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Wholesale Energy Markets in 2016

Report

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Overview:

This report assesses some key indicators that we use to monitor the wholesale energy markets in Great Britain (GB). It gives an overview of conditions in the gas and electricity wholesale markets, and how these compare to previous trends and other similar markets.

Through this report we want to provide independent and reliable information on the wholesale markets in GB. This promotes transparency, improves understanding and shows consumers, market participants and other interested parties how we monitor the markets.

Context

Market monitoring is a crucial part of our role as the regulator of the gas and electricity markets in GB. It helps us keep abreast of developments, informs how we develop new policy, and helps us to assess the impact of existing regulations.

We are looking to foster understanding, trust and confidence among stakeholders by publishing more information about the markets we regulate. This report is part of a wider package of monitoring publications, including an annual report looking at recent developments in the retail markets; a report detailing trends in liquidity in the wholesale electricity market; and a suite of energy markets indicators, which we will publish regularly on a dedicated section of our website. We have also begun the regular publication of key indicators tracking the customer service performance of individual suppliers.

These – and other – regular publications will help to build a picture of how the market is functioning and to identify any specific issues. They will also help to track the contribution of the retail and wholesale markets – including the way in which we regulate them – in achieving the outcomes for consumers set out in our strategy: lower bills, improved reliability, better quality of service, benefits for society as a whole and reduced environmental damage. We are keen to hear stakeholders' feedback on these publications to inform future monitoring outputs.

Associated documents

Website Indicators: https://www.ofgem.gov.uk/market-monitoring

Retail Energy Markets in 2016: https://www.ofgem.gov.uk/publications-and-updates/retail-energy-markets-2016

Wholesale power market liquidity: Annual report 2016
https://www.ofgem.gov.uk/publications-and-updates/wholesale-power-market-liquidity-annual-report-2016

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Executive Summary

Wholesale costs

Over the past decade, both gas and power wholesale prices generally rose as GB moved away from self-sufficiency in gas supplies and now must compete in a global marketplace. Over this period, gas-fired generation has been setting the power price, and as such wholesale electricity prices have followed the wholesale price of gas.

Recently, this trend has changed and prices have fallen. This has been driven by a combination of the loosening of global gas markets, significant declines in the price of oil and local drivers such as mild weather, which has reduced demand.

Gas

We expect that existing gas supply capacity can meet demand well into the future. The diverse nature of GB supplies means that GB is resilient to all but the most extreme circumstances. From day to day, the market generally promotes efficient balancing, even though within-day demand is becoming more variable.

Our indicators suggest that the GB wholesale gas market remains a mature, liquid market with high levels of churn, narrow bid-offer spreads and a growing number of active participants. There is a diverse range of products and platforms available for those looking to trade gas in GB. Historically, the majority of trading has been conducted "over-the-counter" through brokers, but in recent years gas trading has shifted towards exchange platforms.

The GB market appears to be competitive and outperforms virtually all relevant European and US benchmarks. The evidence shows low levels of concentration, robust market entry and exit, and low levels of vertical integration.

Market signals have incentivised major investment in new import infrastructure in the past decade. Investment in seasonal storage has been muted, but this appears to be in line with market signals and the declining summer-winter spreads. On issues of governance and regulatory burden, there have been some encouraging trends, with the number of code modifications falling over time. However, the complexity of many of the new changes continues to pose a challenge. Lastly, from a sustainability perspective, demand has fallen in recent years. There are many likely causes of this, one of which is better energy efficiency.

Electricity

Total generation capacity has been steady over recent years. 2015 and the beginning of 2016 saw a trend of decreasing reliance on generation from coal, replaced partly by more new renewable capacity. For this winter, margins remain manageable and National Grid has procured additional balancing services that it can use to help it balance the system if margins tighten.

As a way to ensure future investment in electricity generating capacity and the security of supply, the government introduced Capacity Market auctions, where

generators can earn additional revenue in return for providing capacity at times of system stress.

The GB electricity market appears relatively illiquid compared to some international power markets, but there are signs that liquidity is improving since our Secure and Promote reforms were implemented. Bid-offer spreads appear to be consistently narrower in recent years, and there is an increasing emphasis on near-term trading which may be due to the difficulty of predicting the level of intermittent generation.

The GB wholesale electricity market appears reasonably competitive, with our analysis showing renewable generation being generally more profitable than conventional generation. Pivotality analysis suggests there is limited scope for generators to exert market power in the GB market.

There has been a large increase in investment in renewable installations, which has led to emissions intensity from electricity generation falling to record low levels.

Introduction

Scope of report

Monitoring and assessing the wholesale markets

1.1. Monitoring is a crucial part of our role as the regulator of the gas and electricity markets in GB. We do this so we can understand the impacts of market trends on consumers. We also monitor market participants' compliance with obligations. Our monitoring:

- ensures we are aware of market developments
- informs our development of new policy
- allows us to evaluate the impact of previous policy decisions, and compliance with these.

1.2. This report is our assessment of a range of key indicators of the wholesale energy markets in GB over the past year. The report describes conditions in the gas and electricity wholesale markets, and how these compare to previous trends and other similar markets. It does not evaluate policies in the energy market. It is an evidence-based view of how the markets have been performing given the current arrangements.

1.3. Through this report we aim to provide independent and reliable information on the wholesale markets in GB. This promotes transparency, improves understanding and shows consumers, market participants and other interested parties how we monitor the markets. This is our second such report, following our first in 2015.

1.4. Alongside our report, we publish a set of wholesale market indicators on our website. These are a selection of those covered in this report and are updated regularly. We also publish a separate report and accompanying set of indicators on the retail markets.

1.5. We are keen to engage with industry stakeholders and interested parties to get their views on the data used in this in this report, the indicators we have published on our website, and to understand more about how the wholesale markets are working for them. You can email us at wholesalemarketindicators@ofgem.gov.uk.

CMA investigation and remedies

1.6. On 24 June 2016, the CMA published its Energy Market Investigation: Final Report. In line with the CMA's recommendation that we produce an annual State of the Market report, we provide here an update on the evolution of wholesale prices, profitability of key players, trends for the forthcoming year.

1.7. Our State of the Market report will build on our existing reports to provide a holistic assessment of the GB energy markets. We expect to publish this for the first time in Autumn 2017.

Framework

1.8. There are many indicators that can be analysed when monitoring the wholesale markets. We characterise the overarching objective of the gas and electricity wholesale markets as: **to provide a dynamic and sustainable mechanism in which informed participants can confidently and efficiently buy and sell the energy they need at a price that reflects economic costs**.

1.9. We have developed a framework of what we consider to be the key features of a well-functioning wholesale market:

- **Security of supply** – critical for consumers, the economy and wider society
- **Access and liquidity** – makes it easy for market participants to trade and facilitates competition
- **Competition** – drives innovation and puts downward pressure on prices to ensure they are as low as possible
- **Investment and sustainability** – ensures there are adequate, clean supplies of energy for current and future consumers

1.10. This framework has indicators that can be assessed in order to provide a comprehensive view of the how the wholesale markets are functioning. In line with our 2015 report, this report is structured based on our framework.

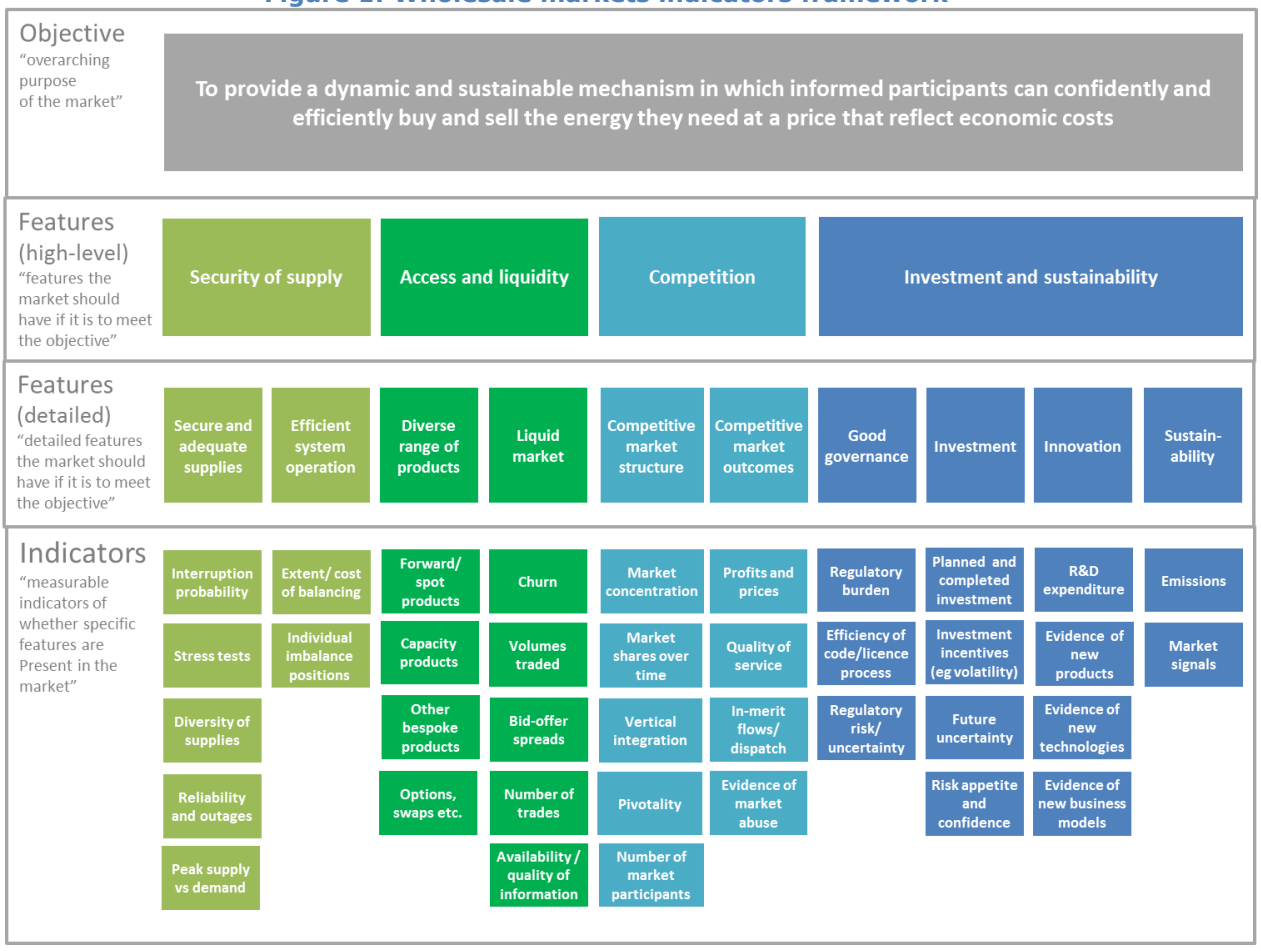
1.11. A well-functioning wholesale market is an integral part of ensuring the energy market works for consumers. The features above are aligned with our key consumer outcomes which form a core part of our strategy.[1] The table sets out this alignment.

[1] https://www.ofgem.gov.uk/publications-and-updates/ofgem-our-strategy

Wholesale market framework features:	Ofgem consumer outcomes				
	Lower bills	Reduced environmental damage	Improved reliability	Better quality of service	Benefits to society
Security of supply			✓		✓
Access and liquidity	✓				
Competition	✓			✓	✓
Investment and sustainability	✓	✓	✓	✓	✓

1.12. The indicators that we monitor cover all four of these key features, and provide a broad view of how the market is functioning. The framework and many of the key indicators we assess are summarised in **Error! Reference source not found.** The framework is explained in greater detail in Appendix 1.

Figure 1: Wholesale markets indicators framework



Wholesale markets

1.13. The vast majority of the gas and electricity in GB must pass through a number of stages in the energy supply chain before it reaches consumers. Figure 2 below is a brief summary of these various stages in the energy supply chain.

Figure 2: The energy supply chain

	Upstream	Wholesale market	Networks	Retail market
Gas	The gas supply chain begins when gas is extracted. This gas is then brought to GB by pipelines or on LNG tankers.	Once gas has reached GB it enters the wholesale market. Upstream producers and importers compete to sell their gas on to retail suppliers.	Various gas market participants pay gas pipeline operators to transport their gas through the pipes in the network.	The gas supply chain ends with the retail market. Here suppliers compete to sell gas on to end consumers.
Power	The power supply chain begins with the fuels that generate most of our power (coal, gas, uranium). We also import power from neighbouring countries.	Once power has been generated or imported into GB it enters the wholesale market. Generators and power importers compete to sell their power on to retail suppliers.	Various power market participants pay power grid operators to transmit their power through the wires in the network.	The power supply chain ends with the retail market. Suppliers compete to sell power on to end consumers.

1.14. The wholesale markets are where gas and power are bought and sold by several different types of participants. Companies that produce or import energy (eg electricity generators and gas producers) sell their energy in the wholesale markets. Companies that consume energy (eg large industrial companies) or have customers that consume energy (eg retail suppliers) buy the energy they need in the wholesale markets. There are also some companies whose primary focus is trading (eg banks and trading houses). They use the wholesale markets to optimise assets, provide liquidity, manage risk and speculate on market movements.

1.15. The wholesale market arrangements in GB are founded on open, non-discriminatory third-party access to the transmission and distribution networks. This allows market participants to transport their gas and power throughout GB according to terms that are fair and transparent. Market participants must pay transmission and distribution charges to network companies in exchange for these transportation services.

1.16. The wholesale markets are based on the principle of market participants balancing their own physical and traded positions. This is the combination of what they physically flow in and out of the networks and what they contract to buy and

sell. The market is therefore the primary mechanism by which the gas and power networks are balanced.

1.17. The system operator (SO) carries out a residual role in which it resolves any imbalances and locational issues that remain after the market has run its course. While the SO's general purpose is the same in gas and power, there are differences in the way it carries out its role in the two markets. The SO in gas is National Grid Gas (NGG). The SO in electricity is National Grid Electricity Transmission (NGET).

1.18. Where market participants fail to balance they must pay imbalance (cash-out) charges. These imbalance charges incentivise balancing and help compensate the SO for any actions it takes to balance the system.

2. Trends in energy prices

Chapter Summary

Wholesale costs are currently the largest component of final consumer bills. So, understanding what drives changes in wholesale prices is crucial to protect the interests of present and future consumers. Over the past decade, both gas and power wholesale prices generally rose as GB moved away from self-sufficiency in gas supplies and now must compete in a global marketplace. Over this period, gas-fired generation has been setting the power price, and as such wholesale electricity prices have followed the wholesale price of gas.

Recently, this trend has changed and prices have fallen. This has been driven by a combination of the loosening of global gas markets, significant declines in the price of oil and local drivers such as mild weather, which has reduced demand.

Why do wholesale prices matter?

Link to retail bills

2.1. A crucial outcome of the gas and electricity wholesale markets is prices. Wholesale costs typically make up around 45% of the average domestic consumer's bill. Understanding how and why wholesale prices change over time is therefore very important to our aim of protecting the interests of present and future consumers.

2.2. In a competitive market wholesale prices are based on the cost of the marginal source of supply. This is the final source of gas or electricity supply needed to meet demand. What makes up the marginal source of supply will vary depending on what supplies are available, the costs of those supplies, and the level of demand.

2.3. This report focuses on the main drivers of GB wholesale gas and electricity prices.

Commodity prices (oil, coal and carbon)

2.4. Wholesale gas and electricity prices are influenced by the prices of a number of other commodities. Of particular importance are oil, coal and carbon prices.

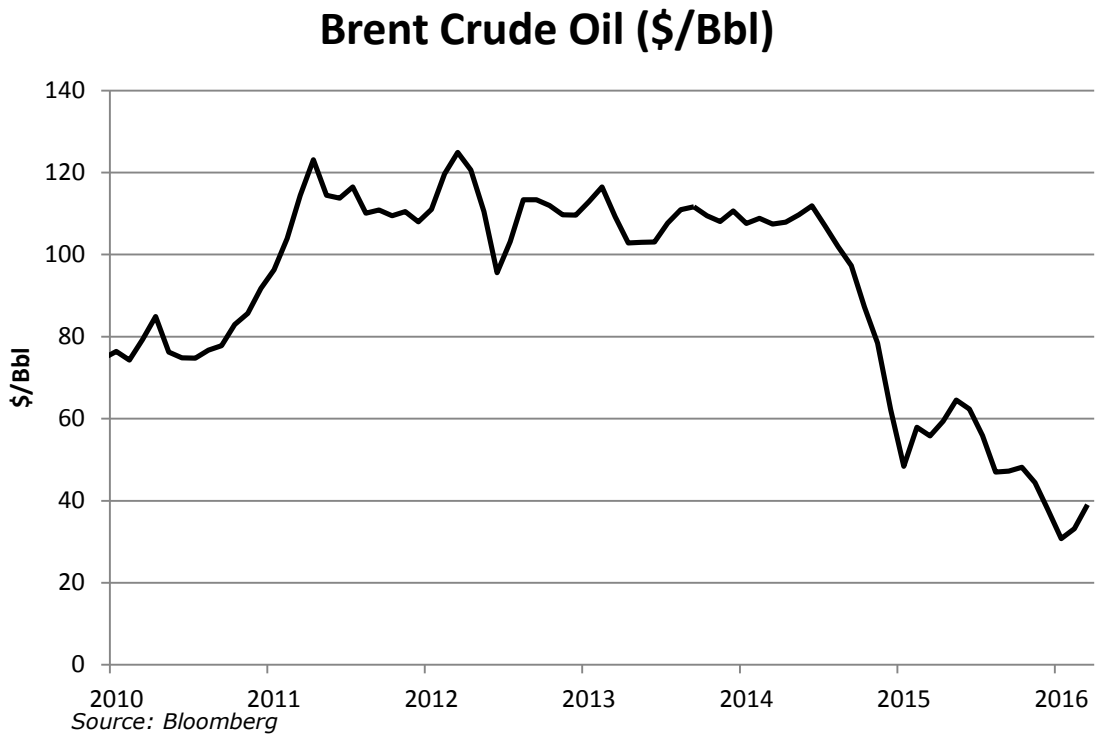
Trends in oil prices

2.5. While gas and electricity prices are based on the fundamentals of supply and demand, the oil market continues to have some influence on GB energy prices. This is because long-term gas contracts in Europe and Asia have historically been linked to the price of oil.

2.6. As shown in Figure 3, Oil prices were relatively stable at levels of above $100/barrel between 2011 and 2014. However, they fell steeply in the second half of 2014 and continued their downward trajectory over the past year, reflecting a sustained period of oversupply in global markets. Brent crude averaged $52/bbl in 2015, 53% down on the previous year.[2]

2.7. Prices continued to fall in 2016, reaching lows of around $28/bbl in January before returning to above $50/bbl at the start of summer.

Figure 3: Brent Crude Oil, 2010 - 2016



Source: Bloomberg

Trends in coal and carbon prices

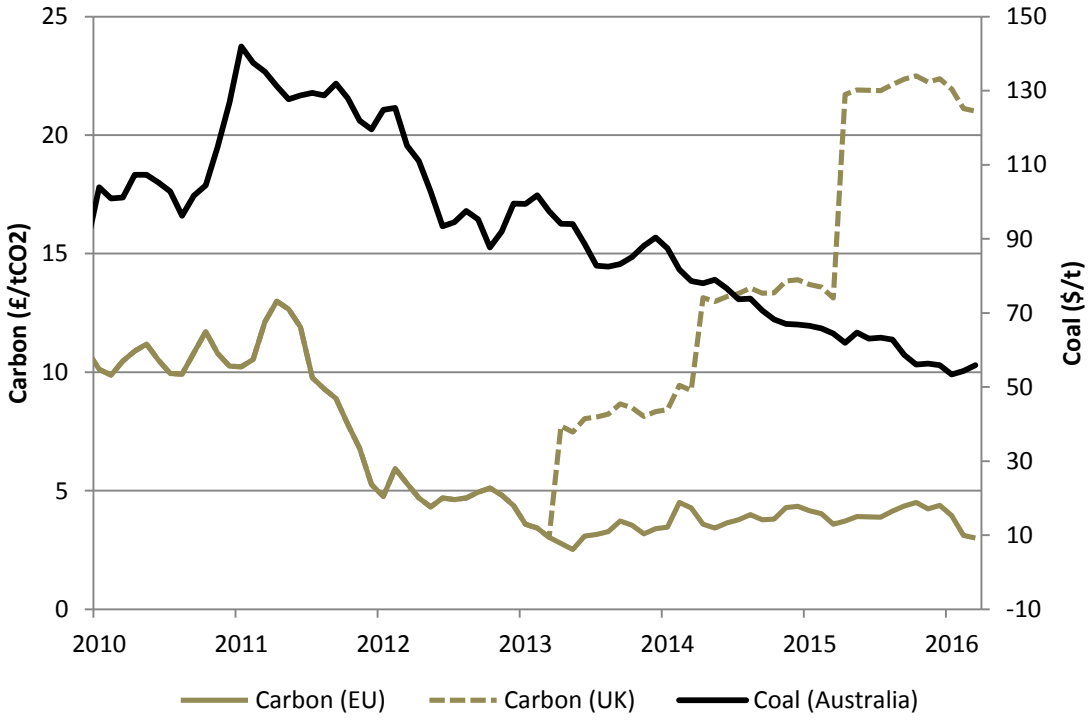
2.8. Coal prices are important for the wholesale electricity market because a significant, but declining, portion of GB's electricity is generated from coal. Coal prices continued their long-term decline over the past year, as the market remained oversupplied.

2.9. Electricity prices are also affected by the price attached to carbon. Fossil fuel power stations in the EU must hold allowances in order to emit CO_2. These allowances are traded through the EU Emissions Trading System (ETS) which was established in 2005 and provides a traded price for carbon.

[2] http://www.eia.gov/todayinenergy/detail.cfm?id=24432

2.10. The EU ETS price peaked in 2008 at around £22/tCO_2. Since then it has declined significantly due to an oversupply of allowances, and is now around £4/tCO_2. On 1 April 2013, GB introduced a Carbon Price Floor (CPF). This effectively sets a minimum price for carbon in GB by "topping up" the EU ETS carbon price. The main intent of the CPF is to send a strong, stable incentive to invest in low carbon generation. This is what is driving the divergence between the EU ETS carbon price and the effective GB price for carbon shown in Figure 4 below. Currently, the CPF comprises the largest share of carbon costs to generators, at around £18/t.

Figure 4: Monthly average carbon prices in Europe and the UK, 2008-2016



Source: Bloomberg

Wholesale gas prices

Recent price movements

2.11. GB wholesale gas prices followed a broadly upward trajectory in the first half of the decade. Since around 2014, however, prices have been generally falling.

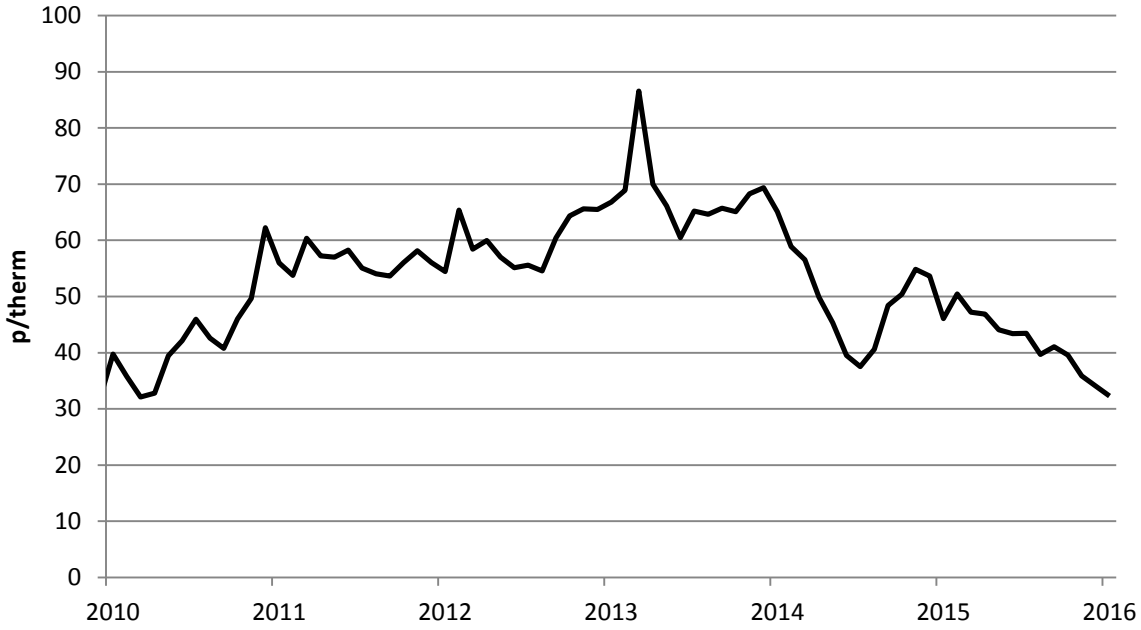
2.12. As shown in Figure 5, the average day-ahead gas price in 2015 was the lowest since 2010 at 42p/therm,[3] compared with 50p/therm in 2014. These trends have

[3] Price data from ICIS Energy.

been driven by a combination of healthy fundamentals (including falling global demand leading to less competition for LNG and hence lower prices and a feed through of oil price drops.

2.13. Downward price pressure continued into 2016, with day-ahead prices in April reaching their lowest levels since 2009 (c.27p/therm). Prices have since recovered slightly, but remain low. Further details of price formation and drivers in the GB gas market can be found in our recent blog.

Figure 5: Monthly average day ahead gas price 2010-2016, p/therm



Source: ICIS Energy

Forward curves

2.14. Similarly, the forward prices for gas also declined over the year. The contract for delivery of gas in winter 2016/17 finished the year 19p/therm (35%) lower than at the end of 2014.

Wholesale electricity prices

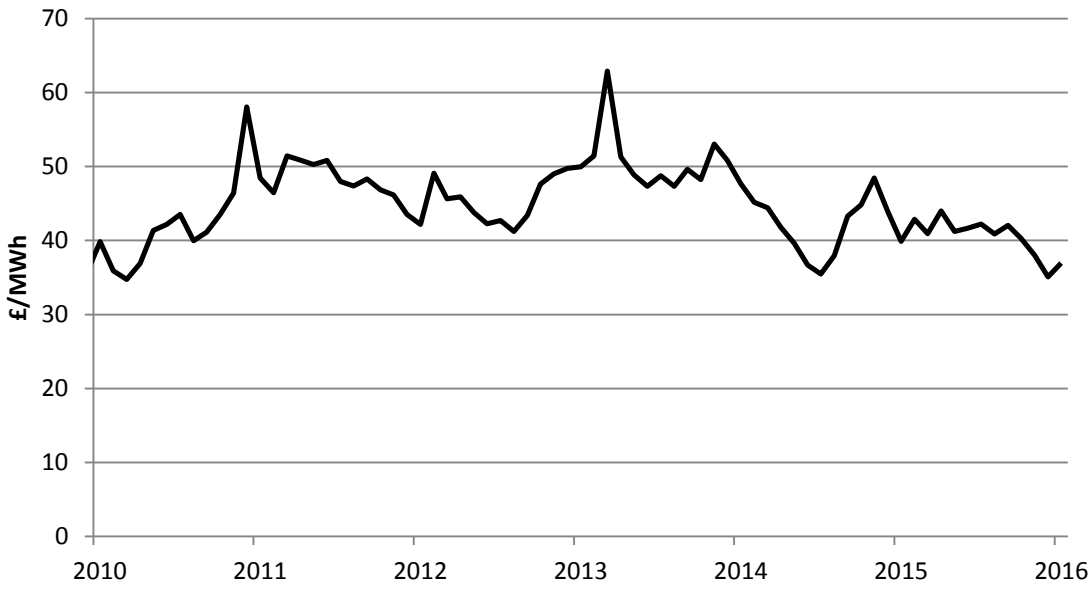
Recent price movements

2.15. In line with gas prices, wholesale electricity prices had also been generally increasing until around 2014. Gas influences electricity prices due to the prominence of gas in the generation mix. The monthly average day ahead price is shown in Figure 6.

2.16. As with gas, prices have since declined, and were also lower in 2015. This was driven largely by falls in oil and gas prices, with downward pressure on prices also coming from increased renewables penetration. In December, the day-ahead electricity contract reached its lowest levels of the decade, below £30/MWh. Overall, however, the decline was less pronounced than in gas, with electricity fundamentals and an increase in carbon costs supporting prices.

2.17. Hourly and half-hourly prices also turned negative with increasing frequency over the past year, particularly at periods of low demand and high inflexible and renewable generation. Boxing Day, for example, saw seven half-hourly periods of negative prices in the intraday timeframe. It's likely these signals were sharpened by the reforms to cash-out.

Figure 6: Monthly average day ahead electricity price 2010-2016, £/MWh



Source: ICIS Energy

Forward curves

2.18. Electricity forward prices also fell over the year. The contract for delivery of electricity in winter 2016/17 finished the year over £10/MWh (28%) lower than at the end of 2014.

3. Gas

Chapter Summary

For **security of supply**, existing gas supply capacity is expected to be capable of meeting demand well into the future. The diverse nature of GB supplies means that GB is resilient to all but the most extreme circumstances. From day to day, the market generally promotes efficient balancing, even though within-day demand is becoming more variable.

On market **access and liquidity**, our indicators suggest that the GB wholesale gas market remains a mature, liquid market with high levels of churn, narrow bid-offer spreads and a growing number of active participants. There is a diverse range of products and platforms available for those looking to trade gas in GB. Historically, the majority of trading has been conducted "over-the-counter" through brokers, but in recent years gas trading has shifted towards exchange platforms.

When assessed using a range of standard **competition** metrics, the GB market appears to be competitive and outperforms virtually all relevant European and US benchmarks. The evidence shows low levels of concentration, robust market entry and exit, and low levels of vertical integration.

On **investment and sustainability**, market signals have incentivised significant investment in new import infrastructure in the past decade. Investment in seasonal storage has been muted, but this appears to be in line with market signals and the declining summer-winter spreads. On issues of governance and regulatory burden, there have been some encouraging trends, with the number of code modifications falling over time. However, the complexity of many of the new changes continues to pose a challenge. Lastly, from a sustainability perspective, demand has fallen in recent years. There are many likely causes of this, one of which is better energy efficiency.

Security of supply

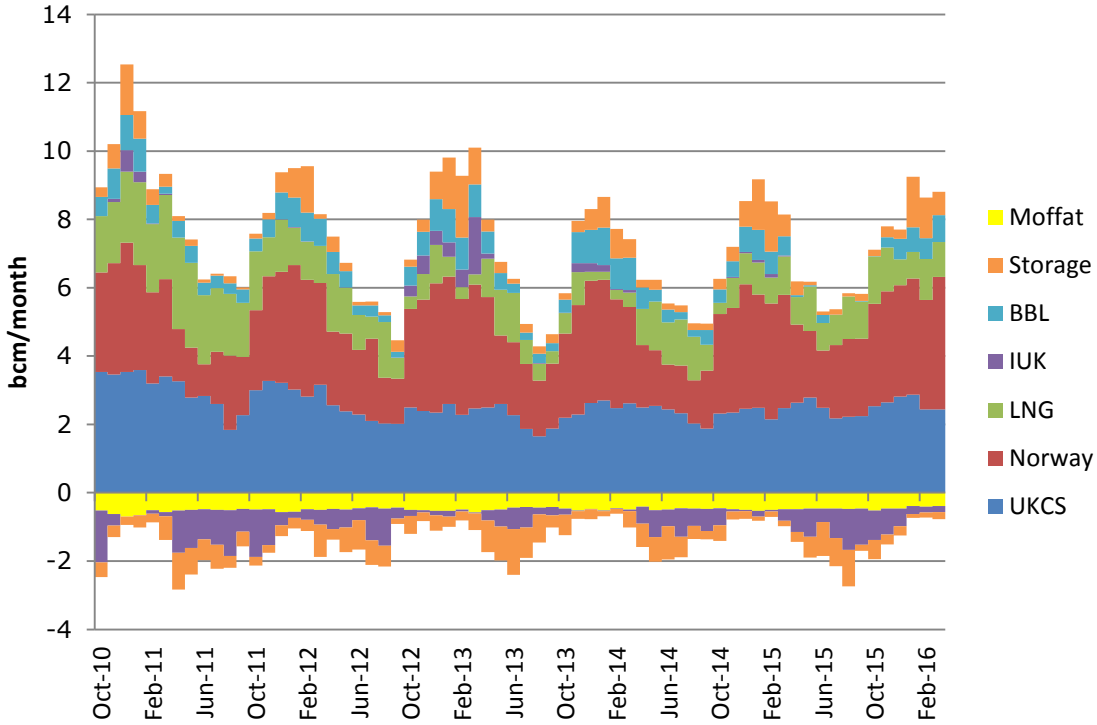
Supply

3.1. Over the past fifteen years, the make-up of GB's gas supplies has changed substantially. As domestic production from the UK continental shelf (UKCS) has declined, GB has increasingly imported gas from a range of sources. The predominant source of supply varies year-to-year dependent on global market conditions. Figure 7 below shows trends in gas supply sources in recent years. Figure 8 shows changes in annual net flows from different sources of supply between 2014/15 and 2015/16.

3.2. Last year saw increase in domestic production and imports from Norway, together with a slight increase in LNG volumes. Less gas was imported from

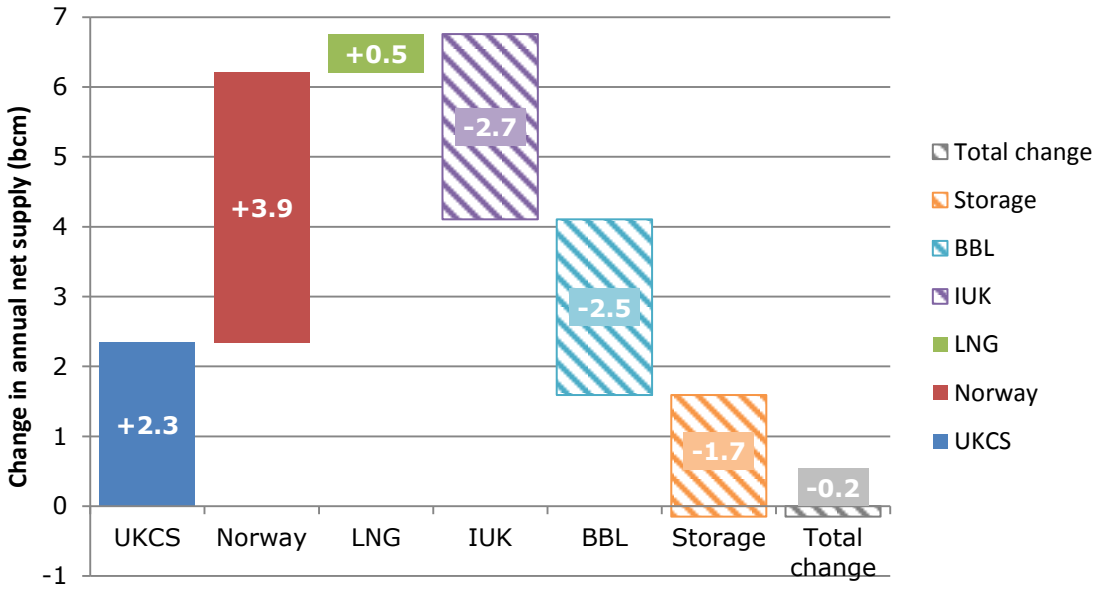
continental Europe via Interconnector UK (IUK) and the Bacton Balgzand Line (BBL). GB gas demand continues to be met from a diverse range of sources.

Figure 7: Detailed gas supply breakdown, Oct 2010 - Mar 2016



Source: National Grid

Figure 8: Net Year on Year change in supply by source, 2015/16

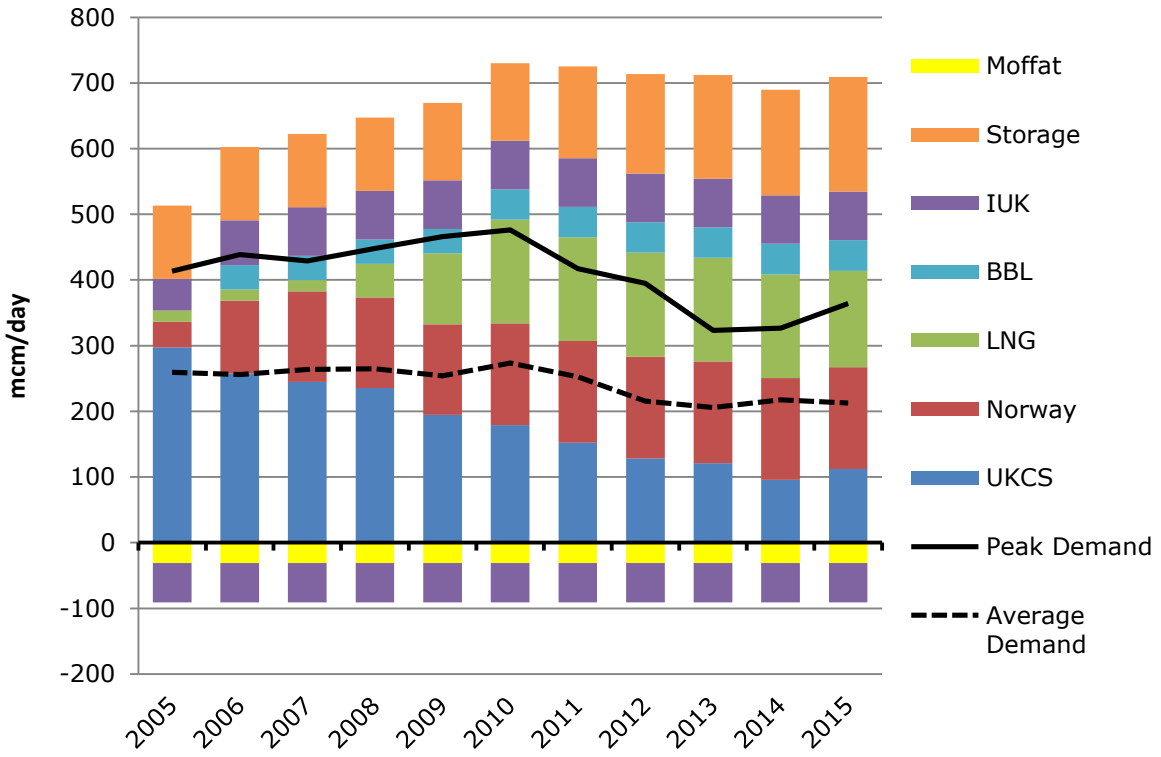


Source: National Grid

Gas supply capacity

3.3. Over the past decade, gas supply capacity has increased significantly, whilst peak demand has fallen (see Figure 9 below). 2015 also saw a slight increase in UKCS deliverability. Deliverability from storage increased as recently constructed facilities continued commissioning their capacity. Available LNG delivery capacity fell due to the decommissioning of Teesside Gasport LNG unloading facility.

Figure 9: GB gas supply and interconnector delivery capacity, 2005-2015



Source: National Grid

3.4. The GB gas market continues to have significant excess supply capacity from a diverse range of sources. This makes the market highly resilient. GB gas demand can be met from a variety of sources of supply as above. The market has sufficient supply capacity to be able to meet peak demand even in the event of significant infrastructure outages or unavailability of supply from a particular source. To date, the GB wholesale gas market has never experienced a national gas supply emergency in which consumers supplies had to be involuntarily curtailed.

3.5. A growing dependence on imports has changed the nature of the security of supply challenges that GB faces. GB increasingly relies on a smaller number of large pieces of import infrastructure (e.g. LNG terminals or interconnectors) and this increases the potential price impact of a single piece of infrastructure failing. Import dependence has also made GB prices more sensitive to global market events. However, it also allows GB to source gas from a range of locations and mitigates risks of reliance on a single source of gas.

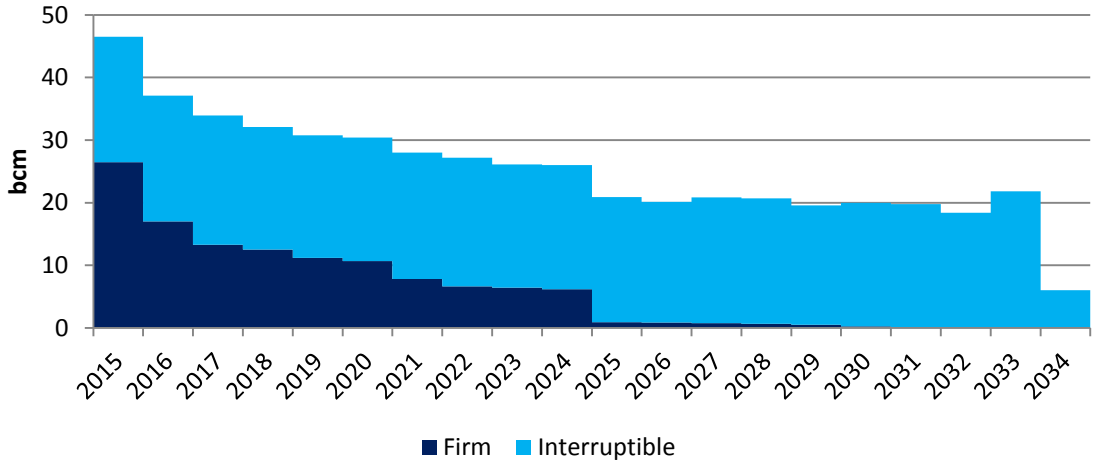
Long term contracts and LNG

3.6. GB gas supplies are delivered under a mixture of long- and short-term deals. Long-term contracts can improve certainty of gas import deliveries into the future. However, securing these contracts may require a commitment to take a minimum volume of gas or pay a premium. Conversely, shorter-term transactions can provide greater flexibility, though potentially at reduced certainty.

3.7. Figure 10 below shows long-term import contracts that were in place as of 1 November 2015. We have divided volumes under these contracts those we consider as 'firm' and 'interruptible'. We regard firm contracts as those where the party supplying the gas is obliged to supply the firm volume and the party buying the gas is obliged to take that volume.[4] We define a contract as interruptible if the volume stipulated in the contract does not necessarily have to be delivered.

3.8. In the coming years, volumes under long-term contracts are around 37 bcm, 50% of annual GB gas demand. Around 17 bcm of volume (20% of GB gas demand) is under firm long-term contracts. Many contracts to import LNG to GB are interruptible, because gas can be delivered to an alternative destination if the price in that alternative market is higher. Contracts such as these provide us with confidence that the GB market has significant volumes of gas that could be delivered if needed in response to price signals.

Figure 10: Long-term gas import contract volumes, by contract type, as of 1 November 2015



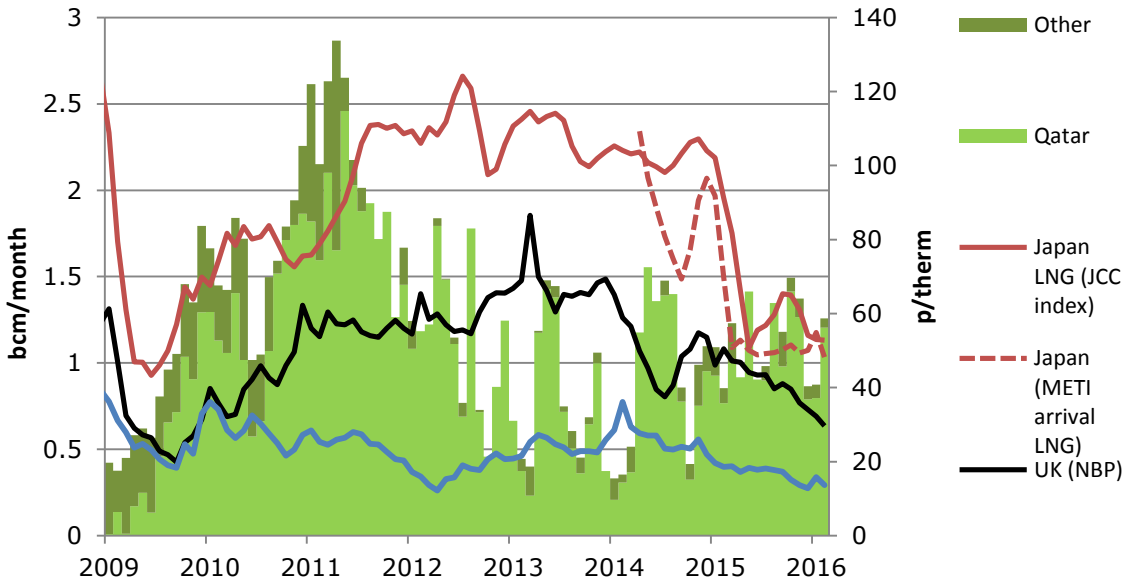
Source: Ofgem information request to shippers

[4] Importantly though, even firm contracts do not necessarily oblige the seller to physically flow gas to GB. The seller may also be allowed to simply buy the gas in the GB market and pass it on to the relevant counterparty in the event that this is cheaper.

3.9. LNG deliveries to GB are driven by the price differential between the NBP and alternative destinations for LNG cargoes. In recent years, the East Asian market has been the highest priced destination. This was primarily driven by the 2011 Fukushima disaster, which led to an increase in Japanese demand for LNG. In turn this reduced the supplies available to GB.

3.10. The past year has seen a change in global LNG prices. Falling oil prices have led to a reduction in the oil-indexed price of LNG delivered to Japan and other markets. This has narrowed the differential between NBP and Japanese prices, making the GB market an increasingly attractive destination for LNG cargoes. The result of this has been that LNG delivery rates have sustained at around 1 bcm/month throughout winter 2015/16, rather than dropping off as had been the case in 2012/13, 2013/14 and 2014/15.[5]

Figure 11: GB LNG flows by origin and and global price trends, 2009-2016



Source: BEIS Energy Trends, ICIS, Bloomberg, Japanese Ministry for Economy, Trade and Industry, IMF

System operation and balancing

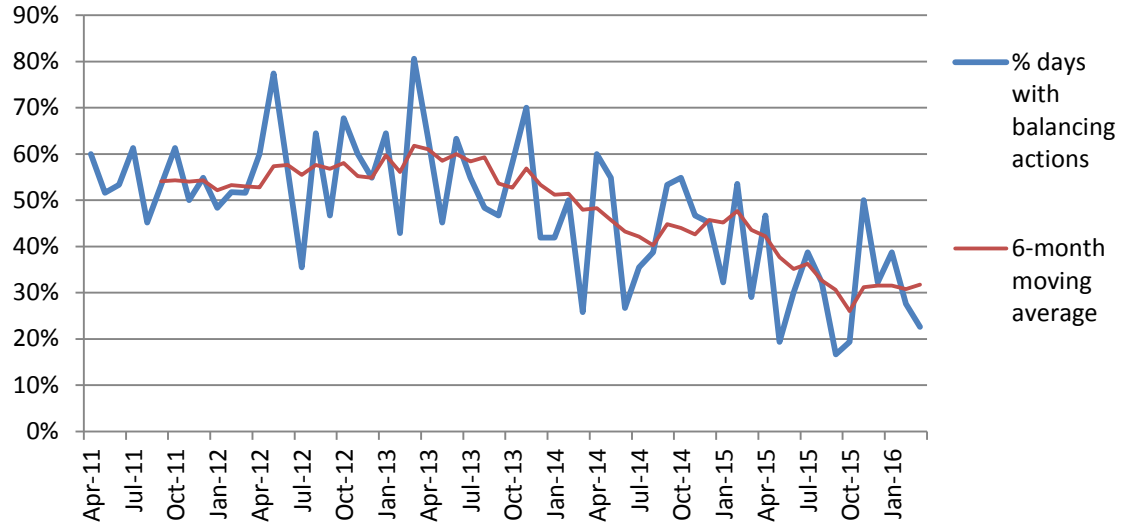
3.11. Gas shippers are incentivised to balance their supply and demand positions, and face imbalance charges if they fail to do so. NGG acts as residual balancer for the gas transmission system. The incentives which shippers face are based on the cost of balancing the system. On days where NGG does not take actions to balance the system, these charges are based on a small adjustment to the average traded price of gas on that day. Where necessary, National Grid can enter the market and

[5]DECC has now been replaced by BEIS (Department for Business, Energy and Industry Strategy)

trade gas as residual balancer. The marginal priced action taken by National Grid then sets the imbalance charge for that day.

3.12. Figure 12 below shows the % of days each month where NGG takes residual balancing actions. In recent years, the number of days where NGG needs to enter the market has fallen. Over the past year, NGG only took balancing actions on 1 out of 3 days. This is evidence of a market which is often able to balance supply and demand itself without the need for action from the system operator.

Figure 12: Residual balancing actions, days per month 2011-2016



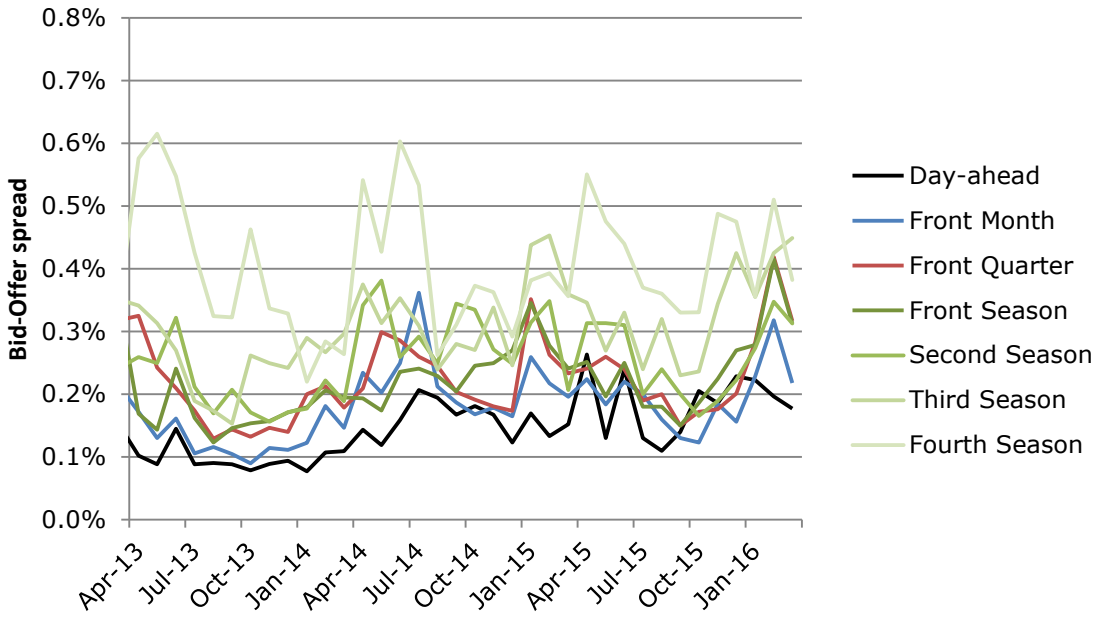
Source: National Grid

Access and liquidity

Liquidity metrics

3.13. The GB gas wholesale market remains highly liquid. When assessing liquidity, we focus on key metrics to measure the ease and transaction costs of trading. Bid-offer spreads measure the difference between the best bid (to buy) and the best offer (to sell) in the market for a particular contract. In a liquid market, competition between many trading parties leads to narrow bid-offer spreads. Figure 13 below shows the GB gas market continues to have very low bid-offer spreads over a range of key traded products.

Figure 13: Gas bid-offer spreads for selected traded products, 2013-2016



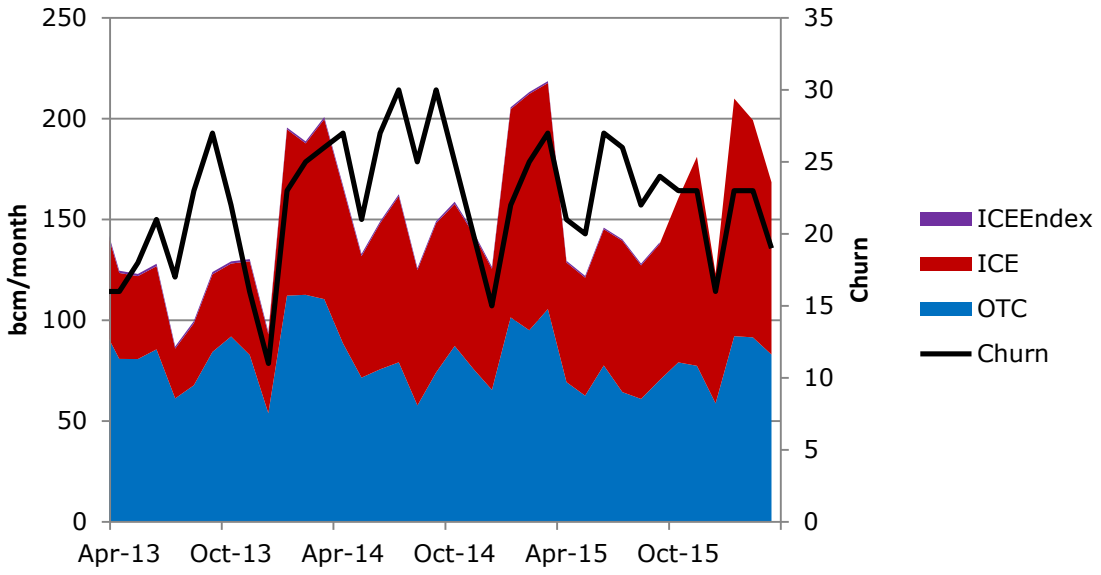
Source: ICIS, Ofgem analysis

3.14. When assessing liquidity we also look at the churn ratio. This measures the number of times a unit of gas is traded before it is finally delivered. A higher churn indicates a greater level of trading activity. This means that it is easy for market participants to trade and optimise their positions before final delivery. Figure 14 below shows that churn remains healthy in the GB market. Over the 12 months to March 2016, churn averaged 22; a churn ratio of at least 10 is generally seen as a benchmark for a mature market.[6]

3.15. Trading volumes on the GB gas market are roughly split equally between exchange traded futures (through Intercontinental Exchange (ICE)) and broker-facilitated over-the-counter (OTC) trades. A small proportion of trading is carried out on the ICE Endex On-the-day commodity market, where gas is traded day-ahead and within day by market participants making final adjustments to their positions.

[6] Source: Patrick Heather (2012), "Continental European Gas Hubs: Are they fit for purpose?".

Figure 14: NBP trading volumes and churn, 2013-2016



Source: LEBA, ICE, ICE Endex, Bloomberg, National Grid

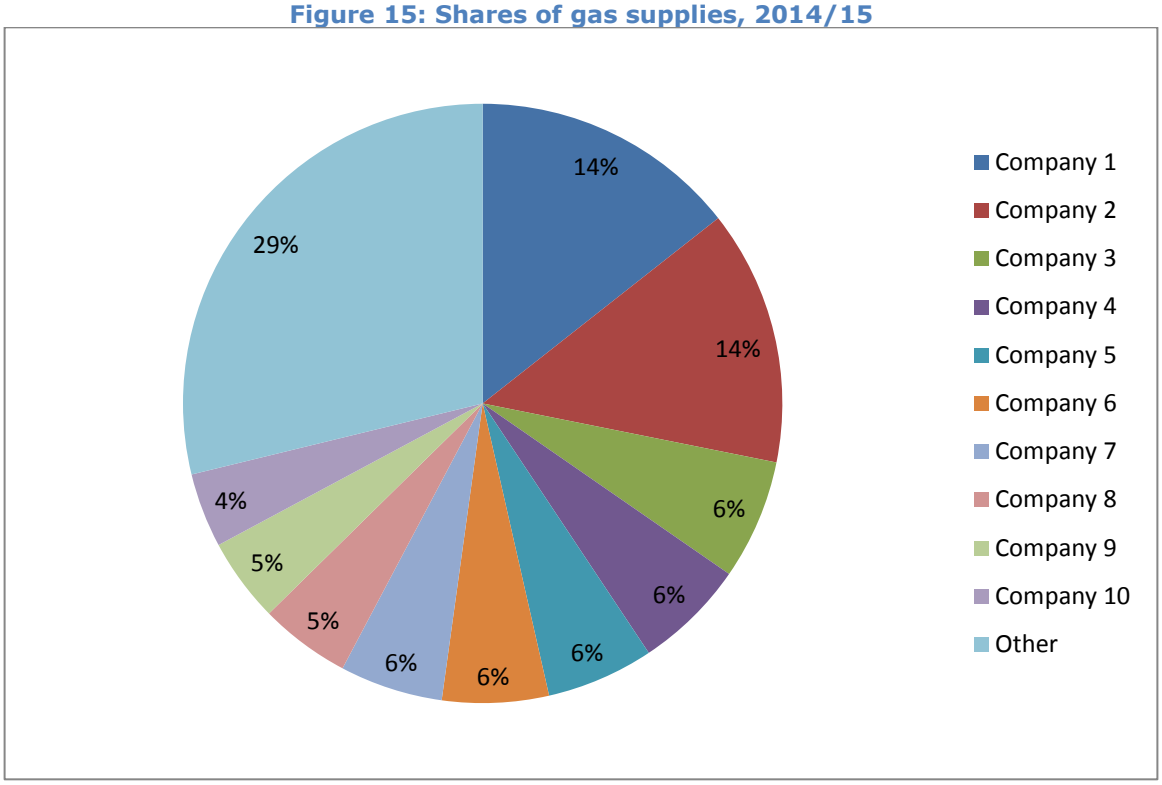
Competition

3.16. A useful first step when looking at the effectiveness of competition is to consider **market concentration**. Figure 15: Shares of gas supplies, 2014/15shows market shares of wholesale gas supplies in GB for 2014/15.

3.17. Measures of overall market concentration suggest that this market is not concentrated. For example, the Herfindahl–Hirschman Index[7] (HHI) for total upstream supplies is 687 for 2014/15, indicating low levels of concentration. Similarly low levels of concentration can also be found when looking at ownership of total supply capacity and flexible supply capacity. These low levels of concentration can be linked to the GB's diverse supply sources, which encourage a wider range of market participants.

[7] This index measures concentration by summing the squares of the market share of each player. A HHI exceeding 1000 is regarded as concentrated and a HHI above 2000 is regarded as very concentrated. Source: CC/OFT merger guidelines.

Figure 15: Shares of gas supplies, 2014/15

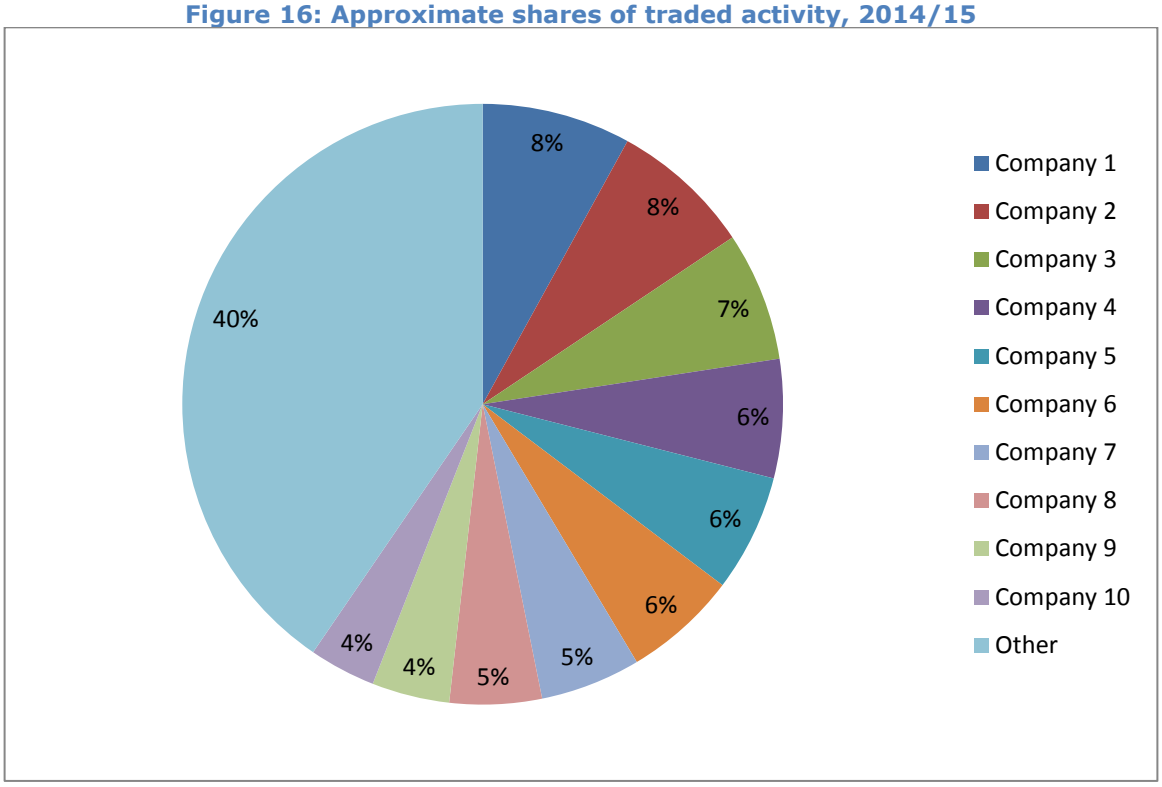


Source: Xoserve, National Grid, Ofgem analysis

3.18. Measuring concentration in the traded portion of the wholesale markets is challenging because most trading takes place in financial markets in which counterparties are either anonymous or kept confidential. One way of gaining some insights into who is trading in the gas market is to look at gas shippers' traded nominations at the NBP, as these nominations are made to National Grid. Although this is an imperfect reflection of total trading activity, it can still provide some useful insights.[8] When looking at gas trading from this perspective, we find that concentration is also low, with a HHI of 431 in 2014/15. This is consistent with the diverse range of participants that engage in trading, from upstream gas producers and importers to downstream retail suppliers, banks and trading houses and companies from across this spectrum are represented in the graph below.

[8] This nomination data does not reflect all trading volumes and so may not be an accurate reflection of market shares or concentration. This is because not all trading that takes place for gas delivered at the NBP actually entails counterparties making the corresponding nominations to National Grid. This discrepancy can be seen when comparing trading volumes reported by the hub operator (ie National Grid) with those reported by exchanges and brokers. Market shares are anonymised at the request of market participants, and do not represent the same companies as Figure 16: Approximate shares of traded activity, 2014/15.

Figure 16: Approximate shares of traded activity, 2014/15



Source: Xoserve, National Grid, Ofgem analysis

3.19. Another way of assessing the effectiveness of competition is to look at the scope for market power. **Pivotality** analysis does this by focusing on gas supply capacity and assessing whether a certain company's supply capacity is necessary to meet demand. Pivotality only looks at the *possibility* for market power. It does not account for the incentives on firms to exploit any dominant position, and is not an indicator of actual market abuse or anticompetitive behaviour. We conduct pivotality analysis using our internal pivotality model.[9]

3.20. Our analysis shows that in recent years there is only one company that could be considered pivotal in the wholesale gas market under normal market conditions. This company was pivotal in meeting a portion of GB demand over the course of a cold winter, but is not pivotal on any given day or week of such a winter.[10] In general, we find that there was a lower chance of pivotality occurring on any given day or week. This is because in the short-term (i.e. over a few days or weeks) alternative supply sources such as gas storage can be utilised to make up any shortfall, but in the longer-term (i.e. over the course of a whole winter) these can be exhausted.

[9] A description of the model can be found in Appendix 4 of our consultation on a Minor Facilities Exemption for Phase 2 of the Stublach storage facility: https://www.ofgem.gov.uk/publications-and-updates/storengy-uk-ltds-application-minor-facilities-exemption-stublach-gas-storage-phase-2

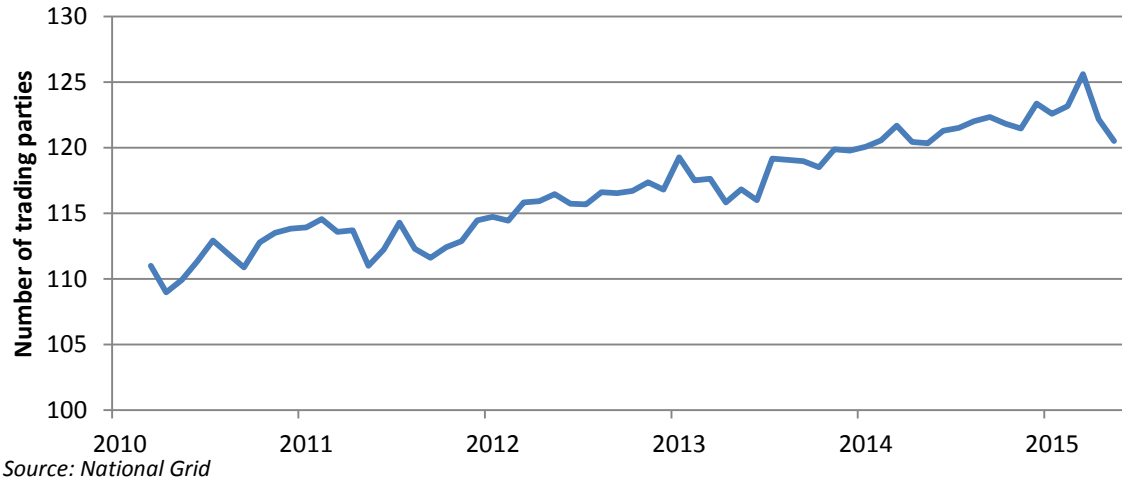
[10] In a cold winter, demand is higher and so a given company's supply capacity is more likely to be needed.

3.21. Beyond looking at concentration in the upstream segment of the market, it is also important to look at **vertical integration** (VI) across the entire market. This is because in certain circumstances VI can lead to some participants being able to foreclose the market.

3.22. The gas supply and demand positions of the top fourteen gas companies suggest there are fairly low levels of VI in the gas market. In particular, the direct production assets of each of the six largest suppliers in the retail market are not able to cover their respective consumer demands.

3.23. There has been increased **entry and exit** throughout the market, with new gas importers entering from upstream and new smaller suppliers entering from the retail market. A number of financial institutions have reduced their gas and power trading in recent years, and some have exited the market entirely. There are many causes of this trend including tougher European financial regulations and falling market volatility. Nevertheless, the number of new entrants has outweighed those exiting and this is reflected in the growing number of active trading parties, shown below.

Figure 17: Number of unique trading parties at the NBP, 2010-2015



Source: National Grid

Investment and sustainability

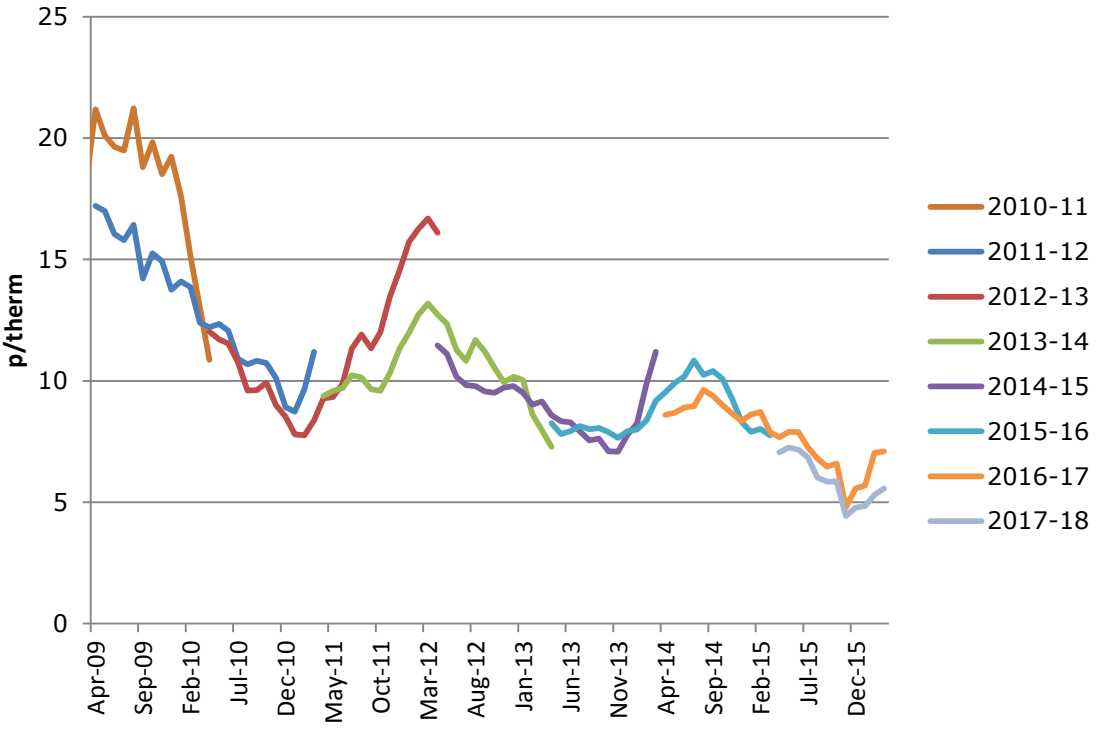
Investment

3.24. Investment in gas supply infrastructure is driven by market fundamentals. The profitability of gas storage and other flexible gas assets is heavily linked to the value that can be extracted from the market by using that flexibility. For example, the major driver of the value of gas storage is the differential in prices between time periods.

3.25. For seasonal gas storage, an important indicator of profitability is the summer-winter spread. This shows the value of purchasing gas in the summer,

storing it, and withdrawing over winter. Figure 18 below shows recent trends in summer-winter spreads at the NBP. Over the past few years, summer-winter spreads have declined. This has been driven by a combination of falling demand and increased availability of flexible supplies (such as LNG). This in turn has reduced the value of seasonal gas storage.

Figure 18: NBP Summer-Winter spreads, 2009-2016[11]

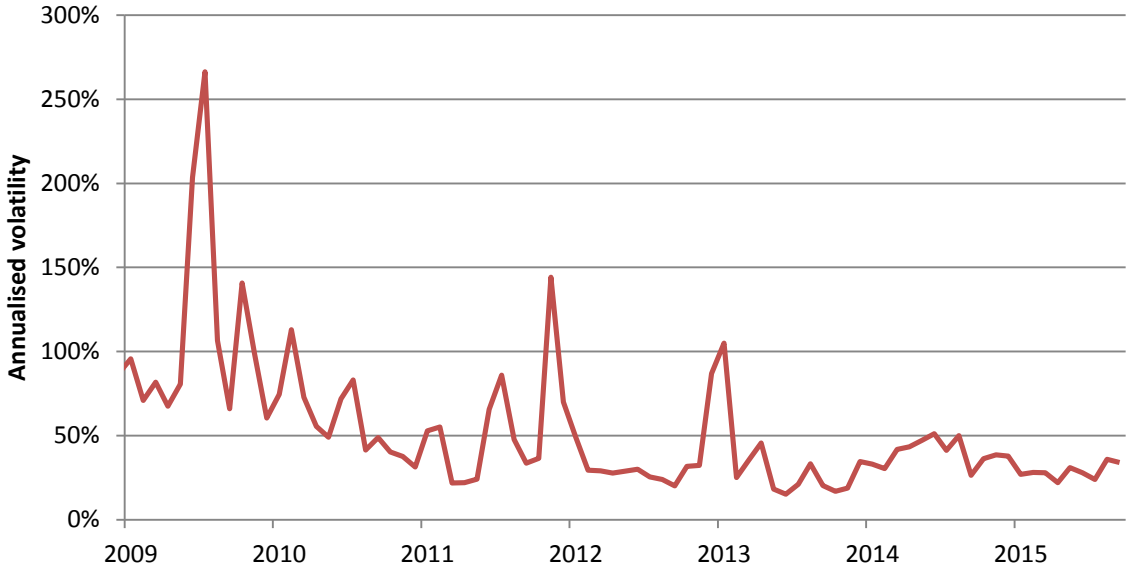


Source: ICIS, Ofgem analysis

3.26. Another key indicator of profitability for gas storage is day-to-day price volatility. In particular, fast-cycle storage facilities rely on short-term variations in price. As with summer-winter spreads, the level of volatility has fallen in recent years, shown in Figure 19.

[11] Summer winter spreads are calculated as the difference between the price of the summer contract and the following Q1 contract.

Figure 19: Day-ahead gas price annualised volatility, 2009-2016

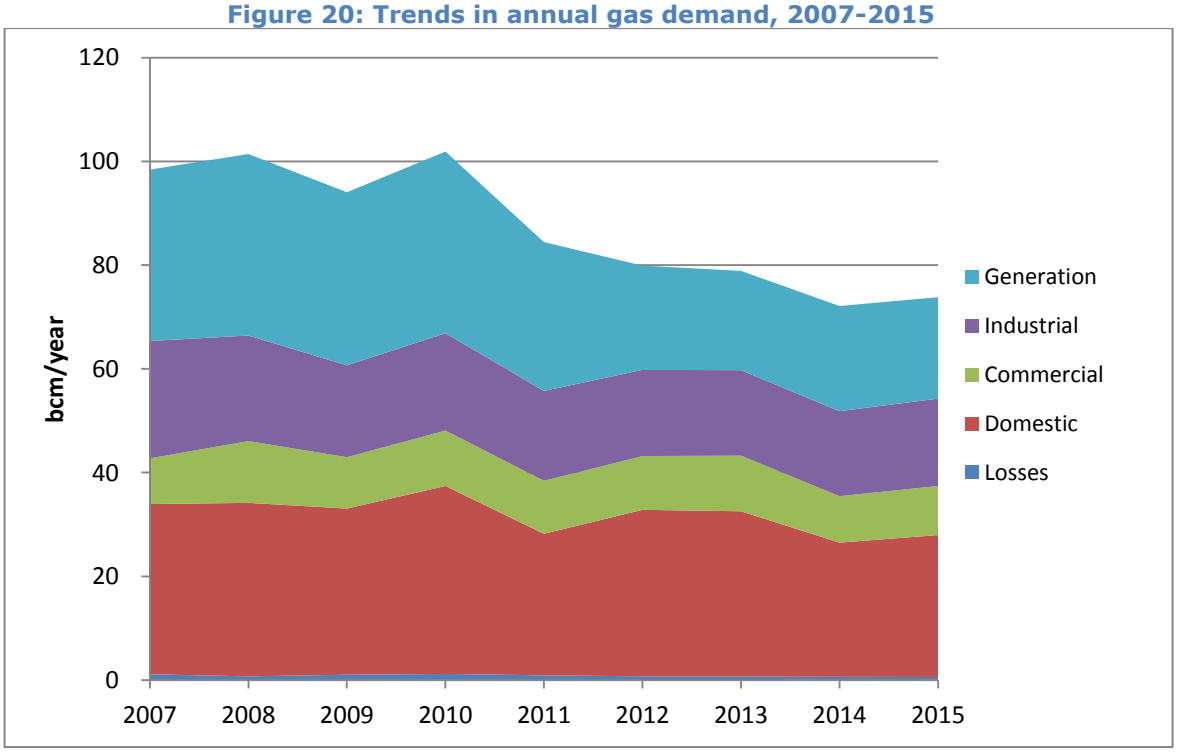


Source: ICIS, Ofgem analysis

Sustainability and Demand

3.27. Decarbonisation requires reducing our consumption of fossil fuels. In the long term this may include reducing consumption of natural gas. Figure 20 shows that over recent years, GB gas demand has fallen significantly.

Figure 20: Trends in annual gas demand, 2007-2015

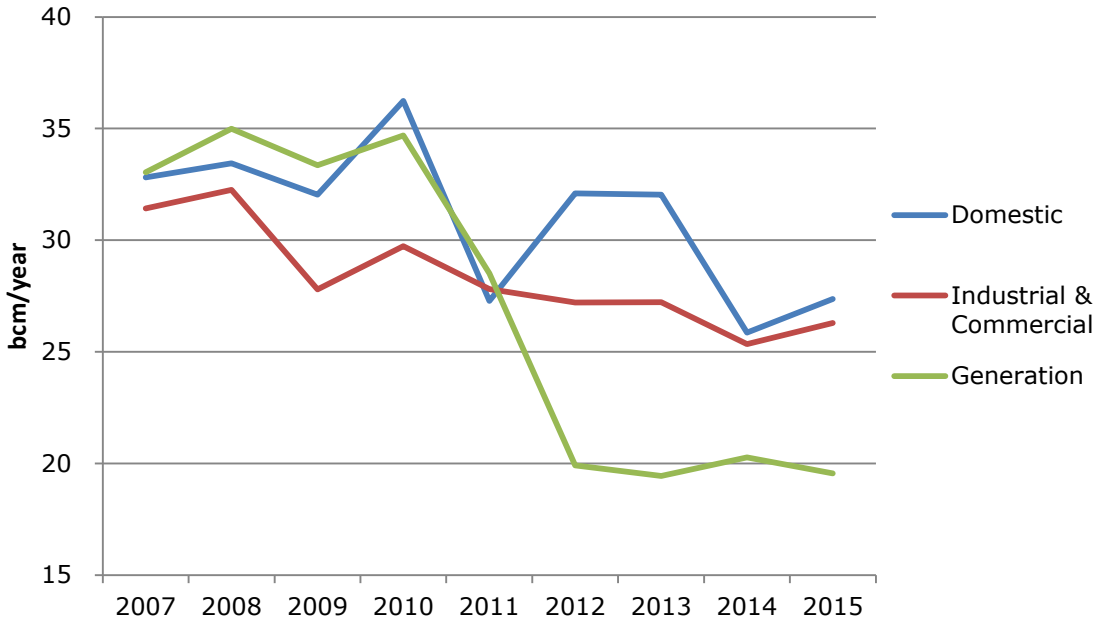


Source: BEIS Energy Trends

3.28. This has been caused by a number of factors, illustrated below, including:

- Milder winters reducing heating demand from domestic and commercial consumers;
- Energy efficiency improvements and changes to consumption habits;
- Recession and low growth leading to reduced industrial demand for gas; and
- Weaker economics for gas-fired power generation, reducing demand from this sector.

Figure 21: Trends in annual gas demand, 2007-2015



Source: BEIS Energy Trends

4. Electricity

Chapter Summary

With respect to **security of supply**, total generation capacity has been steady over recent years. 2015 and the beginning of 2016 saw a trend of decreasing reliance on generation from coal, replaced partly by greatly increased amounts of new renewable capacity. For this winter, margins remain manageable and National Grid has procured additional balancing services that it can use to help it balance the system if margins tighten.

On **access and liquidity**, the GB market appears relatively illiquid compared to some international power markets, but there are signs that liquidity is improving since our 'Secure and Promote' reforms were implemented. Bid-offer spreads appear to be consistently narrower in recent years, and there is an increasing emphasis on near term trading which may be due to the difficulty of predicting the level of intermittent generation.

When assessed using a range of standard **competition** metrics, the GB wholesale electricity market appears reasonably competitive, with our analysis showing renewable generation being generally more profitable than conventional generation. Pivotality analysis suggests there is limited scope for generators to exert market power in the GB market.

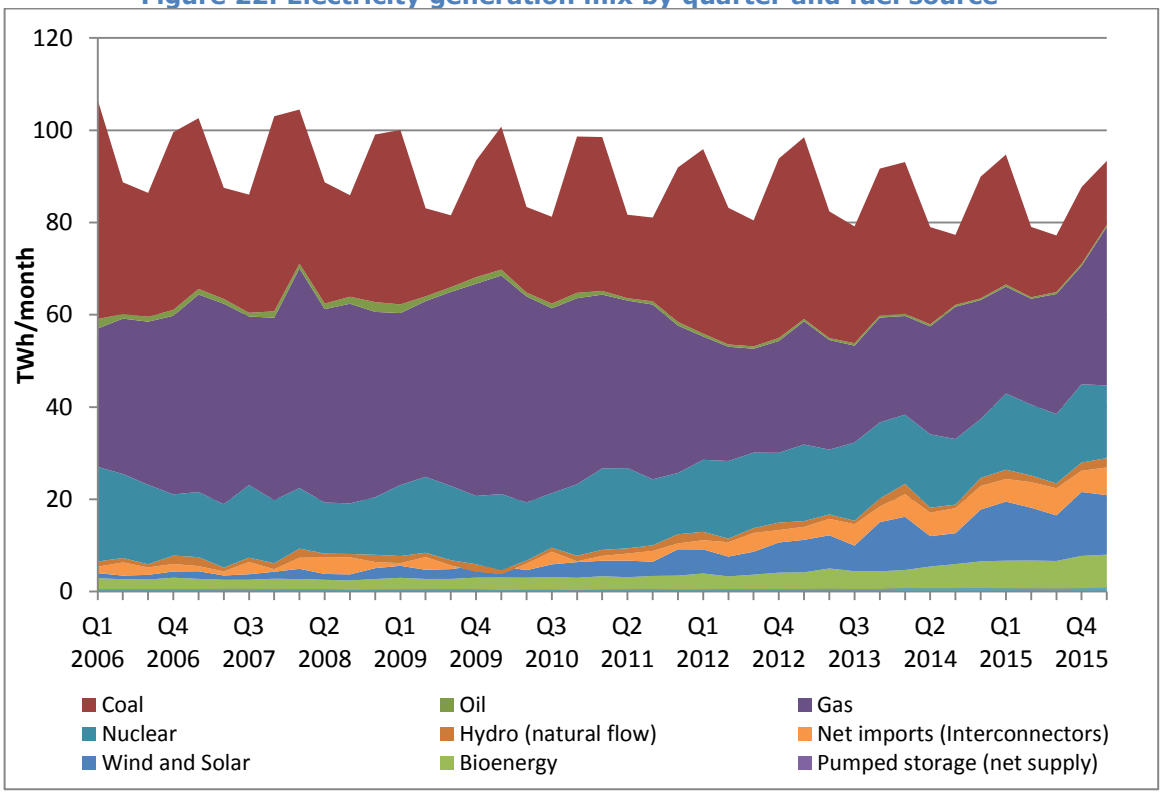
On **investment and sustainability**, there has been a large increase in investment in renewable installations, which has led to emissions intensity from electricity generation falling to record low levels. As a way to ensure future investment in electricity generating capacity and the security of supply, the government introduced Capacity Market auctions, where generators can earn additional revenue in return for providing capacity at times of system stress.

Security of supply

Supply & demand

4.1. The GB power system is undergoing a period of significant change. Figure 22 illustrates the various sources that have supplied our power since 2006.

Figure 22: Electricity generation mix by quarter and fuel source[12]



Source: BEIS Energy Trends

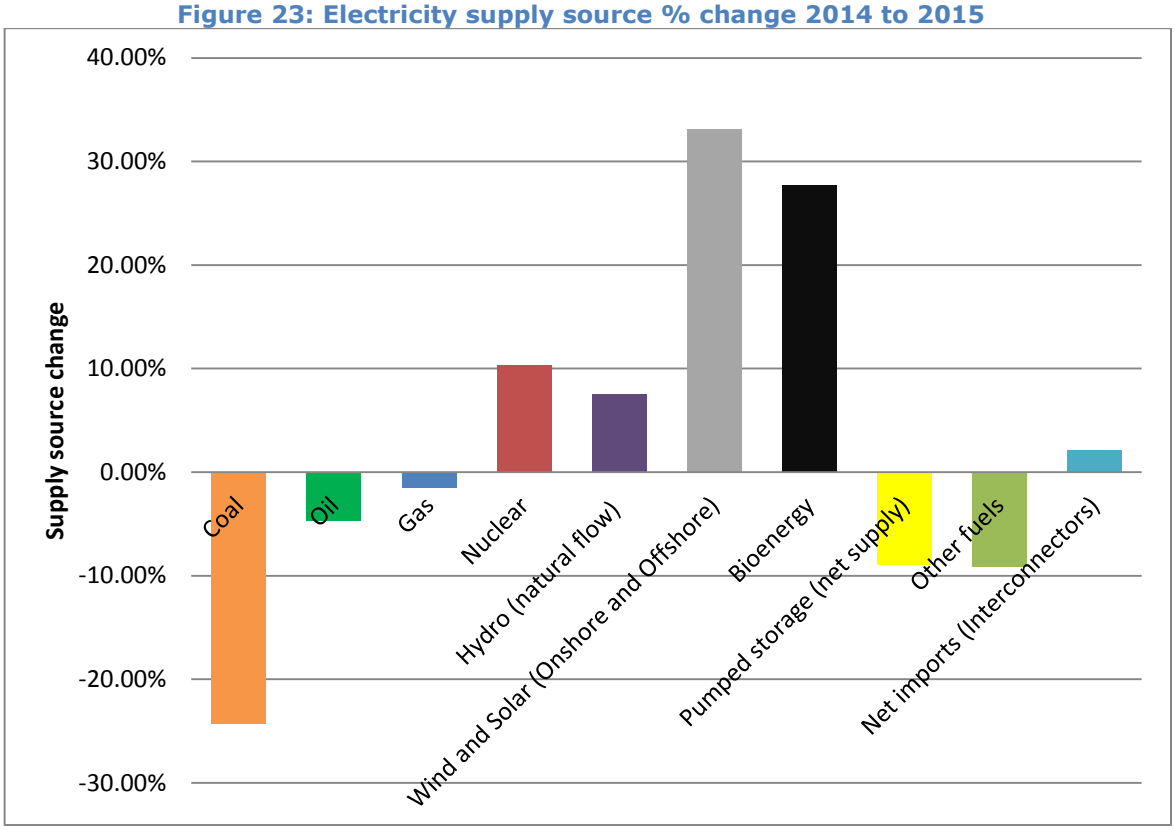
4.2. Figure 23 shows the percentage change for each fuel source in the GB generation mix, comparing 2014 to 2015. The most striking changes have been the reduction in coal fired generation and the large increase in renewable and bioenergy generation, driven by increased capacity. A number of coal plant have closed in the last few years as a result of weaker economics. As discussed in Chapter 2, falling wholesale prices as well as the introduction of the Carbon Price Floor in 2012 has

[12] Net data is underpinned by both positive (generation) and negative (demand) values. For instance, interconnectors can both import and export. Similarly, pumped storage can both demand power for pumping and generates power when releasing water through its turbines. As the chart depicts quarterly datapoints, the netting for these fuel types mean the full extent of generation and demand from these sources is underestimated.

meant reduced generation profitability. This is discussed further in the Profitability section of this chapter.

4.3. The major increase in wind and, in particular, solar output has also been noticeable in recent years, as a result of increased capacity as part of a drive towards more environmentally friendly generation, led by government subsidy schemes. This increase in renewable capacity is discussed further in the Investment and sustainability section of this chapter.

Figure 23: Electricity supply source % change 2014 to 2015

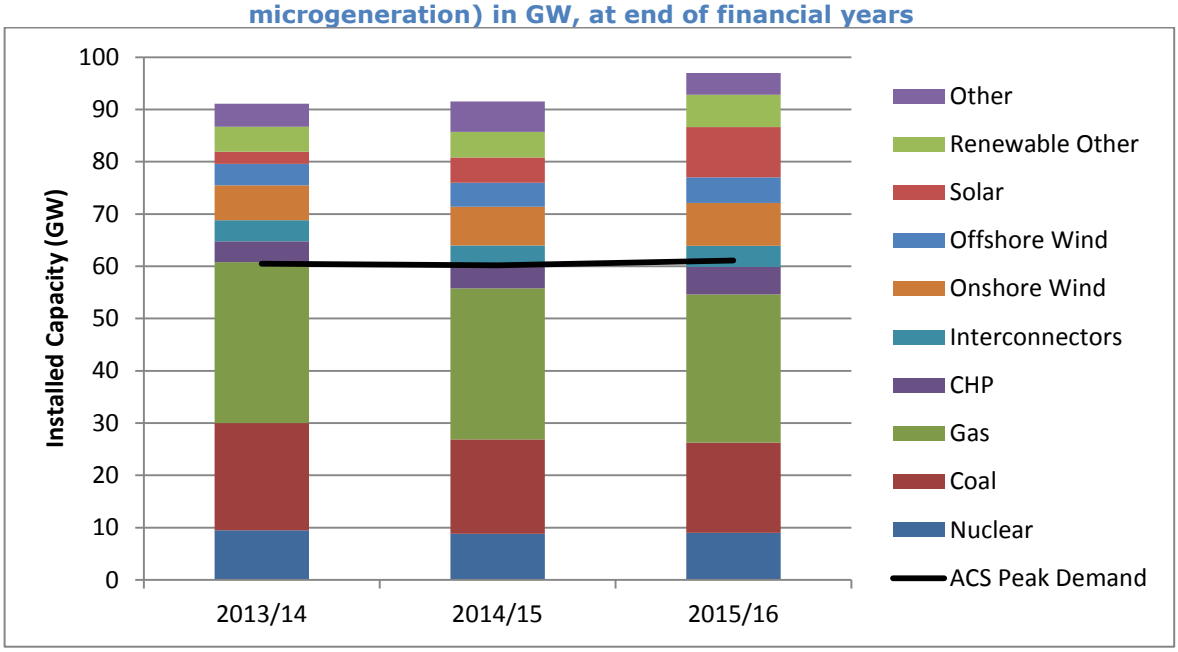


Source: BEOS Energy Trends, Ofgem analysis

4.4. Total capacity in the GB supply mix has risen over the past three years, as can be seen in Figure 24. This increase can be largely attributed to increased renewable capacity, of which the largest increase has been in solar. The chart shows that Installed Capacity is significantly above Average Cold Spell demand,[13] although it must be taken into account that renewable energy is intermittent in nature and therefore this capacity overstates actual availability. This is in contrast to conventional generation, which is generally available when required.

[13] Average Cold Spell Demand is peak winter demand under normal winter weather conditions.

Figure 24: Total Installed capacity (transmission network, distributed generation, microgeneration) in GW, at end of financial years



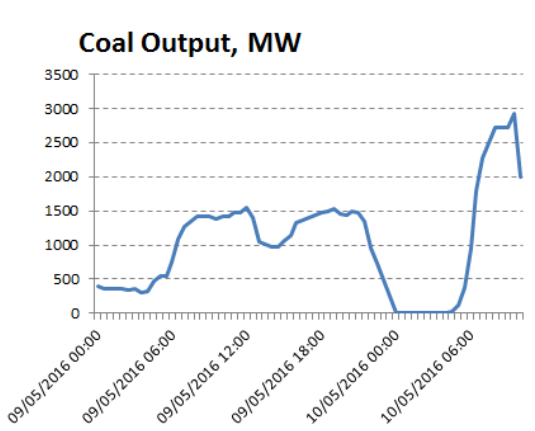
Source: National Grid Future Energy Scenarios

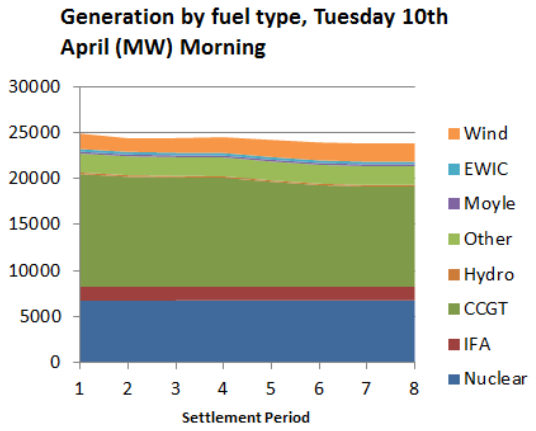
GB goes coal free for the first time

The decrease in the amount of coal in the GB generation mix was highlighted on 10 May 2016. Total coal output dropped to zero between 00:00 and 04:00; at the time, renewable output was not particularly high (wind was generating c.2GW), but the favourable economics for gas generation meant that around 12GW of CCGT (Combined Cycle Gas Turbines) was dispatched ahead of coal in the merit order. This is the first time that coal has been entirely absent from the generation mix in GB since 1882, when the first coal-fired plant was opened in London.

In November 2015 Amber Rudd, Secretary of State for Energy and Climate Change, announced the UK would set out proposals to restrict the use of unabated coal from 2023 and phase it out completely from 2025, on the condition that new gas facilities could replace coal output in these timescales.[14]

[14] "Amber Rudd's speech on a new direction for UK energy policy" https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy





Source: Elexon

Security of supply

4.5. National Grid's Winter Outlook consultation[15] identified that margins remain manageable for the coming winter. Similar to last year, National Grid has procured additional balancing services that it can use to help it balance the system if margins tighten. These services will effectively ensure that the risks reduce to meet the Government's reliability standard.

4.6. This trend in tightening margins highlights the relationship between security of supply and short term wholesale prices. During tighter periods, wholesale prices generally spike in the short term. This provides an incentive to flexible generation and demand side to make supply or demand reduction available to help balance the system.

4.7. From next winter, there will be an additional CM auction. We consider this provides a further incentive to generators to make plant available to help ensure security of supply.

System operation and balancing

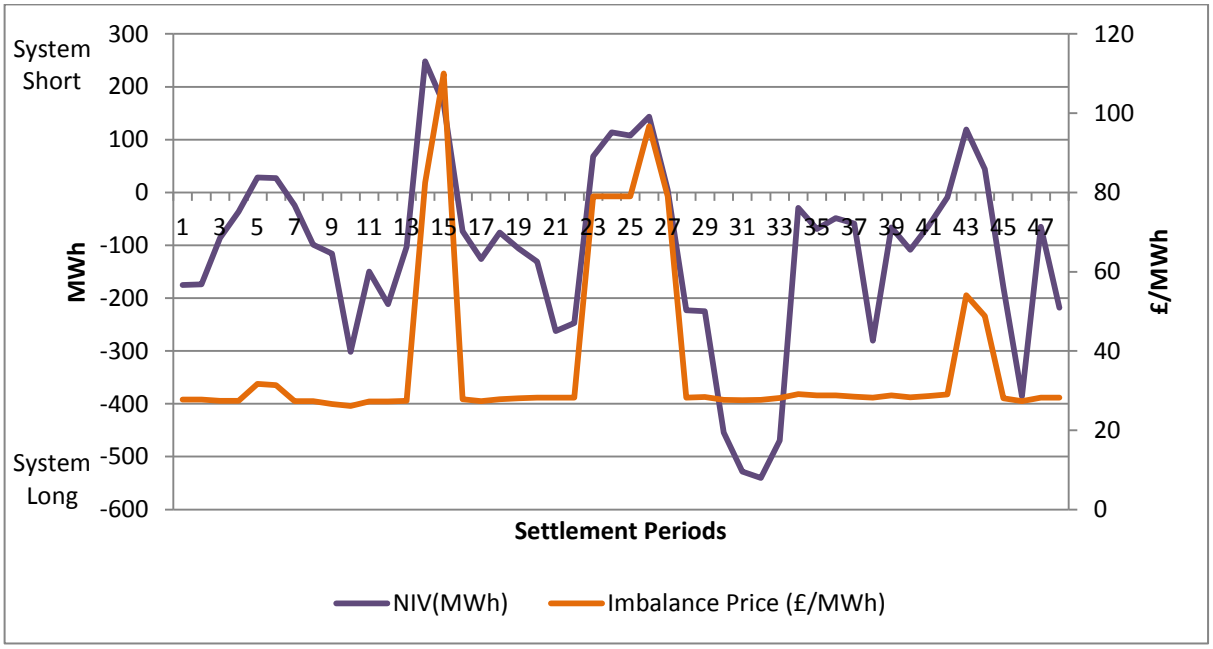
4.8. Where market participants are out of balance they must pay imbalance (cash-out) charges. These imbalance charges incentivise balancing and help compensate the SO for any actions it takes to balance the system (match supply and demand). Further background on market arrangements can be found in Appendix 2 – The GB wholesale energy market arrangements

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

4.9. Imbalance prices are affected by a number of factors, including generation mix and demand, as well as the design of the economic incentives. These incentives were reformed on 5 November 2015, with the implementation of BSC modification P305 sharpening price signals.

4.10. These changes included reducing the volume of actions included in setting the system price, making it more marginal. This has led to an increase in volatility of system prices. The largest volatility is seen in periods when the overall system (measured as Net Imbalance Volume, NIV) moves from being long ('oversupply') to short ('undersupply') or vice versa. An example of this effect can be seen below in Figure 25: Imbalance Price vs. Net Imbalance Volume 29/06/2016. These trends were driven by a range of factors, including system fundamentals (for example increased renewables penetration) and the effect of P305.

Figure 25: Imbalance Price vs. Net Imbalance Volume 29/06/2016



Source: Elexon

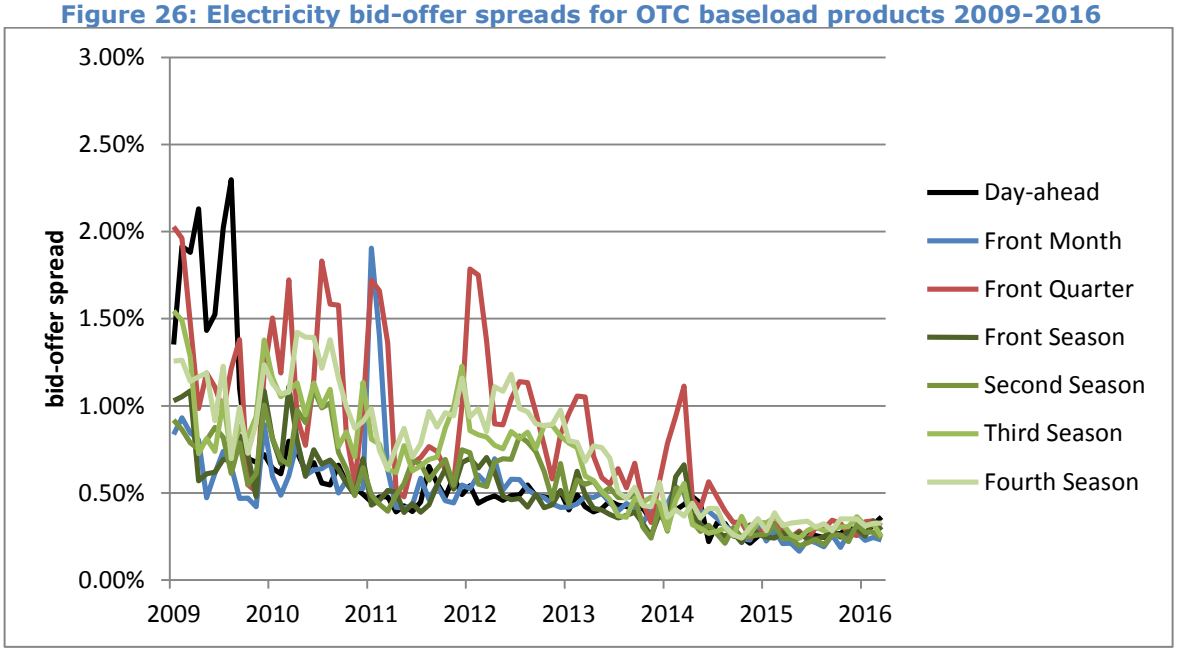
4.11. We will continue to monitor imbalances, system prices and the wider market over the coming months in order to inform a more detailed review before the planned move to PAR1 and a VoLL of £6,000/MWh in November 2017.

Access and liquidity

Liquidity metrics

4.12. There are a number of metrics of liquidity; the health of a market does not depend on one single metric. Historically, the GB electricity wholesale market has been relatively illiquid.[16] However, a number of indicators of liquidity have shown positive trends in the past few years. Notably, bid-offer spreads have consistently narrowed and flattened over the course of the last few years (Figure 26 below).

Figure 26: Electricity bid-offer spreads for OTC baseload products 2009-2016

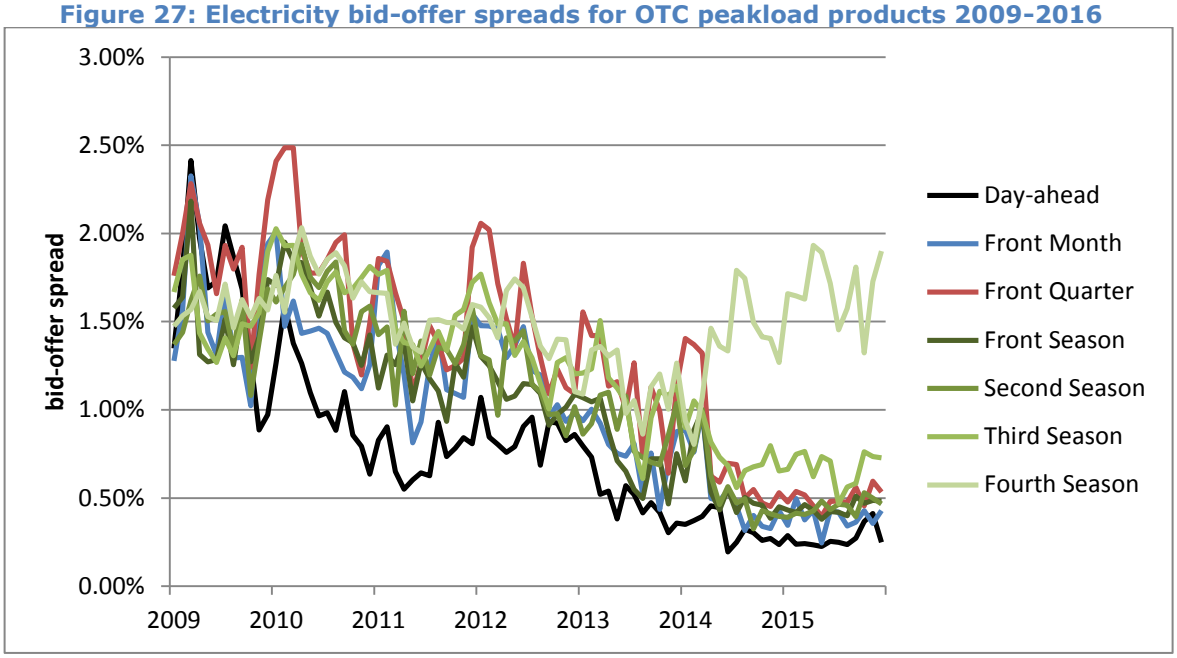


Source: ICIS, Ofgem analysis

4.13. Spreads are typically wider for peak products (the period of the day when demand is typically highest) than for baseload, as well as for products for delivery further out in the future than for the near term. This reflects the higher volume of trading that occurs in baseload over peakload, and in the near term over further into the future. In particular, this is visible in the relatively wider spread for peakload delivery four seasons (two years) ahead.

[16] https://www.ofgem.gov.uk/publications-and-updates/liquidity-great-britain-gb-wholesaleenergy-markets

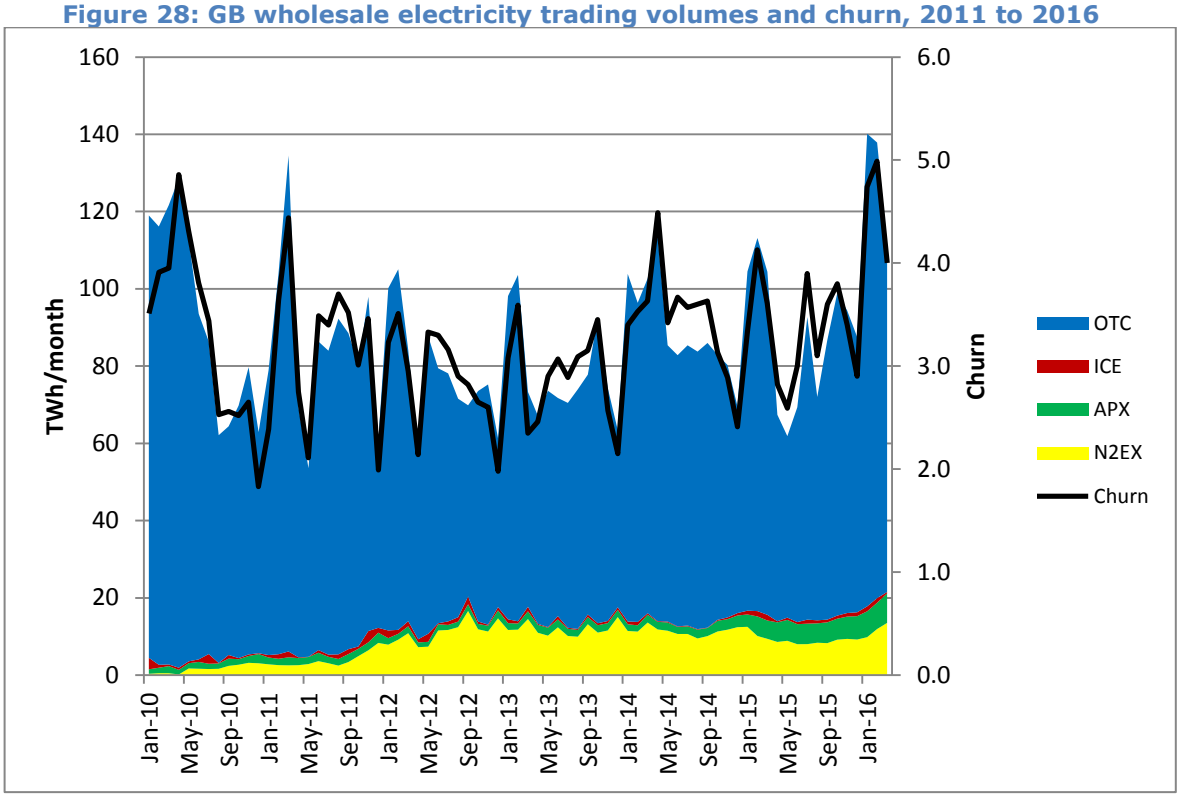
Figure 27: Electricity bid-offer spreads for OTC peakload products 2009-2016



Source: ICIS, Ofgem analysis

4.14. The **churn ratio** is another important indicator of liquidity. Churn peaked in 2002, fell until 2005 and has remained fairly unchanged until the end of 2015. Since then, we have seen an increase. This trend can be seen in Figure 28. Although churn in GB has remained persistently below some other European markets, in particular the German and Nordic markets, it is not easily comparable. Trading activity in a given market is largely driven by the fundamentals and design of the market in question. The liquidity in the German market for example, can largely be attributed to the high interconnection it has with neighbouring markets and the way in which the power sector was privatised.

Figure 28: GB wholesale electricity trading volumes and churn, 2011 to 2016



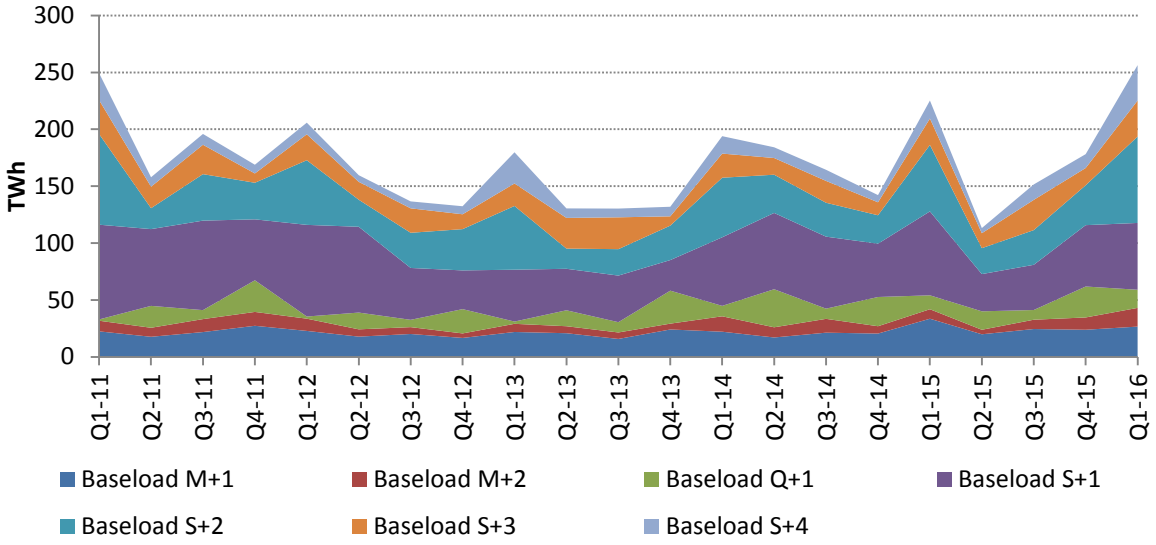
Source: ICIS, APX, Nord Pool Spot, ICE, BEIS Energy Trends

4.15. There are **a diverse range of products and platforms** available for those looking to trade power in GB. Although over the counter trading dominates in GB, there are a number of exchange platforms, including ICE, N2EX and APX.[17] Figure 28 above shows that the majority of electricity trades are still conducted OTC (approximately 85% of total trading is OTC).

4.16. Baseload products account for around 88% of OTC traded volumes. Figure 29 below shows the trading volumes since 2011 for a selection of baseload products that are included as mandatory market-making products under Ofgem's Secure and Promote policy; these products make up around 85% of total baseload OTC products traded. Figure 29 also highlights how the liquidity in these baseload products tends to be clustered in the near-term products, with just over 80% of OTC trading being for delivery within 12 months. Figure 30 below shows the trading volumes for peakload OTC products under Ofgem's Secure and Promote. For peakload products in general and even more so for off-peak products, the emphasis on near-term delivery is even more extensive.

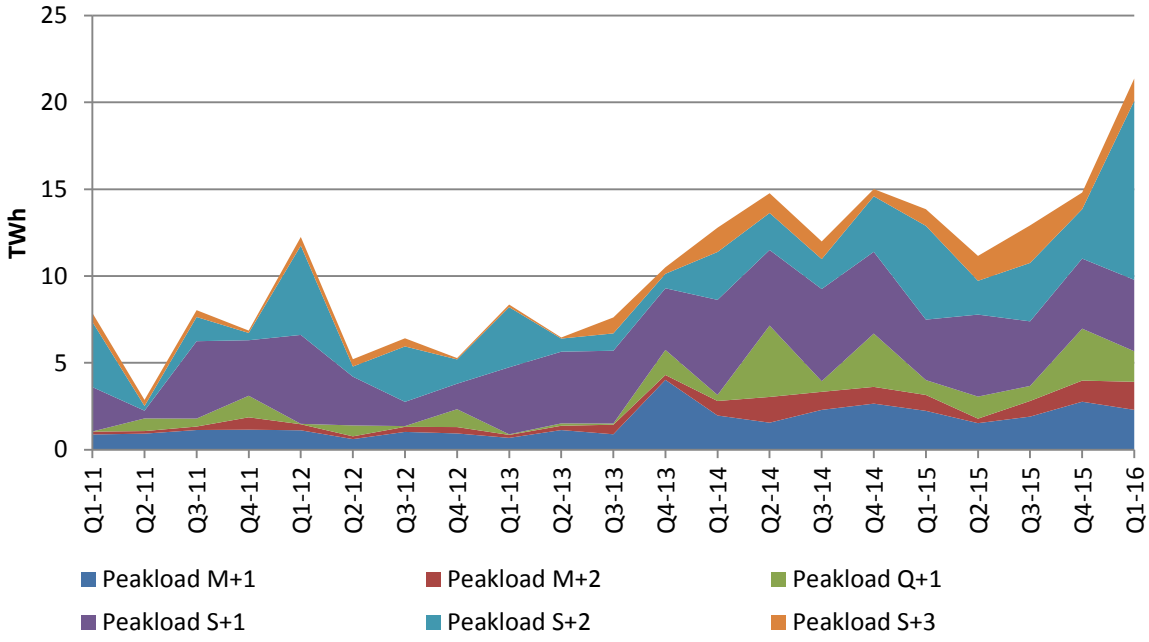
[17] Volumes on the respective platforms tend to reflect the time horizon of the contracts traded and are not reflective of the total contribution to market liquidity.

Figure 29: Baseload trading volumes by contract type, 2011-2016[18]



Source: BEIS Energy Trends

Figure 30: Peakload trading volumes by contract type, 2011-2016



Source: Elexon, NETA Reports, Ofgem analysis

[18] M+1 products are for delivery the next month, Q+1 are contracts for the next quarter, S+1 are for the next season (winter or summer).

4.17. Liquidity has seen an improvement since the 'Secure and Promote' licence condition was implemented. Since the implementation of the policy in March 2014, we have seen key metrics such as the churn and the bid-offer spread move in a positive direction, and stakeholders told us that they saw greater accessibility and price robustness of products at times of market-making. Secure and Promote has also increased access to selected traded products for smaller players. We have seen an overall improvement in the churn rate year on year, with the exception of a lull in the middle of 2015 when the market faced low price, low volatile conditions. More detail on liquidity in the power market and the impact of our reforms can be found in our annual liquidity policy evaluation report.

4.18. It is not desirable to compare liquidity across different commodities such as electricity and gas due to their different characteristics, not the least the ability of the commodity to be stored. Nor is it desirable to compare liquidity across markets with different characteristics, like levels of interconnectedness and market structure. That said, we note that bid-offer spreads in the power market at key times of the day are now in the same range as those of gas. This is a particularly positive indicator of increased liquidity and competition in the market, translating directly into reduced transaction costs for participants and lower price pressure on consumers. The fact that churn levels appear to be on an upward trajectory overall is an encouraging sign, but one that will require ongoing monitoring.

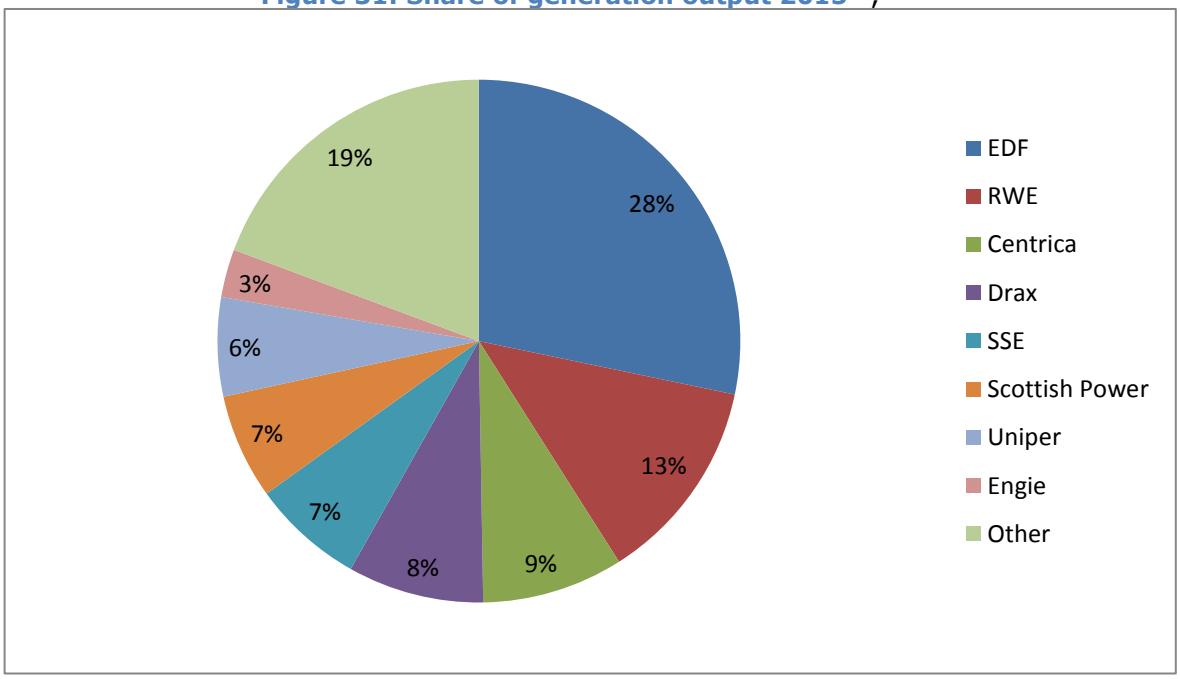
Competition

Structural measures

4.19. In 2015, EDF Energy had the largest share, accounting for over a quarter of total generation, up 2% from last year. Overall, the market shares of the major power producers are relatively unchanged from 2014. **Figure 31** displays this information.

4.20. When assessing the possibility for market power, it is important to consider the type of fuel source. For example, a company with an inflexible portfolio of generating assets would be unlikely to profit from attempting to exert market power by withholding electricity. In any case, REMIT[19] and TCLC[20] are in place to monitor markets and give Ofgem the power to penalise any company found to breach these regulations.

Figure 31: Share of generation output 2015[21],[22]



Source: Elexon, NETA Reports, Ofgem analysis

[19] Regulation in Wholesale Energy Markets Integrity and Transparency https://www.ofgem.gov.uk/electricity/wholesale-market/european-market/remit

[20] Transmission Constraint Licence Condition https://www.ofgem.gov.uk/publications-and-updates/transmission-constraint-licence-condition-guidance

[21] Market shares are calculated based on metered volumes associated with individual generation units (called Balancing Mechanism Units). Assumptions have been made regarding which companies own each BM unit. Volumes have been split based on equity stakes. As with Figure 27, some degree of netting may have taken place for the underlying data. As such generation and demand from pumped storage and interconnectors may be underestimated.

4.21. Our analysis of market concentration suggests that compared to EU markets, the GB market appears to have relatively low levels of concentration. The wholesale market is somewhat concentrated by official metrics when considering generation output with a HHI (Herfindahl–Hirschman Index) of 1267, little changed from 2014's HHI of 1243[23]. There are relatively similar levels of concentration when looking at ownership of overall capacity and flexible capacity.

4.22. We also use pivotality analysis in our monitoring of the wholesale electricity market. Pivotality analysis essentially looks at whether a given company's portfolio of power stations is needed to clear supply and demand in a particular period. Pivotality only looks at the possibility for market power and does not imply any form of market manipulation. It does not account for the incentives on firms to exploit any dominant position, and is not an indicator of actual market abuse or anticompetitive behaviour.

4.23. This kind of analysis is generally used to assess whether a company can exert market power by withholding electricity (i.e. by choosing not to generate in order to restrict supplies and push up prices). However, it is also possible to conduct pivotality analysis to look at situations of excess supply where generators may be required to reduce generation at their power stations. This will become more important as the amount of inflexible, intermittent generation on the system increases and the need for both downward and upward flexibility grows.

4.24. Similar to 2014, our assessment of the GB market as a whole has shown very few instances of pivotality in 2015. However, it is possible that there is greater scope for market power at a sub-national level (e.g. as a result of transmission constraints), therefore we believe that TCLC still provides value as a monitoring tool to help prevent potential market abuse.

4.25. For the first time, in the past year, market participants have been required to register under REMIT.[24] As of June 2016, there are approximately 1000 market participants registered in GB[25] in the wholesale gas and electricity sector. This register helps ACER (Agency for the Cooperation of Energy Regulators) and NRAs

[22] At the start of 2016, E.ON separated its renewable generation business (continuing to be run by E.ON) from its conventional generation business, which is now under a new company, Uniper. As our charts refer to 2015, we have used "E.ON" when talking about both types of generation.
[23] A marketplace with a HHI of 1000 or less is considered to be relatively unconcentrated, whereas a market with only one company would have an HHI of 10000.
[24] Market participants are defined in REMIT as "any person, including transmission system operators, who enters into transactions, including the placing of orders to trade, in one or more wholesale energy markets".
[25] This number takes into account market participants based in GB and those registered in GB but based outside of the EU. The actual number active in the GB market is likely to differ as market participants based in other EU member states are not required to register in GB and some market participants based in GB may only be active in other EU markets.

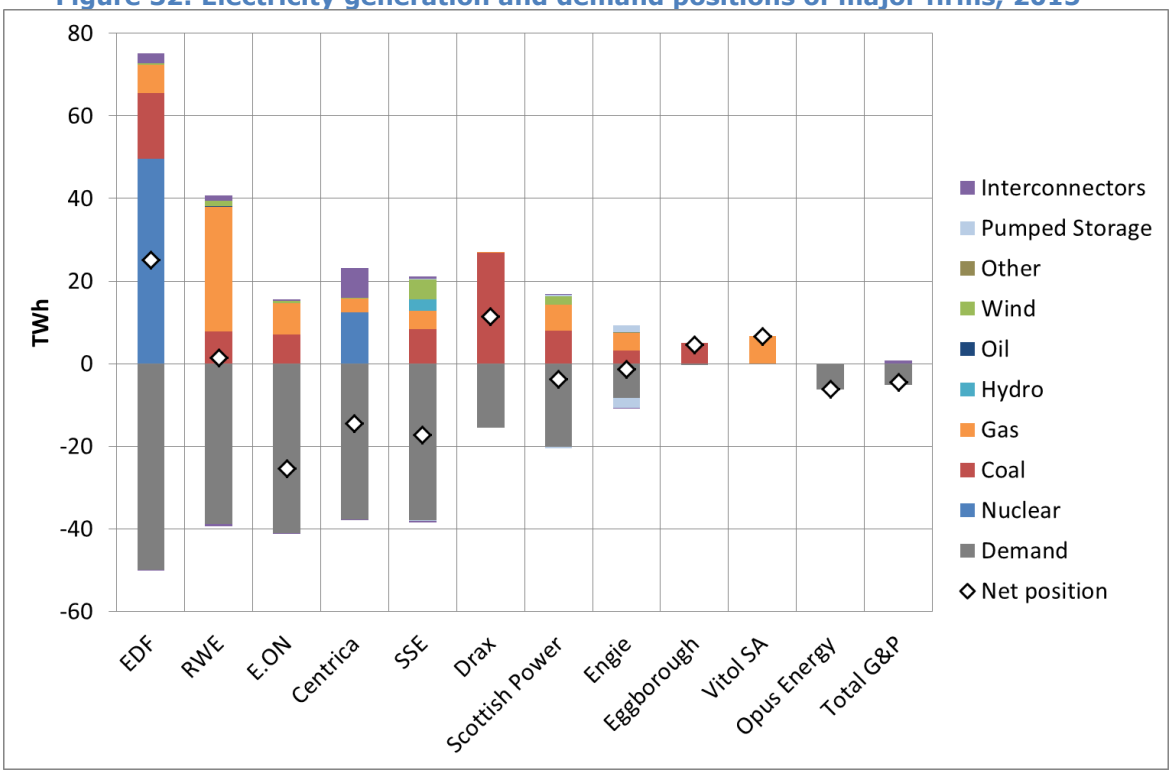
(National Regulatory Authorities) to effectively monitor the wholesale markets, increasing transparency by centrally recording who is active in each market as well as any links between market participants.

4.26. New entry has taken place despite some concerns over barriers to accessing the wholesale electricity market. Some stakeholders have told us that the complexity and extent of credit requirements can pose challenges to new entrants in both the gas and electricity markets. There have also been historical concerns that low levels of liquidity in the wholesale electricity market may constitute a barrier to entry. As mentioned earlier, our Secure and Promote reforms have sought to remedy this through increasing access to selected traded products, particularly for smaller players. It is positive in this respect to see an increase in the number of eligible suppliers under the Secure and Promote reforms to 18, up from six at the outset. There is more detail on liquidity and the impact of our reforms in our annual liquidity policy evaluation document.

Vertical integration

4.27. Vertical Integration shows the extent to which companies own or control the different aspects of the supply chain in its sector, from generation through to the end consumer. Figure 32 shows the level of Vertical Integration of major firms in the electricity market in 2015. This shows that the generation assets of a number of the largest suppliers are not able to meet their customers' demands. For some, this is by a significant margin, although the picture has not changed significantly since 2014. Figure 32 also highlights how each firm has a different mix of capacity.

Figure 32: Electricity generation and demand positions of major firms, 2015[26]



Source: Elexon, NETA Reports, Ofgem analysis

Profitability

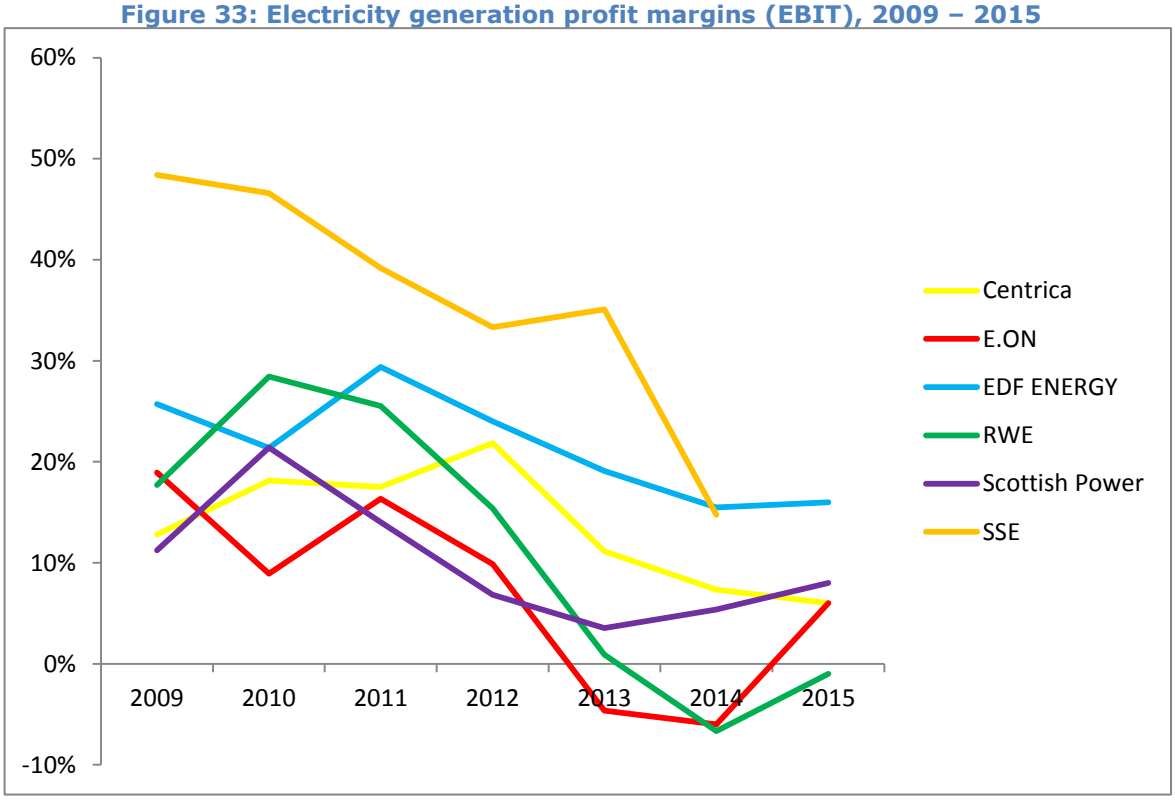
4.28. One way to measure profitability of electricity generation is Earnings Before Interest and Tax (EBIT), which can be shown through analysis of the Consolidated Segmental Statements.[27]

[26] Calculated based on metered volumes associated with individual generation and demand units (BM units), excluding Supplier Units. Assumptions have been made regarding which companies own each BM unit. Volumes have been split based on equity stakes. As with Figure 22: Electricity generation mix by quarter and fuel source some degree of netting may have taken place for the underlying data. As such the full extent of generation and demand from pumped storage and interconnectors may be underestimated. Fuel types are based on classifications used by Elexon so may not be consistent with those used elsewhere in this report (e.g. in Figure 27 which uses data from BEIS). In particular, the conversion of certain coal plants to co-firing is not captured here.

[27] The Consolidated Segmental Statements are an annually published set of accounts covering the retail and generation activities of the six largest suppliers in the GB retail gas and power markets. These are Centrica, EDF Energy, RWE (npower), Scottish Power, SSE and E.ON. The statements are here. Annual data for all companies reflects calendar years, except in the case of SSE whose financial year runs from April to March. For this reason, SSE's CSS for April 2015 to March 2016 had not been published in time for this report. The data in this chart includes a number of adjustments we have made to ensure consistency in the way exceptional items are reported among the suppliers and improve comparability. Please refer to the published statements for the figures as provided by suppliers.

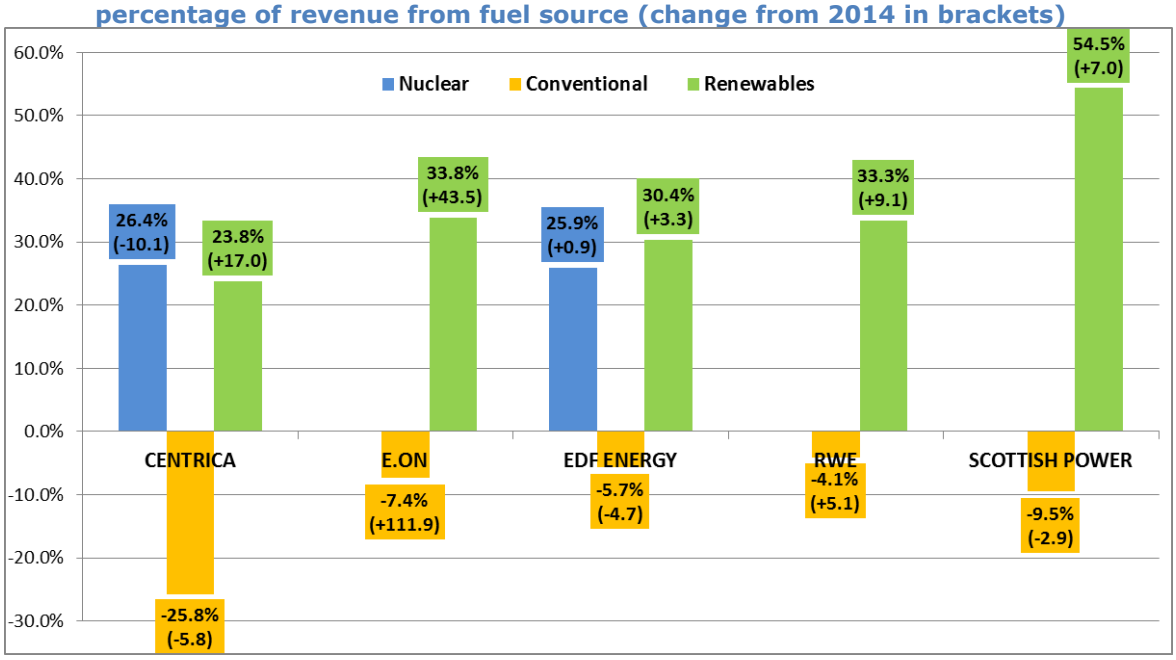
4.29. Figure 33 and Figure 34 show a clear trend of the increased profitability of renewable generation, and the effect this has had on overall profit margins.

Figure 33: Electricity generation profit margins (EBIT), 2009 – 2015



Source: Ofgem analysis Of Consolidated Segmental Statements

Figure 34: Electricity generation EBIT margins 2015 by generation type, as a percentage of revenue from fuel source (change from 2014 in brackets)

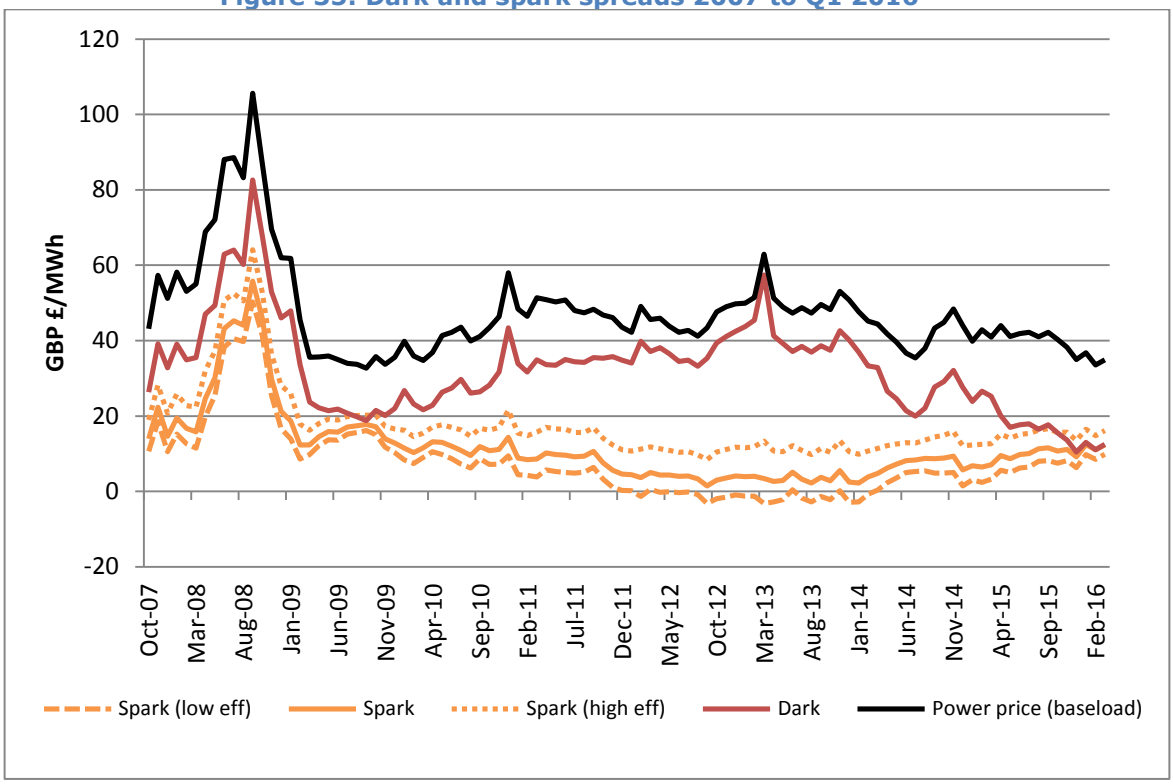


Source: Ofgem analysis Of Consolidated Segmental Statements

4.30. Trends in clean dark and clean spark spreads can be seen in Figure 35: Dark and spark spreads 2007 to Q1 2016. Fuel spreads, such as the clean dark or spark spread, are an indicator of the average revenue a power station can expect from generating a unit of electricity during baseload operation, after accounting for fuel and carbon costs. Clean spark spreads refer to gas generation and clean dark spreads refer to coal generation.

4.31. Key drivers for the recent decrease in the dark spread are the increasing Carbon Price Floor and falling power price, and the recent increase in the spark spread due to the decrease in gas price. This has meant in 2015 there was a convergence between the spark and dark spreads, leading to gas fired plants becoming more profitable to generate electricity, and coal fired plants less profitable. This has led to gas fired plants making up a larger percentage of the generation mix in recent times (see Figure 22), and has accelerated the closure or mothballing of less efficient coal fired plants.

Figure 35: Dark and spark spreads 2007 to Q1 2016[28]

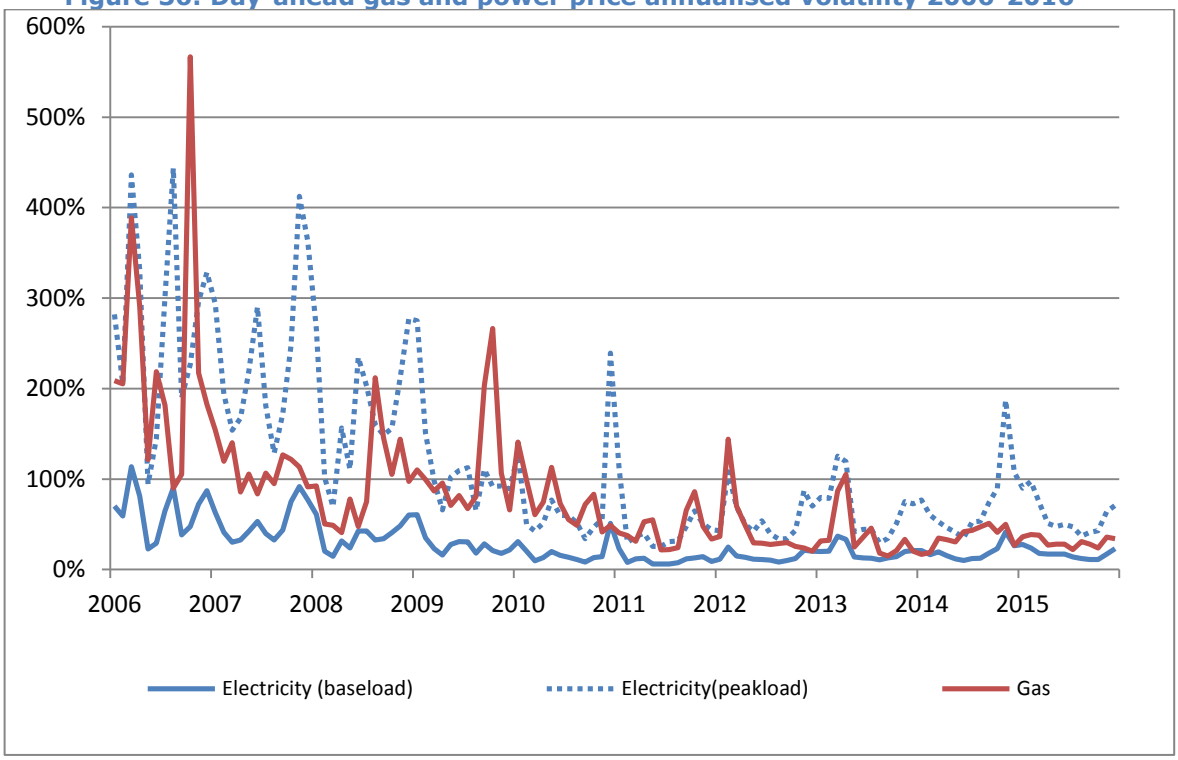


Source: ICIS, Bloomberg, Ofgem analysis

4.32. Price volatility has been generally decreasing over the past decade, and reduced again from 2014 to 2015. This is in line with the changing generation mix – the closure or mothballing of old gas and coal plants, which are considered flexible as they can start up and shut down quickly, as well as the declining profitability of these types of fuel.

[28] Efficiencies: Coal = 35%, Spark = 50%, Spark (high eff) = 60%, Spark (low eff) = 45%. Gas and power price contracts used are the OTC Day-ahead contracts assessed by ICIS. The coal price contract used is the front month Amsterdam Rotterdam Antwerp (ARA) coal contract as reported by Bloomberg. The carbon price contract used is the front month EU ETS price traded on the EUX exchange also as reported by Bloomberg. The relevant Carbon Price Floor levels as set by BEIS are added to the EU ETS carbon prices to get the effective GB price for carbon. The methodology for calculating dark and spark spreads is taken from Platts and can be found here: https://www.platts.com/IM.Platts.Content/methodologyreferences/methodologyspecs/european_power_methodology.pdf

Figure 36: Day-ahead gas and power price annualised volatility 2006-2016[29]



Source: ICIS, Ofgem analysis

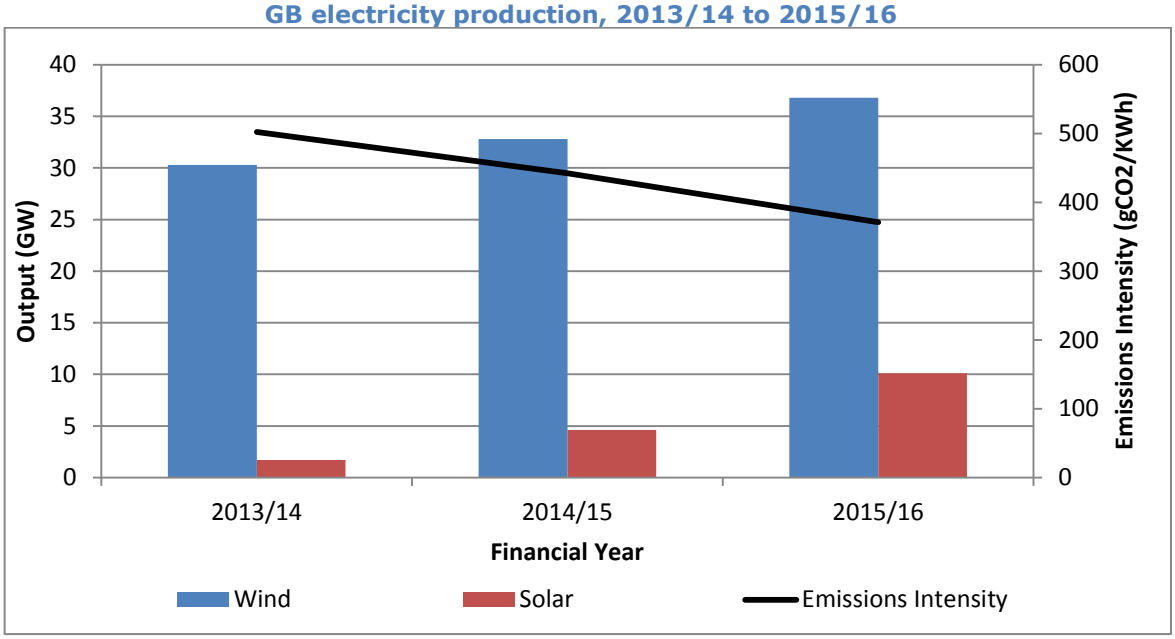
Investment and sustainability

Investment and emissions intensity of generation

4.33. As discussed in the Security of supply section of this chapter, there has been a recent change in the make-up of the GB generation mix towards an increased amount of renewable energy, from a capacity as well as generation point of view. Figure 37: Increase in output from wind and solar, and emissions intensity from all GB electricity production, 2013/14 to 2015/16 shows the change in wind and solar output over the past 3 years, as well as the overall emissions intensity of GB electricity production. Emissions intensity has fallen steadily over the past 3 years, partly as a result of the increase in electricity generation from renewable sources, but also because it has been cheaper to produce electricity from gas rather than coal more often, which until recently was predominantly the marginal fuel source.

[29] The price volatility calculation takes the logarithmical differences of the daily average prices of two consecutive trading days. These values are then used to compute the relative standard deviation on a rolling monthly basis (21 trading days). To annualise the data the value obtained is then multiplied by the square root of the total number of trading days in a year (252 trading days). Finally, the annualised volatility values are multiplied by 100 in order to express them as a percentage. This approach is consistent with the methodology in the European Commission's guidelines, here: http://ec.europa.eu/energy/sites/ener/files/documents/volatility_methodology.pdf

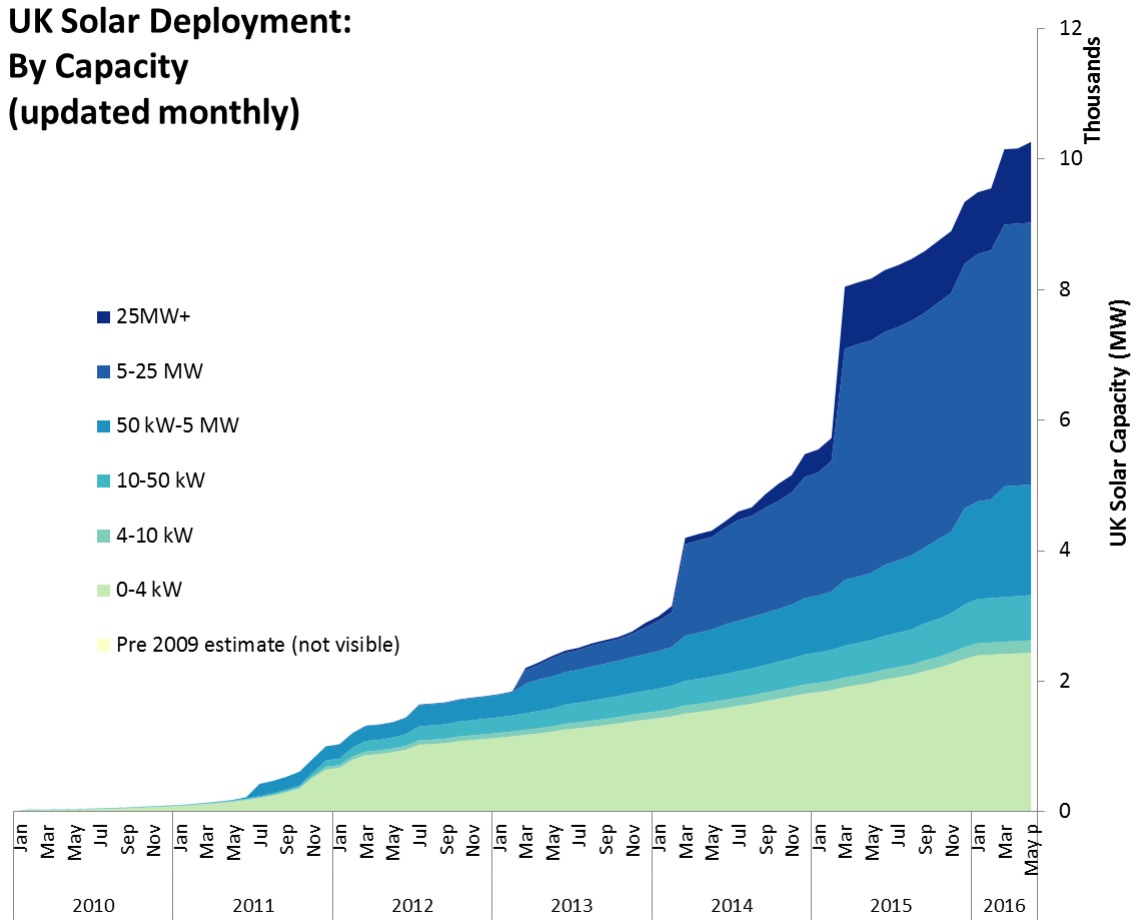
Figure 37: Increase in output from wind and solar, and emissions intensity from all GB electricity production, 2013/14 to 2015/16



Source: National Grid Future Energy Scenarios, Committee on Climate Change

4.34. As mentioned above, solar generation and capacity have greatly increased over the past few years, as a result of investment driven largely by government led subsidies, namely the Renewables Obligation (RO) and Feed-in Tariffs (FIT). Figure 38: Solar deployment by capacity, 2010 to 2016 shows the increase in solar capacity in the UK, broken down into installation sizes.

Figure 38: Solar deployment by capacity, 2010 to 2016



Source: BEIS

The Capacity Market

4.35. Under current market arrangements, energy-only generators get paid for producing energy. Following the introduction of Capacity Market (CM) Auctions, generators can earn additional revenue by securing a capacity agreement. In return, capacity providers must commit to delivering energy at times of system stress or face penalties if they fail to do so. Capacity agreements are determined via competitive auctions, held four years (T-4 Auction) and one year (T-1 Auction) before capacity is expected to be made available. The majority of agreements are secured through the T-4 auction, and in the 2015/16 auction round over 98% of capacity was procured through the T-4 auction. These auctions are technology neutral, and from 2015, interconnectors were able to participate in the CM for the

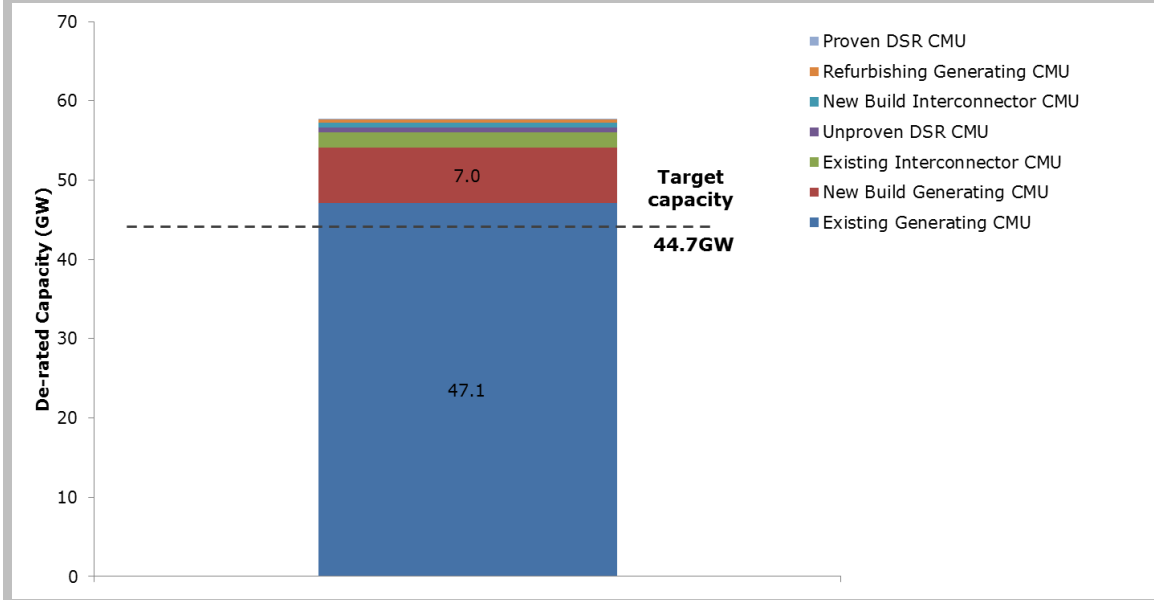
first time. The T-4 auction for delivery in winter 2019/20, was held in December 2015, and results of this auction are shown below.[30]

Capacity Market auctions in 2016

Prospective capacity providers must meet certain eligibility requirements and prequalify before they can participate in the CM auctions. Alternatively, prospective capacity providers may choose to opt out of an auction. Existing generation, interconnector and Proven/Unproven DSR CMUs are eligible for one year agreements only. Refurbishing and New Build CMUs are eligible to receive agreements to up to three and 15 years respectively, provided they meet certain expenditure thresholds.

The final number of prequalified CMUs for the 2015 T-4 Auction was 379, totalling around 57.7GW of de-rated capacity. This compares with the target capacity of 44.7GW, implying there was considerable competition going into the auction (Figure 39: Prequalified capacity by CMU type). The majority of prequalifying de-rated capacity was Existing generating CMU capacity (82%). Around 12% of prequalified de-rated capacity was New Build generating capacity, and around 3% was Existing Interconnector Capacity. The remaining 3% was split between Unproven/Proven DSR, New Build Interconnector and Refurbishing Generating de-rated capacity.

Figure 39: Prequalified capacity by CMU type

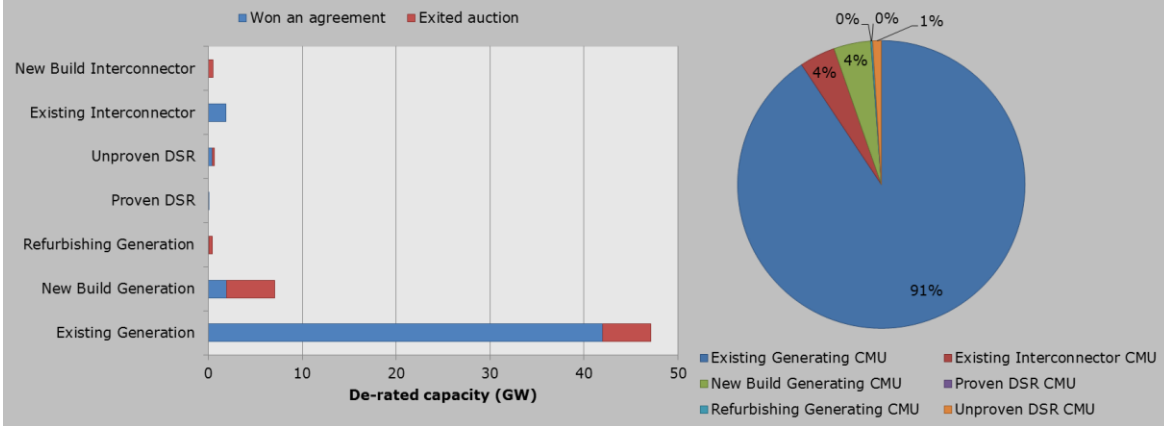


Source: National Grid, Capacity Market Register T-4 2015

[30] More comprehensive analysis of the Capacity Market Auction is available in the Annual Report on the Operation of the Capacity Market in 2015.

A total of 46.4GW of capacity was awarded in the 2015 T-4 Auction at a clearing price of £18.00/kW/year at an estimated total cost of £1,082 million (in 2014/15 prices).

Figure 40: Volume of capacity winning agreements by CMU type



Source: National Grid, Capacity Market Register T-4 2015

The majority of successful CMU capacity awarded an agreement in the 2015/16 auctions were Existing Generation CMUs (42.0GW) consisting mainly of smaller scale assets with an average size of 26MW. New Build CMUs secured capacity agreements for over 1.94GW of capacity, and 1.86GW of Existing interconnector CMU capacity won capacity agreements.

In the 2015 T-4 auction, 5.5GW of de-rated Existing capacity failed to secure a Capacity agreement. This was despite 47.1GW of Existing de-rated capacity prequalified exceeding the total auction target by around 2.5GW.

Appendices

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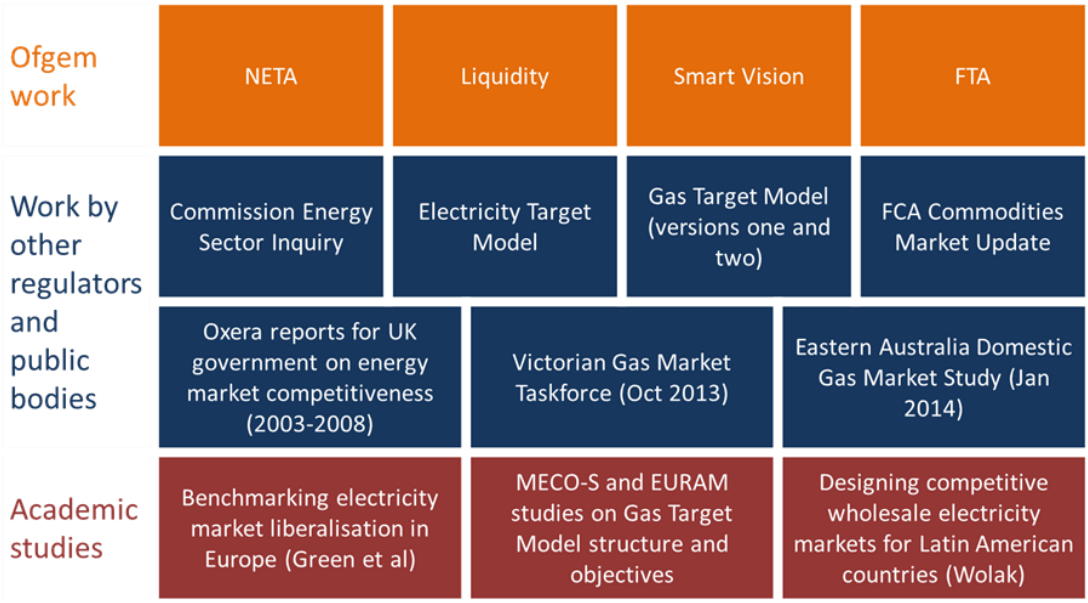
Appendix 1 - Our wholesale markets framework in detail

Background

1.1. In formulating our framework we reviewed a range of prior market studies to understand more about how others had approached such a task. A selection of the studies we looked at are summarised in Figure 41 below.

Figure 41: Selection of relevant studies covered



1.2. Some notable features of the literature we looked at included:

- Attempts at a short, concise statement of an overall market objective;
- Hierarchical approaches to highlight how important aspects of the market relate to one another;
- Emphasis on qualitative as well as quantitative assessment;
- Most avoided ranking or prioritising certain aspects of the market over others. Directly addressing trade-offs seemed problematic and highly subjective;
- Many emphasised the importance of current and future outcomes; and

- Some opted for quite a broad approach so as to capture things like the regulatory environment, transparency and sustainability.

Our approach to developing the framework

1.3. Our approach to creating a framework for assessing the wholesale market uses a hierarchy of categories. It starts with a broad objective and ends with a range of indicators that can be assessed against benchmarks, and over time.

↓ The **Objective** is a single sentence setting out our view of the purpose of the market. It summarises desired market outcomes.

↓ The **Features** are what we consider the market should have if it is to achieve the objective. These are first set out as broad **high-level features**. These are then further sub-divided into more **detailed features**.

↓ The **Indicators** are detailed metrics that can be measured in order to determine the extent to which a given feature is present.

1.4. Our framework is underpinned by a number of basic assumptions:

- Competitive markets drive the most efficient outcomes (making bills lower than they otherwise would have been);
- Markets are generally the most efficient mechanism for matching consumers' demand and producers' supplies;
- Well-functioning wholesale markets are important for well-functioning retail markets;
- Government and EU policy are the context in which the market must operate. They are generally taken as given, although appreciating how they affect the market's ability to function is important; and
- Regulatory and institutional aspects that are within our and/or the industry's control are not taken as given and fall within the framework.

1.5. It is also worth noting there are things framework does not attempt to do. The framework does not seek to:

- Provide a perfect representation of how a well-functioning wholesale market is structured or operates (any market is necessarily complex and there will be interactions and overlaps);
- Weight or prioritise different elements of the market (eg, it does not take a view on the policy trilemma);

- Specify how to manage trade-offs between indicators, although it may help highlight them;

- Provide minimum criteria for the indicators it identifies. It is about flagging up what we should be looking at and how; or

- Provide different approaches for gas and electricity. There is understandably some difference with respect to the detailed indicators but the high-level aspects of the framework are consistent.

The framework

1.6. We have taken the overarching objective of gas and electricity wholesale markets is: **to provide a dynamic and sustainable mechanism in which informed participants can confidently and efficiently buy and sell the energy they need at a price that reflects economic costs**.

1.7. This objective effectively summarises four key features we consider the market needs to deliver if it is to function well. These are set out below. A visual representation of the framework was shown earlier in **Error! Reference source not ound.**.

Security of supply

1.8. Markets are a mechanism for determining the allocation of limited resources. Gas and electricity are also essential services whose supply and demand must be matched on a day-by-day or even second-by-second basis. We therefore consider clearing supply and demand in order to ensure security of supply to be a key feature of gas and electricity wholesale markets. This feature in our wholesale market framework fits very well with our strategic consumer outcome to improve reliability.

1.9. Two detailed features that a wholesale market needs for security of supply are:

- **Secure and adequate supplies** to ensure demand can be met; and

- **Efficient system operation** to ensure the networks remain balanced.

Access and liquidity

1.10. No market is perfect and there are always costs associated with trading.[31] To ensure it is easy for parties to trade, it is important that market minimises

[31] These include the costs of finding the desired good at the lowest price (search and information costs), the costs of striking a deal according to mutually agreed terms (bargaining

transaction costs. This feature in our wholesale market framework is linked to our strategic consumer outcome aimed at lowering bills.

1.11. Two detailed features that are needed for easy access and liquidity are:

- **A diverse range of products** to ensure the variable nature of consumer demand and supply output can be efficiently matched; and

- **A liquid market** to ensure that buyers or sellers that have identified the products they need can then reliably make transactions in a timely way without having to settle for a substantially worse price.

Competition

1.12. Even if the wholesale market clears supply and demand and minimises transaction costs, it is not the case that this alone will produce the best result for the consumer. Ensuring that the market is sufficiently competitive to produce prices that reflect economic costs is an important third feature. This feature in our wholesale market framework has strong ties to our strategic consumer outcomes aimed at lowering bills and improving the quality of service.

1.13. When breaking competition down into more detailed market features it is useful to differentiate between market structure and market outcomes:[32]

- **Competitive market structure** relates to the broader characteristics and structure of the market (eg concentration, vertical integration) that can affect the ability for the market to function in a competitive manner.

- **Competitive market outcomes** relates to the actual results of the competitive process (eg prices, profits) that directly affect consumers.

1.14. When looking at the wholesale markets for gas and electricity it is important to be mindful of the nature and structure of these markets. Accounting for this can alter the way that we may look at competition relative to other sectors.

1.15. The wholesale energy markets are typically characterised by high investment costs. Generation and gas supply assets are large, lumpy investments that take a long time to commission and build. Their returns are also spread over several decades. As such these investments carry a relatively high degree of risk, particularly

costs) and the costs of ensuring any counterparty sticks to the deal (enforcement costs).
[32] See Competition Commission (2013), "Guidelines for market investigations".

given the recent and ongoing changes in the industry, as well as the increasing political importance placed on energy.

1.16. We therefore consider that any assessment of market competition must be mindful of these factors. When looking at whether prices reflect economic costs, it is important to look at long-run as well as short-run marginal costs. This is because market participants must recover their long-run costs if their initial investment is to remain viable. Similarly, profits are not necessarily a problematic feature unless they a symptom of ineffective competition. In a competitive market, some firms could quite legitimately turn a profit, particularly at certain points in time due to cyclical factors or gains made through innovation or efficiency. Because of the large, lumpy and risky nature of new investment, it takes time for competition to respond to these signals and allow new entrants to compete profits back in line with long-run levels.

1.17. Investment and sustainability

1.18. So far, this framework has painted a static view of the market. Our obligations are to both present and future consumers, and so we believe it is very important that the market invests, adapts and improves over time in a sustainable manner. A well-functioning market should provide efficient outcomes now and in the future. Ensuring this is the case has relevance for all five of our strategic consumer outcomes.

1.19. Four detailed market features that are critical to achieving this are:

- **Good governance** underpinned by predictable, simple and flexible regulatory institutions. This is vital to ensuring that the "rules of the game" by which the market operates are conducive to investment, minimise regulatory burden and evolve over time when this is needed;

- **Investment** that is efficient (ie in proportion to need) to ensure we have secure, sustainable and affordable supplies in the future;

- **Innovation** to bring economic and transaction costs down and improve the efficiency with which the market operates; and

- **Environmental sustainability**. Where the wholesale markets are the vehicle that policymakers use to achieve environmental objectives, a well-functioning market will respond to the incentives placed on it. Importantly, the ability of the market to efficiently deliver desired environmental goals is dependent upon the appropriateness of the policy approach.

Appendix 2 – The GB wholesale energy market arrangements

1.1. In 1980s and 1990s, the gas and power industries were privatised. As a result of this the wholesale markets for gas and power were established and this opened much of the sector up to competition. The process of privatisation has played an important role in formulating the arrangements that exist today.

Brief history of the wholesale gas market

1.2. Privatisation of the gas industry began with the Gas Act of 1986 which started to dismantle the monopoly retail supply position of the British Gas Corporation.[33] This was an incremental process that started with the opening up of competition for larger industrial consumers. The Gas Act of 1995 completed this process, with full retail market competition for all consumers, including domestic households and small businesses, by 1998.

1.3. The Gas Act of 1995 continued the process of privatisation. Following its passage there was a process of de-mergers and acquisitions that broke up British Gas plc. Centrica took over the retail supply business, National Grid took over the transportation business, and BG Group took over the upstream production assets. The market arrangements for full third party access to the pipeline network and daily balancing at the NBP were introduced in the same year. These market arrangements were codified in the industry Network Code.

1.4. There have been numerous changes to the market arrangements introduced in their nearly twenty year history. The nature and extent of trading has also changed considerably over that period. Even so, the basic building blocks of the wholesale gas market arrangements have remained largely unchanged to this day.

Brief history of the wholesale electricity market

1.5. The Central Electricity Generating Board (CEGB) historically owned and operated the power stations and transmission system in England and Wales. It sold the power it generated to twelve area boards, which were responsible for distributing and supplying to end consumers. There were also a further two area boards in Scotland and these were responsible for their own generation and transmission.

[33] Source: Patrick Heather (2012), "The Evolution and Functioning of the Traded Gas Market in Britain".

1.6. Privatisation of the electricity industry began with the Electricity Act of 1989. This restructured the industry by first splitting the CEGB into a transmission company and three generating companies. The twelve area boards were replaced by twelve regional electricity companies. The two boards in Scotland were also replaced. Britain's first set of trading arrangements were also established in 1990, known as the "Pool".

1.7. Between 1990 and 1996 almost all the newly created companies were sold off, with the exception of some of the nuclear generation assets which took longer to be transferred to private ownership. From 1990 the retail market also began to be opened up to competition, and this was achieved for all consumers by 1999.

1.8. The Utilities Act of 2000 led to the introduction of the New Electricity Trading Arrangements (NETA). NETA was introduced following concerns about competition and price-setting in the Pool. The central theme underpinning NETA was that the wholesale market for electricity should be more similar to other commodity markets. NETA has been subject to numerous modifications over the years, including an extension to incorporate Scotland in 2005, which became known as the British Electricity Trading and Transmission Arrangements (BETTA). Despite these changes, many of the same broad market arrangements that were implemented in 2001 remain in place today.

The current arrangements

1.9. The system of transporting energy through transmission and distribution networks is a natural monopoly. We regulate these activities through our price control process, which sets the amount of revenue that network companies can earn over a given period. Network companies must also hold a license if they are to engage in energy transportation. These licences set out a range of rules and responsibilities that network companies must adhere to. We govern and grant these licences.

1.10. Unlike transportation, the production, exchange and sale of energy are not natural monopolies. As such these activities take place in markets where there can be strong competition between participating companies. These are the wholesale and retail markets. A different set of licences with a range of rules and responsibilities apply to companies engaging in these activities. We also govern and grant these licences.

1.11. Table 1 below summarises the key features of the GB wholesale market arrangements as they exist today.

Table 1: Summary of the key features of our wholesale market arrangements

Question:	Gas:	Electricity:
Who are the main wholesale market participants?	Shippers are companies that put gas into, or take gas from, the gas network. Most upstream gas producers or importers are also gas shippers	Generators are companies that primarily supply power to the grid and then sell it on to suppliers in the wholesale market. Suppliers are

	and focus on supplying gas to the network. They then sell it in the wholesale market. Similarly, most retail gas suppliers are also gas shippers and focus on buying gas in the wholesale market. They then take it from the network to pass on to their end consumers.	companies that primarily buy power in the wholesale market. They then demand this power from the grid and provide it to their end consumers.
Who operates the gas and power networks?	NGG is the gas SO. It is responsible for ensuring the system remains balanced in real-time. The SO is incentivised to balance the system.	NGET is the electricity SO. It is responsible for ensuring the system remains balanced in real-time. The SO is incentivised to balance the system at least cost.
Who operates the interconnectors?	Interconnector operators are companies that operate the various interconnectors that connect GB's gas and power networks with the networks in other neighbouring countries.	
How are these various companies regulated?	A specific license is required for any company wishing to engage in any of the above activities. These licenses are governed and granted by Ofgem. They set out a range of rules and responsibilities that licensees must adhere to.	
What other companies participate in the market?	A range of trading houses and financial institutions are also involved in wholesale market trading. They look to manage market risk, optimise assets and act as an intermediary for smaller companies that might struggle to trade on their own.	
Over what time period is the *market* balanced?	The gas market is balanced daily. Each "gas day" starts and ends at 6am. This is due to change to 5am soon to bring us in line with the rest of Europe.	The electricity market is balanced on a 30 minute basis. Each day is therefore divided into 48 balancing periods, known as "settlement periods".
What do market participants balance?	In each gas day or settlement period, market participants aim to balance the combination of their physical positions and their traded positions. Their physical position is the gas/power that they physically supply to, or demand from, the network. Their traded position is the gas/power they contract to buy or sell. Balance = gas/power input – gas/power output + gas/power bought – gas/power sold	
How and when do market participants balance?	Market participants have the freedom to choose how to trade and who to trade with. For a given gas day, they may trade before or during that gas day.	Market participants have the freedom to choose how to trade and who to trade with. For a given settlement period they may trade at any point up to one hour before the settlement period begins. This cut-off point is known as "gate closure".
Over what time period is the *network* balanced?	The gas network must be balanced throughout each day. Because gas can be stored and the pressure of the gas in the network is able to fluctuate	The electricity network must be exactly balanced on a second-by-second basis. This is managed after gate closure when the SO becomes the sole

	within certain limits (known as linepack) the gas network does not need to be perfectly balanced on a second-by-second basis.	party responsible for balancing the system. It does this using a range of tools, most notably through the Balancing Mechanism (BM). In the BM the SO contracts with generators and suppliers in order to fine-tune their inputs and outputs. The SO also contracts for a range of ancillary services to ensure system stability (eg frequency response).
How are market participants incentivised to balance?	Market participants are not obliged to balance but are incentivised to do so because they face charges on any imbalance. These charges are called "cash-out" charges and reflect the costs that the SO incurs when balancing the system. Cash-out charges ensure that any imbalanced party is worse off than if they had balanced. This ensures downstream companies are incentivised to contract with upstream companies to buy the gas or power they need to meet their expected demand. In turn, upstream companies are also incentivised to contract with downstream companies to sell their output. Both parties are incentivised to forecast accurately and meet their contractual commitments. These market arrangements ensure the SO only undertakes a small, residual role when it takes control after gate closure.	
Where are the market arrangements set out and how can they change?	Besides the various licenses that market participants must have, the actual market arrangements are set out in a range of industry codes. These include the BSC in electricity or the UNC in gas. Inclusive governance arrangements allow industry participants to propose changes to the codes. We have the final decision on whether any changes are implemented. We can also propose our own changes through the Significant Code Review (SCR) process.	
What determines the wholesale price that participants buy and sell at?	There is no single wholesale price. Each individual trade between market participants exchanging gas or power involves agreeing an individual price. Those that are selling (eg generators) want to obtain a higher price. Those that are buying (eg suppliers) want to obtain a lower price. In a competitive market, prices should reflect the economic costs of delivering the supplies necessary to meet demand. Importantly, we do not set wholesale prices, but we do monitor the market to ensure that it is competitive.	
How can anyone know what the wholesale price is?	Many trading venues report the prices and volumes of the trades that take place in the market. Price reporting agencies also provide information on what wholesale prices were on any given day. Often this is in the form of an index that involves some kind of averaging or assessment of the deals that were struck.	

Appendix 3 - Glossary

A

Agency for the Cooperation of Energy Regulators (ACER)

ACER is a European Union body which cooperates with EU institutions and stakeholders, notably National Regulatory Authorities (NRAs) and European Networks of Transmission System Operators (ENTSOs), to deliver a series of instruments for the completion of a single energy market.

APX

APX owns and operates energy exchange markets in the Netherlands, UK and Belgium. APX provides a power spot exchange service in the UK.

B

Barrier to entry

A factor that may restrict entry into a market.

Baseload product

A product which provides for the delivery of a flat rate of electricity in each hourly period over the period of the contract.

BBL

The Balgzand-Bacton Line (BBL) interconnector is a gas interconnector between Balgzand in the Netherlands and Bacton in GB. At present, it can only physically flow gas into GB, though a virtual reverse flow product is also available.

BETTA

British Electricity Trading and Transmission Arrangements.

Bid-offer spread

The bid-offer spread shows the difference between the price quoted for an immediate sale (offer) and an immediate purchase (bid) of the same product; it is often used as a measure of liquidity.

Broker

A broker handles and intermediates between orders to buy and sell. For this service, a commission is charged which, depending upon the broker and the size of the transaction, may or may not be negotiated.

C

Capacity Market

With the introduction of the Capacity Market (CM), generators will get payments for capacity availability. These new revenues are in addition to the energy-only market revenues that generators receive for actual output and are also intended to help counter the effects of the "missing money" problem.

Carbon Price Floor (CPF)

The CPF, introduced in the UK on 1 April 2013, effectively sets a minimum price for carbon in the UK by "topping up" the EU ETS carbon price. The main intent of the CPF is to send a strong, stable incentive to invest in low carbon generation.

Central Electricity Generating Board (CEGB)

The CEGB historically owned and operated the power stations and transmission system in England and Wales. It sold the power it generated to twelve area boards which were responsible for distributing and supplying to end consumers. There were also a further two area boards in Scotland and these were responsible for their own generation and transmission.

Churn rate

Churn is typically measured as the volume traded as a multiple of the underlying consumption or production level of a commodity.

Clearing

The process by which a central organisation acts as an intermediary and assumes the role of a buyer and seller for transactions in order to reconcile orders between transacting parties.

Competition and Markets Authority (CMA)

The CMA is a non-ministerial government department which promotes competition. Its responsibilities include investigating mergers which restrict competition, conducting market studies and investigations in markets where there may be competition and consumer problems, and investigating breaches of competition law.

Contract for Difference (CfD)

A contract where the payoff is defined as the difference between a pre-agreed 'strike' price and a reference price (determined in relation to an underlying commodity). The Government has proposed the use of CfDs as part of Electricity Market Reform. CfDs under EMR are intended to encourage investment in low-carbon generation by providing greater long-term revenue certainty to investors.

D

Day-ahead market

A form of near-term market where products are traded for delivery in the following day.

Demand Side Response (DSR)

A demand side response is a short-term change in the use of gas or electricity by consumers following a change in the balance between supply and demand.

Department of Business, Energy and Industrial Strategy (BEIS)

The UK Government department responsible for energy and climate change policy. BEIS replaced DECC, the Department for Energy and Climate Change.

E

Electricity Balancing Significant Code Review (EBSCR)

EBSCR was an Ofgem-led project aimed at improving balancing incentives in the electricity market by making cash-out prices more reflective of the costs of balancing the system.

Electricity Market Reform (EMR)

EMR is the Government's approach to reforming the electricity system to ensure the UK's future electricity supply is secure, low-carbon and affordable.

Emissions Performance Standard (EPS)

The EPS effectively prohibits the construction of new generation sources that exceed a certain level of carbon-intensity.

EU Emissions Trading System ETS

The EU ETS is an EU greenhouse gas emissions trading system. It works on a 'cap and trade' basis, so there is a 'cap' or limit set on the total greenhouse gas emissions allowed by all participants covered by the System and this cap is converted into tradable emission allowances.

Exchange

A type of platform on which power products are sold. Typically an exchange would allow qualifying members to trade anonymously with other parties and the risks between parties would be managed by a clearing service.

F

Financial Product

A contract that is settled financially at maturity rather than by the delivery of a physical commodity.

Forward Curve

A series of sequential time segments within which it is possible to trade a particular commodity and for which prices are available.

Forward trading

The trading of commodities to be delivered at a future date. Forward products may be physically settled – by delivery – or financially settled.

G

Gas Year

The Gas Year runs from 1 October to 31 September each year.

Gas Significant Code Review (SCR)

The Gas SCR was an Ofgem-led project focusing on measures to enhance security of gas supply by reducing the likelihood, severity and duration of a Gas Deficit Emergency (a period when the supply of available gas is not sufficient to meet GB demand). A key element of the Gas SCR is the reform of cash-out arrangements in an emergency to increase the incentives on shippers to avoid an emergency.

H

HHI

The Herfindahl-Hirschman Index (HHI) is a measure market concentration and competition. It is calculated by squaring the market share of each company competing in a market, and then summing the resulting numbers.

I

ICE

Intercontinental Exchange, an American financial company that operates Internet-based marketplaces which trade futures and over-the-counter (OTC) energy and commodity contracts as well as derivative financial products.

Imbalance (cash-out) charges

Cash-out arrangements are operated in both the gas and electricity wholesale markets. Under these arrangements, parties who are not in balance incur charges that reflect the costs incurred by National Grid in addressing the imbalance. These

charges are known as cash-out prices. 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 by maintaining the reliability of their production plant, for example.

Intra-day trading

Refers to the market in which products traded are on the same day as delivery.

IUK

Interconnector (UK) Limited (IUK) is a bidirectional gas interconnector between Zeebrugge in Belgium and Bacton in GB.

L

Liquefied Natural Gas (LNG)

Liquefied Natural Gas is natural gas (predominantly methane, CH4) that has been converted temporarily to liquid form for ease of storage or transport.

Liquidity

Liquidity is the ability to quickly buy and sell a commodity without a significant change in its price and without incurring significant transaction costs.

M

Market Maker

A firm which is regularly prepared to buy and sell in a commodities or financial market. Market makers post two-sided (bid and ask) prices on a regular basis, encouraging greater liquidity.

Market Power

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

N

N2EX

The N2 Exchange, a GB electricity market platform, is operated by Nord Pool Spot AS (NPS).

National Balancing Point (NBP)

The NBP is a virtual trading location for the sale and purchase of all gas in the GB market.

Near-term market

The market in which the products are traded close to delivery (for example, on the day of delivery or day-ahead of delivery.

NETA

New Electricity Trading Arrangements.

New Balancing Services (SBR and DSBR)

The Supplemental Balancing Reserve (SBR) and Demand Side Balancing Reserve (DSBR) provide NGET with additional tools to help balance the system in anticipation of tighter generation capacity in the middle of this decade.

SBR is a supply based balancing service that is available for NGET on non-holiday weekdays in the winter months of November to February. In return for payments SBR contracts specify that providers are not able to participate in the market for the duration of their contracts. If called upon SBR providers must provide generation, as required, between 6am and 8 pm during the contract period. DSBR is a demand-side service that offers payments for non-domestic consumers to reduce their demand for specified half-hourly periods between 4pm and 8pm on winter weekdays.

O

Off-peak product

A product which provides for the delivery of a flat rate of electricity for the period of the day when demand is typically lowest for the duration of the contract.

On-the-day Commodity Market (OCM)

The OCM is a gas trading platform in GB. It has been used for short-term balancing since the market was first created. The OCM is operated by ICE ENDEX.

Over the Counter (OTC)

Trading of financial instruments, including commodities, that takes place directly between counterparties. This is in contrast to exchange-based trading where the exchange acts as a counterparty to all trades.

P

Peak product

A product which provides for the delivery of a flat rate of electricity for the period of the day when demand is typically highest for the duration of the contract.

Physical (settlement)

A contract that, at maturity, results in an exchange of the contracted good for its contracted value.

Product

The type of contract available. Examples include day-ahead, weekly, weekend, block seasonal, year, etc. Standard products are those that are widely traded on well-established terms, so exchanges generally deal in standard products. By contrast, structured products are those where the terms are precisely tailored to match the contract buyer's requirements, and they usually involve variable contract volumes and/or non-standard volumes and durations.

Pivotality

Pivotality analysis focuses on gas supply or electricity generation capacity and assesses whether a certain company's supply/generation is necessary to meet demand. Pivotality is an indicator of the possibility for market power; it does not account for the incentives on firms to exploit any dominant position, and is not an indicator of actual market abuse or anticompetitive behaviour.

R

REMIT

REMIT is an EU regulation on energy market integrity and transparency (No 1227/2011). It has been in force since 28 December 2011.

S

Secure and Promote

The Secure and Promote licence condition was introduced to improve liquidity in the GB wholesale power market so that it is sufficient to underpin well-functioning, competitive generation and supply markets. Secure and Promote came into effect on 31 March 2014.

Shippers

Gas shippers buy gas from producers and sell the gas onto suppliers. They are defined as an entity which introduces, conveys and takes out gas from a pipeline system.

Spot market

Refers to the market in which products traded are delivered at (or close to) delivery.

T

TCLC

The Transmission Constraint Licence Condition (TCLC) specifically prohibits companies from taking actions to exploit a dominant position during periods of transmission constraint.

TTF

The Title Transfer Facility (TTF) is a virtual trading point for natural gas in the Netherlands.

U

UKCS

United Kingdom Continental Shelf.

V

Vertical Integration

Where one corporate group owns two or more parts of the energy supply chain. For example, where the same group features both generation and supply businesses.