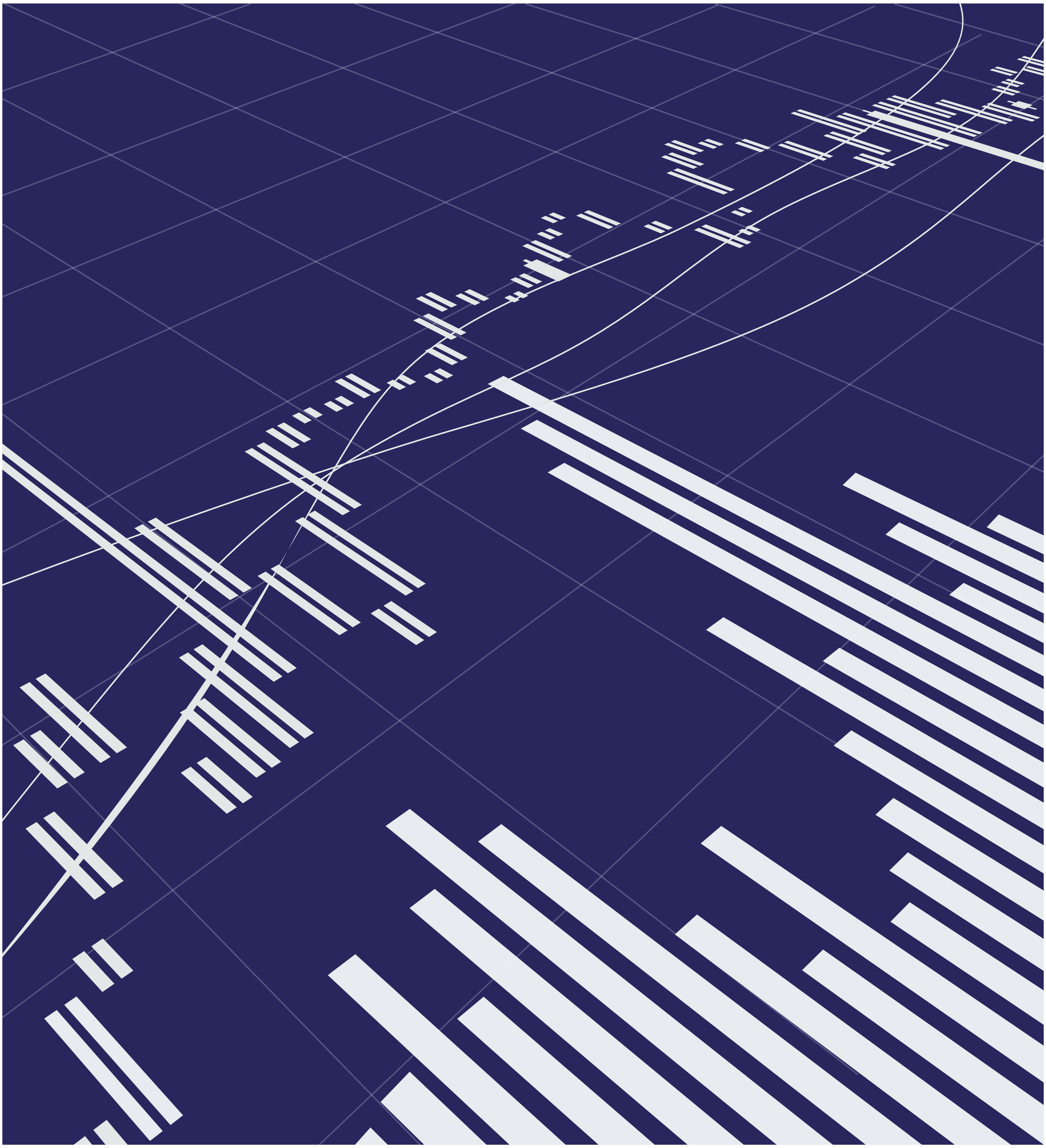
State of the energy market

2019

REPORT



ofgem

Making a positive difference
for energy consumers

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Executive Summary

Energy is an essential service for homes and business around Great Britain, and energy bills are one of the largest single items of regular expenditure. Households and businesses together spend around £55 billion on energy each year. Questions about how energy is produced and supplied, its affordability, and its environmental impact, are at the forefront of public debate. This report aims to contribute to that discussion by providing rigorous and clear analysis of the current state of energy markets, including the retail and wholesale energy markets and the networks.

As the independent energy regulator, we have a crucial part to play in making sure that energy markets are working in the interest of consumers. This year, we published our Strategic Narrative which sets out the outcomes that we want to achieve. These are:

- **Enable competition and innovation which drive down prices and result in new products and services**.

- **Decarbonise to deliver a net zero economy at the lowest cost to consumers**.

- **Protect consumers, especially the vulnerable, stamping out sharp practice and ensuring fair treatment**.

In line with our consumer protection objective, we implemented government legislation to cap the price of default tariffs from January this year. The cap is protecting around 11 million consumers on these tariffs, many of whom are in vulnerable situations, by setting a maximum price that suppliers can charge them per unit of energy. The cap ceases to have effect in 2023, at the latest, and we are required under the Tariff Cap Act to determine whether the cap can be lifted earlier on the basis of whether the conditions are in place for effective competition in the domestic retail market. We have published our framework for doing the assessment alongside this report.

This year's State of the Energy Market Report includes an assessment of competition in retail and wholesale energy markets, affordability and vulnerability, the UK's progress in reducing greenhouse gases, the security of our energy supplies, and, for the first time, how energy networks are performing.

Retail markets – where homes and businesses buy energy

There are some signs of declining quality of service, with large variations across suppliers. While overall customer complaint numbers are relatively stable, there have been big increases in the number of Ombudsman cases relating to small suppliers. In the first quarter of 2019, the Energy Ombudsman accepted more than 100 cases per 100,000 small supplier customer accounts, compared to around 20 cases in the first quarter of 2017. Most consumers remain satisfied with the service they receive, but consumers perceive energy suppliers as performing worse than service providers in most other major sectors.

Switching rates reached a record high, but concerns remain over the reliability and speed of switching. Domestic switching rates have continued to increase; overall annual switching rates reached a record high of over 20% in April 2019. However, the switching process is still marred by issues with reliability and speed, and average switching times remain around 15 days or more.

Despite several supplier failures, market concentration continues to fall. Between June 2018 and June 2019, twelve licensed suppliers exited the retail market, nine of them through the Supplier of Last Resort process. In addition to acquiring customers via switching, medium suppliers have absorbed the majority of the customers from the suppliers that ceased to trade. This has meant that the market continues to become less concentrated as medium suppliers grow and exert more competitive pressure on the large suppliers. Large supplier profit margins fell to a nine-year low of 3% on average in 2018.

Price transparency has improved in the non-domestic sector, but microbusinesses on average pay much more per unit of energy than other businesses. The CMA's price transparency remedy has improved the level of price information available to microbusinesses, but levels of engagement among this group remain low. More than a third of the smallest microbusinesses are on expensive default contracts. Microbusiness complaint rates are higher than for domestic customers, and complaints take longer on average to be resolved.

Wholesale markets – where gas and electricity are bought and sold

Changes in wholesale energy prices are largely driven by global factors. Gas and electricity wholesale prices are the largest single component of consumer bills. They are heavily influenced by external factors such as fluctuating exchange rates and weather events, and are also closely linked together as gas prices are the main driver of electricity prices. Wholesale gas prices increased sharply in September and October 2018, due in part to higher commodity prices, outages in Norwegian plants and maintenance-driven supply restrictions. This trend was reversed from January 2019 onwards, as the system returned to a healthy supply, boosted by increased liquefied natural gas deliveries and steady flows into Great Britain.

The wholesale electricity and gas markets are working reasonably well. Electricity wholesale prices fell in 2019, as the number of generators increased, reducing the opportunity for any generator to exert market power or make excessive profits. Electricity markets are moderately concentrated overall. The wholesale gas market is less concentrated than the wholesale electricity market, with a large number and diversity of gas producers enabling greater competition in the market.

Affordability and vulnerability – managing price and consumption

Relative to income levels, consumers on the lowest incomes spend almost twice as much on energy than the average consumer. Consumers with lower incomes or higher energy needs will typically spend a higher proportion of their budget on energy. The proportion of household expenditure that goes to energy bills varies from around 4% for the average household to almost 8% in the bottom 10% bracket of household incomes.

Fuel poverty is particularly concentrated in households that rent privately, and can have severe impacts. In England and Wales, around one in five privately rented households live in fuel poverty, compared to around a tenth of other households. The impact of fuel poverty can be severe; the best available estimates suggest that fuel poverty may have contributed to 5,500 excess winter deaths in winter 2017-18. From 2013 to 2018, more than 64,000 fuel poor customers have been connected to the mains gas grid, providing access to cheaper energy.

Direct subsidies targeted at vulnerable households amounted to £2.5 billion last winter. There are several mechanisms to help make energy more affordable for consumers, such as the Winter Fuel Payment, which provides around £2 billion each year to pensioners. Additionally, the default tariff and prepayment meter caps can help to protect less-active customers, including those who are in vulnerable situations.

Disconnections are rare, but self-disconnection amongst prepayment meter customers continues to be a concern. Recorded disconnections due to debt are very rare, with just 6 disconnections in 2018 compared to 17 in 2017. However, our latest Consumer Survey found that around 14% of prepayment meter customers self-disconnected in 2018. Our findings suggest that around 129,000 electricity consumers and 128,000 gas consumers self-disconnected for more than three hours at least once during the year.

Decarbonisation of energy – moving to a low carbon economy

The UK has achieved significant reductions in greenhouse gas emissions, but progress slowed in 2018. Greenhouse gas emissions from the electricity sector have fallen by more than half since 2012. However, progress in other sectors has been slow, and overall UK carbon emissions fell by only 12 million tonnes in 2018, the slowest rate of decline since 2012.

The decarbonisation of heat and transport are key to achieving carbon targets. Global warming reached 1°C in 2017, and the Intergovernmental Panel on Climate Change assesses that it is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. Collectively, heat and transport now account for over 40% of the UK's total annual greenhouse gas emissions of 449 million tonnes of CO_2 equivalent, and progress in decarbonisation of these sectors has stalled. Substantial reductions will be central to the UK continuing to meet its challenging carbon reduction targets.

Renewable energy sources are playing an increasingly important role in the power sector. Renewable energy now accounts for one third of overall electricity supply. Carbon dioxide emissions from electricity generation fell by 11% in 2018, driven by wind, solar and bioenergy as well as a reduced reliance on coal. The value for money of policies to support this transition varies widely. We estimate that the carbon price cost consumers around £31 for each tonne of carbon emissions avoided between 2010 and 2018, while small scale renewable subsidies cost consumers around £322.

Security of supply – keeping the lights and heating on

GB continues to benefit from secure energy supplies. There were no periods of unmet gas or electricity demand in 2018/19, and the suspension of the Capacity Market in November 2018 had little appreciable impact on electricity margins. However, the shifting demands of a system in transition are leading to new challenges around security of supply, and the costs of balancing the electricity system have risen over time. System balancing costs were around £1.19 billion in 2018-19, their second-highest level ever (behind £1.21 billion in 2016-17).

A diverse range of gas supplies helps to keep the GB system flexible and resilient. The GB system draws from a diverse range of gas supply sources, particularly from the North Sea, Norway, continental Europe and liquefied natural gas (LNG) imports. This diversity can help to make the system more flexible and resilient to infrastructure or supply shocks. In April 2019, LNG imports reached their highest monthly level since April 2011, meaning that GB gas prices are nohw relatively sensitive to global LNG price changes.

We are investigating the major power outage in August 2019. On 9 August 2019, 1.1 million electricity customers were disconnected following a lightning strike on a transmission circuit and the loss of two transmission-connected generators. Ofgem is investigating the circumstances which contributed to the power cut. The Electricity System Operator published a technical report on these events at the start of September. We expect to outline the causes of this power outage in next year's report.

Energy networks

Customers are satisfied with high reliability and availability. Since 2015, customer interruptions in electricity distribution have fallen by 11%. Customers went without power for around 36 minutes on average over the course of 2017-18. Reliability and availability levels are around 99.99%, and customer satisfaction with network performance is generally high.

Network companies are making financial returns that are above Ofgem's expectations. Network company financial returns are high for a relatively low-risk industry, with many network companies achieving returns on equity of 10% or higher. This is due to several factors, including our setting allowed returns on equity that were with hindsight too high, and companies underspending against their allowances or outperforming incentive schemes.

Key facts on Competition

20% The proportion of consumers switching supplier between July 2018 and June 2019 (last year: 19%)

64 The number of active licensed suppliers in June 2018 (last year: 70)

£260 The approximate amount consumers on a Standard Variable Tariff could save by switching to the cheapest tariff basket in the market between June 2018 and June 2019 (last year: £290)

3% Average large supplier profit margins in 2018 (last year: 4%)

49% The proportion of consumers who reported they have never switched, or have only switched once (last year: 61%)

53% The proportion of domestic consumers on a default tariff, not including prepayment meter tariffs (last year: 53%)

25% The proportion of electricity and gas microbusiness meter points on default and deemed contracts (last year: 26%)

158 The number of licensed gas shippers in 2018 (last year: 146)

189 The number of licensed firms generating electricity in 2018 (last year: 170)

59p/therm Average wholesale day-ahead gas prices in 2018/19 (last year: 48p/th in real terms)

£58.6/MWh Average wholesale day-ahead electricity prices in 2018/19 (last year: £48/MWH in real terms)

Key facts on Affordability and Vulnerability

£1,184 Average dual-fuel energy bill for a typical consumer with the large suppliers in 2018 (last year: £1,117), an increase in real terms of 4% in 2018 prices.

8% The proportion of total expenditure that low income households spent on energy in 2017-18, compared to 4% for the average income household.

19% The proportion of households in England living in privately rented homes that are identified as being fuel poor, compared with 11% of all English households.[1]

26% The proportion of households in Scotland living in privately rented homes that are identified as being fuel poor, compared with 25% of all Scottish households.

20% The proportion of households in Wales living in privately rented homes that are identified as being fuel poor, compared with 12% of all Welsh households.

14% The proportion of prepayment meter customers who reported having self-disconnected in 2018 (last year: 10%)

16,500 The number of excess winter deaths that can be linked to people living in cold homes in winter 2017-18.

£2.5bn The amount of direct subsidies targeted at vulnerable households in winter 2017-18 (last year: £2.5bn)

Key facts on Decarbonisation of Energy

42% The percentage by which the UK reduced its greenhouse gas emissions between 1990 and 2017.

50% The percentage by which carbon emissions have fallen over 2010-2018 in the energy sector, the best performing sector

2% The percentage by which carbon emissions have fallen over 2010-2018 in the transport sector

35% The percentage increase in the market share of electric cars in the UK from 2017 to 2018, to 2.5% of the market.

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[1] Note that definitions of fuel poverty differ across nations.

£31 The estimated consumer cost of carbon price policy per tonne of carbon dioxide saved from 2010 to 2018, up from £27 over 2010-2017

Key facts on Security of Supply

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

403 million cubic meters The maximum demand for gas during winter 2018/19, compared to 418 mcm/day during winter 2017/18

12% of total GB gas supply The contribution of LNG as a source of GB's gas supply in winter 18/19, up from 6.1% in the previous winter.

60 GW The current underlying peak demand for electricity

25.1 GW The average winter margin for 2018/19, compared to an average margin of 24.4 GW in winter 2017/18 and 20.5 GW in winter 2016/17

£1.19 billion National Grid system balancing costs in 2018/19, compared to £1.08 billion in 2017/18

Key facts on Energy Networks

11% The reduction in the number of power cuts across GB since 2015. The duration of power cuts has fallen by 9%.

8.8/10 Customer service scores for gas and electricity distribution companies in 2017-18 (Last year: 8/10)

64,100 The number of fuel poor homes that have been connected to the gas grids since 2013.

850,000 The equivalent number of tonnes of Carbon Dioxide by which the electricity network companies have reduced the carbon footprint of their networks since 2015.

1.7 The number of gigawatts (GW) of generation that was connected to the lower voltage electricity networks in 2017-18 (last year: 3.2 GW).

6 The number of network companies that forecast that they will achieve a Return on Regulatory Equity above 10% over the RIIO-1 price control period.

1. Introduction

Context and related publications

1.1. Energy is an essential service and the lifeblood of our economy. Questions about how energy is produced and supplied, and how affordable it is, are at the forefront of public debate. This report aims to contribute to the discussion by providing rigorous analysis of the current state of energy markets and how well they are working in the interest of consumers. It is our third annual assessment of the state of energy markets in Great Britain.

1.2. The 2019 report follows on from our previous State of the Market reports:

- 2017 State of the Market Report
- 2018 State of the Market Report

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Your feedback

1.3. We are keen to receive your comments about this report, particularly about our coverage of energy networks, which is new in this year's report. We'd also like to get your answers to these questions:

1. Do you have any comments about the overall process of this report?
2. Do you have any comments about its tone and content?
3. Was it easy to read and understand? Or could it have been better written?
4. Are its conclusions balanced?
5. Any further comments?

Please send any general feedback comments to SOTM2019@ofgem.gov.uk

2. Overview

2.1. The energy system is critical to Great Britain (GB). It supplies electricity and gas to most households and commercial premises across the country. Gas provides the main source for heating homes and businesses. It is also a major primary energy source for industry and electricity generation. GB electricity generation is transitioning from a large-scale, conventional fossil-fuel dominated generation mix to renewable generation such as wind and solar farms. Electricity and gas can be imported or exported through interconnectors. These are connections between the electricity and gas transmission systems of different countries, via subsea cables in the case of electricity and pipelines in the case of gas.

2.2. The four main components that make up the energy system are:

- Generation: electricity is produced using either coal, gas, renewable energy, or nuclear power in generating plants. They sell energy to retail suppliers and large businesses in the wholesale markets, typically those that are highly energy-intensive (e.g. iron and steel plants, railways).

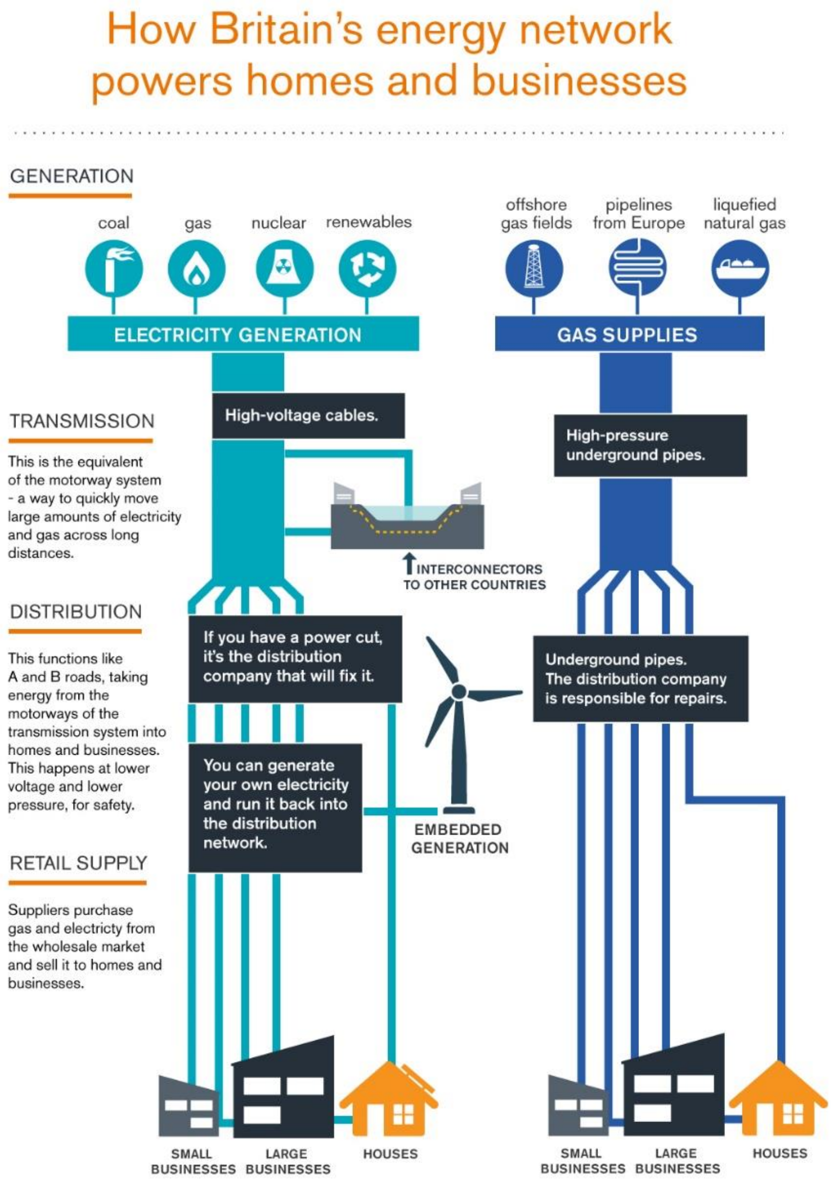
- Transmission network: includes cables and lines that transfer high-voltage electricity from where it is produced to where it is needed throughout the country. It is owned and maintained by regional transmission companies, while the system, as a whole, is operated by a single System Operator (SO). High-pressure underground pipelines play an equivalent role for transmission of gas. The National Transmission System (NTS), which is owned and operated by National Grid Gas plc, transports high pressured gas from entry terminals to gas distribution networks, or directly to power stations.

- Distribution network: includes low-voltage grid that carries electricity from the high voltage transmission grid to industrial, commercial and domestic users. The distribution network also carries electricity from power stations directly connected to the distribution grid (i.e., embedded generators). In the case of gas, distribution is operated through low-pressure pipelines. There are 14 licensed electricity distribution network operators (DNOs), owned by six different groups and eight gas distribution networks (GDNs), owned by four groups.

- Retail supply: the six largest firms in the GB retail market are Centrica, EDF, E.ON, npower, ScottishPower and SSE. They are the former monopoly suppliers of gas and electricity to GB consumers and together they now account for around 70% of the retail energy market.

2.3. Energy companies can operate in any of the areas discussed above and some have a presence across all four.

Figure 2.1: Britain's energy system and its components



Ofgem’s regulatory role

2.4. Ofgem’s principal objective is to protect the interests of existing and future consumers. We do this 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;
- the supervision and development of markets and competition; and
- regulating the delivery of government schemes.

Regulation and the delivery of government schemes

2.5. Ofgem acts independently from the UK government, but carries out its duties within the policy framework established by the UK parliament and the European Union (EU).[2]

2.6. 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. Whilst the UK remains a member of the EU, EU law also has a significan impact on the UK energy sector.

2.7. As the UK prepares to leave the European Union (EU), Ofgem has been working closely with government and industry to provide technical and regulatory advice. Ofgem has no direct engagement in the government's EU Exit negotiations. Our role is to work with government and energy industry stakeholders to ensure that our regulatory framework is fit-for-purpose and protects customers, whatever the arrangements are for the UK’s exit from the EU.

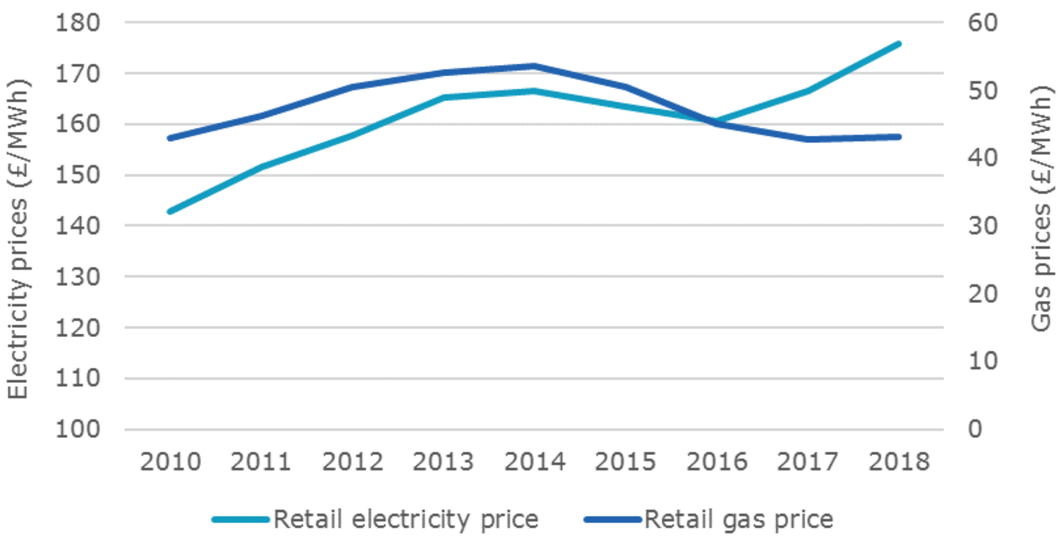
Domestic consumption has fallen, while the price of energy has increased

[2] Ofgem regulates the energy sector in GB. The Northern Ireland Utility Regulator regulates the energy sector in Northern Ireland.

2.8. British households spent around £30 billion on gas and electricity in 2018 and businesses, charities and public bodies spent an additional £25 billion.[3] In 2017-18, energy accounted for 3.9%, on average, of UK households' total expenditure. This is the lowest level since 2008.[4] For the lowest income households, however, energy accounted for just under 8% of total expenditure. Although most consumers do not report being worried about meeting the cost of their energy, about 19% say that they occasionally or constantly struggle to pay their bills.[5]

2.9. Between 2017 and 2018, retail electricity prices increased by 6% and retail gas prices increased by 1% in real terms (see Figure 2.2).

Figure 2.2: Domestic retail energy prices (£ per MWh, real terms), 2010 to 2018



Source: BEIS (2018). Ofgem calculations using annual domestic energy bills data.

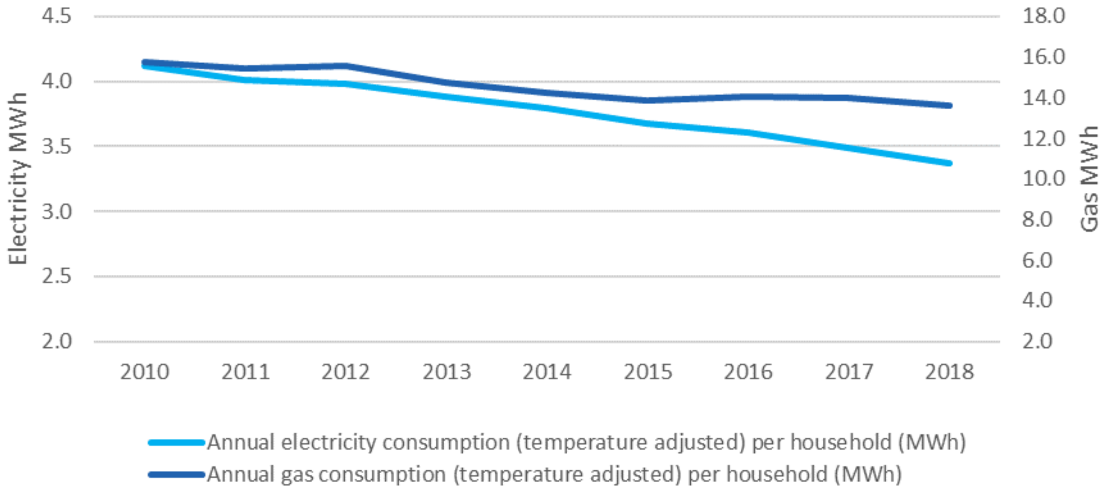
Note: Prices deflated to 2018 terms using the GDP (market prices) deflator. Electricity prices per MWh are calculated assuming annual consumption of 3.8MWh, including VAT. Gas prices per MWh are calculated assuming annual consumption of 15MWh, including VAT. Average prices across payment methods are weighted by the number of domestic customers.

2.10. Over the 2010 - 2018 period, there was a downward trend in domestic energy consumption (see Figure 2.3). Average electricity and gas consumption declined by

[3] Digest of UK Energy Statistics (DUKES): Energy, Sales of electricity and gas by sector, table 1.7.
[4] Source: Office for National Statistics, Family spending in the UK: April 2017 to March 2018.
[5] Ofgem annual Consumer Survey.

18% and 14%, respectively. Both gas and electricity consumption decreased by 3% between 2017 and 2018.

Figure 2.3: Average annual household energy consumption (temperature adjusted): 2010 to 2018



Source: BEIS (2018). Ofgem calculations using Energy Consumption statistics in the UK.

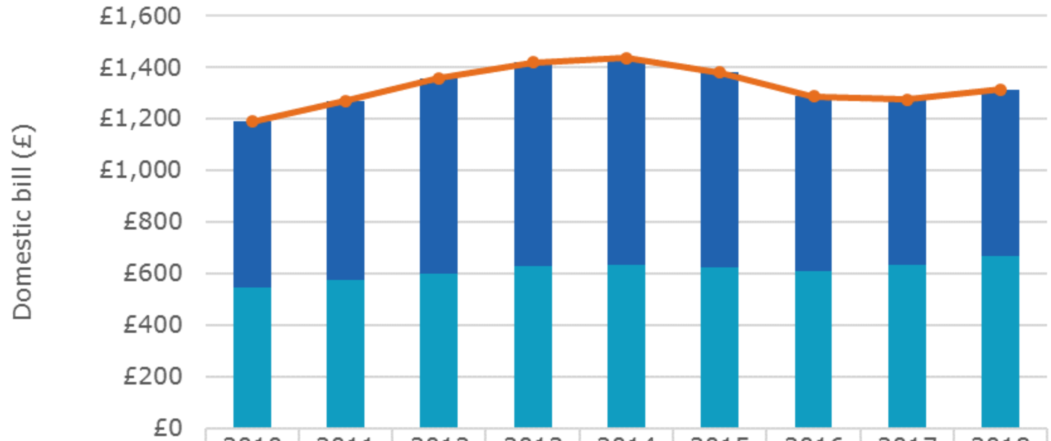
Note: Annual gas consumption has been divided by the estimated number of households that are on gas. Annual electricity consumption has been divided by the number of households on standard electric tariffs.

Bills have risen despite falling consumption

2.11. Gas and electricity bills are calculated using two main components – prices and consumption. For a given level of consumption, rising prices will result in an increase in a household's energy bills. Conversely, if prices are fixed, higher consumption will lead to an increased bill. Figure 2.4 shows the effect of changing prices, while maintaining constant levels of consumption, assuming 3,800kWh annually for electricity and 15,000kWh annually for gas.

2.12. In real terms, based on the same level of consumption, UK households paid on average £41 more for their energy bill in 2018, compared to 2017, an increase of 3%. Electricity bills rose by 6% or £36 and gas bills rose by 1% or £5. This follows a decline in bills from 2015 to 2017, with the average bill falling by 1% from 2016 to 2017 (Figure 2.4).

Figure 2.4: Average annual domestic bill (real terms), based on fixed consumption levels, 2010 to 2018



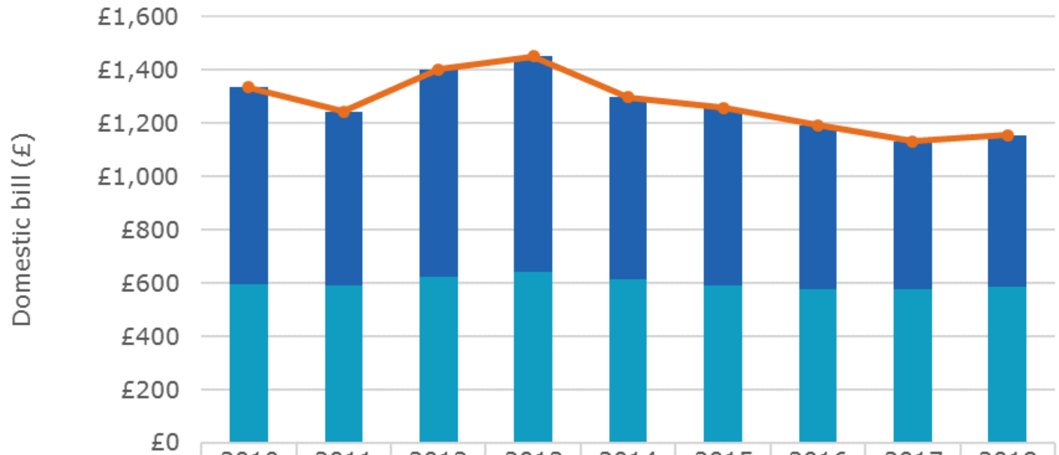
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Gas	£645	£693	£758	£790	£803	£757	£676	£641	£646
Electricity	£543	£576	£599	£628	£632	£621	£611	£632	£668
Total Bill	£1,188	£1,269	£1,357	£1,418	£1,435	£1,378	£1,287	£1,273	£1,314

Source: Ofgem's calculation based on BEIS data on Annual Domestic Energy Bills.

Note: Bills deflated to 2018 terms using the GDP (market prices) deflator. Bills include VAT.

2.13. To isolate the consumption effect from the price effect, we look at the energy bills calculated based on average actual consumption levels. Using actual consumption levels, Figure 2.5 shows that the total bill increased by £22 between 2017 and 2018, as a result of a rise in both electricity and gas prices (by £12 and £10, respectively). This follows a decline between 2014 and 2017.

Figure 2.5: Average annual domestic bill (real terms), based on actual consumption levels, 2010 to 2018



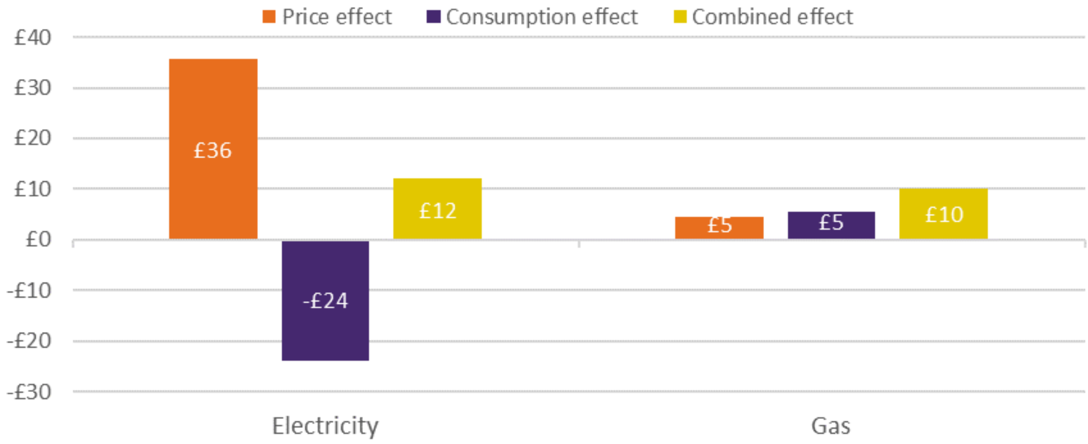
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Gas	£739	£651	£779	£810	£683	£667	£615	£558	£568
Electricity	£596	£593	£623	£642	£616	£591	£577	£575	£587
Total	£1,335	£1,244	£1,402	£1,452	£1,299	£1,258	£1,192	£1,133	£1,155

Source: Ofgem's calculation based on BEIS data on Annual Domestic Energy Bills. Annual actual consumption figures are estimated and updated from Digest of United Kingdom energy Statistics (DUKES).

Note: Bills deflated to 2018 terms using the GDP (market prices) deflator. Bills include VAT.

2.14. Figure 2.6 shows that the price effect added around £41 to energy bills in 2018 (£36 on electricity and £5 on gas), whilst the consumption effect reduced this by £19 (£24 reduction on electricity and £5 increase on gas).[6] The consumption effect was therefore outweighed by the price effect in this case.

Figure 2.6: Changes in annual domestic bill, due to price and consumption effects from 2017 to 2018



Source: BEIS (2018). Annual domestic energy bills data.

Note: Electricity prices relate to Standard Electricity bills.

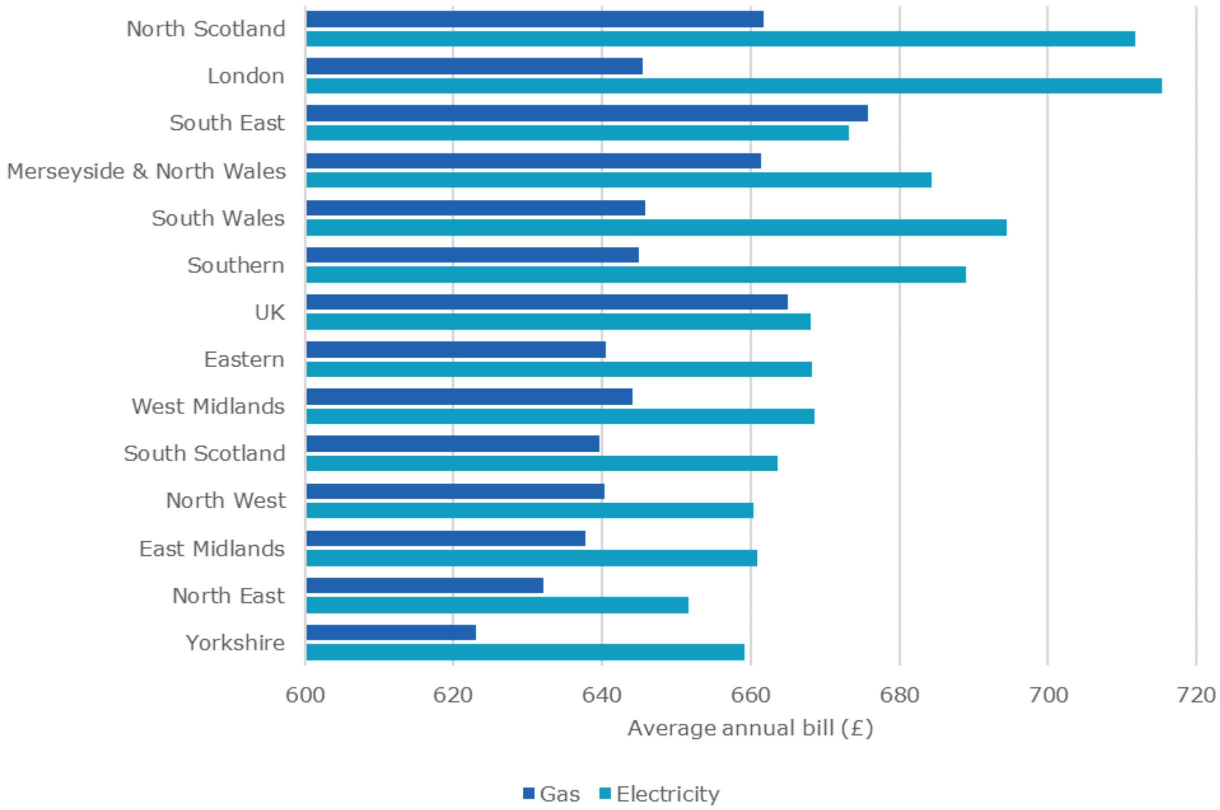
Variation among UK regional energy prices

2.15. The average energy bill for UK domestic consumers varies across regions, as shown in Figure 1.7. In 2018, the average electricity bill ranged from £650 in Yorkshire to £715 in North Scotland.[7] In the same period, gas bills ranged from an average of £623 in North East England to £676 in London.

[6] While Figure 2.3 shows that temperature-adjusted gas consumption declined in 2018, actual consumption, without adjusting for temperature, increased. This is why the consumption effect for gas is positive.

[7] The Hydro Benefit Replacement Scheme helps to protect domestic and non-domestic consumers from the high costs of distributing electricity in the North of Scotland.

Figure 2.7: Annual domestic bill for gas and electricity in 2018 across UK regions



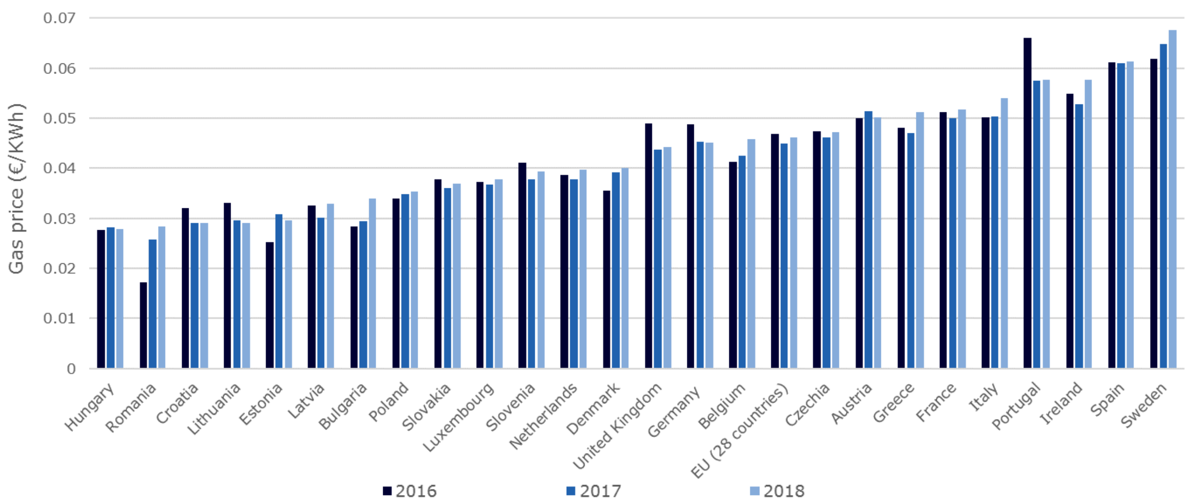
Source: Ofgem's calculation based on BEIS data on Annual Domestic Energy Bills

Note: The average gas bill for UK does not include the figure for Northern Ireland. Bills include VAT.

UK energy prices are close to average EU prices

2.16. In 2018, domestic consumer gas prices among European countries ranged between 0.03 Euros per kWh (Hungary) and 0.07 Euros per kWh (Sweden). In the same year, UK consumers paid mid-range prices of approximately 0.04 Euros per kWh. Although prices tend to fluctuate (Figure 2.8), some countries, for example Spain and Sweden, have had prices that are consistently higher than the EU average over the past three-year period, while others, for example Romania and Hungary, have had prices that are consistently lower over the same period.

Figure 2.8: Gas prices amongst European countries, 2016 - 2018

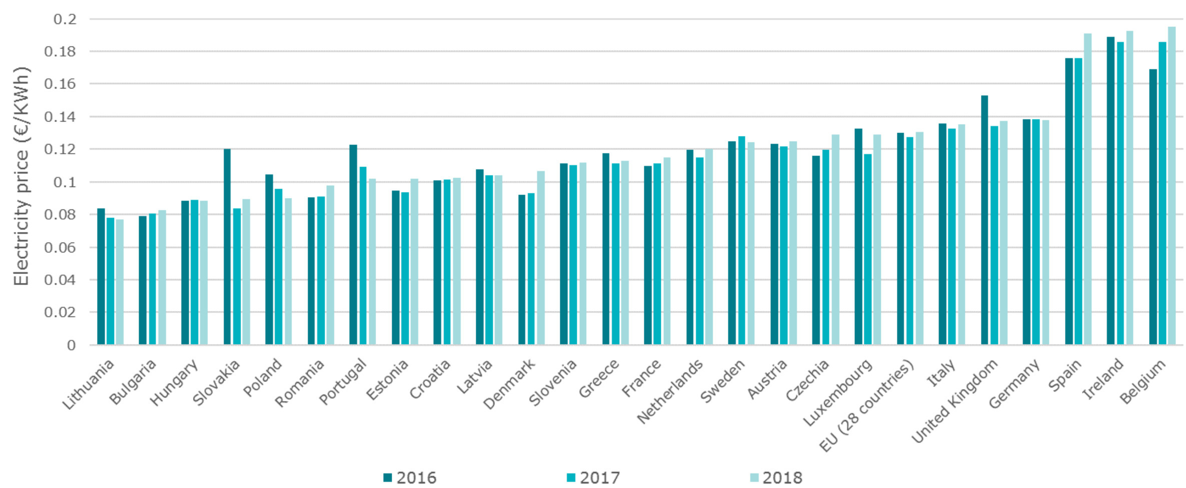


Source: Eurostat, Energy Statistics, Gas prices for household consumers.

Notes: Prices are in Euros per kWh and exclude taxes and levies. Data are recorded bi-annually; prices for each year are a simple average of prices in each half of the year.

2.17. In 2018, domestic consumer electricity prices varied significantly among European countries, between 0.08 Euros per kWh (Lithuania) and 0.20 Euros per kWh (Belgium). UK consumer prices have remained towards the higher end of the distribution for the past three years and were approximately 0.14 Euros per kWh in 2018, having decreased from 0.15 Euros per kWh in 2016 (Figure 2.9).

Figure 2.9: Electricity prices among European countries, 2016 - 2018



Source: Eurostat, Energy Statistics, Electricity prices for household consumers.

Notes: Prices are in Euros per kWh and exclude taxes and levies. Data are recorded bi-annually; prices for each year are a simple average of prices in each half of the year.

Higher energy bills are driven by a rise in wholesale costs and environmental and social obligations costs

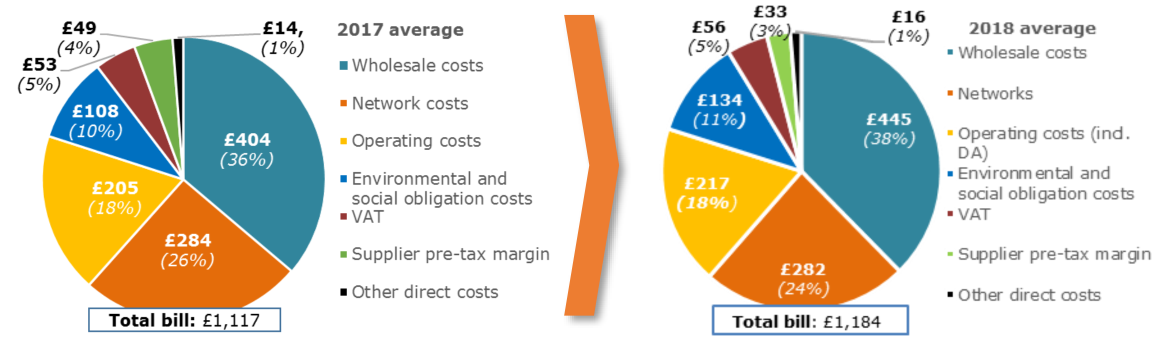
2.18. To measure changes in the costs that determine consumer bills, we typically focus on the six largest energy suppliers who manage roughly seven out of 10 customer accounts in the market. In 2018, the average dual fuel bill (in nominal terms[8]) for customers of the six largest energy suppliers increased from £1,117 in 2017 to £1,184 in 2018 (see Figure 2.10).

2.19. The main cost components of a household's energy bill are the following:

- **Wholesale costs** – the amounts suppliers pay to buy gas and electricity
- **Network costs** – the costs of building, maintaining and operating the transmission and distribution networks that transport energy to consumers
- **Operating costs** – the expenditures associated with running a retail energy business such as sales, metering and billing. This category also includes depreciation and amortisation
- **Environmental and social costs** – the costs of government policies that aim to deliver environmental and social objectives
- **VAT** – the 5% rate of value added tax that applies to the domestic consumption of energy
- **Supplier pre-tax margin** – the earnings (before interest and tax) that accrue to suppliers and are calculated by subtracting total operating costs, depreciation and amortisation from total revenue
- **Other direct costs** – the costs relating to general participation in the market, such as administration and brokers' costs

8 In 2018 prices, the average 2017 dual fuel bill was around £1,143, meaning that real-terms average bills increased by £41 year on year.

Figure 2.10: Annual domestic dual fuel bill for gas and electricity in 2017 and 2018



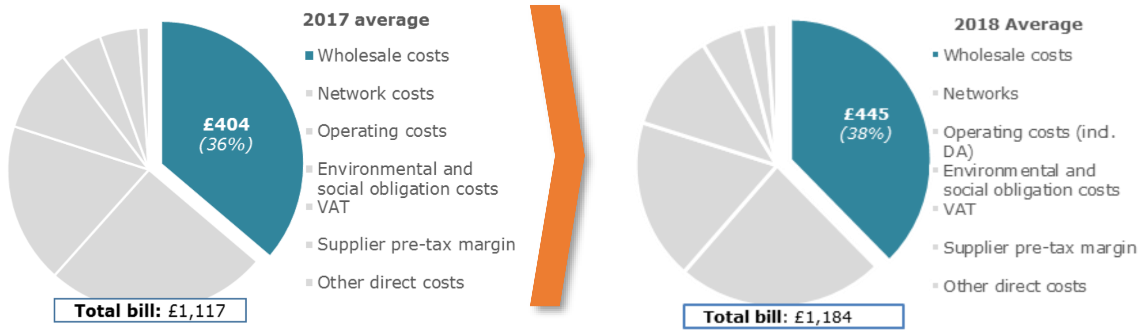
Source: Ofgem analysis based on the Consolidated Segmental Statements (CSS) for the six largest energy suppliers.[9]

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

Wholesale costs are still the largest component of a household's bill

2.20. Wholesale costs accounted for the single largest share of an average domestic dual fuel bill in 2018 at 38%, which is an increase from 36% in 2017 (Figure 2.11). We explore the implications of the changing trends in wholesale markets in the second part of Chapter 3.

Figure 2.11: Wholesale costs that contribute to an average domestic dual fuel bill



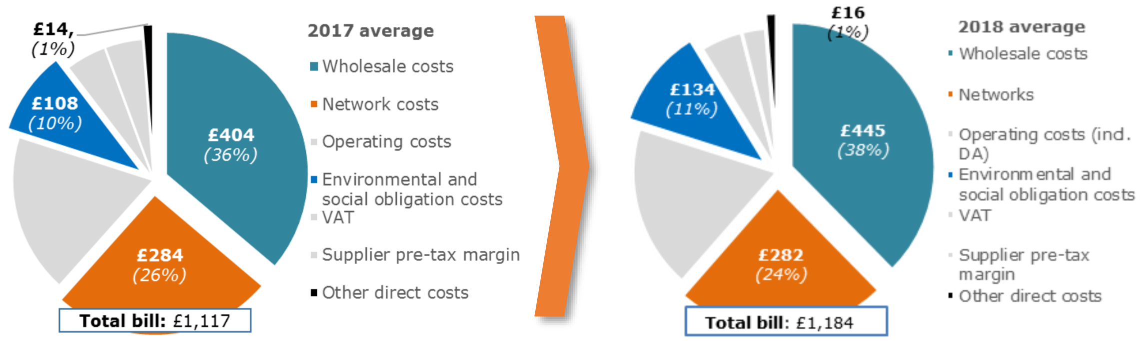
[9] Data cover the period January to December 2018 with the exception of SSE, which relates to April 2018 to March 2019.

Ensuring secure energy supplies is relevant to the bulk of a household's bill

2.21. The share of bills that relate to security of supply was 74% in 2018 (see Figure 2.12). While the direct costs that relate to security of supply (i.e. balancing costs and the capacity market) are relatively small, they cut across the various cost components of a typical household bill.

2.22. We examine the impact of security of supply on the cost of energy in Chapter 6.

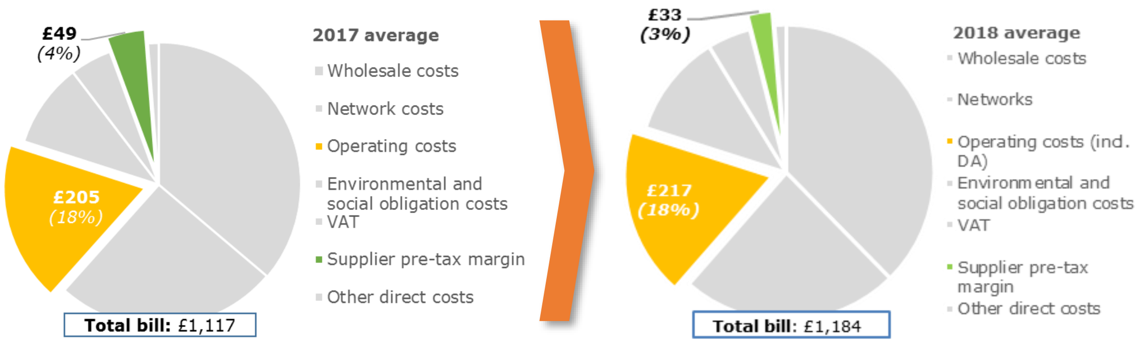
Figure 2.12: Security of supply costs that contribute to an average domestic dual fuel bill



Retail market costs account for the third largest share of household bills

2.23. The share of bills that relate to retail market operation (i.e. operating costs and suppliers' pre-tax margin) decreased slightly from 22% in 2017 to 21% in 2018 (see Figure 2.13). We explore the effects of changes in competition and consumer engagement on price differences in the first part of Chapter 3.

Figure 2.13: Retail costs that contribute to an average domestic dual fuel bill

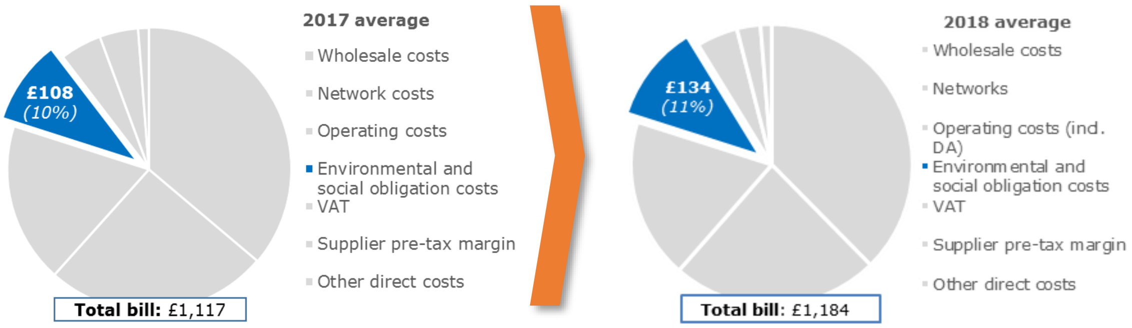


Costs associated with decarbonisation have increased

2.24. Decarbonisation policies made up 11% of an average domestic dual fuel bill in 2018, a small increase from 10% in 2017 (see Figure 2.14). Our analysis reveals, however, that the net cost to the customer is considerably less once the positive impacts of downward pressure on wholesale prices and increased tax receipts are taken into account.

2.25. We explore the costs and benefits of decarbonisation policies in Chapter 5.

Figure 2.14: Decarbonisation costs that contribute to an average domestic dual fuel bill



2.26. The figures above relate to domestic energy bills. The market for larger non-domestic consumers is generally relatively healthy, but small and microbusinesses tend to pay more for their energy. We assess non-domestic energy markets in chapter 3.

Aim of this report

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

2.28. The following chapters discuss market structure and outcomes in the retail and wholesale markets, affordability and vulnerability, decarbonisation, networks and security of GB's energy supply.

3. Competition in energy markets

Summary of findings

- Following Government legislation, in January 2019 we introduced a cap to provide price protection to around 11 million customers on expensive default energy deals. On implementation, we estimate that the cap has saved customers £1 billion, but it is too early to reach conclusions on its wider market impact.

- Switching rates reached a record high, above 20%, in April 2019, before falling off slightly in May and June. We remain concerned with the reliability and speed of the switching process, as well as with other service quality issues, including billing accuracy, ease of contact and complaint handling

- Despite twelve suppliers exiting the market between June 2018 and June 2019, market concentration continued to fall as medium suppliers expanded. In addition to the regular acquisition of customers via switching, they absorbed the majority of the customers from the suppliers that ceased to trade. The six largest suppliers have continued to lose customers, and their average profit margin fell to a nine-year low of 3% in 2018.

- The CMA's price transparency remedy has improved the level of price information for microbusinesses, but engagement for these customers remains difficult. A significant minority of microbusinesses are still on more expensive default contracts and pay much more on average than other businesses.

- The wholesale electricity and gas markets are working reasonably well. Changes in wholesale energy prices are largely driven by global factors such as fluctuating exchange rates and weather events. In addition, the number and diversity of participants in the wholesale markets limit the opportunity for generators or producers to exert market power or make excessive profits.

Domestic retail energy markets

Introduction

3.1. Household consumers paid around £30 billion for gas and electricity in 2018. As of June 2019 the market supplies 23.5 million gas and 28.5 million electricity meter points. This accounts for approximately 60% (309 TWh) and 35% (105 TWh) of total gas and electricity demand respectively.[10]

3.2. In this section we look at how the structural features of the GB domestic retail market and the outcomes for consumers evolved between June 2018 and June 2019.

3.3. In 2018, the government introduced legislation to provide price protection to the estimated 11 million households on default energy deals. Such households typically pay substantially more per unit of energy than households on fixed-term deals. The Domestic Gas and Electricity (Tariff Cap) Act 2018 came into effect on 19 July 2018 and on 1 January 2019, in accordance with this Act, Ofgem implemented a temporary price cap on standard variable and default tariffs in the domestic retail market.

3.4. In this section we include preliminary evidence on the impact of the default tariff cap (DTC). A more detailed assessment will be carried out as part of our review of whether the condititions are in place for effective competition in domestic supply contracts, which Ofgem is required to publish by 31 August 2020.

Domestic retail energy market structure

Market concentration has continued to fall despite fewer active suppliers

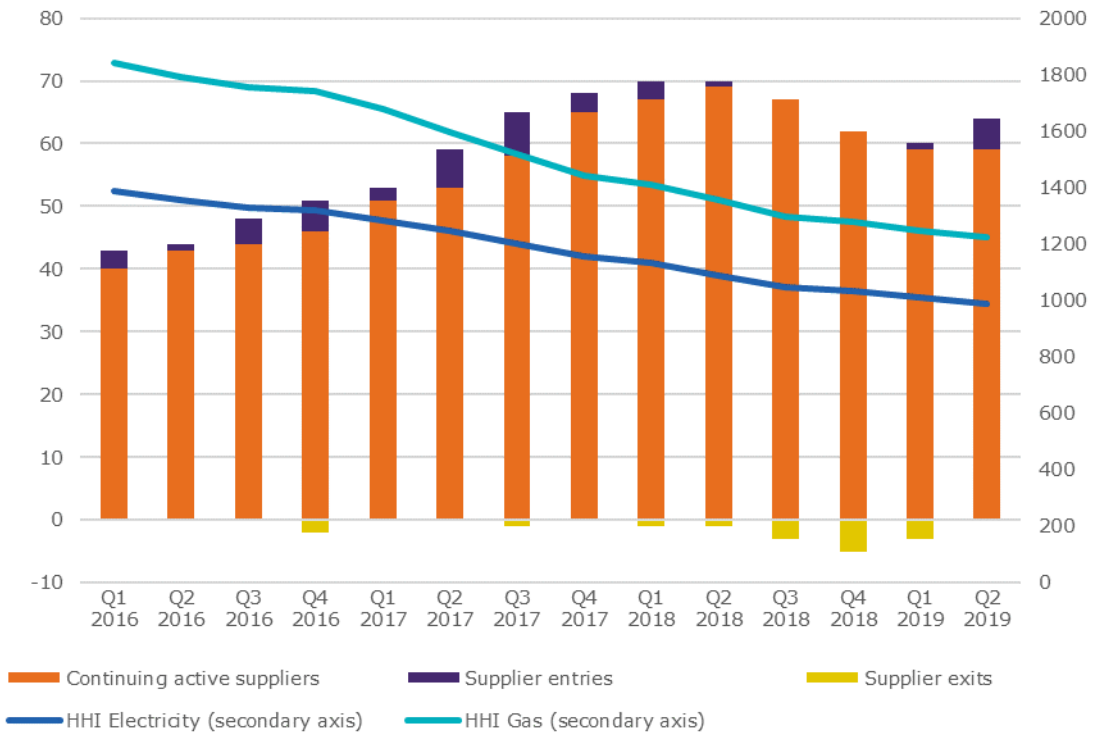
3.5. Over the last six years the domestic retail market has become less concentrated (see Figure 3.1). This has been driven by a sustained net entry and expansion of new

[10] We source data on gas and electricity meter points directly from network operators, while the sources for gas and electricity demand data are: BEIS - Natural gas supply and consumption and BEIS - Supply and consumption of electricity. Spending data is sourced from DUKES_1.7 and is expressed in nominal terms.

suppliers.[11] In June 2019 the Herfindahl-Hirschman Index (HHI) was down to 1224 in gas and to 987 in electricity.[12]

3.6. By June 2019, following a period of net exits, there were 64 active licensed suppliers, of which 56 were dual fuel, 6 gas-only and 2 electricity-only suppliers. In addition, there were 28 white label providers,[13] often with a regional focus. This is a net decrease of 6 licensed suppliers and an increase of 4 white labels since June 2018.

Figure 3.1: Market entries, exits and concentration levels



Source: Ofgem's analysis of Distribution Network Operators and Xoserve data

Note: The chart shows only active licensed suppliers. It does not include white label providers.

[11] See https://www.ofgem.gov.uk/publications-and-updates/state-energy-market-2018.
[12] The Herfindahl–Hirschman Index (HHI) measures market concentration by summing the squares of the market share of each firm. 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). 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. See CMA's latest market investigation guidelines.
[13] Source: Cornwall Energy. White label suppliers are organisations without supply licences that partner with an active licensed supplier to offer gas and electricity using their own brand.

3.7. Most exits have occurred through the regulated Supplier of Last Resort route (SoLR) rather than through market mechanisms such as acquistions. The makeup of suppliers that exited has varied (see Figure 3.2). Many have been smaller and newer market participants, often entering the market via a "supplier in a box", which is a simplified route to market, while some have been larger and more established, such as Spark Energy, Extra Energy and Economy Energy. Several factors contributed to these market exits. These include suppliers' approach to hedging against the risk of increasing costs, which led to problems when prices rose in the second half of 2018, partly due to the 'Beast from the East' weather conditions. Other factors include aggressive customer expansion and the withdrawal of parent company support or third party partners. There were also cases of poor governance and lack of sufficient investment in systems and processes to support adequate customer service provision. We engaged closely with these suppliers, including through compliance and enforcement action.[14]

3.8. The implementation of the DTC from January 2019 is unlikely to have triggered these exits, as the suppliers who exited the market had relatively few default tariff customers. Nevertheless, the DTC may affect overall expectations of future revenues and costs associated with running a domestic supply business.

[14] See https://www.ofgem.gov.uk/investigations/enforcement-annual-reports and https://www.ofgem.gov.uk/investigations/retail-compliance

Figure 3.2: Market exits (June 2016 - June 2019)

Supplier	Entry date (started actively supplying customers)	Entry route	Exit date	Exit route	Number of customers at time of exit
Tempus Energy	2015	Standard licensing process	Sep-16	Customers gradually switched away	N/A
GB Energy Supply	2015	Acquired "supplier in a box" solution	Nov-16	SoLR to Co-operative Energy	Approx. 160,000
Future Energy	2015	Acquired "supplier in a box" solution	Feb-18	SoLR to Greenstar Energy	Approx. 11,000
Flow Energy	2013	Standard licensing process	May-18	Direct acquistion by Co-operative Energy	N/A
Iresa	2016	Standard licensing process	Jul-18	SoLR to Octopus Energy	Approx. 100,000
GEN4U	2016	Standard licensing process	Jul-18	SoLR to Octopus Energy	Approx. 500
Affect Energy	2016	Acquired "supplier in a box" solution	Sep-18	Direct acquistion by Octopus Energy	N/A
Electraphase	2016	Standard licensing process	Sep-18	Customers gradually switched away	N/A
USIO	2017	Acquired "supplier in a box" solution	Oct-18	SoLR to First Utility	Approx. 7,000
Snowdrop Energy	2017	Acquired "supplier in a box" solution	Oct-18	Direct acquistion by Nabuh Energy	N/A
Spark Energy	2007	Standard licensing process	Nov-18	SoLR to Ovo	Approx. 290,000
Extra Energy	2014	Standard licensing process	Nov-18	SoLR to Scottish Power	Approx. 129,000
OneSelect	2017	Acquired "supplier in a box" solution	Dec-18	SoLR to Together Energy	Approx. 36,000
Economy Energy	2012	Standard licensing process	Jan-19	SoLR to Ovo	Approx. 235,000
Our Power	2015	Standard licensing process	Jan-19	SoLR to Utilita	Approx. 31,000
Brilliant Energy	2017	Acquired "supplier in a box" solution	Mar-19	SoLR to SSE	Approx. 17,000

Source: Ofgem’s analysis of SoLR processes and Cornwall Energy

3.9. Although exit is a normal occurrence in any competitive market, in the domestic retail energy market, supplier failure can be disruptive for customers of these suppliers. The SoLR process is designed to minimise such disruptions, but it can affect customers of other firms if it generate costs that are mutualised across the industry (for example, payments due under government schemes and/or significant credit balances that the appointed SoLR can make a claim for).[15] In order to promote higher financial and risk management standards for all suppliers, in 2018 we launched a Supplier Licensing Review. This year we have put in place more robust entry requirements, effective as of

[15] As an example of SoLR levy claim see https://www.ofgem.gov.uk/system/files/docs/2019/02/octopus_solr_derogation_letter.pdf

5 July 2019, and are continuing to work on ongoing monitoring requirements and exit arrangements.[16]

Stronger competitors to the six large suppliers are emerging

3.10. Since June 2018, the six large suppliers (five of which are former electricity incumbents and one the former gas incumbent) had a net loss as a group of around 1.3 million customers[17] and their combined market share fell by around five percentage points in both gas and electricity, broadly in line with the drop observed in the previous two years. By June 2019, they served just above 70% of domestic customers. British Gas remained the largest supplier, holding 28% and 19% of the gas and electricity market respectively.[18] The former incumbent electricity suppliers continue to exhibit a disproportionately high market share in their historic legacy regions, albeit down from 27% in June 2018 to 25% on average in June 2019. This varies between SSE's 55% share in Northern Scotland and npower's 17% share in Yorkshire.

3.11. Medium suppliers[19] have expanded, increasing their ability to exert competitive pressure on the large six suppliers. They achieved a net gain as a group of 1.9 million customers,[20] and their combined market share reached above 20%, up by nearly seven percentage points in electricity and five in gas by June 2019, compared to only around two percentage points in the previous two years. In addition to the regular acquisition of customers via switching, several medium suppliers increased their customer base by absorbing customers from small suppliers via corporate transactions or after being appointed as supplier of last resort (SoLR).

3.12. Bulb, Octopus Energy and OVO each grew significantly in this period. For Bulb and Octopus this growth can be attributed primarily to customers switching away from the six large suppliers, although the direct acquisition of other suppliers/white labels was

[16] See https://www.ofgem.gov.uk/publications-and-updates/update-way-forward-ongoing-requirements-and-exit-arrangements-phases-supplier-licensing-review
[17] Here we use electricity meter points as a proxy measure for the number of customers.
[18] See https://www.ofgem.gov.uk/data-portal/electricity-supply-market-shares-company-domestic-gb and https://www.ofgem.gov.uk/data-portal/electricity-supply-market-shares-company-domestic-gb
[19] On our data portal we periodically review, typically with a lag of one quarter, the group of suppliers the we define as medium, based on their market share being between 1% and 5%. In this report we refer to the following group of medium suppliers in 2018 and 2019: Bulb; Co-operative Energy; Green Star Energy; Octopus Energy; OVO Energy; Shell Energy; Utilita; and Utility Warehouse.
[20] Here we use electricity meter points as a proxy measure for the number of customers.

also an important factor for Octopus. OVO mainly grew by being appointed SoLR for Economy Energy and Spark, and could grow much further if its planned acquisition of SSE's domestic customers is approved.[21] First Utility, which was acquired by Shell in December 2017, saw a reversal in its previously declining market share since its rebranding to Shell Energy in April 2019.

3.13. Small suppliers' joint market share declined by around one percentage point to 9% in electricity and remained almost unchanged in gas at 9%, between June 2018 and June 2019, although there were mixed fortunes for individual small suppliers.

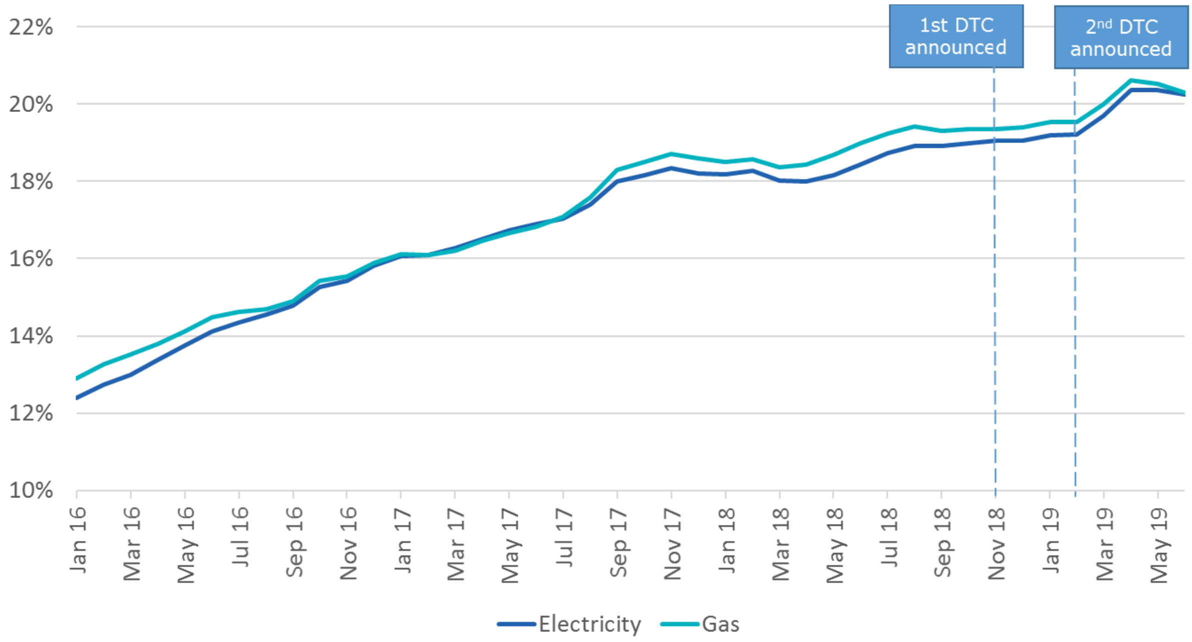
Switching rates have reached a historic high since the default tariff cap was implemented

3.14. Customers switching suppliers are important in driving rivalry between suppliers.[22] Switching rates have been on an upward trend since 2014. In April 2019 rolling annual switching rates reached a GB record of 20.4% in electricity and 20.6% in gas (Figure 3.3), before falling off, respectively, to 20.2% and 20.3% in June 2019. These are high switching rates compared with other utility sectors and retail energy markets around the world (for instance, Norway had the highest electricity switching rate in Europe, reaching 19% in 2017, while the State of Victoria in Australia reached 30% in the financial year 2017-2018).[23]

3.15. Short-term switching fluctuations have traditionally been related to seasonality and price change announcements by the six large suppliers. In 2018 seasonality effects were smaller as prices remained relatively high during the summer months. Updates to the DTC level since its introduction in January 2019 may have acted as new prompts for switching, because of increased media exposure.

[21] The transaction was announced in August 2019 and at the time of publication of this report still had to go through the CMA's approval process.
[22] Customer switching between suppliers only includes voluntary change of supplier events. Hence, it does not include transfers resulting from corporate transactions or SoLR processes.
[23] See BEIS Consumer Green Paper, CEER Retail Market Monitoring Report 2017 and AER State of the Energy Market 2018

Figure 3.3: Rolling annual switching rates between suppliers



Source: Ofgem's analysis of Distribution Network operator data and Xoserve data.
Note: The switching rates at each date are calculated as the ratio between the total number of switches during the previous twelve months and the average number of meter points during the same period.

3.16. In the DTC impact assessment we identified two main channels through which the cap could reduce engagement:[24] (1) a reduction in the differential between default tariffs and acquisition tariffs; and (2) customers' perceived protection under the cap. As a result, customers might not feel it worthwhile or necessary to search for a new supply deal.

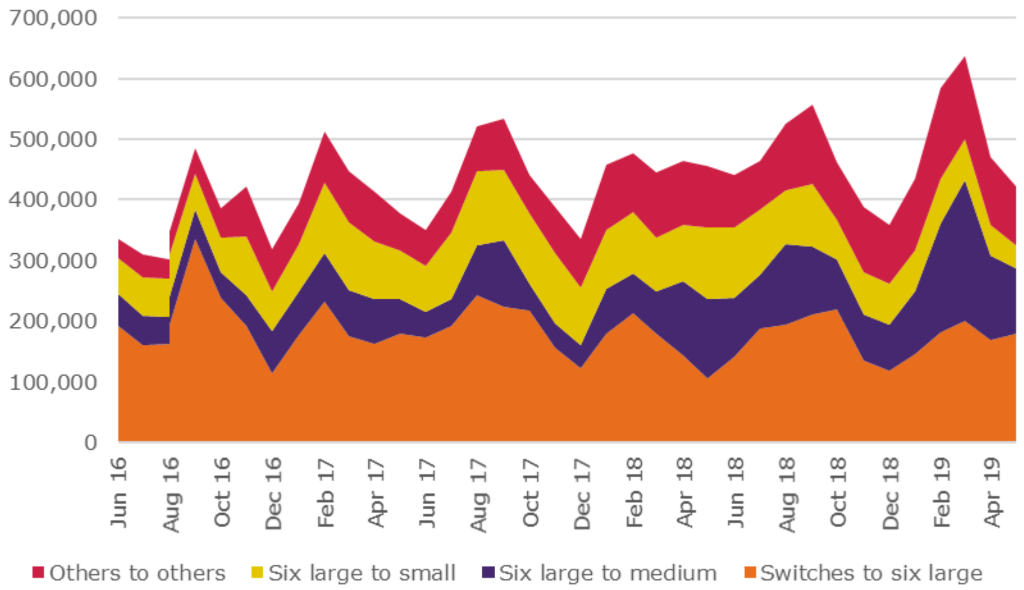
3.17. Although it is too early to reach conclusions on the impact of the DTC, we have seen little evidence so far of these effects. This might be because price differentials have remained at relatively high levels, mainly driven by wholesale prices trends. Moreover, there has been a lot of media attention around the introduction of the DTC and the need for consumers to continue to look for the cheaper market deals. At the same time, survey data indicates that the level of public awareness and understanding of the

[24] See https://www.ofgem.gov.uk/system/files/docs/2018/11/appendix_11_-_final_impact_assessment.pdf

DTC is relatively low (in April 2019 only 29% of consumers reported they had heard about the DTC).[25]

3.18. The majority of switches continue to be to suppliers outside the six largest firms. Customers moving away from those companies accounted for 40% of total electricity switching between July 2018 and June 2019, stable compared with the preceding year. Most of these customers (25%) moved to medium suppliers, rather than small suppliers (16%), which reversed the pattern observed in previous periods (Figure 3.4). Around 36% of switches, down from 41%, still happened to and within the six large suppliers, even though they generally offered higher prices compared to other suppliers. Branding and customer loyalty can partly explain this behaviour.

Figure 3.4: Monthly fluctuations in the number and type of electricity switching movements



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

Note: Gas switching movements followed similar trend and pattern over the same period.

Overall consumer engagement has increased

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25 See https://www.ofgem.gov.uk/publications-and-updates/consumer-perceptions-energy-market-q2-2019

3.19. Our latest domestic customer survey suggests that in 2019 overall engagement increased from the levels observed in 2018 and 2017. Around half (49%) of customers either switched supplier, changed tariff, or compared tariffs in 2019 (it was 41% in 2018). The proportion of customers that reported only comparing without switching stayed steady at 16%, while the proportion who switched supplier reached 24%, significantly higher than 18% in 2018. The proportion of those that reported switching tariff but not supplier grew marginally to 9% (up from 7% in 2018). Of the 24% who reported switching suppliers, 5% were first time switchers (similar to 2018) and the remaining 18% had switched before.

3.20. Saving money is still by far the main reason for switching, with 83% of consumers who switched mentioning it as a motive in our consumer survey, although this is lower than in 2018, when 87% quoted this as a reason. The risks that switching may result in higher bills or not lead to the expected level of saving continued to be the most common concerns in 2019, both for customers who switched and those who did not switch over the past 12 months.

3.21. Price comparison websites (PCWs) and other online channels are becoming key facilitators of engagement: in 2017, 45% of those who switched or compared tariffs or supplier used a price comparison site to find deals. This proportion increased to 54% in 2018. In 2019 we began measuring use of switching and deal-scanning services that consumers can register for online. This year 49% used a price comparison website to find their energy deal, a further 8% used an 'auto-scanning' service that notified them of new deals and 2% used an automatic switching service.

3.22. Over the last two years there has been an increase in the number of intermediaries offering automated switching services that do not require any direct customer engagement with the market, unless they want to cancel an upcoming transfer. As of June 2019 there were around 10 automated switching services, almost doubling the June 2018 number. The increase is partly due to established PCWs entering the auto-switch market (for example GoCompare launched WeFlip and Energy Helpline launched Ecoisme). Although the number of customers subscribed to automated switching providers is still relatively small (around 130,000 in June 2019),[26] this development

[26] Source: Cornwall Energy

could potentially reduce searching costs for customers and thus add competitive pressure on existing suppliers and on the traditional supplier-customer arrangements.[27]

The proportion of unengaged consumers has fallen significantly

3.23. The proportion of unengaged consumers remains high, but has fallen significantly since 2018. Survey data in 2019 shows the proportion of consumers who recalled never switching supplier or switching just once is down to 49% from 61% in 2018 and 58% in 2017. This proportion includes 27% of consumers reporting that they have never switched supplier, down from 34% in 2018.

3.24. Less engaged consumers tend to be on more expensive default tariffs, which have been subject to the default tariff cap since 1 January 2019. The proportion of customer accounts on these tariffs has declined over time. It was around 69% in 2015 and gradually fell to 53% by April 2018.[28] As of April 2019, 53% of electricity customer accounts and 51% of gas accounts, excluding customers on prepayment, were still on default tariffs. Around half of these had been on default tariffs for more than three years. The proportions vary significantly across suppliers due to each supplier's business model, the characteristics of their customers and the prices they offer.[29]

3.25. Whereas most default tariffs are Standard Variable Tariffs (SVTs), which are generally priced above fixed tariffs, there is a wide dispersion of prices and customer uptake levels across tariffs (see Figure 3.5). New entrants typically offer the cheapest SVTs and fixed tariffs and tend to have very few customers on them. The main

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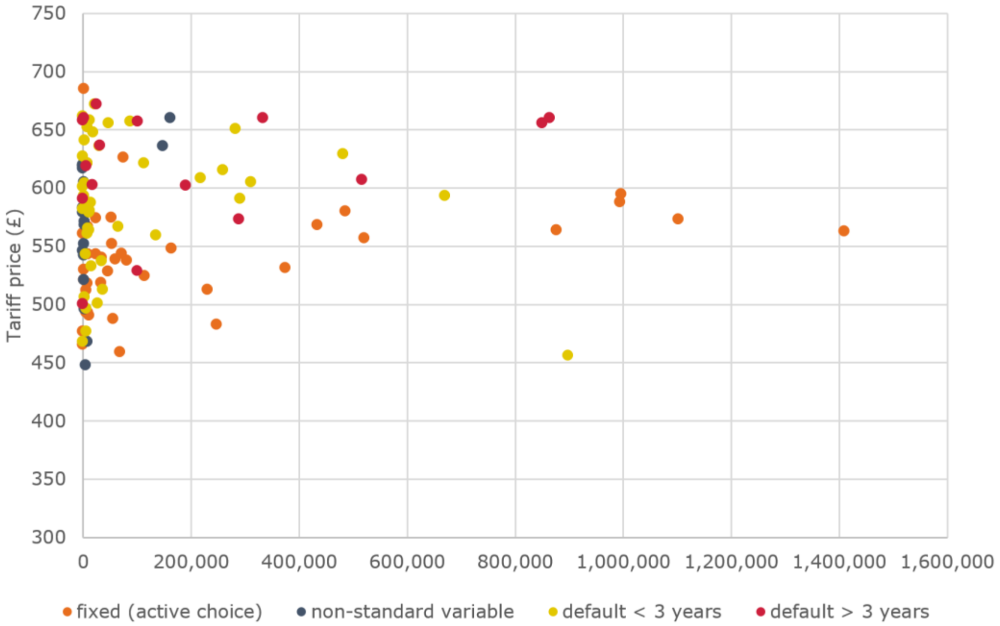
[27] See Future supply market arrangements-response to our call for evidence.
[28] See https://www.ofgem.gov.uk/system/files/docs/2016/08/retail_energy_markets_in_2016.pdf and https://www.ofgem.gov.uk/system/files/docs/2018/10/state_of_the_energy_market_report_2018.pdf

[29] The proportions of customer accounts on default tariffs in 2018 and 2019 are calculated for a comparable selection of around 25 suppliers, serving approximately 95% of the market. These proportions exclude Bulb's customer accounts. This is because Bulb offers only one variable tariff which, while being an SVT, is priced similarly to fixed tariffs and is used to acquire customers. For details on the distribution of customers by tariff type for individual large and medium suppliers see https://www.ofgem.gov.uk/data-portal/number-domestic-gas-customer-accounts-supplier-excluding-pre-payment-customers-standard-variable-fixed-and-other-tariffs-gb and https://www.ofgem.gov.uk/data-portal/number-domestic-electricity-customer-accounts-supplier-excluding-pre-payment-customers-standard-variable-fixed-and-other-tariffs-gb.

exception was Bulb, which offered a single SVT that was among the cheapest tariffs in the market.

Figure 3.5: Distribution of direct debit electricity customer accounts by tariff type and price (£/year)



Source: Ofgem's analysis of gas and electricity customer account data by suppliers

Note: The chart depicts the average annual bill for electricity tariffs based on a medium Typical Domestic Consumption Value (3100 kWh) and for a customer with an unrestricted meter paying by direct debit, as of 1 April 2019, with prices expressed in nominal terms. Each point of the scatter represents a group of tariffs of the same type with the same supplier and indicates the number of customers on these tariffs.

Case study: our programme of engagement trials

The reasons why energy customers do not engage with their energy choices are complex. We have designed a programme of work to understand the behavioural barriers that prevent some customers from engaging, and conducted a series of trials to test what works in prompting engagement. The 10 trials across 9 suppliers have focused on tailoring communications, based on behavioural insights, and have been targeted at the most disengaged customers, i.e. customers who had been on default tariffs for some time. Most of the trials were designed as randomised controlled trials so the impact of the additional information could be robustly compared against a control group who did not receive it. The trials were led by Ofgem and carried out in conjunction with the customers' energy suppliers using our licence powers.

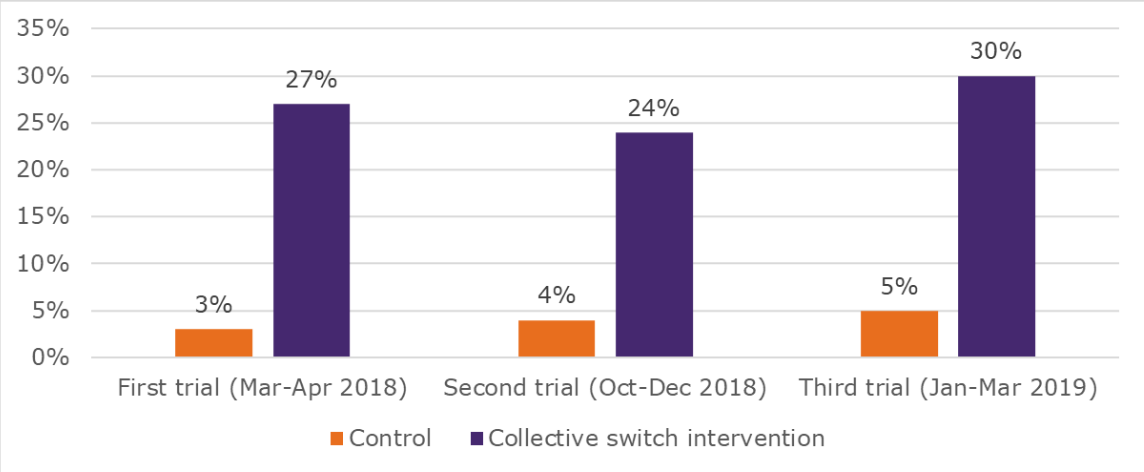
COLLECTIVE SWITCH TRIALS

Common barriers to switching tariff are that customers fear it will be a hassle or they are overwhelmed by the choice of tariffs. We used this understanding to develop an intervention that offered tailored support throughout the switching process.

In the "Collective Switch" trials, customers were sent three personalised letters informing them they could save money by switching tariff and suggesting one alternative fixed term tariff. The letters suggested customers contacted an independent third party price comparison service. This service gave personalised advice and provided reassurance on the switching process, tackling key barriers to engagement. Figure 3.6 shows that there is a substantial difference in the proportion of customers switching between customers receiving these letters and the control group.

These results suggest that with timely information and well designed support, substantial numbers of long term SVT customers can make an active choice and switch tariff.

Figure 3.6: Percentage of participants who chose to switch energy tariff in the three Collective Switch trials



Source: Ofgem

Note: These trials took place over a calendar year with different energy suppliers. For full details of the research method and results see https://www.ofgem.gov.uk/publications-and-updates/what-works-increasing-engagement-energy-tariff-choices

Suppliers have new incentives to improve switching performance

3.26. The effectiveness of the switching process remains poor, with no major improvements in switching speed and reliability over the last few years. According to our 2019 survey data, although most (88%) switchers agreed they found the process easy, up from 86% in 2018, the possibility of something going wrong with the switching process continues to be a concern for 11% of consumers.

3.27. This is supported by industry data that shows that reliability is an area of concern. The proportion of erroneous transfers, where consumers are switched to suppliers against their wishes, has stayed broadly stable since 2014, fluctuating around 1% (between July 2018 and July 2019 there were around 130,000 erroneous gas and electricity transfers).The wrong meter point being switched has typically been the main cause. Inaccurate customer address data held across the industry remains the single largest reason for erroneous transfers.

3.28. Supply licences require licensees to take all reasonable steps to complete a transfer within 21 calendar days after the end of the 14 day cooling-off period (or after an earlier date during the cooling-off period if agreed with the customer). Over the past five years, the system average switching time[30] has fluctuated between 15-16 days for electricity and 15-19 days for gas.[31] Even when the switching process works well, it is slow compared to other sectors. For instance, there is a legal requirement for current account switches to occur within ten working days and for mobile telephony switches to occur within one working day.

3.29. We aim to improve the switching experience for customer through our Faster and More Reliable Switching programme. The programme entered its implementation phase in April 2019 and is expected to go live in Summer 2021.[32]

3.30. Alongside this, we introduced new Guaranteed Standards of Performance for Switching on 1 May 2019 to incentivise suppliers to improve performance and directly compensate consumers where a supplier does not meet its obligations.[33] We are currently working on the introduction of three additional Guaranteed Standards. These include requiring suppliers to complete a switch within 21 days, to issue final bills within six weeks of a switch and to ensure that customers are not erroneously switched.

Smart meter rollout has been much slower than expected

3.31. Traditional meters do not provide accurate and timely consumption information. It is difficult for customers with these meters to monitor how much energy they have used. Because meter readings need to be taken locally, consumption information can only be provided to customers infrequently and is often based on estimates. Smart meters enable the provision of accurate bills and better information, and thus should make consumers more likely to engage. In addition, smart meters enable market reforms such as half-hourly settlement[34] that facilitate the offer of new products and

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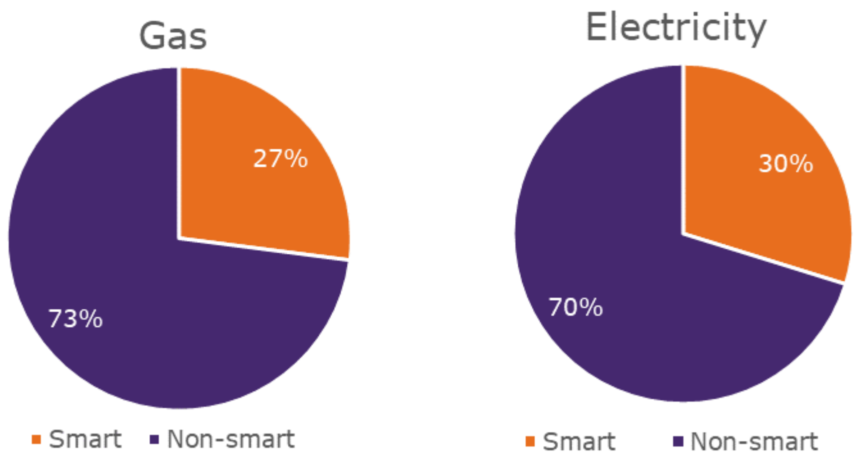
[30] System switching time is measured by the number of calendar days it takes from when a supplier submits a switching request to the transfer taking place. We source our data from distribution network operators, so this statistic does not reflect the time taken by the supplier to submit a switching request, which may happen at the end or during the cooling-off period, nor the additional time to process the contract with the customer.
[31] See https://www.ofgem.gov.uk/data-portal/average-switching-time-domestic-customers-gb
[32] See https://www.ofgem.gov.uk/gas/retail-market/market-review-and-reform/smarter-markets-programme/switching-programme
[33] See https://www.ofgem.gov.uk/publications-and-updates/customers-entitled-automatic-compensation-switching-problems-1-may
[34] See https://www.ofgem.gov.uk/publications-and-updates/decision-access-half-hourly-electricity-data-settlement-purposes. On 25 June we announced that suppliers will be allowed access to half-

services (eg time of use tariffs) and increase customer choice. Evidence from a range of pilot projects across countries suggests that smart meter installation is associated with a 4-5% reduction in energy consumption.

Figure 3.7: Proportion of smart domestic meters in operation on 30 June 2019



Source: Ofgem's analysis of a selection of BEIS Q2 2019 Smart Meter Statistics referred to meters operated by the 14 largest energy suppliers
Note: Non-smart includes smart meters operating in traditional mode, smart-type & traditional meters

3.32. Energy suppliers are legally required to take all reasonable steps to roll out smart meters to all their domestic and small business customers, involving around 50 million smart meters. On 16 September 2019, the government published proposals for energy suppliers to continue installing smart meters after 31 December 2020, when the current rollout duty ends.[35] At the end of June 2019, there were nearly 14 million smart meters operating in domestic premises. This represented a 26% increase compared to 11 million in June 2018, but was far from the former 2020 target.[36] We have recently

hourly dometic customer data and be required to process it for settlement purposes unless the customer opts out. Previously, the access to this data was subject to customers opting in.
[35] See https://www.gov.uk/government/consultations/smart-meter-policy-framework-post-2020
[36] See https://www.nao.org.uk/wp-content/uploads/2018/11/Rolling-out-smart-meters.pdf. For a comparison with smart meter rollout in other European countries see https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/MMR%202017%20-%20CONSUMER%20PROTECTION.pdf (the 2018 update of this ACER/CEER publication is expected by the end of October 2019).

issued an open letter on the rollout progress so far, highlighting the key challenges that suppliers are facing and the regulatory obligations we expect them to meet.[37]

3.33. Over a quarter of domestic meters operating in GB are now smart meters (see Figure 3.7). Technical issues may lead to some smart meters operating in traditional mode. These can include SMETS1[38] meters that lose interoperability when customers switch to a new supplier that is currently unable to communicate with the meter. Although SMETS1 meters are expected to regain smart functionality when they are enrolled with the Data and Communications Company (DCC) from this year, there is a risk that temporary loss of smart functionality affects consumers' switching decisions.

3.34. The transition to SMETS2 meters, which are fully interoperable by design, started in earnest only around mid-2018. Technical constraints have limited the installation of these meters until now. As of June 2019 there were just over 1.3 million domestic SMETS2 meters connected to the system.

Domestic retail energy market outcomes

The default tariff cap has reduced prices overall

3.35. When a market is competitive and working well, there should be downward pressure on prices as suppliers compete to attract customers. Downward pressure does not necessarily mean ever decreasing 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.

3.36. Against a background of rising and volatile wholesale prices,[39] variable and fixed tariff prices were generally increasing between June 2017 and December 2018 (see

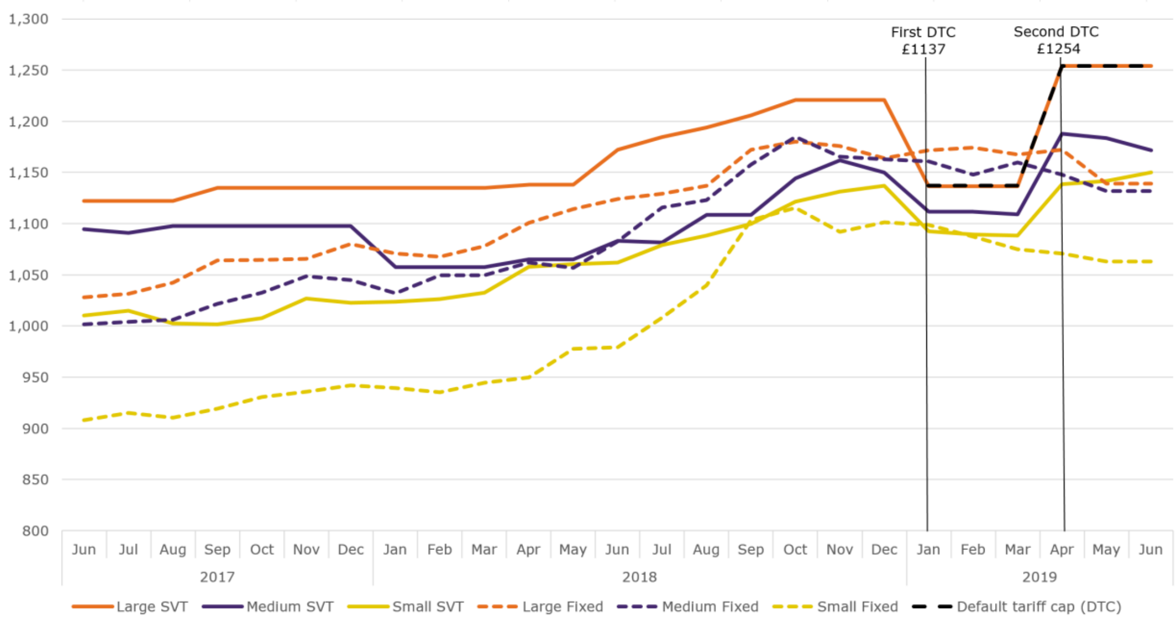
[37] See https://www.ofgem.gov.uk/publications-and-updates/smart-meter-rollout-energy-suppliers-progress-and-future-plans-open-letter-june-2019

[38] A smart meter is a meter compliant with the Smart Meter Equipment Technical Specification (SMETS) and has functionalities such as being able to transmit meter readings to energy suppliers and receive data remotely. The national data and communications infrastructure being delivered by the DCC enables energy suppliers to install and operate the new generation of smart meters (SMETS2 meters) on its systems. The first generation of smart meters (SMETS1 meters) is also expected to enrol into this network in future.

[39] Between June 2017 and September 2018, wholesale energy prices generally increased, including the Beast from the East price shock in March 2018, followed by a declining trend during the last

Figure 3.8). The six large suppliers typically offered the most expensive deals and small suppliers continued to offer, on average, the cheapest deals in the market.

Figure 3.8: Average dual fuel tariff prices (£/year nominal terms) over time split by supplier size



Source: Ofgem's analysis of Energyhelpline data

Note: The chart depicts average prices for Direct Debit variable and fixed tariffs, as well as the default tariff cap at the end of each month. Throughout the period the Typical Domestic Consumption Value was 3,100 kWh for electricity and 12,000 kWh for gas.

3.37. Upon implementation of the DTC,[40] the most expensive SVT tariffs were brought in line with the level of the DTC, while the majority of suppliers that had previously priced their SVTs below the cap kept their prices unchanged. On 1 April 2019, when the new level of the DTC increased by 10% to reflect underlying costs, all six large suppliers increased their SVT prices by a similar percentage, setting them within £2 of the cap level as they had done in the first charging period. By contrast, medium and small

quarter of 2018. See https://www.ofgem.gov.uk/data-portal/gas-prices-day-ahead-contracts-monthly-average-gb.

[40] The DTC, which entered into effect on 1 January 2019, is based on calculations of average efficient costs, so that any change in its level is cost reflective. See https://www.ofgem.gov.uk/data-portal/breakdown-default-tariff-price-cap-gbp

suppliers continued to price their SVTs, on average, at £43 and £78 respectively below the level of the cap between January and June 2019 (see Figure 3.8).

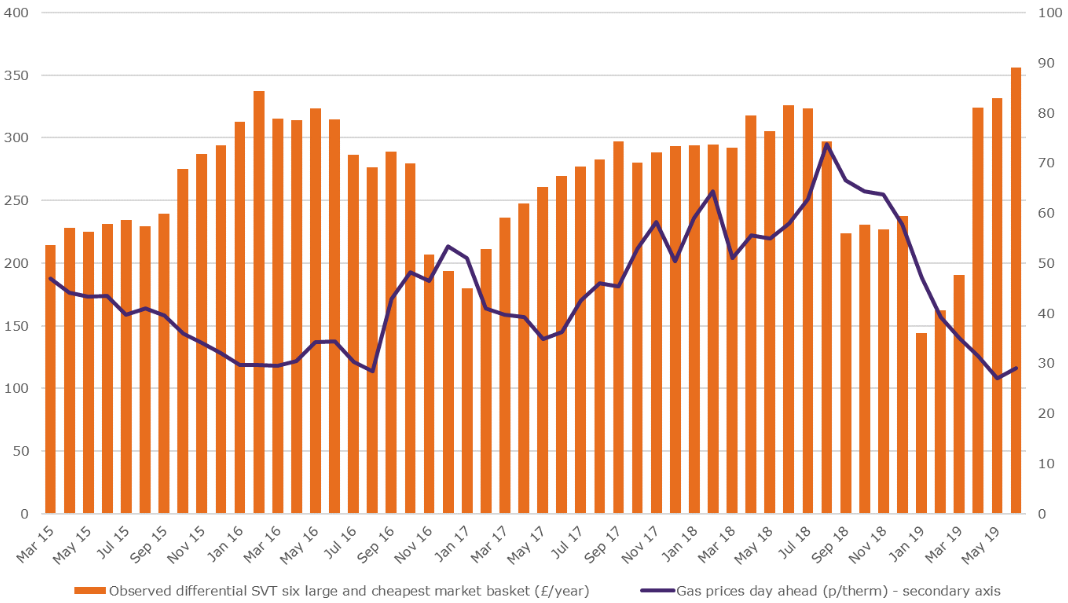
3.38. Fixed-term tariffs, which fall outside the scope of the DTC, have generally followed a downward trend reflecting the decline in wholesale costs since October 2018. As a result, we have not yet seen evidence indicating that suppliers have increased other tariff prices to offset the revenue losses on default tariffs.

High wholesale price volatility has led to widening price differentials

3.39. Price differentials tend to fluctuate over time as suppliers' pricing strategies respond to changes in underlying costs as well as in the market and regulatory environment. In our DTC impact assessment we had estimated that the default tariff cap could narrow the price differential between the average default tariff price with the six large suppliers and the cheapest basket of fixed tariffs to £140.[41] Upon implementation of the DTC this differential fell from £237 in December 2018 to £144 in January 2019. It then increased back to values above £300 between February and May and went above £350 in June 2019 (see Figure 3.9).

[41] This is based on 2017 data published on https://www.ofgem.gov.uk/data-portal/retail-price-comparison-company-and-tariff-type-domestic-gb

Figure 3.9: Retail price differentials (£/year) and gas wholesale prices (p/therm, nominal terms)



Source: Ofgem's analysis of Energyhelpline and ICIS data

3.40. The increase in price differentials was mainly due to declining wholesale prices translating quickly into lower acquisition tariffs, while default tariffs remained relatively unchanged. This is because suppliers hedge default tariff customers with forward contracts that may span between one and two years, depending on the supplier. Moreover, the DTC is set during a six-month observation period which starts eight months before the first day of the cap period, with two months allowed for suppliers to give customers sufficient notice of any price increase. Hence, 60% of the DTC increase that applied from 1 April 2019 was based on the relevant weighted average of wholesale prices between August 2018 and January 2019, which was in turn affected by an exceptionally high level of wholesale prices during the summer months.

3.41. The decrease in wholesale prices between February and June 2019 has driven the updated DTC level down by £75, to £1,179, for the third charging period, starting on 1 October 2019,[42] when we expect a reduction in price differentials.

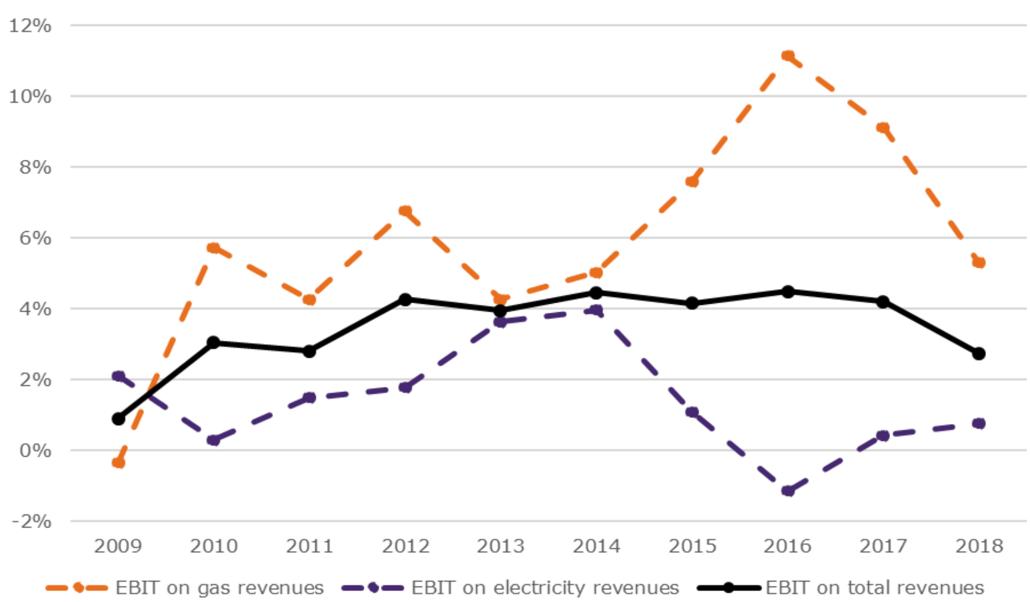
[42] See https://www.ofgem.gov.uk/publications-and-updates/energy-caps-fall-winter-due-lower-wholesale-costs

The six large suppliers' average profit margin fell to a nine-year low in 2018

3.42. A principal way of assessing whether price competition is strong is to consider company profit margins and costs.[43] With vigorous competition putting downward pressure on prices, we would expect costs to be pushed towards their efficient level and profit margins only to reflect the normal rate of return required by investors, unless there is significant innovation in service quality or production methods.

3.43. Total domestic supply profits aggregated across the six largest firms, measured as earnings before interest and tax (EBIT), decreased by 35% in 2018, compared to the 10% reduction between 2016 and 2017. Figure 3.10 shows that the overall average profit margin, measured by EBIT as a percentage of revenue, fell to a nine-year low of 2.7%. This decline reflects the continued fall of the gas profit margin below 6%, which was driven by the significant increase of wholesale gas costs in 2018, while operating and direct costs remained relatively stable. On the other hand, the electricity profit margin rose slightly, but remained significantly lower than gas.

Figure 3.10: Profits of the six large suppliers before interest and tax as a percentage of sales, 2009-2018



Source: Ofgem's analysis of Consolidated Segmental Statements

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

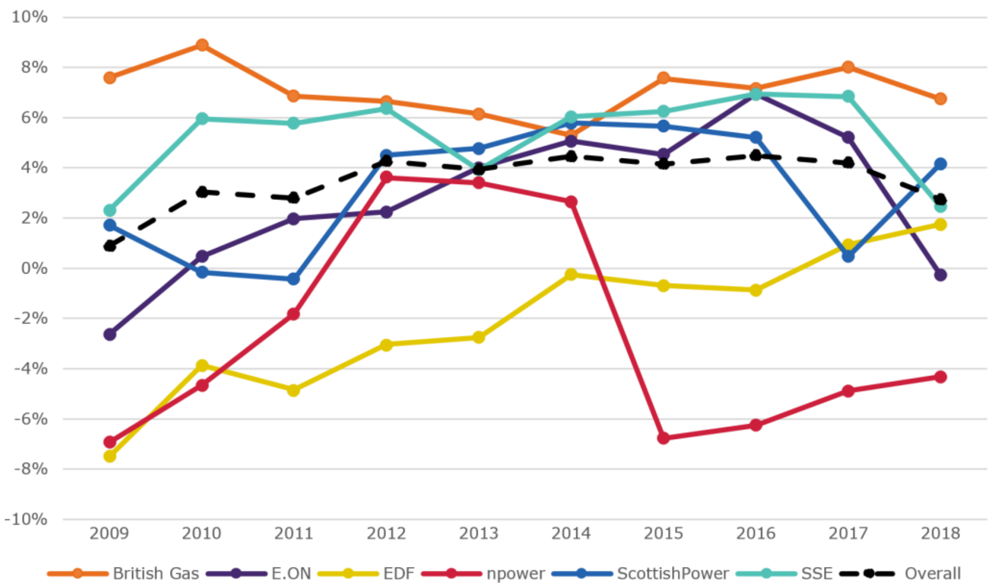
3.44. Profit margins vary across the six large suppliers, with some notable individual changes between 2017 and 2018. E.ON and SSE in particular saw a significant reduction in their margins, down to 0% and 2% respectively. In contrast, both EDF and ScottishPower's profit margins increased, while npower saw a slight reduction in its losses. British Gas experienced the smallest change, with its profit margin only slightly down to 7% from 8% in 2017 (see Figure 3.11).

3.45. As SSE operates on an April-March financial year, the DTC may have in part caused the sharp decline in its EBIT margin. While SSE's physical sales of gas and electricity decreased by 17% and 13%, which was far more than any other of the six suppliers, SSE's tariff revenues did not increase proportionately to offset this loss.

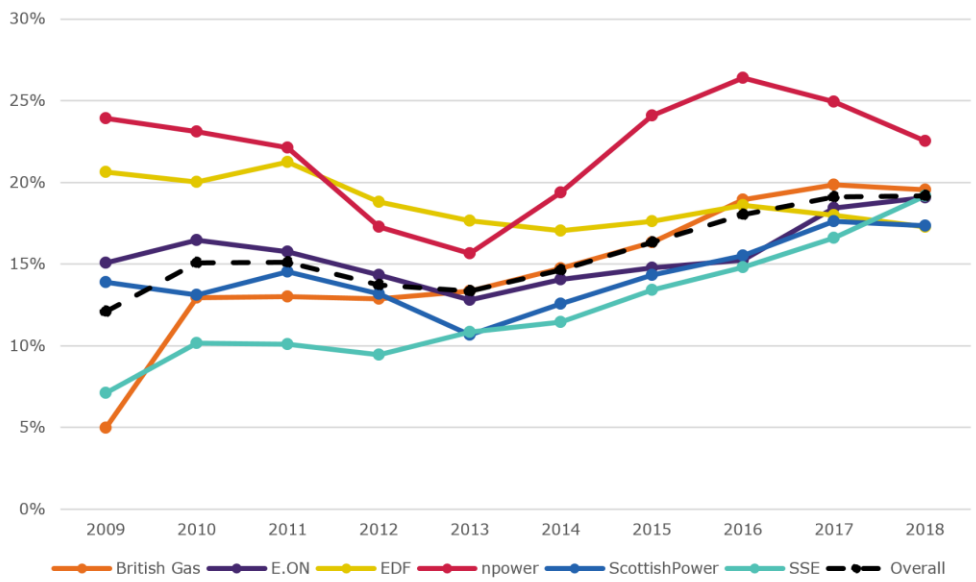
3.46. Operating costs as a percentage of revenue have been on a generally increasing trend over the last six years for the large suppliers as a group, which is partly a consequence of the fixed operating costs being spread over fewer customers as they lose market share. In 2018 operating costs as a percentage of revenue remained relatively stable across the six suppliers (Figure 3.11), except for a small reduction for npower and an increase for SSE. The latter was down to SSE's operating costs remaining relatively unchanged while its revenues fell.

Figure 3.11: EBIT and operating costs as % of sales

Earnings before tax and interest as % of revenue



Operating costs as % of revenue



Source: Ofgem’s analysis of Consolidated Segmental Statements

There are more innovative tariffs and service offerings to choose from

3.47. The overall number of tariffs available to customers has stayed broadly stable at around 220, between June 2018 and June 2019. But we continue to see signs of increasing innovation through new tariff types, such as price-cap trackers and Electric Vehicle (EV) tariffs.

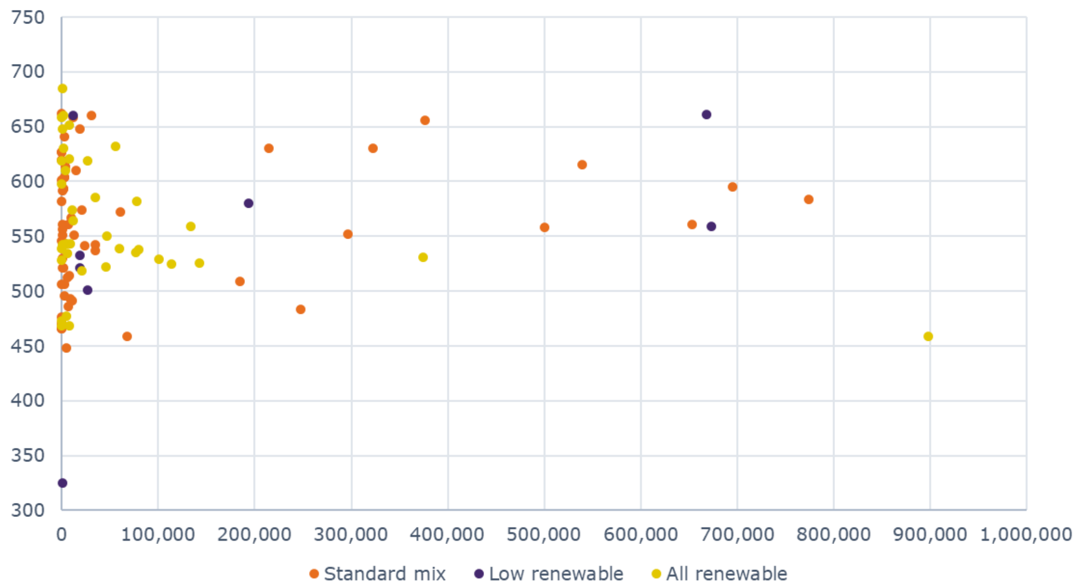
3.48. Most customers tend to be on tariffs with a standard or low renewable content. However, the number of tariffs labelled by suppliers as ‘green’ or ‘100% renewable’ has increased significantly over the last few years, reaching 59 in June 2019, accounting for 34% of the total number of electricity tariffs available across GB. This is partly driven by the growing offer of EV tariffs, which are generally ‘100% renewable’.

3.49. As of 1 April 2019, the uptake of these tariffs was just above 4 million electricity accounts, around 15% of the total number of electricity accounts, most of them with medium and small suppliers. The majority have fewer than 50,000 customers on them. However, a large number of customers on ‘100% renewable’ tariffs[44] are with only one

[44] Three suppliers (Good Energy, Ecotricity and Green Energy) were granted derogations from the DTC on the grounds of supplying renewable energy.

supplier, Bulb (see Figure 3.12). Many "renewable" tariffs are cheaper than others with a low renewables or standard fuel mix.

Figure 3.12: Number of customer accounts on electricity tariffs by price (£/year) and fuel mix label



Source: Ofgem's analysis of gas and electricity customer account data by suppliers**.**

Note: The chart depicts the average annual bill for electricity tariffs based on a medium Typical Domestic Consumption Value (3,100 kWh) as of 1 April 2019, with prices expressed in nominal terms. Each point of the scatter represents a group of tariffs of the same fuel mix with the same supplier and indicates the number of customers on these tariffs. Tariffs labelled as 'green' or 'all renewable' are those tariffs for which suppliers declare acquiring at least 100% renewable electricity (some tariffs will have 100% renewable sources, as well as renewable gas/carbon offsetting).

3.50. The number of smart tariffs continues to be relatively small. As of June 2019, there were only 11 smart tariffs, almost unchanged since June 2018, but there were around 6 million gas and 4 million electricity customer accounts on these tariffs, the majority of which were with British Gas.[45] Most smart tariffs on offer tend to be static, typically involving cheaper tariff rates during pre-determined periods of time, although there are exceptions such as Octopus' Agile tariff, which features prices changing every thirty minutes to reflect variable wholesale prices. The main barriers that suppliers face in offering smart tariffs with dynamic pricing relate to the ongoing rollout of smart meters

[45] Throughout this document we refer to smart tariffs as tariffs for which suppliers require the installation of a smart meter.

and to the current settlement rules.[46] Moreover, customer engagement with these tariffs can be challenging, as clauses around price calculation, data protection and contract termination tend to be especially complex.[47]

There are signs of declining quality of service, with large variations across suppliers

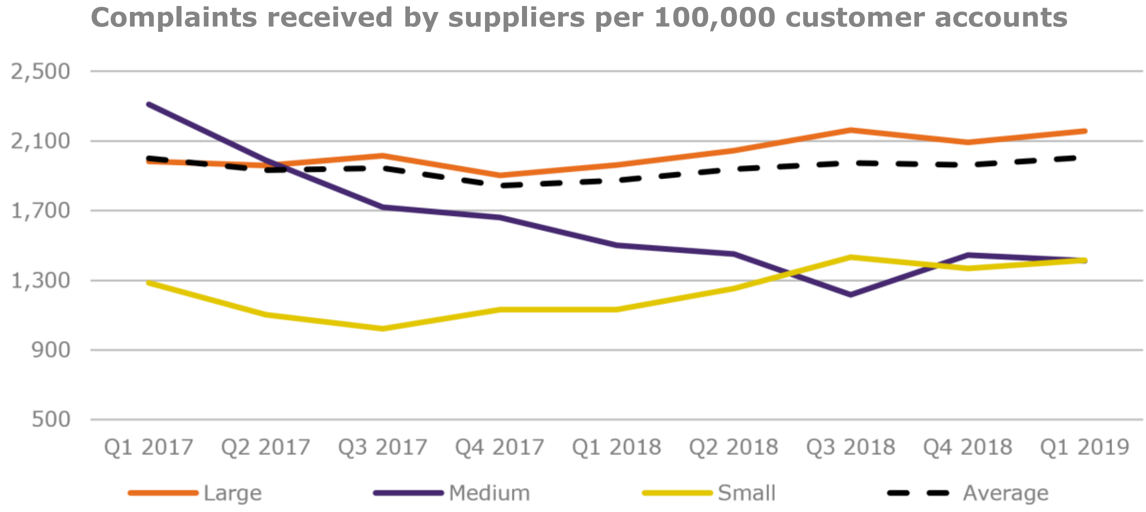
3.51. In a market where competition works effectively for consumers we would expect suppliers to compete both in price and in offering a high quality of service.

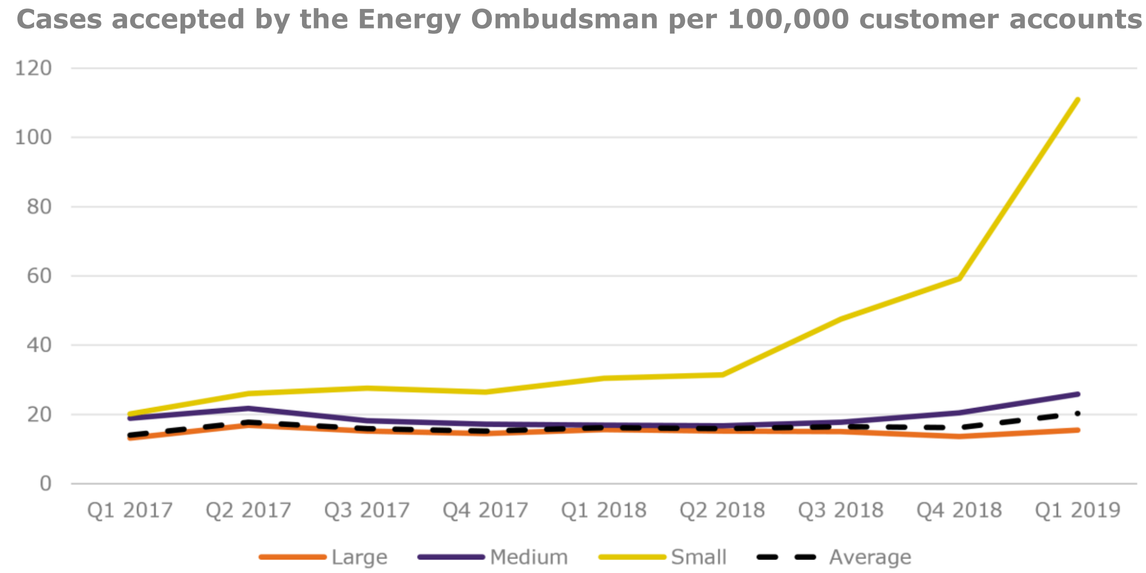
3.52. Over the past year we have seen signs of declining customer service across the domestic retail market, albeit with notable differences for individual suppliers. This decline started in 2018. It may be due to companies' attempts to reduce operating costs and maintain profits by cutting customer service resources in a competitive environment. It may also reflect specific cases of poor performance, including some suppliers which ceased trading during the period.

3.53. Figure 3.13 shows suppliers' direct complaints performance and cases accepted by the Energy Ombudsman between Q1 2017 and Q1 2019 (the latter tend to reflect the most serious complaints that suppliers cannot resolve). The top chart in Figure 3.13 indicates that small suppliers, on average, receive a relatively low volume of complaints from their customers. However, the bottom chart suggests that they have more of the severe complaints compared to both medium and large suppliers.

[46] See https://www.ofgem.gov.uk/electricity/retail-market/market-review-and-reform/smarter-markets-programme/electricity-settlement-reform.
[47] See https://www.beuc.eu/publications/beuc-x-2019-016_flexible_electricity_contracts_report.pdf

Figure 3.13: Complaints received by suppliers and cases accepted by the Energy Ombudsman per 100,000 gas and electricity customer accounts





Source: Ofgem’s analysis of data from suppliers and the Energy Ombudsman

Note: Both charts refer to the same groups of suppliers (the six large suppliers, medium suppliers and twelve small suppliers). For more information see https://www.ofgem.gov.uk/data-portal/complaints-received-small-sized-suppliers-10000-customer-accounts.

3.54. When looking at other quality of service indicators besides complaints, the picture is mixed (Figure 3.14). Between Q1 2018 and Q1 2019, the proportion of accurate bills and that of switches executed within 21 days were either unchanged or improved, while call waiting times and percentage of missed appointments increased for some groups of suppliers. On average, the six large suppliers were the best performers in terms of billing accuracy, missed appointments and switching completion, while small suppliers had the lowest call waiting time. There were large variations in performance, especially among small and medium suppliers.

Figure 3.14: Key quality of service indicators by supplier size groups

Customer action	Key quality of service indicators	Average values, range and direction of change between Q1 2018 and Q1 2019		
		Suppliers		
		Large	Medium	Small
Assess	Billing accuracy (% of customers)	95% =	90% =	90% ↑
		(89% - 98%)	(57% - 98%)	(62% - 100%)
Access	Missed appointments (% out of total)	5% ↓	7% ↑	9% ↓
		(2% - 10%)	(1% - 26%)	(1% - 46%)
	Call waiting (time seconds)	164 =	182 ↑	139 ↑
		(65-310)	(23-1028)	(13-558)
Act	Switches (% executed within 21 days)	97% =	95% ↑	92% ↑
		(91% - 99%)	(79%-100%)	(45%-100%)

Source: Ofgem's analysis of Citizens Advice Supplier Star Ratings and suppliers' data submissions to Ofgem for Guaranteed Standards of Performance.
Note: Citizens Advice includes a combination of quality of service metrics and complaints to third party consumer bodies in its star rating reports, which are aimed at enabling consumers to compare suppliers' performance when choosing a supplier.[48]

3.55. Most energy consumers are satisfied with the service they receive (78% reported satisfaction in 2019 compared to 76% in 2018 and 77% in 2017), but consumers continue to perceive energy suppliers as performing worse than other service providers. In 2019 energy suppliers ranked 8th out of 11 service providers across different sectors in for value for money ratings and 9th out of 11 for customer service, essentially unchanged compared to 2018.[49]

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48 See https://www.citizensadvice.org.uk/about-us/policy/policy-research-topics/energy-policy-research-and-consultation-responses/energy-policy-research/domestic-energy-supplier-performance-data/.

49 Firebrand Insight Limited: 'Customers in Britain'. April 2019.

Structural trends and outcomes in the prepayment segment

3.56. As of March 2019 there were 4.3 million customers on prepayment meters (PPM), representing around 15% of all customers in GB. These customers are more likely to be in vulnerable circumstances and face more barriers to engage effectively with the market and access the best market deals. To address this situation, a cap on PPM prices, excluding those for customers on fully interoperable smart meters, has been in place since April 2017. In July 2019, the CMA issued its decision to align the PPM price cap methodology more closely with our DTC methodology from 1 October 2019. The CMA also recommended that Ofgem extend protection for PPM customers beyond the original deadline of December 2020.[50]

3.57. Below we examine how the market structure and outcomes for PPM customers have evolved during the two-year existence of the PPM cap.

PPM structural market conditions have remained broadly unchanged

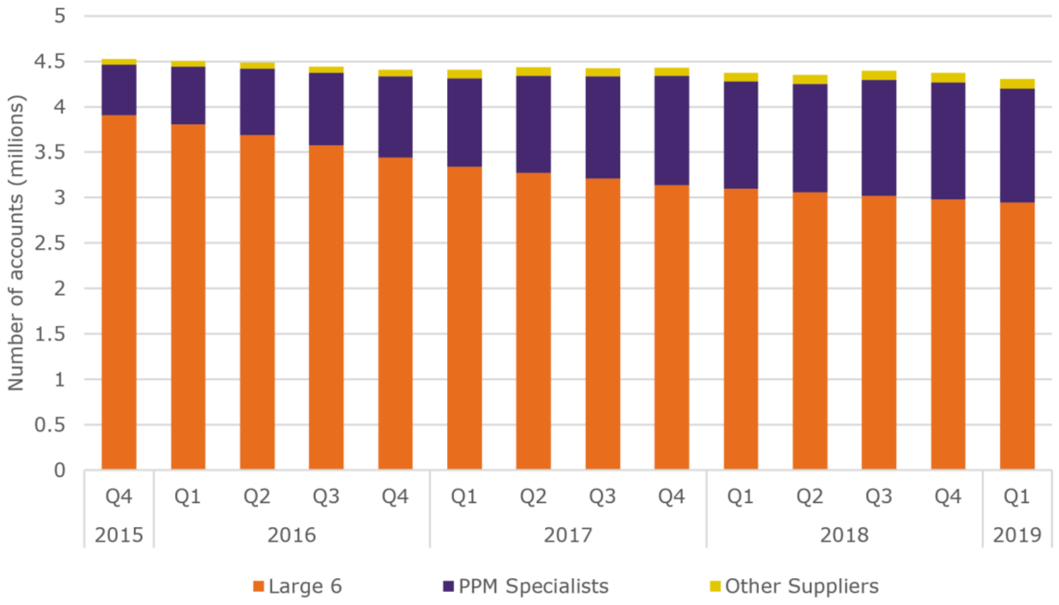
3.58. Customers on PPM tend to have requirements that are different from other domestic customers. Prepayment meters are often installed where a customer has a poor payment history or in specific types of accommodation such as holiday homes and student accommodation. All suppliers must be able to offer the option of a PPM installation to customers in payment difficulties, but it is only those with over 50,000 customers that are obligated to offer PPM as part of the payment options available to their customers. Many small suppliers have chosen not to offer PPM tariffs due to technical constraints to issue new tariffs and to the higher costs to acquire PPM customers.

3.59. As a result, there are typically fewer suppliers active in the PPM segment compared to the overall domestic retail market and only a few PPM specialists have managed to

[50] See https://www.gov.uk/government/news/cma-recommends-protecting-prepayment-energy-customers-beyond-2020

expand beyond the six large suppliers. As of March 2019, Utilita, OVO and E accounted together for nearly the entire market share of PPM specialists (see Figure 3.15).

Figure 3.15: Number of PPM electricity accounts and market shares trends



Source: Ofgem's analysis of Social Obligations Reporting data provided by suppliers.

Note: PPM specialists covered here include Avid Energy, Utilita, OVO, E, Economy Energy (exited in January 2019), Eversmart Energy, Our Power (exited in January 2019), Spark (exited in November 2018), Nabuh Energy and Toto. A similar trend can be observed in the gas PPM segment.

3.60. More than 90% of prepayment customers continue to be on SVTs. In addition to having considerably fewer tariffs available to them, the cheapest PPM tariff available has been significantly higher than the cheapest direct debit tariff (even accounting for differentials in the costs to serve). In this context competition has not worked well for PPM customers.[51]

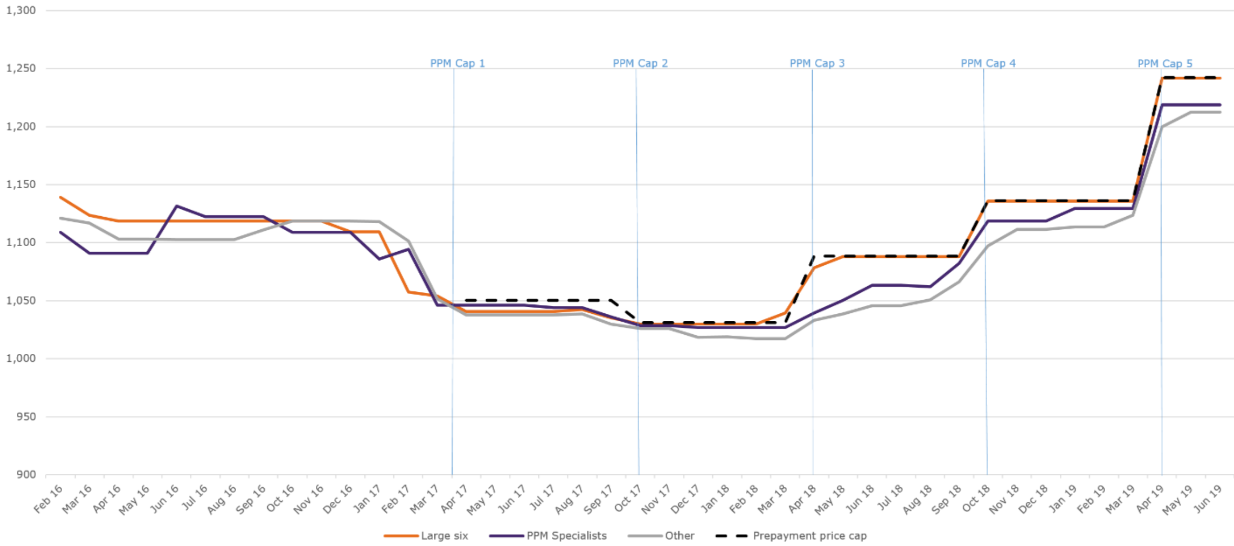
PPM price dispersion has increased but engagement has remained relatively low

3.61. During the first PPM cap charging period average SVT prices charged by large, medium and small suppliers generally converged towards the level of the cap. Differentials among these tariffs started to increase again towards the end of the

[51] See https://www.ofgem.gov.uk/data-portal/cheapest-tariffs-payment-method-typical-domestic-dual-fuel-customer-gb

second charging period and increased significantly in the following periods (see Figure 3.16).

Figure 3.16: Average PPM SVTs by supplier size (dual fuel tariffs)



Source: Ofgem's analysis of Energyhelpline data

Note: The chart depicts the average annual bill for dual fuel SVT tariffs and the prepayment price cap based on medium Typical Domestic Consumption Values (3100 kWh for electricity and 12,000 kWh for gas) for customers on unrestricted prepayment meters. All prices are as of the end of each month and are expressed in nominal terms.

3.62. Similar to what happened with the DTC, the last three charging periods saw an upward adjustment of the PPM cap to reflect higher wholesale prices, but not all suppliers increased their prices to the same extent towards the cap. Specialist and other suppliers tended to price more aggressively, whereas large suppliers generally priced at the cap level (see Figure 3.16). Nevertheless, the level of price dispersion under the PPM price cap remains lower than that observed under the DTC for other payment methods (see Figure 3.8).

3.63. Engagement among PPM customers is lower than for customers who pay by direct debit, although is increasing slowly. In 2019 33% of PPM customers switched supplier, tariff or just compared deals in the past 12 months, marginally up from 32% in 2018 and 29% in 2017, but well below the average for all customers (49%). In 2019, fewer PPM customers switched supplier (16%) compared to 2018 (20%), while more compared prices or switched tariff but stayed with their supplier (17%) compared to 2018 (12%).

Suppliers continue to offer innovative PPM services

3.64. As with the DTC, suppliers can compete on both price and product differentiation under the PPM price cap. A key product differentiator is online-managed, smart 'pay-as-you-go' tariffs, with easier access to top-up and emergency credit. The number of suppliers offering these tariffs and other smart features, such as low credit, high consumption alerts, is increasing (see Figure 3.17) and in 2018 the number of electricity and gas smart PPM meters increased by 37% and 31% respectively since 2017. Survey data suggests that levels of satisfaction with smart meters tends to be higher among those on smart prepayment meters.[52]

Figure 3.17. PPM tariffs with innovative features

Number of suppliers in the PPM segment offering:	2016	2017	2018
Smart pay-as-you-go tariffs	15	18	19
Low credit and/or high consumption alerts	14	17	16
Multiple top-up channels including cash/online/phone/mobile/text	(14/13/8/12/6)	(17/15/8/14/6)	(18/15/12/15/6)

Source: Social Obligation Reporting data

3.65. Whereas quality of service levels seem to have remained broadly stable overall for PPM customers to date, a number of PPM specialists that eventually ceased trading in 2018-19 (Economy Energy, Spark Energy and Our Power) were struggling with persistent failures in customer service, billing and other issues. April 2019 survey data showed that fewer PPM customers were satisfied with their supplier overall (68%), compared to those paying by direct debit (76%).[53]

Non-domestic retail energy markets

[52] See https://www.ofgem.gov.uk/consumers/consumer-research/research-surveys-household-consumers and Smart Energy Outlook March 2019
[53] See https://www.ofgem.gov.uk/publications-and-updates/consumer-perceptions-energy-market-q2-2019

3.66. In 2018, non-domestic customers paid around £25 billion for gas and electricity. As of June 2019 the non-domestic market supplies 900,000 gas meter points and 2.6 million electricity meter points, accounting for approximately 40% (205 TWh) and 65% (195 TWh) of total gas and electricity demand respectively.[54]

3.67. 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 (S&M) and microbusinesses.[55]

3.68. In this section we look at how the structural market features and outcomes for the different business customer segments evolved between June 2018 and June 2019. As in last year's State of the Energy Market Report, our main finding is that non-domestic retail markets typically work well for larger businesses. Small and microbusinesses continue to pay much higher prices and their engagement remains limited.

Non-domestic retail energy markets structure

Entry has slowed down, but market concentration continues to decline

3.69. As of June 2019, there were 86 active licensed suppliers in non-domestic markets, a net decrease of three suppliers compared to June 2018. This is in contrast to last year, when there was a net increase of 10 suppliers. This was partly driven by exits of suppliers that had been mainly active in the domestic segment, such as Affect and Extra Energy.

3.70. Around 40% of business customers use gas rendering dual fuel discounting less prevalent than in the domestic market and resulting in a large proportion of separate

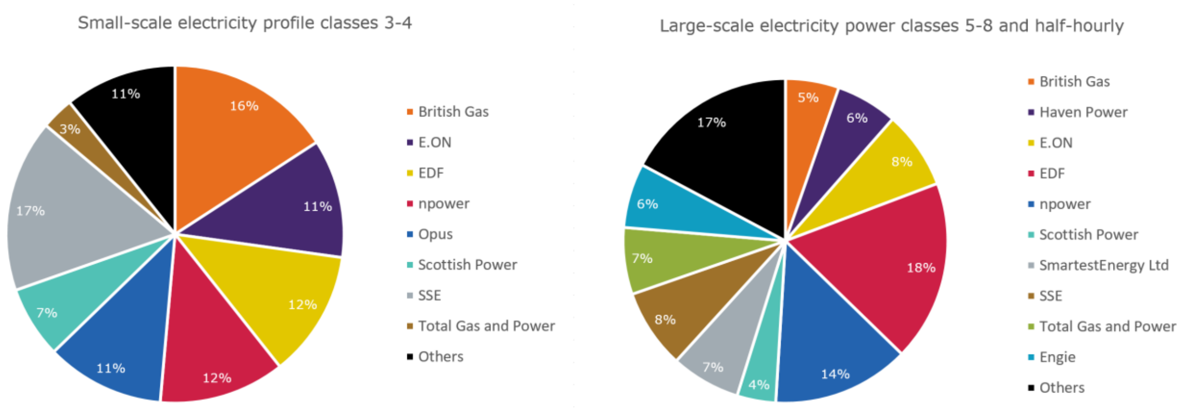
[54] We source data on gas and electricity meter points directly from network operators, while the sources for gas and electricity demand data are: BEIS - Natural gas supply and consumption and BEIS - Supply and consumption of electricity. Spending data is sourced from DUKES 1.7 and is expressed in nominal terms.

[55] A non-domestic customer is defined as a microbusiness if they meet one of the following criteria, as established in existing gas and electricity standard licence conditions: employs fewer than 10 employees (or their full time equivalent) and has an annual turnover or balance sheet no greater than €2 million; or uses no more than 100,000 kWh of electricity per year; or uses no more than 293,000 kWh of gas per year.

contracts for gas and electricity. Furthermore, in contrast to the domestic market, suppliers in the non-domestic market are not obligated to offer a supply contract to customers upon request. This leads to greater segmentation based on customer needs and costs to serve. As of June 2019, 45 non-domestic suppliers provided both gas and electricity, 22 only gas and 19 only electricity. Different groups of suppliers serve small and large businesses, with around half serving microbusinesses.

3.71. Non-domestic markets were liberalised earlier and have historically been less concentrated than the domestic retail market, with several suppliers besides the six large domestic suppliers (Figures 3.18 and 3.19). Between June 2018 and June 2019, these suppliers continued to increase their market shares in all segments and concentration levels declined, albeit at a lower rate than in previous years. In both gas and electricity large business segments, the HHI was at or just below 1,000.[56] For the small gas and electricity business segments, the HHI was respectively at 1,148 and 1,139.

Figure 3.18. Non-domestic market shares for electricity in June 2019

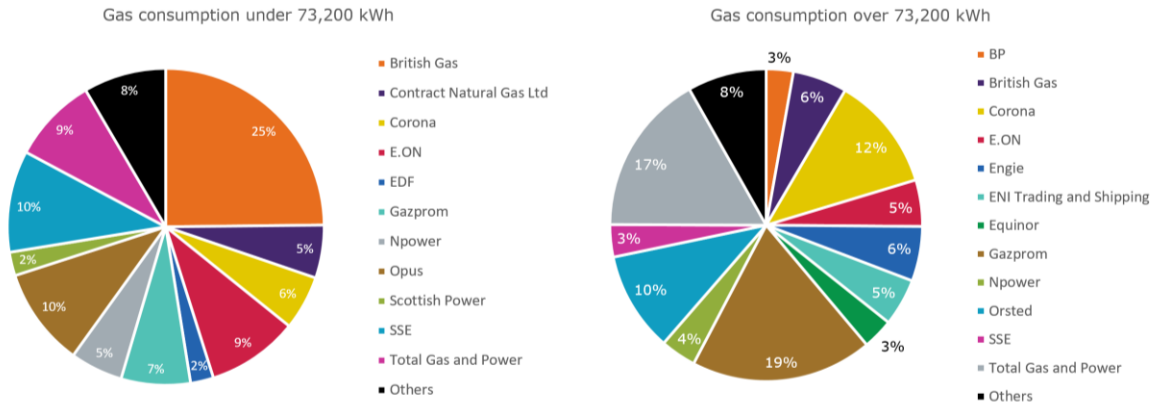


Source: Ofgem's analysis of Elexon data.

Note: Electricity profile classes' definitions refer to Elexon Guidance. Profile classes 3 & 4 are typically small businesses and market shares are measured in terms of meter points; profile classes 5 to 8 and half-hourly (HH) customers are typically larger and market shares are measured in terms of volume.

[56] The Herfindahl-Hirschman Index (HHI) measures market concentration by summing the squares of the market share of each player. See the note below Figure 2.1 for a more detailed explanation.

Figure 3.19. Non-domestic market shares for gas in June 2019



Source: Ofgem's analysis of Xoserve data.

Note: Market shares are measured in terms of meter points for businesses with gas consumption under 73,200 kWh and in terms of volume for businesses with gas consumption over 73,200 kWh.

Microbusinesses still face significant barriers to engage

3.72. In May 2019 we launched a review of the microbusiness retail market,[57] which aims to identify suitable measures to improve outcomes for microbusinesses. Despite changes to the regulatory framework,[58] including the remedies implemented by the CMA in 2017, [59] there is evidence that the market is still not working well for some microbusinesses and that they continue to face significant barriers to engage.

3.73. Our evaluation of the CMA's price transparency remedy found that, although the remedy has improved the level of price information that is available to microbusinesses, engaging with the market remains difficult for microbusinesses due to

[57] See https://www.ofgem.gov.uk/system/files/docs/2019/05/opening_statement.pdf

[58] In 2013 we introduced 'Standards of Conduct' for microbusinesses to act as overarching rules for suppliers to follow when engaging with microbusinesses. We also introduced rules to limit back billing in November 2018.

[59] On 26 June 2017 the CMA issued an order to suppliers to stop locking firms into automatic rollover contracts. The CMA also ordered suppliers to help microbusinesses search for the cheapest available deals, by making information clearly available on their websites or via a link to a price comparison website. See https://www.gov.uk/cma-cases/energy-market-investigation.

price complexity, inconsistent implementation of the remedy across suppliers and low awareness, especially among the smallest of the microbusinesses.[60]

3.74. Our data[61] indicates that, within the microbusiness segment, contract types vary significantly across the different consumption categories. The smallest microbusinesses (with consumption below 15 MWh in gas and 5 MWh in electricity), which account for around 40% of the microbusiness meter points, continue to have the lowest proportion of customers on negotiated contracts[62] – 65% in gas and 62% in electricity in Q1 2019 – which represents only a slight increase compared to 2017 and 2018. However, the proportion of customers on negotiated contracts was between 76% and 87% for microbusinesses with higher consumption levels (see Figure 2.20).

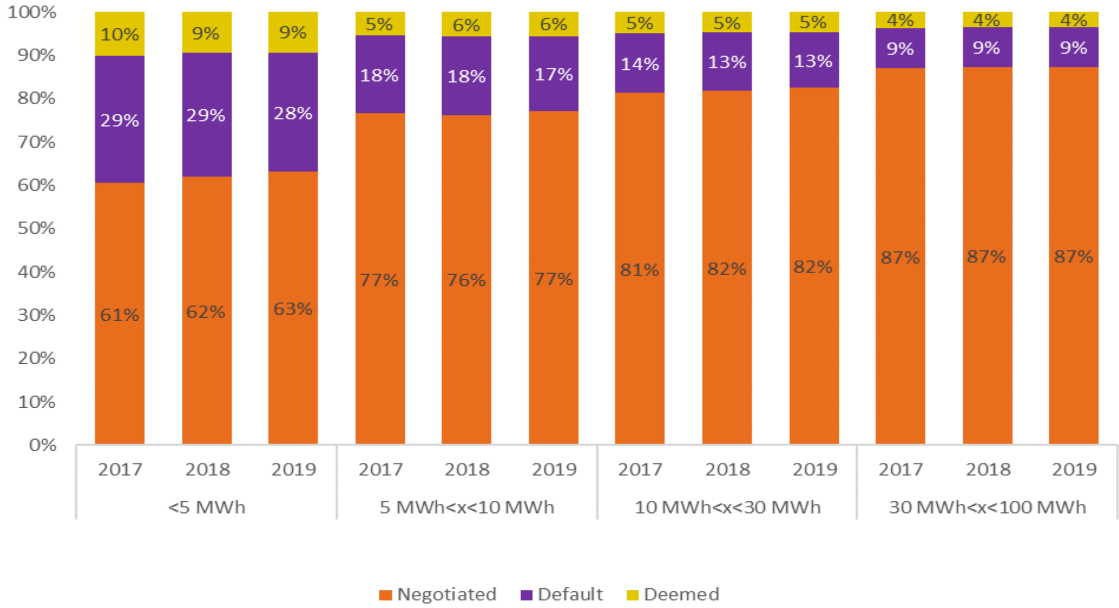
[60] See https://www.ofgem.gov.uk/system/files/docs/2019/05/evaluation_of_price_transparency_remedy_-_final_report.pdf

[61] We regularly collect data on microbusiness meter points, prices and contract types from British Gas, CNG Ltd, Corona, E.ON, EDF, Gazprom, npower, Opus, SSE, ScottishPower and Total Gas and Power. This data does not include typically home-based single site businesess (for instance, where an individual uses one room in their home as an office). These are unlikely to engage with the business energy market, instead consuming energy under a domestic supply contract.

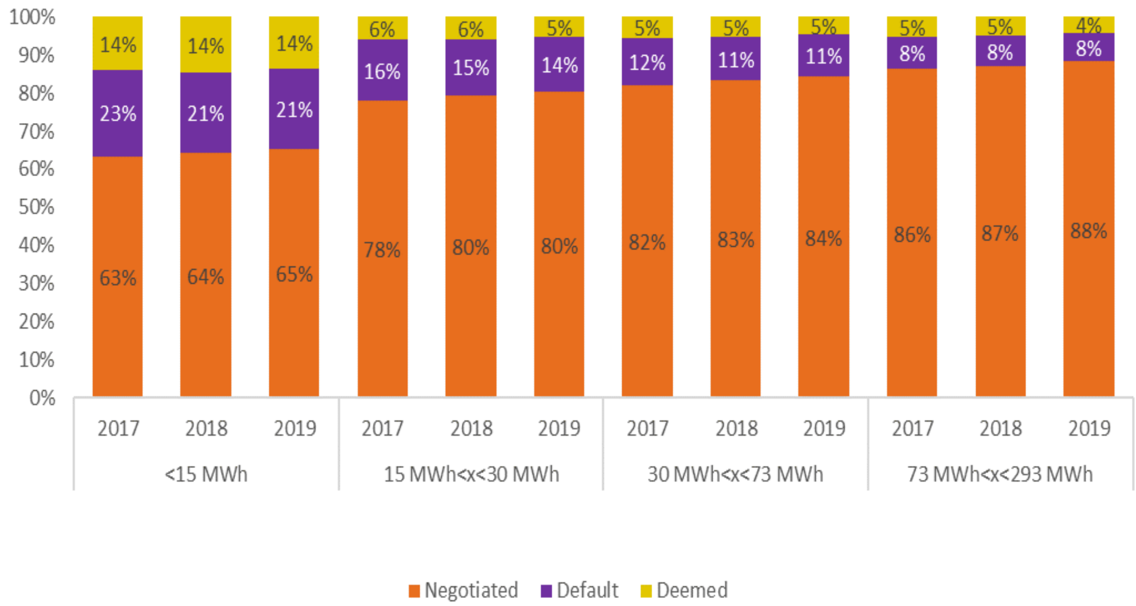
[62] Negotiated contracts involve a customer choice and include both customer acquisition and retention contracts. Conversely, default contracts refer to any contractual arrangement (evergreen, rollover or out of contract) that applies in cases where the customer does not make any choice at the end of a fixed contract. A deemed contract is normally in place when a customer moves into new premises and starts to consume gas, electricity, or both, without agreeing a contract with a supplier.

Figure 3.20: Proportion of microbusiness meter points in varying consumption brackets and contract types

Electricity



Gas



Source: Ofgem's analysis of suppliers' data

Note: For 2017 and 2018 the data shown in the charts refers to the proportion of meter points on the different types of contracts at the end of the year. For 2019 it refers to the end of the first quarter.

Non-domestic retail energy market outcomes

Microbusiness customers are still paying significantly higher prices than other business customers

3.75. Energy contracts for business customers are mostly negotiated and bespoke. As a result, there is generally less public information available about them. Larger industrial customers have an advantage in being able to negotiate better deals than smaller businesses given their stronger bargaining power. In addition, they are metered half-hourly and some have flexibility to 'load shift' from periods of high price to periods of low price.[63]

3.76. There is more transparency on prices for microbusinesses since the CMA required suppliers to make tariff information clearly available on their websites or via a link to a price comparison website. However, there are features of this market that seem to limit the effectiveness of this remedy,[64] including the high number and complexity of tariff options, the widespread practice of negotiation and the reliance on brokers. As a result, search costs and tariff differentials do not appear to have reduced significantly, with average prices for microbusinesses continuing to be disproportionately higher than those for large businesses. In Q1 2019, very small businesses paid on average a price for gas supply that was nearly twice as high and an electricity price that was around 30% higher than the average across all business customer segments (see Figure 3.21).[65]

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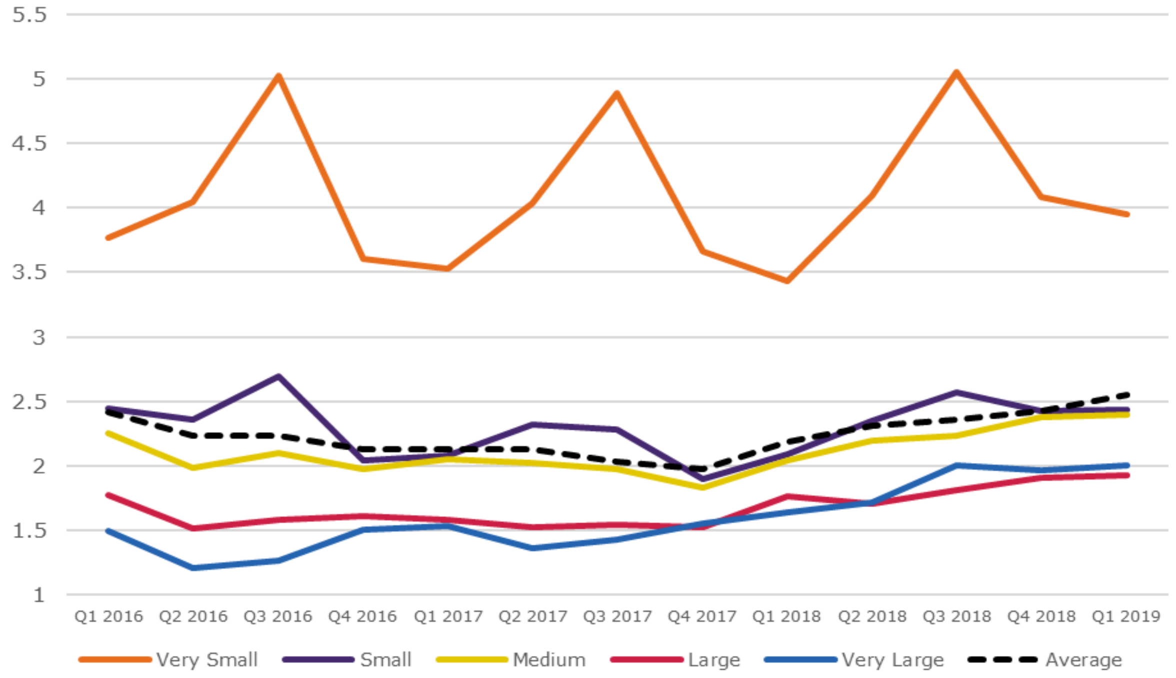
[63] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633442/upgrading-our-energy-system-july-2017.pdf . In electricity, BEIS uses the following consumption categories to identified different business customer segments: very small (0-20MWh), small (20-499MWh), small/medium (500-1,999MWh), medium (2,000-19,999MWh), large (20,000-69,999MWh), very large (70,000-150,000MWh) and extra large customers (>150,000MWh). For gas the relevant segments are: very small (<278MWh), small (278-2,777MWh), medium (2,778 - 27,777MWh), large (27,778-277,777MWh) and very large (277,778-1,111,112MWh).

[64] See https://www.ofgem.gov.uk/system/files/docs/2019/05/evaluation_of_price_transparency_remedy_-_final_report.pdf

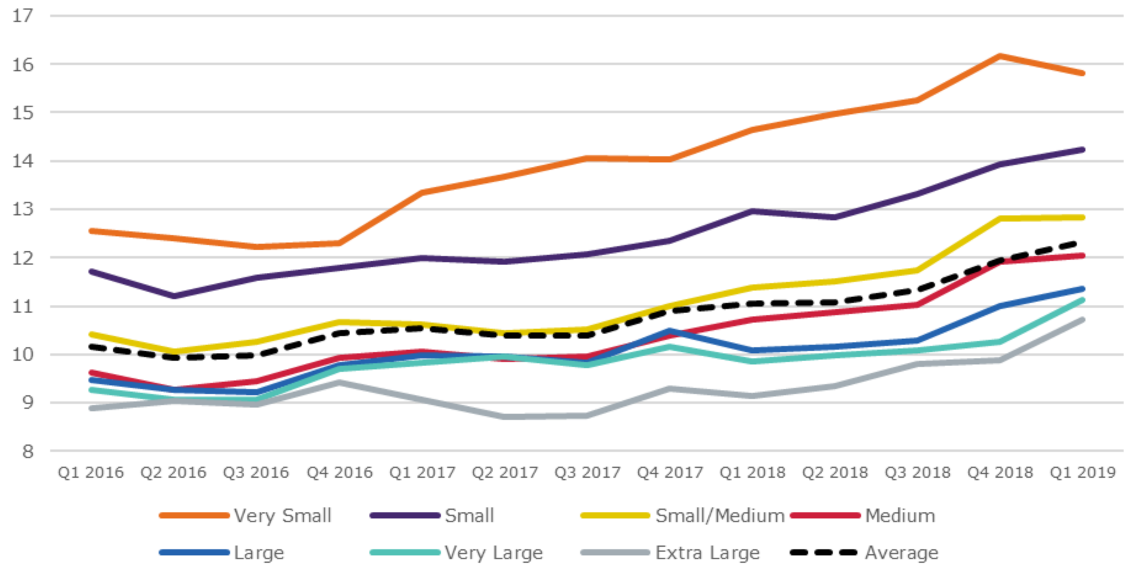
[65] The annual consumption threshold (20 MWh/year) identifying very small electricity business customers in BEIS industrial price statistics differs from our definition of electricity microbusinesses (100 MWh/year).

Figure 3.21: Average gas and electricity non-domestic prices (pence/kWh nominal terms)

Gas



Electricity



Source: BEIS, Gas and electricity prices in the non-domestic sector.

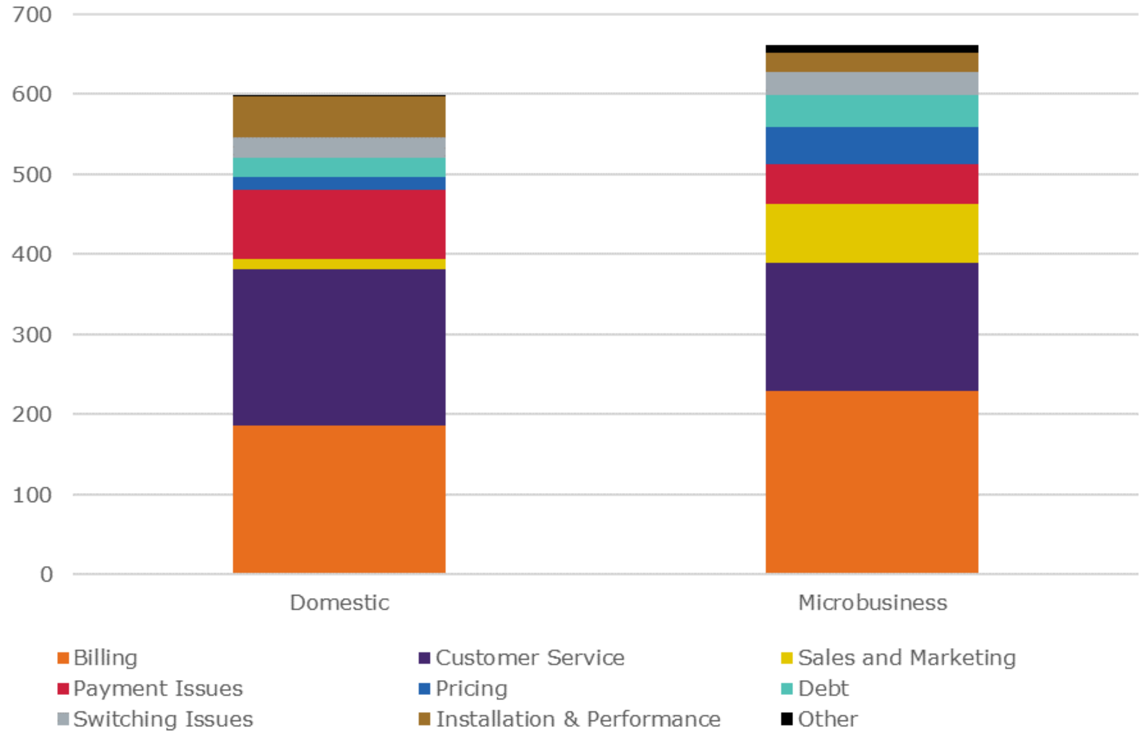
Note: Prices exclude VAT and the Climate Change Levy. Gas price spikes are related to a standing charge effect in those months (Q3) where consumption, driven by space heating, is lowest.

3.77. Our findings indicate that there are still considerable variations across microbusiness contract prices, in both gas and electricity. In Q1 2019, the lowest average prices were 4 pence/kWh and 15 pence/kWh, respectively for negotiated gas and electricity contracts (ie acquisition and retention contracts), while the most expensive ones were 8 pence/kWh and 26 pence/kWh for deemed contracts. Customers on rollover and evergreen contracts on average pay more per unit of energy than customers on negotiated contracts but less than deemed contracts (around 6 pence/kWh for gas and 19-23 pence/kWh for electricity). In Q1 2019 the differential between default contracts and negotiated contracts was around 2 pence/kWh for gas and 8 pence/kWh for electricity.

Sales & marketing issues feature more prominently in microbusiness complaints

3.78. Between July 2018 and April 2019 the number of microbusiness complaints per 100,000 customer accounts received by suppliers has been broadly stable, fluctuating around 700/month per 100,000 customer accounts. This suggests that microbusiness satisfaction levels have not changed much during this period, but they remain above the comparable level recorded for domestic customers (around 600/month per 100,000 customer accounts). Complaint resolution speed has also remained fairly stable, with around 88% of microbusiness complaints being resolved within eight weeks. This is a worse resolution rate than for domestic complaints, which was nearly 95% during the same period.

Figure 3.22: Microbusiness and domestic complaint categories per 100,000 customer accounts (April 2019)



Source: Ofgem's analysis of complaints data provided by suppliers.

Note: The distribution across complaint categories has remained fairly stable between July 2018 and April 2019.

3.79. As in the domestic segment, billing and customer service were the most complained about issues in the microbusiness segment, accounting respectively for 35% and 24% of complaints. However for microbusinesses other issues were more prevalent. In particular, sales and marketing, which only accounted for around 2-3% of total domestic complaints, represented 11% of total microbusiness complaints, the third largest complaint type (Figure 3.22). The majority of these complaints were related to sales generated via a third party intermediary. This reflects microbusinesses' reliance on brokers to shop around, which has increased over the last year.

Wholesale energy markets

Introduction

3.80. Gas and electricity wholesale markets have a significant impact on consumer outcomes as wholesale costs are the largest single component of consumer bills. The level of competition in these markets is an important determinant of wholesale energy market prices and consequently wholesale costs incurred by retail energy market suppliers.

3.81. In this chapter we consider how well competition is working in wholesale energy markets. We first look at structural features such as market participants, including market power of producers, ease of entry and exit, and the degree of market concentration and vertical integration. We then look at the outcomes they deliver, including prices and their determinants, the sources of supply and market liquidity.

Wholesale gas market structure

Imports account for the majority of UK wholesale gas market supply

3.82. UK Continental Shelf (UKCS) production in the North Sea is a key source of supply in the wholesale gas market. Its contribution to GB gas supplies has declined substantially from nearly all in 2000 to half in 2010,[66] and around 36%[67] of total GB gas supply in 2018/2019, a 2 percentage points increase compared to 2017/2018. The remaining 64% of GB gas supply is imported from a diverse range of sources – by pipelines from Norway and the European gas grid, and via ships in the form of Liquefied Natural Gas (LNG).[68]

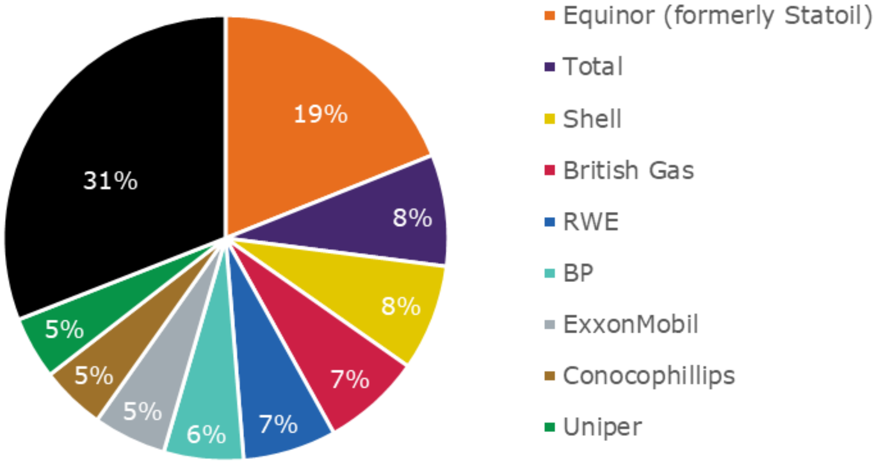
3.83. Shippers must have a licence to purchase gas from a producer and sell it to a supplier, and they do so by submittng their buy and sell trades to the National Balancing Point (NBP). The overall number of licensed entities in the NBP market increased from 146 in 2017 to 158 in 2018, of which 136[69] traded during the period, and around 22 entered and exited the platform over the year. This suggests that the market continues to have low barriers to entry and exit.

[66] Oil and Gas UK: Economic Report 2018
[67] Ofgem data portal: Gas Demand and Supply source by month (GB).
Percentages are calculated for gas years that run from April to March and express the share of gas originating from UKCS that supplied the GB gas system for each gas year.
[68] Ofgem data portal: Gas Demand and Supply source by month (GB)
[69] Data provided to Ofgem from National Grid

Structural features of the wholesale gas market are conducive to competition

3.84. The level of concentration in the wholesale gas market, as measured by the HHI, remained low at 754 in 2018.[70] This is because there continues to be a large number and diversity of gas producers, which enables competitive pressure in the market and reduces the possibility of individual gas suppliers exerting unilateral market power. The six largest gas suppliers accounted for 55% of the market in 2018/2019 (Figure 3.23).

Figure 3.23: Share of UK gas supply 2018/2019



Source: Annual data from National Grid provided to Ofgem.

3.85. Even though the wholesale gas market is not concentrated, competition could be adversely affected if, instead of improving efficiency and passing on saving to consumers, vertically integrated producers leverage their advantages in the wholesale or retail markets to undermine the ability of other producers to sell. While vertical integration does exist in the gas market there is no evidence that it is resulting in anti-competitive behaviour, especially as many of the largest gas shippers do not have integrated supply arms.

[70] Ofgem calculation based on the data provided directly from National Grid.

3.86. Overall, structural indicators such as the HHI and levels of vertical integration show that the market structure facilitates competition and there is limited opportunity for firms to exert market power in the wholesale gas market.

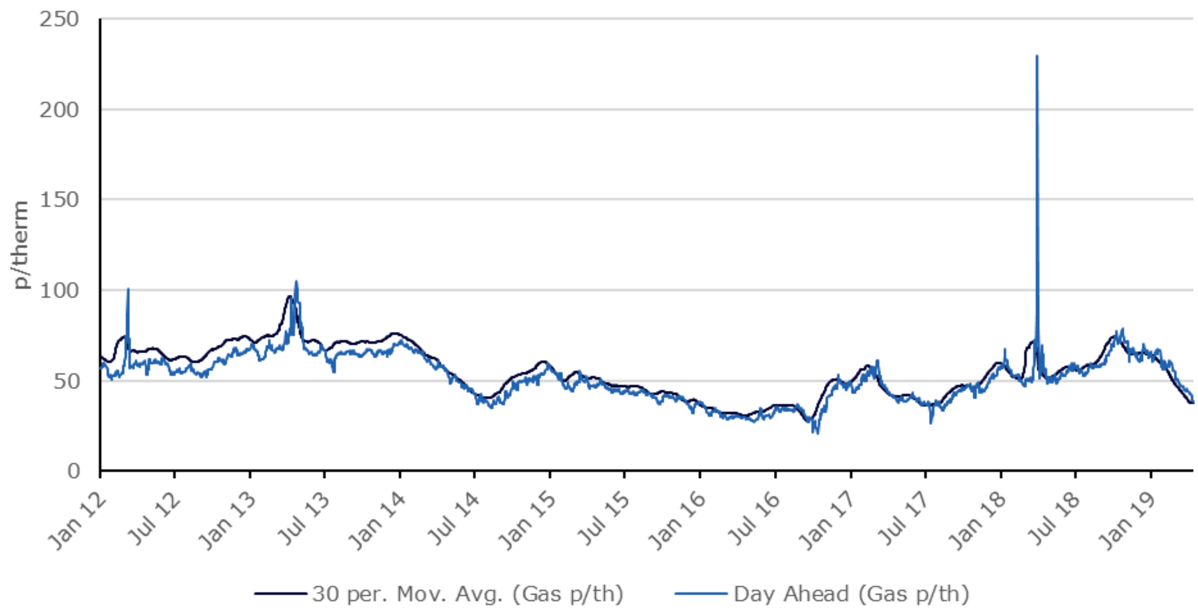
Wholesale gas market outcomes

GB gas prices are driven by commodity prices and global conditions

3.87. Imported gas accounts for the majority of GB supply and as a result GB gas prices are partly determined by global conditions. Other factors such as weather conditions affect demand, which in turn affect gas prices.

3.88. In summer 2018, gas prices traded higher than in previous years, increasing sharply in September and October 2018 – in September 2018 the average day ahead trading price was 73.48p/therm and in October 2018 67.04p/therm.

Figure 3.24: Wholesale gas prices: day ahead contracts, GB (April 2019 prices)



Source: Bloomberg. Gas prices are NBP day ahead[71] and were adjusted for inflation using CPIH Index.

[71] Day-ahead prices are a good indicator of the short-term price of gas in GB. However, because

Gas flows suggest an efficient deployment of gas sources

3.89. Patterns of gas flows into GB are consistent with competition driving the efficient deployment of gas sources. Injections into storage facilities tend to increase in spring and summer, when demand is low, and are then withdrawn during the winter months when demand increases. A similar seasonality effect is true for interconnectors between other European countries, which often import from GB in the summer when demand is low in GB and export to GB in the winter, when demand is high.

3.90. Imported gas volumes decreased by almost 11% in 2018/2019, in comparison to the previous year.[72] Whilst the majority continued to come from Norway through the pipeline, we saw a significant increase in LNG deliveries to GB terminals throughout Q4 2018 that continued in Q1 2019.

Suppliers can access a range of products in the wholesale gas market

3.91. A liquid market provides some degree of confidence that market participants can buy products at prices that reflect underlying supply and demand. The bid-offer spread, which is the difference between the best bid to buy and best offer to sell, is an indicator of market liquidity. In the GB gas market they are low by international standards, indicating that it is relatively easy to trade. In 2018 the day-ahead average spread fell from 0.16% to 0.14% (Figure 3.25) while gas contracts expiring in the nearest (front) quarter remained unchanged and gas contracts expiring in the nearest (front) month increased slightly from 0.14% to 0.15%. In Q1 2019 the day ahead average spread fell to 0.12%, while the nearest (front) month remained unchanged at 0.15% and the nearest (front) quarter increased to 0.26%.

3.92. Another indicator of liquidity is the churn ratio, which is the number of times a unit of gas is traded before it is delivered to the end consumer. The monthly churn ratio averaged 20 in 2018, having decreased from 23 in 2017.[73] During Q1 2019 the

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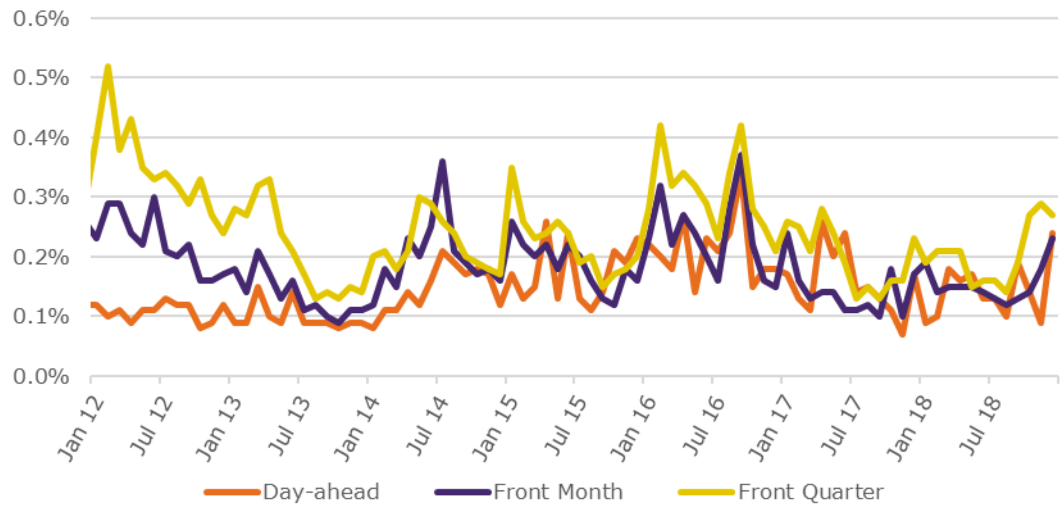
suppliers often buy most of their gas in advance of when it will be delivered, day-ahead prices may not necessarily reflect the price that suppliers will have paid.

[72] Ofgem Data Portal: Gas Demand and Supply source by month (GB)

[73] Ofgem Data Portal: Gas Trading Volumes and Monthly Churn

monthly churn ratio hovered between 12 and 18. Although this ratio is slightly lower than in 2018, it is still indicative of a liquid market.

Figure 3.25: Gas bid-offer spreads for selected traded products, 2012-Q1 2019



Source: Ofgem calculations using data from ICIS taken from Ofgem Data Portal: Gas bid-offer spreads by contract type (GB) Data correct as of July 2019.

Wholesale electricity market structure

The number of generators entering the wholesale electricity market continues to increase

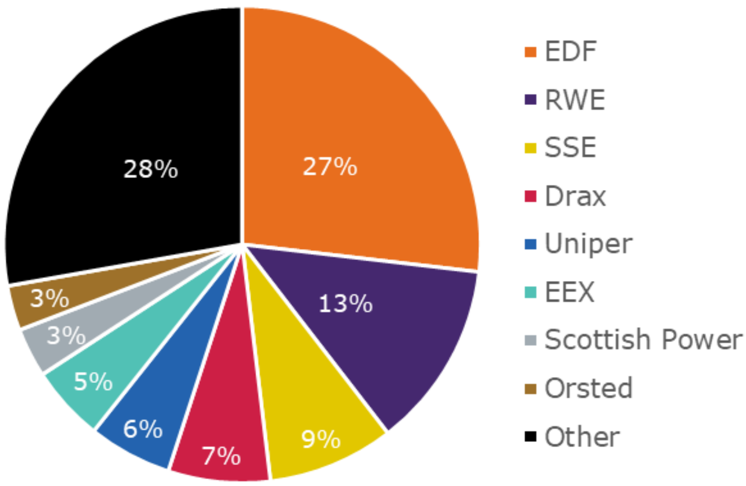
3.93. There are currently 189 firms in GB with a licence to generate electricity, up from 170 in August 2018.[74] In addition, there are many operators generating electricity at a small scale that is then typically transferred into the distribution network. Between August 2018 and June 2019, 9 new firms generating electricity signed up to the Balancing and Settlement Code (BSC) and 12 firms exited the market.[75] The high number of firms entering and exiting electricity generation suggests that any barriers to entry and exit that may exist are low and not a concern.

[74] Source: Ofgem list of all electricity licences (information correct as at 27 July 2019).
[75] Source: Elexon.

Market concentration is moderate

3.94. The wholesale electricity market is still moderately concentrated. The HHI index has remained slightly above 1,000 for the past three years, decreasing from 1,117 in 2016 to 1,034 in 2017 but then increasing to 1,138 in 2018. In 2018, the eight largest electricity companies provided 72% of the metered volumes that came from individual power stations and interconnectors, similar to 71% in 2017 but less than the 77% in 2016.[76] In addition, total installed capacity increased from 103.5 GW in 2017 to 107.9 GW in 2018.[77] This suggests that the structure of the market is not deterring investment in wholesale electricity supply.

Figure 3.26: Share of GB electricity supply, 2018



Source: Ofgem calculations using data from Elexon and NETA reports, April 2019
Note: This chart shows the market shares of companies who supply electricity to the GB National Transmission System.

3.95. In our 2018 State of Energy Market Report, we did not identify any areas where vertical integration in the electricity market was likely to have a detrimental impact on market competition. Since then, Scottish Power has sold its 2.6GW generation capacity of remaining gas plant to Drax in October 2018. The degree of vertical integration of

[76] Ofgem calculations using data from Elexon and NETA reports.
[77] Source: National Grid, Future Energy Scenarios 2018 and 2019.

the big six energy suppliers is similar to that in 2017, and there continues to be no evidence that this is likely to be detrimental to market competition.

Limited opportunity for generators to exert market power

3.96. We use pivotality analysis to assess whether companies have an opportunity to influence the market. The analysis considers whether power stations owned by a particular company are essential to meet demand in a given period. If this is the case, the company could potentially use this leverage to influence wholesale prices in that period. A power generating firm's access to flexible generating capacity, such that output can be easily varied, could prevent other generators from taking advantage of their pivotality.

3.97. It follows that a reduction in overall flexible generating capacity could make it more likely that certain generators become pivotal at clearing demand at certain times.[78] This could increasingly be a possibility as flexible coal-fired generation capacity continues to decline. Our assessment of the GB market as a whole suggests that there has been an increase in the number of hours of pivotality compared to the previous year. The length of time that any generating capacity could be pivotal was 7% of the total tested hours in 2018, up from 2% in 2017. However, once we account for the flexibility of generating capacity, three companies exhibited some degree of pivotality and this was limited to just less than 1.1% of the total tested hours over the period.[79] Thus, while pivotality appears to be increasing, there were still only short time periods where companies could have exerted market power. As such, competition in the wholesale electricity market appears to be working reasonably well.

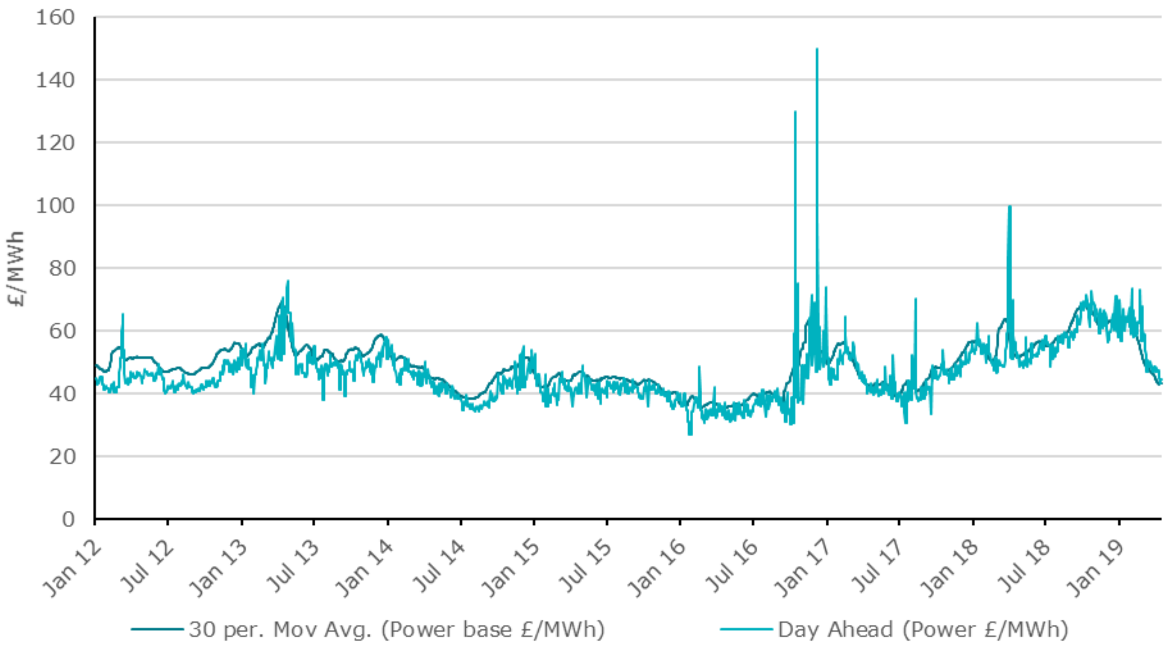
[78] Pivotality analysis is focused on transmission generation, but it may be that changes in the distribution network and small scale generation have, conversely, increased flexibility.
[79] In 2017, one company exhibited some degree of pivotality and this was limited to just less than 0.1% of the total tested hours over the period.

Wholesale electricity market outcomes

GB electricity prices have fallen

3.98. Wholesale electricity prices were at a relatively high level from summer 2018 to the end of 2018, but began falling at the beginning of 2019, back to 2015 levels (Figure 3.27).

Figure 3.27: Wholesale electricity prices: day ahead contracts (April 2018 prices)



Source: Bloomberg. Electricity prices are baseload day ahead.

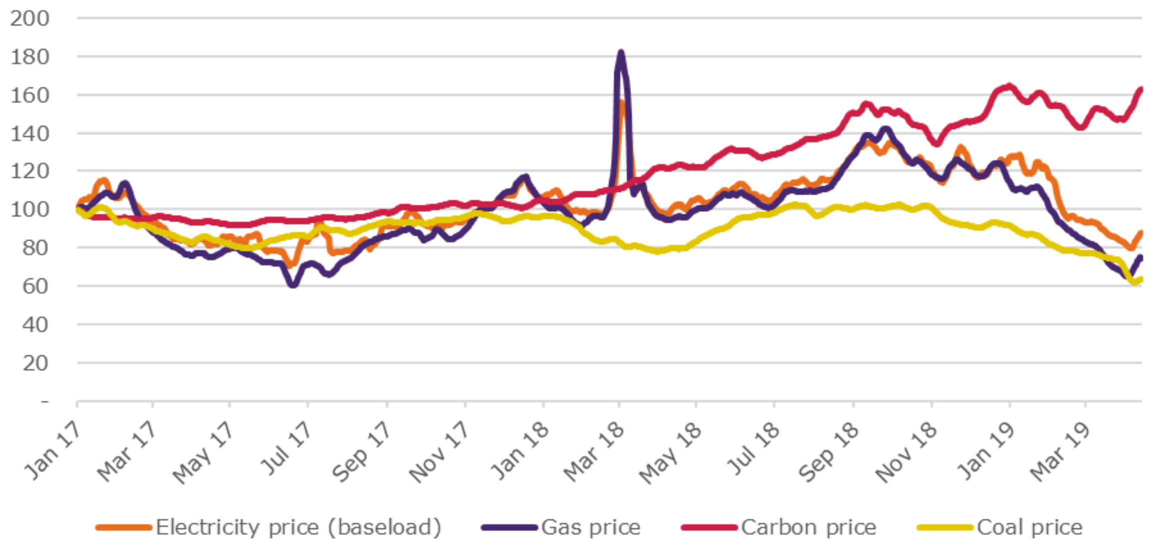
3.99. The main driver of electricity prices is the cost of gas. Wholesale electricity prices have been closely related to gas prices, with a correlation coefficient between day ahead gas and electricity (baseload[80]) of 0.90 in the year up to April 2019. The movement in electricity prices since 2017 is broadly aligned with changes in the gas price (see Figure 3.28). This is consistent with competition driving electricity prices to

[80] The 'baseload' rate refers to a contract for electricity that is produced continually throughout the day and is distinct from 'peak rates' when electricity is bought/sold for consumption at peak times (7am to 7pm).

reflect changes in input costs. Coal prices are now only weakly related to electricity prices, as coal accounts for an ever decreasing share of the generation mix.

3.100. To some extent electricity prices will be affected by carbon costs, with the main ones arising from the EU Emissions Trading Scheme (EU ETS) and UK carbon price support (CPS). The CPS is set by the UK government and only periodically adjusted, which explains its limited correlation with baseload electricity prices.

Figure 3.28: Index of electricity, fuel and carbon prices (3 January 2017 = 100, rolling averages of 10 days, April 2018 prices)



Source: Electricity and gas prices taken from Bloomberg. Carbon and coal prices taken from Aurora.

Note: Prices deflated using CPIH. Electricity is the day-ahead baseload prices, gas is the day-ahead NBP, coal is the Rotterdam Coal Futures (ARA) spot price plus transportation cost and carbon is the daily EU ETS price plus the UK CPS.

3.101. Fluctuating exchange rates are one factor associated with changes in wholesale prices. The correlation coefficients between GBP-Euro exchange rates and electricity baseload prices and gas prices are -0.38 and -0.45, respectively. This means that, all else equal, if the pound weakens against the euro, leading to a fall in the exchange rate, wholesale gas and electricity prices are likely to increase. Castagneto Gissey et al.

(2018)[81] estimated that GB wholesale electricity prices increased by 18% in the year after the 2016 EU Referendum. According to the authors, the dominant factor was input costs rising due to sterling's depreciation by 15% against the US dollar and the euro. However, other factors, such as demand and supply fluctuations due to extreme weather, have a greater impact than exchange rates on short-term price movements.

Interconnectors support convergence of prices between GB and the EU, but differences in carbon pricing can result in divergence

3.102. There are currently five operational interconnectors that enable the movement of electricity between GB and other jurisdictions.[82] Market coupling aims to improve trading efficiency over the interconnectors, and enable electricity to flow in response to price signals.[83] In Q1 of 2019, electricity imports of interconnectors to GB were 6 Terawatt-hours (TWh), accounting for 7% of total electricity demand in GB.[84] This additional source of supply benefits competition in the GB wholesale electricity market and should increase security of supply.

3.103. GB's current electricity interconnector capacity is 5 GW, compared to total generation capacity of 107.9 GW in 2018. Four new links – to France, Norway and Denmark – are under construction, which should increase GB interconnector capacity by 4.8 GW. Ofgem has approved projects that could increase this further, up to 15.9 GW in total if all new projects go ahead.

3.104. Ofgem commissioned University College London (UCL) to assess how market coupling has affected electricity trading and price differentials between Great Britain and some connected electricity markets. The researchers estimate that, relative to the uncoupled cross-border markets before 2014, market coupling has led to greater

[81] Castagneto Gissey G., Grubb M., Staffell I., Agnolucci P., Ekins P., 'Wholesale Cost Reflectivity of GB European Electricity Prices', report commissioned by Ofgem, Institute for Sustainable Resources, UCL, 2018
[82] https://www.ofgem.gov.uk/electricity/transmission-networks/electricity-interconnectors
[83] Market coupling has been in place on IFA and BritNed since February 2014 and on EWIC and Moyle since October 2018.
[84] Ofgem Data Portal, calculations from BEIS Energy trends section 5: Electricity (ET 5.1).

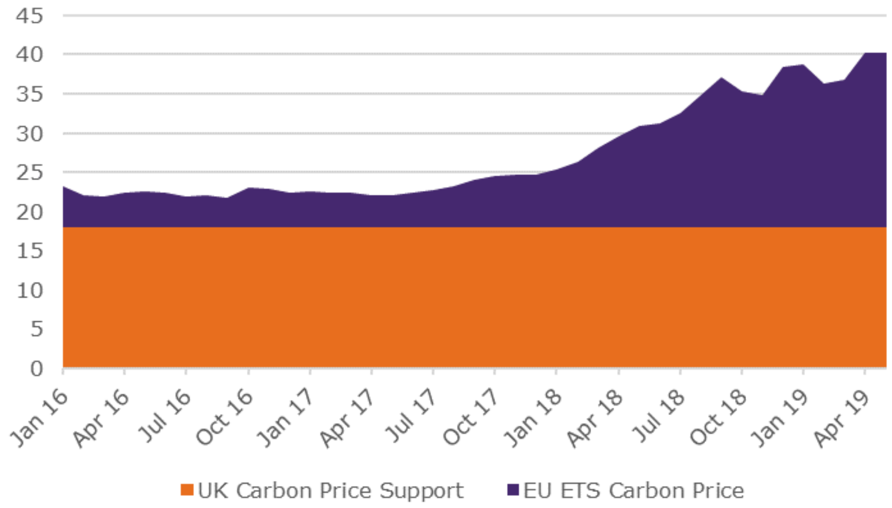
convergence of day-ahead prices between GB and France (by €0.4/MWh in 2014-2019) and between GB and the Netherlands (by €0.28/MWh during 2015-2018).[85,86]

3.105. GB Carbon Price Support[87] applies to fossil fuels used in electricity generation, and is in addition to the carbon price in the EU ETS. Its objective is to reduce the cost advantage of fossil fuel based power plant to incentivise investment in low-carbon electricity generation capacity. We estimate[88] that the UK carbon price (including EU ETS and UK CPS) increased wholesale electricity prices by £6.62/MWh in the four quarters up to 2019 Q1. For the period 2015-2018, UCL estimated that the CPS raised GB day-ahead prices by an average of about €10/MWh (in the absence of compensating adjustments through increased imports). They also found that the CPS had led to an increase in price differentials between GB and France and the Netherlands by about €8/MWh as domestic generation was replaced by cheaper imports.

3.106. The European Commission's Market Stability Reserve (MSR) policy[89] has substantially driven up the EU ETS carbon price, and this explains the ETS's increasing impact on GB wholesale electricity prices (see Figure 3.29 and 3.30). As shown in Chapter 4, carbon pricing is one of the most cost-effective policies for reducing carbon emissions.

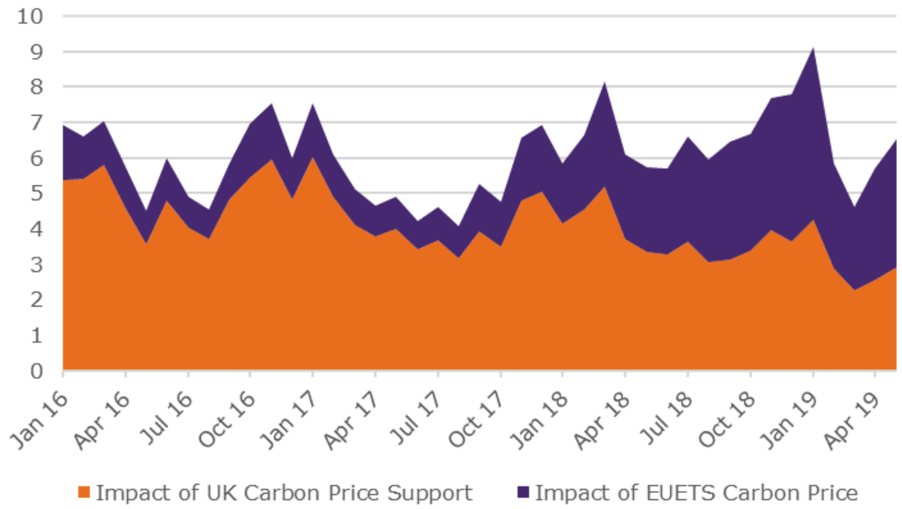
[85] Castagneto Gissey G., Guo B., Newbery D., Lipman G., Montoya L., Dodds P., Grubb M., Ekins P., 'The Value of Internatinal Electricity Trading', a project commissioned by Ofgem, UCL and University of Cambridge, 2019
[86] Geske, J., Green, R. and Staffell, I. (2019), 'Elecxit: The Cost of Bilaterally Uncoupling British-EU Electricity Trade', EPRG Working Paper 1916/Cambridge Working Paper in Economics 1947, develop a model of frictions for market uncoupling. Based on this model and 2009 data (before market coupling), it is estimated that in 2030 a less efficient market and abandonment of some planned interconnectors would raise generation costs by EUR 560 million a year (1.5%) compared to remaining in the Single Electricity Market. EUR 300 million of these welfare losses occur in GB.
[87] The UK-only element of the carbon price floor is capped at £18 per tonne of carbon dioxide from 2016-17 to 2019-20, freezing the carbon price support rates for each of the individual taxable commodities across this period.
[88] Difference between spark (dark) spread and clean spark (dark) spread gives the carbon emission cost per MWh generated with gas (coal) fuel. These are weighted by percentage of MWh generated from gas and coal respectively, multiplied by a cost pass through factor.
[89] The market stability reserve is an attempt to address the surplus of emission allowances that has built up in the EU ETS since 2009. It was implemented in January 2019.

Figure 3.29: Breakdown of UK carbon price (£/tonne of CO_2 equivalent, nominal)



Source: Aurora.

Figure 3.30: Carbon price impact on wholesale electricity price (£/MWh, nominal)



Source: Aurora, Ofgem's own analysis.

3.107. Differences in network charges can also affect relative prices across borders. EU regulation stipulates that average annual transmission charges paid by GB generators must be within the range of €0/MWh to €2.50/MWh.[90] In 2018-2019, National Grid

[90] Source: https://www.nationalgrid.com/sites/default/files/documents/Open%20letter_Compliance%20with%20838_2010.pdf

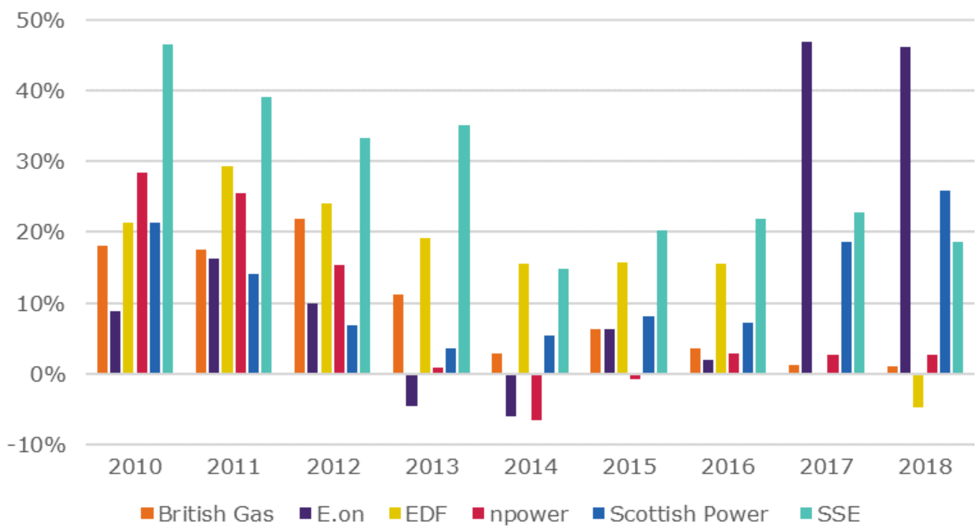
charges for use of the transmission network[91] added around £1.7 per MWh on average to wholesale prices in GB, which is a 9% increase from the previous year.

Generation profits have fallen and vary significantly

3.108. Figure 3.31 shows the recent trend in profit margins for electricity generation by the large six retail energy market suppliers. Although the generation profit margins of E.ON, Scottish Power and SSE are considerably higher than other suppliers in 2018, the aggregate profit margin of all six was 8% in 2018, 2 percentage points lower than in 2017.

3.109. There has been a marked reduction in conventional generation profitability in recent years. For the six largest suppliers, the average EBIT margin from conventional generation in 2018 was -3.7%. In comparison, renewable generation has on average been very profitable over recent years in the UK. Average renewable generation profitability of the largest suppliers in 2018 was 44.3%.[92] This reflects rapidly falling costs of renewable generation, which means that generators with government support contracts have been able to make high profits.

Figure 3.31: Generation profit margins of large suppliers



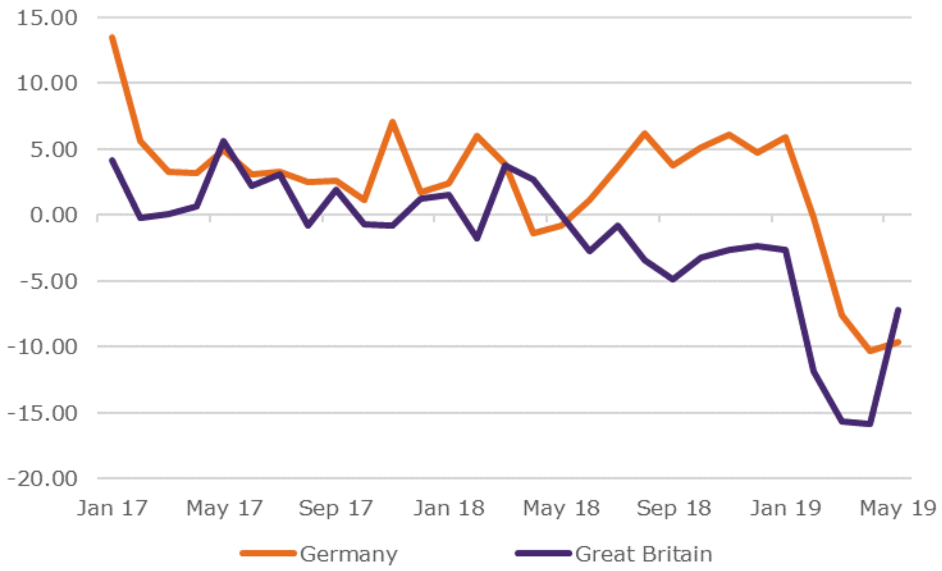
Source: Ofgem analysis of Consolidated Segmented Statements.

[91] Having considered the allowed generation transmission charges, National Grid sets a target revenue amount to recover the cost of installing and maintaining the transmission system.
[92] Ofgem Data Portal. Large suppliers: Electricity generation profitability by technology type in 2018 (GB).

Note: Margin is calculated as total earnings before interest and taxes (EBIT) divided by total revenue.

3.110. Another indicator of competitiveness in the market is 'average system uplift' of generation units. This is the difference between wholesale electricity prices and system variable costs of the marginal generators.[93] In a competitive market, there is less room for higher profit margins and thus the average system uplift tends to be lower. Figure 3.32 shows that the average system uplift in Britain was mostly lower than in Germany[94] from January 2017 to May 2019. This is consistent with competition in GB being as or more effective than in Germany.

Figure 3.32: Average system uplift (£/MWh) by month, Jan 2017 – May 2019



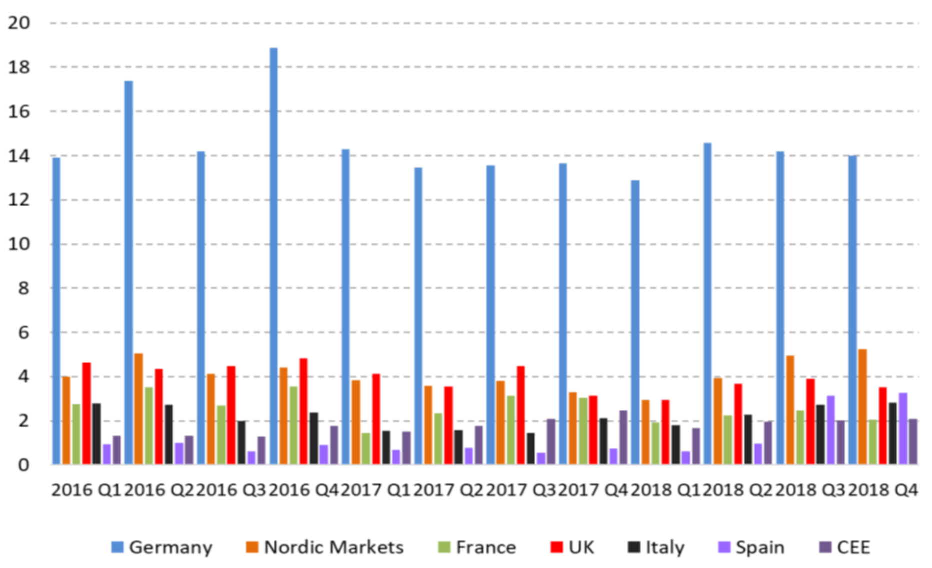
Source: Aurora.

GB electricity market liquidity: churn remains similar to most major European markets

[93] A marginal generator is the generator in operation on the market which has the highest variable cost and lowest profit margin. The marginal generator can be different from time to time, depending on real time demand and supply conditions.
[94] We take Germany as the comparator to GB markets because, with over 180GW of installed capacity, Germany is the largest electricity market in Europe.

3.111. The churn ratio shows that GB electricity markets are consistently in line with or more liquid than some European power markets, with the exception of the market leader Germany (see Figure 3.33).

Figure 3.33: Churn rates on selected European wholesale electricity markets



Source: EC Quarterly Reports on European Electricity Markets, Quarter 4 2018.

3.112. In 2014, we introduced our Secure and Promote (S&P) policy to help increase liquidity. This requires the eight largest generating companies to provide access to hedging products in the wholesale market. In mid-2018, a number of mergers and divestments in the retail market reduced the number of parties falling under the Market Making Obligation (MMO) to four, and then to three in January 2019.

3.113. Some liquidity measures have improved since the introduction of the S&P. For example, reference prices for market making products have improved because of the mandated bid-offer spreads.[95] Traded volumes of forward products increased, suggesting some improvement in the availability of products that support hedging. However, the churn ratio has remained low relative to Germany, averaging around 3.5

[95] Reference prices that are along the forward curve are considered to be a fair reflection of the value of products.

to 4.7 since 2014, with spikes of almost 5 in quarters with relatively high price volatility.[96]

3.114. In November 2018, following consultation with industry and other stakeholders, Ofgem decided not to suspend the market-making obligation.[97] However, with further divestments and mergers coming, it seems likely that the MMO will need to be fundamentally changed. In May 2019, Ofgem published an open letter explaining its desire to work with industry to consider alternatives to the MMO.[98]

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[96] Ofgem analysis based on data from ICIS Energy, EPEX Spot, ICE, N2EX, BEIS DUKES.
[97] https://www.ofgem.gov.uk/publications-and-updates/november-2018-update-secure-and-promote
[98] Wholesale Market Liquidity Policy – Open Letter, May 2019

4. Affordability and vulnerability in the domestic energy sector

Summary of findings

- Energy bills as a proportion of household spending fell modestly between the financial years ending 2017 and 2018, accounting for 3.9% and 7.8% of total spending for average income and the lowest income households respectively.

- The proportion of households in fuel poverty has fallen across each of England, Scotland and Wales, down to 10.9%, 24.9% and 12%, respectively, in 2017.[99] Fuel poverty is highest for those in privately rented properties.

- Disconnections due to debt are very rare, with just 6 disconnections in 2018 compared to 17 in 2017. However, self-disconnections remain a concern, with our latest Consumer Survey suggesting that around 14% of prepayment meter customers self-disconnected in 2018.

- The cold weather during winter months increases the risk that people develop ill health. Over winter 2017-18, we estimate that fuel poverty may have contributed to 5,500 excess winter deaths and that 16,500 excess winter deaths may have been linked to people living in cold homes.

- There are several mechanisms in place to help make energy more affordable for consumers: around £2.5bn in direct subsidies was targeted at vulnerable households in winter 2017-18. In addition, the default tariff and prepayment meter caps aim to ensure that energy bills are cost reflective for customers who are less active in the market and may also be in vulnerable situations.

[99] These figures are not directly comparable because fuel poverty is a devolved issue, with definitions differing across England, Scotland and Wales.

Introduction

4.1. Ofgem's statutory obligations include a requirememt that we have regard to the interests of vulnerable consumers.[100] This year we will publish our new Consumer Vulnerability Strategy,[101] which identifies key areas where improvements can be made to help support consumers in vulnerable circumstances. We have also published our Vulnerable Consumers in the Energy Market: 2019 report.[102] We summarise some of the findings from the report in this chapter, which looks at:

- recent trends in the affordability of domestic energy, focusing in particular on customers in vulnerable situations.
- the range of financial and non-financial support for vulnerable consumers that comes from government, Ofgem, charities and community groups, and the energy industry itself.

Affordability and vulnerability are linked

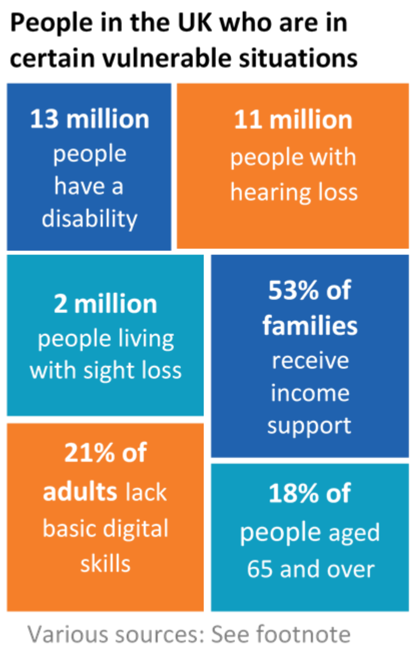
4.2. The affordability of energy and consumer vulnerability are related issues. A consumer who is vulnerable because they are on a low income or because of higher energy needs (for instance due to disability) will typically spend a higher proportion of their budget on energy and can therefore be at greater risk of fuel poverty.

- The affordability of energy bills is a product of a number of factors, not all of which can be influenced through regulation of the energy market. We typically identify how many households are struggling to pay their energy bills by assessing the rate of fuel poverty, though this concept is defined differently in England, Scotland and Wales.

[100] In performing certain of our duties, 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. See Section 3A(3) of the Electricity Act 1989 and Section 4AA(3) of the Gas Act 1986.
[101] See Ofgem (2019) "Updating the Ofgem Consumer Vulnerability Strategy - CVS2025"
[102] See Ofgem (2019) "Vulnerable consumers in the energy market: 2019"

- Vulnerability is about the situations that consumers are in, rather than about the consumer per se. The causes of vulnerability can be varied and complex. While some consumers may be temporarily vulnerable due to a sudden change in circumstances, such as becoming temporarily unemployed or suffering a bereavement, the causes of vulnerability for others may be longer-lasting (e.g. being in poverty or having a mental or physical illness). Figure 4.1 provides some illustrative examples.[103]

Figure 4.1:



Box 1: Defining vulnerability

We consider a consumer to be in a vulnerable situation 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 in the energy market; and/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.

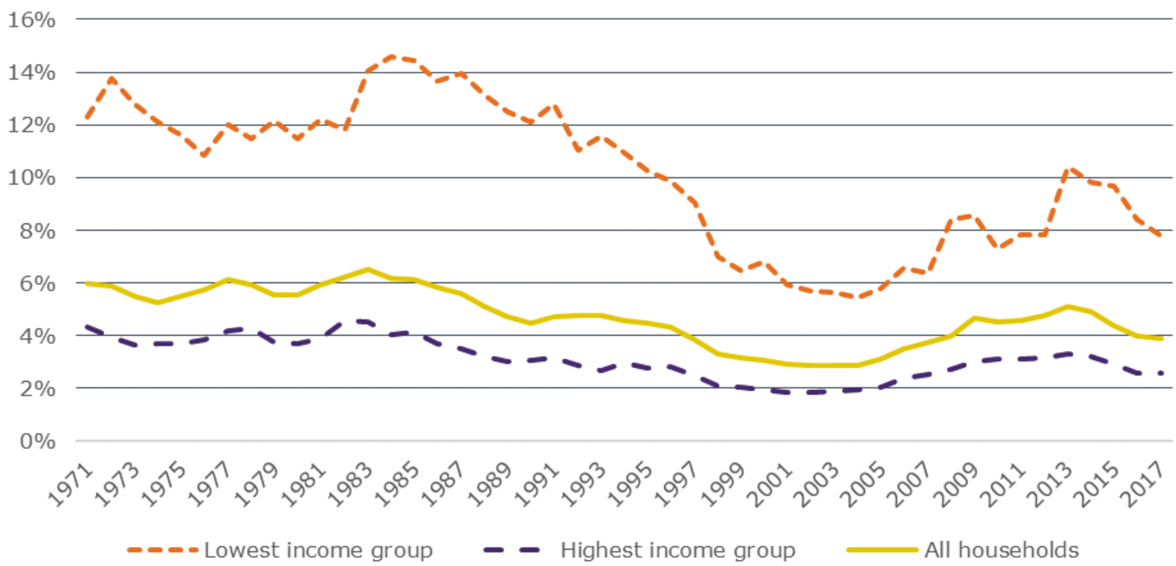
Affordability of energy bills and vulnerability

The proportion of total household expenditure that goes towards energy has fallen since 2013

[103] Sources for Figure 4.1: Ipsos Mori (2018) Basic Digital Skills UK Report 2018, RNIB Key information and statistics on sight loss in the UK, Action for Hearing Loss - Facts and Figures, Department of Work and Pensions (2019) Family Resources Survey 2017/18, Office of National Statistics (ONS) Report (2018) Overview of the UK population

4.3. Figure 4.2 illustrates average household expenditure on energy as a proportion of total household expenditure, from 1971 to 2017 (financial year ending 2018), the latest year for which data is available.

Figure 4.2: Energy costs as a proportion of total household expenditure



Source: Ofgem analysis of ONS: [Spending patterns of UK households, with findings taken from the Living Costs and Food Survey (LCF)].

4.4. In 2017, energy costs accounted for just under 8% of total household expenditure for households in the lowest income decile; this is the lowest it has been since 2012 and 0.6 percentage points lower than in 2016. This remains however, far larger than the proportion for those in the highest income decile, for whom less than 3% of expenditure is dedicated to energy. For the average household, energy expenditure accounts for around 4% of total expenditure, its lowest share since 2008.

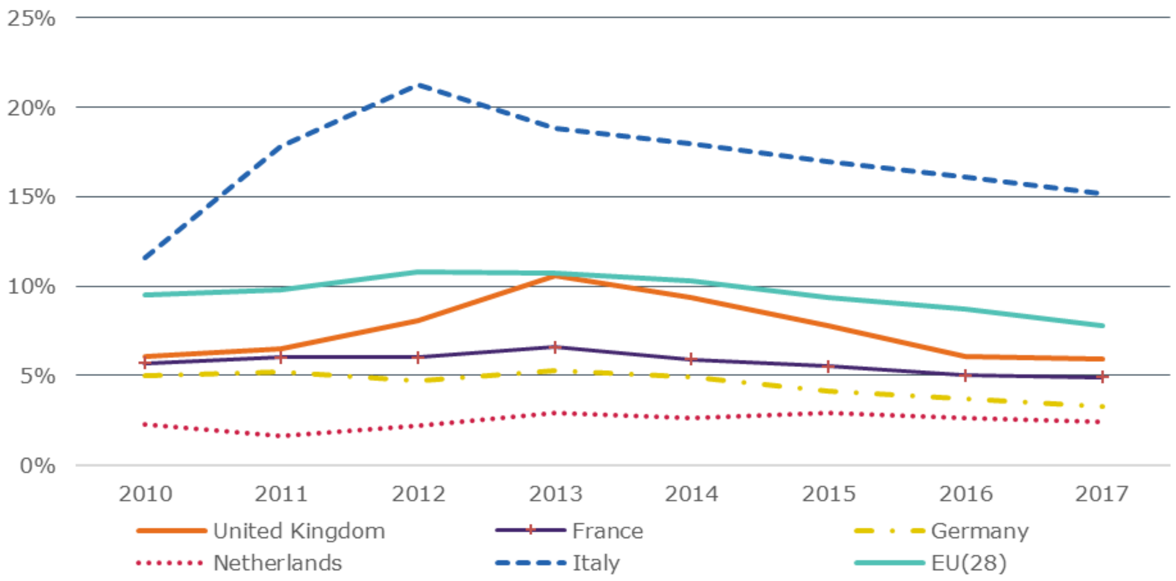
4.5. The proportion of household expenditure that goes towards energy costs has fallen for four consecutive years. Since 2013 it has fallen by

- 2.6 percentage points for the average household in the lowest income decile.
- 1.2 percentage points across all households on average.
- 0.7 percentage points for the average household in the highest income decile.

Fewer UK households report being unable to keep their home adequately warm

4.6. Alongside the recent fall in the proportion of household expenditure that covers energy costs, the proportion of UK households that reported being unable to keep their homes sufficiently warm fell every year during the period 2013 to 2017 (Figure 4.3). In 2017 it was 5 percentage points lower than in 2013. However, these figures do not capture the rise in bills during 2018 and how this affected households' ability to keep their homes warm.

Figure 4.3: Percentage of the population that report being unable to keep their home adequately warm



Source: Ofgem analysis of European Union Statistics on Income and Living Conditions (EU-SILC).

4.7. In 2017, around 6% of households in the UK felt unable to keep their homes sufficiently warm. This was higher than the proportion in the Netherlands, Germany and France, but lower than the EU 28 average of 8% and substantially lower than for households in Italy, 15% of whom reported being unable to keep their home sufficiently warm.

Fuel poverty has fallen across England, Scotland and Wales

4.8. Fuel poverty is a devolved issue, with the definition used varying across England, Scotland and Wales (Table 4.1).

4.9. Fuel poverty can result from a multitude of factors associated with vulnerability, including low income, disability, and living in accommodation with poor energy efficiency. It can also be linked to physical and mental health issues, potentially compounding the latter through the stress that it can place on individuals and households.[104]

Table 4.1: Definitions of fuel poverty across England, Scotland and Wales

Geography	Definition of fuel poverty
England	A household is considered to be fuel poor if: (a) they have required fuel costs that are above average (the national median level). (b) were they to spend that amount, they would be left with a residual income below the official poverty line.
Scotland	A household is in fuel poverty if, the fuel costs necessary for the home[105] are more than 10% of the household's net income and after deducting fuel costs, benefits received (if any), the household's remaining net income is insufficient to maintain an acceptable standard of living.
Wales	A household is in fuel poverty if, in order to maintain a satisfactory heating regime,[106] it would be required to spend more than 10% of its income (including Housing Benefit or Income Support for Mortgage Interest) on all household fuel use.

Source: BEIS(2018) Annual Fuel Poverty Statistics Report; Scottish Government; Welsh Government.[107]

Fuel poverty in England has fallen

4.10. According to the latest UK Government statistics,[108] the proportion of households in fuel poverty in England fell by 0.2 percentage points between 2016 and 2017, from

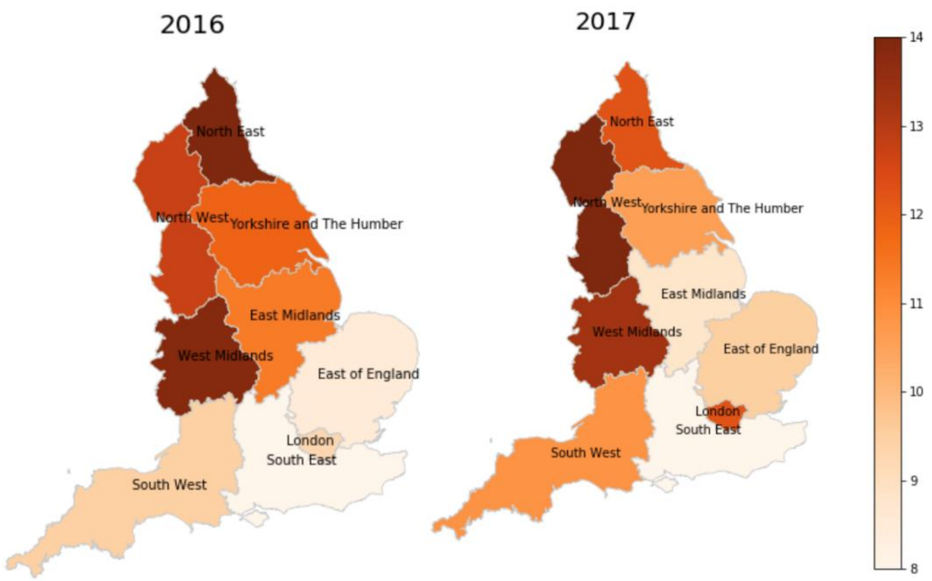
[104] Marmot Review Team (2011) "The Health Impacts of Cold Homes and Fuel Poverty". Friends of the Earth & the Marmot Review Team.
[105] (a)the requisite temperatures are met for the requisite number of hours, and (b)the household's other reasonable fuel needs within the home are met.
[106] The definition of a satisfactory heating regime follows from the World Health Organisation (WHO). It specifies satisfactory temperatures for households, with higher temperatures for elderly and infirm households.
[107] For England definition : BEIS (2018) "Annual Fuel Poverty Statistics Report, 2018"
- For Scotland definition: Legislation (2019) Fuel poverty (Targets Definitions and Strategy) (Scotland) Act 2019
- For Wales definition:https://gov.wales/topics/environmentcountryside/energy/fuelpoverty/?lang=en
[108] BEIS, Annual Fuel Poverty Statistics, 2019.

11.1% to 10.9% (2.5 million households).[109] The average fuel poverty gap - the additional income that would be needed to bring a household out of fuel poverty – was £321 in real terms in 2017,[110] compared to £333 in 2016 and £355 in 2010.[111]

Fuel poverty by English region

4.11. Figure 4.4 illustrates how the rate of fuel poverty varied across the nine English regions in 2016 and 2017; for each year it displays the percentage of households in a given region that were in fuel poverty. In 2017, the regions with the highest rates of fuel poverty continued to be the North West, West Midlands and the North East, with rates between 13% and 12% respectively, whilst the South East had the lowest fuel poverty rate at just under 9%. The biggest improvements were in the North East and East Midlands, with both experiencing a 2 percentage points reduction between 2016 and 2017. There were some increases however, with the largest being in London where the rate of fuel poverty rose by almost 2 percentage points to just under 12%.

Figure 4.4: Percentage of households in Fuel Poverty across English regions, 2016 and 2017



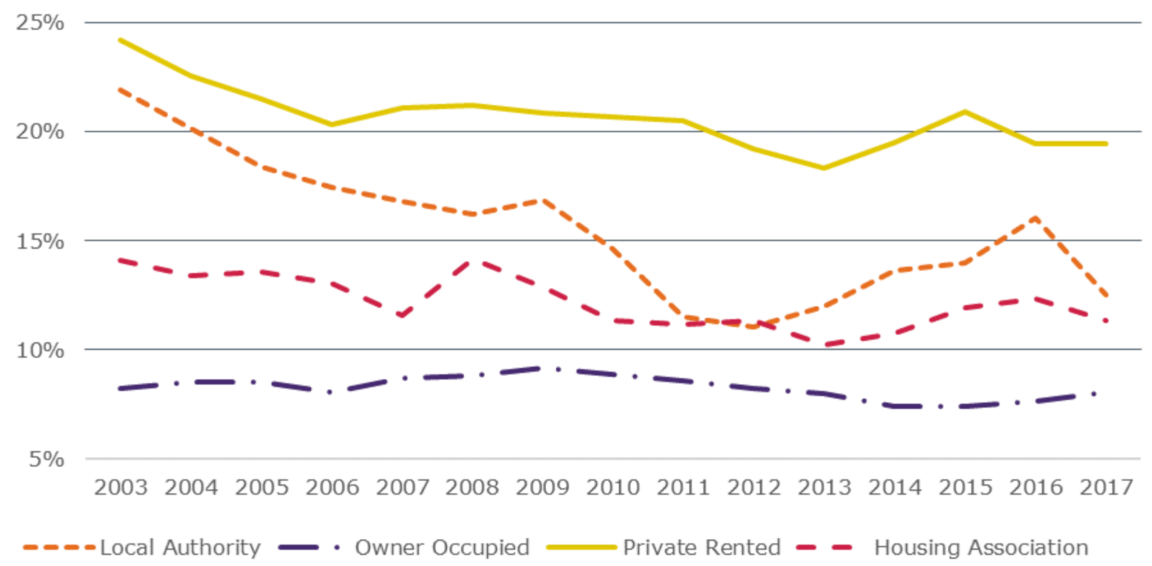
Source: Ofgem analysis of BEIS, Annual Fuel Poverty Statistics (2019 and 2018).
Notes: The colour scale bar on the right side of the figure denotes the rate of fuel poverty.

[109] The small difference between the 2016 and 2017 figures is not statistically significant.
[110] Figures in 2017 prices.
[111] Ibid.

Fuel poverty by tenure type

4.12. As shown in Figure 4.5, the rate of fuel poverty is consistently highest for those in privately rented accommodation, and lowest for owner occupiers, with little change between 2016 and 2017. Fuel poverty across those in local authority and housing association properties fell by 3 percentage points and 1 percentage point respectively during the same period. Fuel poverty tends to be highest among private renters due to a combination of private renters having lower incomes than owner occupiers, and higher energy needs than those in social housing due to poorer energy efficiency,[112] with 6% of privately rented homes being rated F or G for energy efficiency compared to 1% in the social sector.[113] The poor energy performance of a building contributes to higher bills, as more energy is required to maintain adequate warmth. As an increasing proportion of households are living in privately rented accommodation (around one fifth, double the proportion in 2003), the rate of fuel poverty in privately rented accommodation is a growing concern.[114]

Figure 4.5: Rate of Fuel Poverty in England, by property tenure type



Source: Ofgem analysis of BEIS, Annual Fuel Poverty Statistics, 2019.

[112] SAP is the Standard Assessment Procedure for assessing energy efficiency of dwellings. In 2017-18 private rented houses had an average SAP rating of 61, compared to 68 for the social sector.
[113] Ministry of Housing, Communities and Local Government, English housing survey headline report 2017- 2018: Section 2-Household tables, table 2.7, January 2019.
[114] English housing survey headline report 2017 to 2018: Section 1-Household tables, table 1.1, January 2019.

Fuel poverty by household income

4.13. Figure 4.6 illustrates how concentrated the rate of fuel poverty is among low income households: more than 40% of households in the first and second income deciles are in fuel poverty; this is three times the rate among households in the third and fourth income deciles.

Figure 4.6: Percentage of households in fuel poverty in England, by income decile

Source: Ofgem analysis of BEIS, Annual Fuel Poverty Statistics, 2019.

Fuel poverty in Scotland has fallen

4.14. The Scottish Government estimated that in 2017, 24.9% (613,000) of households in Scotland were living in fuel poverty, compared with a rate of 26.5% (649,000 households) in 2016.[115]

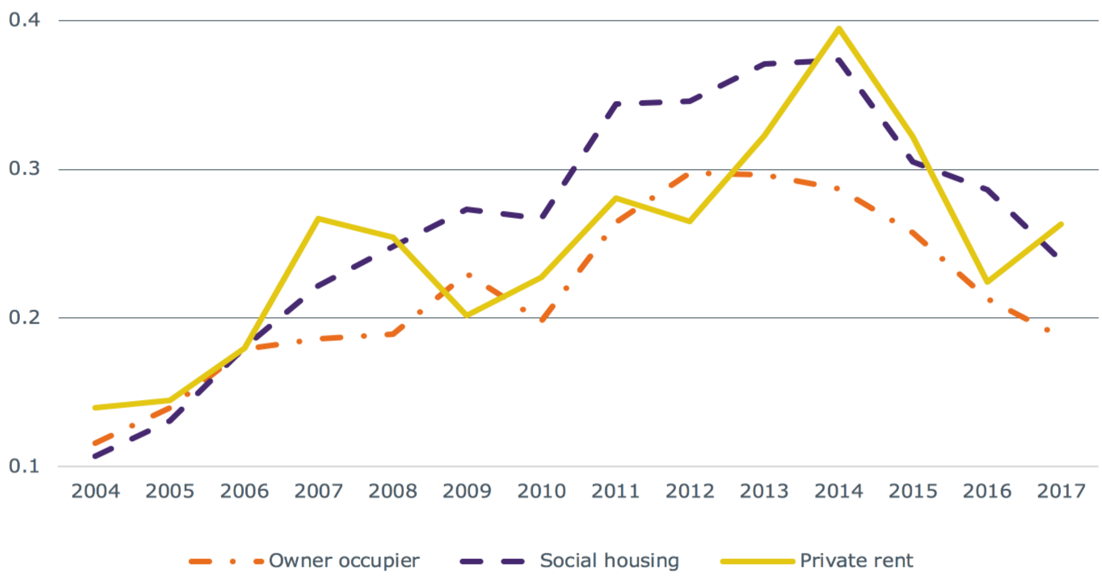
Fuel poverty by tenure type

4.15. Figure 4.7 shows that the incidence of fuel poverty by tenure type is less clear-cut for Scotland than in England. Analogous to the results for England, the rate of fuel

[115] Scottish Government, Scottish House Condition Survey: 2017 Key Findings.

poverty among owner occupiers is unambiguously lower than for those in social housing, and tends to be the lowest overall. However, the rate of fuel poverty among private renters is more variable: between 2016 and 2017 fuel poverty among this group increased by 4 percentage points, making this the tenure type with the highest rate of fuel poverty at 26%. This variability may in part be explained by the relatively uniform distribution of earners that live in privately rented accommodation, compared to distributions that are more skewed towards higher earners for owner-occupiers, and lower earners for those in social housing.

Figure 4.7: Rate of Fuel Poverty in Scotland, by property tenure type[116]



Source: Ofgem analysis of Scottish housing condition survey (2017, 2015-2016, 2013-2014 and 2003/2004 – 2012).

Note: The results are not directly comparable over time due to differences in methodology for calculating fuel poverty. Broadly, the increases in fuel poverty over 2004-12 were driven by increases in fuel costs offsetting housing efficiencies and income growth.[117]

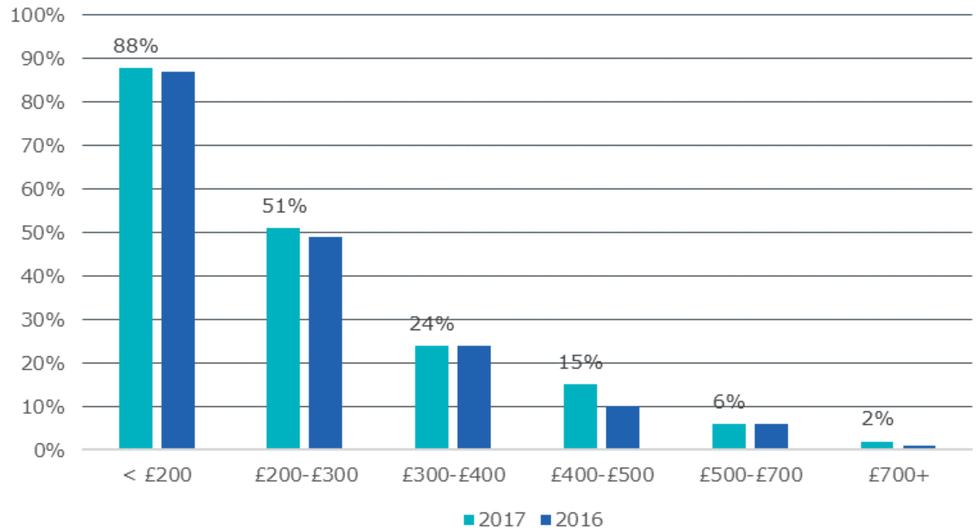
Fuel poverty by household income

4.16. The incidence of fuel poverty falls rapidly as weekly income increases (see Figure 4.8): in 2017, almost 90% of households with a weekly income of less than £200 were

[116] Owner occupier tenure consists of Owned outright and mortgage tenure type, and social housing tenure type consists of local authority (LA/public) and Housing Association (HA/Co-op) tenure types.
[117] See para. 153 in Scottish Government, Scottish House Condition Survey: 2017 Key Findings.

in fuel poverty, while around 25% of households with weekly income up to £400 were in fuel poverty. This is reflected in fuel poverty by tenure type (see above) in that the majority of Scottish households in social housing have a weekly income of less than £400 per week, while the opposite holds for owner-occupiers.

Figure 4.8: Fuel poverty in Scotland by weekly household income, 2016 and 2017



Source: Ofgem analysis of Scottish housing condition survey (2016 and 2017).

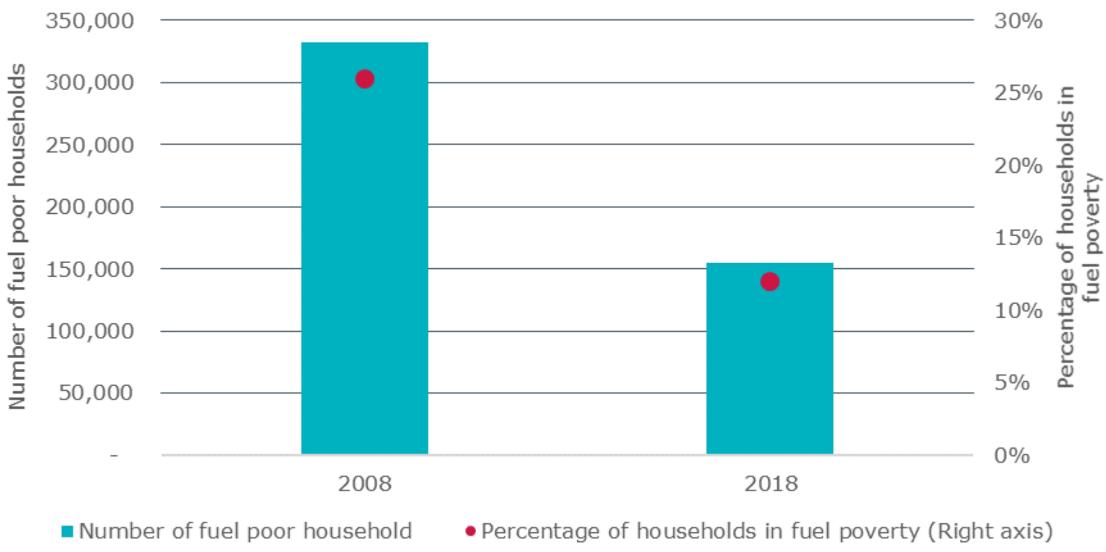
Estimated fuel poverty in Wales has fallen significantly over the past ten years

4.17. As shown in Figure 4.9, the Welsh Government estimated that 12% (155,000) of households in Wales were living in fuel poverty in 2018; this is the first comprehensive set of estimates of fuel poverty in Wales since 2008, when the rate of fuel poverty was 26% (332,000 households).[118] While there have been changes to the methodology in this time, the Welsh government states that the results are broadly comparable.[119]

[118] Welsh Government (2019) "Fuel poverty estimates for Wales 2018: Headline Results". The 2008 and 2018 fuel poverty statistics use largely the same methodology and the same definitions for satisfactory heating regime and vulnerable households, so broad comparison can be made. There has however been a change in calculating energy consumption and the SAP methodology since 2008.

[119] See p. 17 of Welsh Government (2019) "Fuel poverty estimates for Wales 2018: Headline Results".

Figure 4.9: Fuel poverty in Wales, 2018



Source: Ofgem analysis of fuel poverty estimates for Wales: 2018.

Note: Because of methodological changes between 2008 and 2018, these figures are only broadly comparable.

4.18. In addition, 32,000 (2%) of all households were classified as being in severe fuel poverty in 2018. This means that they spent more than 20% of their income on maintaining a satisfactory heating regime.[120] Around 11% of households that were considered vulnerable – by way of age, disability or long term limiting condition – were in fuel poverty in 2018.

4.19. While some statistics were produced in 2016, they are not comparable with the above estimates due to differences in definitions used for satisfactory heating requirements and vulnerable households.[121]

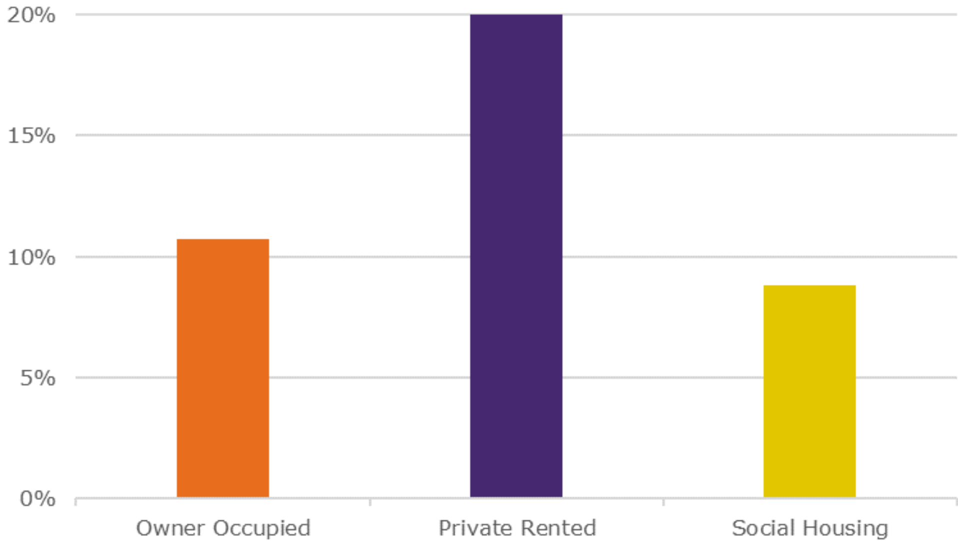
Fuel poverty by tenure type

4.20. In 2018, owner-occupied households made up the majority of fuel poor households due to the fact that this is the most prevalent tenure type within the Welsh housing stock. The private rented sector however had the highest proportion of households in

[120] Ibid.
[121] Welsh Government (2019) "Fuel poverty estimates for Wales 2018: Headline Results"

fuel poverty. As shown in Figure 4.10, around 20% of all privately rented households were in fuel poverty compared to 11% of owner occupied and 9% of social housing.

Figure 4.10: Rate of Fuel Poverty in Wales, by property tenure type, 2018

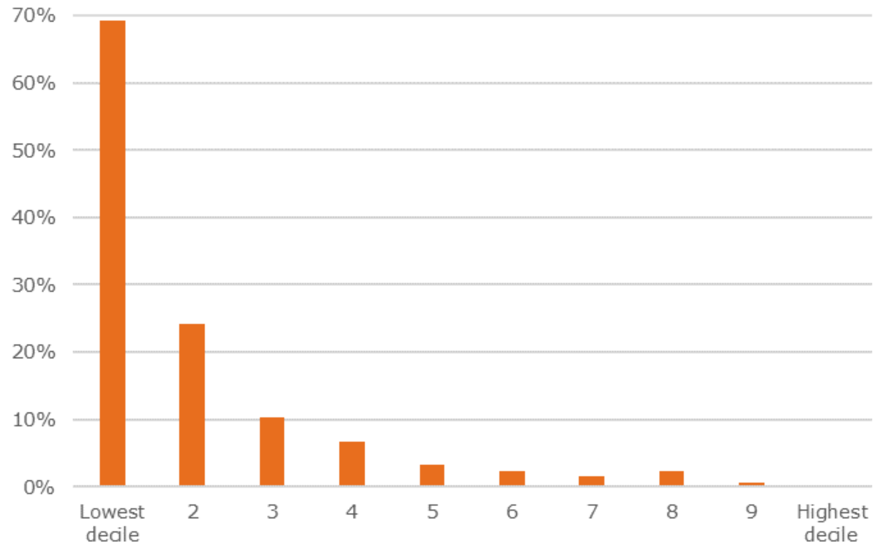


Source: Fuel poverty estimates for Wales: 2018.

Fuel poverty by household income

4.21. Figure 4.11 shows that fuel poverty is predominantly experienced by households with low income. In 2018, 69% and 24% of all households in the lowest income decile and second decile were fuel poor respectively whereas there were no fuel poor households among households in the highest income decile.

Figure 4.11: Percentage of households in fuel poverty in Wales by income decile, 2018



Source: Fuel poverty estimates for Wales: 2018.

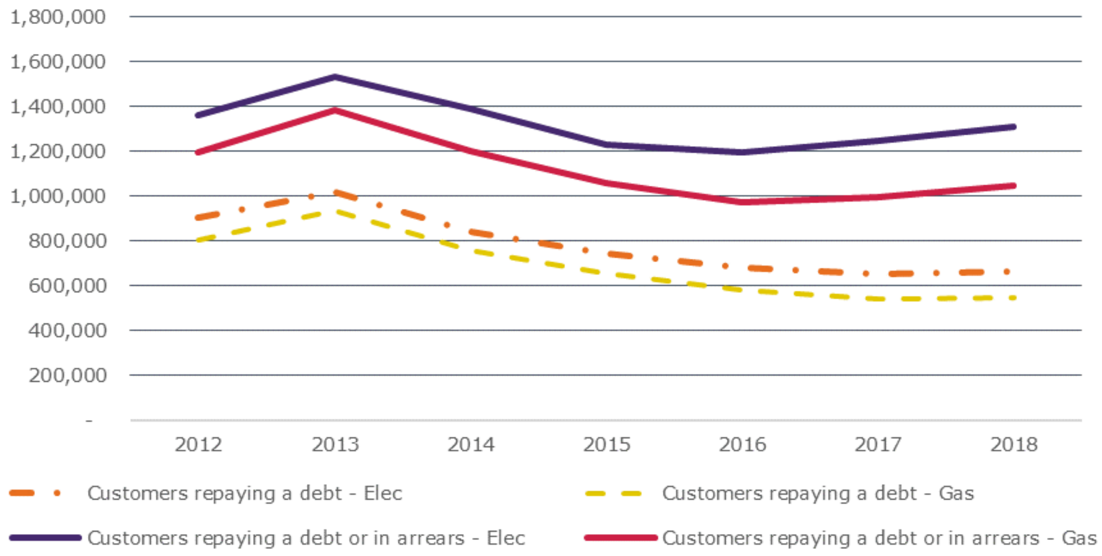
Debt and disconnection

4.22. Debt is an important indicator of vulnerability. It may result, for example, from involuntary unemployment or low income (themselves indicators of vulnerability). Consumers that are in debt to their energy supplier may also be in debt in other areas of their life.

4.23. As shown in Figure 4.12, the number of customers repaying a debt or in arrears in 2018 was around 1.3 million for electricity and just over 1 million for gas, an increase of 0.1 million for both fuel types since 2017.[122]

[122] The number of customers repaying a debt increased between 2017 and 2018 by around 9,200 and 4,555 for electricity and gas, respectively, while the number of customers in arrears increased by around 52,500 and 49,500, respectively.

Figure 4.12: Number of customers in debt to their supplier



Source: Social Obligations Reporting Data 2019, Ofgem.

4.24. When a customer gets into debt with their supplier, a prepayment meter may be installed to help them better manage their energy use and repay their debt. The total number of electricity and gas prepayment meters installed for debt has fallen from 114,559 and 111,184 in 2017 to 106,667 and 93,329 in 2018 respectively due to fewer PPMs being installed overall.[123] Moreover, the total number of prepayment meters under warrant has decreased, reversing the trend of a year ago and reaching approximately 36,000 and 35,100 for electricity and gas respectively in 2018.[124]

4.25. Consumers pay the costs of installing prepayment meters under warrant. This can cause serious distress for consumers already in debt. To ensure that the warrant process is used consistently by suppliers as a last resort to avoid disconnection, we introduced new protections that came into effect in 2018. They include a ban on using warrants for consumers who would find the experience traumatic, a prohibition on warrant-related charges for the most vulnerable consumers and a cap of £150 in all other cases.

[123] Vulnerable Consumers in the Energy Market: 2019 Report.
[124] Ibid.

4.26. Disconnection due to debt is now extremely rare. In 2018 there were only 6 electricity disconnections in total and zero gas disconnections.[125] This is down from 17 disconnections across both fuels in the previous year. This is a marked reduction from the 640 disconnections that occurred in 2013, and a continued downward trend from 1998, which saw just under 30,000 disconnections.[126]

4.27. Some consumers with prepayment meters 'self-disconnect', because of a lack of credit on the meter. There are a range of different studies estimating the number of self-disconnections. Our 2019 Consumer Survey found that around 14% of consumers with a prepayment meter self-disconnected in the last year. The reported duration of the disconnections suggests most of these cases were related to forgetfulness or not realising the meter was low on credit. Of those consumers that reported having been disconnected from their electricity or gas supply in the last year, 21% and 27% respectively said they did not manage to top up and reconnect within three hours.[127] These findings suggest that around 129,000 electricity consumers and 128,000 gas consumers self-disconnected for more than three hours at least once during the year.[128]

4.28. For consumers who cannot afford to top up their meters, the consequences can be severe. Previous research by Citizens Advice found that in 2017, 140,000 households in Great Britain had been left without gas and electricity because they couldn't afford to top up their meter.[129] Of those, 56% had been left with cold homes, 35% without sufficient light, and more than half cited emotional impacts, such as stress and shame. 88% of the households disconnected because they couldn't afford to top up their meter contained either a child or someone with long-term health issues.

Getting a better deal

4.29. There are several reasons why consumers may not be on the energy deals that are best for them. These include the extent of their engagement with the market, the type

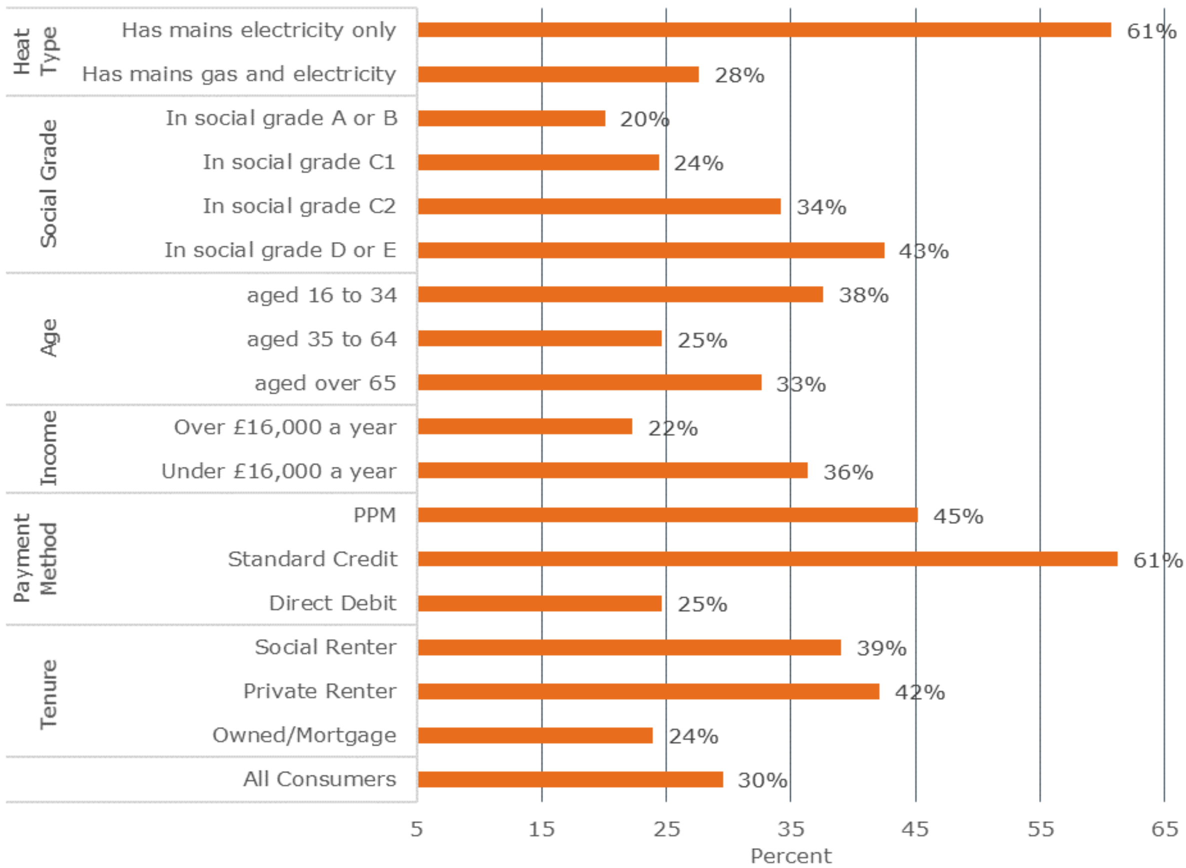
[125] Vulnerable Consumers in the Energy Market: 2019 Report.
[126] Ofgem (2008) Domestic suppliers' social obligations: 2008 Annual report
[127] Ofgem, Consumer Survey, 2019.
[128] As per Vulnerable Consumers in the Energy Market: 2019 Report, in 2018, there were 4.4 million and 3.4 million electricity and gas prepayment consumers respectively.
[129] Citizens Advice (2018) "Switched on: Improving support for prepayment consumers who've self-disconnected'.

of meter they are on, and whether or not they are connected to the gas grid. We discuss each of these below.

Some vulnerable consumers are less likely to make an active choice

4.30. Our 2019 Consumer Survey found that, overall, 49% of respondents had either switched supplier, changed tariff with their existing supplier, or searched for a better deal over the last year. Engagement in the market tends to be lower for some groups of consumers who are at greater risk of being vulnerable. For instance, only 34% of social renters had engaged with the market, as had 24% and 33% of households using standard credit and prepayment meters respectively.[130] This means that consumers in vulnerable circumstances are likely to be paying more for their energy than is necessary.

Figure 4.13: Breakdown of consumers who have never switched



Source: Analysis of Ofgem Consumer Survey 2019.

130 Ofgem, Consumer Survey, 2019.

4.31. Figure 4.13 shows that consumers in vulnerable circumstances are more likely to report that they have never switched supplier. For instance, those having electricity as their main heat type, those in social grades D and E, prepayment meter or standard credit customers, and those living in privately rented accommodation are the most likely to report having never switched supplier.[131]

4.32. Consumer perceptions of the benefits of switching may pose a barrier to engagement, and these perceived barriers may be significant among those more likely to be in vulnerable situations.

4.33. Our 2019 survey found that a combination of inertia, perceived hassle and limited understanding of the benefits of switching act as a barrier to switching. Among those who had not engaged, 30% of consumers cited satisfaction with their existing supplier, 19% believed it would be a hassle to switch, and 10% believed there was no financial benefit to switching. The most commonly perceived risks of switching among potentially vulnerable consumers are a fear that prices could go up or a fear they may not save as much as they think. Elderly consumers and consumers with a disability find it more difficult to compare energy tariffs compared to the population average, which can also prevent switching.

Some groups find it difficult to reduce their bills

4.34. Prepayment meter usage is associated with vulnerability. Almost half (48%) of consumers in the lowest income decile have an electricity prepayment meter and more than half of consumers in the lowest income decile have a gas prepayment meter.[132] Inactive customers with a prepayment meter are now protected from very poor value deals by the Safeguard Tariff.[133] But the best deals in the market are still not available to them. On 28 June 2019, a prepayment customer could have saved up to £300 per annum were they able to change to the cheapest direct debit tariff in the market.[134]

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[131] For a discussion of social grades, see http://www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade.
[132] Ofgem analysis of Office of National Statistics, Living Cost and Food Survey data.
[133] https://www.ofgem.gov.uk/about-us/how-we-work/working-consumers/protecting-and-empowering-consumers-vulnerable-situations/consumer-vulnerability-strategy/vulnerable-customer-safeguard-tariff
[134] Vulnerable Consumers in the Energy Market: 2019 Report.

Several suppliers still refuse customers' requests to switch from prepayment meters to credit meters, in what they see as an effort to prevent them from returning to debt.

4.35. Customers with a prepayment meter who are in debt and are unable to switch to a credit meter should still be able to switch supplier if they owe less than £500. In 2018, successful switches decreased from 3,395 to 2,241 for electricity and from 2,694 to 1,842 for gas customers. The success rate of switching requests for indebted consumers remains very low, at around 4.5% and 4% for electricity and gas respectively.[135]

Connection to the gas grid

4.36. In 2018, there were 3.4 million homes in Great Britain not connected to the gas grid.[136] Households that are not connected to the gas grid will generally spend more on their energy bills than an equivalent house with a dual fuel supply. This is because:

- Electric heating is currently generally more expensive than gas heating, both because of fundamental efficiency differences and because most policy costs are assigned to electricity rather than to gas. Consumers that rely solely on electricity therefore contribute considerably more towards these costs than those with gas heating.

- Homes that rely on electric heating often have restricted meters. Customers who are on restricted meters other than Economy 7 have less choice of suppliers and tariffs, which limits their ability to access cheaper prices.

4.37. The Fuel Poor Network Extension Scheme supports fuel poor households by helping towards the costs of connection to the gas network.[137] Between April 2018 and March 2019, this scheme connected 12,443 eligible households to the gas grid.

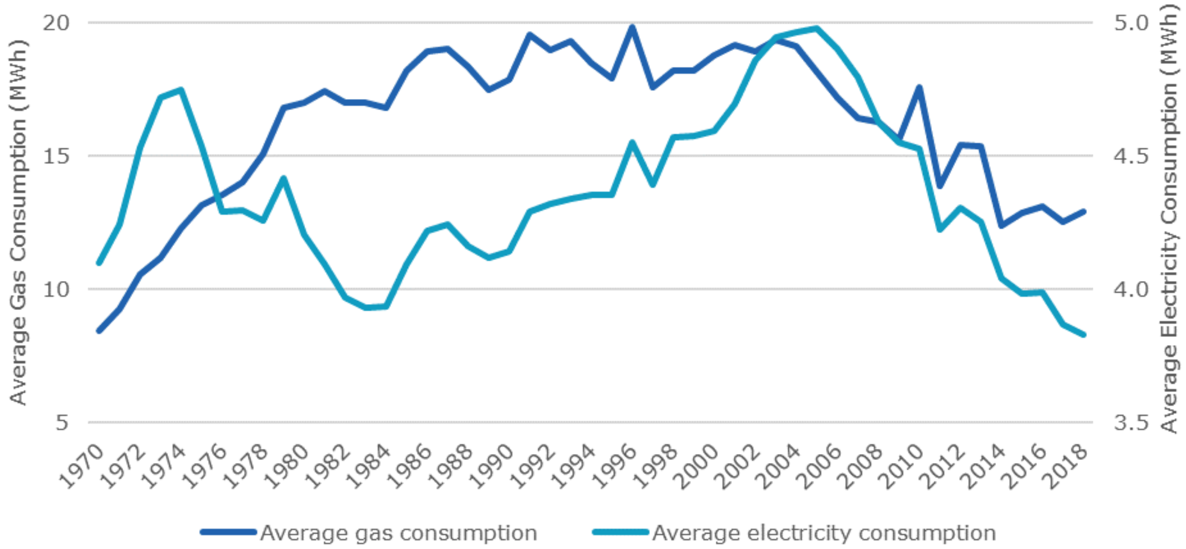
[135] Vulnerable Consumers in the Energy Market: 2019 Report.
[136] BEIS, Domestic Energy Price Statistics, Annual Domestic Energy Bills, Table 2.3.5.
[137] Ofgem (2017) "Decision to change the criteria for the Fuel Poor Network Extension Scheme"

Consuming less to reduce bills

Domestic consumption is falling

4.38. Energy consumption has been falling over the last 16 years. On a temperature corrected basis,[138] final domestic energy consumption fell by 18% between 2002 and 2018.[139] This is despite the population increasing by 12%, and the number of households by 11%, during this time.[140]

Figure 4.14: Annual household consumption of gas and electricity (MWh)



Source: Ofgem analysis of BEIS, Energy consumption statistics in the UK (1970-2018) and BEIS, historical gas data: gas production and consumption and fuel input (1920 to 2016). The figure is not weather corrected as weather corrected data are available only since 2002.

4.39. Figure 4.14 shows how average annual household consumption of gas and electricity have evolved over time. The short term fluctuations in gas consumption reflect years with particularly warm or cold winters, leading to changing demand for heat. Electricity, which is less commonly used for domestic heating, presents a much smoother

[138] Meaning that the data has been adjusted to remove the effects of particularly warm or cold weather.
[139] Ofgem analysis of Energy Consumption in the UK, 2019, Consumption data tables - Table C5.
[140] Ofgem analysis of Energy Consumption in the UK, 2019 intensity tables –Tables C 13.

downward trend. Consumption continued to fall in 2018 for electricity but an uptick in consumption of gas can be seen during this year, driven by the 'Beast from the East'.[141]

4.40. The longer-term downward trend in household energy consumption may reflect a combination of more efficient use of energy, or a decision by households to consume less.

The energy performance of homes has improved for fuel poor households

4.41. The energy efficiency of our homes, and the appliances we use within them, has been improving over the last 16 years. This means that for a given level of comfort or wellbeing, we are consuming less gas and electricity, making energy bills more affordable as a result. In 2017, the average Standard Assessment Procedure (SAP) rating – which indicates household energy and environmental performance – was 62, up from 46 points in 2001. However, the increase appears to be slowing and there was no change in the average SAP rating of homes between 2016 and 2017.[142]

4.42. Improving household energy efficiency is driven by three main areas:[143]

- Insulation improvements: The proportion of the homes known to have cavity walls that have been insulated has increased dramatically since 1976, when just 3.8% were insulated, compared with 70% in 2018.[144] However, as with insulation of lofts, of which the majority are now thought to be insulated, the rate of growth of cavity wall insulation has slowed, with just a 0.5 percentage point increase from 2017.

- More efficient electrical products: regulation and technological improvements have made electrical goods more efficient. This has enabled domestic electricity

[141] BEIS, Energy Consumption in the UK, July 2019.
[142] English Housing Survey: Headline Report, 2017-2018, available here: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774820/2017-18_EHS_Headline_Report.pdf
[143] BEIS, Energy Consumption in the UK, July 2018 and 2019.
[144] BEIS, Energy Consumption in the UK, July 2019, Supplementary tables, table S11.

consumption to fall steadily since 2005, despite the number of appliances such as fridges and washing machines increasing.

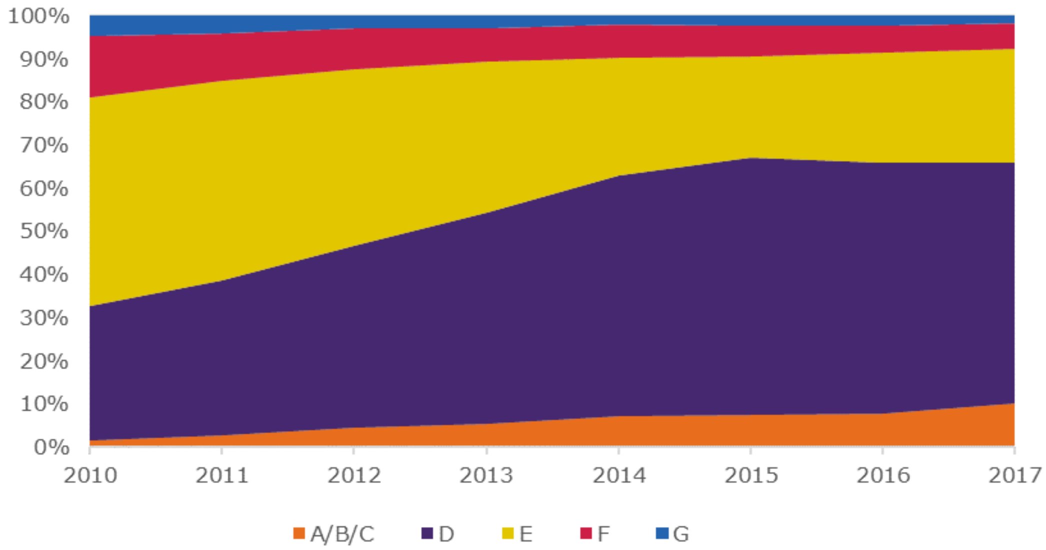
- More efficient boilers: In 2017, 66% of households had either a condensing or condensing-combination boiler, compared with just 2% in 2001. Installing a condensing boiler can reduce consumption by over 7%.[145]

4.43. Figure 4.15 shows the collective impact that such energy efficiency schemes, along with the tightening of building regulations for new buildings, have had on the energy efficiency ratings of homes occupied by fuel poor households. Between 2010 and 2017, there has been a large shift in the number of fuel poor homes being rated A-D instead of E-G. During this time, the proportion of fuel poor homes rated A-D rose from 33% to 66% (with the majority occupying properties with a D rating) and the proportion of fuel poor homes rated E-G declined, moving from 67% to 34%.[146]

4.44. In 2017, fuel costs for the most efficient[147] properties (which are rated A-C) were on average £939 compared to £2,861 for the least efficient properties.[148] The energy efficiency of a home can therefore have a significant impact on the risk of a household being in fuel poverty.

[145] English Housing Survey-Headline Report, 2017-2018: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774820/2017-18_EHS_Headline_Report.pdf
[146] Ofgem analysis of Department for Business, Energy & Industrial Strategy, Fuel Poverty Trends 2019: Table 2 - Fuel poverty, by fuel poverty energy efficiency rating (FPEER), 2010-2016.
[147] Energy efficiency measured using FPEER.
[148] Annual Fuel Poverty Statistics Report, 2019 (2017 Data).

Figure 4.15: Energy performance of homes occupied by fuel poor households



Source: Ofgem analysis of BEIS, Annual Fuel Poverty Statistics, 2019.

Some households are at risk of under consuming energy

4.45. Consumers may make active choices to reduce their energy consumption for environmental and financial reasons. However, in some cases, consumers may be reducing their consumption of gas and electricity below desirable levels, reducing their comfort and well-being, and potentially harming their physical or mental health.[149]

4.46. Consumers may also self-ration their energy consumption, for example by not turning on their heating when it is cold or limiting use of electrical appliances. The health risks of under-consumption of energy for heating purposes are fairly well understood. Living in a cold home can create or worsen health problems, particularly for young children, older people, or those with existing health conditions. There is less information about the impacts on vulnerable households from rationing electricity for other purposes, such as for cooking hot meals, lighting the home, or turning on the television. But rationing such functions and activities could contribute to poor physical and mental health, social exclusion, and poor educational and employment outcomes.

[149] This also relates to our earlier discussion of self-disconnection due to fuel poverty.

Trends in winter deaths due to inadequate heating

4.47. Each year the Office for National Statistics (ONS) publishes statistics on "excess winter deaths" (EWD). This captures the extra number of deaths that occur during the winter period (December to March) relative to the average of the surrounding four months of April to July and August to November.[150]

4.48. The cold weather during winter months can both increase the risk that individuals develop respiratory and circulatory problems, and exacerbate existing health problems.[151] There are studies that suggest that:

- 30 percent of EWDs can be directly linked to cold homes.[152]
- 10 percent of EWDs can be directly linked to fuel poverty.[153]

4.49. While such estimates should be treated with a degree of caution, in particular as the studies were undertaken a number of years ago in 2011 and 2012, they serve to provide a reference for the potential magnitude of winter deaths that can be linked to cold homes and, more narrowly, fuel poverty. Assuming that these estimates remain applicable, Figure 3.16 suggests that in 2017-18:[154]

- Just under 16,500 EWDs can be linked to people living in cold homes.
- Just under 5,500 EWDs can be linked to people being in fuel poverty and the difficulties that this causes.

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150 Formally, excess winter deaths are calculated as

$$\text{EWD} = \text{No. of Deaths in Dec to Mar} - \text{Average}\,(\text{No. of Deaths in Apr to Jul},\ \text{No. of Deaths in Aug to Nov})$$

151 Public Health England, UCL Institute of Health Equity (2014) "Local action on health inequalities: Fuel poverty and cold home-related health problems.

152 Rudge, J. (2011) "Indoor cold and mortality", In Braubach, M., Jacobs,. D., and Ormandy, D. (2011) "Environmental burden of disease associated with inadequate housing: A method guide to the quantification of health effects of selected housing risks in the WHO region", World Health Organisation.

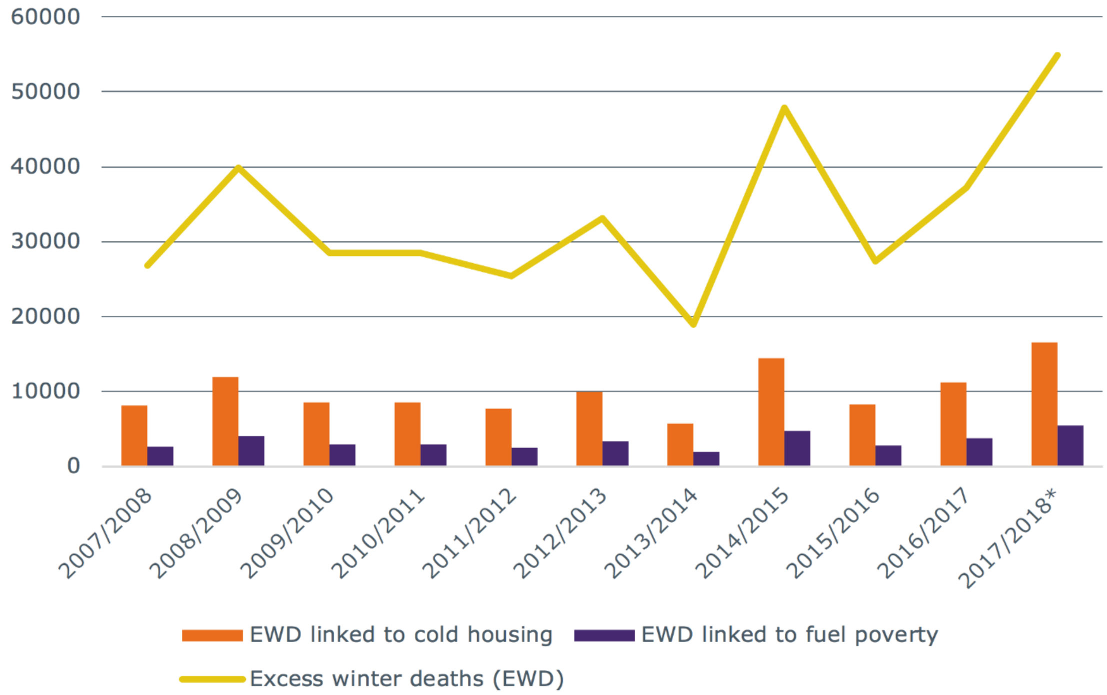
153 Hills, J. (2012, p.27) "Getting the measure of fuel poverty: Final Report of the Fuel Poverty Review", Centre for Analysis of Social Exclusion.

154 The appropriateness of this assumption will depend, for example, on the extent to which improvements in energy efficiency have reduced the number of EWDs that could be linked to cold homes. This requires further investigation.

4.50. These numbers were higher in 2017-18 than in the previous year: this is because, firstly, the total number of EWDs was higher in this year than previously, and secondly, we are applying constant ratios of EWDs that can be linked to fuel poverty and cold homes (at 10% and 30%, respectively) for each year in our analysis in Figure 4.16.

4.51. The number of EWDs in 2017-18 was the highest on record since 1975-76, at an estimated 50,100. This high level has been attributed to lower than average winter temperature, a predominant strain of flu and the ineffectiveness of the influenza vaccine.[155]

Figure 4.16: Excess winter deaths that may be linked to cold housing and fuel poverty



Source: Ofgem analysis of Office for National Statistics: Excess winter mortality in England and Wales, and National Records of Scotland: Winter mortality in Scotland.

Note: 2017/2018 data is provisional.

[155] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/excesswintermortalityinenglandandwales/2017to2018provisionaland2016to2017final

Support for consumers in vulnerable situations

4.52. The first part of the chapter highlighted some, but not all, of the circumstances that can lead to consumers being vulnerable, suffering detriment, and needing support as a result. There are several ways in which suppliers, the government, Ofgem, and charities provide support for these consumers, either to make their bills more affordable, or to help them engage in the market directly to protect their own interests. This section summarises the main financial and non-financial support available, and the impact these interventions have.

Financial support is available for energy consumers in vulnerable situations

Direct subsidies

Table 4.2: Direct financial support for consumers in vulnerable situations

Policy	Eligible	Recipients (winter 2017-18)	Payment to Individuals, nominal (£)	Total Cost, 2018 prices (£m)	Funding source
Winter Fuel Payment	All pensioners	11.8 million individuals	£100 to £300	£2,055	Central government
Warm Home Discount: Core group	Low-income pensioners	1.2 million individuals	£140	£173	Energy bill payers
Warm Home Discount: Broader group	Consumers on a low income and vulnerable to fuel poverty	0.96 million individuals	£140	£161	Energy bill payers
Cold Weather Payment	3.8 million benefits claimants	4.7 million payments	£25 for each cold week of weather	£121	Central government

Source: Department for Work and Pensions, Winter Fuel Payment Statistics 2017-18; Ofgem, Warm Home Discount Annual Report: Scheme Year 7, December 2018; and Department for Work and Pensions, Cold Weather Payment Statistics, 2017-18.

Notes: The total cost has been converted to 2018 prices using the CPIH index.

4.53. The UK government provides direct financial support to consumers in circumstances that make them vulnerable, with most of the support directed towards pensioners. As illustrated above, the total amount of financial support provided in the financial year ending 2018 was around £2.5 billion in 2018 prices, spread across winter fuel payments (around £2 billion); the Warm Home Discount (around £330 million); and cold weather payments (around £121 million) (Table 4.2).

4.54. A low-income pensioner on Pension Credit could receive financial support up to £440 (excluding any cold weather payments), depending on their age.[156] This would cover around 37% of the average dual fuel energy bill in 2018. Cold Weather Payments are another source of financial support for potentially vulnerable consumers during sustained periods of very cold weather, when heating requirements increase. Payments are made to pensioners and consumers receiving income support or income-based jobseeker's allowance, when the average local temperature is recorded as, or forecast to be, at or below freezing for seven consecutive days. In winter 2017-18, there were 4.7 million cold weather payments, worth a total of £121 million in 2018 prices. In winter 2018-19, this decreased to 1.08 million payments totalling £27.1 million. This was largely down to the winter of 2018-19 being, on average, warmer than that of 2017-18 across much of the UK.

4.55. In 2018, the government extended the Warm Home Discount scheme until at least March 2021, and broadened the scope and scale of the support. In particular, the threshold for the size of suppliers that must participate, based on the number of customer accounts they hold, will fall over time.[157]

Price protection

4.56. Ofgem has put in place a cap on default tariffs and we also administer a cap on prepayment meter tariffs that was designed by the CMA. These price protections are likely to benefit vulnerable groups proportionately more as they are more likely to be on these tariffs.

4.57. In January 2019 we introduced the cap on default tariffs, protecting around 11 million consumers on more expensive tariffs by ensuring that the price they pay for their energy more closely reflects the underlying costs of energy. The cap sets a maximum price that suppliers can charge customers per unit of energy, as opposed to a maximum bill, which depends on the amount of energy used. The savings for individual customers will depend on how much energy they use, the price of their

[156] https://www.gov.uk/pension-credit
[157] Ofgem (2018) Warm Home Discount Annual Report: Scheme Year 7

current tariff, whether they have both gas and electricity and how they pay for their energy. When the cap was first introduced, we estimated that it would save customers who use a typical amount of gas and electricity around £76 per year, with a typical customer on the most expensive tariff saving £120. In total, we expect that the price cap will save consumers in Great Britain around £1 billion per annum in nominal terms.[158]

4.58. Prior to the price cap on default tariffs, Ofgem administered the CMA's Safeguard Tariff on prepayment meter tariffs which came into force in April 2017, initially protecting over 4.5 million households.[159] In February 2018, the Safeguard Tariff was extended to protect a further 0.8 million vulnerable consumers that are in receipt of Warm Home Discount. We estimated that eligible vulnerable consumers would initially make annualised savings of around £110 in nominal tems.[160]

Energy Company Obligation 3 (ECO 3)

4.59. The Energy Company Obligation (ECO), first introduced in 2013, is an energy efficiency scheme for Great Britain. ECO places legal obligations on larger energy suppliers to deliver energy efficiency measures to domestic premises. It focuses on insulation and heating measures and supports vulnerable consumer groups. Following completion of the ECO2 in September 2018, the current ECO3 scheme came into force in December 2018 and will run until March 2022. ECO3 is comprised entirely of a single obligation – the Home Heating Cost Reduction Obligation (HHCRO) – which focusses on reducing heating costs for low income, fuel poor and vulnerable households living in private or social housing. Between December 2018 and the end of August 2019, almost 76,000 measures were approved to improve the efficiency of homes.[161]

[158] See our default tariff cap decision document at https://www.ofgem.gov.uk/publications-and-updates/default-tariff-cap-decision-overview. For an overview see https://www.ofgem.gov.uk/publications-and-updates/energy-price-cap-will-give-11-million-fairer-deal-1-january
[159] We calculate the level of the PPM cap following the CMA's methodology.
[160] https://www.ofgem.gov.uk/system/files/docs/2017/10/financial_protections_for_vulnerable_consumers_-_technical_document.pdf
[161] https://www.ofgem.gov.uk/environmental-programmes/eco/contacts-guidance-and-resources/eco-public-reports-and-data/measures

Wider (non-financial) support

4.60. There are a range of channels through which consumers can receive non-financial support.

Support to engage

4.61. There are mechanisms in place to support vulnerable consumers to engage with the market and ultimately save money. These include:

- Big Energy Savings Network (BESN), funded by both BEIS and National Energy Action (NEA) to support third sector organisations and community groups in advising vulnerable consumers.[162] This has provided support to over 500,000 consumers in vulnerable situations since 2013.

- Big Energy Saving Week, a national campaign to help people cut their energy bills and take-up/be aware of the financial support they are eligible for.

- Energy Best Deal Extra run by Citizens Advice, which is funded by some energy suppliers' Warm Home Discount industry incentives allowance. This programme gives advice to vulnerable groups such as people with low incomes and those living with a disability or long term health concerns.

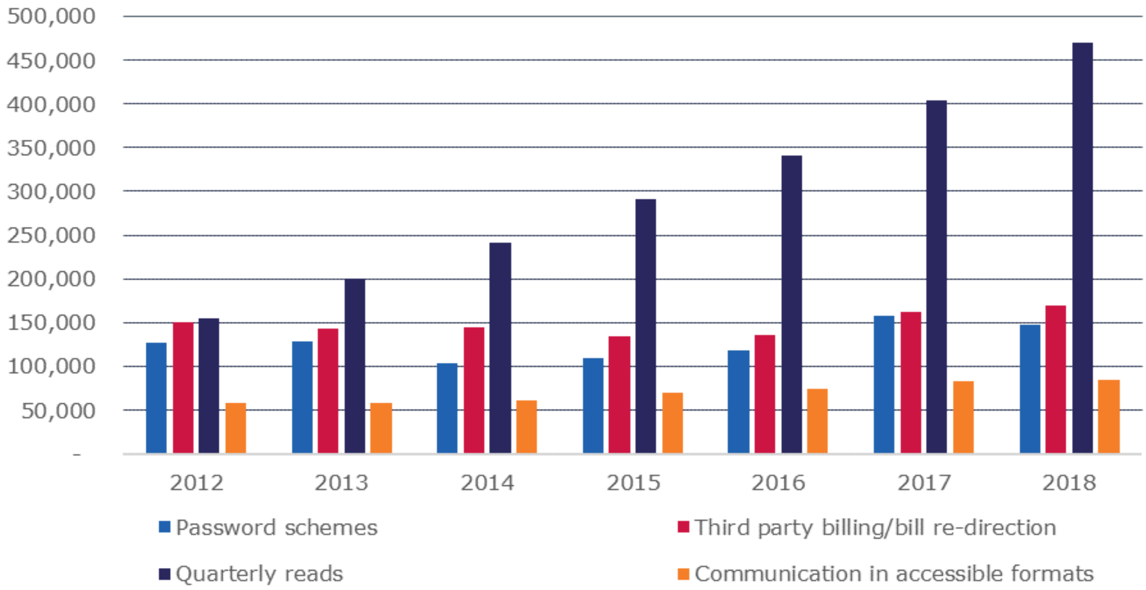
Priority Services Register (PSR)

4.62. Suppliers are required to register vulnerable customers onto their PSR. This enables them to help these customers better manage their energy needs through a range of services including: assistance with meter reading; communication in accessible formats services; password protection schemes; and advance notice of planned power cuts. Figure 4.17 illustrates the number of PSR services provided to electricity customers over the period 2012-18. There has been a marked increase of almost 200% in the

[162] https://www.gov.uk/government/publications/big-energy-saving-network-grant-offer-fund

number of quarterly meter readings undertaken by suppliers over this period, from 155,000 in 2012 to 470,000 in 2018.[163]

Figure 4.17: The number of PSR services provided to electricity customers on PSRs



Source: Social Obligation Reporting Data 2018, Ofgem.

Addressing problems when things go wrong

4.63. Vulnerable consumers may need help understanding their situation or to make complaints when things go wrong. Citizens Advice Extra Help Unit (EHU)[164] has a specialist team that investigates complaints on behalf of vulnerable domestic consumers, as well as microbusinesses that may require extra support. Domestic consumers reported reaching either a satisfactory or very satisfactory outcome in over 88% of the 12,056 complaints cases that the EHU closed in 2018, compared with 6,123 cases closed in 2017. The volume of complaints made by domestic consumers to the EHU increased substantially in 2018 compared to previous years, with the majority of complaints continuing to be about billing (42%) and debt/disconnections (22%). When

[163] If no person occupying the premises is able to read the meter and there isn't anyone else that the customer can nominate to read the meter on their behalf, the supplier will come out to read it.
[164] The Citizens Advice Extra Help Unit (EHU) is a GB wide service managed by Citizens Advice Scotland on behalf of the Citizens Advice Service. It has statutory powers and responsibilities which are outlined in section 12 and 13 of the CEAR Act (2007).

market share is taken into account, the number of cases referred to the EHU is disproportionately higher for some small and medium sized energy suppliers.

5. Decarbonisation of Energy

Summary of findings

- The UK is a global leader in emissions reduction and the electricity sector has been at the forefront of this progress. Greenhouse gas emissions from the electricity sector have fallen by more than half since 2012. However, progress in other sectors has been slow, and overall UK carbon emissions fell by only 12 million tonnes in 2018, the slowest rate of decline since 2012. This presents risks to the UK's strong record of fulfilling its decarbonisation obligations.

- Carbon dioxide emissions from electricity generation fell by 11% in 2018, driven by wind, solar and bioenergy as well as a reduced reliance on coal. The value for money of policies to support this transition varies widely. We estimate that the carbon price cost consumers around £31 for each tonne of carbon emissions avoided between 2010 and 2018, while small scale renewable subsidies cost consumers around £322.

- The decarbonisation of heat and transport are key to achieving carbon targets. Collectively, heat and transport now account for over 40% of the UK's total annual greenhouse gas emissions of 449 million tonnes of CO_2 equivalent, and progress in decarbonisation of these sectors has stalled.

Introduction

5.1. Dramatic cuts in annual global greenhouse gas emissions are required to limit temperature rises. The Climate Change Act (2008) requires the UK to reduce carbon emissions by at least 80 per cent of 1990 levels by 2050 and, in the 2016 Paris Agreement, the EU pledged to reduce its emissions by at least 40% below 1990 levels by 2030. The UK is a party in its own right to international climate change agreements and has signalled its intention to retain these commitments following its expected withdrawal from the EU.[165]

5.2. The Intergovernmental Panel on Climate Change (IPCC) has voiced serious concerns about the pace of change. It believes that the world is heading towards temperature rises of 3°C above pre-industrial levels and that policy makers need to consider more rapid and far-reaching measures to avert disaster.[166] This sense of urgency contributed to Parliament's decision to declare a 'climate change emergency' on 1 May 2019. In June 2019, the Government announced that it will target net zero emissions by 2050.

5.3. Ofgem plays a part in ensuring that the UK delivers its pledges on reducing emissions in the electricity and gas sectors. We have a duty to current and future consumers to protect their interests taken as a whole, including their interest in the reduction of greenhouse gases. As such, sustainability is an integral part of our medium-term strategy, which includes facilitating decarbonisation efforts to deliver a net zero economy at the lowest cost to consumers. We've committed to carrying out more direct decision making that will support the transition to a low carbon world, including efficiently administering renewable energy and energy efficiency schemes, and factoring environmental impacts into all of our significant regulatory decisions.

5.4. In this chapter, we examine:

- progress in reducing emissions;
- the extent to which reductions may be attributable to policies; and
- the cost-effectiveness of policies in reducing carbon emissions.

5.5. In this context, we consider the environmental benefits of reducing greenhouse gas emissions. We recognise that decarbonisation policies can contribute to greater

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[165] BEIS (2019). *Guidance: Meeting climate change requirements if there's no Brexit deal*. Available at: https://www.gov.uk/government/publications/meeting-climate-change-requirements-if-theres-no-brexit-deal/meeting-climate-change-requirements-if-theres-no-brexit-deal
[166] IPCC (2018). *SPECIAL REPORT: Global Warming of 1.5ºC*. Available at: https://www.ipcc.ch/sr15/

innovation, productivity and, by extension, economic growth, but these areas do not form part of the scope of this chapter.[167]

5.6. We also consider the challenges in meeting our commitments from 2023 onwards, as well as the potential role that different technologies can play in supporting the transition to a low carbon energy system.

5.7. We focus on 'production based' emissions from electricity and gas to avoid the risk of double counting that can arise if both 'production based' and 'consumption based' figures are used to calculate total emissions.[168] However, using only production-based figures can lead to an underestimation of the carbon impact of UK activity - production and consumption carbon emissions are both falling but consumption-related emissions are falling at a much lower rate. Increasing reliance on imported goods results in a shift to more carbon intense production processes and a relative increase in the emissions impact.

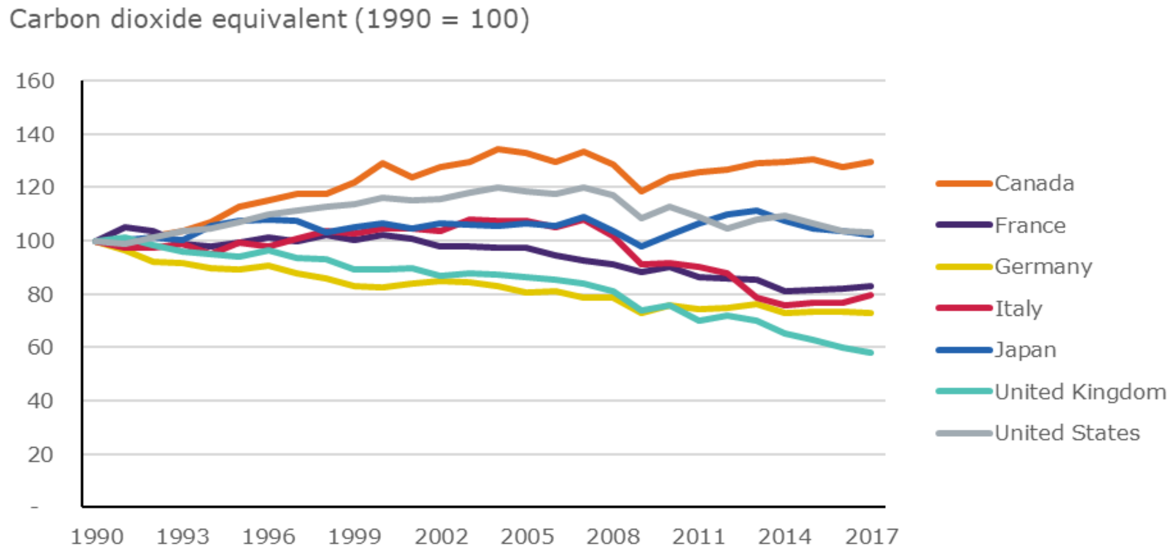
Progress in reducing emissions

The UK has performed better than other advanced economies

5.8. The UK has reduced its emissions of greenhouse gases at a greater rate than any other G7 country. This has been achieved principally by policies aimed at developing a lower carbon electricity generation mix, but also through reduced demand for energy across homes, businesses and industry. Figure 5.8 shows that UK emissions in 2017 were around 42% lower than they were in 1990.

[167] See discussion in: Frontier Economics (2019). *Carbon Policy and Economy-wide Productivity: A report for Energy Systems Catapult*. Available at: https://es.catapult.org.uk/wp-content/uploads/2019/04/2019-03-29-RDI-WP6-Report-FINAL.pdf
[168] 'Consumption based' estimates also consider the UK's trade in goods and services with the rest of the world and the emissions that are associated with their production. See Carbon Brief analysis for further discussion of this topic: https://www.carbonbrief.org/guest-post-the-uks-carbon-footprint-is-at-its-lowest-level-for-20-years

Figure 5.1: Total greenhouse gas emissions in G7 countries



Source: United Nations Framework Convention on Climate Change (2019). Greenhouse Gas Inventory Data - Detailed data by Party.

Note: This is total greenhouse gas emissions including LULUCF (Land Use, Land-Use Change and Forestry).

5.9. However, with global warming having reached 1°C in 2017, the IPCC is confident that global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. It states that any path to limiting global warming to less than 1.5°C will require significant emissions reductions before 2030, likely equating to a 40–50% reduction from 2010 levels.[169]

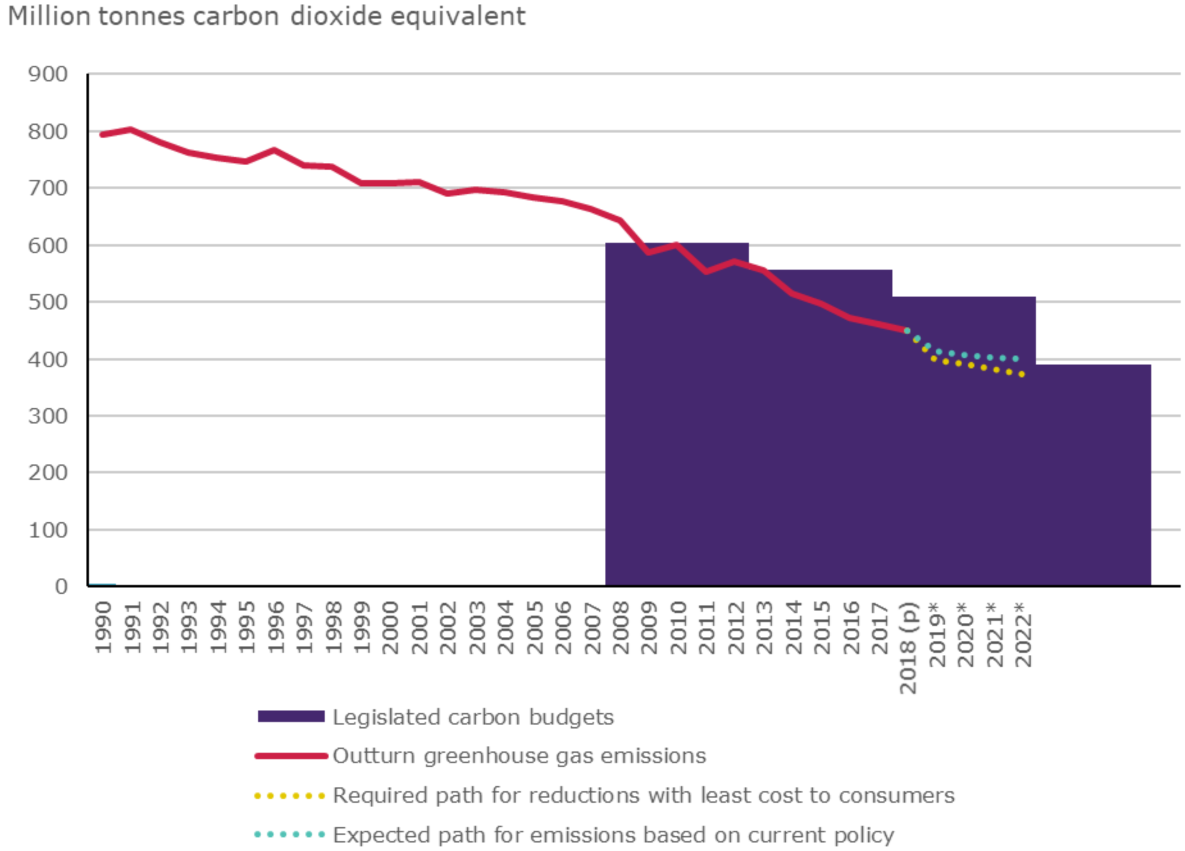
The UK is on course to meet carbon reduction targets to 2022 but risks remain

5.10. The government measures progress in reducing emissions using 'carbon budgets', which are a commitment to cap the amount of greenhouse gases the UK can emit over a five-year period. Between 2018 and 2022, the UK is committed to emitting no more than 2,544 million tonnes of carbon dioxide across all sectors of the economy. The Committee on Climate Change (the CCC) assesses that the UK is on track to outperform this target. In 2018, provisional figures from BEIS indicate that emissions fell by 2.5% and that the UK emitted approximately 152 million fewer tonnes of carbon dioxide equivalent than it did in 2010 (see Figure 5.2). However, the CCC has

[169] IPCC (2018). Global Warming of 1.5 ºC. Available at: https://www.ipcc.ch/sr15/.

previously projected that, based on current policy, the path for future emissions reduction is currently above the required trajectory.

Figure 5.2: Total greenhouse gas emissions, UK

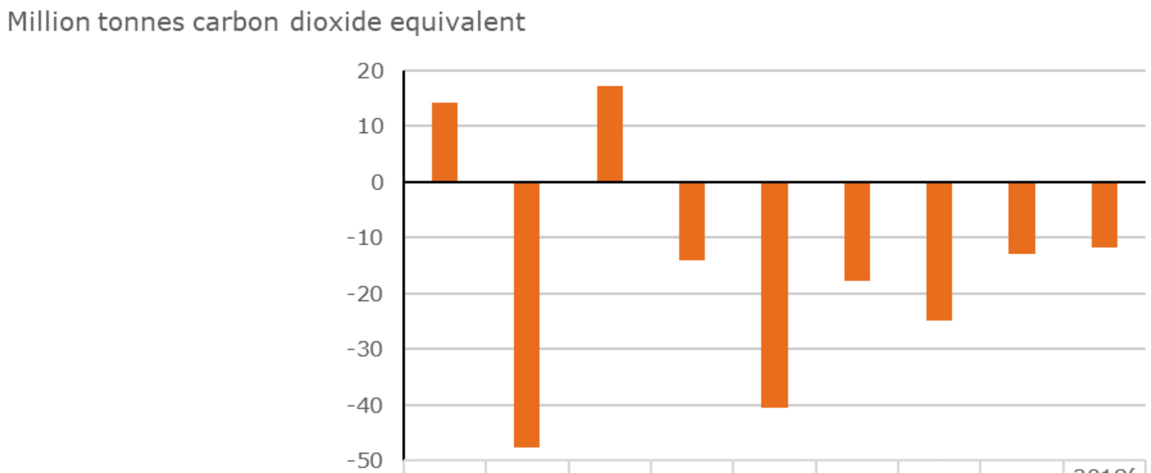


Sources: BEIS (2019). Final UK greenhouse gas emissions national statistics: 1990-2017; BEIS (2019). Provisional UK greenhouse gas emissions national statistics 2018; CCC (2018). Reducing UK emissions – 2018 Progress Report to Parliament.

Note: 2018 is a provisional estimate, while the values from 2019 onwards are forecasts. The dotted lines show estimates by the CCC.

5.11. Figure 5.3 shows that year-on-year reductions in emissions have fallen since 2016, reaching 12 million tonnes of CO_2 equivalent in 2018. This is the lowest reduction since 2012.

Figure 5.3: Change in year-on-year greenhouse gas emissions, UK



	2010	2011	2012	2013	2014	2015	2016	2017	2018(p)
Total greenhouse gas emissions	14	-48	17	-14	-41	-18	-25	-13	-12

Sources: BEIS (2019). Final UK greenhouse gas emissions national statistics: 1990-2017; BEIS (2019). Provisional UK greenhouse gas emissions national statistics 2018.

Note: 2018 is a provisional estimate.

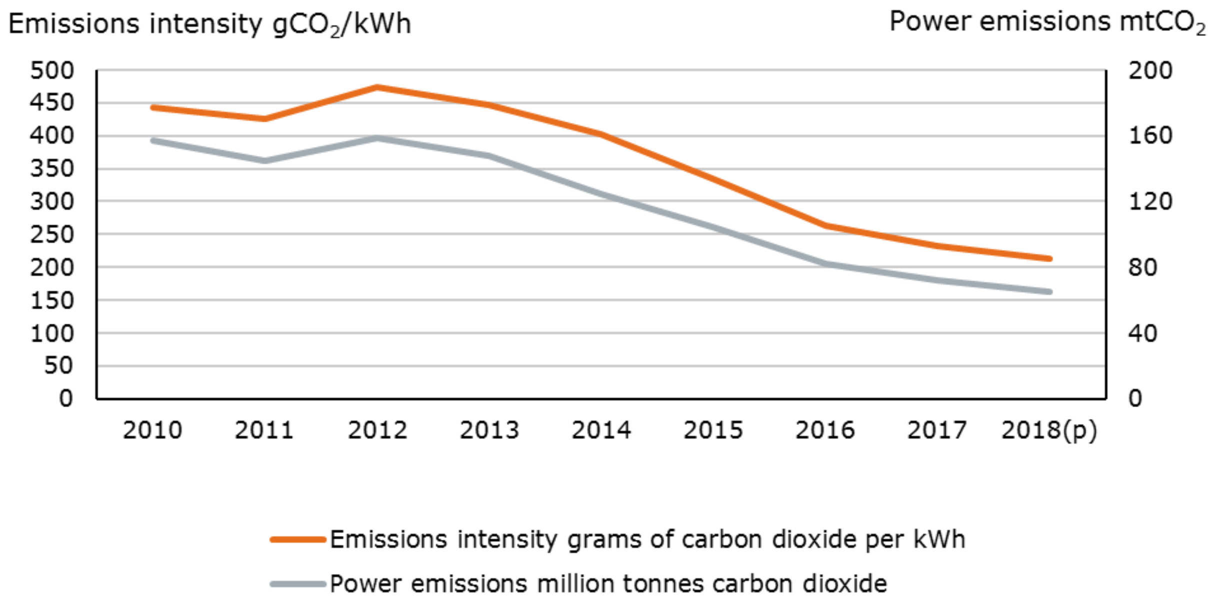
Reductions in emissions continue to be driven largely by low carbon intensive electricity generation

5.12. Looking at carbon dioxide emissions in particular, estimated emissions from electricity generation fell by 11%, from 72.4 million tonnes in 2017 to an estimated 65.2 million tonnes in 2018. Electricity therefore accounted for about 60% of total greenhouse gas emissions reductions achieved in 2018.[170] These reductions are largely driven by lower carbon intensity and to some extent by less generation; total electricity generation fell by 1.4% in 2018 and carbon intensity by 9%.

5.13. Figure 5.4 shows that there is a close correlation between the electricity grid's carbon intensity and emissions.

[170] BEIS (2019). Provisional UK greenhouse gas emissions national statistics 2018. Available at: https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2018.

Figure 5.4: Carbon intensity and electricity sector emissions, UK

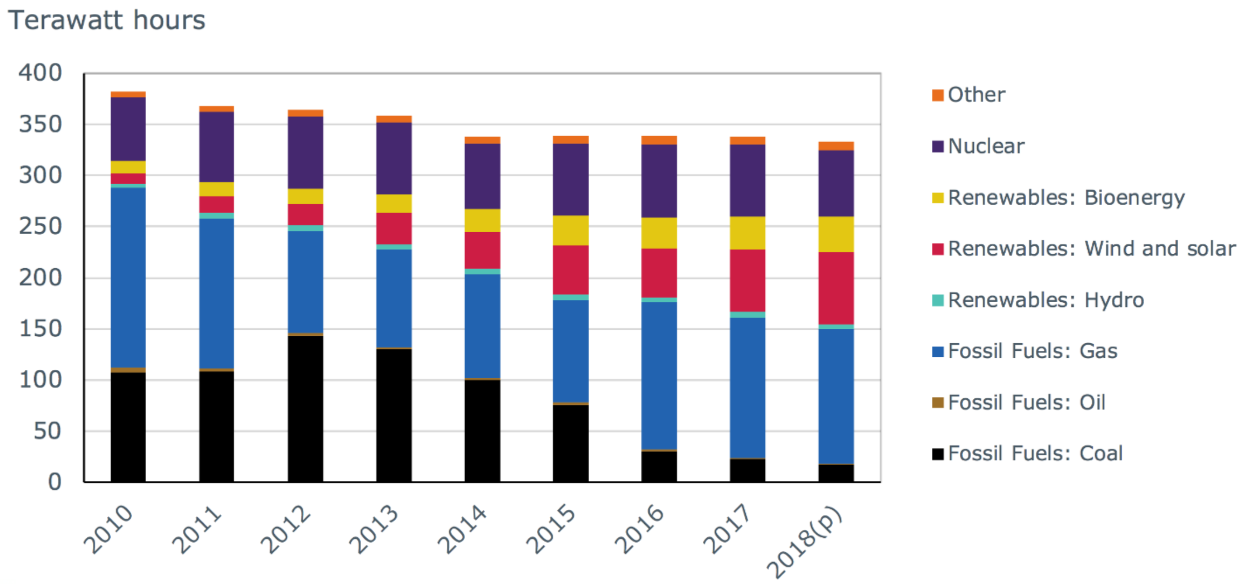


Sources: BEIS (2019). Energy Trends: electricity; BEIS (2019). Provisional UK greenhouse gas emissions national statistics 2018.

Note: 2018 is a provisional estimate. Losses incurred in transmission are excluded from the generation figures.

5.14. Falling carbon intensity can be attributed, in part, to the new record contribution of renewables, which accounted for 33% of all generation in 2018 – up from 29% in 2017 (see Figure 5.5). This was primarily driven by wind, solar and bioenergy. A reduced reliance on coal also contributed to the decline, with its share falling from 7% in 2017 to 5% in 2018 (there was little change in the shares of oil and gas). The government is committed to ending unabated coal generation in GB by 2025.

Figure 5.5: Electricity generation by technology type, UK



Source: BEIS (2019). Energy Trends: Electricity.

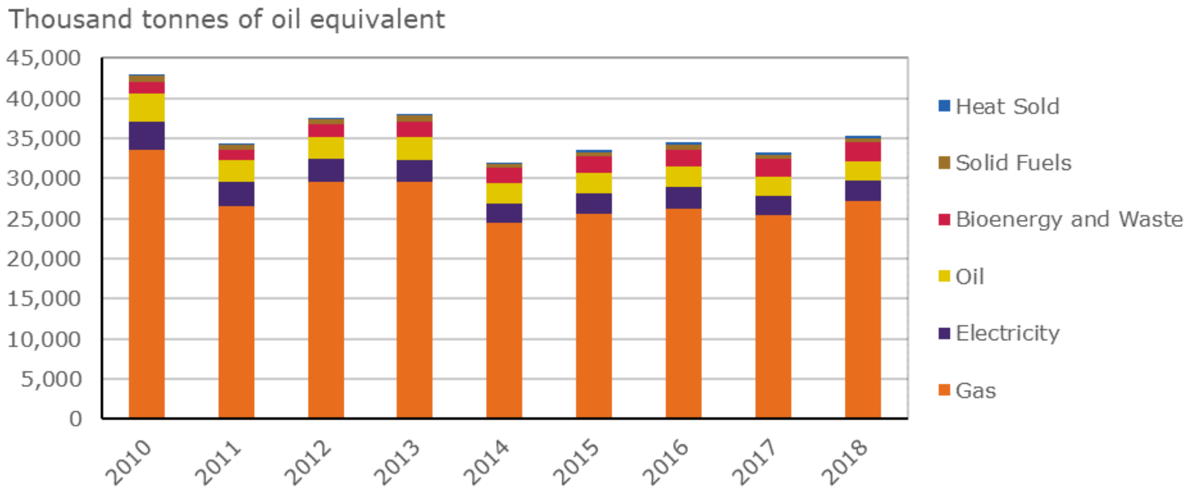
Note: 2018 is a provisional estimate. Other includes Pumped Storage and Other fuels.

Domestic heat consumption has also fallen

5.15. Figure 5.6 shows that domestic heat consumption has fallen by around a fifth since 2010, in part aided by the success of energy efficiency measures. However the progress made between 2010 and 2014 has slowed and levelled off in the last four years.

5.16. In the UK, gas continues to be the dominant fuel source for heating space and water, and for cooking, accounting for 77% of the total in 2018. This is only a small fall from 78% in 2010. There has been greater movement in some other categories, with the amount of bioenergy and waste used as a source for domestic heat consumption more than doubling from 3% in 2010 to 7% in 2018.

Figure 5.6: Domestic heat consumption by fuel type, UK



Source: National Statistics (2018). Energy consumption in the UK.

Note: The chart includes domestic energy consumption for space, water and cooking use only. Consumption for use of lighting and appliances is excluded.

5.17. The CCC reported that, despite the financial support that is provided by the Renewable Heat Incentive, take-up of renewable heat technologies, such as heat pumps, is still very low. It argued that a robust plan is needed to decarbonise buildings by 2050 in the Government's forthcoming 2020 Heat Roadmap.171 In the Spring Statement 2019 the Chancellor announced, in line with recommendations from the CCC, that the installation of gas heating systems in new homes would be banned from 2025.[172]

5.18. The National Infrastructure Commission points to the need for further trials of the use of hydrogen as a replacement for natural gas, measures to reduce the cost of installing heat pumps and a ramping up of investment in energy efficiency improvements in buildings. In our upcoming RIIO2 network price controls, we have signalled our intention to support further innovation in heat decarbonisation.

5.19. Heat networks, which are networks of insulated pipes that connect multiple buildings to a central energy source, can be an efficient and cost-effective means of reducing carbon emissions from heating in areas with sufficient population density. The

[171] The Committee on Climate Change (2019), "Net Zero: The UK's contribution to stopping global warming".
[172] See: https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

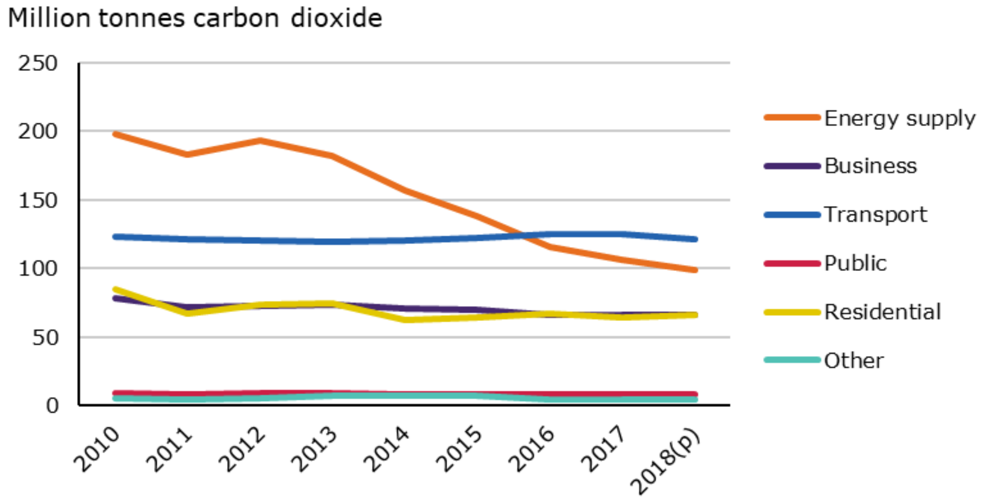
government is developing a market framework to encourage the growth of heat networks, which could include a role for Ofgem as the regulator of heat networks.

Progress in most sectors remains limited

5.20. The CCC said in its 2019 Progress Report to Parliament on reducing UK emissions that not enough has been done in agriculture, land use or waste.[173] These sectors make up a large part of the 'other' category in Figure 5.7, and their emissions continue to rise.

5.21. Emissions in the residential sector increased by 3% from 2017 to 2018. This increase can be mostly explained by the colder weather in Q1 2018 compared to Q1 2017. When this is accounted for, residential emissions decreased by 1.5%.[174]

Figure 5.7: Carbon dioxide emissions by sector, UK



Sources: BEIS (2019). Final UK greenhouse gas emissions national statistics: 1990-2017; BEIS (2019). Provisional UK greenhouse gas emissions national statistics 2018.

Note: 2018 is a provisional estimate. Other includes Agriculture, Industrial Process, Waste

[173] The CCC (2019). *Reducing UK emissions – 2019 Progress Report to Parliament*. Available at: https://www.theccc.org.uk/publication/reducing-uk-emissions-2019-progress-report-to-parliament/.

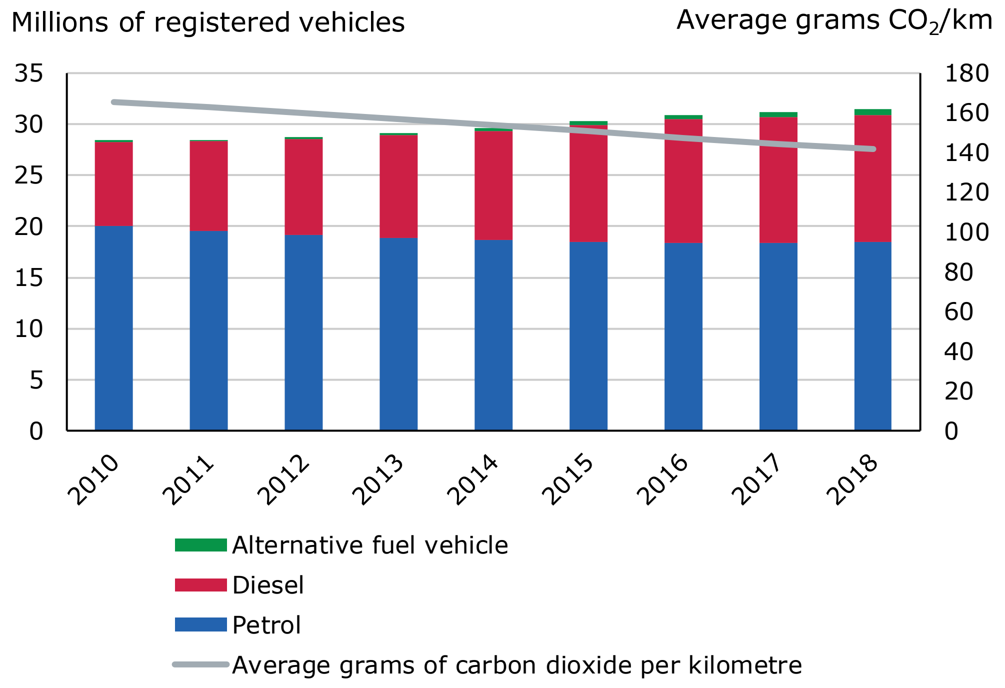
[174] BEIS (2019). *2018 UK greenhouse gas emissions: provisional figures - statistical release*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790626/2018-provisional-emissions-statistics-report.pdf

Management and Land use, land use change and forestry.

Transport sector is the highest single source of emissions but there has been a small reduction

5.22. The provisional estimates for 2018 indicate that emissions from transport were 121 million tonnes of carbon dioxide – a 3% fall from 125 million tonnes in the previous year. Road transport is the most significant source of emissions in this sector. Since 2010, the average grams of carbon dioxide emissions per kilometre travelled of licensed cars has fallen by 14%. This is mostly because of increased fuel efficiency of fossil-fuel powered vehicles, but it also reflects the increasing prevalence of alternative fuel vehicles which now account for 2% of the licensed cars on the road in GB (see Figure 5.8).[175]

Figure 5.8: Licensed cars at the end of the year, GB



Source: DfT (2019). Vehicle Licensing Statistics.

Note: Alternative fuel vehicles include Hybrid Electric, Plug-in Hybrid Electric, Battery Electric, Range-

[175] Alternative fuel vehicles are those that can be powered by a fuel source other than petrol or diesel fuel. These sources include hybrid electric, battery electric, gas, gas bi-fuel, and hydrogen / fuel cell electric.

Extended Electric, Fuel Cell Electric, Gas and Other.

5.23. The market share of electric vehicles in particular rose to 2.5% in the UK as a whole in 2018, which is a 35% increase from the previous year. Plug-in hybrid electric vehicles remain the most popular alternative-fuel vehicles.[176]

5.24. The CCC argues that the planned 2040 phase-out of new sales of petrol and diesel vehicles is not happening fast enough and that the government's Road to Zero Strategy needs to be underpinned by more detailed plans.[177] To support the roll out of electric vehicles Ofgem is developing reforms that will provide incentives for flexible charging, to reduce the need for expensive new power stations and extra grid capacity to be built. These measures, coupled with the ongoing improvements in battery performance, should facilitate a greater uptake of electric vehicles in the future.

Contribution of selected decarbonisation policies to carbon emission reduction

5.25. Building on the analysis in last year's report, we use LCP's EnVision model of the GB power sector to estimate the effect of selected decarbonisaion policies in terms of emissions saved in tonnes of carbon dioxide, cost (in 2016 prices) and value for money (cost per tonne of emission saved) from 2010 to 2018.[178]

5.26. The estimates are contingent on a range of assumptions and input data and whilst not definitive, they do provide broad estimates of the impact of these policies.

5.27. We use four cost metrics to compare each policy against observed outcomes from the period 2010 - 2018[179]:

- Policy cost: the direct transfer of funds by energy consumers or the government to pay for capital investment, subsides and other policies. This broad definition of

[176] The CCC (2019). *Reducing UK emissions – 2019 Progress Report to Parliament*.
[177] The CCC (2019). *Net Zero: The UK's contribution to stopping global warming*.
[178] This truncated timeline has a sizeable impact on the evaluated emissions savings and costs that are attributed to each policy.
[179] The metrics are in 2016 prices as in the 2018 report, to be able to make comparisons across the two years, and are the totals for the whole 2010-2018 period rather than per year values.

policy cost can be negative if the policy generates tax receipts that exceed the costs.

- Wholesale cost: the impact that a policy has on wholesale energy costs through price effects. For instance, the carbon price adds to wholesale costs whereas renewables policies could potentially lower wholesale costs by displacing more expensive fossil fuel generation.[180]

- Net consumer cost: the sum of the impact of policy cost and wholesale cost. This can be negative if a policy reduces wholesale electricity cost by more than the policy cost or if the net policy cost is negative. Here we use the term consumer to refer more broadly to both energy consumers and UK taxpayers together.

- System cost: the sum of resource costs including generation, balancing and network costs (but excluding the costs associated with carbon). This metric is neutral as to whether costs are incurred by consumers or producers, and instead focuses on the GB electricity market as a whole.

5.28. The primary cost metric that we use is the consumer cost metric as it helps us to understand the impact that the decarbonisation policies we focus on in this chapter have had on electricity bills. We also consider the system cost metric as this provides a view of the overall cost implications of each policy for the UK energy market. Table 5.1 below outlines the decarbonisation policies that we analyse. On the supply-side, the key ones are the carbon price, subsidies for renewables (large and small scale) and air quality Directives. These policies are designed to promote the use of cleaner sources of energy, whereas the selected demand-side policies, which typically involve more efficient or cleaner ways of using energy, are intended to reduce overall consumption of electricity and gas.

5.29. Any comparison of the cost-effectiveness of the different policies should take account of the following caveats:

- Several policies do not have decarbonisation as their sole or even central objective, e.g. small scale renewable schemes also aim to raise awareness of low carbon

[180] Note that balancing and network effects do not form part of the scope of this analysis.

technology and smart metering is designed to allow consumers to manage their energy use better.

- We look only at the effect of policies in 2010-2018. Where policies were in place before this, e.g. the first wave of CERT, we do not assess any sustained effect in 2010-2018. This means that we may understate the cost-effectiveness of demand-side policies as some measures were enacted prior to 2010.

- The policies that feature in our model account for around 39% of the total in-scope electricity energy savings that BEIS estimates for the period 2010-2018. However, other important initiatives, such as the products policy which delivered 23% of the total savings, are excluded from the analysis because of data availability.

- Renewables subsidies, including ROCs and CfDs, generate benefits over the lifetime of the generation asset (not just the lifetime of the policy itself) and by looking at a shorter time horizon we may underestimate the scale of emissions reduction.

Table 5.1: Selected decarbonisation policies in the electricity sector

Intervention	Policy [Years]	Description
Carbon price	**EU emissions trading system (ETS)** [2005-ongoing]	Taxes carbon through a limited number of tradeable permits
	Carbon Price Support (CPS) [2013-ongoing]	Tops up the carbon price as determined by the EU ETS
Large scale renewable subsidies	**Renewable Obligation Certificate (ROC)** [2002-2017]	Obliged electricity suppliers to source a proportion of the electricity they supply from renewable sources
	Levy Exemption Certificates (LECs) [2001-2015]	Granted a rebate to eligible renewable generators
	Contracts for difference (CfD) [2014-ongoing]	Provides low-carbon generators a fixed price, topping up the wholesale price when it is lower than the agreed price (clawing money back otherwise)
Small scale renewable subsidies	**Feed-in tariff (FiT)** [2010-2019]	Subsidises small-scale low-carbon electricity generators
Demand-side policies	**Carbon Emissions Reduction Target (CERT) Extension and +20%)** [2008-2012]	Required larger gas and electricity suppliers to achieve reductions in carbon emissions from domestic premises
	Energy Company Obligation (ECO) and Extension [2013-ongoing]	Obliged energy suppliers to deliver energy efficiency measures to domestic premises
	Renewable Heat Incentive (RHI) Domestic and Non-Domestic [2012-ongoing]	Subsidises low carbon heat sources
	Smart Metering Domestic and Commercial	Mandates suppliers to roll out electricity and gas smart meters to homes and small

Intervention	Policy [Years]	Description
	[2011-ongoing]	businesses
	Community Energy Saving Programme (CESP) [2009-2012]	Required gas and electricity suppliers / generators to deliver energy saving measures to domestic consumers in specific low income areas
Air quality Directives (regulations)	**Large Combustion Plants Directive (LCPD)** [2001-ongoing]	Aims to reduce emissions of acidifying pollutants, particles and ozone precursors
	Industrial Emissions Directive (IED) [2013-ongoing]	Assigns the cost of plant updates to the polluter

5.30. We used the EnVision model to simulate what we observed in dispatch, investment and retirement of generation plants since 2010, as well as the accompanying emissions and costs. We then re-ran the model to simulate 'counterfactuals' where key decarbonisation policies implemented from the start of 2010 are 'turned off'.[181] The change in cost and emissions allows us to assess the effect of policy.[182] The model accounts for the estimated marginal carbon intensity of imported electricity, assuming that this is provided by gas generation.

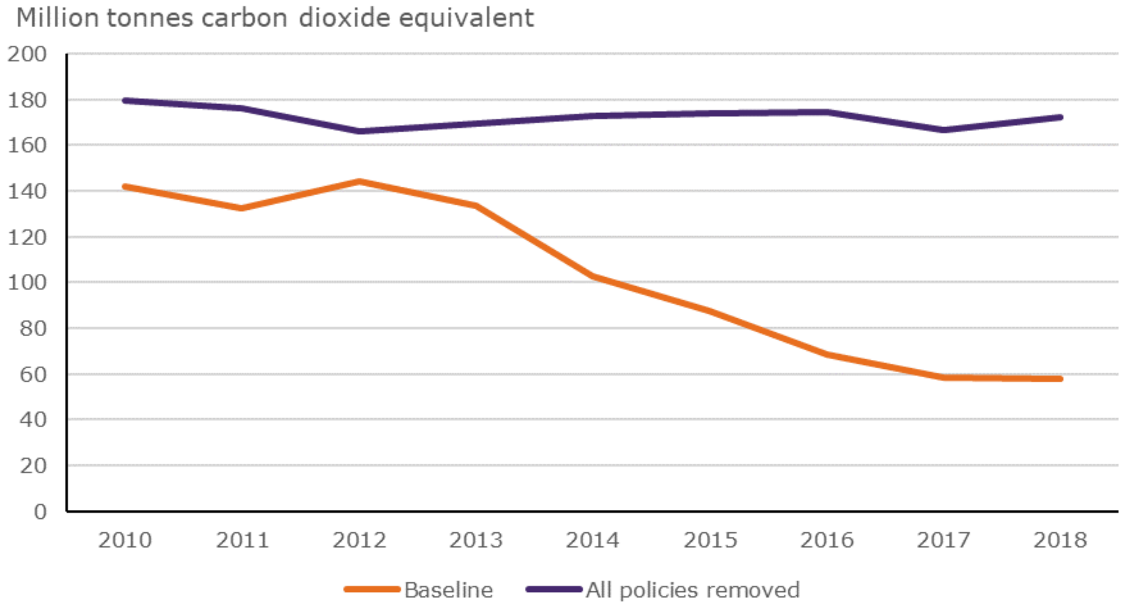
5.31. Ofgem validates Guarantees of Origin (GoOs) issued by other EU member states, which helps us to measure the emissions intensity of electricity imports. For example, in 2018, the share of imports from France increased to 62% of the total – up from 52% the previous year.[183] The carbon intensity of imports from France is around 53 grams per kilowatt hour compared to around 200g/kWh for UK generation.[184] This suggests that the level of emissions associated with interconnector imports is likely to have fallen.

[181] For example, for the ROC we only 'turn off' plants commissioned after 2010 – earlier plants still receive subsidies and are assumed to remain in place.
[182] We focus on policy effects at the GB level. Before recent reforms, interactions with the EU ETS coulc change the impact of national policy on global carbon emissions.
[183] National Statistics (2019). Energy Trends: electricity. Table 5.6 Imports, exports and transfers of electricity. Available at: https://www.gov.uk/government/statistics/electricity-section-5-energy-trends.
[184] Staffell, I. (2017). *Measuring the progress and impacts of decarbonising British electricity*. Energy Policy, Vol. 102, Pages 463-475. Available at: https://www.sciencedirect.com/science/article/pii/S0301421516307017.

The carbon price and renewable subsidies have been the main drivers of emissions reductions in electricity

5.32. Between 2010 and 2018, without key decarbonisation policies, we estimate that the GB electricity sector would have emitted 624 million tonnes of carbon dioxide more than it actually did (see figure 5.9), about 69 million tonnes each year on average.

Figure 5.9: Simulated electricity sector baseline emissions compared with emissions in the absence of selected decarbonisation policies

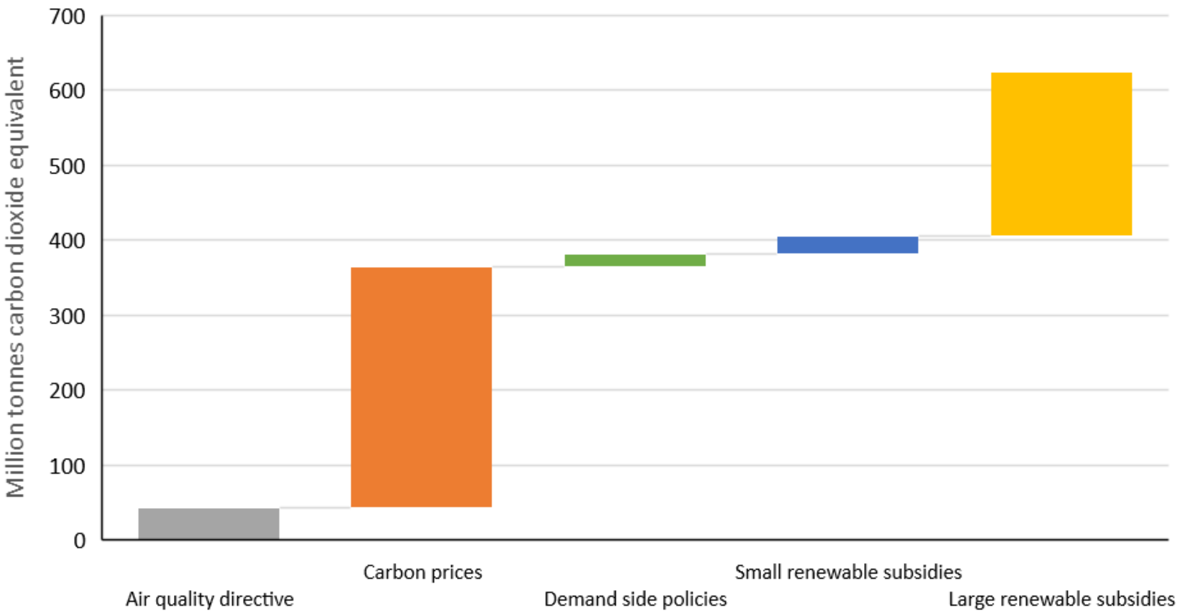


Source: LCP and Ofgem analysis.

Note: The baseline is the actual scenario, in which all of the policies are in place.

5.33. We estimate that the most important policies in driving emissions reduction were carbon prices (see Figure 5.10), with large-scale renewables subsidies being the next most significant contributor. The combined effect of all the policies is nearly 15% greater than the sum of individual policy contributions, with the model suggesting that there are ‘synergies’ that augment the effect of each individual policy when they work in tandem.

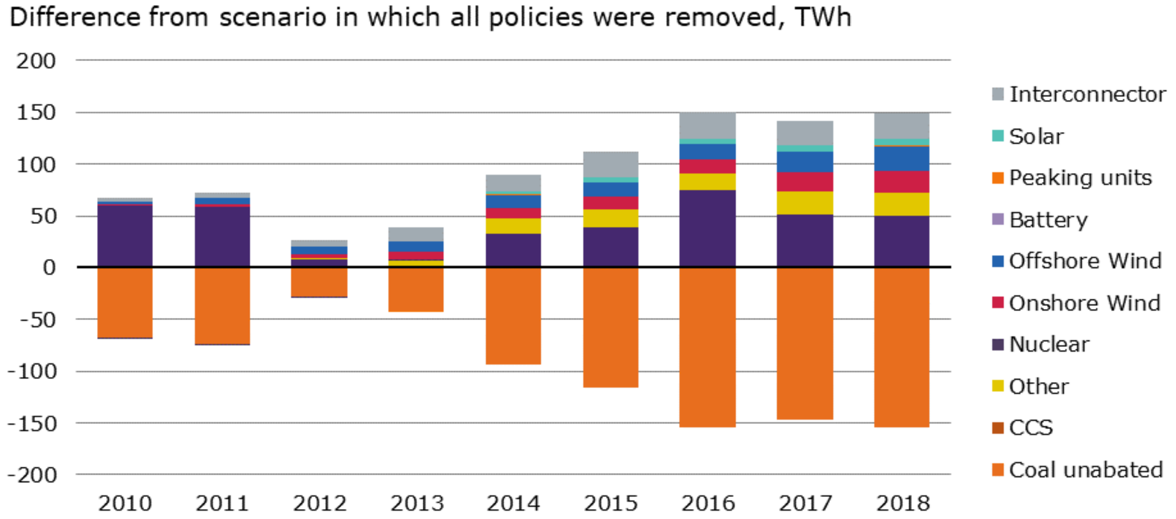
Figure 5.10: Estimated emissions reductions by selected electricity decarbonisation policy, 2010-2018



Source: LCP and Ofgem analysis.

5.34. The results suggest policies have driven these emissions reductions by removing unabated coal and replacing it with lower-carbon-content generation, such as gas (CCGT) and carbon-free generation, including wind. Figure 5.11 shows that the level of reduction in coal generation collapsed in 2012 as the carbon price did likewise, but picked up with introduction of the CPS. The removal of coal stimulated an increase in gas, wind and solar generation amongst others. While the carbon price is substantially responsible for the switch to gas, renewable subsidies aided the movement to low carbon generation.

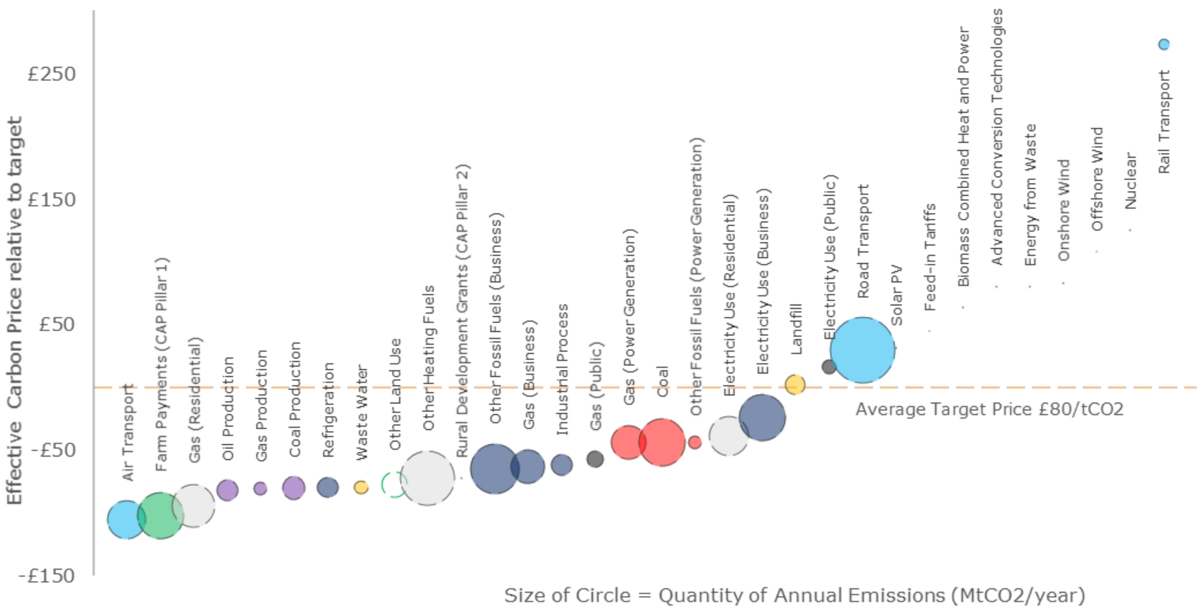
Figure 5.11: Estimated change in share of electricity generation mix due to selected decarbonisation policies



Source: LCP and Ofgem analysis.

Note: This refers to the combination of clean air Directives, carbon prices, demand-side policies, small renewables subsidies and large renewables subsidies.

Figure 5.12: Effective Carbon Price and emissions in the UK by sector



Source: Energy Systems Catapult (2019). Rethinking Decarbonisation Incentives: Future Carbon Policy for Clean Growth.

Note: Negative effective carbon prices relative to target imply that the estimated effective carbon price was below £80. Positive figures imply that the estimated carbon price was above £80.

5.35. Figure 5.12 shows estimates of the effective carbon price for various activities in sectors across the UK. The effective carbon price is a measure of the incentive to decarbonise in different sectors as a result of the UK's current energy policy mix. The Energy Systems Catapult describes it as: 'how much a firm or an individual is paid or rewarded per tonne of carbon (or CO_2e) saved when they make a choice that lowers emissions'.[185]

5.36. Figure 5.12 demonstrates the difference between the calculated effective carbon price and the average carbon price for 2030 used by BEIS for public policy appraisal, around £80 per tonne of CO_2 equivalent.[186] There is substantial inconsistency in the incentives applied to significant sources of carbon emissions. Activities on the left-hand side of the figure, such as air transport, farm payments and residential gas (cumulatively accounting for 27% of emissions), either receive subsidies that are linked to their carbon emissions or face very low effective carbon prices. Conversely, the Energy Systems Catapult estimates that both road and rail transport, along with several low-carbon sources of electricity generation, face effective carbon prices in excess of £80 per tonne of emissions.

The policies we assessed have added an average of £42 per year to a typical household electricity bill

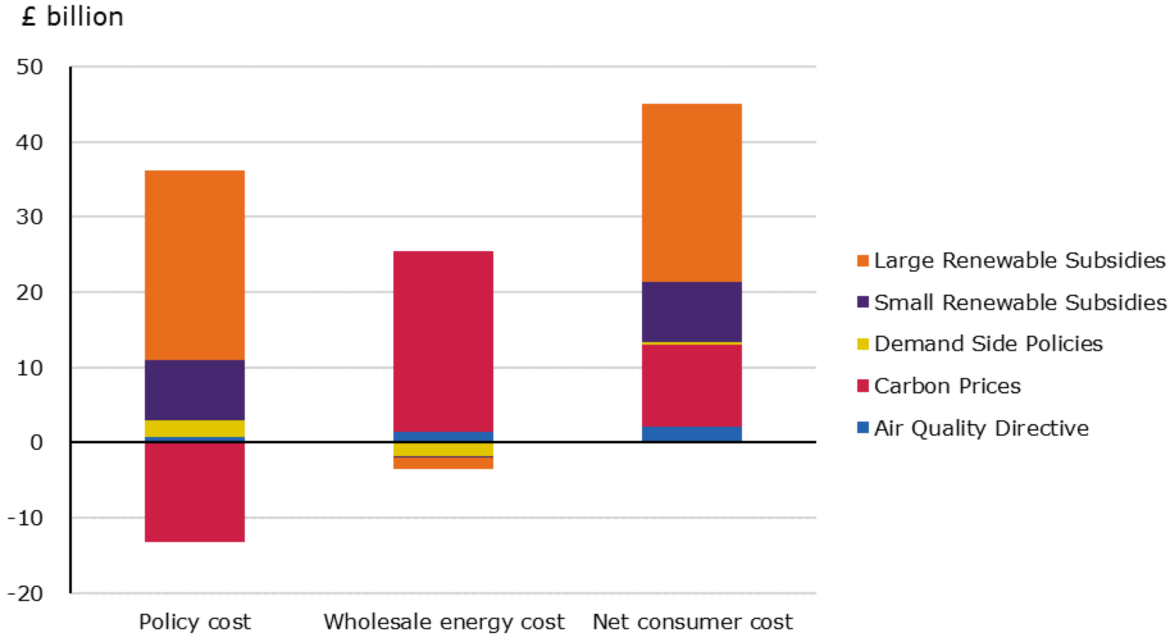
5.37. LCP and Ofgem analysis shows that over 2010-2018 the estimated net consumer cost (affecting both energy consumers and UK taxpayers as a whole) is around £41 billion for electricity (£8 billion more than in 2017).

5.38. Tax receipts from the carbon price (shown as a negative policy cost in the first column of Figure 5.13) substantially diminished its overall cost. However, the effect of renewable subsidies on lowering wholesale energy costs has been modest so far.[187] Demand side policies also led to considerable wholesale energy savings, but these did not fully offset the policy costs and, as such, a net consumer cost can be attributed to these policies.

[185] https://es.catapult.org.uk/impact/projects/rethinking-decarbonisation-incentives/
[186] The price used is the 2030, central carbon target price (£80.83/tCO2e) - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794186/2018-short-term-traded-carbon-values-for-appraisal-purposes.pdf

[187] The VAT implications of reduced energy consumption have not been modelled.

Figure 5.13: Estimated annualised consumer cost (2016 prices) of selected decarbonisation policies in electricity sector, 2010-2018



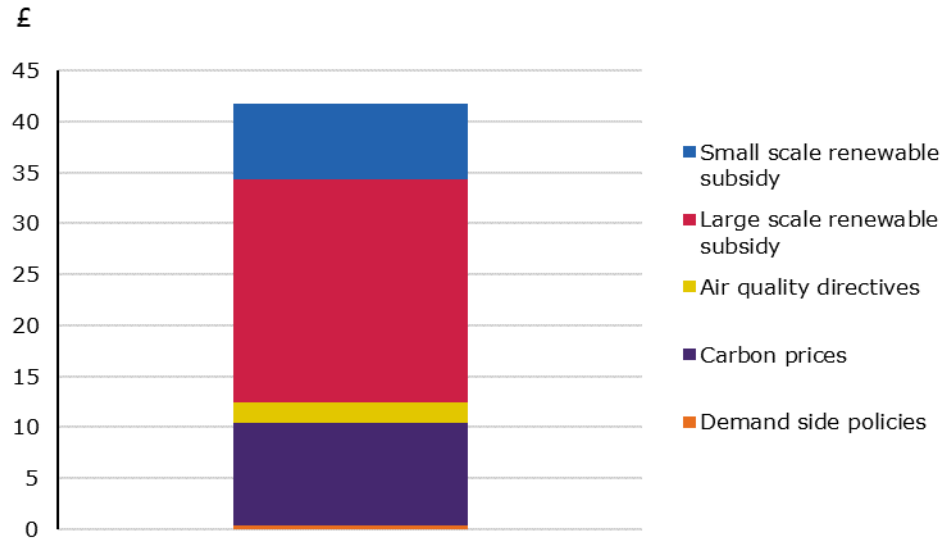
Source: LCP and Ofgem analysis.

Note: Cost figures give estimates of the contribution to overall costs made by each policy, treated as independent from all the others. Because of interactions between policies, the sum of the estimates of net consumer costs is somewhat higher than the £41 billion consumer cost figure reported above.

5.39. The annual bill, for the typical household, of the selected decarbonisation policies is around £42 per year for electricity (an extra £5 since 2017). The figure is £56 when tax receipts from the carbon price policies are taken out. These findings differ from our analysis of the large six suppliers' Consolidated Segmental Statements (CSS),[188] which suggests that all policies added around £134 to a typical dual fuel household bill in 2018. This reflects different methodological approaches (for instance, we net off impacts on wholesale prices) and a different range of policies covered.

[188] The large vertically integrated energy companies are required to publish CSS, which are annual statements segmenting the financial results of their supply and generation activities. They can be found here: https://www.ofgem.gov.uk/publications-and-updates/energy-companies-consolidated-segmental-statements-css.

Figure 5.14: Estimated effect on typical annual electricity household bill of key decarbonisation policies, 2010-2018



Source: LCP and Ofgem analysis.

Demand-side policies are particularly cost-effective in reducing carbon emissions

5.40. The cost of each policy in reducing a tonne of carbon dioxide emissions can be assessed against the non-traded carbon value, which averaged around £63 per tonne of carbon emitted over the period 2010-2018.[189] Policies that drive a unit reduction in emissions at less than this price can be considered good value for money. Our analysis does not take into consideration that:

- The cost of unaddressed climate change is projected to rise significantly over time, so policies that have sustained effects beyond the scope of our analysis would see an increase in their value for money over time.
- Investment in new technologies can result in spill-over effects that improve their cost-effectiveness over time.

[189] See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/666406/Data_tables_1-19_supporting_the_toolkit_and_the_guidance_2017.xlsx

Consumer cost

5.41. The net cost to the consumer per tonne of carbon dioxide emissions saved over 2010-2018 varies substantially by selected decarbonisation policy in the electricity sector:

- Demand-side policies as a group cost around £21 per tonne of carbon dioxide saved, based on BEIS estimates of their impacts.[190] The estimate over 2010-2017 was higher at £30. The fall is unsurprising, as for the energy efficiency installations that come under demand-side policies, total emissions savings increase over their lifetime while their biggest cost component remains the initial installation cost.

- In last year's analysis carbon price policies were estimated to cost around £27 per tonne of carbon dioxide saved, and were the most cost-effective. This year we find that, per tonne of carbon dioxide saved, the carbon price policies cost around £31. The positive contribution of the carbon price aligns with expectations from economic theory and global analysis of policies by, for instance, the OECD.[191] This has been supported by recent increases in the traded price of carbon (see case study). However, given that there is limited coal now left on the system, it may be that the cost-effectiveness of the carbon price diminishes over time.

- Small scale renewable subsidies (or FiTs) are estimated to cost around £322 per tonne of carbon dioxide saved, which is an increase from last year's estimate of £315 over 2010-2017.

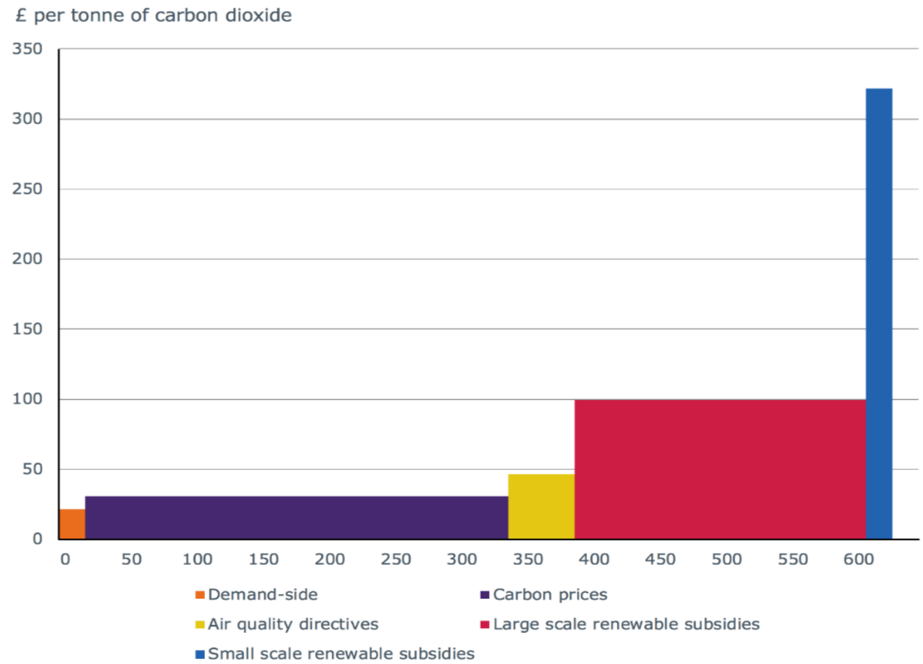
- Air quality Directives have a cost estimate of £46 per tonne, nearly the same as the £47 estimated last year.

- Subsidies to large scale renewables cost about £99, a slight fall from the estimate of £101 that came out of last year's analysis.

[190] Costs are annualised (over twenty years) in order to assist comparison with policies such as large-scale renewable subsidies. We apportion costs of policies in non-electricity sectors according to the portion of carbon dioxide savings attributed to non-electricity sectors.
[191] OECD (2013). Effective Carbon Prices.

- Combined, we estimate that the policies cost around £64 per tonne of carbon dioxide saved, slightly above the non-traded carbon value.

Figure 5.15: Average net consumer cost (2016 prices) of policies per tonne of carbon dioxide saved, 2010-2018



Source: LCP and Ofgem analysis.

System cost

5.42. The system cost metric measures the change in the costs of constructing and operating the power system that arises from incorporating a given quantity of a new generation technology. This allows for a more robust comparison of the cost of different policies that accounts for when, where and how electricity is generated.

5.43. Using the system cost metric we find that:

1. Carbon prices delivered substantial emissions reductions at a cost of around £13 per tonne, which is the same as last year's estimate for the period 2010-2017.

2. Large scale renewables subsidies achieve reductions at around £127 per tonne (close to the £124 value from last year).

3. Demand-side policies achieve reductions at a cost of around £47 per tonne, which is noticeably lower than the estimate of £68 for 2010-2017.

4. Air quality Directives are once again the best value for money in terms of system costs. They have an estimated saving of £12 - even higher than the £6 per tonne estimated last year.[192]

5. FiTs are still the most expensive. The scheme is now estimated to cost around £171 per tonne, an increase from £162 last year, with the lower cost compared to the consumer metric reflecting a significant transfer to generators.

6. The combination of all policies over 2010-2018 saved a tonne of carbon dioxide at a system cost of roughly £55, which is less than the non-traded carbon value.

5.44. Our analysis focuses on the effects of decarbonisation policies on greenhouse gas emissions in electricity generation. However, these policies have also contributed to lower emissions from gas and other sources of energy. Further details of these effects can be found in the latest energy and emissions projections from BEIS.[193]

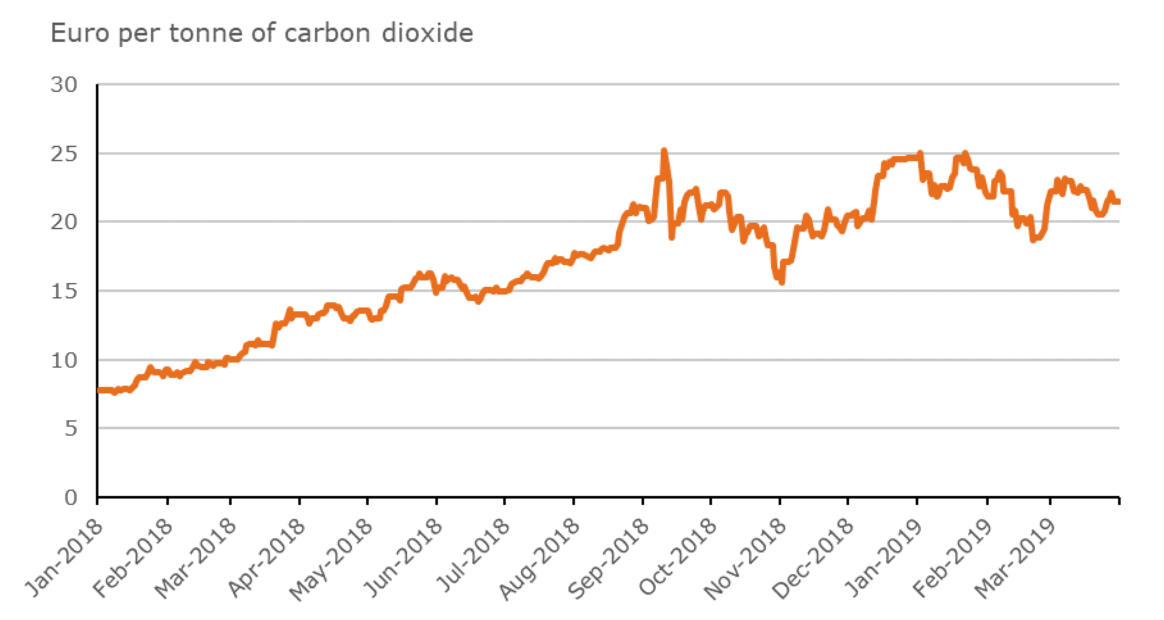
[192] This saving mostly arises due to avoided operational expenditure costs incurred by out of merit coal plants in later years. Our analysis draws on estimates from BEIS, see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/65919/6483-running-hours-lcpd-et-article-sep-2012.pdf

[193] BEIS (2019). *Updated energy and emissions projections 2018*. Available at: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018

Case Study: rising carbon prices incentivise shift to low-carbon energy

The EU ETS sets a 'cap' or limit on the total greenhouse gas emissions allowed by all participants covered by the system, which is then reflected in the level of tradable emission allowances. Participants in the scheme, which include power stations and industrial plants in the UK, have the option to purchase additional allowances if they exceed their limit.

The chart below shows that the price of these allowances has nearly trebled in the last 15 months. This surge has been driven by several factors, including the implementation of the Market Stability Reserve on 1 January 2019, which will hold back 24 percent of the outstanding cumulative surplus of allowances each year between 2019 and 2023.Price of EU ETS greenhouse gas emissions allowance



Source: Aurora

The government is consulting on the future design of the carbon pricing scheme, after EU exit. Its preferred option is to link the UK ETS with the EU ETS with many aspects remaining as they are.[194]

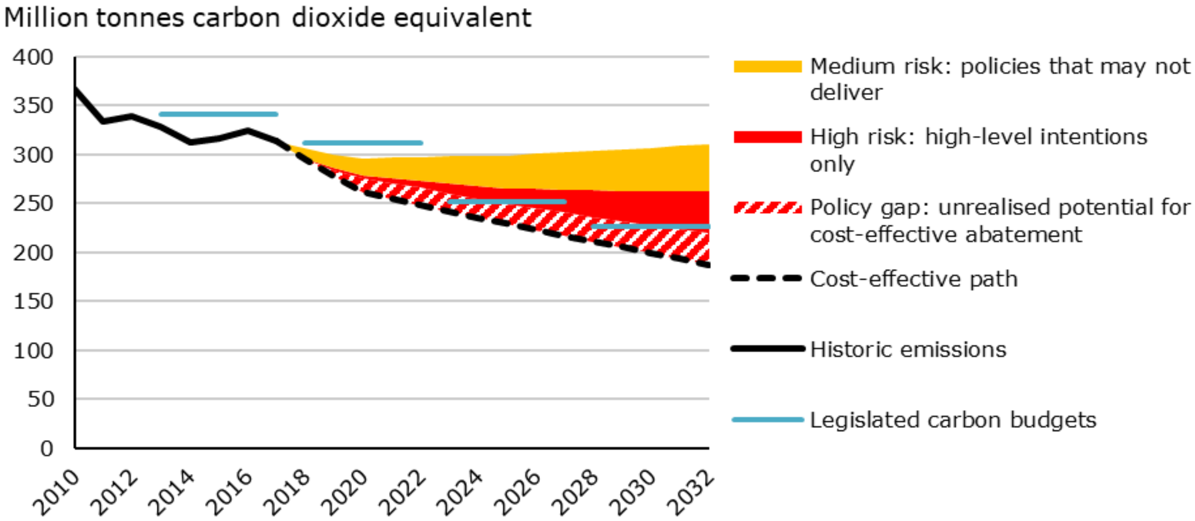
[194] BEIS (2019). The future of UK carbon pricing. Available at:

Meeting the challenge of future carbon targets

The UK is not on track to meet its decarbonisation commitments from 2023 but there are reasons to be optimistic

5.45. The CCC estimates that the UK is not on course to meet its legally binding carbon budgets from 2023 onwards (see Figure 5.16, from the CCC's 2018 report). It further states that the government's Clean Growth Strategy, whilst a step in the right direction, requires more detailed policy if it is to close the gap in meeting the UK's existing carbon budgets.

Figure 5.16: Delivery of policies to meet the fourth and fifth carbon budgets



Source: The CCC (2018). Reducing UK emissions – 2018 Progress Report to Parliament.

5.46. However, the CCC recommended that it was feasible, cost-effective and, indeed, necessary for the UK to set a 'net-zero' target for greenhouse gas emissions by 2050.[195] The government accepted this recommendation, and introduced legislation to implement the net zero target, which came into force in June 2019. Figure 5.17 shows how much more ambitious the net zero target is than the 80% reduction target that

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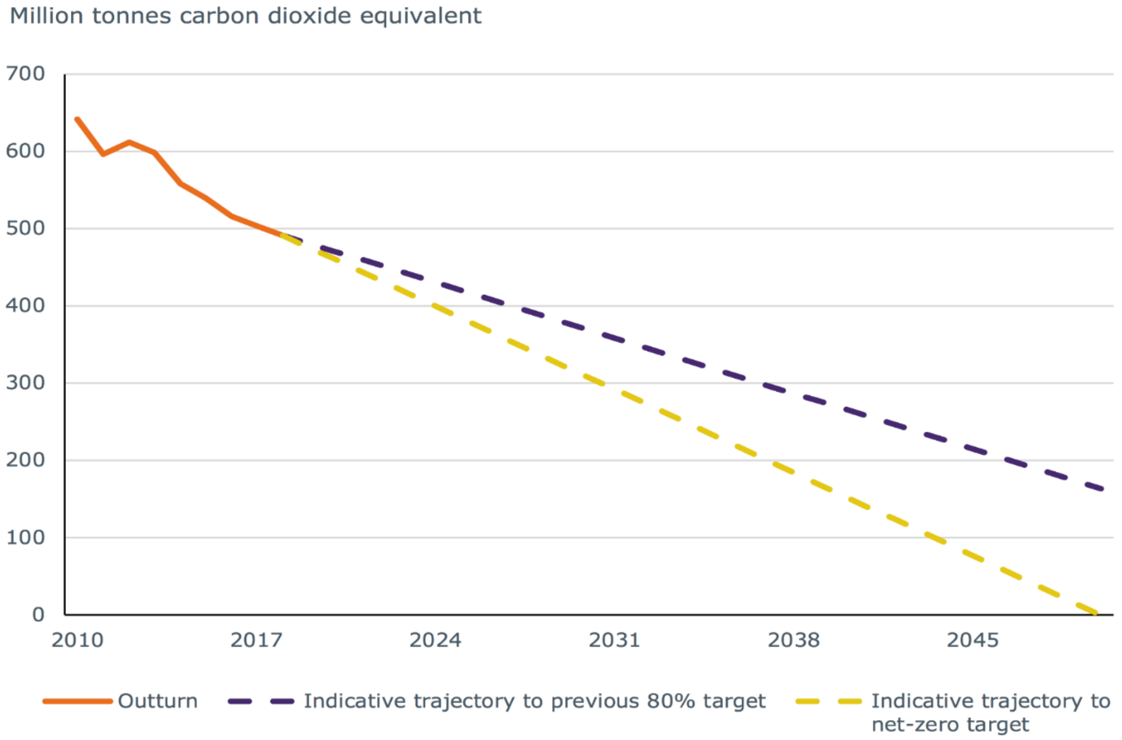
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/799573/THE_FUTURE_OF_UK_CARBON_PRICING.pdf

[195] The Committee on Climate Change (2019), "Net Zero: The UK's contribution to stopping global warming".

was in place previously, assuming an immediate policy shift (the later the shift, the steeper the net zero trajectory will become). A smooth path to the net zero target would require total UK greenhouse gas emissions (including from international aviation and shipping) to fall to 307 MtCO2e by 2030 (368 MtCO2e under the 80% target) and 154 MtCO2e by 2040 (266 MtCO2e under the 80% target).

Figure 5.17: Indicative rates of decarbonisation required to achieve 80% and 100% reductions by 2050



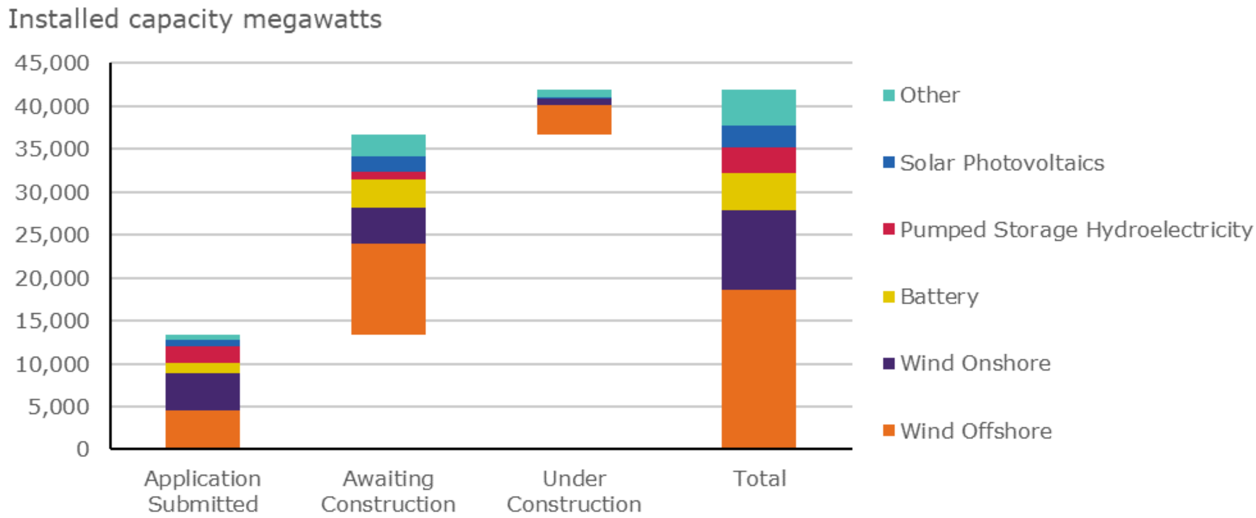
Source: The CCC (2019). Reducing UK emissions – 2019 Progress Report to Parliament.

5.47. Moving beyond the CCC’s position, our research on flexibility agrees that a significant proportion of the assets required to transition to a more flexible responsive electricity system are already connected to the grid. However, to unlock the benefits from these assets, the system requires the development of enabling technologies and platforms. For example, flexibility platforms, which are IT platforms that could enable the trading of flexibility services while providing the systems for managing the prioritisation of constraint management and resolving conflicts between users, are not in place and need to be developed. Our research sets out how they would benefit from cross-industry development and agreement of principles, to set common standards and methods to promote interoperability, reduce barriers to entry and lower costs.[196]

Meeting carbon budget commitments from 2023 will require more investment in low carbon generation

5.48. The National Infrastructure Commission (NIC) recommends that government should establish a pipeline of 'established' technologies such as onshore wind and solar for Contracts for Difference auctions to allow the system to deliver at least 50 per cent renewable generation by 2030. This would be equivalent to 12-19 GW of offshore wind, additional to the deployment already being planned.[197] BEIS's energy planning database provides some insight into the pipeline of planned investment in renewable generation capacity (see Figure 5.18). Whilst many projects are planned, especially in wind generation, only 12% of these are under construction.

Figure 5.18: Planned investment in renewable electricity capacity, UK



Source: BEIS (2019). Renewable Energy Planning Database.

5.49. Key renewable technologies have achieved substantial cost reductions in recent years, in part aided by the success of subsidy-driven deployment and auctions of long-

[196] www.ofgem.gov.uk/publications-and-updates/ofgem-s-future-insights-paper-6-flexibility-platforms-electricity-markets
[197] National Infrastructure Commission (2018). *National Infrastructure Assessment*. Available at: https://www.nic.org.uk/assessment/national-infrastructure-assessment/

term contracts. The June-August 2019 CfD allocation round resulted in further reductions in expected costs. The winning bidders, for projects set to start operating in 2023/24 or 2024/25, committed to provide power at strike prices of £39.65 (2023/24 projects) and £41.61 (2024/25 projects). These prices compare to strike prices in the previous auction round of £74.75 (2021/22 projects) and £57.50 (2022/23 projects), and are below average wholesale prices in 2018/19.[198] The successful bidders were six offshore wind, four remote island wind, and two advanced conversion technology projects. They are expected to provide more than 5.8 GW of generation capacity in total.

[198] Auction strike prices are in 2012 prices (the average 2018/19 wholesale electricity price was around £49 in 2012 prices). See https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-3-results.

6. Security of Great Britain's energy supply

Summary of findings

- GB continues to benefit from secure energy supplies. There were no periods of unmet gas or electricity demand in 2018/19, and the suspension of the Capacity Market in November 2018 had little appreciable impact on electricity margins. However, the shifting demands of a system in transition are leading to new challenges around security of supply, and the costs of balancing the electricity system have risen over time. System balancing costs were around £1.19 billion in 2018-19, their second-highest level ever (behind £1.21 billion in 2016-17).

- A diverse range of gas supplies helps to keep the GB system flexible and resilient. The GB system draws from a diverse range of gas supply sources, particularly from the North Sea, Norway, continental Europe and liquefied natural gas (LNG) imports. This diversity can help to make the system more flexible and resilient to infrastructure or supply shocks. In April 2019, LNG imports reached their highest monthly level since April 2011, meaning that GB gas prices are now relatively sensitive to global LNG price changes.

- On 9 August 2019, 1.1 million electricity customers were disconnected following a lightning strike on a transmission circuit and the loss of two transmission-connected generators. Ofgem is investigating the circumstances which contributed to the power cut and the Electricity System Operator published a technical report on these events at the start of September. We expect to outline the causes of this power outage in next year's report.

Introduction

6.1. Security of supply is one of the pillars of government energy policy and forms one of Ofgem's five strategic consumer outcomes; it brings benefits to consumers, the economy and to wider society. By delivering sufficient gas or electricity to meet demand, the energy market provides consumers and business with confidence they can get heat and power when they require it. Since liberalisation, GB has had secure energy supplies with no gas deficit emergencies or significant deficits in electricity supply.

6.2. Ofgem helps secure GB's energy supplies by ensuring that gas and electricity markets work properly to reduce or eliminate any barriers that stop the market functioning effectively, and to regulate and incentivise the gas and electricity System Operator – National Grid – to balance supply and demand. We work alongside the UK and national governments, who set the long-term direction for energy policy. The government also has specific roles in areas such as determining levels of capacity to be purchased in the Capacity Market (CM).

6.3. In this chapter, we review the security of supply for gas and electricity in Great Britain. In addition, we look at the impact of the increase in LNG on the gas system and the impact that the suspension of the CM has had on the electricity system. We do not assess the outage on 9 August 2019, which we expect to examine in next year's report.

Security of Great Britain's gas supply

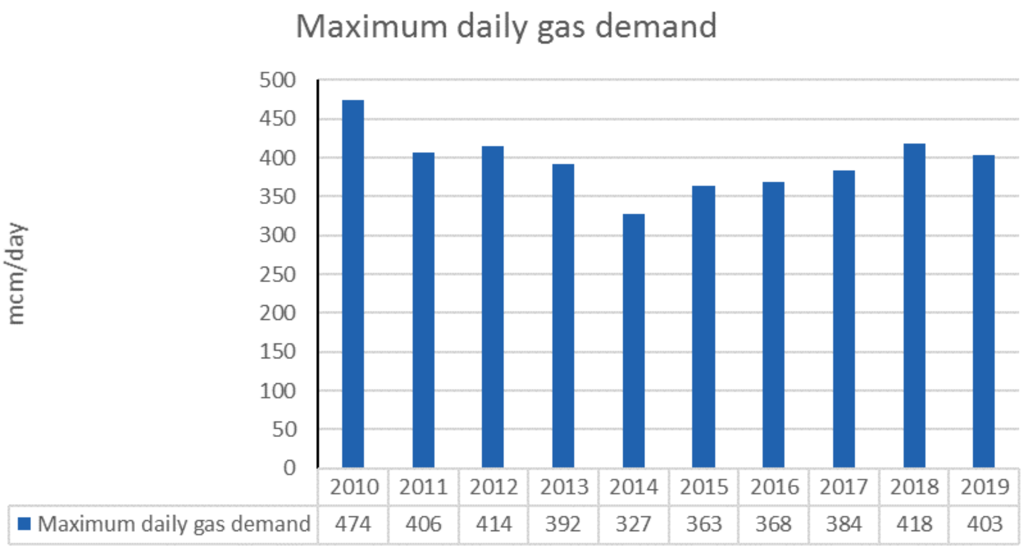
Gas demand

Gas demand has fallen and is expected to continue to fall

6.4. Winter 2018/19 was the fifth warmest winter experienced in GB in the past 59 years. These milder temperatures meant that aggregate gas demand in winter 2018/19 was slightly lower than winter 2017/18 and below seasonal norm.[199] Maximum demand during winter 2018/19 was 403 mcm/day compared to 418 mcm/day during winter 2017/18 (Figure 6.1). However, it was not as low as forecast by the Electricity System Operator (ESO).

[199] See weather data: http://www.metoffice.gov.uk/weather/uk

Figure 6.1: Gas Demand for the highest day (million cubic meters/day)



Source: National Grid data item explorer.[200]

6.5. This divergence from forecast was mostly due to higher demand for gas for electricity generation than anticipated. Actual gas used for electricity generation was 12.4 billion cubic metres in winter 2018/19.[201] Although the growth in renewables reduced overall gas demand for electricity generation, gas prices were still lower than expected and resulted in a significant increase in gas-fired generation compared to coal.[202] This contributed to winter 2018/19 having the highest ever single day for gas demand from electricity generation (97.2 mcm).[203]

6.6. The variable demand for gas for electricity generation is one of the factors that are creating new challenges for the system operator in managing linepack.[204] The ESO said

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[200] Gas Demand figure for 2019 includes only the first quarter of 2019.

[201] See the ESO's Winter Review 2019: https://www.nationalgrideso.com/document/145396/download and https://www.nationalgridgas.com/document/116546/download

[202] Gas demand for electricity generation is highly sensitive to spark spreads. The increase in coal plant variable costs this year has been driven by carbon (coal being more carbon intensive). The Carbon Price Support (CPS) of £18/tCO2 means it is relatively more expensive to generate with coal rather than gas. For information on the CPS see https://www.gov.uk/government/publications/carbon-price-floor-reform

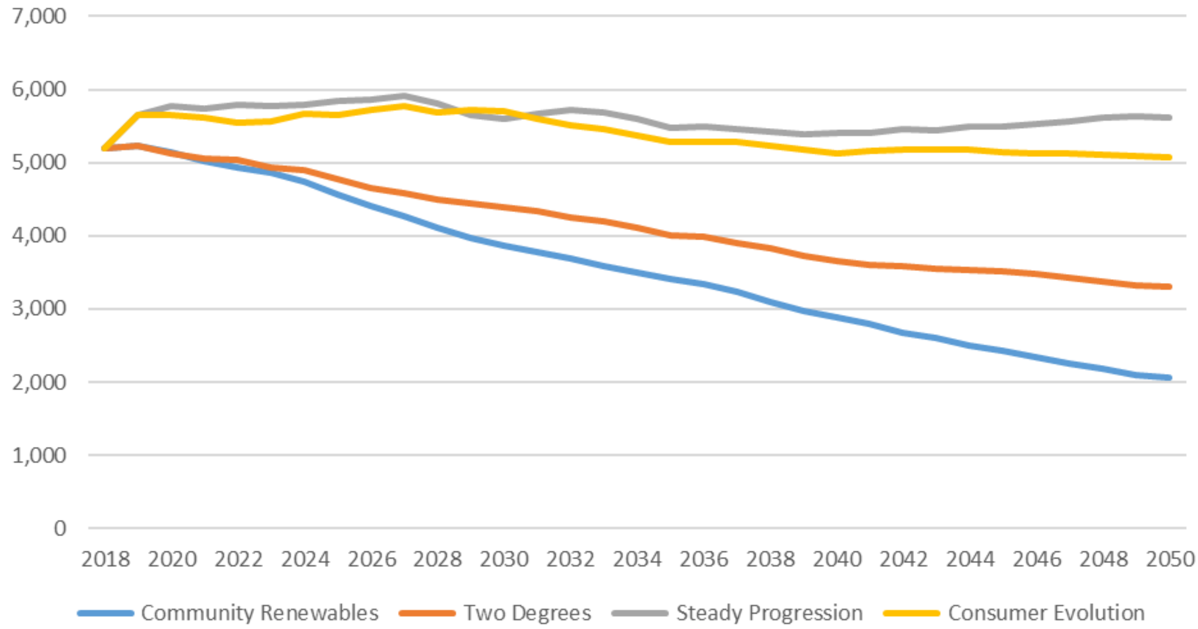
[203] See the ESO's Winter Review 2019: https://www.nationalgrideso.com/document/145396/download

[204] Linepack is the volume of gas within the National Transmission System (NTS) pipelines at any time, while the linepack swing is the difference between the amount of gas in the system at the start of the day and at the lowest point during the day. The amount of linepack swing managed by National Grid Gas (NGG) has increased since 2001, which is increasing operability challenges. NGG projects

that the growth in renewable generation has led to more variable patterns for thermal electricity generation throughout 2018. A higher proportion of renewable generation has led to more frequent movements in gas-fired generation within-day, and gas-fired power stations responding to more volatile within-day electricity price signals can increase linepack swing, especially in the summer when demand levels are lower.

6.7. Gas demand overall has fallen by more than a fifth compared with 2000. This long-term trend of falling gas demand continued in the first three months of 2019.[205] While the long-term outlook for gas demand is uncertain, influenced by developments in technology, consumer preferences, and policy, National Grid's Future Energy Scenarios (FES) forecast gas demand to fall across the four scenarios modelled, as shown in Figure 6.2, but not before rising slightly in the short term. In the short term, there are still likely to be periods of high peak demand.

Figure 6.2: Annual gas peak demand[206] forecast excluding exports (GWh)



Source: National Grid, Future Energy Scenarios 2019

Note: There are four different scenarios in the FES. Community Renewables and Two Degrees both have fast decarbonisation compared with Consumer Evolution and Steady Progression. Community

this trend will continue up to 2025 with an increase in the frequency of large linepack swing days, especially in the summer.

205 See FES Report: http://fes.nationalgrid.com/media/1409/fes-2019.pdf

206 This is a 1-in-20 demand which means that statistically, in a long series of winters, it would be exceeded in one out of twenty winters.

Renewables and Consumer Evolution have more decentralised technologies while Two Degrees and Steady Progression have less decentralised technologies.

Gas supply

GB has diverse sources of gas supply

6.8. GB continues to meet its gas demand through diverse sources - United Kingdom Continental Shelf (UKCS), Norway, LNG, and imports from the Continent (Figure 6.3) - which provides significant flexibility and resilience. Moreover, GB is not dependent on any one piece of infrastructure for security of supply, which increases resilience in the event of an outage.

UKCS and Norwegian supply

6.9. Gas supply from UKCS production (also referred to as North Sea gas) is a key source of gas for GB, accounting for about 34% in 2017/18 and almost 36% in 2018/19.[207] The UK, along with the Netherlands, is one of the two major gas-producing nations within the EU.[208] Supplies from the UKCS fell by around 8% a year between 2000 and 2013. Since 2014 there has been an upturn in UKCS volumes as a result of increased production in new and existing fields in the North Sea, and cushion gas from the Rough storage facility.[209] However, in the medium term, domestic production from the UKCS is set to decline, creating increasing import dependence.

6.10. Supply from Norway continental shelf to GB declined slightly in 2018/19. Supply from Norway is greater than that of UKCS, accounting for almost 49% of the GB total supply in 2018/19, compared to 50.5% in 2017/18.[210]

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[207] Wholesale Market Indicators: https://www.ofgem.gov.uk/data-portal/wholesale-market-indicators. Calculations are based on a 12 month average and exclude offtakes and storage.
Wholesale Market Indicators: https://www.ofgem.gov.uk/data-portal/wholesale-market-indicators. Calculations are based on a 12 month average and exclude offtakes and storage.
hment_data/file/753170/BEIS_Ofgem_Statutory_Security_of_Supply_Report_2018.pdf
[209] See the ESO's Winter Review 2019: https://www.nationalgrideso.com/document/145396/download
[210] Wholesale Market Indicators: https://www.ofgem.gov.uk/data-portal/wholesale-market-indicators. Calculations are based on a 12 month average and exclude offtakes.

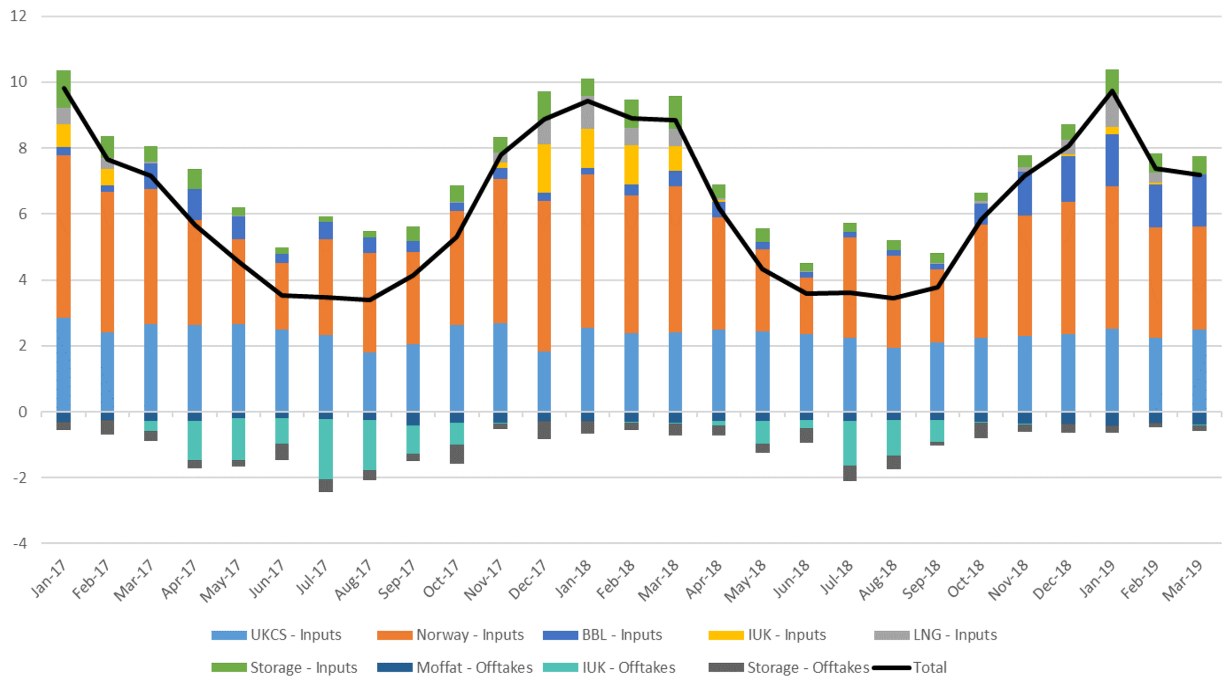
Continental imports

6.11. EU imports fell further than forecast in winter 2018/19; imports via the BBL and IUK gas interconnectors contributed only 2.5% and 0.5% in winter 2018/19, respectively, compared to 3.5% and 5.4% in the previous winter, respectively. The main cause for this was the increase in LNG to meet demand, reducing the need to import gas from the continent.

LNG supplies

6.12. Whilst LNG imports fell overall in 2017/18 (5.1 bcm) compared to 2016/17 (7.3 bcm), there was a significant upturn in LNG imports to GB in the last quarter of 2018. This reversal in the trend of LNG cargoes in the latter part of 2018 resulted from a fall in the spot LNG price premium between Asian markets and the GB market. The increase in LNG volumes to multi-year highs, coupled with a clement winter, was key to lowering gas prices – and therefore power prices - from Q4 2018. As LNG has increased supply, margins, and has improved security of supply, we focus on this in the next section.

Figure 6.3: Gas supply by source (billion cubic metres/month)



Source: Ofgem calculations, National Grid.

Case Study – LNG imports at multiyear highs

LNG Volumes

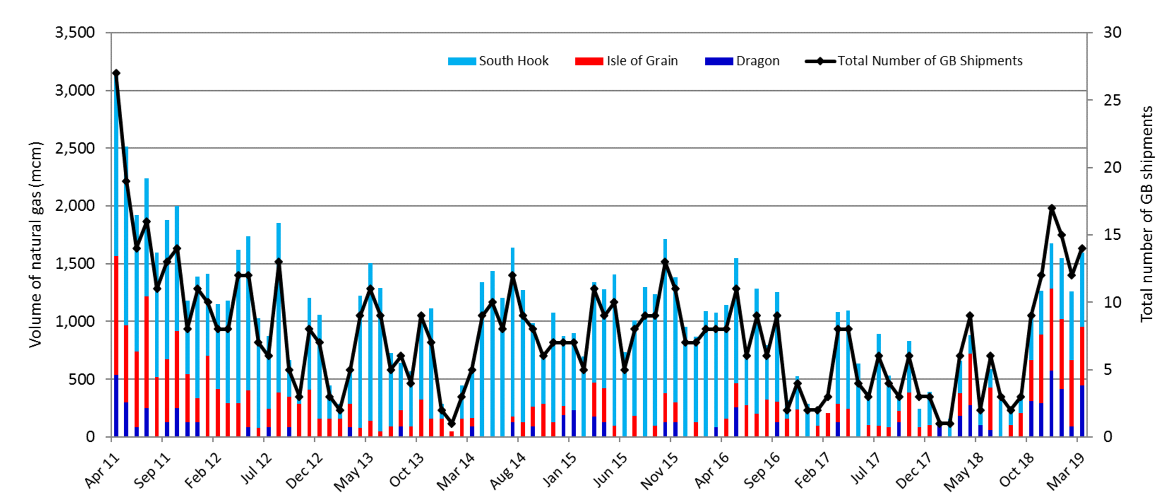
As shown in Figure 6.4, LNG imports were relatively low in 2018 but increased in the last quarter with highs in December 2018 (volume of 1,674 mcm) and subsequently in April 2019 (volume of 2,336 mcm). Such high volumes had not been seen since April 2011 (3,154 mcm).

As it is a global commodity, LNG deliveries are highly price responsive to the world market. So while an increase in LNG volumes is a positive for security of supply, it also means that GB prices are more sensitive to changes in global LNG market prices. Given the remarkable increase in LNG deliveries that we have seen in 2018, it is important to understand the drivers and implications of increased LNG supply.

One of the key drivers of the increase in LNG supplies was the fall in the premium between LNG spot prices at key Asian hubs and hubs in North West Europe (NWE), including in GB. It was therefore more profitable for U.S. and Qatar cargoes as well as for cargoes in the Atlantic basin to sell their LNG to Europe rather than to Asia. Figure 6.5 below shows the spread between GB and Asian LNG prices.

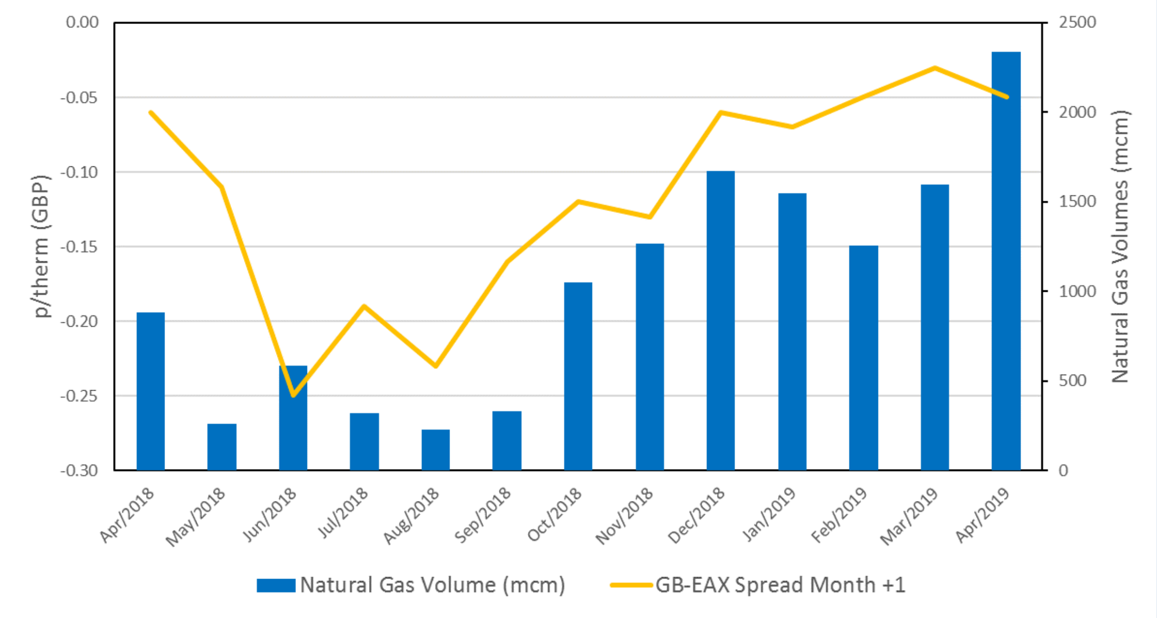
The global trend of stronger LNG flows to GB has affected GB's gas supply mix – LNG became an important source of GB's gas supply in winter 18/19, making up almost 12% of total GB gas supply compared to just 6.1% in the previous winter. As LNG prices have been relatively low, the effect on GB of the LNG influx was higher margins rather than high prices, which has been positive for security of supply.

Figure 6.4: LNG volumes and number of cargos from April 2011 to April 2019



Source: Ofgem calculations, Bloomberg.

Figure 6.5: LNG volumes and the spread between Asian[211] and GB LNG prices (April 2018 to April 2019)



Source: Ofgem calculations, Bloomberg, ICIS Heren.

211 The East Asia Index (EAX) for spot deliveries to Japan, China, South Korea and Taiwan. The spread is the difference between GB and EAX prices. Asian LNG prices tend to maintain a thin premium to NWE during times of healthy supply, to ensure cargoes from suppliers such as Qatar (as the biggest LNG producer) retain an incentive to deliver and sell eastwards, as LNG is the sole source of gas supply for Japan. During periods of tighter supply as a result of lower production and higher demand, the Asian market tends to build a much bigger premium, causing the spread between EAX and GB prices to be wider.

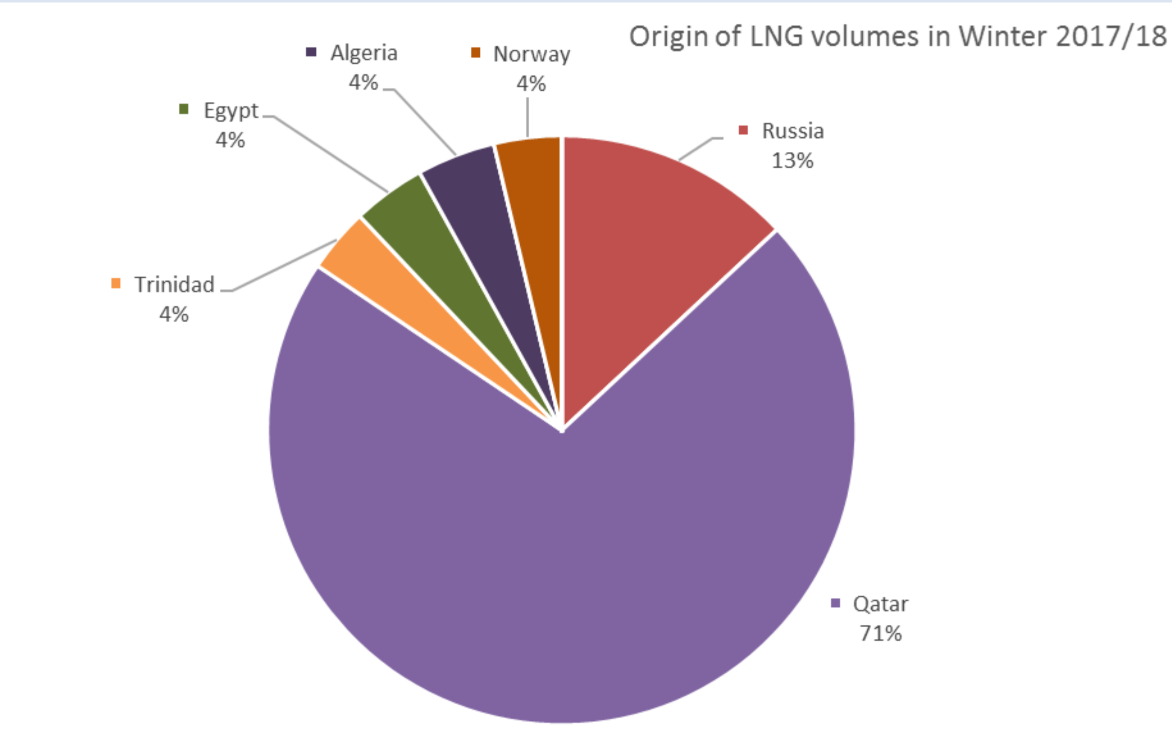
The origin of LNG

Increase in LNG deliveries from the US and Russia and less from Qatar

Security of supply is also strengthened by LNG deliveries from more diverse origins, as happened in 2018. The greater diversity reflected an increase in global production capacity. It is a positive development for GB security of gas supply because it raises the likelihood that GB will attract LNG cargoes when needed.

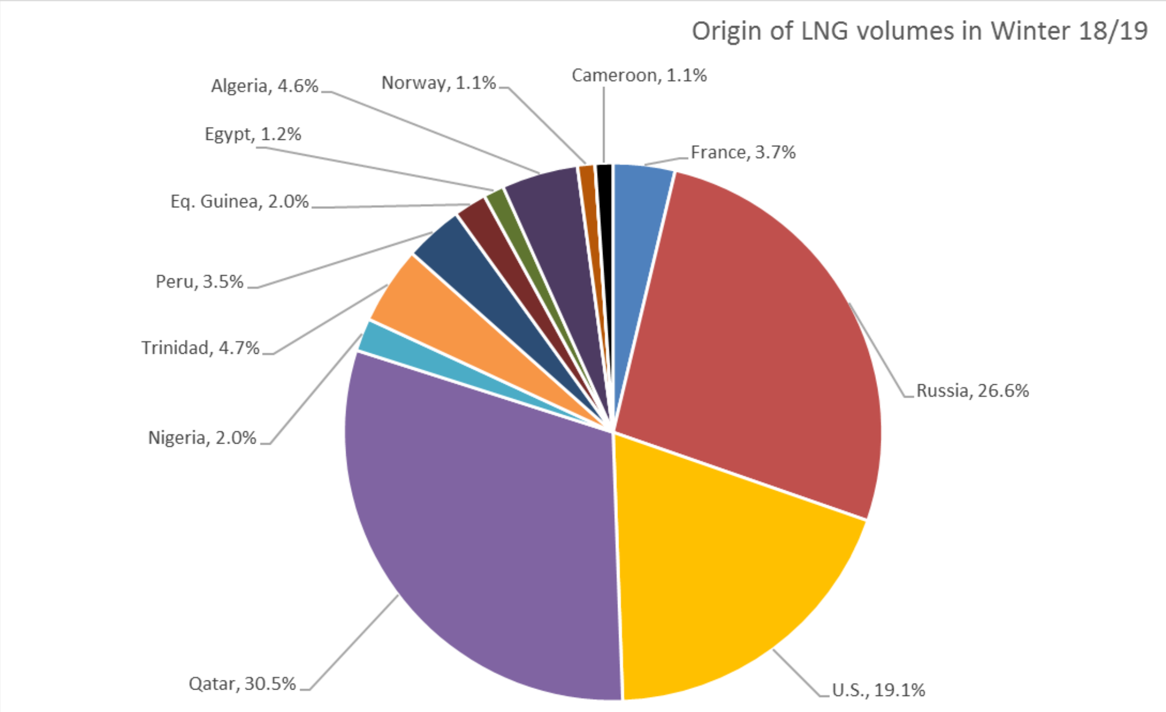
In 2017, more than 83% of all LNG imports came from cargoes originating in Qatar, but in 2018 this fell to 40%. In contrast, arrivals from US and Russia increased significantly in 2018 compared to 2017. LNG from the US in 2018 was almost 16% of total LNG imports, while there were no cargoes from US in 2017. Similarly, LNG from Russia in 2018 was just over 19% of total LNG imports in 2018, compared to 1.5% in 2017. This increase in LNG volumes from Russia is due in part to the early start-up of the Yamal train exports, which reached its full planned capacity of 16.5 million tons per year. Figures 6.6 and 6.7 show the changing picture of the origin of LNG.

Figure 6.6: The origin of LNG volumes in Winter 2017/18



Source: Ofgem's calculations, Bloomberg.

Figure 6.7: The origin of LNG volumes in Winter 2018/19



Source: Ofgem's calculations, Bloomberg.

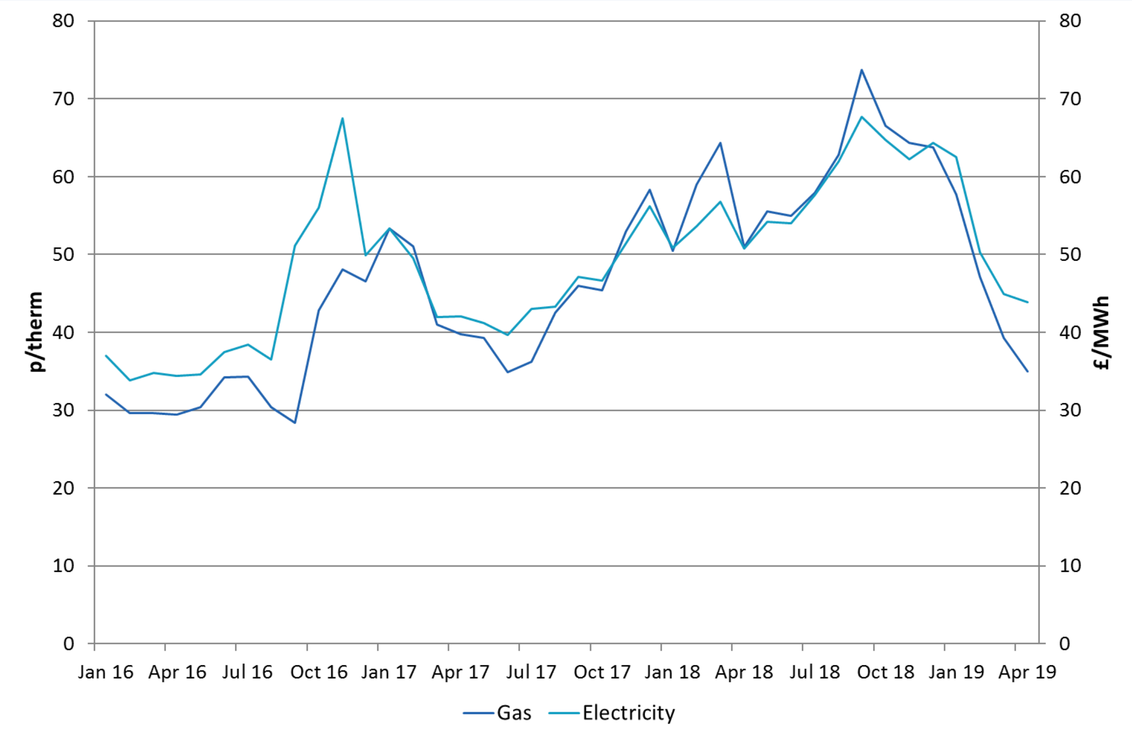
With the additional competition in Europe from US and Russian LNG, Qatar may shift its focus to emerging markets such as Bangladesh, India and Pakistan. However, Qatar is likely to remain a key supplier into the UK as it has a majority stake in the South Hook terminal.

Impact on wholesale prices[212]

High LNG volumes delivered to GB terminals (as well as to north-western European terminals) were one of the factors that helped to drive wholesale gas prices down since the start of winter 2018/19. Figure 6.8 shows this declining trend in gas prices that influenced wholesale electricity prices in turn. From an average peak of 73.7p/th in September 2018, prices for the gas day ahead contract decreased to an average of 39.3 p/th by end of March 2019.

[212] Prices used are nominal, highlighting mainly the recent trend in energy prices from Q4 of 2018 to Q1 2019.

Figure 6.8. Average monthly price movements for Gas and Electricity (Day-ahead contracts) from 2016 to Q1 2019



Source: Ofgem's calculations,[213] ICIS Heren.

Storage

Storage levels rose during 2018 and remain very healthy, in GB and in the Continent

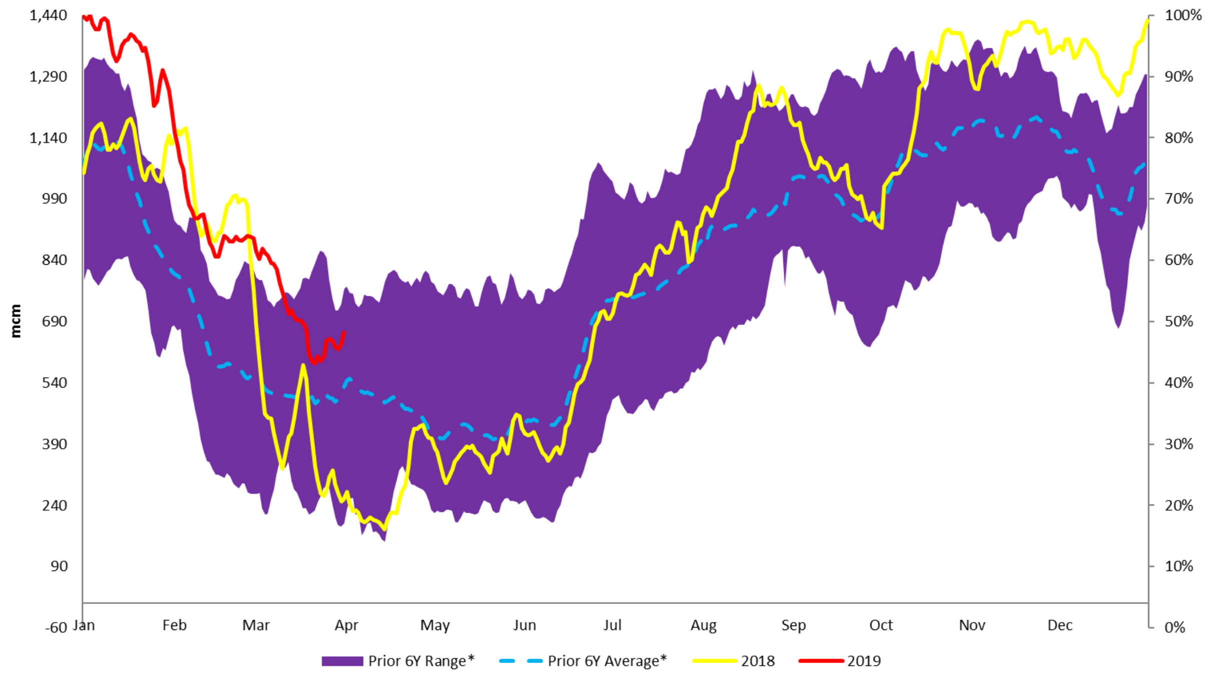
6.13. The increase in LNG has had an effect on storage utilisation in GB. Owners of storage capacity inject gas when prices are low and withdraw it when prices are high (usually during peak demand). GB storage operates flexibly in response to relatively short-term price signals.[214] When storage levels are low, the market may be nervous about the ability of the system to meet spikes in demand, therefore if storage levels are high, it may be reassuring for the market from the perspective of security of supply.

[213] Ofgem publishes average monthly price movements for both gas and electricity (day ahead contracts) in the website: https://www.ofgem.gov.uk/data-portal/wholesale-market-indicators
[214]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/753170/BEIS_Ofgem_Statutory_Security_of_Supply_Report_2018.pdf p.28

6.14. After the 'Beast from the East' cold snap in March 2018, GB storage levels were nearly depleted at the end of winter 2017/18, at only 18% by the end of March 2018. However, with milder temperatures over winter 2018/19 and an abundance of LNG there was less need for storage withdrawals. As a result, storage levels were much higher and steadier for most of Q3 and Q4 of 2018 as well as in Q1 of 2019 than in the 2017/18 winter, remaining above prior 6-year averages as shown in Figure 6.9.

6.15. This was a European wide story. UK storage only makes up about 1.4% of European storage but is connected to the continent by two major interconnectors, BBL and IUK. As in GB, European storage ended winter 18/19 at 5-year highs due to low demand and sustained arrivals of LNG. This curtailed withdrawals from European storage sites in the second half of February and March 2019, further depressing gas prices and helping to give the market confidence in GB's ability to meet any supply challenges.

Figure 6.9: Medium Range Storage (MRS) Gas Storage levels in mcm and in %, Q1 2018 to Q1 of 2019, GB



Source: Ofgem calculations, Bloomberg

Note: Prior 6Y Range* - is the range over previous six years with base year as 2018.

MRS storage is now GB's only source of storage capacity

6.16. In 2018, EDF announced the withdrawal of the Hole House Farm storage facility from commercial operation. With a capacity of 0.022bcm, Hole House Farm was the

UK's smallest storage facility and no significant security of supply impact is expected to arise from this commercial decision.[215] Medium range storage (MRS) sites, totalling around 1.36 bcm now make up GB's remaining storage capacity since the closure of storage capacity at the long-range Rough site (3.7 bcm) in 2017.

6.17. GB still has significant infrastructure capacity to receive gas, as confirmed by the modelling work and analysis undertaken by Ofgem and BEIS to assess GB gas security of supply.[216] These studies concluded that GB should have adequate supplies to meet high demand scenarios even in the absence of Rough[217] and when there are supply outages.[218]

Security of Great Britain's electricity supply

Electricity margins

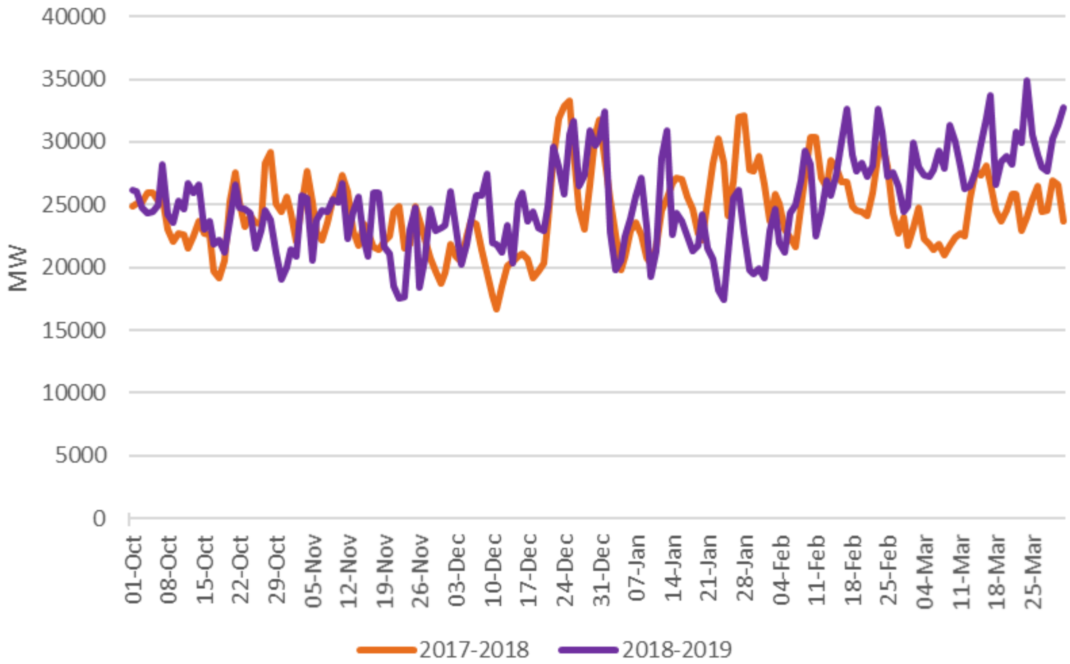
Margins were generally higher this winter

6.18. Electricity margins – the difference between supply and demand - remained healthy in winter 2018/19, and were on average higher than in winter 2017/18 and 2016/17 (Figure 6.10). Higher margins are an important indicator of security of supply. The average winter margin for 2018/19 was 25.1 GW, compared to an average margin of 24.4 GW in winter 2017/18 and 20.5 GW in winter 2016/17 – see figure 6.10. These healthy margins for winter 2018/19 can be attributed in part to the Capacity Market, despite its suspension in mid-November 2018. Margins were also supported by the fact that several power plants remained in the wholesale market that did not have Capacity Market contracts. This meant that potential generation capacity was even greater that

[215] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/753170/BEIS_Ofgem_Statutory_Security_of_Supply_Report_2018.pdf
[216] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774288/national-risk-assessment-security-gas-supply.pdf
https://www.gov.uk/government/publications/statutory-security-of-supply-report-2018
[217] In June 2017, Centrica Storage Limited announced the permanent ending of storage operations of the Rough gas field for essential maintenance. This changed the facility from a storage site to a production facility.
[218] Norwegian outages in December 2018 in the North Sea put some upward pressure on prices. One unplanned outage happened in 2018 at the Aasta Hansteen gas field, which subsequently became a planned outage due to the long duration of the event. No other significant unplanned outages were reported during Winter 2018/19.

had been procured through the CM, helping to maintain electricity supply margins well in excess of demand.

Figure 6.10: Winter indicated margin daily average (MW)



Source: EnAppSys Neta Reports.

Electricity demand continues to fall

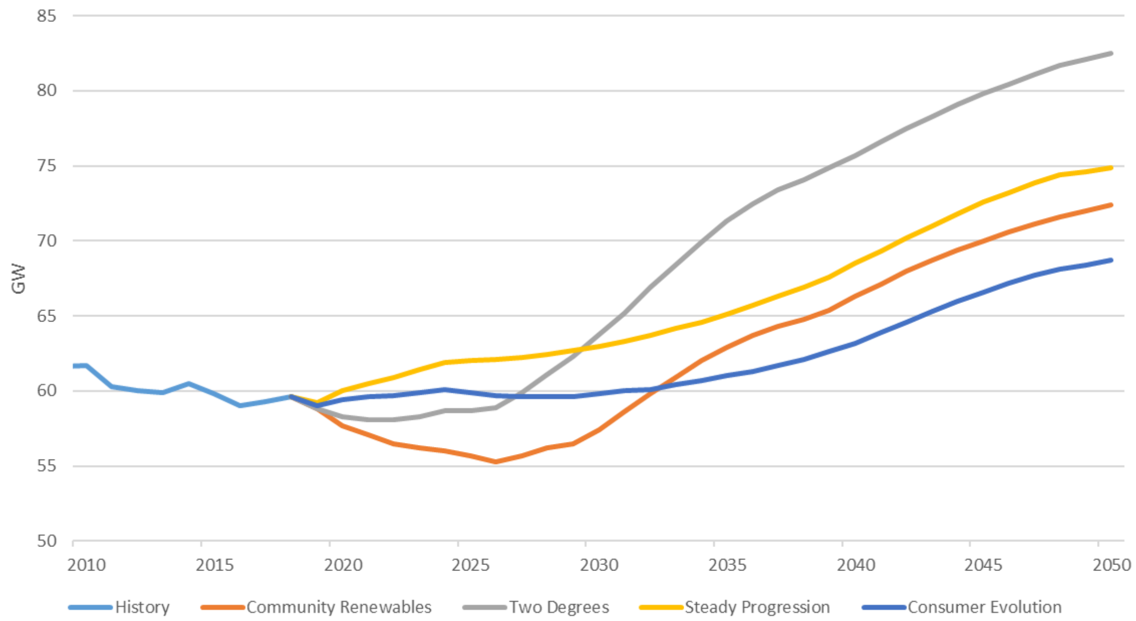
6.19. For winter 2018/19, forecast peak transmission system demand was 48.2 GW, while the actual (weather corrected) peak demand was 48.5 GW. This is lower than the actual peak transmission system demand of 51.6 GW in winter 2017/18.[219] The underlying peak demand is currently around 60 GW.[220]

6.20. Peak electricity demand, which is typically the most relevant type of demand to consider for security of supply, has been on a downward trend since 2005. Peak demand periods usually occur in the winter period when demand for lighting and

[219] See the ESO's Winter Review 2019: https://www.nationalgrideso.com/document/145396/download and page 18 of https://www.nationalgrideso.com/document/93911/download
[220] See National Grid, FES Report: http://fes.nationalgrid.com/media/1409/fes-2019.pdf Underlying demand is total demand on the transmission and distribution systems, whereas transmission demand is the demand that is net of generation embedded within the distribution network.

heating is highest. However the daily demand profile we typically see will likely change in the future with an increase in the adoption of technology such as smart meters and other smart devices, and as relatively flexible demand like electric vehicles take advantage of cheaper prices when system demand is lower or renewable output is high.

Figure 6.11: Annual electricity peak demand forecast (including losses) (GW)



Source: National Grid, Future Energy Scenarios 2019.

6.21. Minimum demand is also important for system operability, and increasingly so. This is because large amounts of zero marginal cost, inflexible renewable capacity are now more common, and can put too much electricity into the network, potentially more than demand. Forecast minimum demand of 20.8 GW was slightly lower than the actual (weather corrected) demand of 21.0 GW. Minimum demand periods typically occur on a summer's weekend day at around 6am.[221]

6.22. NG ESO is obligated under its licence to provide accurate and unbiased forecasts. In doing so, NG ESO supports security of supply in two ways - by providing information that allows market participants to make efficient operational decisions, and ensuring the ESO procures the appropriate level of reserve.

[221] Ibid.

Electricity supply

Electricity supply is dominated by gas but renewables are increasing

6.23. Gas remains the main source for generating electricity, accounting on average for around 32.8% of total generation output in 2018. But in 2018 both solar and wind generation hit record levels. Wind and solar are collectively the second largest sources of generation after gas and made up about 17.5% of the total electricity generation mix in 2018 compared to 15.4% in 2017.

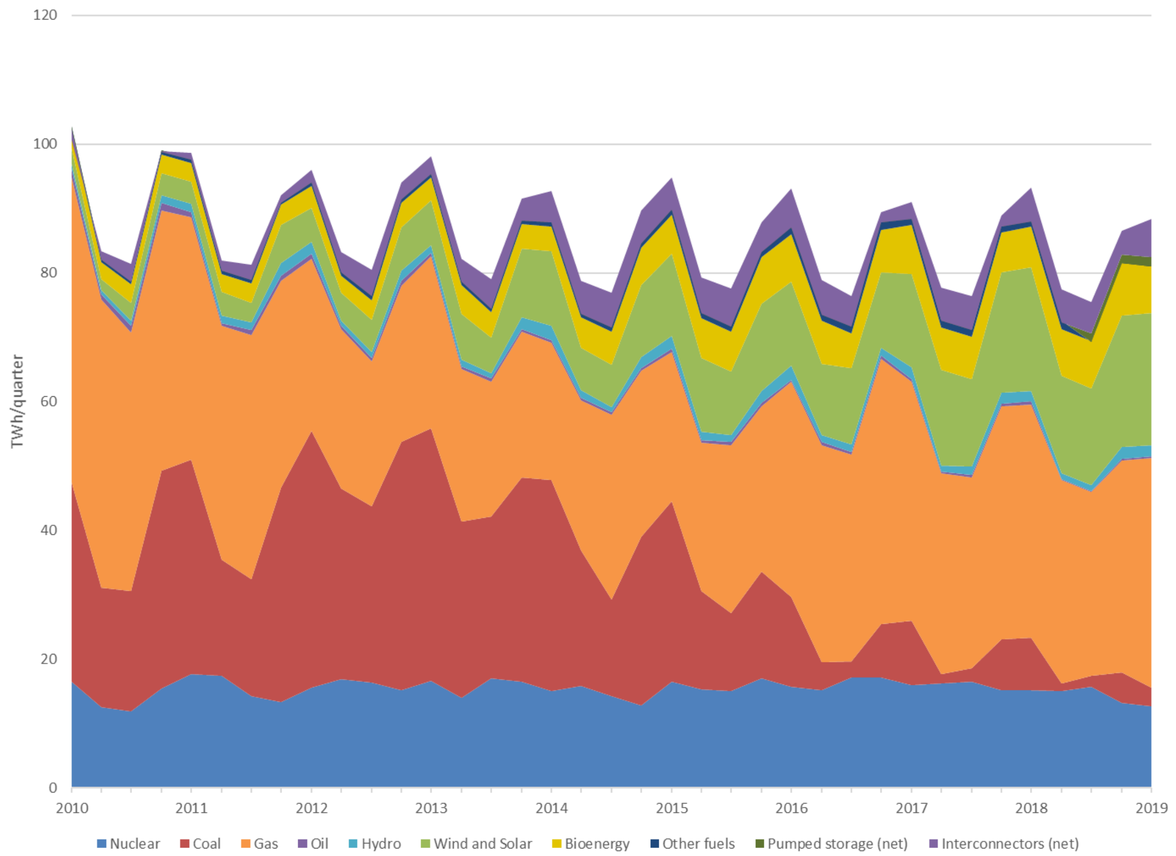
6.24. Solar generation[222] even overtook gas generation on certain summer days. For example, in the afternoon of Saturday 5th May between 11:00-15:00, solar output was the GB's top electricity generation source. Solar generation also overtook CCGT on 19 days during 2018; the longest run was on 27 May for six hours, between 09:00-15:00.

6.25. We also saw an increase in wind generation. Over 2GW of new offshore wind became operational in GB during 2018. Walney Extension (659MW), which is the world's largest wind farm, Rampion (400MW) and Race Bank (573MW) all commissioned in 2018.

6.26. Wind generation peaked in January, November and December 2018. The maximum daily average wind generation was recorded on the 12th December 2018 at 10.7GW compared to 8.8GW in 2017, and a record was set for a half hour period of wind generation with 15.1GW on the 18th December 2018, meeting almost 35% of demand.

[222] This is embedded solar generation which is distribution connected.

Figure 6.12: Electricity supply by source (TWh/Quarter)



Source: BEIS, Ofgem's calculations.[223]

6.27. Overall, the sources of electricity generation are becoming more diverse but with less predictable output. Renewables are contributing an ever-greater proportion and coal generation is becoming a rarity in the generation mix. The fall in coal generation in particular is a positive outcome in line with achieving government climate policy objectives. However, the increase in intermittent generation has increased the difficulty of operating the system.

Electricity System Operation

6.28. The Electricity System Operator must ensure there is enough overall electricity supply to meet demand, and ensure that the system stays within the required frequency range on a second by second basis. It does this by paying market

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223 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/789363/ET_5.1.xls

participants either to increase or decrease their generation in the Balancing Mechanism, and using ancillary service contracts. These actions then set the charges faced by companies who have produced too little or too much power relative to their customers' demand. These charges are imbalance prices, which are often referred to as cash-out. Cash-out prices are designed to provide market participants with strong commercial incentives to balance their contractual and physical positions and therefore avoid exposure to cash out prices. This may include contracting for supply ahead of time, or maintaining the reliability of their production plant. Both of these measures taken in response to the incentives created by cash-out prices help secure supply.

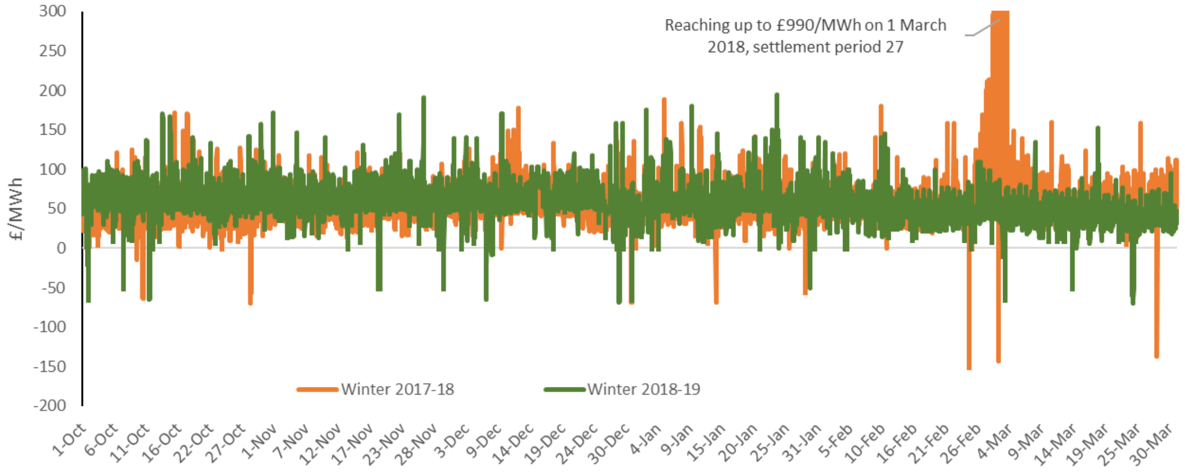
Cash-out prices continued to be less volatile in winter 2018/19

6.29. Figure 6.13 below shows cash-out prices over the last three winters. Cash-out prices were less volatile in winter 18/19 than in the previous two winters, despite the change to the cash-out regime in November 2018.

6.30. Ofgem's Electricity Balancing Significant Code Review (EBSCR) led to a number of changes in imbalance price calculation implemented in November 2015.[224] Further changes were made on 1 November 2018 to the electricity cash-out regime. If a market participant generates or consumes more or less electricity than contracted for, they face the cash-out price for the difference. Prior to November 2018 the price was set according to the average of most expensive 50MWh (PAR 50) of relevant balancing actions taken by the system operator. Since 1 November 2018, the price reference has been set only by the last 1MWh (PAR1). This makes prices higher and more volatile in periods of scarcity and incentivises market participants to match their supply and demand more exactly. Consequently, the cost of balancing the system is reduced and there are stronger market signals for investment in flexible generation or technology.

224 https://www.ofgem.gov.uk/system/files/docs/2018/08/analysis_of_the_first_phase_of_the_electricity_balancing_significant_code_review_as_final_version_publication.pdf

Figure 6.13: Cash-out prices (£/MWh)



Source: Ofgem, EnAppSys Neta Reports.

The costs of managing the network have increased, mainly due to system balancing costs

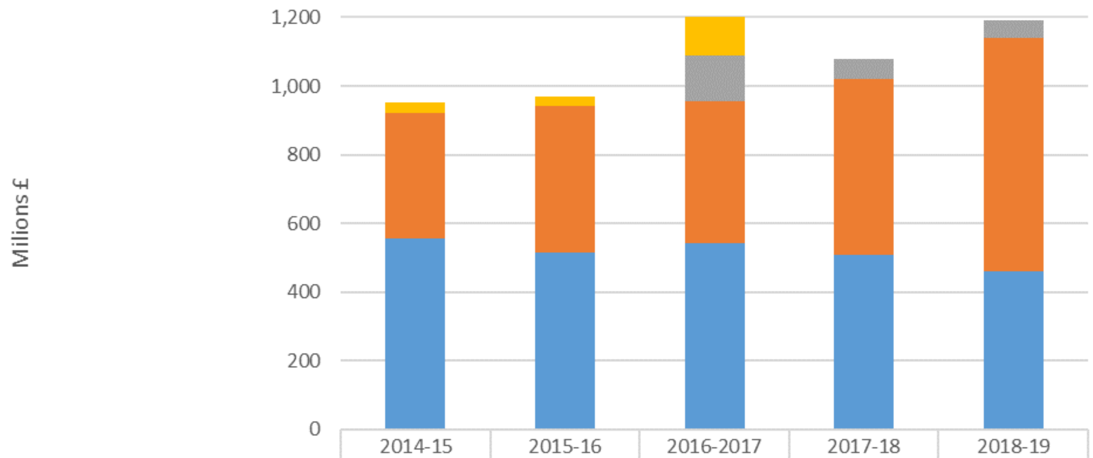
6.31. System flexibility, accurate forecasting and efficient procurement for balancing services are key to keeping balancing costs under control. As shown in Figure 6.14 total system balancing costs have increased this year compared to last year. Total costs in 2018/19 were around £1.19 billion compared to just over £1.08 billion in 2017/18.[225] This is an increase of over 10% and close to the record high total costs of £1.21 billion in 2016/17.[226]

6.32. System balancing costs reflect underlying issues for security of supply. The increase in costs compared to last year has been driven by higher system costs, which are the costs for dealing with constraints on transmitting electricity around the national system. This is mostly due to the growth in renewables outpacing the growth in transmission capacity between the areas where electricity is generated and where it is consumed.

[225] https://www.nationalgrideso.com/balancing-data/system-balancing-reports, https://www.nationalgrideso.com/document/113976/download

[226] Nominal terms. Total 2016/17 costs included Supplemental Balancing Reserve (SBR) and Demand Side Balancing Reserve (DSBR) costs.

Figure 6.14: System balancing costs between 2014-15 and 2018-19 (millions £)



	2014-15	2015-16	2016-2017	2017-18	2018-19
SBR and DSBR	32	27	118	0	0
Black Start	0	0	134	58	49
System	365	428	413	512	680
Energy (excluding SBR and DSRB)	556	514	543	509	461

Source: Ofgem analysis of National Grid Balancing Services Summary Data.

Note: Figures in nominal terms. "Energy" costs relate to balancing supply and demand. "System" costs refer to managing network flows. SBR and DSBR no longer exist. SBR was a generation service where a generator was kept on standby, outside the market, if NGET required additional resources to balance the system. DSBR was a demand side response service aimed predominantly at large-scale customers and aggregators prepared to shift or shed demand when instructed by NGET.

A new regulatory framework for the ESO

6.33. Increased intermittent and inflexible generation presents new challenges for the ESO. In response to this, Ofgem is changing the way we regulate the ESO. The first step was to legally separate the ESO from National Grid's Electricity Transmission Operator business. This went live from 1 April 2019. We think a more independent ESO will enable it to achieve benefits for consumers by taking on a more active role in shaping the energy system transformation. In order to facilitate this, we implemented a new regulatory and incentives framework for the ESO.

Case Study – Capacity Market suspension in 2018

Background

The Capacity Market (CM) is a mechanism introduced by the UK Government as part of its Electricity Market Reform policy.[227] The CM, which became operational in October 2017, was intended to ensure secure supplies of electricity through procuring capacity in capacity auctions. The CM was expected to ensure sufficient generation or load-management capacity in the system to cope with times of stress in the network. For example, when intermittent generation output is low or when there is a surge in demand in peak hours.

Market participants including new and existing generators, embedded generators, Demand Side Responders (DSR), storage providers and interconnectors, are paid a rate per megawatt (MW) for the capacity they make available to the market. This capacity must be available when providers are called upon by National Grid at any time during the contracted period. Non-delivery at times of system stress incurs a penalty.

In July 2014, the European Commission (EC) approved the CM under State aid rules, noting that it would "contribute to ensuring the security of energy supply in the United Kingdom (UK), in line with EU objectives, without distorting competition in the Single Market".[228]

Subsequently, four auctions for delivery 4 years ahead (T-4) and one for delivery one year ahead (T-1) have been held. Two so-called "Transitional Auctions"[229] were also held to support DSR. The Early Auction held in January 2017 was granted separate State aid

[227] The EMR is a government policy to improve security of supply, affordability, and incentivise investment: https://www.ofgem.gov.uk/electricity/wholesale-market/market-efficiency-review-and-reform/electricity-market-reform-emr
[228] European Commission Website: http://europa.eu/rapid/press-release_IP-14-865_en.htm and https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2014:348:FULL&from=EN
[229] BEIS: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/753170/BEIS_Ofgem_Statutory_Security_of_Supply_Report_2018.pdf

approval.[230] Collectively, these auctions have resulted in £3.8 billion of payments due to capacity providers.[231]

The CM suspension

In December 2014, Tempus Energy appealed the EC's approval of the CM and won. The court ruling annulled the state aid clearance on November 15, 2018, effective immediately. The UK government put the CM into a standstill period, which means it is still operating as normal but with payments currently suspended. The EC has opened an investigation to reconsider the state aid case. If and once the CM has been re-approved, it is the UK government's policy to reinstate payments. In the meanwhile, margins remain healthy at over 16%.

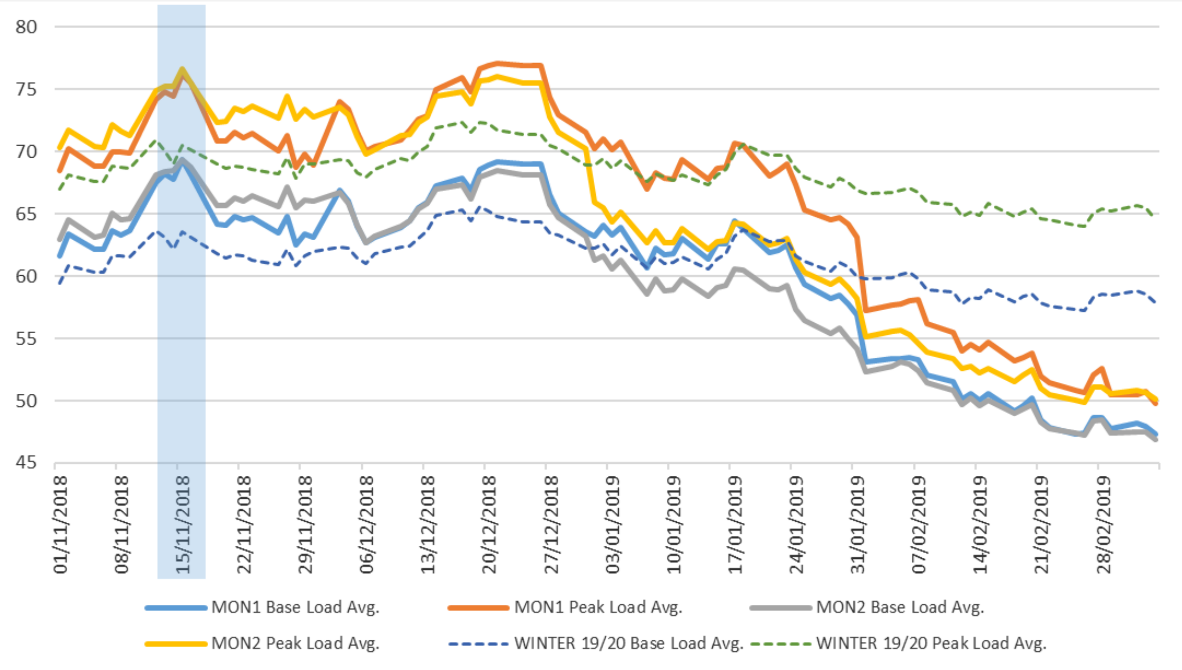
Market reaction

Prices reacted to fundamental demand and supply drivers rather than the CM suspension

Prices were muted following the announcement of the suspension, indicating that the market assessed security of supply as adequate for the winter. There was a brief reaction in prices after the announcement, but this was a continuation of a trend seen in the preceding days. Following this, forward contract prices fell for the rest of winter. Figure 6.15 shows that prices of the forward month and forward two months contracts and the winter 19/20 contract all fell after the CM suspension, reflecting the market's view of a well supplied system for the rest of winter.

[230] European Commission Website: http://ec.europa.eu/competition/state_aid/cases/265707/265707_1850846_123_2.pdf
[231] BEIS: https://www.gov.uk/government/collections/capacity-market-parameters-for-auctions-2019-to-2020-and-2022-to-2023, See also: https://insight.lcp.uk.com/acton/attachment/20628/f-b4a526c5-7c8d-4b5a-97b3-a8a0f8ef6e14/1/-/-/-/-/Suspension%20of%20the%20GB%20capacity%20market.pdf

Figure 6.15: The price of Forward Power Contract for Month ahead (MON1) and Two Months ahead (MON2) (£/MWh)



Source: Bloomberg.

Note: The figure shows the price of the delivery for the month ahead and two months ahead delivery (baseload and peakload), since the beginning of November 2018. The blue line indicates when the CM announcement was made.

We did not observe a price reaction to the suspension because sunk costs had already been incurred by CM contract holders at the beginning of winter, therefore capacity was already secured. In addition, the government was clear that it expected the CM would be reinstated, subject to State aid approval.

Security of Supply

There was no evidence of security of supply concerns during winter 2018/19 as seen in the muted price reaction to the suspension. The CM helped to support higher daily margins for the 2018/19 winter than in preceding years, and it continued to lower and stabilise cash-out prices by increasing system capacity.

While CM payments are suspended, revenue from the wholesale and ancillary markets are the only income streams for power plants. So while in theory we could have seen higher wholesale prices and price spikes at times of system tightness as the most marginal plants seek higher prices to cover missing income, in fact we have not observed such price spikes as conditions in the market have been benign. Comfortable margins have been reflected in the downward price trends since Q4 2018 and cash-out prices have remained well within the normal range.

Next steps

On the 6th March 2019, Tempus Energy issued a claim for judicial review against BEIS, arguing that BEIS is prevented from continuing to operate the CM during the suspension period. Tempus is asking for domestic courts to order that the government recoup payments made related to auctions in January 2016 and March 2017, and it has also asked that the replacement T-1 auction not take place. BEIS has said it will defend its position.

Summary

Despite the CM suspension, the price reaction has been muted with margins remaining in excess of demand, although clearly some market participants are under financial stress due to lost revenues. The government is working to get the CM reinstated, and both BEIS and Ofgem have supported these efforts through holding replacement auctions, contingent on the EC State Aid decision and continuing development of the CM through Five Year Reviews. In the context of the state aid case, BEIS is seeking immediate state aid approval for a replacement T-1 auction for winter 2019/20 delivery and has already held a T-1 auction on 11th and 12th of June 2019 with an urgent submission aid clearance.

7. Energy networks

Summary of findings

- GB's energy networks continue to provide safe and reliable energy to consumers, with high levels of customer satisfaction and reliability and availability levels at around 99.99%.
- The financial returns earned by the network companies in providing these services remain above Ofgem expectations, with most of the network companies achieving double-digit, or close to double-digit financial returns.
- Growth in low carbon and distributed energy continues. In 2017/18, nearly 1.7 GW of smaller scale generation was connected to the electricity network, bringing the total to almost 9 GW connected over the last three years.
- Environmental performance of networks has also improved, with electricity network companies (transmission and distribution) reducing their carbon footprint by the equivalent of over 1 million tonnes of CO2 over the past three years.
- In 2017-18 over 16,000 electric vehicle chargepoints were connected to the electricity distribution networks, up 80% from the previous year.

Introduction

7.1. This is the first year we have included energy networks in our State of the Market report. We aim to expand our coverage of networks in future years, and welcome any comments as to which areas would be of most interest.

7.2. Sitting at the heart of the energy system, GB's gas and electricity networks are essential to the functioning of society and the economy, moving energy from where it is produced to the homes, businesses, and other premises where it is needed. The electricity network consists of around 821,000km of lines and cables, while around 284,000km of pipes make up the gas network.

7.3. The cost of operating, maintaining and strengthening these networks is significant, currently averaging around £12.5 billion each year. These costs are ultimately reflected in the prices that consumers pay for their energy, representing around one quarter of the costs of standard energy bills, or in the region of £250 for a typical household. The average GB customer in 2019-20 pays around £114 per annum[232] for gas distribution costs, £87 for the costs of electricity distribution networks, £35 for electricity transmission, and around £10 for gas transmission.

7.4. The GB energy networks are run by private companies, who have a monopoly on their operation. Ofgem sets price controls to incentivise these companies to act in the best interests of energy consumers. In doing so, we have a principal objective to protect the interests of current and future consumers, including those in vulnerable situations. We must also ensure that companies are able to finance their activities and efficiently deliver services to consumers.

7.5. Since 2013 we have used the RIIO (Revenue = Incentives + Innovation + Outputs) framework to set price controls for the gas and electricity networks. This new performance based framework sought to put consumers at the heart of network companies' plans for the future and encourage longer-term thinking, greater innovation and more efficient delivery.

7.6. In this chapter we provide a high level summary of network company performance to date under the RIIO price controls. For each year of the price controls, Ofgem reports on how network companies in each sector have performed against a broad range of measures, including outputs, expenditure and financial returns. The latest reports for 2017-18 were published in March 2019.[233]

Assessing network performance under RIIO

7.7. The aim for the first set of RIIO price controls (RIIO-1) was to drive high levels of innovation and efficiency, improve service quality and cut costs for consumers. Some of these aims have been realised. Service quality has improved, highlighted by the

[232] Ofgem data. Measured in real 2017-18 prices.
[233] https://www.ofgem.gov.uk/network-regulation-riio-model/current-network-price-controls-riio-1/network-performance-under-riio

reduction in the number of interruptions to power supply and the improvements in customer satisfaction levels, as shown in Figures 7.1 and 7.2.

7.8. Responding to RIIO-1 incentives, companies have increased their efficiency in delivering services to consumers. This improved efficiency results from network companies re-phasing or retiming their work profiles relative to their original plans, as well as some other external factors (such as different volume of low carbon technologies connecting to the networks than was anticipated at the beginning of RIIO-1). Network companies have undertaken considerable development to respond to changes in how the networks are used, and innovation and R&D have increased.

7.9. However, despite these significant successes, the overall costs of the transmission and distribution networks to consumers in RIIO-1 to date have turned out to be higher than they needed to be. In practice, the majority of network companies are achieving profit margins towards the higher end of our expectations for each sector.

Significant improvements in network reliability levels

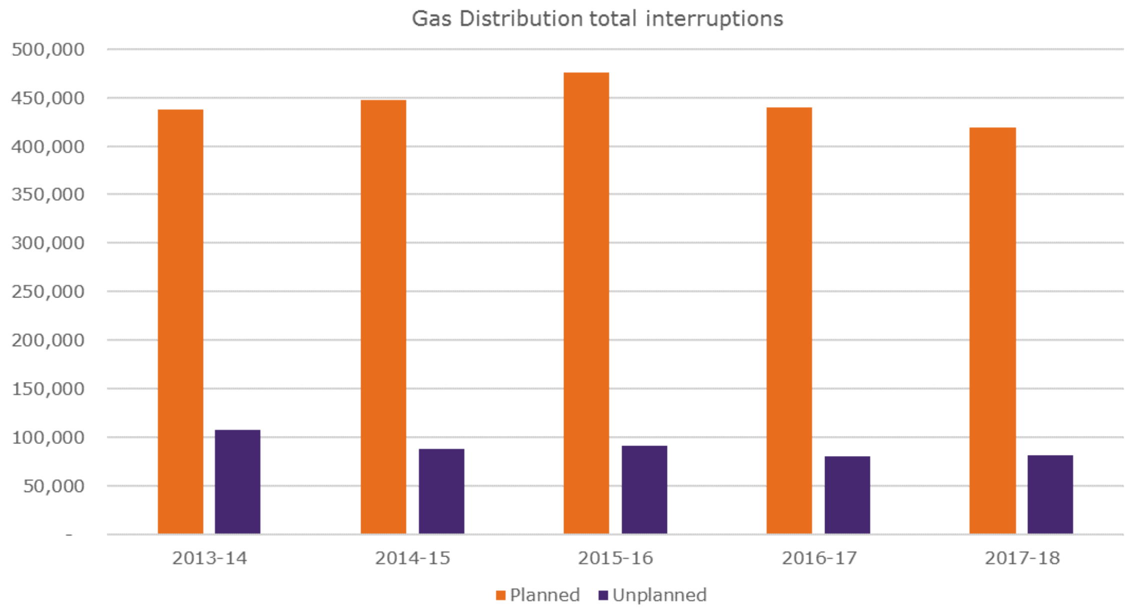
7.10. GB's gas and electricity networks deliver safe and reliable energy. Data from the Energy Networks Association (ENA) show that the average gas customer will experience an unplanned interruption just once in their lifetime. For electricity consumers, the number of interruptions has fallen by around 50% since 1990, whilst the length of those interruptions has fallen by around 60%.[234]

7.11. Looking at recent performance, the service availability of the gas distribution network was 99.99% in 2017-18. The sector continues to make sufficient capacity provisions to ensure customers' gas supply is not interrupted during periods of highest demand in harsh winter conditions, such as the extreme cold weather snap – the Beast from the East – in early 2018. The Gas Distribution Networks (GDNs) work together during major incidents to minimise the loss of gas supply to customers. For example, all GDNs contributed engineers to restore gas supplies following an incident that affected around 3,500 customers in March 2018.

[234] http://www.energynetworks.org/news/publications/ena-publications/

7.12. Within these headline indicators, some areas of concern remain. GDNs are required to deliver minimum levels of network reliability performance for consumers, specifically in managing the number and duration of planned and unplanned interruptions of gas supply. In 2017-18, planned interruptions fell by 20,500 compared to the previous year, but there was a marginal rise in the number of unplanned interruptions and their average duration.

Figure 7.1: Total interruptions on the gas distribution networks

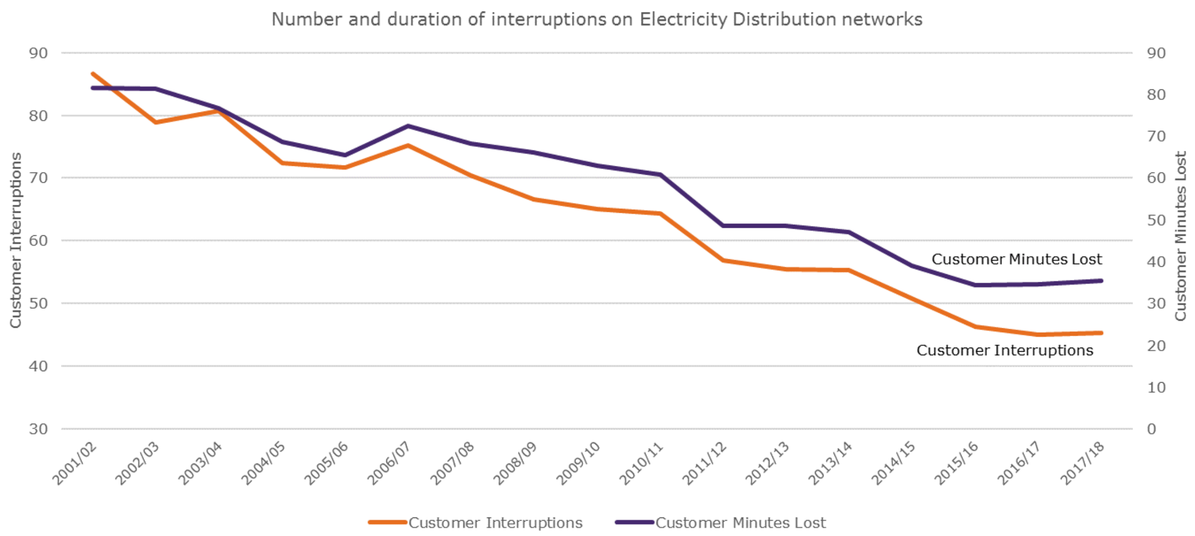


Source: 2017-18 RIIO-ED1 Regulatory Reporting Packs and Ofgem historical data

7.13. One GDN (Cadent) was unable to provide a forecast for unplanned interruptions for North London in its 2017-18 submission. This raised concerns on the achievability and reliability of future forecasting due to the large number of multi-occupancy buildings (MOBs) and the uncertainty of the volume of work that will be required. We are concerned by the deterioration in Cadent North London's network performance, and are discussing with them how the issue can be remedied. We have asked Cadent to provide us with a satisfactory action plan; if we do not think its proposals adequately protect consumers, we will consider further steps.

7.14. Network reliability for local electricity grids has remained high at around 99.99%. Since 2015, customer interruptions in electricity distribution have fallen by 11%, and the duration of interruptions has fallen by around 9%. On average, in 2017-18 each customer was without power for around 36 minutes over the course of the year.[235]

Figure 7.2: Reliability improvements in electricity distribution



Source: 2017-18 RIIO-ED1 Regulatory Reporting Packs and Ofgem historical data.

7.15. On 9 August 2019, 1.1 million electricity customers were disconnected following a lightning strike on a transmission circuit and the loss of two transmission-connected generators. We are investigating the circumstances which contributed to the power cut and the Electricity System Operator (ESO) published a technical report on these events at the start of September.[236]

Maintaining high levels of customer satisfaction

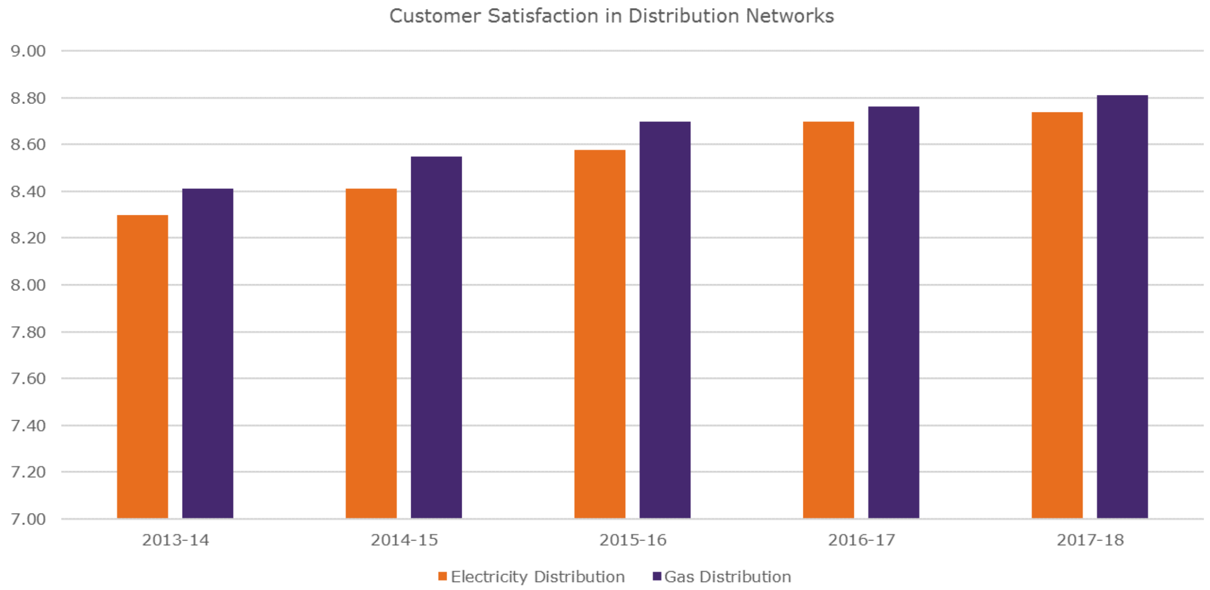
7.16. In well-functioning markets, where consumers are empowered and have choice, companies must understand and respond to shifting consumer needs; otherwise they may go out of business. Consumers of energy network services do not have choice over their network provider. One of the ways we try to mimic the outcome of a

[235] For reliability, we focus on some key indicators at an aggregate level. These are the average percentage of customers interrupted in a year, and the average total duration of interruptions throughout the year.
[236] https://www.ofgem.gov.uk/publications-and-updates/ofgem-has-published-national-grid-electricity-system-operator-s-technical-report

competitive market is by requiring network companies to engage with a range of different stakeholders, and we provide a financial reward for those that do it well.

7.17. Since the start of the RIIO price controls, levels of customer satisfaction with gas and electricity services have increased, reflecting the steps network companies are taking to improve their customer service, as shown by Figure 7.3.

Figure 7.3: Customer satisfaction levels in distribution networks



Source: 2017-18 RIIO-ED1/GD1 Regulatory Reporting Packs.

7.18. In gas distribution, the number of complaints has fallen by 20% since 2013 to a total of 12,874 in 2017-18 across all GDNs and, in most cases, the GDNs are achieving high levels of customer satisfaction, with some consistently achieving survey scores over 9/10.

7.19. All GDNs met their annual targets for 2017-18 except Cadent, whose North London network missed its target for the connections survey, and whose West Midlands network missed its target for the connections and planned interruptions surveys. In 2017-18, Cadent received a £1.16 million penalty (in 2017-18 prices) under the Broad Measure of Customer Satisfaction (BMCS) incentive for failing to meet these targets.[237]

[237] Cadent did achieve a net reward for the BMCS, based on its wider performance such as in other customer satisfaction surveys

7.20. The BMCS has been a key driver of improvements in customer service in electricity distribution. It has three individual mechanisms: a Customer Satisfaction Survey (CSS), the Complaints Metric, and the Stakeholder Engagement and Consumer Vulnerability incentive. All Distribution Network Operators (DNOs) met or outperformed their CSS targets in 2017-18, building on their performances in RIIO-ED1 to date; the industry average score is 8.7 out of 10. In terms of complaints, all DNOs outperformed their targets, and continued to improve their performances in this area.

7.21. In electricity transmission, each of the three Transmission Owners (TOs) continued to exceed their targets during 2017-18. In gas transmission, there was a reduction in both the customer satisfaction survey scores and stakeholder engagement survey scores compared to the previous year, but these remained above the target levels set by Ofgem.

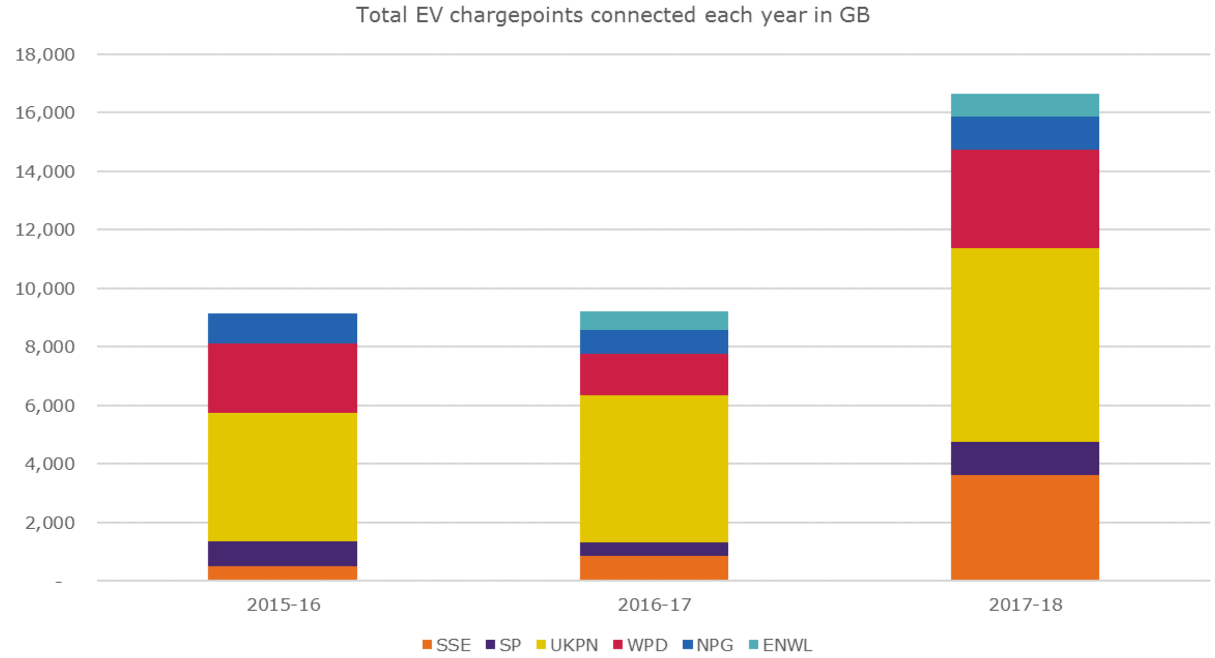
Supporting the low carbon transition and responding to new sources of demand

7.22. A key objective of Ofgem's regulation is to ensure that network companies support the transition to a smarter, more flexible, sustainable and lower-carbon energy system, taking the appropriate steps to mitigate their own environmental impact. With the UK and Scottish Governments recently agreeing new net-zero emissions targets, there will be an increasing focus on decarbonisation, particularly in the transport and heat sectors.

7.23. As the growth in electric vehicles accelerates and more homes and businesses source their heat and power from cleaner energy sources, a core responsibility of networks will be to facilitate these changes. This means responding to the demands for low carbon connections in a timely way, finding efficient ways to respond to new sources of demand and flexibility on the networks, and supporting innovation that could expand the range of possibilities for the decarbonisation of heat, power and transport.

7.24. In electricity distribution, enabling the connection of low carbon technologies across the country is an increasingly important element of the outputs that the DNOs are expected to achieve. As shown in Figure 7.4, DNOs facilitated the connection of over 16,000 electric vehicle chargepoints in 2017-18, up more than 80% from 2016-17 levels.

Figure 7.4: Total Electric Vehicle chargepoint connections by DNO group



Source: 2017-18 RIIO-ED1 Regulatory Reporting Packs.

7.25. The generation of power is also becoming increasingly distributed, with low carbon generation connecting directly to the distribution network. During 2017-18, 1.7 gigawatts (GW) of generation was connected to the distribution network. This is lower than the 3.2GW of generation that was connected in 2016-17, bringing the total amount of distributed generation up to 8.6GW.

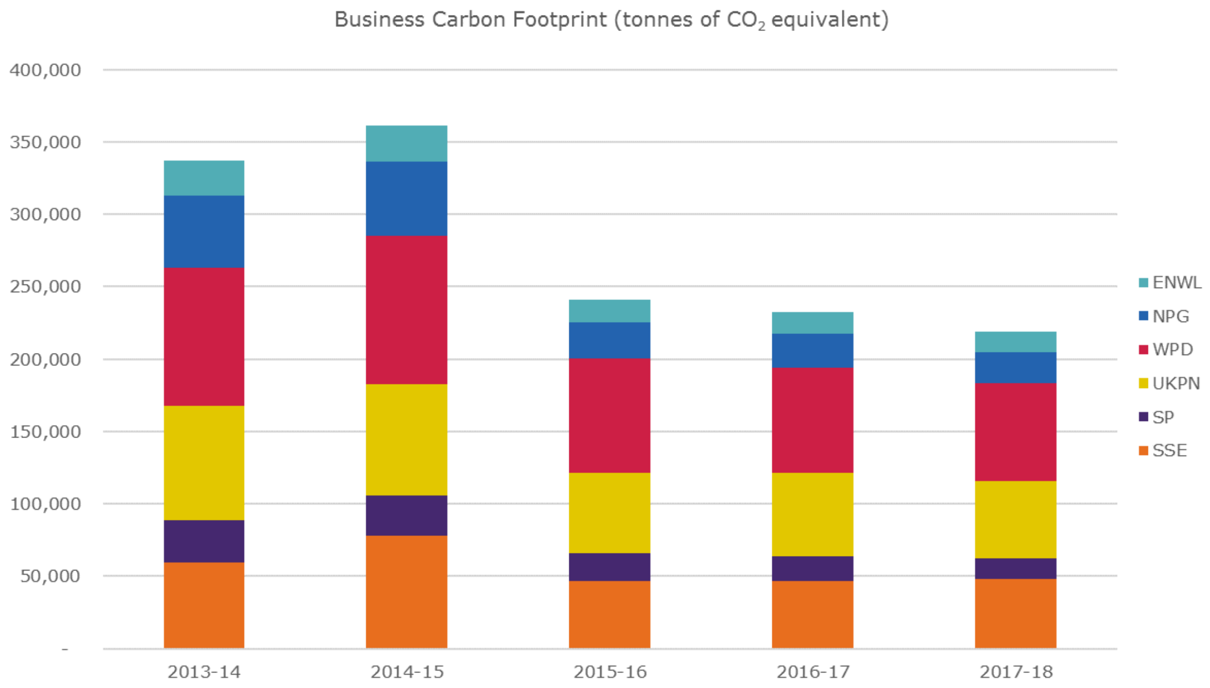
Mitigating direct environmental impacts

7.26. Alongside their responsibilities to facilitate decarbonisation of the energy sector, the gas and electricity networks also need to mitigate the environmental impact of their own business activities. This includes reductions to their corporate carbon footprint, reducing emissions of carbon dioxide and sulphur hexafluoride (SF6),[238] and minimising any network losses or leakages.

[238] Sulphur hexafluoride (SF_6) is used in the electricity industry as an electrical insulator for high-

7.27. In electricity distribution, all DNOs are on track to meet their targets for Business Carbon Footprint (BCF) reduction. However, compared to last year, performance against SF6 emissions and oil leakage is notably mixed. We expect all DNOs to meet their commitments to achieve their targets by the end of the price control in 2023.

Figure 7.5: Total BCF emissions (tonnes of CO2 equivalent) by DNO group



Source: RIIO-ED1 Annual Report 2017-18 Supplementary Data File.

7.28. In gas distribution, the GDNs have consistently met their environmental output targets since 2015.

7.29. In electricity transmission, all three TOs reduced their SF6 leakage rates to outperform the agreed annual limit. This is the first time they have achieved this in RIIO (or ever, in the case of Scottish Hydro Electric Transmission).

7.30. In gas transmission, National Grid missed its greenhouse gas emissions target (of 2,897 tonnes) in 2017-18 by 996 tonnes. National Grid's failure to meet this target was driven mainly by the need to manage uncertainty around supply and avoid constraints.

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voltage circuit breakers, switchgear and other electrical equipment, but it is an inorganic and extremely potent greenhouse gas.

Continuing to protect consumers, including the vulnerable

7.31. Network companies are required to deliver a high quality and reliable service to all network users and consumers, including those who are in vulnerable situations. A number of social outputs and obligations were set under the RIIO-1 price controls to support this process.

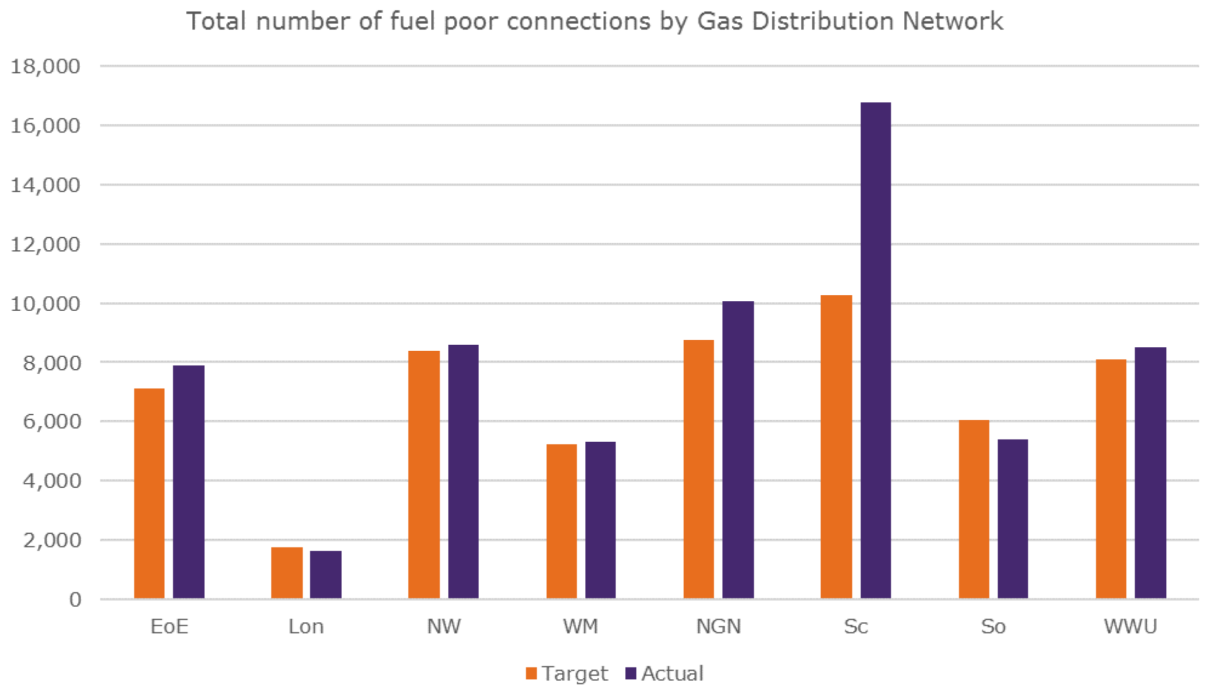
7.32. Since 2013, there have generally been steady improvements in network companies' work to address vulnerability and engage with their stakeholders. There remains, however, work to do for some sectors and companies.

7.33. The Fuel Poor Network Extension Scheme (FPNES) in the gas distribution sector helps vulnerable and fuel poor households that are not connected to the gas grid by offering funding towards the cost of connecting to the gas network.

7.34. Most GDNs are on track to exceed the target of connecting 91,000 fuel poor households to the gas network between 2013 and 2021, currently forecasting to connect over 96,000 households in this period. Since 2013, GDNs have connected 64,100 fuel poor households, which is 5,200 more than planned at this stage of the price control.

7.35. Both Cadent and SGN Southern are currently off-track from their eight-year FPNES connections targets, but both still expect to meet the target by the end of RIIO-GD1. SGN Southern expects to meet its 8-year target through increased consumer engagement, together with the introduction of new initiatives arising from its £20m additional funding commitment to tackle fuel poverty. This was part of the November 2017 £145m voluntary contribution (in 2009-10 prices) it made to benefit customers.

Figure 7.6: Fuel Poor Connections by GDN



Source: 2017-18 RIIO-GD1 Regulatory Reporting Packs.

7.36. Where network companies do not deliver the level of service that we expect of them, they are required to make a payment to the customers that are affected; these are known as the Guaranteed Standards of Performance. Payments under the Guaranteed Standards are not funded through the price control, which gives all network companies an additional incentive to ensure they provide these minimum levels of service. Since 2015, the DNOs have paid over £5.5million to customers (in 2012-13 prices), with around half of this coming from voluntary payments.[239]

Financial returns have been high

7.37. Despite the significant successes of the RIIO-1 price controls, including generally high levels of service delivery, the overall costs to consumers of the transmission and distribution networks have turned out to be higher than they needed to be. The

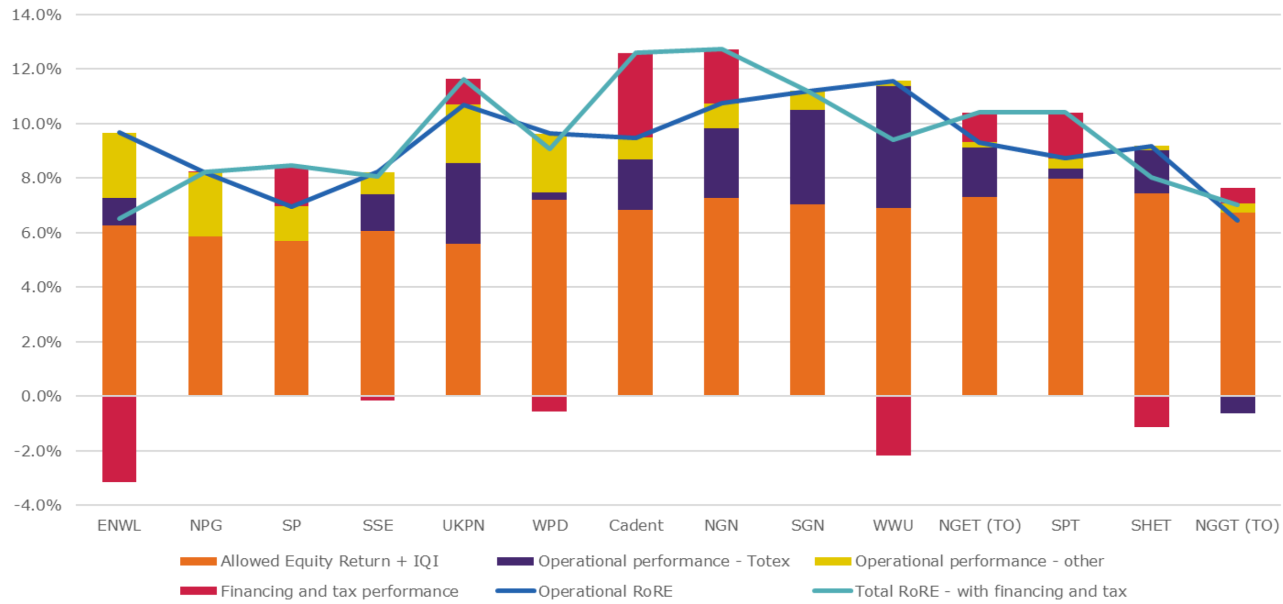
[239] Voluntary payments can be made either where customers do not qualify for a payment but the company decides to pay it anyway, or where the DNO decides to pay a higher amount to customers than is required under the regulations.

majority of network companies are achieving earnings towards the higher end of our expectations for each sector.

7.38. Ofgem assesses the overall financial performance of network companies during the RIIO-1 price controls using a measure called the Return on Regulatory Equity (RoRE). RoRE is an estimate of the financial return achieved by network companies' shareholders during a price control period based on actual (and forecast) performance. It is an established way of gaining an overall picture of how regulated companies have been performing under the price control. It may though underestimate returns achieved by ultimate investors where regulated network companies are owned by holding companies.

7.39. Measured in terms of operational RoRE (which excludes debt and tax performance), almost half of the network companies have been achieving double-digit returns in real terms throughout the RIIO-1 price control period (the turquoise line in Figure 7.7).

Figure 7.7: Operational Return on Regulatory Equity for all sectors



Source: 2017-18 Regulatory Financial Performance Reporting Annex.

7.40. A number of factors have driven this, including efficiency, good performance against targets, or companies innovating to cut costs. However, it also reflects a combination of forecasting errors, some budgets set too high, and some targets set too low.

7.41. To compound this, with hindsight it now appears that the allowed return on equity was set too high in RIIO-1. This was partly because of a failure to forecast interest rates accurately, but mainly because of a conservative approach taken to setting allowances to avoid the perceived risk of under-investment. A long price control period has meant we have had to wait several years to correct these issues.

7.42. There are some variations in these key drivers of performance across the individual sectors and indeed for the companies within those sectors. In the electricity transmission (primarily for National Grid Electricity Transmission) and gas distribution sectors, the main driver is underspend against the allowances set for each company (totex performance).

7.43. Totex is our name for "total expenditure", which is the sum of capital expenditure (capex) and operating expenditure (opex) incurred by a network company over a price control. By providing an overall allowance to deliver their outputs (rather than designated opex or capex allowances), we believe companies are driven to deliver more efficiently and find the most cost-effective solutions. This includes looking at alternative solutions, such as demand-side management and increased flexibility, to avoid installing expensive new capacity such as new pipes and overhead lines.

7.44. In the electricity distribution sector, outperformance at the sectoral level has been driven largely by underspend against allowances as well as rewards from incentives, particularly against the Interruptions Incentive Scheme (IIS) which has supported high levels of network reliability.

7.45. For further details on these performance drivers please consult the annual reports for each sector and the Regulatory Financial Performance Reporting (RFPR) annex published by Ofgem in March 2019.[240]

Strengthening competition in networks

7.46. Ofgem's principal objectives include protecting existing and future consumers '…wherever appropriate by promoting effective competition between persons engaged in, or in commercial activities connected with…' the transportation of gas and the

[240] https://www.ofgem.gov.uk/publications-and-updates/regulatory-financial-performance-annex-riio-1-annual-reports-2017-18

transmission and distribution of electricity. This is reflected in our regulatory stances, which we consider when developing our policies.

7.47. Along with the UK Government, we launched the Offshore Transmission Owners (OFTO) regime in 2009. This tendered to third parties the ownership and operation of new electricity links to connect offshore wind farms to the grid for a set licence period. Winning bidders have so far invested more than £3.6 billion in links and generation assets which have connected 5GW of offshore wind farms. Two independent reports have, taken together, assessed that between c.£700m and £1.2bn of savings have been achieved for consumers so far across the first three tender rounds. These savings are based upon comparisons to two merchant-based and three regulated price control counterfactuals.

7.48. We have also set out plans to introduce forms of competition into the ownership and operation of new onshore transmission links, as well as to open up high-value network investment to competition across the gas and electricity sectors. We expect these to improve efficiency, and deliver lower costs for consumers, and are considering introducing models for competition into RIIO-ED2.

Driving efficiency through innovation

7.49. Innovation is a key pillar of the RIIO framework, ensuring that the network companies can support the transition to a smarter, more flexible, sustainable low-carbon energy system and reduce costs to consumers by finding new ways of operating and developing their networks.

7.50. The RIIO-1 innovation stimulus consists of three mechanisms: the Network Innovation Allowance (NIA), the Network Innovation Competition (NIC) and Innovation Rollout Mechanism (IRM) (Table 7.1).[241] The NIA is a percentage of a network company's totex allowance that they are permitted to spend on innovation projects. The NIC is an annual pot that companies can bid into for larger scale low carbon projects, up to a maximum value of £70m in electricity and £20m in gas (in nominal

[241] Details of all NIA and NIC projects are registered on the Energy Network Association Smarter Networks Portal; https://www.smarternetworks.org/

prices). The IRM is an opportunity for network companies to request funds for the rollout of successful innovation trials into their business as usual activities.

Table 7.1: Scale of RIIO-1 Innovation Stimulus

Mechanism	Available 2013-23	Spend/funding awarded
Network Innovation Allowance	~£500m	£190m (up to March 18)
Network Innovation Competition	~£720m	£270m (up to end 18)
Innovation Rollout Mechanism	No funding limit	£32m

7.51. There is a time lag in the benefits that can be seen from innovation, due to the time it takes to develop and demonstrate new technologies or processes, and then incorporate these into business practice. However, research carried out by Pöyry found that innovation projects by local electricity DNOs could deliver up to £1.7bn of benefits by 2031. Additional benefits could be achieved if all network companies roll out successful innovation into their everyday activities.[242]

7.52. Key developments in networks through innovation have included the development of pipeline robotics in gas networks operations, and active network management and increased flexibility across electricity networks.

Preparing our networks for the future

7.53. The energy networks sit at the heart of our energy system, and the RIIO-2 price controls, which will operate from April 2021, will have a critical enabling role in driving better value for consumers by learning lessons from both the current and previous price controls at the same time as preparing the networks for the energy system of the future.

7.54. Ofgem is currently going through the process of setting the next round of price controls. The sector methodology for the gas and electricity transmission, gas

[242] Pöyry's evaluation of the Low Carbon Network Fund (LCNF) estimated that the LCNF, costing around £300m in total, could deliver between £4.8-£8.1bn in financial benefits by 2030 if all solutions were rolled out, as well as delivering £600-£1.2bn in carbon reduction benefits.
An independent evaluation of the LCNF, Pöyry, October 2016;
https://www.ofgem.gov.uk/system/files/docs/2016/11/evaluation_of_the_lcnf_0.pdf

distribution, and new ESO price controls was published in May 2019.[243] An open letter for the next electricity distribution price control, which runs from April 2023 to March 2028, was published in August.[244]

7.55. Our aims for RIIO-2 are to prepare our networks for a low carbon future whilst ensuring costs are kept as low as possible for consumers. The new price controls should promote the delivery of high quality services at lower cost to consumers, paving the way for a cheaper, smarter, and more sustainable energy system.

243 https://www.ofgem.gov.uk/publications-and-updates/riio-2-sector-specific-methodology-decision
244 https://www.ofgem.gov.uk/publications-and-updates/open-letter-consultation-riio-ed2-price-control