to 68 in June 2017).

Figure 2.17 Non-domestic market shares for electricity in June 2017

Small-scale electricity class 3 & 4



Large-scale electricity profile class 5 to 8 + HH



Note:

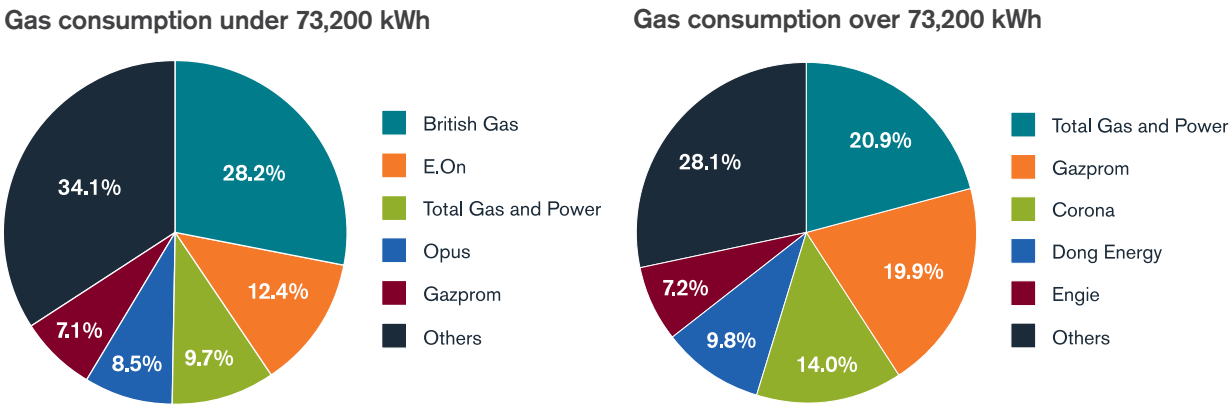
Share is measured by meter points for the low consumption market, and by volume for high consumption. Electricity profile classes' definitions refer to Elexon Guidance.
Profile classes 3 & 4 are typically small businesses; profile classes 5 to 8 are typically larger.

Source:

Ofgem's analysis of Elexon data

[33] For electricity, we look separately at supply to non-half hourly (nHH) meters for profile classes 3 and 4 (typically smaller businesses) and nHH meters for profile classes 5 to 8 or half hourly (HH) meters (typically larger businesses with higher electricity consumption), as recorded by DNOs, iDNOs and Elexon. For gas, we look separately at supply to consumers with annual consumption below 73.2MWh, and those with consumption above 73.2MWh. For the larger customers, the shares are based on the total volumes of energy supplied rather than the number of sites.

Figure 2.18 Non-domestic market shares for gas in June 2017



Note:

Share is measured by meter points for the low consumption market, and by volume for high consumption. For businesses consuming more than 73,200 kWh we have used May 2017. This is because of errors in the in June 2017 data.

Source:

Ofgem's analysis of XOserve data

Most of the smallest business customers are served by one of the six largest suppliers. In contrast, the majority of gas sold to larger businesses is supplied by firms other than these suppliers, as is over a third of the electricity supplied to larger businesses. Over the last year, the six largest suppliers continued to lose ground across all non-domestic customer types. The HHI measure of concentration shows that all non-domestic markets are moderately concentrated on the CMA's definition. The market for smaller gas customers is the most concentrated (Figure 2.19).

Figure 2.19 Non-domestic HHI

	Jun-16	Jun-17
Electricity (PC 3&4)	1,276	1,200
Electricity (PC 5-8 & HH)	1,112	1,017
Gas under 73,200 kWh	1,544	1,320
Gas over 73,200 kWh	1,115	1,270

Note:

For businesses consuming more than 73,200 kWh we have used data from May 2017. This is because of errors in the June 2017 data.

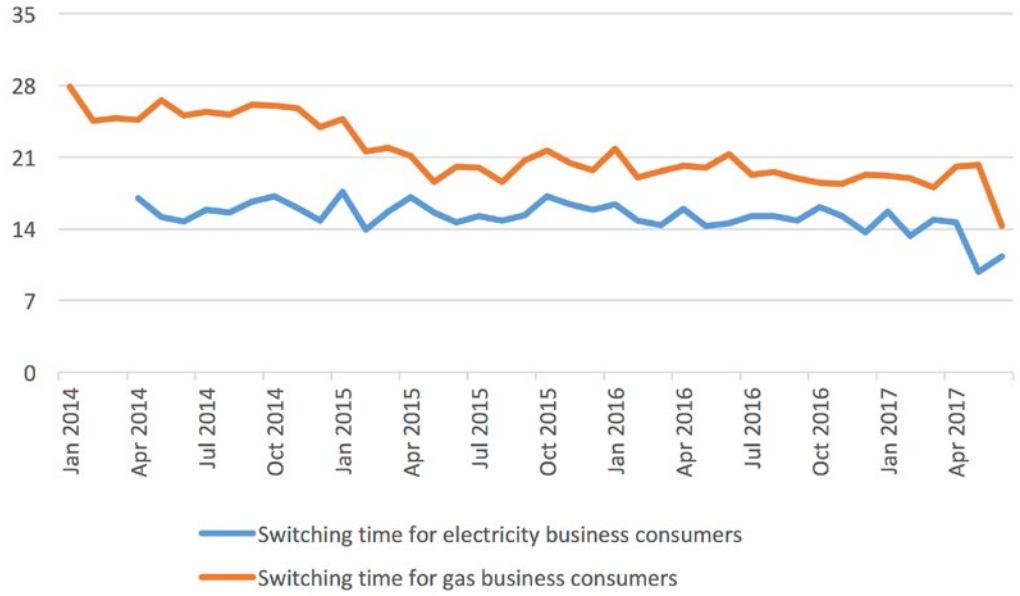
Source:

Ofgem's analysis of XOserve data.

Speed and reliability of switching have improved, but problems remain

As with domestic consumers, average switching times are typically between two and three weeks in the non-domestic market. Switching times for gas consumer improved substantially between 2014 and 2015. There was a sudden reduction in switching times for both fuel types in June 2017, though it is too early to be sure this will be sustained. (Figure 2.20).

Figure 2.20 Non-domestic average switching time in calendar days



Note:

Switching times reflect the time between a supplier switching request and the transfer taking place, and include all switches, including those with a legitimate cause for delay. There is no cooling-off period requirement for business contracts.

Source:

Ofgem's analysis of network operator data.

Our survey has consistently shown that contract lock-in is a significant factor in preventing firms from switching. In 2016, around half (53%) of small and microbusinesses that had not switched supplier, nor attempted to do so, stated that they did not try to do so because they were tied to their current contract. Around a third (32%) reported that they stayed with their current supplier to avoid exit fees.

To improve competition for non-domestic consumers, the CMA ordered suppliers to stop locking firms into automatic rollover contracts from June 2017. This means that suppliers are no longer able to charge exit fees or to include no-exit clauses in automatic rollovers. Customers can now give termination notice at any time.

Most small and microbusinesses switch or renegotiate, but some remain unengaged

Non-domestic customers have different energy needs and very different engagement features. Some both produce and consume energy, some have direct connection to the transmission network, and some look very similar to average domestic consumers. Industrial and commercial customers can typically use their bargaining power to negotiate commercially, while small businesses often rely on third party intermediaries to help them navigate the market.

Despite challenges navigating the market, two-thirds of small and microbusinesses have engaged in the market in some way in the past 12 months, through switching supplier, switching tariff or comparing deals.[34] The numbers switching supplier declined over the past year, with 21% of businesses switching in 2016 compared to 25% in 2015. But those renegotiating tariffs with their supplier have increased from 30% to 39% over the last year.

Survey data shows that the main driver for switching is the appeal of lower prices. In 2016, 85% of small and microbusinesses who switched said they did so because they were offered or found a cheaper deal from another supplier. In addition to financial reasons, around three-quarters (73%) stated that knowing their contract was coming to an end prompted them to switch.

A significant proportion of non-domestic consumers do not engage with the energy market, limiting suppliers' incentives to compete. In 2016, more than a quarter of businesses (27%) believed that it was too complex or time-consuming to find a new tariff or supplier.

Non-domestic retail energy market outcomes

Significantly higher prices for small firms

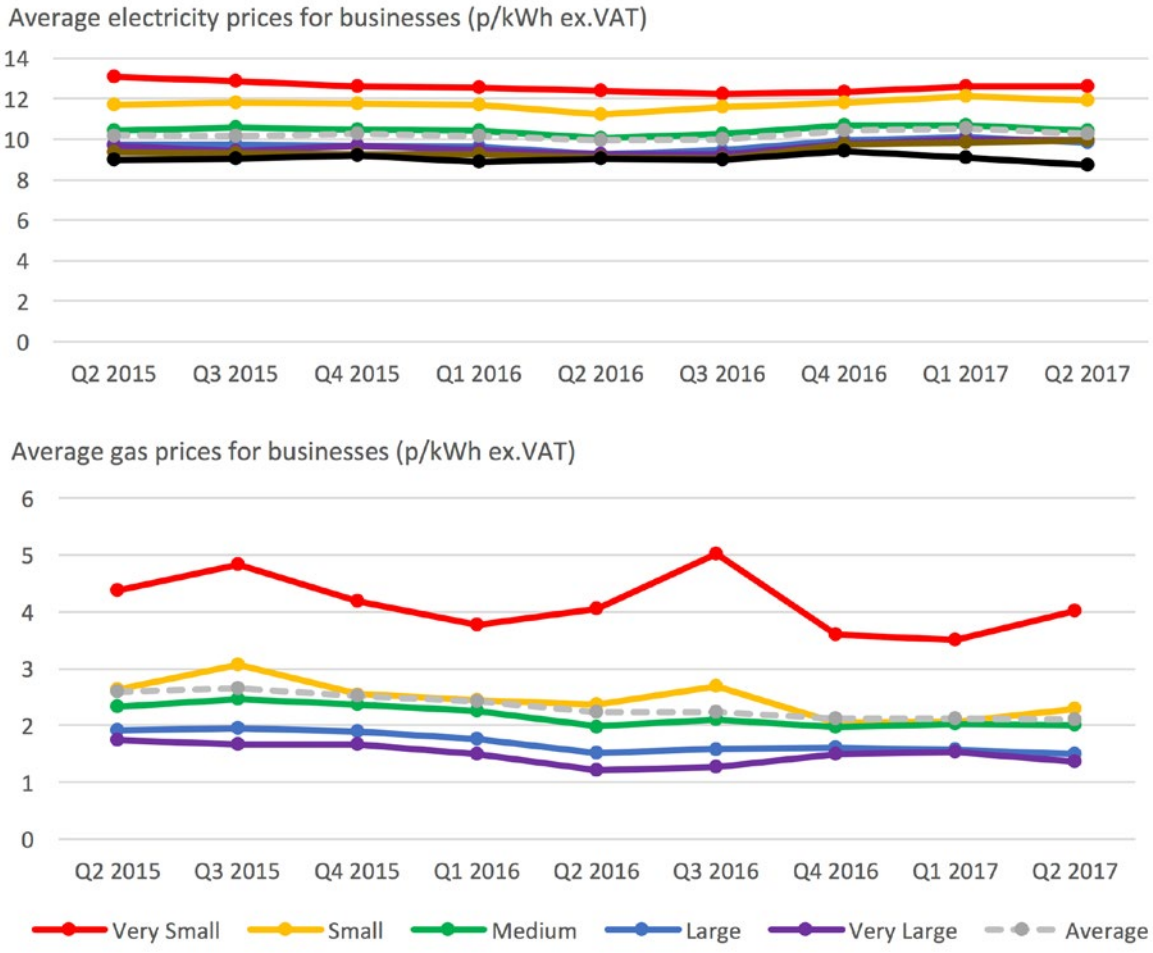
In its energy market investigation, the CMA found that, because of a lack of price transparency and high exit fees, small and microbusinesses are paying £180 million a year more than they would in a competitive market. Business tariffs tend to be bespoke and there is generally less public information available on them. Small and microbusinesses are typically on fixed-term, fixed price tariffs, and prices for the smallest – especially in the gas segment where there are also marked seasonal spikes[36] – remain significantly higher than those for larger customers. Larger businesses have a distinct advantage in being able to negotiate better deals than smaller businesses given their higher bargaining power. In addition, large I&C consumers are metered half-hourly and some have flexibility to 'load shift' from periods of high price to periods of low price.

Figure 2.21 shows that average non-domestic electricity prices are around 50% higher for very small firms than for large or very large consumers, while non-domestic gas prices can be twice as high.

[34] The figures supporting this section come from our non-domestic consumer survey.

[35] These spikes seem to be related to a standing charge effect in those months (Q3) where consumption, driven by space heating, is lowest.

Figure 2.21 Average gas and electricity non-domestic prices.



Source:

BEIS, Gas and electricity prices in the non-domestic sector, 2017

Stable satisfaction with service quality

Consumer satisfaction in the non-domestic segment has remained unchanged. Survey data shows that over two-thirds (67%) of small and microbusinesses reported they were satisfied with their current supplier's overall service in 2016, the same proportion as in 2015.[36] However, only 17% of smaller businesses in the 2017 survey would recommend their energy supplier to others.

[36] This is supported by other measures of satisfaction such as value for money (54% in 2016 vs 53% in 2015) and information provided about satisfaction with available tariffs (46% in 2016 vs 51% in 2015).

Wholesale energy markets

The function of gas and electricity wholesale markets is to provide a way for participants to buy and sell energy efficiently, now and in the future. Wholesale costs form the largest part of consumer bills, so the effectiveness of wholesale competition substantially affects final consumer bills.

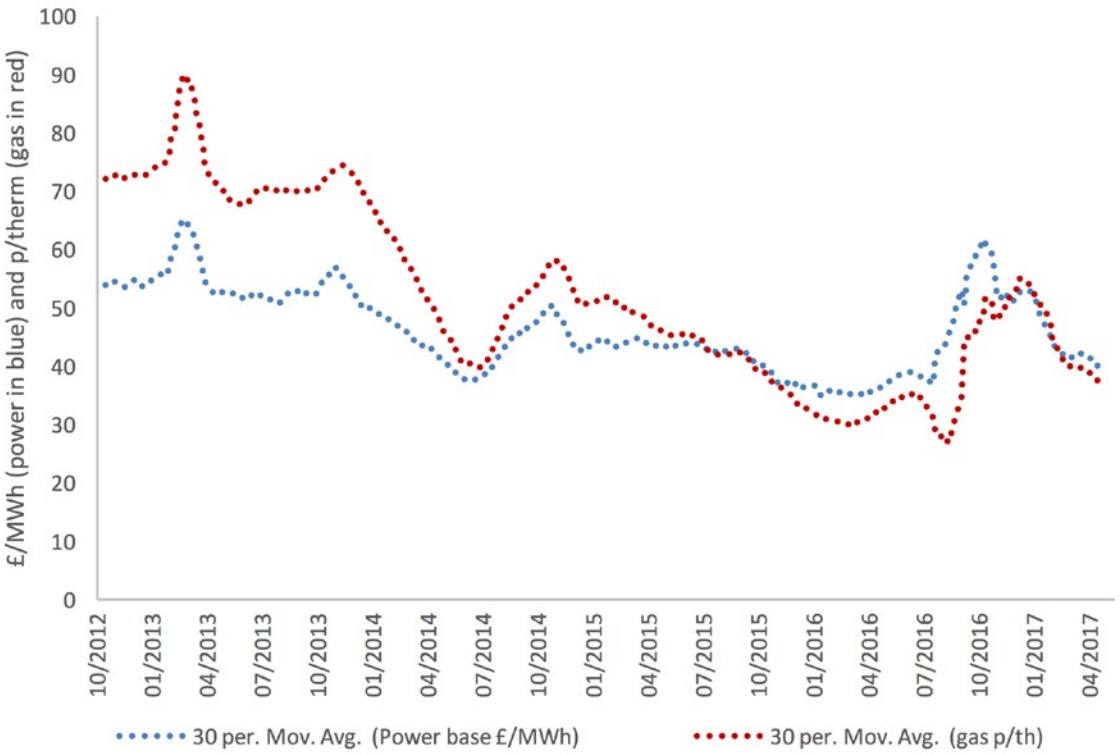
In its investigation into the energy market, the CMA found adverse effects on competition in the wholesale sector.

These included the pricing of transmission losses,[37] the process for allocating support for low-carbon generation, and the governance of the energy system.

Here we assess the structure of wholesale energy markets and the outcomes they achieve.

We consider the gas market first, followed by electricity (power). Figure 2.22 shows the substantial variability of gas and power prices since 2012.

Figure 2.22 Power and gas prices (30-day moving average, deflated to April 2017)



Note:
Power prices are baseload day ahead, gas is NBP day ahead.

Source:
Bloomberg

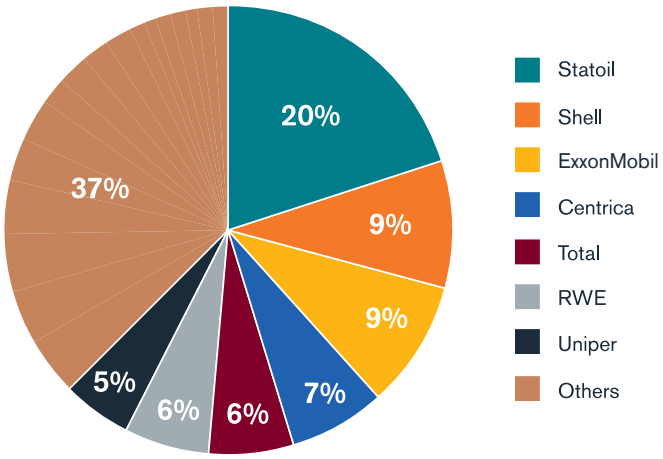
[37] During the transmission of electricity, some energy is 'lost' from the transmission system, usually in the form of heat. This lost energy is known as transmission losses.

Wholesale gas market structure

Many gas producers

The primary source of supply in the wholesale gas market has been UK Continental Shelf (UKCS) production in the North Sea. This accounted for nearly all UK gas supplies in 2000, half in 2010, and now meets 38% of UK annual demand. The rest is met by a large number of gas importers bringing in supplies from a diverse range of sources – from Norway and the European gas grid by way of interconnectors, and from Liquefied Natural Gas (LNG) via ships. Over the past year, out of 142 licensed entities trading in the National Balancing Point (NBP)[38] market, 120 traded continuously during the period, and around 22 entered and exited the platform over the year, suggesting that entry and exit are not difficult.

Figure 2.23 Shares of gas supply, 2016/17



Source:

Xoserve, National Grid, Ofgem analysis

Low gas market concentration, and plant pivotality has not been an issue

The number and diversity of gas producers are reflected in a low level of concentration in the wholesale gas market. For total supplies, the Herfindahl-Hirschman Index (HHI) of market concentration is 819, below the threshold that would suggest potential competition concerns.[39] Concentration is also low when looking at ownership of total supply capacity and trading activity between gas shippers at the NBP. It is therefore unlikely that gas producers can exercise unilateral market power to increase the price of wholesale gas.

While in general individual gas producers do not have market power, there could be times when the supply capacity of a given gas producer is pivotal to meeting demand. This could give it an opportunity to exploit temporary market power. However, our analysis based on our pivotality model[40] shows that in recent years, only one company's supply capacity – at some points in winter – could be considered necessary to clear demand in the wholesale gas market. But it was not pivotal on any given day or week, largely because in the short term (over a few days or weeks) alternative sources of supply such as gas storage could be used to make up the shortfalls.

[38] The National Balancing Point is a virtual trading location for the sale and purchase and exchange of UK natural gas.

[39] The estimate of 819 is a sizeable jump from last year's estimate (687) from the Wholesale Energy Market report 2016: this is because of a computational error in omitting the winter period. The corrected estimate for 2015 is 810.

[40] Pivotality analysis assesses the scope for market power. It does not account for the incentives on firms to exploit any dominant position, and is not an indicator of actual market abuse or anti-competitive behaviour. The model is described in Appendix 4 of our consultation on a Minor Facilities Exemption for Phase 2 of the Stublach storage facility: https://www.ofgem.gov.uk/publications-and-updates/storengy-uk-ltds-application-minor-facilities-exemption-stublach-gas-storage-phase-2

Vertical integration not a significant risk

There is some degree of vertical integration in the gas market. This can be a source of concern, as in certain circumstances vertically-integrated entities can undermine competition by using their position in one market to disadvantage rivals in another. In its final report, the CMA concluded that harm that can sometimes arise from vertical integration is not a significant risk in the gas market. This is consistent with the findings in our 2016 Wholesale Energy Market Report. On the basis of the gas supply and demand positions of the top 14 gas companies, we consider that the direct production assets of each of the six largest suppliers in the retail energy market are not sufficient to cover their respective consumer demands.

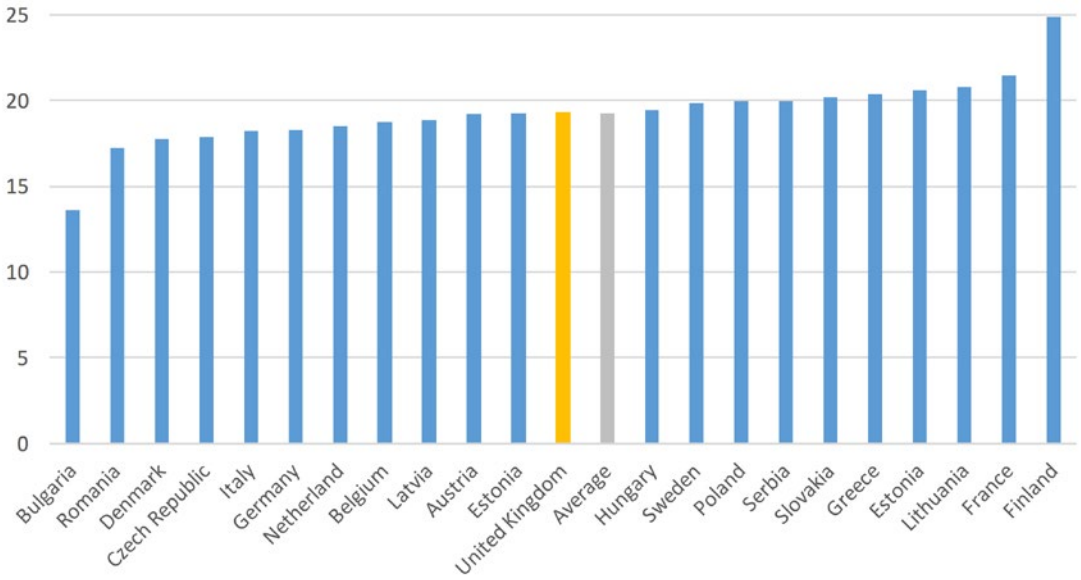
Taken together, the structural indicators show that the wholesale gas market has a competitive market structure that should deliver good outcomes.

Wholesale gas market outcomes

Gas prices largely determined by global conditions, and slightly below European average

GB has many different sources of gas supply. As almost all gas producers are price takers most of the time, there is little scope for excessive profits. And as imported gas remains the marginal source of supply, GB gas prices are substantially determined by global conditions.[41] The fall in oil prices since 2013 and relatively weak global gas demand contributed to a downward trend in GB wholesale gas prices to mid-2016.[42] If retail energy markets are working well, this should put downward pressure on consumer bills. Gas prices increased significantly during winter 2016/17, from 30p/therm to around 55p/therm, but then fell back below 40p/therm. Overall, UK gas prices were about 10% below the European average between April and September 2016, 4% more expensive between October and December 2016, and about average in the first three months of 2017 (Figure 2.24).

Figure 2.24 A comparison of average European gas prices in Quarter 1 2017 (€/MWh)



Note:

This figure presents a simple average of gas prices reported by the European Commission for each country.

Source:

European Commission, Quarterly Report on European Gas Markets, Volume 10, Issue 1, 2017.

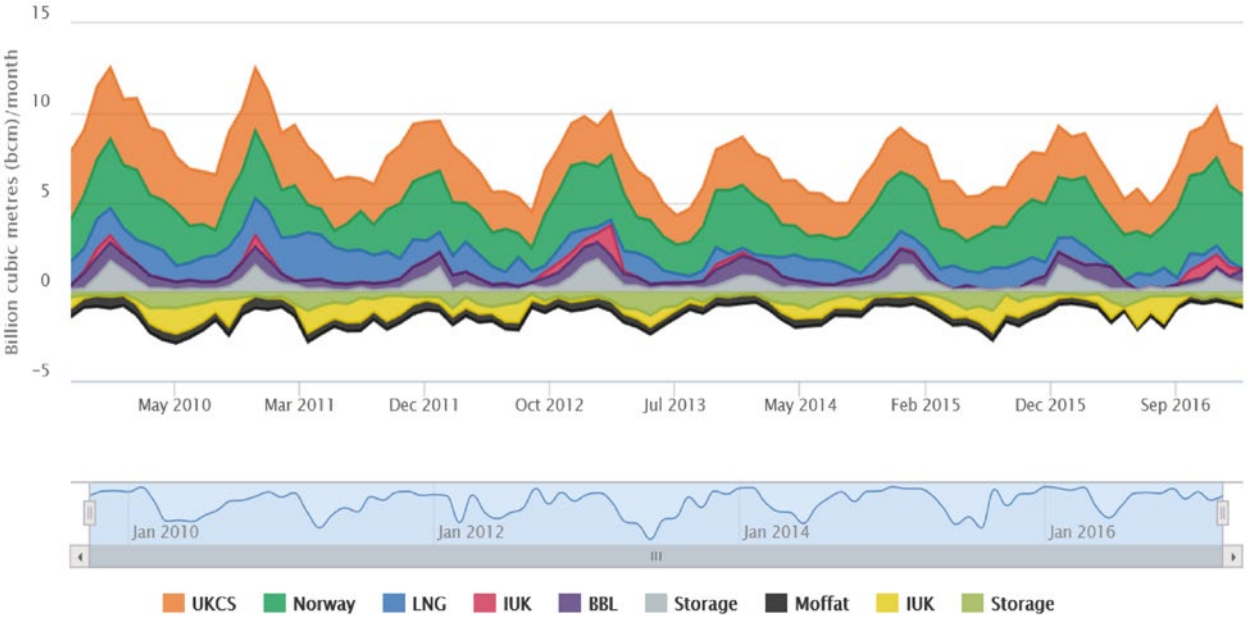
[41] Historical correlations with international gas prices have typically been above 90% https://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/10/NG-79.pdf

[42] The average day-ahead price in 2016 was 35 p/therm, compared to 43 p/therm in 2015. https://www.ofgem.gov.uk/system/files/docs/2017/08/new_donagh_report.pdf

Flows into GB consistent with efficient deployment of resources

Patterns of gas flows into GB are consistent with competition driving the efficient deployment of gas sources and infrastructure (Figure 2.25). Inflows of gas from the UKCS – which connects only to GB – typically supply a 'baseload' level of gas. As production has fallen over time, inflows from Norway have increased. More flexible infrastructure such as storage, interconnectors and LNG compete to meet demand. Storage facilities tend to inject into storage when demand is low (in summer) and withdraw when demand is higher (in winter). Interconnectors demonstrate similar patterns, tending to export when GB demand is low and import when demand and price differentials with the continent are high.[43]

Figure 2.25 Gas flows



Note:

UKCS is UK continental shelf, LNG is liquefied natural gas, IUK, BBL and Moffat are gas pipelines connecting with Belgium, Netherlands and Ireland.

Source:

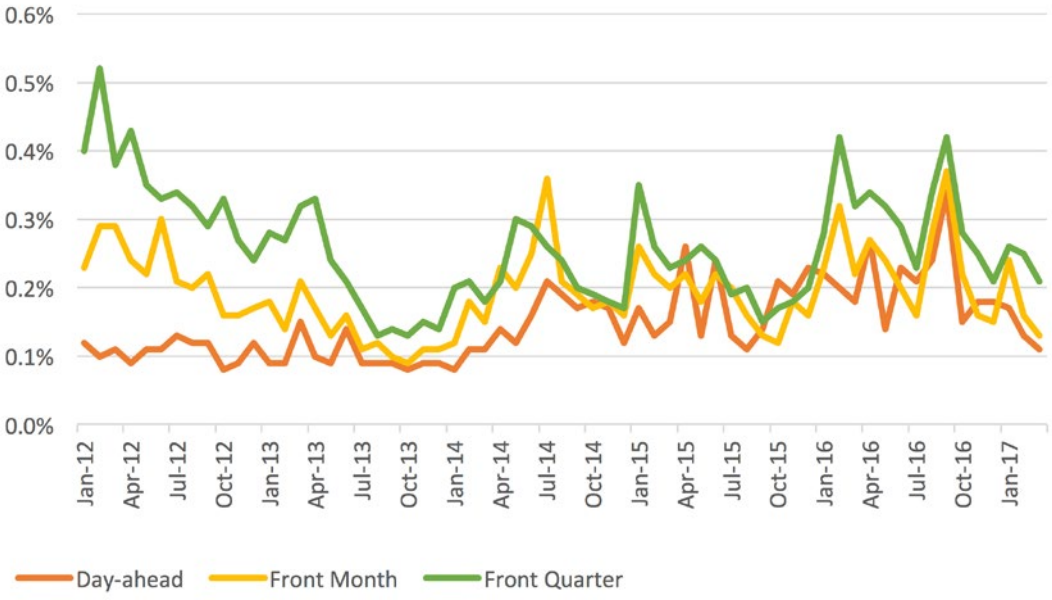
Ofgem Data Portal, Wholesale Market Indicators

[43] For instance, National Grid's review of winter 2016/17 highlights changes in direction of flows with Belgium following price differentials.

Relatively high liquidity and access

The GB gas wholesale market is highly liquid, allowing market participants a degree of confidence that price reflects underlying market supply and demand. GB bid-offer spreads[44] compare favourably with the rest of Europe, although they have risen recently (Figure 2.26).[45] The churn ratio – the number of times a volume of gas is traded – averaged 22 in 2016, indicating a high level of forward market trading activity.[46] This should support competition in the retail markets by enabling suppliers to smooth purchasing costs.

Figure 2.26 Gas bid-offer spreads for selected traded products, 2012-2017



[44] The difference between the best bid (to buy) and the best offer (to sell) in the market for a particular contract. As buyers of gas pay a portion of the spread in addition to the 'underlying' cost of gas, the higher the spread, the higher is the cost of gas.

[45] See 'tradability index' in https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/05/European-traded-gas-hubs-an-updated-analysis-on-liquidity-maturity-and-barriers-to-market-integration-OIES-Energy-Insight.pdf

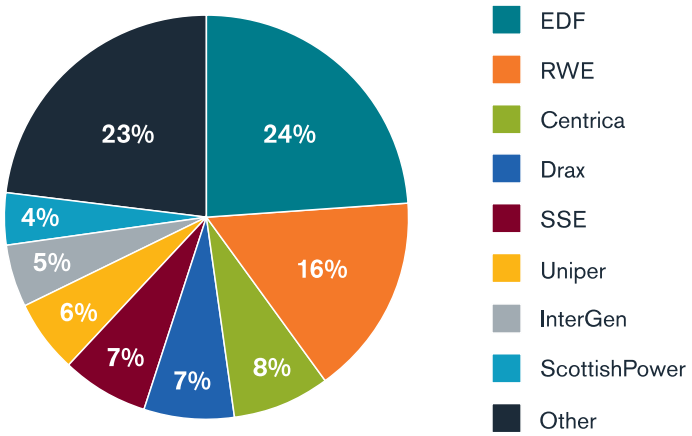
[46] A comparison of churn rates across a number of traded gas hubs shows that British NBP churn rates are among the highest in Europe. See table 4, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/05/European-traded-gas-hubs-an-updated-analysis-on-liquidity-maturity-and-barriers-to-market-integration-OIES-Energy-Insight.pdf

Wholesale electricity market structure

Many wholesale electricity market participants

In GB, there are 149 firms with a licence to generate electricity, and at least 137 plants provided electricity during 2016.[47] There are four operational interconnectors and ten that are under construction or GB approved. Since the start of 2016, 18 new generating firms have signed up to the Balancing and Settlement Code (BSC), while three have exited, suggesting that any barriers to entry and exit are not prohibitive.[48]

Figure 2.27 Market shares of wholesale electricity supply (2016)



Note:

We calculate market shares from metered volumes on national transmission system associated with individual power stations and interconnectors (called Balancing Mechanism Units or BM units). We have made assumptions about which companies own each BM unit. Volumes are split based on equity stakes.

Source:

Ofgem data portal

[47] BSC statistics from Elexon, plant output from eos.auroraer.com. There are also many unlicensed generators.

[48] This does not account for changes in active or inactive signatories.

Electricity market more concentrated than gas, but less than in other European countries

The wholesale electricity market is moderately concentrated, with eight generators providing three-quarters of metered volumes. However, the market is becoming less concentrated in terms of transmission system metered volumes. The HHI fell from 1,267 in 2015 to 1,117 in 2016, the lowest measure this decade.[49] Total installed capacity increased to 103GW in 2016, from 97 GW in 2015, while demand was stable.[50] This should reduce the potential for any one generator to influence prices. Against many measures of concentration, the GB market is less concentrated than most other European markets.[51]

Increasing possibility of generators being pivotal – from a low base

A reduction in flexible generating capacity may make some generators more likely to become pivotal at clearing demand. A quarter of flexible coal-fired generation capacity closed between 2011 and 2015. Our assessment of the GB market as a whole suggests a small up-tick in the number of hours of pivotality in 2016. However as with 2014 and 2015, the absolute level is very low – limited to a small number of hours (up to 20). When accounting for the flexibility of different kinds of capacity, only two companies exhibit more than a couple of hours of market power. It is possible that there is greater scope for market power at a sub-national level (for instance, as a result of transmission constraints). Ofgem actively monitors the market to help prevent potential abuses of market power.

[49] Based on review of Ofgem National Reports to European Commission.

[50] National Grid Future Energy Scenarios 2015 and 2016.

[51] Compared with other European countries, GB has over the last ten years typically ranked among the highest for the number of main generators that produce at least 5% of national net electricity generation (see http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_market_indicators) and one of the lowest for market shares of the largest generator in the electricity market. However, it should be noted that the level of interconnection with other markets is relatively limited in GB compared with continental European countries.

Vertical integration still unlikely to present a material barrier

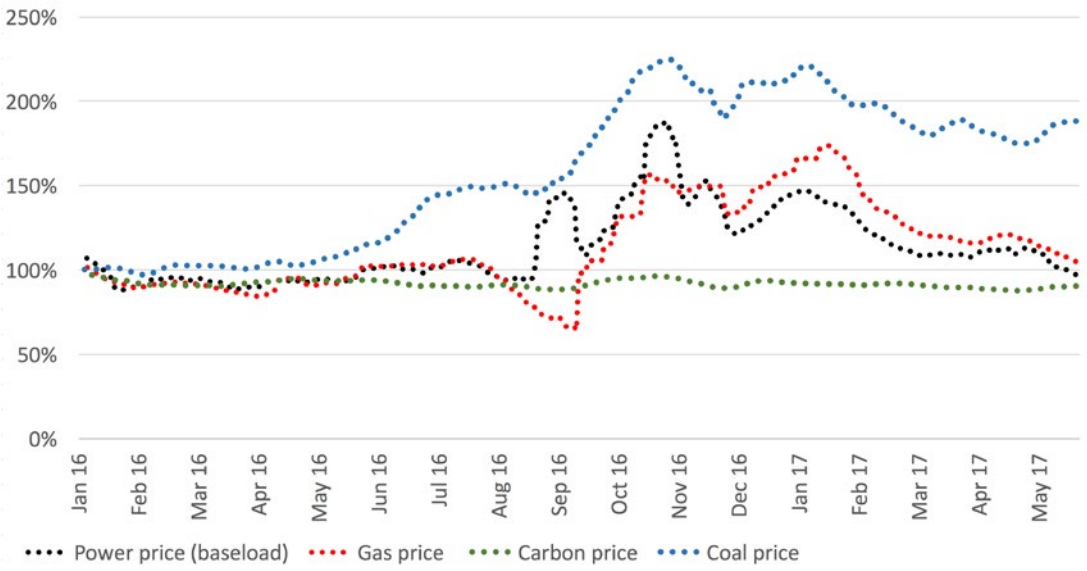
In its energy market investigation, the CMA did not identify any areas where vertical integration in the electricity market is likely to have a detrimental impact on competition for independent suppliers or generators. The level of vertical integration has not changed significantly since.[52] Moreover, the generation assets of vertically-integrated firms are not enough to meet their customers' demand. We therefore consider that there is limited if any scope for vertical integration to create barriers that would impede firms that are not vertically integrated.

Wholesale electricity market outcomes

Cost-reflective but high electricity prices relative to other European countries and falling profits

The main drivers of power prices are currently the costs of gas, coal, and carbon (through the carbon price). Since the start of this decade, wholesale electricity prices have been closely related to gas prices, with a correlation coefficient between day ahead gas and power (baseload) of 0.76. Overall, pricing patterns appear broadly to follow cost developments (see Figure 2.28) since 2016. This is consistent with (though does not prove) competition effectively exerting downward pressure on prices as input costs fall.

Figure 2.28 Index of power, fuel and carbon prices
(4 January 2016 = 100, rolling average of 10 days, deflated)



Note:

Power is day-ahead baseload prices, gas is day-ahead NBP, coal is one month ahead, carbon is daily price.

Source:

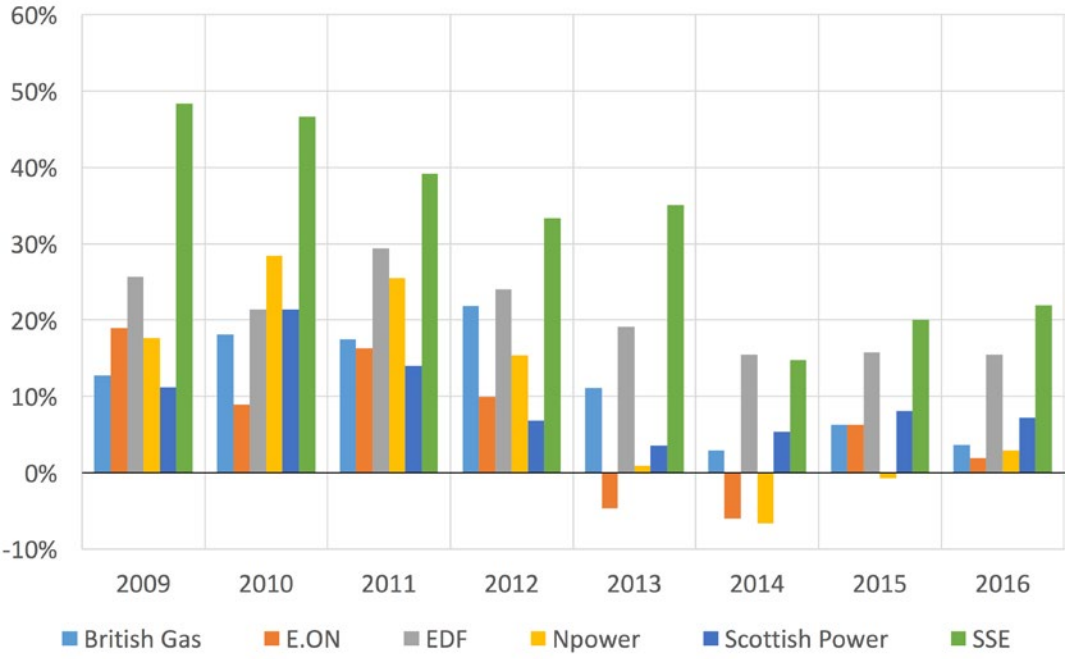
Bloomberg and Aurora

[52] E.ON and Uniper have been operating as separate legal entities since January 2016. On the other hand, Drax Group acquired Opus Energy Group (retail) in February 2017.

This is supported by analysis of outcomes of the UK wholesale market:

- Historic calculations of 'up-lifts' – the difference between modelled system variable costs and out-turn prices – for GB and Germany are consistent with competition in Britain being at least as effective as in Germany in driving system costs down to the actual cost components.[53]
- the CMA's energy market investigation concluded that out-turn levels of generator profitability are not excessive. We have likewise not found evidence that generators are making excessive profits. Figure 2.29 shows the evolution of electricity generation profit margins. SSE and EDF profits continue to be much higher than others. The aggregate margin of the six largest generators was 11% in 2016, 5% lower than the average of the last eight years, consistent with competition applying downward pressure on price.[54]

Figure 2.29 Generation margins of large suppliers



Note:

Margin is earnings before interest and tax of aggregate electricity generation as a proportion of generation revenues. SSE data refers to financial years.

Source:

Consolidated Segmented Statements

However, GB wholesale electricity prices were the highest in the European Union during most of 2016-17 (Figure 2.30 shows the first quarter of 2017).[55] The average price differential with the EU average ranged from €11 per MWh to €22 per MWh in the four quarters. This is substantially due to policy factors, including the UK carbon price support and network charges, which GB generators bear unlike most continental counterparts.[56]

[53] German wholesale markets may form a reasonable comparator as they are considered highly competitive, assisted by substantial interconnection. This analysis is based on data from the energy consultancy Aurora at https://eos.auroraer.com/gbpower/. Aurora's results hinge on their modelling techniques and assumptions, and are independent of Ofgem.

[54] It is also consistent with, for instance, the expected effect of the growth of subsidised low marginal cost renewables – though there is little conclusive evidence of this having a sizeable effect on GB prices to date.

[55] This is sensitive to the exchange rate and does not necessarily reflect final cost differences to energy consumers. Data were unavailable for Cyprus, Malta and Croatia. A simple and unweighted average over the four quarters suggests a €16 per MWh difference.

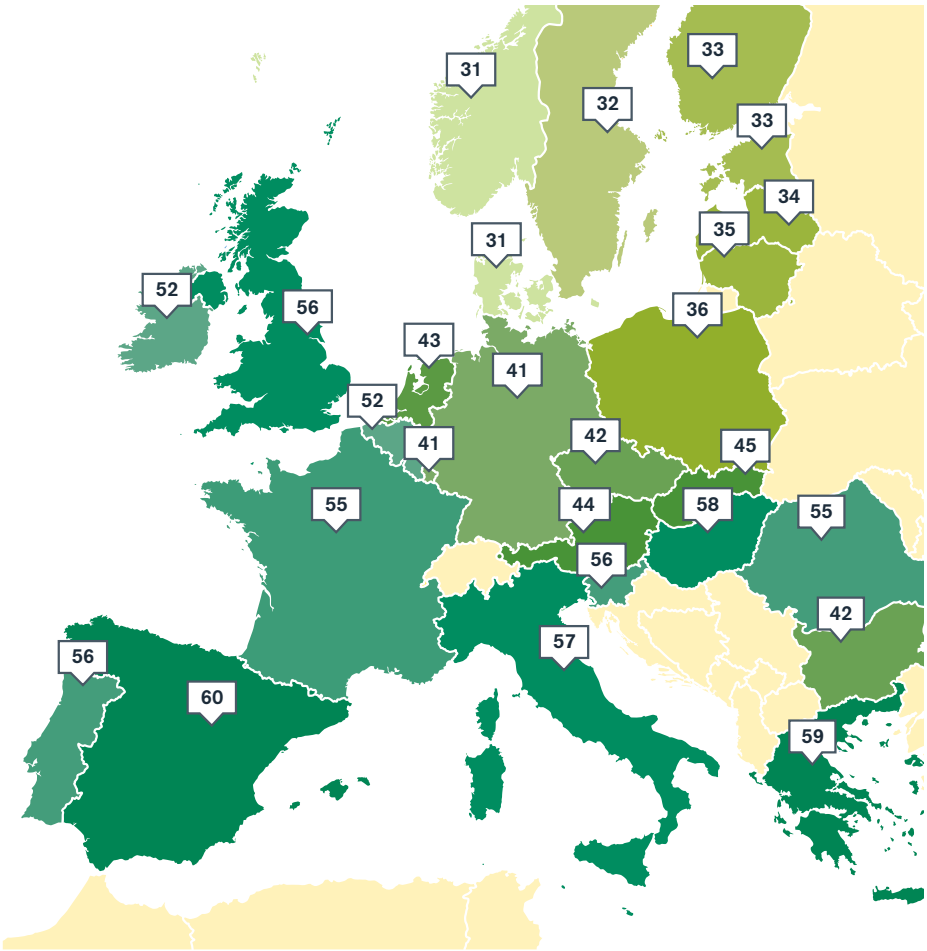
[56] See table 4.1 of https://www.entsoe.eu/publications/market-reports/Documents/ENTSO-E%20Overview%20of%20Transmission%20tariffs%202015_FINAL.pdf

- Carbon price support: over 2016/17, carbon price support added an additional £18 per tonne of carbon dioxide emitted to GB fossil-fuelled generators. This could increase running costs for a typical gas (CCGT) plant by around £7 per MWh, and around £17 per MWh for a typical coal plant. The net effect of these cost increases on prices will depend on dynamic effects and interactions, such as impacts on interconnector flows, coal retirement, and stimulation of renewables, which are hard to estimate. But modelling in advance of the introduction of the Carbon Price Floor is consistent with carbon price support increasing 2016/17 wholesale prices by between £5 and £10 per MWh.[57]
- Network charges: over 2016/17, charges for use of the transmission network may have added around £1.70 per MWh on average to wholesale prices in GB.[58]

GB also has a lower level of cross-border capacity relative to demand compared to other countries. Increased interconnection in future should stimulate price convergence, reducing GB wholesale prices.

Figure 2.30 Comparison of average wholesale baseload prices in Europe in Quarter 1 2017, €/MWh

Country	
Norway	31
Denmark	31
Sweden	32
Estonia	33
Finland	33
Latvia	34
Lithuania	35
Poland	36
Germany	41
Luxembourg	41
Bulgaria	42
Czech	42
Netherlands	43
Austria	44
Slovakia	45
Average	45
Belgium	52
Ireland	52
France	55
Romania	55
Portugal	56
Slovenia	56
UK	56
Italy	57
Hungary	58
Greece	59
Spain	60



Source: European Commission Quarterly Report on European electricity markets, Volume 10, Issue 1, 2017.

[57] For instance, Redpoint (2012) modelling suggests the short term impact of each additional £10/tonne is a £5/MWh increase in wholesale prices.

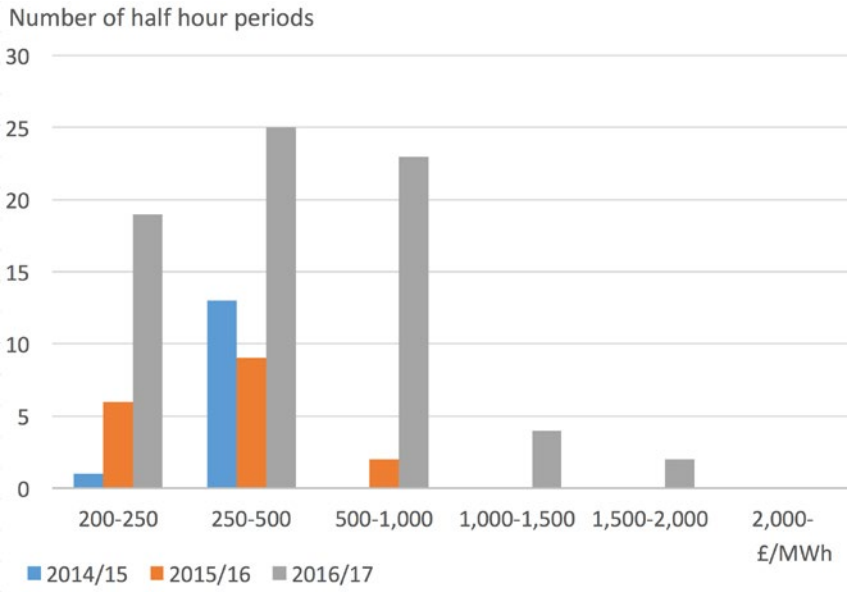
[58] Network charges are charged on capacity rather than energy flows. This means that the extent to which charges are passed on in wholesale prices in any particular year is uncertain. £1.70 per MWh is derived by dividing £453 million costs on generators by 258 TWh generator output. See Table 10 in http://www2.nationalgrid.com/UK/Industry-information/System-charges/Electricity-transmission/Transmission-network-use-of-system-charges/

Significant price spikes observed

The structure of the wholesale electricity market is competitive overall, and should support good outcomes. Opportunities could nevertheless arise for some generators to exercise market power.

In 2016-17, the frequency of price spikes in the Balancing Mechanism, which National Grid uses to balance electricity supply and demand, increased significantly (Figure 2.31). Margins were somewhat tighter in 2016-17 compared with previous years.[59] This has meant that in certain periods competition may not have been as strong, potentially leading to more peaky and volatile prices.[60] Price spikes can be understood as part of efficient price formation when they are the result of tight adequacy margins. They can send useful signals to investors, for instance, about the characteristics of the capacity required by the market, which we reinforced through our Electricity Balancing Significant Code Review.

Figure 2.31 Frequency of high system buy prices



If not driven by (unmanipulated) market conditions, price spikes could indicate market abuse. To ensure against this, Ofgem scrutinises market behaviour to distinguish price spikes that reflect actual market conditions from those that could mean market abuse. Where there is evidence of this, Ofgem can take action under the Competition Act, the Transmission Constraint Licence Condition and the EU regulation on energy market integrity and transparency (REMIT).[61]

Diverse supplies are dispatched largely according to relative costs, but with room for improvement

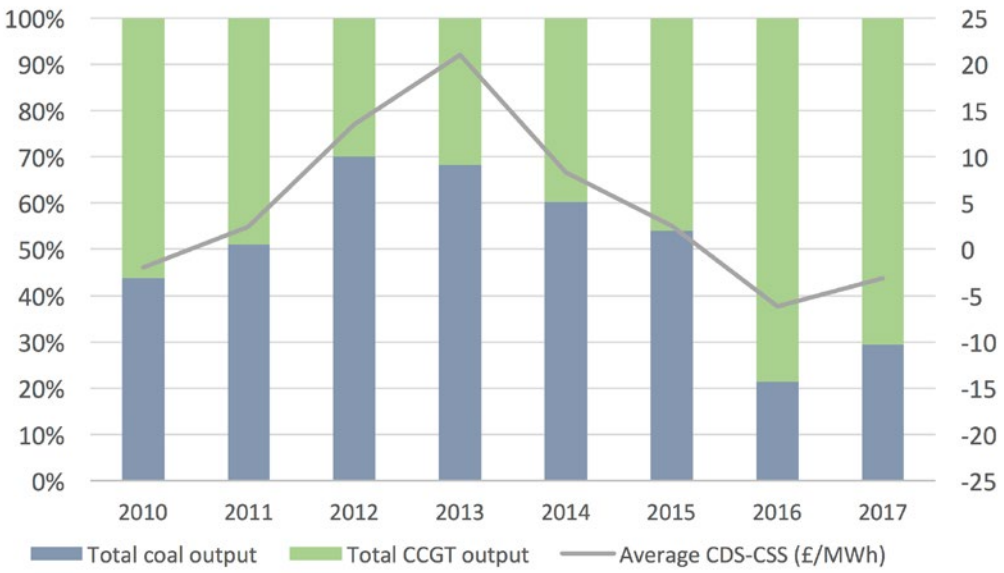
The GB generation mix is diverse. Fuel sources include coal, nuclear, wind, solar, oil, hydro, bioenergy, gas, pumped storage and net imports via interconnectors. Coal-fired generation has declined significantly, while government subsidies have fuelled a large increase in renewable generation. GB trading arrangements have been designed to bring about efficient deployment of resources. Figure 2.32 shows that gas (CCGT) and coal tend to displace each other according to their relative cost advantage, and is consistent with competitive forces driving the efficient deployment of resources.

[59] The average out-turn margin during the tightest 50 hours of each financial year has fallen steadily since 2013/14 with a cumulative 16% reduction by 2016-17 (as measured by reported maximum export limits, using Bloomberg data).

[60] Note that the energy transition could also weaken market power in other periods. For instance, analysis of the Italian wholesale market suggests that market power was weakened by renewable penetration during peak hours over 2010 to 2013. See http://www.eprg.group.cam.ac.uk/wp-content/uploads/2017/06/1711-Text.pdf

[61] In December 2016, we published a letter outlining our position on the interaction between the pricing of scarcity in the wholesale energy markets and potential market conduct issues. See https://www.ofgem.gov.uk/publications-and-updates/open-letter-scarcity-pricing-and-conduct-wholesale-energy-market.

Figure 2.32 Relative output of gas CCGT and coal (% of combined output, left axis) and difference between spark (CSS) and dark (CDS) clean spreads (£/MWh, right axis)



Source:

Ofgem analysis of eos.Auroraer.com data

However, we think issues with the way network costs are borne by users have distorted the playing field between generation that connects to the transmission network and generation that connects at the distribution network or on the consumer's site. These issues may give a competitive advantage – one that does not reflect any fundamental benefit to the consumer – to generation that connects at the distribution or on-site level. Ofgem is reviewing and reforming how network costs are passed on to users.[62]

Other areas for improvement include inefficient interconnector flows between GB and Ireland. European regulatory bodies estimate that these contributed to a net societal welfare loss (shared between both countries) of around £90 million during 2016. This emphasises the importance of reform in the pipeline.[63]

Liquidity increasing, but is lower than in some markets

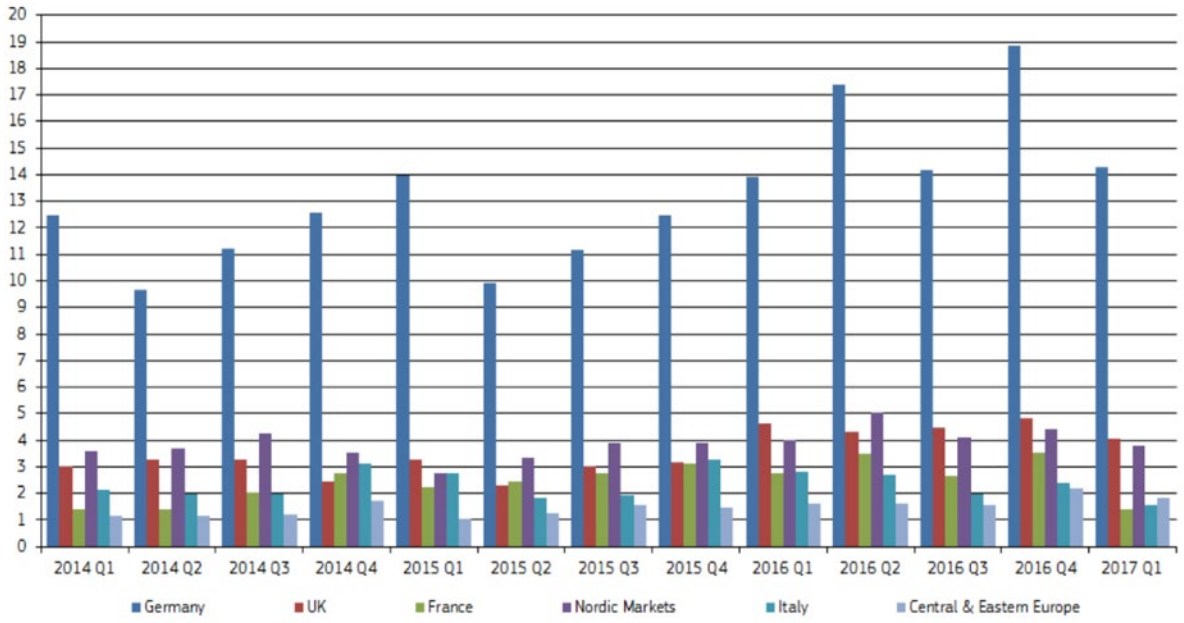
There are a large number of independent generators, platforms and products to support liquidity. However, GB electricity markets remain consistently less liquid – for instance in measures of churn – than some international power markets, in particular market leader Germany (see Figure 2.33).[64]

[62] https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-consultation and https://www.ofgem.gov.uk/publications-and-updates/embedded-benefits-impact-assessment-and-decision-industry-proposals-cmp264-and-cmp265-change-electricity-transmission-charging-arrangements-embedded-generators

[63] 'Market coupling' is a key element in the European Commission's approach to creating an integrated energy market. Market coupling with Ireland, expected to come into effect on May 2018, will drive more efficient allocation of interconnector capacity and flows. See ACER/CEER Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2016.

[64] High liquidity in the German market is due to a range of factors, including high interconnection with neighbouring markets.

Figure 2.33 Churn rates on selected European wholesale electricity markets



Source:

EC Quarterly Reports on European Electricity Markets Q2, 2017

In 2014, we introduced our Secure and Promote policy to help increase liquidity. This included requiring the eight largest generating companies to provide access to hedging products in the wholesale market.[65] Some indicators of liquidity showed some improvement during 2016. Bid-offer spreads of mandated products have dropped (averaging below 0.5% since implementation), the churn ratio has increased slightly, and the total traded volume of electricity increased by 36% to 1,432 TWh. Independent suppliers have told us they are finding it easier to access the products they need.

However, it remains to be seen whether these improvements are sustained. The increase in trading and churn may have been driven by increased price volatility rather than by a structural change.

[65] https://www.ofgem.gov.uk/publications-and-updates/wholesale-power-market-liquidity-statutory-consultation-secure-and-promote-licence-condition

Ofgem actions to improve competition

Ensuring the market works effectively for all consumers will be tough. But our ambition is clear – collectively, we need to build a transformed energy sector that provides secure and clean energy to consumers – at a cost that consumers recognise as fair.

Ofgem will continue to monitor energy markets to ensure that we act quickly to address problems. Where the market is not working well, we are taking action to protect consumers, both by reducing the harm that results, and by tackling the root causes. In addition, we are taking specific actions to implement the CMA remedies, to improve retail competition for household and business consumers, and to facilitate wholesale market competition.

- We have been implementing **the CMA's proposed remedies** since it published its energy market investigation in June 2016. In particular, we have been focussing on making it easier for people to engage in the market. Our implementation strategy and detailed implementation plan are set out on our website. To improve competition, we lifted restrictions on the number of tariffs suppliers may offer consumers. We have also introduced changes to our accreditation scheme for price comparison sites, which should mean that consumers will more easily be able to use Ofgem-accredited price comparison sites to find a tariff they can switch to through the sites. We are trialling several different ways to improve consumer engagement, including trialling a new 'Check Your Energy Deal' online switching service. We will assess the results of these trials at the end of 2017. As discussed above, we introduced a safeguard tariff to protect consumers on prepayment meters, based on the CMA's methodology.
- In **domestic retail markets**, we are undertaking a programme of work, besides the CMA remedies, to ensure competition works more effectively and consumers are protected. This includes transforming current switching arrangements to deliver faster, more reliable switching for consumers by 2020 through our Switching Programme. We will set safeguard tariffs (for vulnerable customers and, if legislation is passed, for all households on default deals) to protect customers from the lack of competition. In parallel, we will work with industry to create the conditions for a better functioning market so that price protections can be scaled back from the early 2020s. We are also exploring the case for wider use of collective switching, to ensure that even less-engaged consumers can benefit from competition.
- In **non-domestic retail markets**, we are consulting on measures to help improve access and outcomes for small businesses. This includes potentially extending protections that household consumers already benefit from – such as cooling-off periods and reducing a supplier's ability to object to a customer switching – to the smallest microbusiness customers. We recognise that data on the non-domestic sector is limited and we have recently started to collect a broader set of data about the non-domestic sector to allow for more comprehensive analysis.
- In **wholesale markets**, we have approved modifications that will correct the adverse effects to competition identified by the CMA in relation to transmission losses, and are monitoring its introduction. This reform comes into effect in 2018. We are also continuing to monitor liquidity developments, and are conducting a review of the Secure and Promote policy.

Chapter 3: Affordability and vulnerability in the domestic sector

Summary of findings

- In 2016, the average household's dual fuel bill was 16% lower than its peak in 2013. Despite this, bills remained higher than 10 years ago, and prices increased in 2017.
- In England, fuel poverty is affecting more children and young people, but consumers aged over 60 are now the least likely to be fuel poor. In Scotland, pensioners remain the most likely group to be fuel poor.
- Consumers on PPMs and those not connected to the gas grid have less choice and cannot access the cheapest prices, although there have been some improvements
- Consumers use significantly less energy than 10 years ago, reducing their potential bills by around £280 (20%) from what they would have been. Most of this change is down to energy efficiency improvements, but we are concerned that, for consumers less able to invest in efficiency, part of their reduction in gas consumption is due to self-rationing.

Our approach

By themselves, competitive markets cannot ensure that energy markets deliver all the outcomes that energy users care about, including affordability and the protection of consumers who are not able to engage effectively in the market. Even if suppliers provide energy at the lowest feasible prices, some consumers may find it hard to manage their bills. In addition, limited competition in some segments of the domestic market makes affordability a greater concern. This can potentially leave customers with high bills, debts, or under-heated homes.

Ofgem's principal statutory objective is to protect the interests of existing and future consumers. We must take into account the needs of those who are of pensionable age, disabled, chronically sick, on low incomes, or living in rural areas, and we can take into account the needs of other groups of consumers.[66]

In this chapter, we examine the overall cost of energy bills, and identify which customers are struggling to pay them. We then analyse the two components of energy bills: the prices that customers pay per unit of energy, and the amount of energy they consume, including the impact of energy efficiency programmes.

[66] Ofgem, Consumer Vulnerability Strategy 2013.

Defining affordability and vulnerability

Affordability in the energy sector is typically defined in relation to fuel poverty.[67] Fuel poverty is defined differently in England, Scotland and Wales, and is explored in detail below.

We consider a consumer **vulnerable** if their personal circumstances and characteristics combine with aspects of the market to make them:

- significantly less able than a typical consumer to protect or represent their interests; or
- significantly more likely than a typical consumer to suffer detriment (such as higher energy costs or poor service), or that detriment is likely to be more substantial.

There are many reasons why people become vulnerable. Some of those are long-lasting, such as being in poverty or having a mental or physical illness or disability, but others may be transitory, such as pregnancy, becoming unemployed, or suffering a bereavement.

Support for vulnerable consumers

Government sets policy to protect and support consumers who are vulnerable or less able to afford their energy needs. Support takes three forms:

- Financial support, which subsidises consumers' bills or controls prices. For instance, the Warm Home Discount scheme reduces bills by £140 for certain low-income pensioners. The PPM safeguard tariff caps the amount that companies can charge PPM customers for a given level of consumption.
- Support in helping consumers improve their energy efficiency, which reduces the amount of energy consumers need to purchase. For instance, Energy Company Obligation installs energy-efficient boilers and insulation in low-income households.
- Non-financial support to help vulnerable consumers engage in the energy market, such as through training and information, or services which suppliers are required to provide, such as for access, safety and communication.

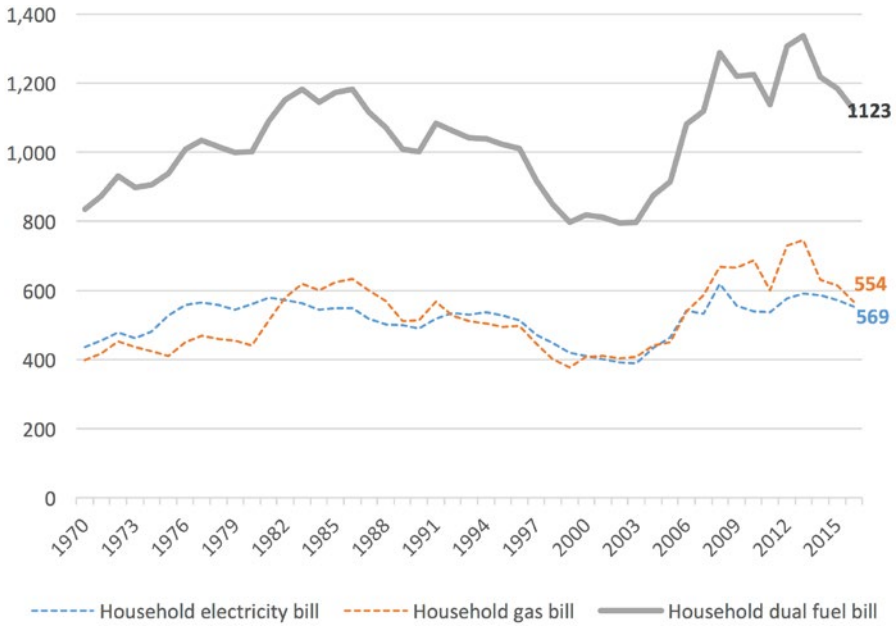
[67] UKRN, Understanding Affordability Pressures In Essential Services, 2015.

Energy bills

Energy bills have fallen, but they are still higher than 10 years ago

In 2016, households on average paid £1,123[68] for gas and electricity, £214 (16%) less in real terms than in 2013 when dual fuel bills last peaked. During the same period, average spending on gas fell by £177 to £554, 24% below peak spending in 2013. Electricity bills were £37 (6%) lower (Figure 3.1).[69] Despite reductions, average bills remain 4% higher than bills 10 years ago (£1,081 in 2006), and 39% higher than 15 years ago (£810 in 2001).

Figure 3.1 Average Household Bill (£ per household in 2016 real prices)



Notes:

Prices have been adjusted for inflation using GDP deflators.
From 2009 we use financial reports from the six largest energy suppliers, excluding consumers with other suppliers.
Dual fuel combines the average gas bill with the average electricity bill.
We do not control for the 6% of consumers with electric heating.

Sources:

Ofgem, Consolidated Segmental Statements, 2009 to 2016; BEIS, Energy Consumption statistics in the UK (1970 to 2008); BEIS, United Kingdom housing energy fact file (1996 to 2008); BEIS, Historical gas data: gas production and consumption and fuel input 1920 to 2016; DCLG, Live tables on household projections, Table 4.01; and Office of National Statistics, Total household expenditure on energy (1970 to 2008).

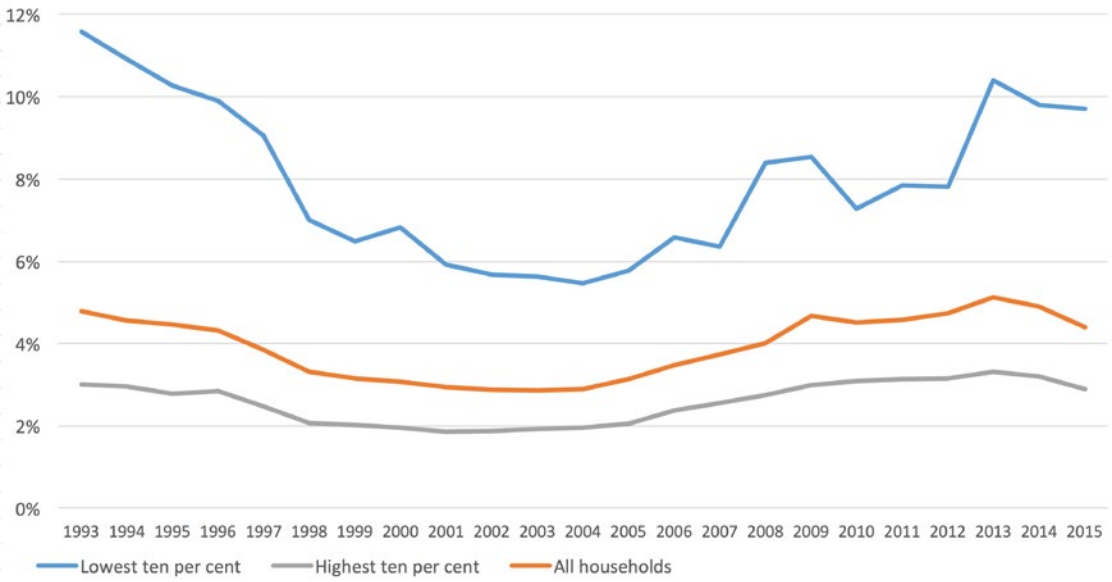
[68] This cost is based on the average amount of gas and electricity that customers of the six largest energy suppliers consumed in 2016, as recorded in the Consolidated Segmental Statements. Our retail market indicators give tariff estimates based on Typical Domestic Consumption Values (TDCVs). TDCVs use the median consumption level, which is lower than the average (mean) consumption level. We use the average to show the combined effect of actual changes in prices and consumption.

[69] See sources for Figure 3.1.

Many suppliers announced price increases during 2017. These increases affect both the cheapest tariffs available in the market (returning to 2015 levels), and the six largest suppliers' SVTs (returning to 2014 levels). The impact of these changes on customer bills will depend on levels of consumption.

Changes in energy prices affect consumers with low incomes most. In 2015, the 10% of households on the lowest disposable incomes in United Kingdom spent 10% of their household expenditure on energy costs, while households with the highest incomes only spent 3% (Figure 3.2).[70] Consumers spend more on energy as a proportion of their income than they did ten years ago. Of course, changes in this measure partly reflect changes in disposable incomes as well as energy bills.

Figure 3.2 Energy costs as a percentage of disposable household expenditure



Notes:

Energy costs includes all types of fuel. Most people use gas and electricity. Other fuels include solid fuels and oil.
Disposable income is defined as gross weekly cash income less the statutory deductions and payments of Income Tax and National Insurance contributions.

Sources:

Office of National Statistics, Living Costs and Food Survey

[70] Ofgem analysis of the Office of National Statistics, Living Costs and Food Survey

Concerns about energy bills have fallen, but remain for a significant minority

The proportion of consumers who say they have been worried about paying for their energy bills fell by almost half between March 2013 and March 2017, from 59% to 30%. This reduction tracks the fall in average energy bills relatively closely, and is also in line with falling concerns in other areas of expenditure such as food, rent, and transport.[71]

Fuel poverty in England increasingly affects children and young people

Fuel poverty is not the same as poverty. Across the UK, 17% of people live below the poverty line.[72] Fuel poverty tries to express the impact of high energy needs on people with low incomes. Each of the nations in the UK define fuel poverty differently. This means that figures across England, Scotland and Wales are not comparable, and we analyse them separately.

- In England, a household is said to be fuel poor if it has above-average energy needs, and if it were to spend the amount needed to fully meet its energy needs, it would be left with income below the official poverty line.
- In Scotland and Wales, fuel poverty is defined as households which would have to spend 10% of their income to achieve adequate standards of warmth (although their calculating methods differ).

England

In England in 2015 – the latest year available – 2.5 million households (11% of consumers) were living in "fuel poverty". Fuel poverty rates have remained roughly stable since 2003 (Figure 3.3).[73] But people in fuel poverty are in significantly greater need than ten years ago. In 2015, the average "fuel poverty gap" – the amount by which a consumer's energy needs would need to be reduced in order for them not to be fuel poor – was £353, which is 39% higher than in 2005 (in real terms). Over the same period, the average energy bill increased by 27%. This implies that fuel-poor consumers were less able than the average consumer to reduce their energy needs, or that they consumed less than their energy needs.

Households with children under 16 have had consistently high rates of fuel poverty and the proportion has risen. Fuel poverty has grown fastest in households where the youngest person is aged between 16 and 24, although rates have fallen since 2010. Over a quarter of young people that live independently (between 16 and 24 years old, and the oldest in their household) are in fuel poverty. These differences may be related to lower incomes and the higher rate of private rental among these households, which is associated with substantially higher fuel poverty.

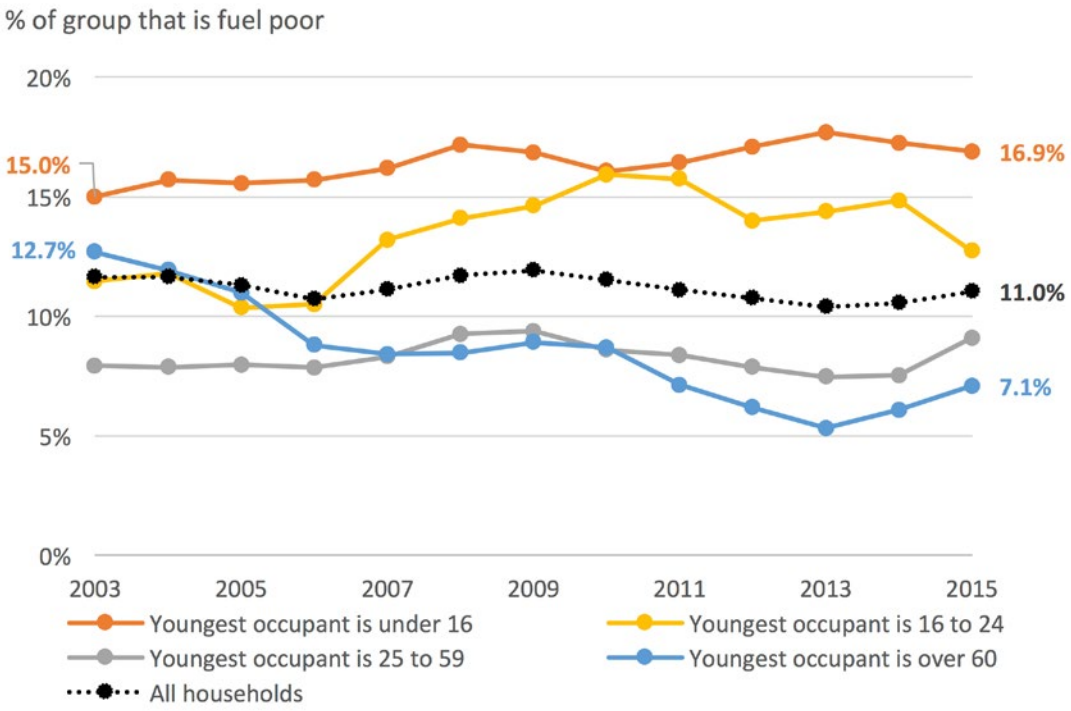
Older consumers are now the least likely group of consumers to experience fuel poverty (7.1% in 2015, down from 12.7% in 2003, when they were one of the groups most likely to be in fuel poverty). In part, this reflects the financial support given to pensioners, in particular the Warm Home Discount – which gives £140 to low-income pensioners – and Winter Fuel Payments.

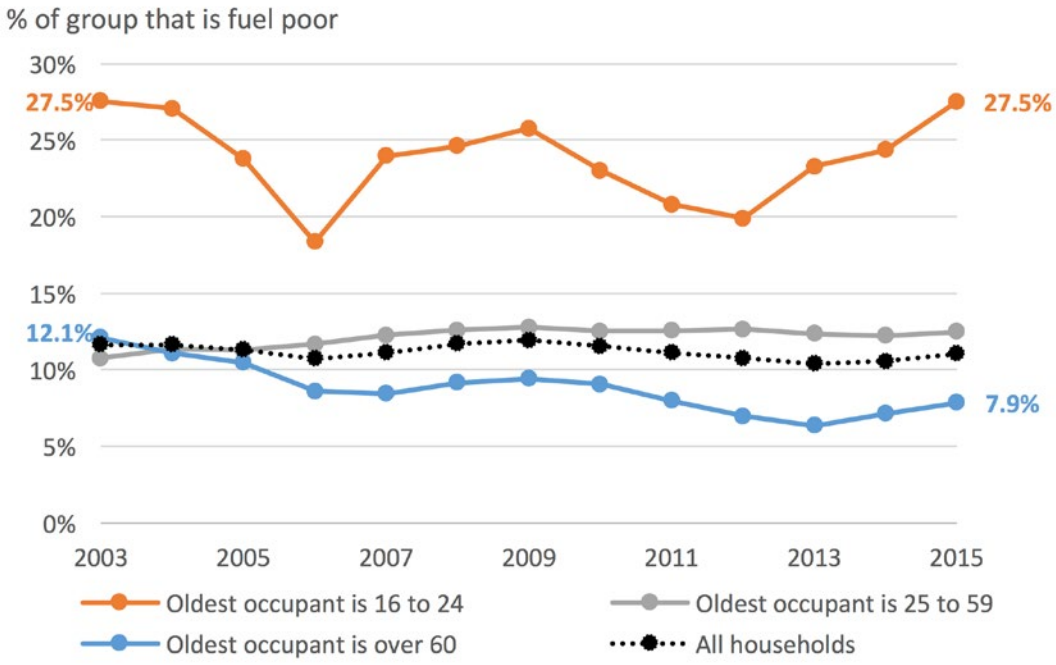
[71] BEIS, Energy and Climate Change Public Attitudes Tracker, last updated August 2017.

[72] The poverty line is defined as a household with an equivalised disposable income that falls below 60% of the national median in the current year Office for National Statistics, Persistent poverty in the UK and EU: 2015

[73] Given that the proportion of customers in fuel poverty is based on national income thresholds and median consumption, it generally remains stable over time. BEIS, Annual Fuel Poverty Statistics Report 2017 (2015 data)

Figure 3.3 Fuel poverty rates in England





Notes:

We have combined consumers aged between 60 and 74 with those aged over 75. The trends for the two groups are similar.

Sources:

BEIS, Fuel poverty trends 2017, June 2017

Scotland

In Scotland in 2015, the Scottish government estimated that 30.7% of households were in fuel poverty (a reduction of four percentage points since 2014), and 8.3% in extreme fuel poverty (a reduction of one percentage point).

Older households are the most likely to be fuel poor. Forty-five percent of older households are in fuel poverty, compared to 16% of families and 29% of other households. This is because older households on average have lower incomes and larger houses, and often need more heating.[74]

Wales

The Welsh government estimated that 23% of households were in fuel poverty in 2016, a reduction of six percentage points since 2012. Severe fuel poverty is estimated to have fallen from 5% to 3% over the same period. Fuel poverty in households considered vulnerable (those where any member of the household is over 60, under 25 or has a long-term limiting condition or disability) is slightly higher, at 24%, and has also reduced by seven percentage points. For customers in social housing, the rate of fuel poverty is higher again, estimated at 27% in 2016, having fallen from 33% in 2012.[75]

[74] Scottish Government, Scottish House Condition Survey 2015: Key Findings, Dec 2016. The Scottish Government provided us with additional data, showing a slight reduction in fuel poverty for older households since 2012.

[75] Data has not been collected on fuel poverty in Wales since 2008. These estimates are based on the 2008 figures, with modelling to adjust for changes in income, price, and installation of energy efficiency improvement measures. The figures for 2016 are also projected based on the data available at the time of publication. The Welsh Government has announced plans to carry out a new housing condition survey 2017-18 which will provide updated figures. Welsh Government, The Production of Estimated Levels of Fuel Poverty in Wales: 2012-2016, July 2016.

Managing energy prices to reduce bills

Consumers can reduce the price they pay per unit of energy by switching to a cheaper tariff or by changing their payment method or meter type. They can also reduce the amount of energy they consume. This section examines trends in the prices consumers pay. In particular, we look at what is preventing vulnerable consumers from accessing cheaper prices, and the impact of financial support provided to them.

Barriers to accessing cheaper prices

Less choice for prepayment and off-gas grid customers

In 2016, 4.4 million customers paid for electricity using a prepayment meter (16% of all electricity customers) and 3.5 million prepaid for their gas (15% of gas customers). This was a slight reduction in the number of customers on PPMs after a long-term increase.

Customers on PPMs cannot easily switch to credit meters, which would give them access to a wider range of market tariffs, including the cheapest. In 2016, 4% of PPM consumers changed to credit meters. This is an increase on previous years, but there continues to be a substantial number of cases where the supplier refuses to let the customer switch, or sets a condition (such as a credit check or security deposit) that the consumer did not meet. In 2016, 14% of electricity customers and 18% of gas customers who requested to change to a credit meter were prevented from doing so.[76]

Indebted PPM customers (about 10% of all PPM consumers) generally cannot switch to a credit meter, but those with a debt below £500 have the right to change supplier, which gives access to cheaper PPM tariffs.

The number of successful switches by indebted PPM customers remains low (fewer than 3,000 in 2016, which is 5% of the consumers that applied to switch supplier), but has risen following an increase in the debt threshold for customers to be eligible. We have been working with industry to improve the process.[77]

Concerns with competition led the CMA to introduce a transitional safeguard tariff for PPM customers, administered by Ofgem. As a result, the average price fell by around £60 for a typical dual fuel PPM consumer. However, the cheapest available prepayment tariffs remain consistently more expensive than the cheapest tariffs available to those using direct debit. The growth of smart metering should increase tariff choice for PPM customers, by lowering the technical and structural barriers to competition. By the end of 2016, PPM customers were slightly more likely to have smart meters than other consumers (14% of electricity PPMs and 16% of gas PPMs were smart).[78]

There were 5.2 million UK households not connected to the gas grid in 2016.[79] Our 2015 study showed that a household with electric heating tends to spend 30% to 50% more than a similar household with gas heating.[80] Electric heating is generally more expensive than heating with mains gas. Customers who are on restricted meters other than Economy 7 (which are primarily in households with electric heating) have less choice of suppliers and tariffs. This limited competition constrains their ability to access cheaper prices. In addition, the disparity between gas and electric heating is increased by the way policy costs are passed onto consumers. In 2016, 16% of household electricity bills went on policy costs, whereas only 2% of gas bills funded social policies.[81]

[76] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[77] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[78] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[79] BEIS, Energy Consumption in the UK, 2017.

[80] Ofgem, Insights paper on households with electric and other non-gas heating, December 2015.

[81] Ofgem analysis of largest suppliers' Consolidated Segmental Statements.

For customers not connected to the gas grid, the Fuel Poor Network Extension Scheme supports fuel poor households by helping towards the costs of connection to the gas network. Between April 2007 and March 2017, this connected 96,000 eligible households to the gas grid.[82]

Some groups of consumers are less likely to access lower prices

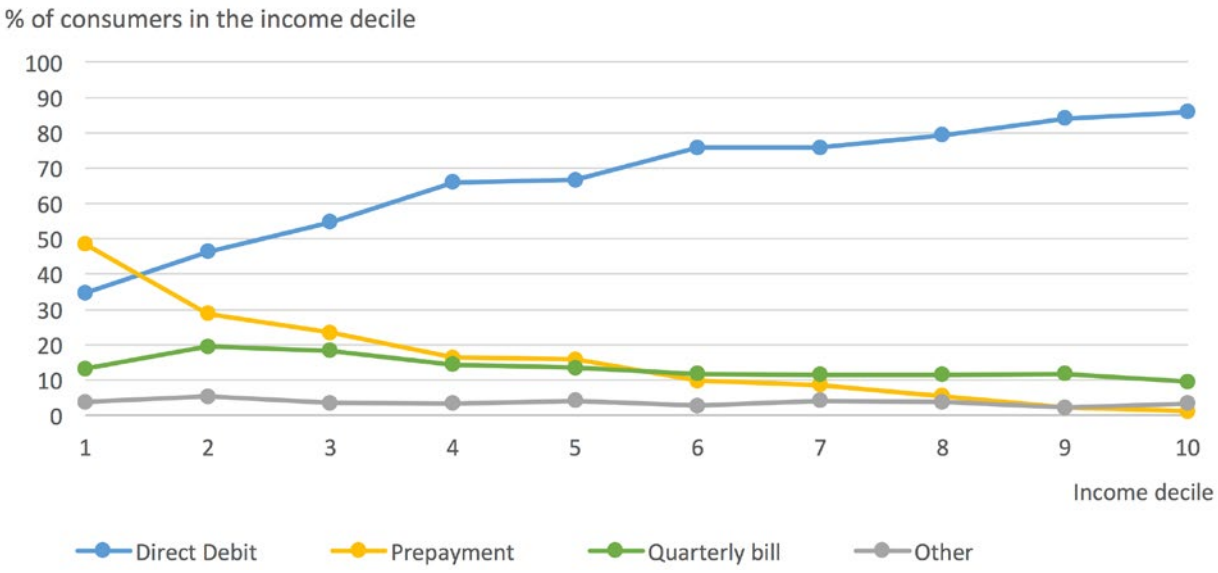
As a result of the structural barriers faced by PPM consumers and those off the gas grid, some groups of consumers are more likely than others to be unable to access the cheapest tariffs, such as:[83]

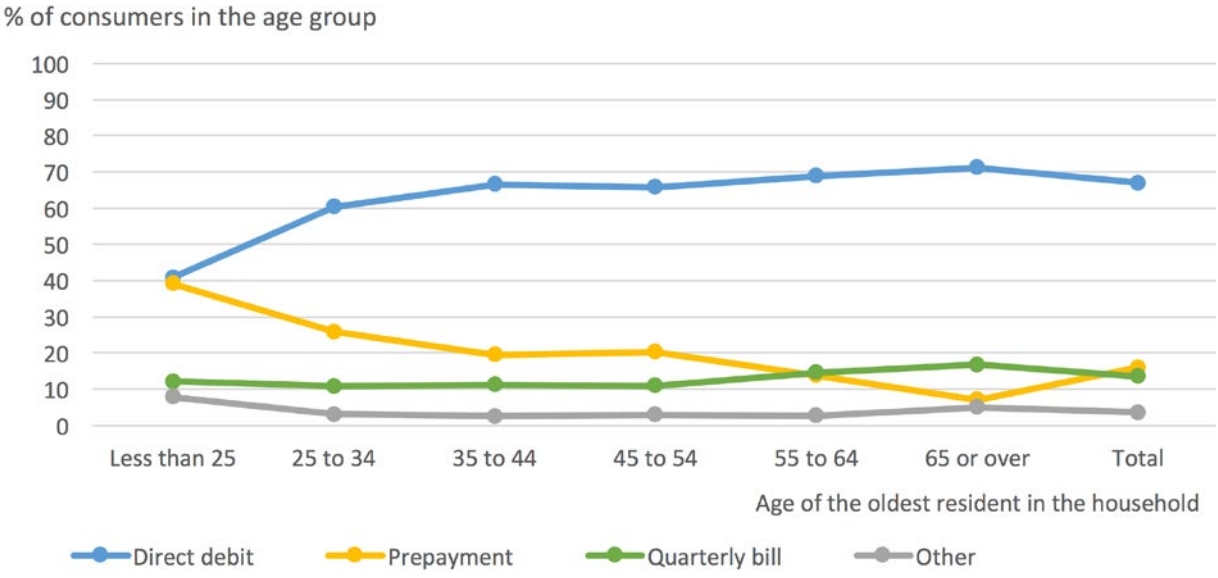
- **Consumers on low incomes:** Half of people in the lowest income decile have prepayment meters, whereas the vast majority of consumers with high incomes pay by direct debit;
- **Young consumers:** A higher proportion of young households have prepayment meters than older consumers do. Electric heating is also more common in young households (11% of young consumers) than it is for consumers in general (6%);
- **Consumers renting their homes:** 67% of consumers with both prepayment meters and electric heating rent their homes (either privately or from the local authority);
- **Consumers living in low-income urban areas:** People living in low-income urban areas are much more likely to have electric heating than people in suburban areas;
- **Consumers in rural communities:** 56% of customers in rural communities do not have gas central heating, of whom 13% have electric heating and 65% use oil.

[82] Ofgem RIIO-GD1 Annual report 2015-2016

[83] Ofgem analysis of Office of National Statistics, Living Cost and Food survey.

Figure 3.4 Payment methods by different income decile and age groups





Notes:

"Direct debit" includes consumers that pay dual fuel bills or separate gas and electricity bills by direct debit. "Prepayment" includes all consumers that prepay for either or both of their gas and electricity consumption.

Sources:

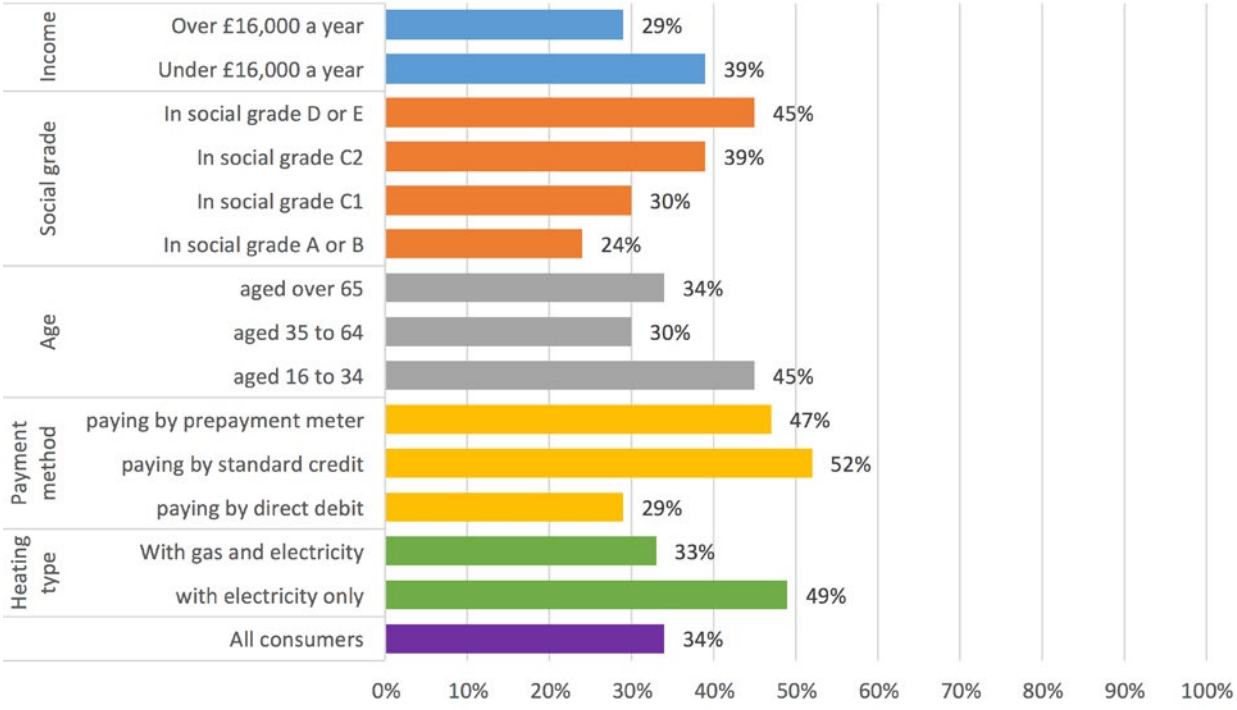
Ofgem analysis of Office of National Statistics, Living Cost and Food survey.

Some vulnerable consumers are less likely to switch

As discussed in Chapter 2, customers who switch supplier regularly benefit from the cheapest prices, and those who have never switched are more likely to pay a lot more. Ofgem's Consumer Engagement Survey 2017 found that customers who have never switched supplier are those who can least afford higher prices (Figure 3.5). Nearly half of customers who are in semi-skilled or unskilled jobs or are unemployed (social grades D or E) have never switched, along with 40% of consumers living in households earning less than £16,000, compared to under one-third of other customers.

Low switching rates appear to reflect barriers to engagement. These groups are also more likely never to use the internet or to use it less frequently. Internet access is a key to comparing tariffs and accessing lower prices: 55% of customers who switched supplier used a price comparison website to find out about the deals on offer.[84] In addition, the cheapest direct debit tariff available if the account is managed completely online is around £100 cheaper than if the customer receives paper statements.[85]

Figure 3.5 Breakdown of consumers who have never switched (%)



Sources:

Ofgem Consumer Engagement Survey 2017
Social grades classify the households, based mainly on the occupation and employment status of the main income earner. The highest grade is A and the lowest E. [86]

[84] Analysis of the Ofgem Consumer Engagement Survey 2017.

[85] Prices for the cheapest monthly direct debit dual fuel tariff for a single rate meter, for a customer with medium consumption. Ofgem analysis of data from Energyhelpline, using prices as of 28 September 2017. This includes some tariffs where an online discount is given (average around £30), but is mainly due to the fact that the cheapest tariffs are only available as 'paperless' tariffs.

[86] Social grades are usually based on the occupation and employment status of the main income earner in the household, but can use other characteristics. More details are provided by the Market Research Society.

How support is helping vulnerable consumers

There is support available to help vulnerable consumers engage in the market, but it only reaches a small proportion of the total number of those who are vulnerable or struggle to afford their bills. For instance, government's Big Energy Saving Network programme provides face-to-face support to help vulnerable consumers engage in the market. Between 2013 and 2017 it helped over 500,000 consumers.[87] Between 2011 and 2017 the Citizens Advice Energy Best Deal (delivered by local Citizens Advice and other community partners) trained around 60,000 customers in or at risk of fuel poverty on engaging with the energy market. They also trained frontline workers and volunteers who support an additional half a million customers. The training includes how to get the best deal, help available from suppliers and government, and energy efficiency.[88]

Alongside efforts to improve engagement, government provides direct financial support to consumers in circumstances that make them vulnerable. Government directs most of this support to pensioners. In winter 2016-17, Winter Fuel Payments paid £2.0 billion to 12 million individual pensioners. In winter 2015-16 (the latest available data), Warm Home Discount redistributed £325 million from billpayers to 2.2 million vulnerable consumers, 1.35 million (61%) of whom were low-income pensioners (Figure 3.6).

The financial impact of this support is considerable. A low-income pensioner on Pension Credit could receive £340 or £440 depending on their age (£140 from Warm Home Discount and £200 or £300 from Winter Fuel Payment). For those in the lowest income decile, £340 reduces their bills from 10.8% of their expenditure to 7.5% (around 32% less) (figure 3.7). A low-income pensioner who receives financial support and switches their tariff could reduce their bill further.

Figure 3.6 Table of financial support for vulnerable consumers

Policy	Eligible	Recipients	Payment to individuals (£)	Total cost (£m)	Funding source
Winter Fuel Payment	All pensioners	12.0 million individuals in Winter 2016-17	£100 to £300	2,045	Central government
Warm Home Discount: core group	Low-income pensioners	1.4 million individuals in Winter 2015-16	£140	189	Energy bill payers
Warm Home Discount: broader group	Consumers on a low income and vulnerable to fuel poverty	0.8 million individuals in Winter 2015-16	£140	136	Energy bill payers
Cold Weather Payment	4.1 million benefits claimants	0.1 million households in Winter 2016-17	£25 for each cold week of weather	£3	Central government

Notes:

- Pensioners with low incomes or aged over 80 are eligible for higher Winter Fuel Payments.
- Claimants of Pension Credit Guarantee Credit are automatically eligible for the Warm Home Discount. Individual suppliers set the eligibility criteria for the broader group to match best their customer profile. However, the criteria must be approved by Ofgem before being used. Suppliers with fewer than 250,000 consumers are not required to participate in the Warm Home Discount scheme.

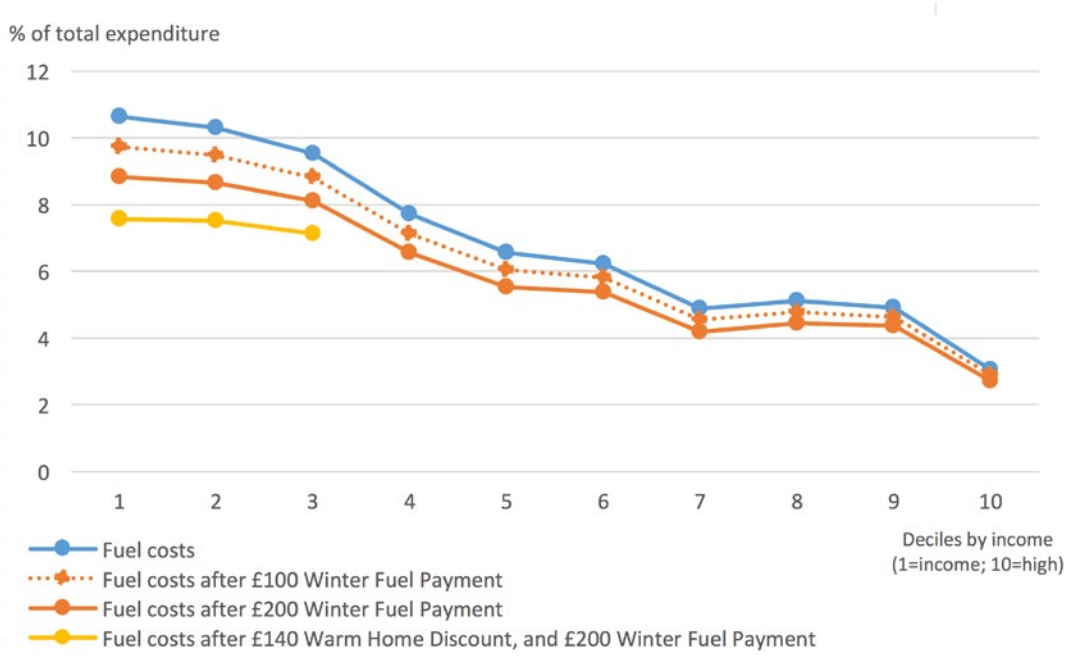
Sources:

Department for Work and Pensions, Winter Fuel Payment Statistics: Winter Fuel Payment amounts by Local Authority (2016/17), September 2017; Ofgem, Warm Home Discount Annual Report: Scheme Year 5, November 2016; and Department for Work and Pensions, Cold Weather Payment statistics: 2016 to 2017, April 2017.

[87] DECC, Evaluation of the Big Energy Saving Network, January 2015.

[88] Data from Citizens Advice on the Energy Best Deal and Energy Best Deal Extra programmes.

Figure 3.7 Impact of financial subsidies on pensioners' energy bills



Note:

- Warm Home Discount is available to low-income consumers that claim the Guarantee element of Pension Credit. Not all consumers will apply and not all consumers in the bottom three deciles will be eligible.
- Warm Home Discount transfers money to recipients from other bill payers. This chart only shows the impact of Warm Home Discount on consumers that receive it, not on consumers that fund it.

Source:

Ofgem analysis of Office of National Statistics data, Living Costs and Food Survey.

Consuming less to reduce bills

Consumers can also reduce their consumption in order to lower their bills. Here, we assess trends in consumption, reasons for recent falls in consumption levels and how energy efficiency policies have helped consumers.

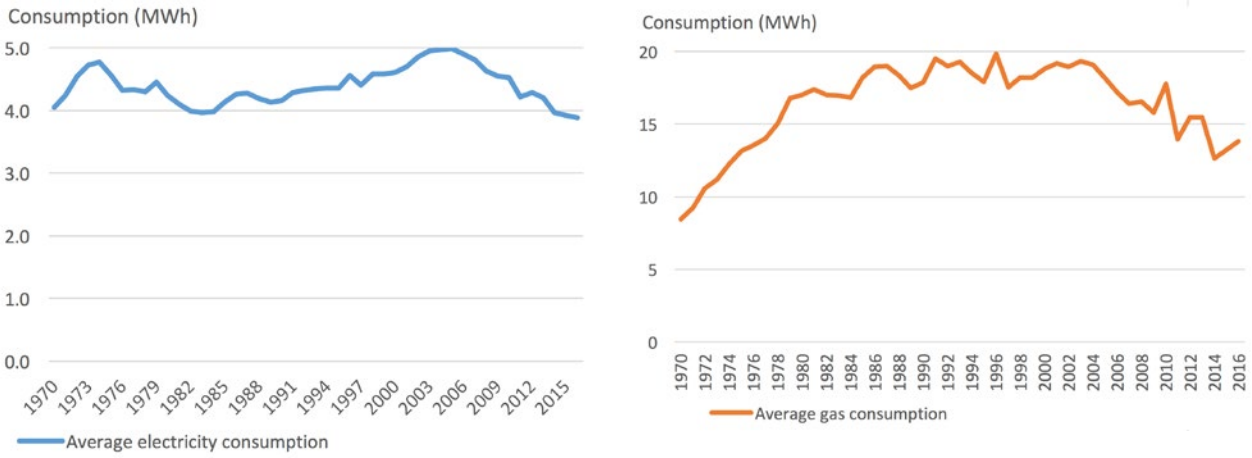
Trends in consumption

Consumption is falling

Over the last decade, consumers have reduced their energy consumption substantially (Figure 3.8).[89] In 2016, average electricity consumption was 3.9 MWh, 21% less than in 2006. Average gas consumption was 13.8 MWh, 20% less than in 2006. We estimate that a household that still consumed energy at average 2006 levels would face an energy bill £284 higher than the actual average bill in 2016 (£145 higher electricity bill and £139 higher gas bill).[90]

Low-income households have reduced their consumption more than households with higher incomes (Figure 3.9). On average, households earning below £30,000 reduced their gas consumption by 35% between 2005 and 2015. Households earning over £50,000 reduced their gas consumption by 30% or less.

Figure 3.8 Energy consumption: 1970 to 2016



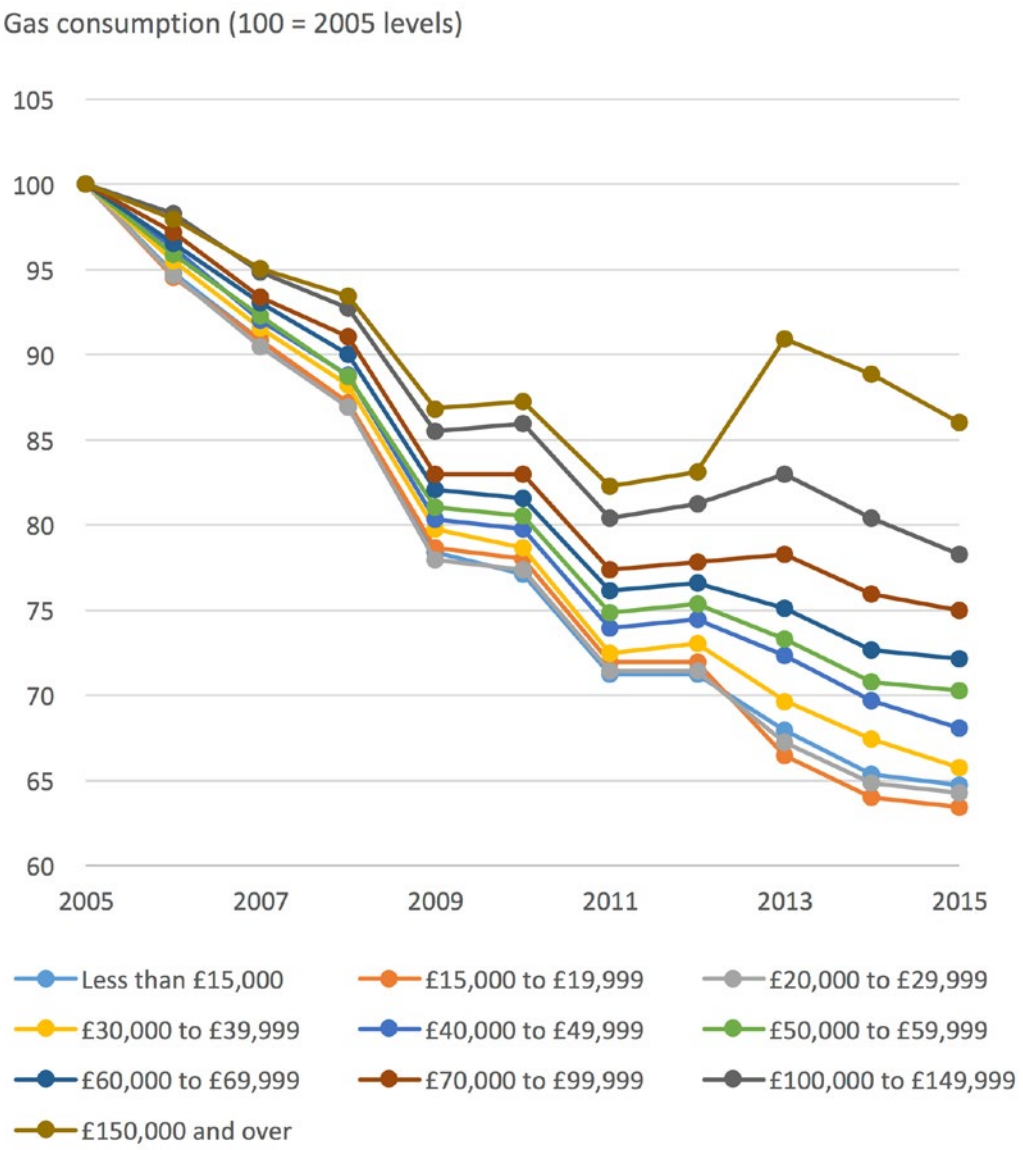
Source:

BEIS, Energy consumption statistics in the UK (1970 to 2016)

[89] These calculations use average (mean) consumption levels. Typical Domestic Consumption Values are lower: 3.1 MWh of electricity and 12 MWh of gas for consumers with median consumption levels in 2016.

[90] These figures illustrate the impact that reducing consumption can have for consumers with a fully variable tariff. Consumers with a standing charge will experience smaller changes. Changes in national consumption levels will only reduce variable costs (wholesale costs, and some policy costs). Fixed costs, such as network charges, will not fall with consumption. Data from BEIS, Energy Consumption in the UK, Table 3.01: Domestic final energy consumption by fuel 1970 to 2016

Figure 3.9 Changes in median gas consumption by income group: 2005 to 2015.



Note:

The National Energy Efficiency Data framework samples approximately four million properties in England and Wales. The methodology is different from BEIS's statistics on UK consumptions levels. Although the two sources show the same overall trends in consumption, average consumption levels are not exactly the same.

Source:

BEIS, National Energy Efficiency Data - framework.

It is important to understand why some groups of consumers have reduced their energy use more than others. Lower consumption can reflect:

- **Better energy efficiency,** meaning consumers require less gas and electricity to achieve comfort or wellbeing. For example, they require less gas to heat their home to the same temperature.
- **Self-rationing energy use,** meaning consumers reduce their energy use. For example, a consumer reduces the temperature of their home, in order to use less gas.

Better energy efficiency

The energy efficiency of our homes and appliances has increased markedly over the past decade, reducing consumption while enabling stable or increasing comfort levels. Between 2005 and 2015, the average Standard Assessment Procedure (SAP) rating – which indicates household energy and environmental performance – improved from 49 to 62 in England. The SAP assesses how much energy a dwelling will consume, when delivering a defined level of comfort and service provision.

Improving energy efficiency is mainly being driven by:[91]

- **More efficient electrical products:** Regulation and technological improvements have made electrical goods more efficient, and overall efficiency has improved as consumers replace or upgrade their appliances and white goods.
- **More efficient boilers:** In 2015, 15.3 million UK homes had condensing or condensing-combination boilers, compared with only 1.1 million in 2005.
- **Insulation improvements:** In 2016, 69% of properties with cavity walls were known to have cavity insulation, compared to 44% in 2006.[92]

European and UK policies have helped to increase energy efficiency. In 2014, the UK government estimated the total impact of policies, including EU legislation, on consumers. The analysis has not been updated since, but at the time, the Department of Energy and Climate Change expected gas consumption to be 14% lower in 2020 than it would have been if its policies were not in place. It expected electricity consumption to be 29% lower. Only consumers affected by the policies will cut consumption, but as most of the savings come from laws governing the efficiency of new consumer products, most consumers should receive some benefit. Expressed as an average across all households, the government expected policies to reduce annual bills by £216, although the exact figure will change as energy prices and policies develop over time.[93]

Some government energy efficiency programmes have targeted low-income households and areas with high levels of social deprivation. For instance, the Energy Company Obligation (ECO) was split into three schemes, two of which targeted low-income households and those in deprived or rural areas: Home Heating Cost Reduction Obligation (HHCRO) and Carbon Saving Community Obligation (CSCO). Figure 3.10 shows that these programmes successfully supported households in deprived areas, whereas Carbon Emission Reduction Obligation (CERO), which is open to all consumers, under-represents low-income households.[94]

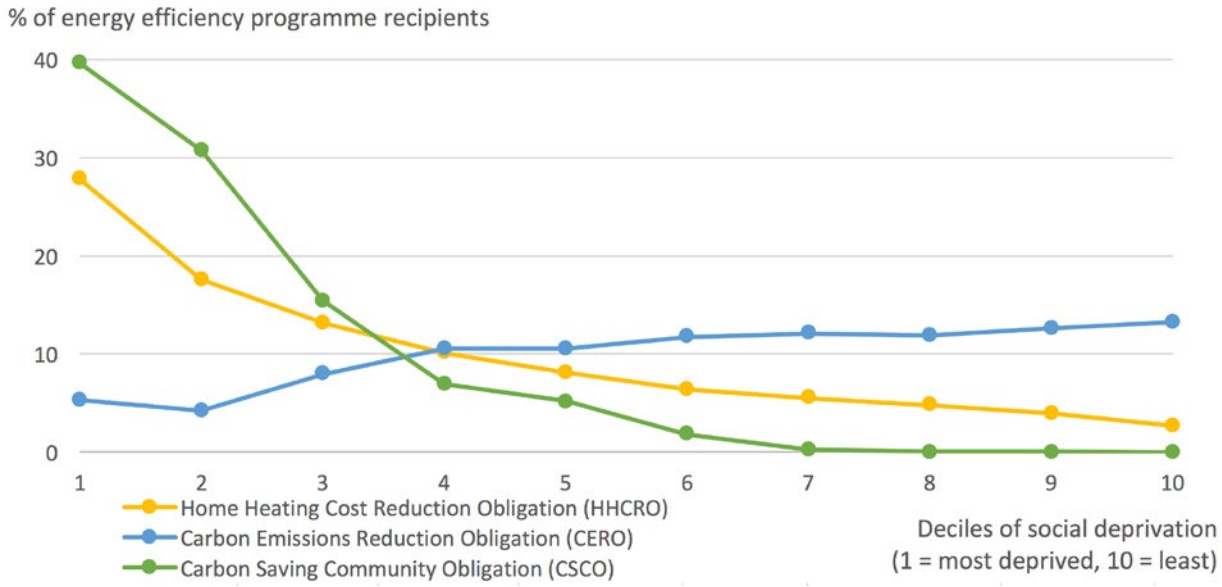
[91] BEIS, Energy consumption in UK; English Housing Survey 2015 to 2016: headline report, March 2017; Annex Table 2.6: Mean SAP rating, by tenure, 1996 to 2015

[92] BEIS, Energy consumption in UK, July 2017.

[93] Ofgem analysis of BEIS, Estimated impacts of energy and climate change policies on energy prices and bills: 2014, supplementary tables

[94] There is a wide range of government energy efficiency policies. Analysis of intended impacts by the Joseph Rowntree Foundation suggests programmes affect different income deciles relatively evenly. JRF "Distribution of carbon emissions in the UK: Implications for domestic energy policy" (2013)

Figure 3.10 Distribution of ECO installations by area social deprivation



Note:

This analysis looks at ECO installations between April 2015 and March 2017 by English Local Super Output Areas. ECO's predecessor, the Carbon Emissions Reduction Target (CERT), installed 8.6 million insulation measures, 46% of them in the priority group (reserved for low-income households and pensioners that could be vulnerable).

Source:

Analysis of Ofgem administrative data.

We looked in particular at HHCRO, also known as 'Affordable Warmth'. Between 2013 and March 2017, four million low-income consumers were eligible for HHCRO support to improve their energy efficiency. However, only a minority of consumers took up the support. 728,000 energy efficiency measures were installed in 516,000 households, 91% of which replaced boilers or installed heating controls. Only 8% of measures installed insulation (61,000 installations).

Participants in HHCRO benefit in two ways: lower bills (from reduced consumption), and warmer homes (as consumers can better afford to heat their homes adequately). We estimate that people receiving a new boiler would reduce their bills by between £48 and £189 each year.[95]

From April 2017, the UK government changed its support for low-income and vulnerable consumers. These changes should widen HHCRO eligibility requirements to about 4.7 million consumers and make them more flexible. They should also encourage a wider range of energy efficiency measures to be installed in people's homes.[96]

[95] BEIS reports that the notional value of cheaper bills and warmer homes is £8.2 billion over the lifetime of HHCRO measures installed between 2013 and 2016. These 'notional' savings are not actual reductions in consumers' bills. The median notional saving a year is £1,876. Most of the notional saving calculated by BEIS reflects its estimate of the value to consumers of a warmer home.

[96] BEIS, Energy Company Obligation: Help to Heat April 2017 to September 2018, 2017.

Risks that some consumers self-ration their gas consumption

Energy efficiency improvements appear to have been successful in enabling consumers to consume less energy, without reducing their use of electrical goods. But the picture is more mixed in gas. We are concerned that consumers who are less able to make energy efficiency improvements are more likely to have self-rationed their gas consumption in response to price increases. Analysis commissioned by the Committee on Climate Change suggests that centrally-heated households reduced their average internal temperature by around 8% between 2005 and 2015.[97]

Over the same period, BEIS's analysis of 'gas price elasticities' suggests that just over a third (39%) of the reduction in gas consumption can be explained by consumers responding to higher prices. BEIS found that for every 10 per cent increase in gas prices, consumers use one per cent less.[98] Between 2005 and 2015, gas prices increased by 107%, which implies price increases led consumers to use 10.7% less gas (39% of the overall reduction in consumption during that time).

These estimates must be treated with caution. BEIS's estimate is not precise, and may not reflect longer-term behavioural responses.[99] However, the analysis does highlight that self-rationing is a more significant risk for low-income consumers, particularly for the large number of homes that have not participated in energy efficiency programmes. BEIS notes the lack of established research on differences between income groups, but concludes that "initial indications suggest that lower income groups possess higher price elasticities and are more sensitive to changes in price compared to higher income groups."[100]

Some consumption reduction is likely to be a consequence of PPM customers self-disconnecting from their energy supply. Self-disconnection can relate to customers not having enough money to top up their meter, but can also be because topping up a PPM is inconvenient. It is hard to measure the extent of self-disconnection, but Citizens Advice research in 2013 estimated that 15% of PPM customers had self-disconnected in the previous year.[101] Smart PPMs support people with alerts and more convenient top-up methods, which can help them to avoid accidental self-disconnection.

The risk of colder homes

Not all consumers reducing the temperature of their homes will under-heat their homes. But for consumers already on low-incomes, temperature reduction would pose a greater risk. Living in a cold home can create health problems, particularly for young children, older people, and those with existing health conditions. The NHS spends substantial amounts treating preventable cold-related illness.[102] In extreme cases, this can contribute to people's deaths: there were 28,000 excess winter-related deaths in 2015-16,[103] and the World Health Organisation estimated in 2011 that around 30% of excess winter deaths are related to living in cold homes.[104]

[97] Ofgem analysis of Committee for Climate Change, Energy Prices and Bills Report, Figure 1.11. Average temperatures fell 8.0%, but vary year to year. We also measured the reduction in fitted temperatures on lines of best fit. The linear trend showed an 8.1% reduction. The non-linear trend showed a 6.6% reduction.

[98] BEIS, National Energy Efficiency Data-Framework (NEED) report: summary of analysis 2016, Annex D: Gas price elasticities.

[99] The analysis excludes the impact of government programmes to increase energy efficiency, but does not separate short-term effects, such as turning internal temperatures down, from long-term effects, such as private investment in better insulation.

[100] BEIS, National Energy Efficiency Data-Framework (NEED) report: summary of analysis 2016, Annex D: Gas price elasticities, p. 10.

[101] Citizens Advice, Topping-up or dropping-out, 2014

[102] Estimated at over £1 billion per year by the charity National Energy Action.

[103] Office for National Statistics, Excess winter mortality in England and Wales: 2015/16 (provisional) and 2014/15 (final)

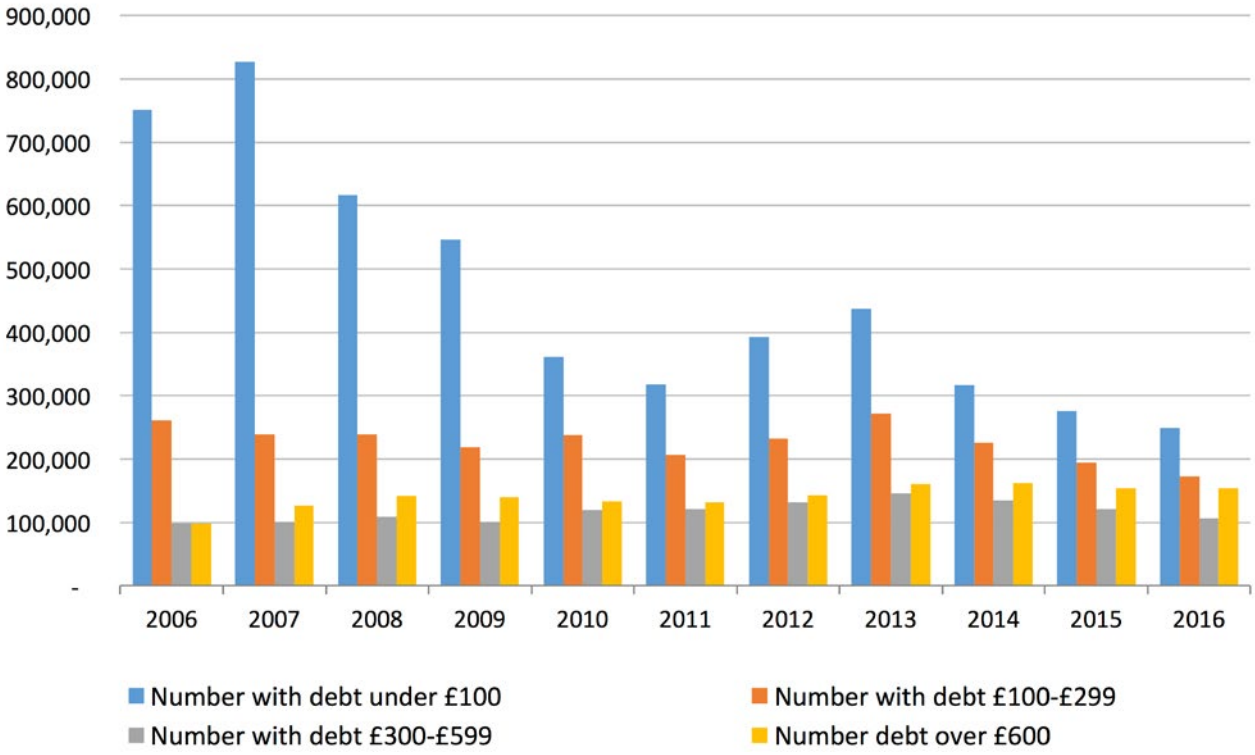
[104] World Health Organisation, Environmental burden of disease associated with inadequate housing, 2011. The World Health Organisation described this figure, based on various studies on the impact of cold homes in England and Europe, as a conservative estimate.

Support for vulnerable customers

There are ways that suppliers, Ofgem, charities and government support vulnerable energy customers that go beyond energy prices or consumption. These include:

- ensuring that indebted customers have affordable debt repayments and that their debts are correctly managed;
- avoiding imposing PPMs on customers and avoiding disconnection;
- providing services to help customers engage with the market and their energy use; and
- supporting them to complain when required.

Figure 3.11 Number of electricity customers with outstanding debt, by value of debt



Note:

The figure is expressed in nominal prices, not adjusted for inflation, as the data is submitted by suppliers in these windows. The real average value of the outstanding debt has increased over the same period from £196 in 2006 to £427 in 2016 (in 2016 prices).

Source:

Ofgem Social Obligations Reporting

Fewer customers in debt, but the number with high debts remains fairly stable

When customers get behind on their bills, suppliers must engage with them to assess their individual ability to pay and the best way to repay their debt. In 2016, 1.2 million electricity customers were in debt to their suppliers, and 1.0 million gas customers were in debt, of which around 60% were repaying their supplier. This is a significant reduction since the number of consumers in debt last peaked in 2013 (there are 22% fewer electricity accounts in debt, and 30% fewer gas accounts). However, the number of customers with high debts has remained fairly stable, compared to large reductions of customers with smaller debts (figure 3.11).[105]

This suggests that suppliers could do more to identify and support customers in the greatest financial difficulty, and to stop debts from escalating. Some suppliers' debt management processes are weak, with problems such as high average debts, a low proportion of indebted customers making repayments, or customers making very high weekly repayments (see our report on Vulnerable consumers in the retail energy market).[106]

Prepayment meters imposed on indebted consumers and disconnection

Historically, most PPMs were installed to repay debt, though the proportion has fallen over time. In 2016, just under half of new prepayment meters were installed to pay off a debt. If a supplier and customer cannot reach an arrangement to repay debt, suppliers have the right to go to court for a warrant to install a prepayment meter to collect repayments and to prevent further debt building up. The number of warrants has fallen slowly, but not as fast as the number of customers in debt, and it remains at around 40,000 per year per fuel.[107]

The costs of installation are passed onto customers, and vary widely – typically from £200 to over £900 for a dual fuel customer. We have proposed restrictions on the use of warrants and their costs.[108]

There has been a long-term reduction in the number of customers disconnected due to debts. In 2006, suppliers disconnected over 5,000 gas and electricity accounts, while in 2016, only 210 accounts were disconnected due to debt. Most suppliers successfully use alternative tools to recover debt from customers.[109]

Services for vulnerable customers

We require energy suppliers to provide free help to vulnerable customers to manage their energy by providing access, safety and communication services. The services include communication in accessible formats, re-directing bills to a third party, providing a password so that customers can identify staff from the supplier, and reading the meter on the customer's behalf. The total number of services provided has risen consistently in recent years.[110]

Suppliers are required to register vulnerable customers onto their Priority Services Register (PSR). The proportion of customers on the PSR has grown in recent years, to 16% in England, 13% in Scotland and 19% in Wales in 2016. We are concerned that the proportion of customers has been consistently low in Scotland, since it seems unlikely that a lower proportion of Scottish customers would benefit from priority services.[111]

[105] Ofgem, Social Obligation data.

[106] Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[107] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[108] Ofgem, Prepayment meters installed under warrant: statutory consultation

[109] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[110] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

[1111] Ofgem Social Obligations Data, see Ofgem, Vulnerable consumers in the retail energy market: 2017, October 2017.

Complaints

Vulnerable consumers may need support to navigate complaints processes and to ensure their voices are heard. The Citizens Advice Extra Help Unit has a team of specialist caseworkers who investigate complaints on behalf of vulnerable residential consumers. The most common complaints are about billing (36% in 2016) and debt or disconnections (25% in 2016).[112]

It is difficult to draw broader conclusions from the consumers seeking support from Citizens Advice as they may be more engaged, or in greater need than other vulnerable consumers. Our Consumer Engagement Survey 2017 found that customers in arrears or with a disability were more likely than the average to have complained to their own or previous supplier (27% and 14% respectively, compared to 10% for other customers). Some groups of customers felt less confident about making a complaint if they had reason to do so, including customers from households with an income below £16,000, customers with a physical or mental health disability, customers who rarely or never use the internet, and customers on PPMs.[113]

Ofgem actions to address vulnerability

We continue our work to protect and empower vulnerable domestic consumers. This includes:

- Administering a safeguard tariff for PPM customers, which we have proposed to extend to 1 million customers receiving the Warm Home Discount this winter;
- Proposing that suppliers should not be allowed to bill customers for energy that they consumed more than 12 months ago;[114]
- Introducing into the domestic Standards of Conduct a broad principle about identifying and supporting vulnerable customers; and
- Proposing restrictions on the use and costs of warrants to install a PPM for debt.[115]

[112] Data provided by Citizens Advice to Ofgem. Percentages are for domestic complaints only, which excludes cases logged as business, enquiries and Ask the Advisor cases.

[113] Analysis from Ofgem Consumer Engagement Survey 2017.

[114] Ofgem, Open letter - notifying of our intention to launch a project to protect consumers from back billing, April 2017

[115] Ofgem, Prepayment meters installed under warrant: statutory consultation

Chapter 4: Decarbonisation of energy

Summary of findings

- Since the Climate Change Act 2008, over half of the overall reduction in greenhouse gas emissions has come from cleaner electricity. However, there has been limited progress in reducing emissions from heat and transport.
- Recent progress in reducing emissions has been driven by low-carbon policies. Carbon prices helped reduce coal to 9% of generation in 2016. Subsidies combined with significant reductions in development costs have helped renewables to grow to 25% of UK electricity supply.
- Renewable technology is getting cheaper. Offshore wind turbines producing energy from 2022-23 will cost £57.50 per MWh (in 2012 prices) including wholesale prices, less than half the cost of turbines that started providing energy in 2017-18. However, many contracts for support have been issued with limited or no competition, increasing costs to consumers.
- Introducing new sources of power increases the need for flexible generation and consumption. Analysis by UKERC suggests that the cost of integrating these sources of power remains relatively modest (between £5 to £10 per MWh), but could increase substantially if the grid fails to adapt.

Our approach

Reducing environmental damage from generating electricity and using gas to heat homes and businesses is one of Ofgem's five strategic aims. Our principal objective, to protect the interests of existing and future consumers, includes the reduction of greenhouse gas emissions.

The UK is committed to reducing its greenhouse gas emissions by 80% of 1990 levels by 2050, to around 170 megatonnes of carbon dioxide equivalent gases. Reducing emissions from energy is crucial to achieving that goal, both because the energy sector contributed 26% of total emissions in 1990, and because decarbonisation of energy is important in reducing emissions from other sectors.[116]

[116] Committee on Climate Change, 2017 Report to Parliament – Meeting Carbon Budgets: Closing the policy gap (June 2017); BEIS, Provisional GHG statistics for 2016 (2017); and BEIS, Final GHG statistics for 1990-2015 (2017).

There are three main components of government actions to decarbonise the energy sector: promoting low-carbon electricity; promoting low-carbon heat; and supporting energy efficiency. In this chapter, we examine decarbonisation of heat and electricity. Energy efficiency was discussed in Chapter 3 – in part, because energy efficiency programmes increasingly target low-income groups to reduce the risk that they experience fuel poverty. The major low-carbon policies are:

- **Renewables Obligation:** subsidies for large-scale renewable electricity projects. The programme is responsible for the majority of costs, but is now closed to new generating capacity.
- **Contracts for Difference:** replaces Renewables Obligation, provides low-carbon generators a constant price per MWh, topping up the wholesale price when it is lower than the agreed price (or clawing money back where the wholesale price is higher).
- **Feed-in Tariffs:** Subsidies for small-scale distributed generators.
- **Carbon prices:** Increases wholesale prices for carbon producing generators. This is not a subsidy; it aims to monetise the environmental cost of greenhouse gas emissions.
- **Renewable Heat Incentive:** subsidies for low-carbon sources of heat.

Government funds its low-carbon policies for electricity and heat differently. For low-carbon heating, the costs are paid out of general taxation. For electricity, carbon taxes and subsidies for renewables are spread across consumers' electricity bills. In 2016, 16% of residential consumers' electricity bills covered policy costs, the majority of which relate to decarbonisation.[117]

In this chapter, we assess: the UK's progress towards reducing emissions overall; how government policies to support clean electricity have helped reduce emissions; and challenges posed by integrating new sources of generation.

[117] Ofgem analysis of Consolidated Segmental Statements of the six largest suppliers.

Progress reducing emissions

UK on track to achieve carbon reduction targets up to 2022

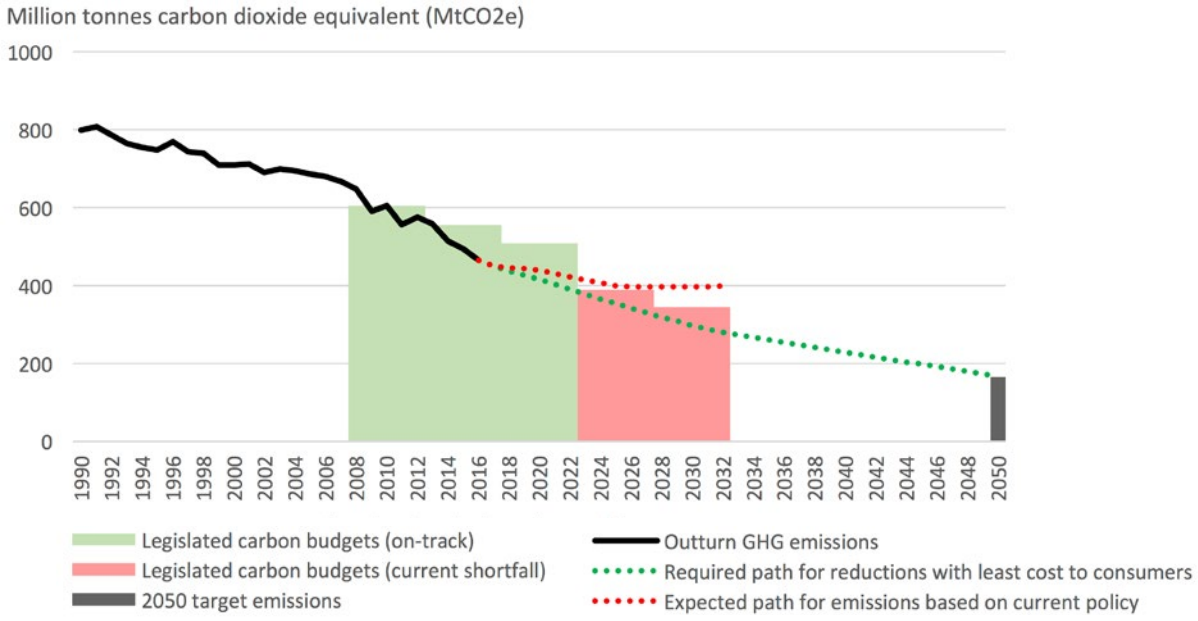
In 2016, the UK emitted 467 megatonnes of greenhouse gases, a 42% reduction since 1990. The government tracks its progress reducing emissions against carbon budgets – which cap the amount of greenhouse gases the UK can emit over a five-year period. The UK is on track to meet the first three of those budgets (2008 to 2022), but is not likely to meet budgets beyond 2022 without policy changes (Figure 4.1).

In June 2017, The Committee on Climate Change (CCC) – which advises the government on setting and meeting carbon budgets – identified two types of 'policy gap':[118]

- Policies not in place: The CCC estimates that by 2030, emissions will be 121 megatonnes (15% of 1990 emissions) higher than the required trajectory unless further policies are announced to fill this gap. In particular, there are no policies announced for: an additional 100 TWh of low-carbon power stations; carbon capture and storage; ensuring high take-up of electric and low emission vehicles; and increased energy efficiency and low-carbon heating; and
- Policies at risk of under-delivery: The CCC estimates that emissions in 2030 could be another 73 megatonnes higher (9% of 1990 emissions) if government plans underperform, or if it delays certain policies. It is particularly concerned that plans for 50TWh of low-carbon energy, including Hinkley power station, could be delayed, and that programmes to install insulation and low-carbon heating could under-perform.

In October 2017, the government published its proposals to achieve carbon budgets up to 2032.[119] The Committee on Climate Change will publish its assessment of these proposals in 2018.

Figure 4.1 Total UK greenhouse gas emissions



Source:

Committee on Climate Change, 2017 Report to Parliament – Meeting Carbon Budgets: Closing the policy gap (June 2017); BEIS, Provisional GHG statistics for 2016 (2017); and BEIS, Final GHG statistics for 1990-2015 (2017).

[118] Committee on Climate Change, 2017 Report to Parliament – Meeting Carbon Budgets: Closing the policy gap, June 2017.

[119] HM Government, The Clean Growth Strategy, October 2017.

Strong progress in generating cleaner electricity

Since the Climate Change Act 2008, over half of the reduction in overall emissions comes from generating cleaner electricity (Figure 4.2). Emissions come from across all sectors of the economy. In 2016 the largest four sectors for emissions were: transport (26%), industry (22%), heating for buildings (19%), and electricity generation (17%).

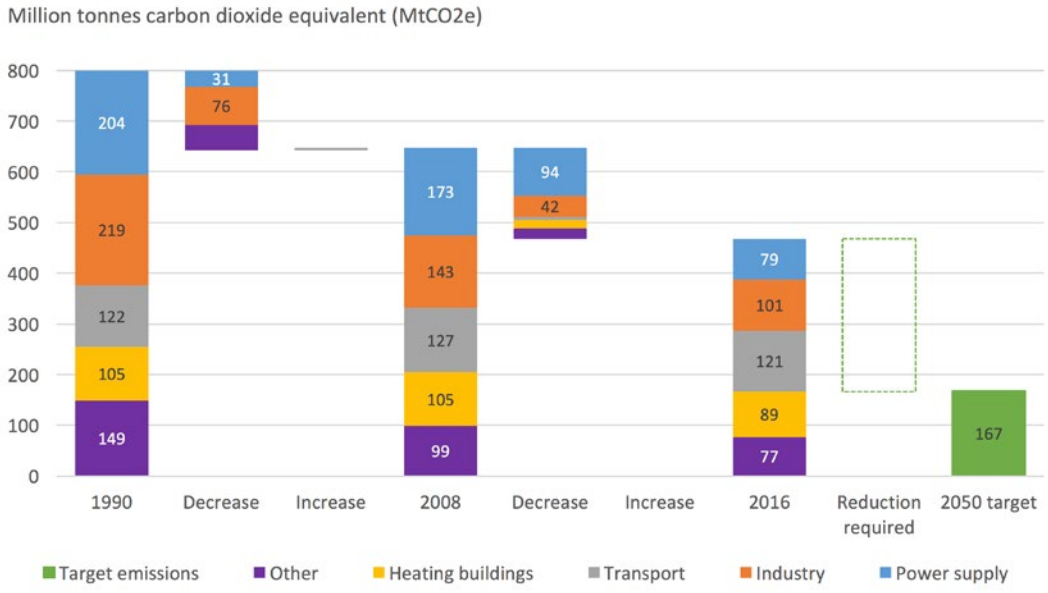
Two factors determine emissions from electricity generation: the amount of power produced, and how cleanly that power is generated.

- Compared to 1990, the gross electricity supplied increased 8% to 321TWh (not including 18 TWh of imports).[120] But the electricity supply was 15% lower than its peak in 2005, mainly due to lower demand. Demand has fallen for several reasons, including the recession following the financial crisis and improved energy efficiency in homes and businesses.
- The carbon intensity of electricity generation has fallen significantly. The average unit of electricity generated in 2016 was 64% cleaner than in 1990 (emitting 242 grams of carbon dioxide per kWh compared with 680 grams). Reducing carbon intensity depends on changes in the mix of power stations supplying our electricity (Figure 4.3).

Carbon intensity has fallen dramatically since 2012.[121] This recent decline in carbon intensity is due to:

- A fall in the contribution of coal-fuelled power stations from 40% of supply in 2012, to 9% in 2016; and[122]
- Low-carbon sources of power now contribute 45% of electricity generation (before imports). Nuclear power provides about 20% of our electricity. In 2016, renewable power provided another 25% (Figure 4.4).[123]

Figure 4.2 Emission reductions by sector



Source:

Committee on Climate Change, 2017 Report to Parliament – Meeting Carbon Budgets: Closing the policy gap (2017); BEIS, Provisional GHG statistics for 2016 (2017); BEIS, Final GHG statistics for 1990-2015 (2017).

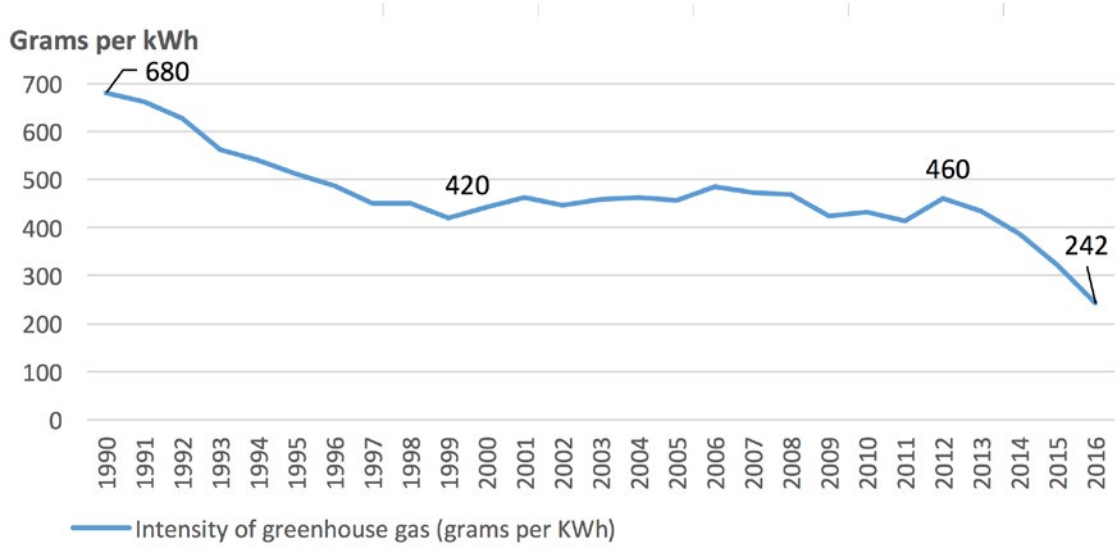
[120] We look at the gross electricity supplied not including pumped storage. For a reconciliation between total supply, electricity supplied, and final consumption see BEIS, Digest of UK Energy Statistics, Table 5.5.

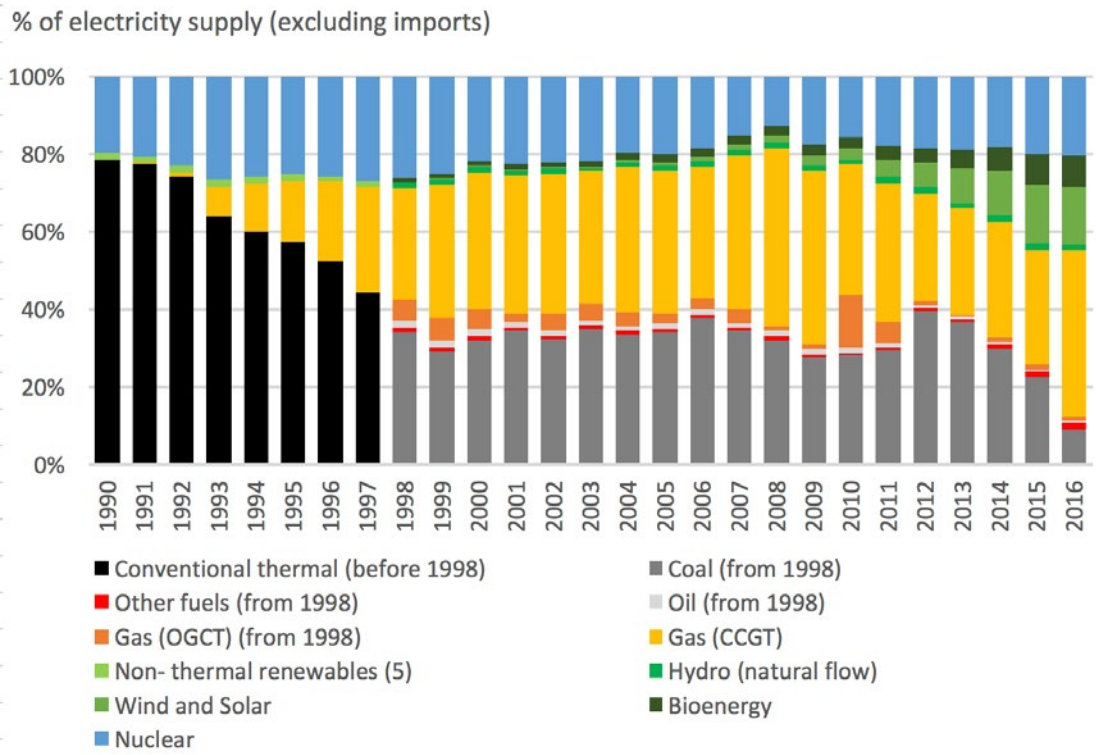
[121] The UK energy mix has changed in two distinct phases since 1990: (1) between 1990 and 2000: the 'Dash for Gas' replaced half of the power generated by coal plants with power from cleaner gas turbines; and (2) between 2012 and 2016: coal-fuelled power stations rapidly declined, replaced by gas turbines and renewable energy sources.

[122] Ofgem analysis of BEIS, Digest of United Kingdom Energy Statistics.

[123] Ofgem analysis of BEIS, Digest of United Kingdom Energy Statistics.

Figure 4.3 Carbon intensity and generation mix





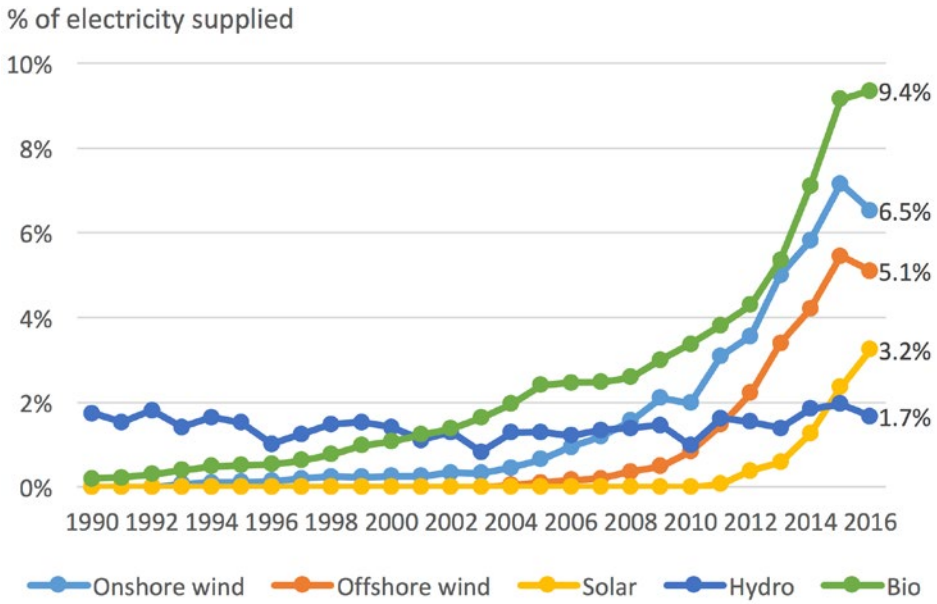
Notes:

We analyse the electricity supplied (net), as defined in Digest of UK Energy Supply, which excludes imports, exports, and electricity used on works. The data includes transmission and distributed generators. We also add back the net impact of pumped storage. See Table 5.5 in the Digest of UK Energy Statistics for reconciliations.

Sources:

Ofgem analysis of BEIS, Digest of UK Energy Statistics

Figure 4.4 Percentage of electricity generated by renewable generators



Notes:

We have shown generation as a percentage of gross electricity supply not including pumped storage (321TWh), which includes transmission and distributed generators.

Sources:

BEIS, Digest of UK Energy Statistics, table 6.1.1.

Significant challenges remain for reducing emissions

Low-carbon electricity should reduce emissions from transport

As the carbon intensity of electricity falls, it offers a way to reduce emissions from the most polluting sector in 2016: transport. In 2016, the transport sector emitted 121 megatonnes of greenhouse gas, similar to 1990 levels, but 3% more than in 2013.

The number of electric vehicles is currently low, but the industry is developing quickly. At the end of June 2017, 106,000 plug-in electric vehicles were registered in the UK, nearly triple the number registered in June 2015.[124] The current impact on overall demand for electricity and emissions is negligible. It is highly uncertain what impact electric vehicles will have on overall and peak demand in the future, dependent on factors such as policy choices, technological development, and the success of smart charging arrangements.

[124] Department for Transport, Vehicles statistics: all vehicles, Table VEH0131, last updated 14 September 2017.

Reduction in emissions from heating buildings has stalled

So far, reducing emissions from buildings has relied on energy efficiency improvements. In 2016, heating buildings emitted 89 megatonnes of greenhouse gas, 15% less than in 1990, despite the UK population growing by 8.4 million people (15%) over the same period.[125]

However, progress in improving efficiency has slowed. Emissions from heating buildings were higher in 2016 than in 2014, even after adjusting for mild winters. Fewer homes are having insulation installed. Between 2013 and July 2017, government's main energy efficiency programme (Energy Company Obligation) installed 1.4 million insulation measures to improve energy efficiency (0.3 million a year). The previous programme, CERT, installed 8.6 million insulation measures between 2008 and 2012 (1.8 million a year).[126]

Low-carbon sources of heating are still at very low levels

Most consumers heat their homes with fuels that emit greenhouse gases: 82% of households use gas, 6% use electricity, and 7% use oil.[127] To reduce greenhouse gas emission in line with targets, low-carbon sources of heating will need to be introduced. In 2010, the government expected that 12% of heating could be supplied from renewable sources by 2020.[128] Currently, around 4% of heating for buildings, residential and commercial, comes from low-carbon sources.[129]

Most renewable heat comes from wood combustion (58% of renewable heating) and plant biomass (28%). Only 5% comes from air source or ground source heat pumps.[130]

Government provides financial support for residential and business consumers to adopt renewable sources of heat. Between November 2011 and June 2017, its programme, the Renewable Heat Incentive (RHI), has supported 56,600 residential consumers and 16,400 commercial consumers to install renewable heating sources. Over 90% of commercial consumers (with RHI support) install biomass systems, whereas 64% of residential consumers install ground source or air source heat pumps.[131]

Since November 2011, RHI support has helped commercial consumers generate15.8 TWh of renewable heat, and residential consumers generate 1.8TWh.[132] For scale, residential consumers used 311TWh of gas in 2016. Low-carbon policies affect incentives for greater take up of low-carbon heat. Without RHI support, gas consumers are less likely to save money by switching to an electric-powered heat pump, so they look relatively less attractive to these consumers. The cost of carbon prices and low-carbon policies mostly fall on electricity bills rather than gas bills, contributing to the disparity in running costs for consumers.[133]

[125] Office of National Statistics, United Kingdom population mid-year estimates.

[126] Ofgem analysis of BEIS, Household Energy Efficiency National Statistics, headline release September 2017 and Ofgem, Carbon Emissions Reduction Target update 19 - May 2013.

[127] Ofgem analysis of the Office for National Statistics, Living Costs and Food survey.

[128] DECC, National Renewable Energy Action Plan, July 2010, p5

[129] Based on 2015 statistics, the most recent data available. Committee for Climate Change, 2017 Report to Parliament – Meeting Carbon Budgets: Closing the policy gap, June 2017; p.77

[130] Ofgem analysis of data on renewable sources of heat in 2016. BEIS, Digest of United Kingdom Energy Statistics, table 6.1.1.

[131] BEIS, RHI deployment data: June 2017

[132] BEIS, RHI deployment data: June 2017

[133] Committee on Climate Change, Next steps for UK heat policy, October 2016.

Financial support for low-carbon electricity

The impact of low-carbon electricity policies

So far, the rapid growth in renewable electricity has relied on subsidies. Figure 4.5 shows that, in 2016 prices, the annual gross cost of carbon prices and subsidies for renewable electricity has grown from £2.3 billion in 2010 to £7.4 billion in 2016 (or around £90 per year for the typical household). The growth in total gross payments simply reflects the increasing contribution these policies have had. Emissions avoided and electricity generated from renewable sources have increased in line with gross costs. The gross cost per tonne of carbon dioxide avoided was relatively stable between 2010 and 2015. We estimate that it fell by around 30% in 2016, to £103 per tonne of carbon dioxide, mainly due to the increased impact of carbon prices. The cost of support per MWh of renewable electricity has also been broadly stable, although the costs of individual policies and technologies vary considerably.

Consumers' bills are affected by the net cost of polices, not the gross cost of payments. Historically, the net costs and gross costs of support have been similar. But as low-carbon generators contribute more, the net cost of decarbonisation is more difficult to estimate, for two main reasons:

- First, on top of direct subsidies and carbon prices, integrating inflexible or intermittent sources of electricity can incur additional costs for maintaining the whole electricity system, which will vary depending on a range of policy decisions.[134] In 2016, 15% of electricity came from intermittent wind and solar. At these levels, the UK Energy Research Centre (UKERC) estimates that integration costs are between £5 per MWh and £10 per MWh of intermittent energy (up to £478 million in 2016).[135]
- Second, in the long run, low-carbon generators reduce wholesale electricity prices, offsetting some of their subsidies. Most low-carbon generators have lower marginal costs than conventional generators. To the extent that they replace conventional generators in setting the wholesale price (the merit order effect), wholesale prices should fall.

Both BEIS and the CCC argue that the rising cost of supporting low-carbon generation is, on average, more than offset by savings from policies that increase energy efficiency.[136] Most savings come from consumers replacing appliances and boilers with more efficient models, and improving the insulation in their homes (see Chapter 3).

Below we look in more detail at how these policies have helped reduce greenhouse gas emissions. In particular, we look at how:

- **Carbon prices** have reduced the profitability of coal, lowering its contribution; and
- **Subsidies for renewables** have helped develop renewables and reduce costs for new generators.

[134] Frontier Economics, Whole power system impacts of electricity generation technologies: a report prepared for the department of energy and climate change, February 2016. Published by BEIS in March 2017.

[135] UKERC, The costs and impacts of intermittency – 2016 update, February 2017.

[136] BEIS, Estimated impacts of energy and climate change policies on energy prices and bills: 2014, November 2014; Committee on Climate Change, Energy Prices and Bills Report 2017, March 2017.

Figure 4.5 The effects of electricity generation decarbonisation policies to date

Carbon avoided (MTCO2e)	2010	2011	2012	2013	2014	2015	2016
Renewable Obligation	12.0	15.3	17.3	24.6	29.4	33.7	34.4 (p)
Feed-in Tariff	0.0	0.2	0.8	1.3	2.0	2.7	3.1 (p)
Contracts for Difference							
Carbon pricing				0 (e)	5.1 (e)	10.2 (e)	33.7 (e)
Total	**12.0**	**15.5**	**18.1**	**25.9**	**36.5**	**46.6**	**71.6**

Gross cost of decarbonisation payments (£bn)	2010	2011	2012	2013	2014	2015	2016
Renewable Obligation	1.4	1.6	2.1	2.7	3.2	3.8	4.6 (p)
Feed-in Tariff payments	0.0	0.2	0.5	0.7	0.9	1.1	1.3 (p)
Feed-in-Tariff: reduced wholesale	0.0 (e)	0.0 (e)	0.0 (e)	-0.1	-0.2 (e)	-0.2 (e)	-0.3 (e)
Contracts for Difference							0.1
Carbon taxes - charges only	0.9	0.8	0.9	1.3	1.8	2.4	1.7
Total	**2.3**	**2.5**	**3.4**	**4.6**	**5.7**	**7.1**	**7.4**

Gross payments per tonne of carbon avoided (£)	2010	2011	2012	2013	2014	2015	2016
Renewable Obligation	120	103	121	108	107	112	133
Feed-in Tariff: net of reduced demand	365	567	549	443	357	331	308
Contracts for Difference							
Carbon pricing	N/A	N/A	N/A	N/A	356	240	52
Total	**194**	**160**	**190**	**177**	**155**	**153**	**103**

Renewable electricity generated (TWh)	2010	2011	2012	2013	2014	2015	2016
Renewable Obligation	23	31	35	50	56	69	84
Feed-in Tariff	0	0	2	3	4	6	8
Contracts for Difference							
Total	**23**	**32**	**37**	**52**	**60**	**75**	**92**

Gross payments per MWh (£)	2010	2011	2012	2013	2014	2015	2016
Renewable Obligation	62	51	60	54	57	55	55
Feed-in Tariff: net of reduced demand	188	279	271	220	189	161	127
Contracts for Difference							
Total	**100**	**79**	**94**	**88**	**95**	**95**	**81**

Notes:

- **Provisional data (p):** Data for Renewable Obligation and Feed-in-Tariff comes from Ofgem administrative data. 2016 data is provisional and marked '(p)'. Annual reports on Feed-in Tariffs and Renewable Obligations will be published in December 2017 and March 2018 respectively.
- **Carbon tax estimates (e):** The carbon avoided due to carbon taxes is an Ofgem estimate. We assume that without carbon prices, coal would have remained profitable between 2013 and 2016 and produced 55% of the combined generation from gas and coal in those years. We then use the government's greenhouse gas reporting conversion factors for each relevant year to calculate the carbon avoided.
- **Feed-in-Tariff estimates (e):** To calculate emissions avoided and costs to consumers we assume that all electricity generated by consumers with Feed-in-Tariffs would have been generated by power stations if Feed-in-Tariffs had not been available. This is a strong assumption. BEIS analysis of consumers installing solar PVs suggests that consumers use 500kWh less electricity from the grid each year after installing a solar PV.

Source:

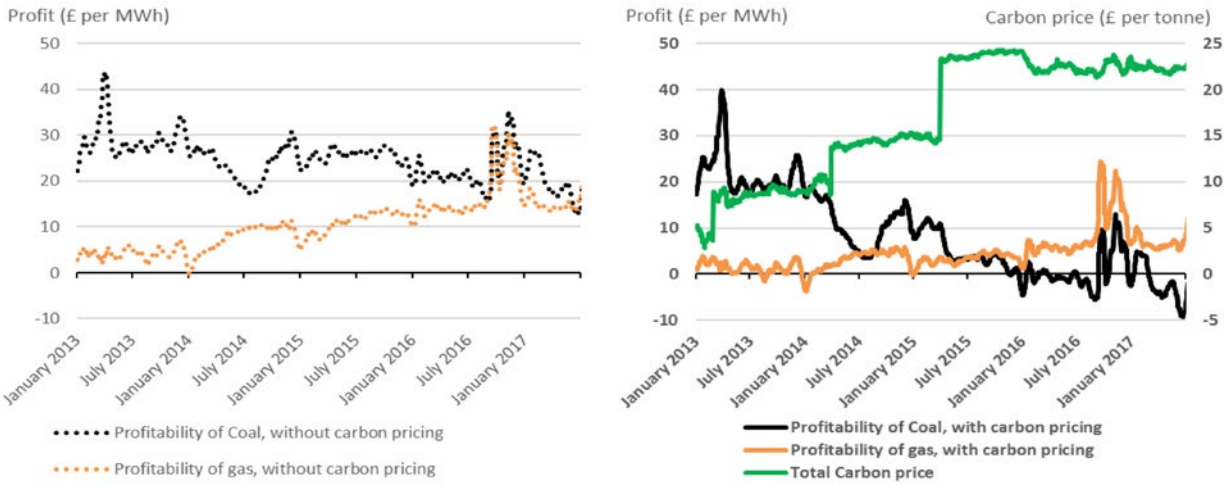
Ofgem analysis of Ofgem administrative data on Renewable Obligation and Feed-in Tariffs; BEIS, Provisional UK greenhouse gas emissions national statistics 2016. BEIS, Government emission conversion factors for greenhouse gas company reporting.

Carbon pricing is driving out coal-fuelled power

The government has committed to removing coal from the UK's energy mix by 2025.[137] Coal plants are encouraged to leave the market through a combination of lower revenues (due to competition from low-carbon power sources), and higher costs (such as those imposed by the EU Industrial Emissions Directive and carbon prices).

All of these factors have contributed to coal's decline, but in the last few years, higher carbon prices have been particularly important. We estimate that carbon prices now make coal unprofitable in the UK. Last year, UK power stations were charged an average of £22 per tonne of carbon dioxide they emitted. Figure 4.6 shows how increasing carbon prices between 2013 and 2016 helped make coal less profitable than gas. In the rest of the EU, where carbon prices are lower, coal and carbon emissions have not fallen at the same rate.

Figure 4.6 Carbon prices affect the profitability of coal and gas



Notes:

Wholesale prices and spreads show a 14-day rolling average of the day-ahead spot rates.

Source:

Ofgem analysis of Bloomberg data

[137] BEIS, Government announces plans to close coal power stations by 2025, November 2015.

Reducing the average cost of subsidies

Figure 4.7 shows that the total gross costs of financial support will continue to grow as low-carbon generation expands. Over the next five years, most costs are legacy costs: Renewable Obligation and Feed-in-Tariffs payments to generators that are already operating.

Figure 4.7 Office for Budget Responsibility forecasts for low-carbon electricity support (£bn)

	Forecast gross expenditure in £ billions (2017 prices)				
	2017-18	**2018-19**	**2019-20**	**2020-21**	**2021-22**
Renewables obligation	5.4	6.3	6.6	6.8	7.0
Feed-in tariffs	1.3	1.4	1.5	1.5	1.6
Contracts for difference	0.7	1.3	1.9	2.7	3.2
Low-carbon subsidies passed on to consumers	**7.5**	**9.0**	**10.0**	**11.0**	**11.8**
Carbon reduction commitment	0.6	0.5	0.5	0.0	0.0
Capacity market	0.2	0.7	1.0	1.3	1.4
Warm home discount	0.3	0.3	0.3	0.4	0.4
All 'environmental levies' in OBR forecasts	**8.7**	**10.7**	**11.9**	**12.6**	**13.5**

Note:

Forecasts include expenditure for current policy commitments only. The OBR lists six environmental levies, which we show for completeness. The Capacity Market is discussed in chapter 5 , and the Warm Home Discount in chapter 3.

Source:

Office for Budget Responsibility, Economic and Fiscal Outlook, March 2017

Technological innovation and better-developed supply chains mean that the cost of building and operating renewable generators is falling. This reduces the amount of financial support consumers need to provide to new generators. In particular:

- The UK's first solar power farm to be built without government subsidy was opened in September 2017.[138] The middle rate provided to new solar panels under Feed-in-Tariffs has fallen from between £360 and £442 per MWh (depending on size) in 2011 to between £18 and £39 per MWh in 2017.[139]
- Figure 4.8 shows that, for less-established technologies such as offshore wind turbines, new generators in 2022-23 will receive £57.50 per MWh, including the wholesale price. That total price is 52% less than generators built five years earlier will receive. Depending how the wholesale price develops, a total price at £57.50 per MWh should represent a very low level of subsidy and a low net cost on consumers' bills.

Figure 4.8 Contracts for Difference prices awarded to less established technologies

	Clearing Price award from year of deployment (£/MWh)					
Technology	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**Reduction in price**
Advanced Conversion Technologies	119.89	114.39		74.75	40.00	
Dedicated Biomass with CHP				74.75		
Offshore Wind	119.89	114.39		74.75	57.50	
Total (weighted by capacity in MW)	119.89	114.39		74.75	57.44	-52%

Note:

Costs are stated in 2012 prices.

Source:

Ofgem analysis of BEIS, 'Contracts for Difference Second Allocation Round Results' and 'Contracts for Difference Second Allocation Round Results' and Electricity Market Reform Delivery Body, Contracts for Difference Round Guidance.

[138] Financial Times, Solar power breakthrough as subsidy-free farm opens, 26 September 2017.

[139] Ofgem analysis of Ofgem, Feed-in Tariffs (FIT) rates.

Competition has also played an important role in reducing costs. From 2015-16, the government introduced Contracts for Difference to replace the Renewables Obligation. Contracts for Difference have been allocated through competitive auctions since 2015, reducing costs for consumers compared with prices set administratively. Figure 4.9 shows that the first set of Contract for Difference auctions set average prices 15% lower than average administrative prices. The second auction, held in 2017, set average prices 41% below the average administrative threshold.

Figure 4.9 Strike prices and administrative prices for competitive Contracts for Difference auctions announced in February 2015 and September 2017

	Allocation round 1			Allocation round 2		
	Weighted Administrative price (£/MWh)	Weighted clearing price (£/MWh)	Reduction	Weighted Administrative price (£/MWh)	Weighted clearing price (£/MWh)	Reduction
Advanced Conversion Technologies	140.00	117.58	-16%	123.76	70.43	-43%
Dedicated Biomass with CHP				115.00	74.75	-35%
Offshore Wind	140.00	117.77	-16%	105.00	62.14	-41%
Energy from Waste with Combined Heat and Power	80.00	80.00	0%			
Onshore wind	90.30	82.04	-9%			
Solar PV	117.30	65.80	-44%			
Total (weighted by capacity)	**119.19**	**101.85**	**-15%**	**105.62**	**62.62**	**-41%**

Note:

Costs are stated in 2012 prices

Source:

Ofgem, analysis of data in BEIS, 'Contracts for Difference Second Allocation Round Results' and BEIS, 'Contracts for Difference Second Allocation Round Results'.

So far, low-carbon generation in the UK has not been provided at the lowest-possible cost to consumers, for reasons such as supporting less-established technologies or avoiding investment delays. In particular:

- Less-established technologies have been prioritised. In the first Contracts for Difference auction, established generators were, on average, 32% cheaper than less established generators. Figure 4.10 shows that 90% of the annual budget for Contracts for Difference auctions went to less-established technologies.
- Administratively-set or negotiated prices have been common. The Competition and Markets Authority estimated that, for 15 years, consumers are paying about £250-310 million per year (equivalent to 1% of their bill) more than necessary because the first Contracts for Difference offered administrative prices that were between 30% and 60% higher than the auction prices bid by similar wind farms a few months later.[140] The negotiated Hinkley Point C Contract for Difference commissions 3.2GW of capacity at a cost of £92.50 (in 2012 prices) per MWh for 35 years (between 2025 and 2060).

As requirements for low-carbon electricity increase, it becomes even more important for consumers that they are funded cost-effectively. The market may soon be able to provide generation at zero subsidy without a government framework. However, given the high fixed costs and low marginal costs of most low-carbon generators, a scheme that provides certainty of revenues to investors, such as Contracts for Difference, could still be beneficial.

[140] Competition and Markets Authority, Energy market investigation: Final report, June 2016.

Figure 4.10 Budgets and awarded capacity for Contracts for Difference auctions one and two.

	Annual Budget		Capacity by 2022-23		Delivery
Auction one	(£m)		(MW)		
Established	65	17%	915	43%	From 2015-16
Less established	325	83%	1,224	57%	From 2016-17
Total	**390**		**2,139**		
Auction two					
Established	0		0		
Less established	290	100%	915	100%	From 2021-22
Total	**290**		**1,224**		
Combined auction results			2139		
Established	65	10%		0%	
Less established	615	90%	0	0%	
Total	**680**		**3,346**		

Note:

All costs in 2012 prices. Annual budgets for the first round were lower in the first year. Established technologies in 2015-16 were allocated £50 million and less established technologies were allocated £155 million in 2016-17.

Source:

Ofgem, analysis of data in BEIS, Budget Notice for CFD Allocation Round 1; BEIS, Budget Notice for the Second CFD Allocation Round, March 2017; BEIS, 'Contracts for Difference Second Allocation Round Results'; and BEIS, 'Contracts for Difference Second Allocation Round Results'.

Adapting to new sources of power

The electricity system needs to adapt

Decarbonisation is changing how we generate power in three important respects:

- Increasing the proportion of power generated by 'intermittent' sources – generators that do not control when they produce electricity.
- Increasing the proportion of 'inflexible' generation – generators that cannot easily change the amount of energy they produce in response to changes in demand. For instance, nuclear power stations provide relatively fixed amounts of energy (as a group they consistently provided between 6 and 8 GW in 2016).
- Increasing the amount of embedded generation – power sources that provide electricity to the distribution network for local use, rather than to the transmission network. In 2016, embedded wind and solar generators supplied 19 TWh of electricity (6% of demand).[141]

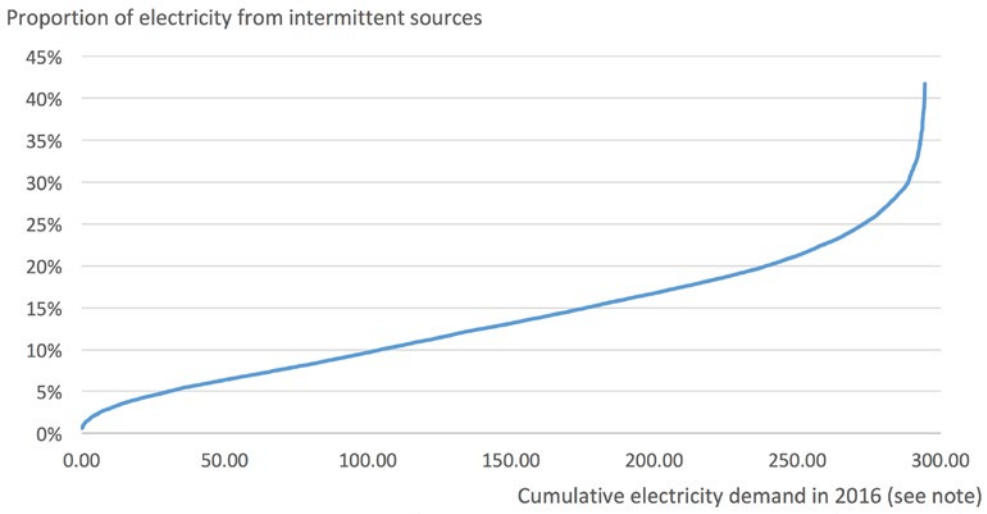
Unless the grid adapts to these new features, matching demand and supply will be more difficult or expensive. Figure 4.11 shows how the contribution of wind and solar varied in each half-hour trading period across 2016. For the majority of the year, wind and solar met between 5% and 25% of demand. Very high and very low levels of wind and solar were relatively rare, but both extremes present challenges:

- Low levels of intermittent power – in these periods, other sources of power are required to meet demand. If there is high demand, and few sources of generation, consumers risk high prices and, potentially, supply shortages.
- High levels of intermittent power – in these periods, intermittent generators reduce the demand for power from other generators. If there is low demand and a high level of inflexible power, National Grid's options for balancing the system are constrained.

We discuss the impact that intermittent energy is already having on the energy system in chapter 5.

[141] Ofgem analysis of National Grid data.

Figure 4.11 Contribution of solar and wind in 2016



Note:

The x-axis shows cumulative demand in each half-hour trading period in 2016, it includes: a) 'National Demand', which is the sum of metered generation in Great Britain, but excludes generation required to meet station load, pump storage pumping and interconnector exports; and b) National Grid's estimate of embedded wind and solar generation in each half hour trading period. Each half-hour trading period is ordered by the proportion of demand met by intermittent generation.

Source:

Ofgem analysis of National Grid, DemandData 2011-2016 and Elexon, BM reports.

Adapting to these changes affordably requires greater flexibility in the energy system. Broadly, flexibility can be provided in three ways:

- **Flexible generation:** Flexible generators – such as combined cycle gas turbines – can provide power quickly when intermittent power is unavailable, and switch off easily and affordably when it is not required.
- **Flexible demand:** instead of shifting supply to match demand, consumers could shift their demand in response to increases or decreases in supply. 'Time of use' tariffs charge consumers more in peak periods, and less in periods of low demand in order to reduce strain on the system. Similarly, 'aggregators' can reduce or increase a large number of consumers' demands at once to adjust to supply.
- **Storage and interconnectors:** Storage allows electricity to be shifted to periods in time with scarcer supplies. Interconnectors allow electricity to be moved between countries to locations with scarcer supplies. Both tools reduce the need for supply and demand to match in specific periods and locations.

We outline some of the actions we are taking to encourage flexibility in the next chapter, which looks at security of supply.

Chapter 5: Security of Great Britain's energy supply

Summary of findings

- Secure energy supplies in Great Britain have been maintained, without using contingency measures.
- Electricity supply has consistently been more reliable than the government's reliability standard. This could suggest overall consumer costs of ensuring security of supply have been higher than necessary.
- The Capacity Market should provide adequate capacity when it begins operating in 2017-18, and could also mitigate the cost impacts of inflexible generation. Good forecasting and effective competition are key to maximise consumer value from the market.
- National Grid's activity to balance electricity supply and demand cost consumers about £1.15 billion in 2016-17, almost one third higher than the previous year. The increase is largely due to one-off factors, but partly reflects the challenges of balancing a system with growing inflexible generation sources.

Introduction

Secure energy supplies bring benefits to consumers, the economy and wider society. Reliability is a cornerstone of government energy policy and forms one of Ofgem's five strategic consumer outcomes.

Consumers and businesses must be confident that they can heat and power their homes and commercial premises when needed. This requires the energy system to operate efficiently and to be resilient to demand and supply shocks. The transition to clean energy presents challenges for ensuring secure supplies, since an increasing proportion of our electricity comes from inflexible sources.

Three main bodies have a role in ensuring security of supply in GB gas and electricity:

- The UK and national governments set the long-term direction for energy policy, and the UK government also has specific roles in areas such as determining levels of capacity to be purchased in the Capacity Market;
- National Grid manages flows on the grid so that supply matches demand;
- Ofgem works to ensure that gas and electricity markets work properly, to reduce or eliminate any barriers that stop companies doing their job, and to regulate and incentivise National Grid.

This chapter examines the security of GB electricity and gas supplies by considering whether there is sufficient generating capacity to meet consumer demand and whether the system remains balanced and reliable while operating efficiently.

Security of Great Britain's gas supply

Secure and adequate gas supplies

A diverse range of gas supplies

GB gas supplies are relatively diverse, limiting exposure to shocks. For winter 2016-17, 42% of UK supplies came from Norway, 38% from UK production fields, 10% from European pipelines and 4% from liquefied natural gas (LNG) from global markets. The main sources of gas imports are the gas interconnectors connecting Bacton in the UK with Belgium and the Netherlands, pipelines through Norway that connect the National Transmission System (NTS) to continental Europe, and LNG which arrives through four import terminals.

Storage provided 6% of supplies in winter 2016-17. In June 2017, Centrica announced the permanent closure of Rough – the UK's largest gas storage facility – after a period of technical problems. Although this will significantly reduce UK storage capacity, Centrica estimates that there are around 5 billion cubic metres (bcm) of recoverable gas in Rough.[142] GB is not dependent on any one piece of infrastructure, including Rough, for security of supply.

The gas system is reliable and margins are comfortable

Since liberalisation in the 1990s, the gas market has delivered secure supplies and investment in new import infrastructure. We have never had a gas deficit emergency where consumer supplies had to be involuntarily stopped, and there is low likelihood of one occurring. If gas supplies were to be insufficient to meet demand, National Grid can take emergency measures to maintain demand and supply balance. These would allow prices to spike temporarily to bring in additional supplies and to require consumers, starting from the largest industrial ones, to reduce demand, reducing the risk of interrupted services for household consumers.[143]

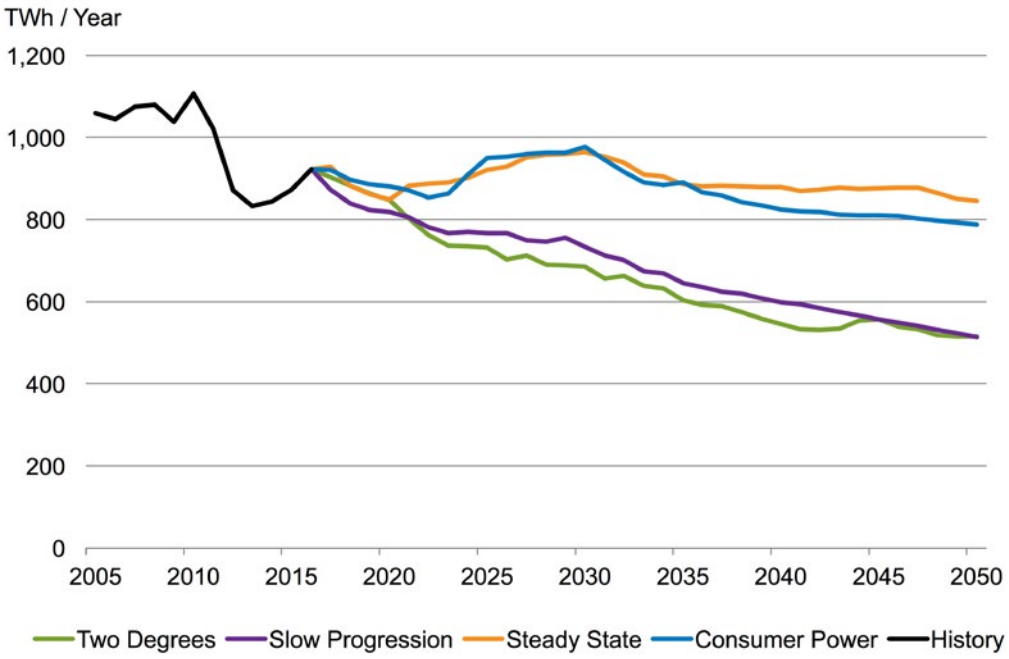
In winter 2016-17, GB demand for gas was 52.5 billion cubic metres (bcm). This was 7% higher than National Grid's forecast (49.1 bcm). The increase was due to low gas prices encouraging gas turbines to generate more electricity than expected. The highest demand over 2016-17 was on 26 January 2017, at 372 million cubic metres (mcm) per day. Infrastructure was able to deliver more than 600 mcm of gas per day in 2016, and supply easily met demand.

In the longer term, the demand for gas is highly uncertain, depending on factors such as policy and technological developments, as well as consumer willingness to replace gas as a heating source. National Grid's Future Energy Scenarios expect demand for gas to fall, limiting pressure on security of supply (Figure 5.1).

[142] http://www.centrica-sl.co.uk/sites/default/files/rough_permanent_cessation_of_storage_operations_200617.pdf.

[143] See http://www2.nationalgrid.com/UK/Industry-information/Gas-transmission-system-operations/Balancing/Gas-DSR/

Figure 5.1 Projections of UK gas demand



Notes:

The four scenarios reflect different possible future outcomes. 'Two Degrees' projects a cost-optimal pathway to meet the UK's 2050 carbon emissions reduction target. 'Steady State' reflects a pathway with current levels of progress and innovation. 'Consumer Power' represents a world where there is high economic growth and high disposable income. 'Slow Progression' is a scenario where low economic growth competes with the desire to decrease carbon emissions.

Source:

National Grid, Future Energy Scenarios 2017.

The UK gas system remains resilient to disruptions

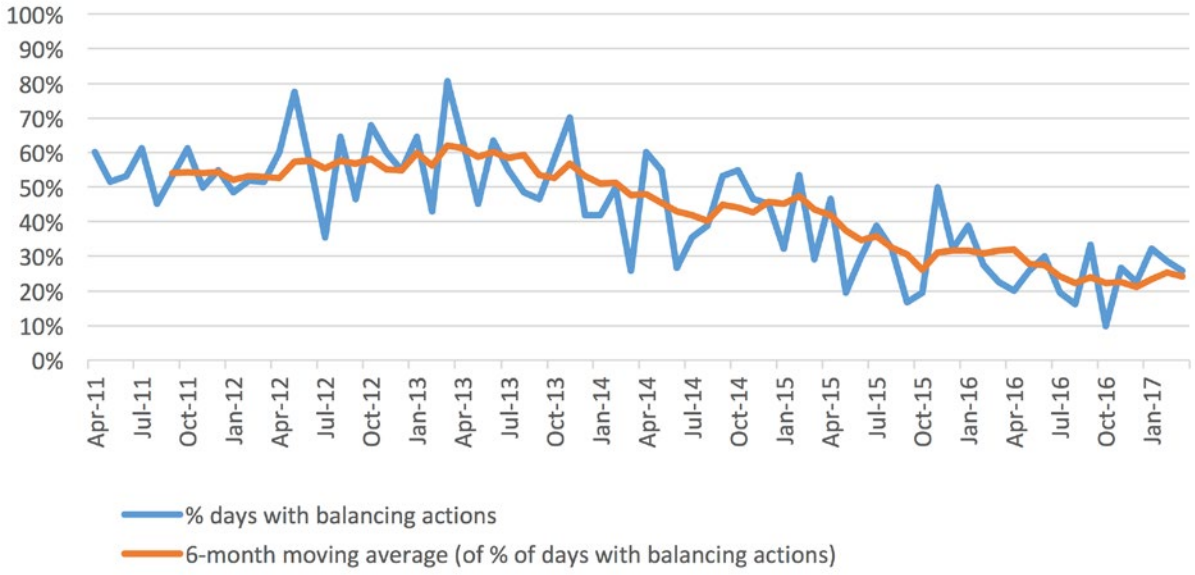
Although storage capacity has reduced, we expect risks to be manageable. According to National Grid's analysis in its 2017-18 Winter Outlook, the UK is resilient to potential gas infrastructure disruptions.[144] Drawing on this analysis, we estimate that, in the event of loss of the largest gas supply routes, supply will still be able to meet around 106% of GB peak demand. This suggests that there is sufficient supply capacity to be able to meet peak demand even in the event of significant infrastructure outages or unavailability of supply from a major source.

System operation and balancing

National Grid imposes imbalance charges on gas shippers that fail to balance their supply and demand by the end of the gas day. These charges have promoted a steady reduction in the number of days each month on which National Grid acts as residual balancer because the market fails to balance itself (Figure 5.2). The System Operator has never had to deploy emergency balancing actions.

[144] http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589942578

Figure 5.2 % days with balancing actions



Source:

National Grid data item explorer

Security of Great Britain's electricity supply

Security of electricity supplies

The electricity system is reliable and no 'out-of-market' measures were required to maintain supply in 2016

The government assesses and procures adequate supplies against its 'reliability standard', published in 2013.[145] This standard implies that National Grid should use its 'out of market' measures to balance supply and demand for three hours each year on average (assessed over a period of many years). This is the same standard as in France and Germany.[146] Out of market measures are actions that the System Operator employs when additional activities are required to balance supply and demand beyond those provided by the normal operation of the market (Figure 5.3).

[145] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223653/emr_consultation_annex_c.pdf. BEIS is conducting a review of the reliability standard which is expected to conclude within a year.

[146] See https://publications.parliament.uk/pa/ld201415/ldselect/ldsctech/121/12106.htm.

Figure 5.3 Out-of-market actions available to National Grid in 2016

'Out of market' actions	What it does	Price or cost to consumer
New Balancing Services included Supplementary Balancing Reserve (SBR) and Demand Side Balancing Reserve (DSBR)	DSBR was a demand-side service that offered payments to half-hourly metered non-domestic consumers for reducing demand at peak times. SBR was a supply-based balancing service available between 6am and 8pm on winter weekdays. DSBR was discontinued in 2016 and SBR in 2017, linked to the introduction of the Capacity Market Early Auction.	This was priced to the market at £3,000 / MWh.
Voltage reduction	For small events, in both energy and duration, the System Operator can manage the system by reducing the voltage level and hence the level of consumption.	It is currently priced at £3,000 / MWh.
Maximum generation	'Maxgen' involves generators operating at above 100% of their rated output.	Between £1,200 and £10,000 / MWh (2013)
Emergency interconnector assistance	Emergency services from interconnectors are used as a last resort before beginning controlled disconnections of GB customers.	Variable price, determined day ahead with interconnected System Operator, can be around £500 / MWh
Demand disconnection	Controlled disconnection of customers: the System Operator asks the Distribution Network Operators to disconnect load.	Households and small businesses are estimated to assign a value of around £17,000 / MWh to uninterrupted supplies. Values for large businesses are typically lower. Demand disconnection is currently priced at £3,000 / MWh.

Source:

Demand disconnection costs from 'The value of lost load for electricity in GB', London Economics, 2013, https://www.ofgem.gov.uk/ofgem-publications/82293/london-economics-value-lost-load-electricity-gb.pdf; New Balancing Services from https://www.elexon.co.uk/mod-proposal/p323/; demand disconnection and voltage reduction prices from Ofgem EBSCR reforms https://www.ofgem.gov.uk/publications-and-updates/electricity-balancing-significant-code-review-final-policy-decision; maxgen prices from http://www2.nationalgrid.com/uk/services/balancing-services/system-security/maximum-generation/; interconnector prices based on discussions with National Grid.

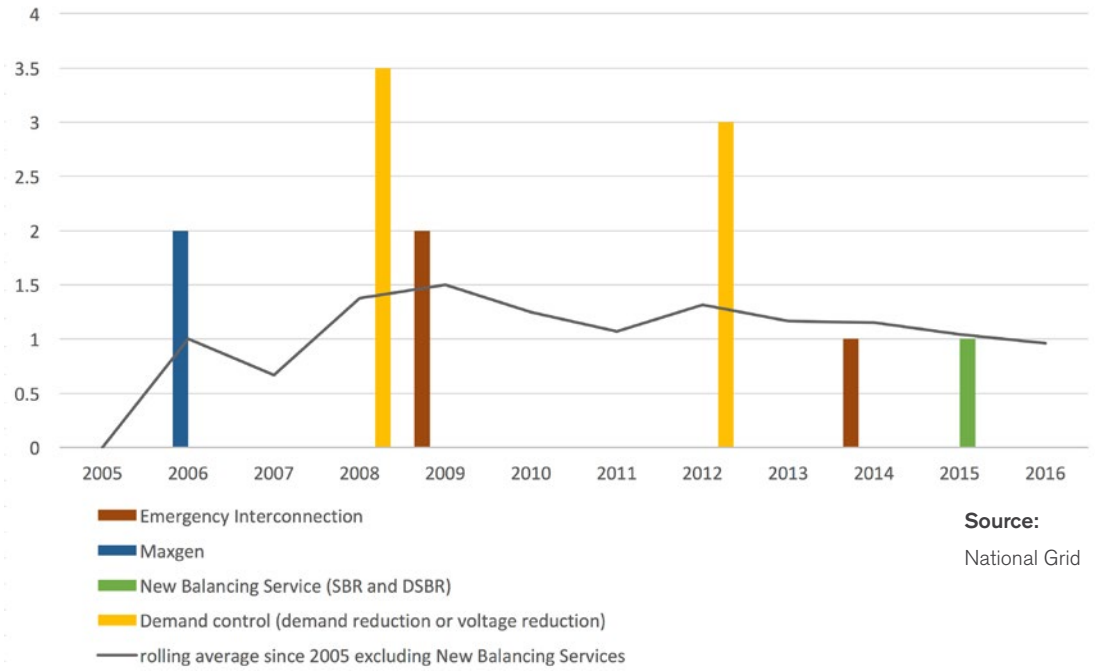
The three-hour reliability standard suggests that it is less costly for consumers to have three hours of out-of-market actions each year – taking into account the associated costs of possible interruptions – than it is to build extra generating capacity for those three hours. Conversely, the government expects using out of market measures for more than three hours a year to be poorer value for consumers than building extra capacity.[147]

There was no loss of load in 2016, meaning that National Grid did not deploy any out-of-market measures to maintain supplies. Although an out-of-market action was taken in 2015 – to deploy Demand-Side Balancing Reserve – it transpired that the action had been unnecessary as the market had provided sufficient supplies.

In total, National Grid has carried out around 12 hours of out-of-market actions since 2005, about one hour each year on average (Figure 5.4). Given that out-of-market actions have typically been less than expected in the reliability standard, this suggests a risk that security has been maintained at a higher cost to the consumer than necessary.[148] National Grid expects less than 40 seconds of out-of-market measures to be deployed during winter 2017-18.[149]

In addition, National Grid has recently begun to estimate the risk of a loss of load for each half-hour settlement period across the year.[150] This offers another way of considering outturns against the reliability standard. On this basis, in 2016-17 there were 437 hours when the risk of a loss of load was above zero but less than 10%, and 1.5 hours when the risk was between 20% and 30%. This suggests that the cumulative expectation of a loss of load across the year was around 45 minutes – a quarter of the government's reliability standard.

Figure 5.4 Duration (hours) of out of market actions deployed by National Grid



Source: National Grid

[147] The government's Panel of Technical Experts notes that the reliability standard is defined in terms of the costs of involuntary disconnection, but is applied to assess the amount of capacity required to avoid 'loss of load', which includes actions that are less costly than involuntary disconnection. The result may therefore be to provide a more stringent standard in practice. See https://www.gov.uk/government/publications/electricity-market-reform-panel-of-technical-experts-2017-final-report-on-national-grids-electricity-capacity-report-2017

[148] Other possible explanations include new capacity being cheaper than the government expected when setting its reliability standard, or the period since 2005 being unusually benign for security of supply.

[149] http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/FES/Winter-Outlook/

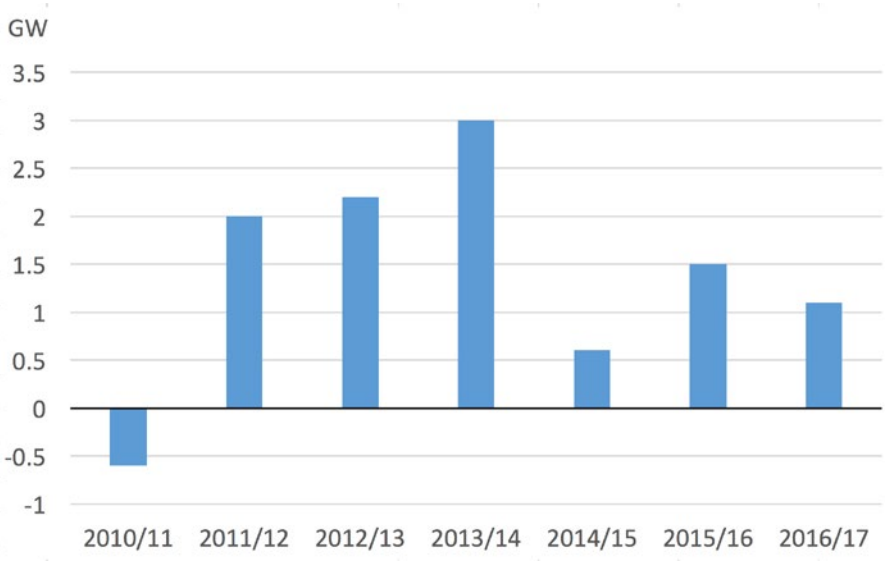
[150] Published by Elexon.

Capacity margins are adequate and not as tight as forecast for 2016

The margin between peak demand and available supply has generally been falling since 2010. Our last assessment of the risks noted that the outlook for winter 2016-17 had a wide range of uncertainty as the margin between peak winter demand and available supply narrowed.[151] However, in our view there was potential for the risks to be managed by either a strong market response or a continued reduction in demand.

Margins were ultimately less tight than expected, in part because demand was 1.1 GW (roughly 2%) lower than National Grid forecast. National Grid stated that it had underestimated the role of on-site generators and of consumer demand management during peak periods.[152] Since 2011, National Grid's forecasts of transmission demand have been consistently above out-turns (Figure 5.5), by around 1.5GW on average. Reported differences are smaller for 'underlying demand' – a broader definition of demand – but this is not objectively measurable.[153] Overall, this could suggest that risks have been over-estimated.

Figure 5.5 Difference between forecast and out-turn demand (one-year ahead normal weather corrected peak transmission system)



Source:

National Grid calculations

[151] https://www.ofgem.gov.uk/sites/default/files/docs/2015/07/electricitysecurityofsupplyreport_final_0.pdf

[152] National Grid Winter review and consultation 2017

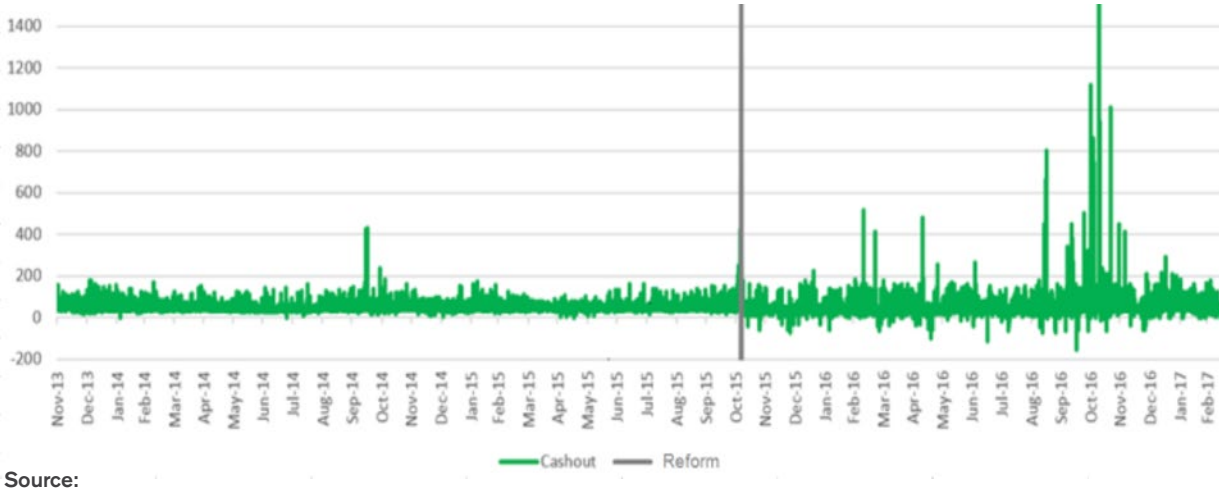
[153] The average difference is smaller – and improves over time – when comparing 'underlying demand' out-turns with National Grid forecasts in its 'slow progression' Future Energy Scenario. 'Underlying demand' includes peak demand at the transmission and distribution system levels as well as peak demand reduction by Demand Side Response. This definition is most relevant to the Capacity Market, since procurement volumes are based on underlying demand. However, underlying demand is not objectively measurable. Total peak demand in the system is not metered, as most end users of demand are metered annually, and not all distributed generators are metered at peak. National Grid considers that proper forecasting of Peak National Demand at the transmission level requires it to seek to fully understand and forecast all the elements of total peak demand (see https://www.ofgem.gov.uk/sites/default/files/docs/2015/09/decision_on_revenue_outputs_and_incentives_for_nget_plcs_roles_in_electricity_market_reform_0.pdf.)

Great Britain had over 100 GW of installed capacity in 2016-17, compared to peak winter transmission-level demand about 51 GW, and peak underlying demand estimated at about 60GW. However, not all of that capacity will be available at any given moment. About 30 GW comes from intermittent solar and wind. Other plant may not be available, for instance if offline for repair.

During winter 2016-17, available capacity was between 1 GW and 2 GW higher than forecast. National Grid expected an average of 55 GW of capacity to be available during the winter (including the 3.5 GW of SBR held in reserve). Between mid-November 2016 and February 2017, the market (plus SBR) provided 56 GW to 58 GW of available capacity. Capacity was higher than expected for a range of reasons, including higher plant utilisation rates ('load factors') for gas and nuclear, and lower than expected breakdown rates for coal, nuclear and some gas technologies. There were specific periods of greater risk: overall, there were 21 hours where de-rated margins were less than 1 GW.

Extra capacity was available partly because generators responded to forecasts of high market prices. To help ensure price signals that are responsive to needs, in 2015, Ofgem reformed 'cash-out' arrangements to ensure that system prices better reflected the marginal cost of balancing the system – and the value that consumers assign to secure supplies. Prices can now rise higher when margins between supply and demand tighten, incentivising generating capacity to be available (Figure 5.6).[154]

Figure 5.6 System prices ('cashout') over time (£/MWh)



Source:

NETA reports website

[154] Elexon has found that the standard deviation of prices when the market is short of generation has increased by 731% in the year since introduction of the reform. See https://www.elexon.co.uk/wp-content/uploads/2017/02/P305-Post-Implementation-Review.pdf

Longer-term risks and the Capacity Market

In 2013, the government identified a risk that at times of scarcity, wholesale prices may be too low to reward generators sufficiently for their contribution to secure energy supplies.[155] This 'missing money', or even the perception of it, could reduce planned investment in the capacity required to cover peak demand, increasing the risk of insufficient future supply.

To address this risk, the government introduced the Capacity Market to pay generators that provide available capacity during the winter, beginning in 2017-18. These payments provide a source of revenues to generators in addition to wholesale prices. Four major auctions have been held so far: an early auction one year ahead of delivery in 2017-18 with payments of around £380 million, and three auctions for capacity four years ahead of delivery between 2018-19 and 2020-21 with payments of around £1 billion each (Figure 5.7).[156] These gross costs will be passed on to electricity suppliers and ultimately to consumers.

Because of its auction structure, the gross cost of the Capacity Market can be very sensitive to the amount of capacity procured. Figure 4.8 provides indicative analysis of the financial risk of errors in forecasting required capacity. Procuring 1.5 GW less capacity in the 2017-18 Capacity Market (the 'Early Auction') than was actually purchased (54.43 GW) would have saved about £15 million. But procuring 1.5 GW more would have cost an additional £374 million, roughly doubling the total gross cost. Note that this analysis does not take into account possible changes to numbers of bidders and bidding strategies as capacity procured changes.

Figure 5.7 Major Capacity Market auctions

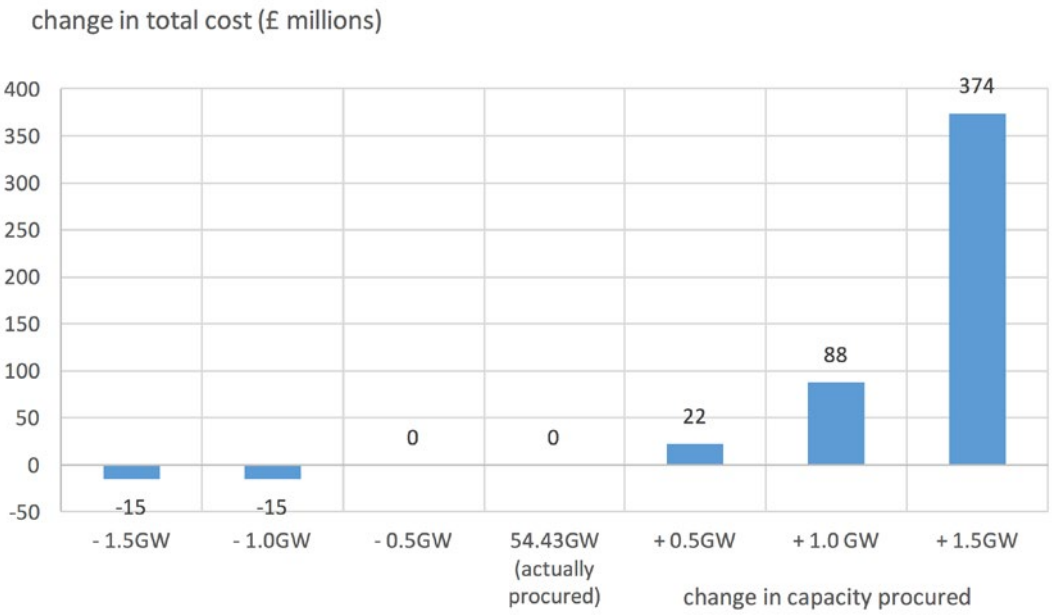
Delivery year	2017-18	2018-19	2019-20	2020-21
Main auction date – years before delivery	1 year	4 years	4 years	4 years
Price (£/kW per year)	7	19	18	23
Capacity (GW)	54	49	46	52
Total payments (£m, nominal)	378	956	834	1,180

Source:
EMR Delivery Body

[155] The government's analysis drew on the findings of Ofgem's Project Discovery: https://www.ofgem.gov.uk/ofgem-publications/40354/projectdiscoveryfebcondocfinalpdf.

[156] There have also been some additional auctions, for instance to purchase particular types of capacity.

Figure 5.8 Illustrative change in 2017-18 Early Auction gross cost as capacity procured is changed



Source:

Ofgem analysis of Capacity Market bid data

While the gross costs of the Capacity Market are substantial, the additional capacity it procures should reduce wholesale prices, meaning that the net costs to consumers will be substantially lower. Net costs could even be negative if the Capacity Market reduces the risks of investment in generating capacity.

The net effect of capacity payments on wholesale prices and consumer costs is difficult to establish in practice and will require ongoing monitoring. Our analysis of the impact on wholesale prices of the Early Auction suggests that its announcement was associated with a reduction in peak wholesale prices of around £1 per MWh.[157] This could imply a reduction in wholesale revenues (and associated consumer costs) of around £150 million in 2017-18, compared with Capacity Market payments of about £380 million. This analysis provides initial evidence of the transfer of value from the wholesale market to the Capacity Market. The difference between these two figures sheds light on the extent of 'missing money' – the theory that wholesale prices do not respond fully to supply shortages.[158]

The government has established a Panel of Technical Experts to advise it on technical aspects of Electricity Market Reform, with a particular focus on scrutiny of the analysis behind Capacity Market decisions. Many of the panel's recommendations so far relate to the risk of over-procurement of capacity.[159] To help address this, we have placed incentives and obligations on the System Operator to improve its forecasts underpinning Capacity Market procurement targets. In 2015, we introduced an obligation requiring National Grid to explain what it is doing to improve its demand forecasting.[160]

[157] See technical appendix.

[158] A full analysis would also need to consider impacts on other revenue streams such as National Grid's ancillary services, not assessed here.

[159] See https://www.gov.uk/government/publications/electricity-market-reform-panel-of-technical-experts-2017-final-report-on-national-grids-electricity-capacity-report-2017

[160] https://www.ofgem.gov.uk/sites/default/files/docs/2015/09/decision_on_revenue_outputs_and_incentives_for_nget_plcs_roles_in_electricity_market_reform_0.pdf

Operating the system

Balancing the electricity system has become more challenging

Even with adequate capacity, security of supply requires that the grid operates efficiently and effectively to deliver energy to consumers. National Grid uses several tools to operate the system. It resolves discrepancies between supply and demand by, for example, buying more energy in the balancing mechanism or trading ahead of time with forward trades. It also provides availability payments for plants that offer valuable ancillary services in keeping the system balanced. Finally, through the cash-out mechanism, it reflects the costs for these services on generators and suppliers according to the extent that these parties contributed to a given imbalance.

Increased flexibility of demand helps in balancing the system. According to National Grid, the extent of industrial demand offering to reduce its consumption during peak demand periods (Demand Side Response or DSR) increased by 0.5GW between 2008 and 2015, from 0.8GW to 1.3GW.[161] There are now over four million electricity smart meters on the system, an increase of almost two million in 2016-17.[162] These developments should encourage greater flexibility of energy consumption.

However, the reduction of conventional plant to meet our carbon targets removes some sources of flexible generation. Changing how we generate power heightens three main challenges:

- Maintaining frequency across the whole system. Intermittent power makes forecasting available supplies harder. At short notice, back-up supplies may be required to cover shortfalls, or plants may need to reduce their output to prevent over-supply. Also, large changes in frequency can lead to a loss of power. Conventional turbines have inertia, resisting changes in frequency on the grid. Maintaining frequency with less inertia may require new services, such as power sources that can provide energy rapidly.
- Maintaining voltage. Large generators that can synchronise with the grid help transfer power across the grid effectively. Changes in operating patterns of generators affect the tools available for National Grid to manage voltage.
- Managing bottlenecks on the transmission system. Changes to the location of generators across GB may mean that the System Operator needs to take different actions to coordinate the flows across the country

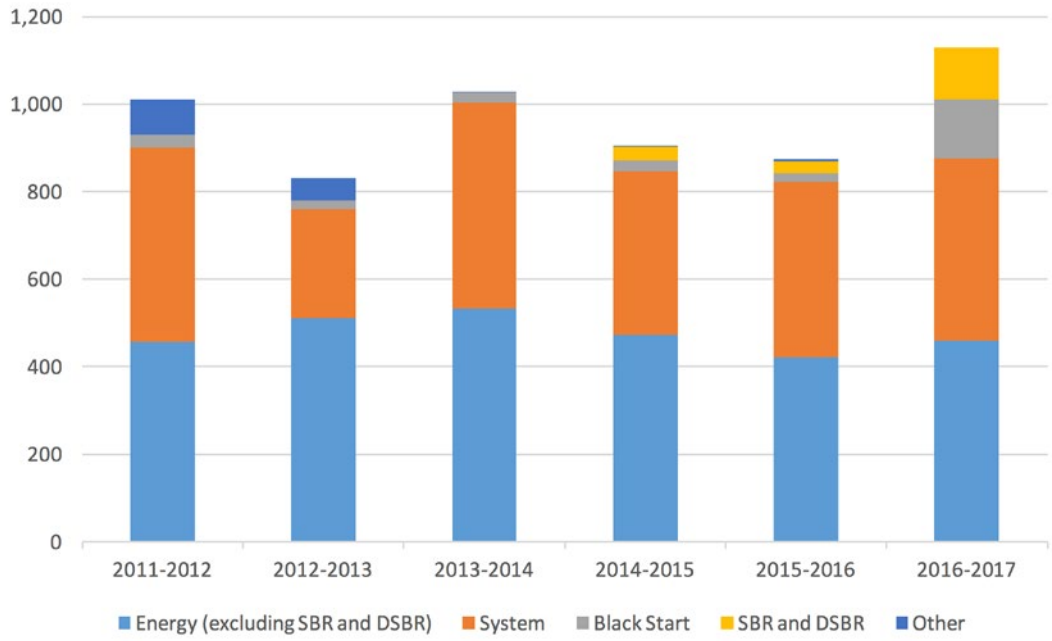
Activity and expenditure to keep the system in balance have recently risen

Activity and expenditure to keep the system in balance increased in 2016-17 by around £250 million. At over £1.1 billion, 2016-17 costs are at their highest level since at least 2011-12 (Figure 5.9).

[161] National Grid, Future Energy Scenarios, 2017. Employing a broader definition of DSR, National Grid estimates 2 GW in 2015/16, an increase of 1GW since 2009/10 (see Power Responsive Annual Report 2016).

[162] BEIS, Smart Meters, Great Britain, quarter 2 2017.

Figure 5.9 Balancing costs between 2011-12 and 2016-17 (2016 prices, £m)



Notes:

"Energy" costs relate to balancing national supply and demand. "System" costs relate to managing network flows. "Other" costs include reconciliation and the Transmission Loss Incentive Calculation.

Source:

Ofgem analysis of National Grid Monthly Balancing Services Summary data.

Figure 5.9 shows the composition of balancing costs in 2016-17. The three main components of increased expenditure in that year were:

- Supplemental Balancing Reserve (SBR) costs rose to about £120 million from around £30 million. It was ultimately not deployed, and has been discontinued from 2017;
- Black Start, the procedure to recover from a total or partial shutdown of the transmission system, rose by £117 million to £136 million. This followed the announcement of the potential closure or mothballing of thermal electricity plants;
- the Operating Reserve (an 'energy' cost) increased by £98 million to £174 million, linked to the outage of nuclear power plants in France that are interconnected with GB.

In addition, some smaller cost elements grew significantly, partly related to the costs of integrating intermittent energy sources. For instance, 'footroom' costs - incurred by the System Operator to allow it to adjust supply or demand when demand decreases - have increased from £2 million to £22 million. The introduction of the Capacity Market in winter 2017-18 may lessen pressure on cost by enhancing capacity, thereby reducing the opportunity for scarcity rents in balancing and ancillary services.

The System Operator's range of products procured to balance the market has grown over time, with multiple timeframes for delivery, and procurement and auction designs that may not maximise welfare.[163] National Grid is rationalising its suite of products to try to ensure they best serve consumer interests, through its 'System Needs and Product Strategy' (SNAPS).[164] This should help to reduce consumer costs through enhanced competition and better recognition of the interdependencies between different products.

Ofgem actions to support secure supplies

In addition to the actions we have already taken, we are:

- Reforming our incentive regulations on the System Operator to ensure it is appropriately incentivised to facilitate the transformation of the electricity system over the coming decades.[165] We are considering changes to the broader regulatory framework to ensure the System Operator procures and designs ancillary services in a way that drives both short- and long-term benefits for consumers and accommodates new business models.
- Increasing the price of demand disconnection and voltage reduction in 2018 (subject to our forthcoming review), to send sharper signals to the market to balance the system when margins tighten.
- Reforming network charging arrangements to address concerns that imperfections in the way network charges are levied distort investment and dispatch decisions.[166]
- Working alongside BEIS to increase the flexibility of the energy system. This includes removing barriers to smart technologies, including storage, enabling smart homes and businesses, and opening up markets to deliver greater flexibility.[167]

[163] See, for instance, Greve and Pollitt, A VCG auction for electricity storage, http://www.eprg.group.cam.ac.uk/wp-content/uploads/2016/04/1613-PDF.pdf.

[164] www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589940795

[165] https://www.ofgem.gov.uk/system/files/docs/2017/02/future_arrangements_for_the_so_-_the_regulatory_and_incentives_framework_0.pdf and https://www.ofgem.gov.uk/publications-and-updates/ofgem-confirms-plans-greater-separation-national-grid-s-electricity-system-operator-role

[166] https://www.ofgem.gov.uk/publications-and-updates/embedded-benefits-impact-assessment-and-decision-industry-proposals-cmp264-and-cmp265-change-electricity-transmission-charging-arrangements-embedded-generators and https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-significant-code-review-launch

[167] https://www.ofgem.gov.uk/publications-and-updates/upgrading-our-energy-system-smart-systems-and-flexibility-plan

www.ofgem.gov.uk