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GB GAS SECURITY OF SUPPLY AND FUTURE MARKET ARRANGEMENTS

A report to the Gas Forum

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Pöyry Energy Consulting is Europe's leading energy consultancy providing strategic, commercial, regulatory and policy advice to Europe's energy markets. The team of 250 energy specialists, located across 15 European offices in 12 countries, offers unparalleled expertise in the rapidly changing energy sector.

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EXECUTIVE SUMMARY

The last 20 years have seen natural gas establish itself as a vital part of Britain's energy mix. It provides heat for around 80% of our homes, is used to generate more than a third of our electricity demand and is a key feedstock for our energy intensive industry. In this context, the importance to energy policy of maintaining secure gas supplies is easy to understand and there has generally been a high degree of consistency in the policymakers' approach – leave it to the markets.

As the importance of natural gas has increased in the energy mix, our gas supply position has fundamentally changed, with a growing dependence on imports as gas from the UK Continental Shelf (UKCS) declines. We now import around 30% of our annual gas requirements and this figure is expected to rise to around 70% by 2020.

Against this background, the ability of current market arrangements to continue to ensure supply security remains an active area of policy debate. In its Annual Energy Statement, published in July 2010, the Department of Energy and Climate Change (DECC) restated the Coalition's promise to introduce 'further measures on gas security' aimed at giving our gas market arrangements 'a sharper focus on increased flexibility and resilience'. The aim of this report, produced by Pöyry Energy Consulting for the Gas Forum, is to assess the robustness of current market arrangements to maintain security of supply.

Has the market delivered?

Achieving a given level of gas supply security requires sufficient, reliable and diverse gas sources and infrastructure capacity to be available to ensure customer demands can be met. In GB, market arrangements have been established that allow participants to assess the costs and benefits of mitigating imbalance risks and contracting or investing appropriately. The decisions are based on a series of price signals that drive short-term consumption and production behaviour and long-term investment in infrastructure.

The main elements of the framework are:

- capacity/supply obligations – that specify pre-defined security standards that market participants, primarily network system operators, must deliver;
- cash-out arrangements (including under emergency conditions) – that penalise shippers for imbalances and so incentivise them to deliver the requisite gas supplies to the gas system in order to meet demand; and
- safety monitors – an early warning system employed by the transmission system operator of potential future emergency conditions.

The last decade has been a perfect test-bed of the market arrangements. The shift from net exporter to net importer has required a major transformation in our gas supply infrastructure, to ensure we have the capability to import gas through several routes and from a diverse range of producers. Experience of the 2009/10 winter with sustained high demand confirms that the **market has delivered and is working fine.**

In the last 5 years, over £5bn of additional pipeline and import capacity – broadly equivalent to the current annual demand on the system – has been commissioned. This has included no fewer than 4 new LNG regasification facilities and 3 new pipelines and interconnectors, alongside a trebling of the import capacity of the existing IUK interconnector. This expansion, facilitated by TPA exemptions, has increased the diversity of GB entry capacity and has enhanced our access to new sources of supply through the LNG markets. As a consequence, the response of the market to the highest demand in the last 30 years, during January 2010, was markedly different to similar episodes a few years ago.

While such an achievement cannot be underestimated, it has to be acknowledged that the market experienced a very uncomfortable winter as recently as 2005/6 with the first Gas Balancing Alert being issued and spot prices being both high and volatile. Does this suggest fundamental market flaws? Our assessment suggests not, for three reasons.

- Infrastructure investment requires long lead times – while an investment need was anticipated for the period between 2005 and 2007, the ability to accelerate such an investment when new information (such as the more rapid decline of the UKCS) becomes available is difficult. Earlier, accurate market information may have allowed investors to respond more quickly and more efficiently to the situation, but it does not suggest a problem with the framework of market arrangements.
- Non-market barriers were a more immediate issue for infrastructure developers – the flexibility required at that point in time would generally have been met by gas in storage, but several proposed projects, equivalent to 4.5bcm, were at that time held up within the planning process. The market was trying to respond and provide supply flexibility but was unable to in time due to other factors.
- Observed price spikes were exacerbated by interconnection to markets with different regulatory regimes – this limited the available gas to flow to Britain in response to high prices.

What new challenges does the future hold?

The underlying fundamentals of GB's supply-demand position are continuing to change for two main reasons.

First, a growing import dependence. Previous governments have acknowledged that import dependence itself is not an issue; however, what it does change is the nature of the risks facing gas shippers and suppliers and their ability to influence or mitigate these risks. Importation brings with it the inevitable reliance on more remote sources and exposure to long delivery chains. It introduces the prospect of sourcing gas from less stable regions and, through the increasing emphasis on LNG, is also dependent on the continued development of the nascent LNG market.

Second, the growing uncertainty over gas demand as a result of climate change initiatives. This leads to uncertainty over future annual demand requirements and profiles of gas use – particularly due to increased variability in power generation gas demand in response to growth in intermittent sources of generation.

The implication of these changes is that the volume of flexibility/swing in infrastructure required to maintain current security standards is likely to increase. Analysis by Pöyry and National Grid indicates a need for more fast-cycle storage and/or increased demand response (voluntary interruption) towards the end of this decade. The Pöyry work on gas security of supply, undertaken for DECC, shows that around 2–6bcm of new storage capacity will make the GB market resilient to all but the most extreme combination of demand and supply shocks. At present, 7bcm is already waiting for financial investment decisions or in the planning process.

The type of investment required is driven by price volatility and spreads – assets require an efficient set of market prices to signal the value of flexibility. This means policy should be focussed on 3 vital areas:

- enhancing the efficiency of market signals – market signals may need to be sharpened/reinforced to provide the right incentives for demand-side response and additional storage;
- removal of non-market barriers, such as planning restrictions – ensuring new investment is operational as quickly as possible; and
- managing the external risks – with GB much more dependent on developments outside of our own market boundaries, it should be inherent on policymakers to seek to mitigate those risks and hence reduce the cost to the GB consumer.

Recommended policy actions

Having qualitatively assessed how a long list of potential policy interventions would impact on security, consumers and competition, across several aspects of market arrangements our **general conclusion is that there is no need to fundamentally change the market**. If it is allowed to work effectively, then the pricing signals can be expected to drive the necessary investment.

However, to achieve this efficient response we feel there are some valuable policy developments that could be considered in three main areas.

Enhancing market operation

Though the market is functioning well, it is crucial that improvements in both market signals and liquidity can drive the need for additional supply flexibility. Efficient price signals require:

a) strong, liquid markets with a wide range of participants;

b) certainty of a liquid market into the future, with sufficient width and based on market fundamentals;

c) prices that reflect the true value of interruptions/imbalances; and

d) transparent and open information on market conditions.

Our assessment suggests that more formal requirements such as gas security obligations may be counter-productive and policy attention should focus more directly on two aspects of the current market framework:

- better marginal price signals – review of the potential benefits and risks from modifying the cash-out price arrangements to provide more efficient signals during times of market tightness should be progressed; and
- more active demand side participation – when we are looking for flexibility, the demand-side may offer a more cost effective alternative to physical infrastructure in some circumstances. Exploring the potential for more interruption needs more incentive for both large consumers and suppliers to consider this as a viable source of flexibility.

Providing a clear, stable policy framework

Uncertainty in the policy framework increases the risk for investors and can lead to delays in major infrastructure delivery. We want investors to respond quickly to market requirements and maintain security of supply at as low a cost to consumers as possible. Such an environment requires:

- a review and clear statement of the appropriate gas security standards and the resilience that government believes the market should have and whose responsibility it is to deliver;
- urgent action to ensure the steps that have already been taken in relation to streamlining planning continue to be supported despite the uncertainty around the system post-IPC; and
- consistent and proportionate regulatory oversight of assets post-TPA exemption.

Active external policy focus

One of the implications of increased import dependence is a greater exposure to developments in global gas markets that are beyond the immediate control of GB market players. While markets can respond to these risks, they have limited scope to influence the materiality of these risks – this can only be achieved through active policy efforts. We have identified two main areas of policy focus here:

- developing and enhancing strategic relationships with producer countries; and
- continued support for the effective implementation of the Third Energy Package measures and further progress on liberalisation and development of liquid wholesale gas markets on the Continent.

1. INTRODUCTION

1.1 Overview

Gas is a vital part of Britain's energy mix, responsible for around 80% of domestic heating (and cooking) requirements and fuelling around a third of our power generation output. The importance to energy policy of maintaining secure gas supplies is therefore easy to understand and there has generally been a high degree of consistency in the policymakers' approach – leave it to the markets.

In the Energy White Papers of 2003 and 2007 this approach is clearly stated:

'we will not intervene in the market except in extreme circumstances...' (2003)

'well functioning markets are the best way to deliver security of energy supplies...' (2007)

Indeed, though the 2007 White Paper emerged in the aftermath of the winter of 2005/6, when infrastructure failures and slight investment delays conspired to create tight market conditions and very high and volatile prices, the commitment to strengthening and improving our gas market arrangements remained.

However, despite the reassuring conclusions of DECC's recent gas security statement[1] (April 2010) that market mechanisms are performing well, it did go on to identify some potential policy options it was considering to further strengthen the position.

The Coalition Programme for Government set out its intention to introduce further measures on gas security as part of its Coalition agreement. This was reiterated in the first Annual Energy Statement, published in July 2010[2], with specific action on gas security as set out below:

'We will introduce further measures on gas security as promised in the Coalition Programme for Government. In the future, we need more gas storage capacity, more gas import capacity, and greater assurance that our market will deliver gas when it is needed. This means that **our gas market arrangements must have a sharper focus on increased flexibility and resilience.**'

Key concerns around future gas security are generally linked to the changing nature and scale of risks associated with growing import dependence and the ability of the market to anticipate and respond appropriately. Over the last five years or so, GB has invested around £5bn in new importation capacity, to improve the diversity of supplies and entry points, to the extent that the GB market now has more than sufficient importation capacity to meet its gas demands over the foreseeable future.

Despite this, doubts over the ability of the current arrangements to ensure sufficient flexibility or spare capacity persist. Ofgem's recent Project Discovery final report, published in February 2010[3], observed that current short-term price signals (for gas, primarily during emergency conditions) may not provide the incentives necessary to

1 DECC – Gas Security of Supply Statement – April 2010

2 Annual Energy Statement – DECC – 27 July 2010

3 Project Discovery: Options for delivering secure and sustainable energy supplies – Ofgem – 3 February 2010

stimulate the further investment required and that the future interdependence of the GB gas market with international gas and LNG markets may undermine GB's security of supply.

While mooted changes to the gas market arrangements are nothing like the scale of reform being considered for the electricity market, any changes may materially impact on the functioning of the gas market. The key question therefore is whether there is a real need for change in the gas market given that it has generally delivered timely investment and continued security of supply over the last forty years and the last five years in particular, which has seen Britain move from self-sufficiency to becoming import dependent.

Against this background, the Gas Forum has engaged Pöyry Energy Consulting to perform a review of the existing GB market arrangements, assess how effective it has been in maintaining security of supply, and consider whether there is any need to implement additional safeguards in light of future energy market developments.

1.2 Structure of this report

The report is structured as follows:

- Section 2 provides a brief introduction to security of supply, an overview of the current GB gas security of supply arrangements and a summary of arrangements across Europe;
- Section 3 describes how the existing GB market has delivered against the supply security requirements in terms of infrastructure investment and market operation;
- Section 4 outlines the key market developments, both in the GB market and further afield, which could impact on GB's gas security of supply; and
- Section 5 identifies and evaluates a number of potential options for enhancing GB's gas security of supply and presents the conclusions and recommendations.

1.3 Conventions

1.3.1 Sources

Where tables, figures and charts are not specifically sourced they should be attributed to Pöyry Energy Consulting. All data is in gas years (where the year '2009' runs from 1 October 2009 to 30 September 2010), unless specified.

2. WHAT IS SECURITY OF SUPPLY?

To assess whether markets are delivering security of supply we must have a clear understanding of what is meant by 'security of supply', how an appropriate level of security is determined and the mechanisms through which security is delivered. In doing this, our immediate focus is on the GB gas market.

2.1 Defining security of gas supply

Underpinning most definitions of security of supply is the premise that the system is aiming to avoid socially unacceptable levels of interruption to physical supply and excessive costs to the economy from unexpectedly high or volatile prices. These two dimensions of security of supply were emphasised by DECC in its Gas Security of Supply Statement this April, where it differentiated between:

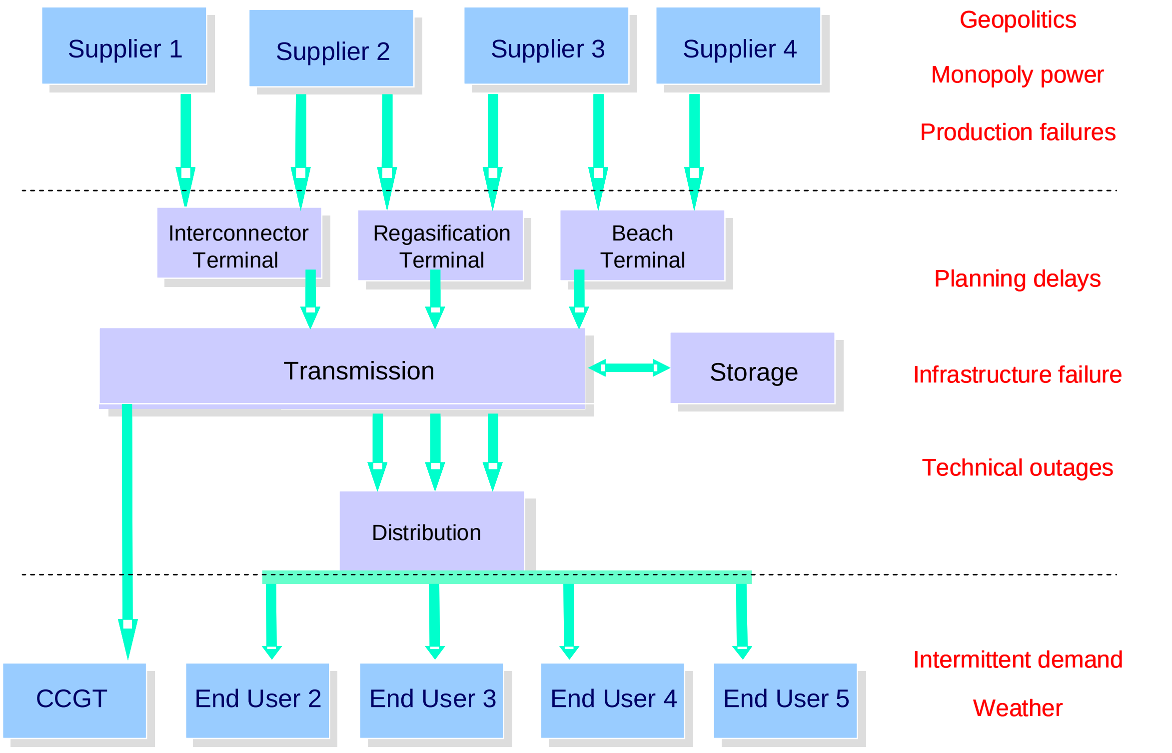
- ***physical risk*** – the ability to avoid involuntary physical interruptions of gas supply to consumers through the failure of infrastructure or disruptions to gas supplies; and
- ***price risk*** – the ability to continue to provide gas to consumers at a reasonable price and to avoid significant price spikes which may lead to physical interruptions (or switching from gas to an alternative fuel).

Implicit in these definitions is that security of supply cannot be perfect – it is about balancing the physical and price risks of insecurity with the cost of mitigating the risk. The appropriate security position is one where the cost of reducing the physical and/or price risk equals the value to society of lower interruptions and/or prices; hence the reference above to 'socially unacceptable' interruption and 'excessive' cost.

The nature of the gas supply chain is important in this regard as security risks can arise at different points in the supply chain and for a variety of reasons, from technical failures, through geopolitical fragility to extreme weather conditions. A stylised representation of the gas supply chain is shown in Figure 1, indicating some of the main risks that can occur at each stage:

- production/source risks – production outages at fields or technical problems at liquefaction plant alongside more strategic risks around reliability of supplies from key producers such as geopolitical risk or market power;
- infrastructure risks – outages or failures in delivery infrastructure (transit pipelines, entry points or storage facilities) reduce the volume of gas that can enter the GB system; and
- demand risks – security is about being able to match supply and demand. Uncertainty and unpredictability in demand patterns, caused by weather conditions or volatile demand profiles, increase the risk that supply will be unable to respond in a timely fashion.

Figure 1 – Security of supply through the gas supply chain



Across time, changes in the fundamentals of the market (e.g. the entry or exit of suppliers and shifts in gas consumption patterns), alongside local and global infrastructure investment, will affect the reliability of the gas system to maintain supply-demand balance. The upshot of this is that, over time, the optimal level of supply security may change or, put another way, to maintain the same security of supply, alternative levels of system flexibility and resilience may be required and the cost of providing these may be excessive.

Though the risks are varied, many security standards refer to specific conditions for which supply-demand balance must be maintained. For example, while the current GB security standards differentiate between the capacity of the system to deliver and the availability of gas, these are both defined in terms of extreme demand conditions.

- 1-in-20 peak day – this is used in the design criteria of the existing GB gas transmission and distribution networks and requires capacity to be sufficient to deliver gas supplies in the event of daily gas demand reaching a level that would be expected only once in every 20 years.
- 1-in-50 winter – this is used to ensure available gas supplies are sufficient to meet the requirements of domestic customers in the event of winter gas demand (over the October to March period) reaching the level that would be expected only once in every 50 years.

More recently, the European Union has developed a new gas security of supply regulation[4] to replace the 2004 Gas Security Directive. The new regulation stipulates that regulators in EU member states shall require that natural gas undertakings take the necessary measures to ensure the continuity of gas supplies to ‘protected customers’ (defined as residential customers and a limited number of additional customers providing essential social services) under specific circumstances:

- Extreme temperatures during a 7-day period statistically occurring once every twenty years;
- Any period of at least 30 days of high gas demand occurring once every twenty years; and
- For a period of at least 30 days in case of disruption to the largest infrastructure under average winter conditions.

Notably, the final condition acknowledges a the concurrent risk of adverse supply and demand conditions, applying an N-1 security standard to the gas system.

2.2 Existing GB gas security of supply framework

Achieving a given level of gas security requires sufficient, reliable and diverse fuel and infrastructure capacity to be available to ensure customer demands can be met. In GB, a market-based framework has been the basis for delivering security of supply, allowing market participants to assess the costs and benefits of mitigating imbalance risks and contracting or investing appropriately. The decisions are based on a series of price signals – for example, requirements to purchase gas at high prices in the event that a supplier makes inadequate provision to supply its customers – that drive short-term consumption/production behaviour and long-term investment.

The main elements of the framework are:

- capacity/supply obligations – by which market participants, primarily network system operators, aim to deliver security to pre-defined levels;
- cash-out arrangements (including under emergency conditions) – by which gas suppliers are incentivised to deliver the requisite gas supplies to the gas system; and
- safety monitors – by which the transmission system operator provides an early warning system for gas market participants of potential future emergency conditions.

2.2.1 Capacity/supply obligations

As already described, the capacity/supply obligations in the GB market reflect requirements in terms of infrastructure provision to ensure peak demands can be met (the 1-in-20 peak day) and in terms of gas supply that sufficient gas is available for domestic consumers over a severe winter (the 1-in-50 winter).

Responsibility for delivering these standards rests with the system operators – National Grid Gas (NGG) at the transmission level and the Distribution Networks (DNs) – and is incorporated into their gas transportation licences.

4 The new regulation was agreed in draft form by the European Parliament (EP) in July 2010 and is now awaiting final agreement at a later plenary session.

Responsibility for the 1-in-50 standard has only recently become that of the transporters, having, until 2007, been part of the gas supply licence. This occurred at the instigation of Ofgem as the supplier licence obligation had become effectively unenforceable due to the inclusion of spot gas purchases from the National Balancing Point (NBP), often in the short-term, as sufficient to meet the condition.

The gas transporter is now required to provide 'reasonable economic incentives' for the relevant supplier to secure the continued provision of gas supply to its domestic customers in the event of a 1-in-50 winter. Whilst this obligation has been transferred from gas suppliers to gas transporters it is still unclear how the obligation can be monitored and/or enforced.

The transporters have four main instruments to ensure these conditions are met:

- LNG peak storage;
- operating margins;
- gas balancing alerts; and
- interruptible contracts.

LNG peak storage

LNG peak storage facilities are situated in strategic locations close to areas of high demand or at the extremities of the network. As they provide high deliverability they are a source of peak gas supply to shippers and also supplement NGG's network capacity, acting as a contingency against the risk of emergencies such as system constraints, failures in supply or failures in end user interruption. As patterns of supply and demand on the NTS have changed, NGG has reviewed its requirements for Peak Shaving LNG. Following a lack of interest in the potential sale of its Dynevor Arms facility, this was closed in April 2009. The remaining three facilities are currently the subject of a risk and economic review by NGG.

Operating margins

Operating margins ('OM') are options to procure volumes of gas, held by NGG (following a tender process), that could be exercised for a variety of reasons. These reasons are split into three groups:

- Group 1 – events that are rarely expected to occur, e.g. a loss of supply or loss of infrastructure;
- Group 2 – events that are expected to occur, e.g. a loss of compression on the network, routine forecasting errors, or a significant supply loss; and
- Group 3 – a declared gas network emergency, for the orderly rundown of the system.

The volumes required by each group are calculated independently by NGG.

OM were historically provided by LNG peak facilities, however due to licence changes introduced by Ofgem and a decreasing need for locational OM services), NGG now tenders for these services from a variety of physical and demand-side sources. The costs of OM services are included in NGG's regulated revenues and comprise an availability cost (for example, the cost of storage capacity) and a utilisation cost (for example, storage injection and withdrawal commodity charges). Availability costs are currently passed through directly to transportation charges, whilst utilisation costs are subject to an incentive scheme overseen by Ofgem.

Gas Balancing Alerts

The Gas Balancing Alert (GBA) mechanism was introduced to indicate to the market when NGG considers it likely that some form of demand-side response or additional supplies might be required to ensure the physical balance and the future safety, of the network. NGG publishes a demand level (a 'trigger level') that it considers can be met, based on the current capability (defined by reference to the anticipated available (non-storage) supplies into the network plus storage deliverability) and the recent reliability of supplies to the market. An initial trigger level is set based on assumptions that are consistent with those used to calculate the storage safety monitor and the trigger level is revised to reflect actual supply performance during the winter and the proximity of actual storage stock levels to the safety monitor level. A GBA is issued if the forecast day-ahead demand is above the trigger level.

Since its introduction, the GBA mechanism has only been issued on five occasions. The first GBA occurred on Monday 13 March 2006, at a time when the Rough storage facility was unavailable due to a fire, a couple of planned outages were in force and cold weather was predicted. As a result, market forward prices rose from around 60p/th to peak, within day, at 255p/th. During the day of 13 March, the weather was less severe than forecast and the high forecast demand did not materialise. Prices gradually returned to their previous position during the following day.

Pöyry understands that NGG came close to issuing a GBA during the Ukrainian transit crisis of January 2009, but did not actually do so. Prices during this period remained mostly stable, averaging 60p/th and fluctuating between 53p/th and 70p/th.

The other four occasions on which a GBA was declared occurred in January 2010 during the coldest winter in the past 30 years. On each of these occasions, the desired market response was achieved, i.e. additional gas supplies were delivered to GB and market prices were relatively stable. Further details of the January 2010 GBAs are included in Section 3.4.2.

It is also worth noting that the GB electricity market equivalent, Notice of Insufficient Margin (NISM), has been used on a more regular basis, e.g. 7 times during the winter 2004/05, and without seeming to cause misplaced concerns on security of supply.

Transporter interruption

The GB gas system has also benefited in the past from the use of customer interruption to provide additional demand side flexibility, thereby contributing to overall supply security.

Transporter interruption is the arrangement whereby the transporter (NGG) identifies a number of customer sites which will provide it with the interruption capability required to maintain system security and assigns to them 'transporter interruptible' status. In the past, such customers have received discounts to their transportation charges. However, the recent Network Code Modification 90 removes such interruptible status and requires suppliers (and Distribution Network Operators) to bid for interruptible capacity via an auction.

Transporter Interruption has been used by NGG primarily as a mechanism to avoid additional network investment rather than as a physical balancing tool. In other words, NGG would determine that it was cheaper to provide the Transporter Interruptible discount on transportation charges, thereby providing it with the ability to interrupt supplies for system security reasons, than invest to reinforce the network.

2.2.2 Cash-out arrangements

GB gas shippers are required to balance their inputs to, and outputs from, the gas system on a daily basis, to contribute to the overall supply security of the gas system. Any shipper imbalances are cashed out, at penal prices to incentivise the shippers to self-balance. The cash-out arrangements differ between emergency and non-emergency (normal) market conditions.

Non-emergency shipper cash-out

Under the Network Code, shippers are incentivised to balance their inputs to and outputs from, the system via a cash-out mechanism. Shippers are required to buy gas at premium price if they are ‘short’ (i.e. their outputs exceed their inputs) and are required to sell gas at a discounted price if they are ‘long’ (i.e. their inputs exceed their outputs). The prices paid (or received) by shippers are determined by reference to the System Marginal Price (SMP) achieved in the On The Day Commodity Market (OCM), which is the market facilitated by NGG for the daily balancing of the GB gas market. The SMP paid by shippers (‘SMP buy’) for being ‘short’ is set as the highest price paid by NGG on the OCM for additional gas to be delivered to the system, whilst the SMP for gas sold by shippers (‘SMP sell’) for being ‘long’ is set as the lowest price for gas sold by NGG on the OCM for gas to be removed from the system. If NGG does not transact in the market to set the marginal prices then a fixed differential is added to or subtracted from the weighted average price of all shipper trades to maintain the incentive to balance.

NGG remains revenue neutral to such shipper cash-outs, as the net total payment to/from NGG over the day is recycled amongst shippers as part of the ‘revenue neutrality’ mechanism. Better performing shippers benefit to the detriment of worse performing shippers.

The balancing incentives to which shippers are subjected via the cash-out arrangements have evolved over time. When the GB Network Code went live in 1996, a system of volumetric tolerances was in place for shipper imbalances, which provided some relief from the more penal SMP-based cashout prices. Following improvements to shipper data quality, in 2002 all such tolerances were finally removed and since that time shippers have been subject to the resulting sharper balancing incentives.

Emergency shipper cash-out

Shipper balancing obligations are modified during periods of system emergency, specifically in the event of a Gas Deficit Emergency (GDE) occurring. A GDE is deemed to occur when NGG assesses that the GB gas system may not be able to achieve a safe balance for supply and/or demand reasons. An example of a potential cause of a GDE is a breach (or potential breach) of the safety monitor described in Section 2.2.3. In such circumstances, in order to maintain gas security of supply, shippers may be required, at the request of NGG, to:

- provide additional gas inputs to the system (within the constraints of their existing gas purchase contracts, but irrespective of the commercial terms of such additional supplies); and/or
- curtail offtakes from the system, by interrupting customer supplies.

Imbalances incurred during an emergency are cashed out at System Average Price (SAP) for shipper over-delivery and at SMP ‘buy’ for shipper under-delivery. Where shippers consider that they have suffered financial loss as a result of their delivering additional gas during an emergency, they are able to claim back such losses, following a claims process overseen by an independent 'claims reviewer', appointed by NGG.

Supplier interruption or demand side response (DSR)

One way of mitigating exposure to penal cash-out charges or to reduce the amount of TSO balancing actions is for suppliers to sign interruptible contracts with customers. Here, some customers, predominantly large industrials and power stations, make provision for an alternate fuel supply (e.g. distillate) and sign up to a cheaper interruptible supply contract, allowing their supplier to request that they cease taking gas for a maximum number of days per year.

Such arrangements also provide suppliers with additional balancing flexibility at times of high demand and/or supply disruptions. However, many end consumers are only keen to be interrupted for transportation constraints and the number of sites with shipper interruption rights have reduced over time.

2.2.3 Storage monitors

Storage monitor curves describe minimum volumes of gas that need to be held in storage through the winter period to ensure that certain demands can continue to be met if the remainder of the winter was to suffer a particular weather severity. There are two monitor curves used: the safety monitor and the firm monitor.

The safety monitor is the curve that ensures the safety of the gas pipeline network. It enables 'the preservation of supplies to domestic customers, other non-daily metered (NDM) customers and certain other customers who could not safely be isolated from the gas system if necessary in order to achieve a supply-demand balance and thereby maintain sufficient pressures in the network.'[5] As such, the safety monitor represents an element of the safety case of NGG and use of this gas in store would only be considered in the event of a gas supply emergency. A breach (or potential breach) of the safety monitor is one reason that NGG might declare a Gas Deficit Emergency (GDE).

The firm monitor curve is published by NGG for information purposes only and represents its view of the level of gas in store required to ensure that all 'firm' gas demand can be met in a 1-in-50 winter.

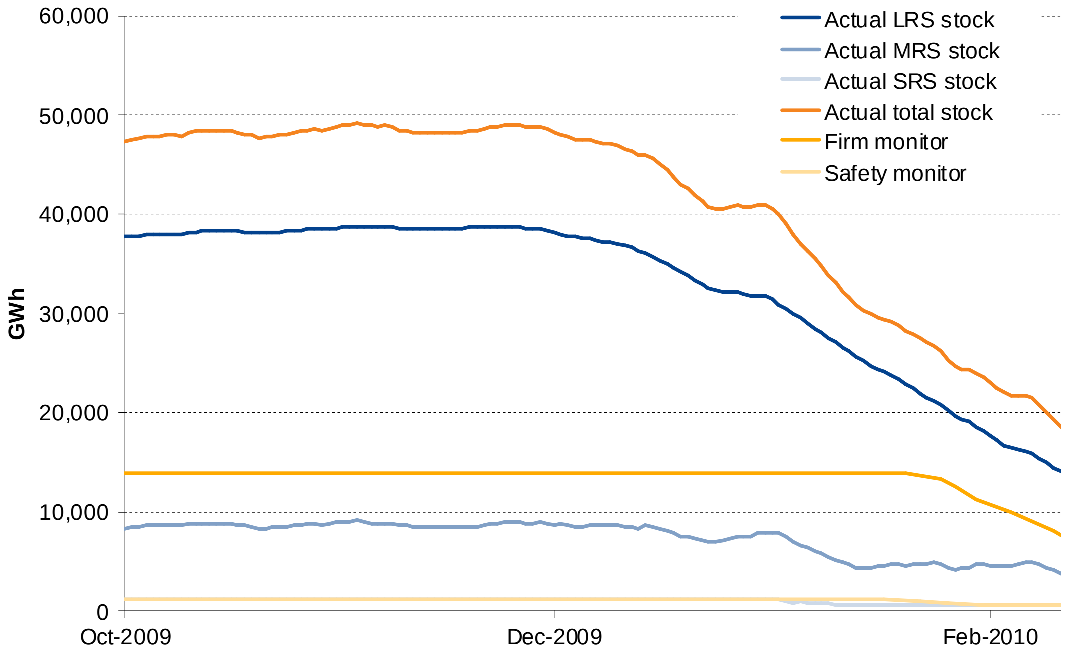
The volumes of gas in store and the storage monitor curves are published by NGG. The volumes of gas in store are published for three categories of storage, which are defined by the potential number of days of gas withdrawal at maximum deliverability before the storage facility is fully depleted, as follows:

- Short Range Storage (SRS) – less than 5 days at maximum deliverability;
- Medium Range Storage (MRS) – between 5 and 70 days; and
- Long Range Storage (LRS) – over 70 days.

An example of the information published by NGG is shown in Figure 2.

[5] NGG, 'Safety Monitor and Firm Gas Monitor Requirements', September 2008

Figure 2 – GB Storage monitor curves and stocks



Source: National Grid

2.3 Gas security of supply measures in the EU

There exists a range of gas security of supply measures across EU gas markets. These measures can be categorised as follows:

- General suppler obligations – whereby gas suppliers are obliged to make provision to maintain supplies to certain categories of customer for a specified number of days and under defined weather (temperature) severity. Such a measure applies in Germany, the Netherlands and Spain.
- Supplier storage obligations – whereby gas suppliers are either allocated storage capacity automatically based on their customer portfolio and/or are obliged to maintain a defined level of gas in store to meet the demands of their customer portfolio under defined weather (temperature) severity. Such a measure applies in Italy, Denmark, and France.
- Network operator obligations – whereby the network operator (typically the gas TSO) is obliged to maintain supplies to gas customers (potentially limited to residential customers only) under defined weather (temperature) severity. Such a measure applies in Belgium, the Netherlands and Denmark.

Many countries have a mix of the above measures. Further details of the specific measures in selected EU countries are provided in Annex A.

When making a comparison between the measures existing in other EU markets and those in GB, there are a number of causal factors behind the differences.

Firstly, many EU countries have more rigid (and, typically, more closely regulated) measures than GB, requiring, for example, suppliers to maintain defined levels of storage stocks. This reflects the fact that these countries have less competitive gas markets than GB resulting in less liquid spot gas markets and therefore have required more stringent regulatory requirements. Because of its highly liberalised and liquid gas market, GB's supply security measures are predominantly market-based.

Secondly, many EU countries have access to fewer sources of supply flexibility than GB has had historically, typically restricted to predominantly storage and therefore security of supply in the country relies more heavily on the effective (and typically, regulated) use of the flexibility (typically storage). It should be noted that as GB's import dependence increases and the flexibility of its supply sources decreases (from the previously very flexible UKCS supplies to longer haul pipeline supplies and LNG), a comparison of GB's supply security regime and that of other European countries becomes more important.

2.4 GB security of supply framework summary

Britain has a clearly defined and well established security of supply standard and this has been used as an integral part of the planned extensions to the gas system throughout its expansion. There are GBAs and storage monitors to provide signals to the market that there maybe a supply shortage and various mechanisms for the TSO to provide short-term support to keep the system in balance.

However, the question remains does this framework provide sufficient signals and incentives for the system to deliver the right amount of infrastructure in a timely manner going forward. To answer this we will first look at how GB has performed in the recent past and then consider the challenges it faces going forward.

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3. HOW WELL HAS THE GB MARKET DELIVERED?

Developments in the underlying supply-demand position in Britain over the last decade have presented us with a perfect test-bed for assessing whether, and how efficiently, the market arrangements have maintained gas security of supply. During this time, the GB market has experienced:

- the shift from net exporter to net importer;
- major infrastructure failures, such as the loss of the Rough storage facility;
- some of the highest demand periods in the last 30 years; and
- disruption to supplies in interconnected markets as a result of the Russian-Ukrainian crisis.

Notably, though NGG has issued several gas balancing alerts during this period, there has been no physical interruption to firm supplies and the gas system has demonstrated considerable resilience in the face of shocks.

When we characterise market behaviour, we generally distinguish between the actions it encourages over different time periods.

- In the short-run, market price movements should provide signals to maintain supply-demand balance, encouraging producers to bring more gas to market and/or (large/ flexible) consumers to reduce their gas consumption when there is market tightness.
- In the long-run, expectations of future price and volume risk exposure will indicate the value of new investment or contractual arrangements to increase and/or diversify supply and change consumption patterns.

Both of these dimensions must be considered when looking at how well the market has performed in maintaining security of supply.

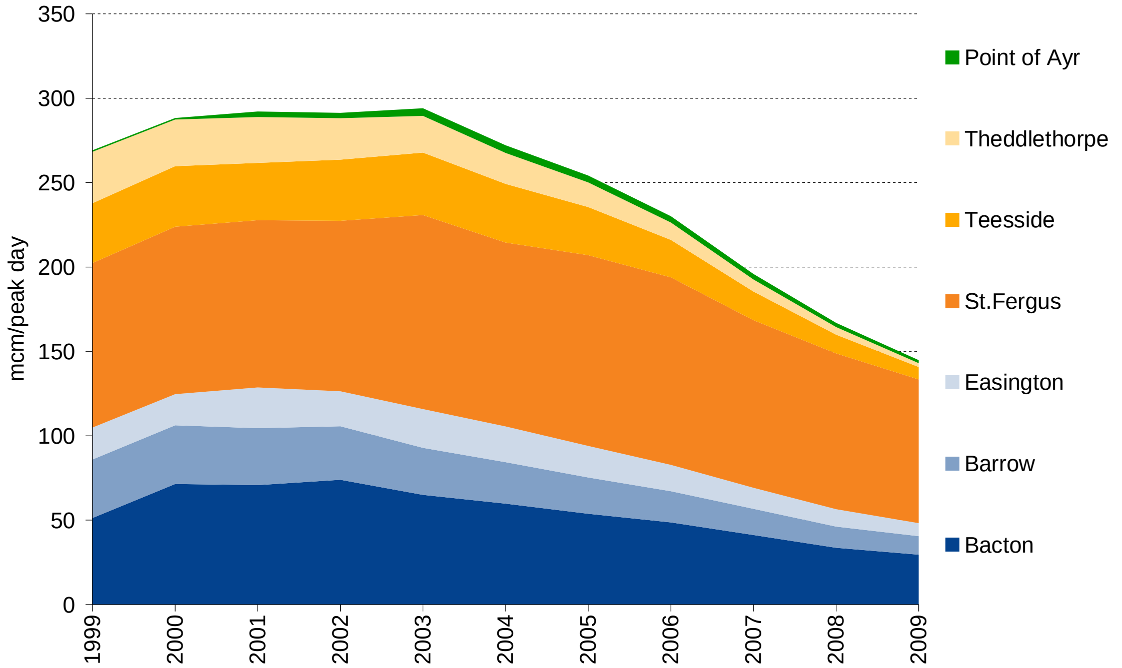
3.1 Infrastructure requirements

The decline of the UKCS has been well documented and is generally well understood. However, at the start of the decade there was uncertainty regarding the speed of the decline and the point at which GB would become a net gas importer.

The Ten Year Statement (TYS), published annually by National Grid (formerly Transco), provides a good benchmark of the outlook for the GB gas market at the time of publication. Looking back to the 2000 TYS, data from which is reproduced in Figure 3, we can see that a decline in the UKCS was clearly anticipated.

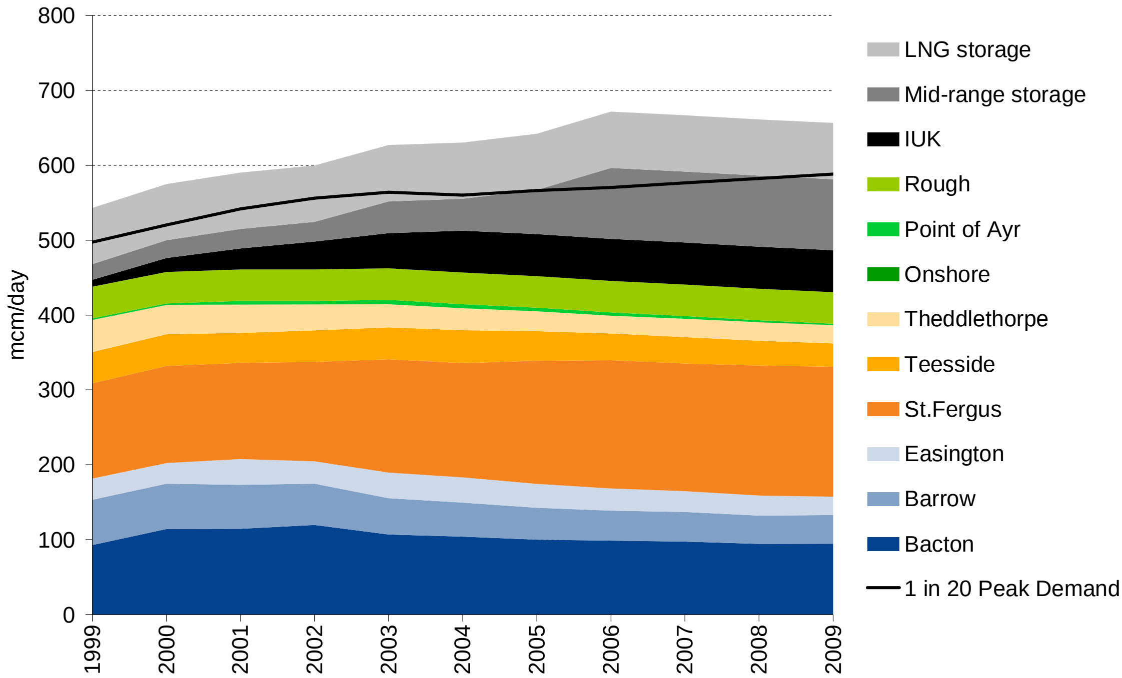
In line with the anticipated decline in the UKCS, the 2000 TYS supply-demand matching scenarios, one of which is shown in Figure 4, indicated a need for new investment to meet the 1 in 20 peak demand. The increments to capacity were expected to arrive from 2005 and consist of improved flows through GB terminals of 46 mcm/day (either through new UKCS discoveries or through further imports from Norway); increased capacity of the existing IUK interconnector with Belgium (an extra 47 mcm/day); and, a considerable increase in mid-range storage deliverability (of up to 74mcm/day by 2010).

Figure 3 – Information received from suppliers for the 2000 Ten Year Statement



Source: 2000 TYS

Figure 4 – A supply-demand scenario for investment purposes from the 2000 TYS



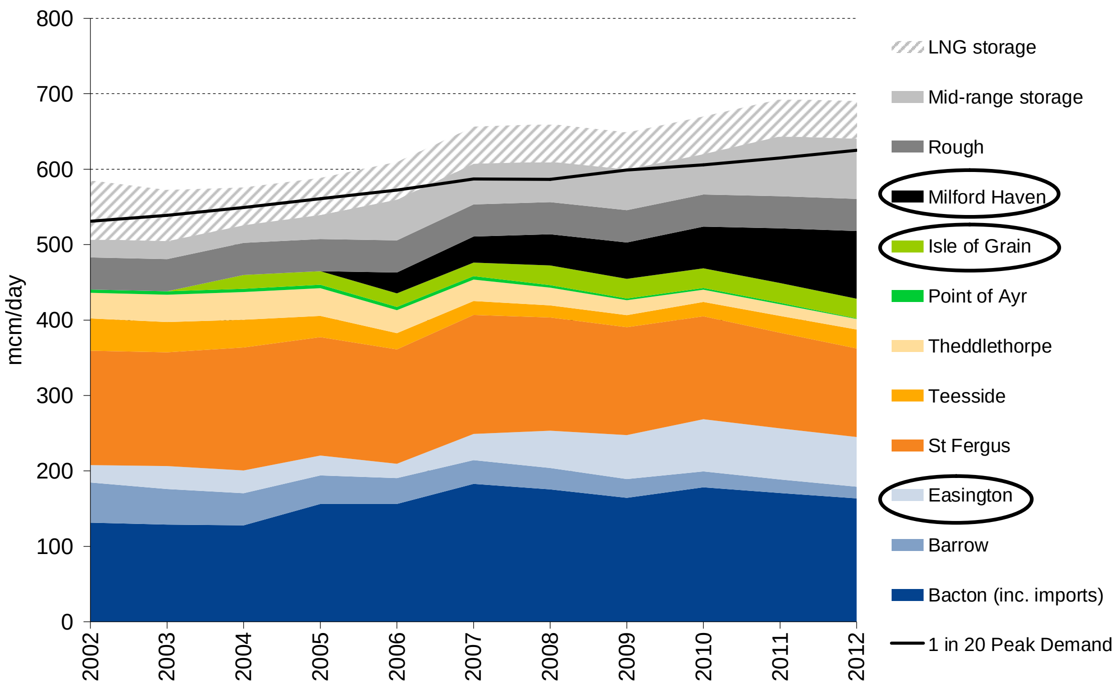
Source: 2000 TYS

Though peak demand projections did not change significantly over the next few years, subsequent Ten Year Statements offered a different picture of how the supply-demand balance would be maintained as the UKCS short-fall became clearer and project developers stepped forward to fill the gap.

- In the 2001 TYS it was noted that a peak day shortfall was predicted after 2005/06, especially if gas storage projects were delayed. In this TYS the need for further imports and possibly LNG was also mentioned.
- By the 2002 TYS more details of where the imports would come from were provided – potential LNG terminals at the Isle of Grain and Milford Haven were mentioned, as were possible new import pipelines from the Netherlands and Denmark or expansion of existing Norwegian pipes.
- By 2003 a number of projects were being announced and the supply-demand scenario in the 2003 TYS, shown in Figure 5, included more details of the sources of gas that would fill the gap. Compared to the 2000 TYS this showed a significant increase in LNG import capacity (accounting for 74mcm/day) and Norwegian imports via Easington (35mcm/day) to meet the shortfall. Mid-range storage capacity was expected to grow much more slowly as a consequence (only 30 mcm/d).

Therefore, the market was clearly indicating a peak shortfall arising in the period 2005-2007. The uncertainty was over how this would be delivered and over time the balance shifted more to LNG capacity than mid-range storage.

Figure 5 – A supply-demand scenario for investment purposes from the 2003 TYS



Source: 2003 TYS

3.2 Infrastructure delivered

That a major investment in import infrastructure was required to mitigate exposure to high and volatile spot market prices is evident from the discussion above. The response of the market in light of these changing fundamentals, was dramatic.

As Table 1 shows, in the space of 5 years, additional pipeline and import capacity broadly equivalent to the current annual demand on the system was delivered. This included no fewer than 4 new LNG regasification facilities and 3 new pipelines and interconnectors, alongside a trebling of the import capacity of the existing IUK interconnector. This expansion has increased the diversity of GB entry capacity and enhanced our access to new sources of supply through the LNG markets.

Details of the specific projects, including their announcement and commissioning dates can be found in Annex B.

Table 1 – Summary of investments since 2005

Type of capacity	Annual capacity (bcm/year)	Peak capacity (mcm/day)	Total investment* (2009 money)
Pipelines/interconnectors	62	170	£2,660 million
LNG re-gasification	47	129	£2,200 million
Gas storage	0.82	50	£ 460 million

* Estimated based upon a variety of published sources

3.2.1 *Third party access (TPA) exemption*

None of this development would have been forthcoming had the projects not been able to attract the required funding, regardless of whether this was from debt or equity. Historically the financing requirement for regular and known revenues came from negotiated long-term supply contracts. However, in GB's competitive wholesale market many suppliers are reluctant to enter into such contracts due to uncertainty on their future demand and customer numbers. At the very least where such long-term deals have been negotiated in recent years they have all been priced at the NBP and not to the historical oil indexed link. Examples are the Centrica's gas supply deals with Statoil and Gasunie, used to underpin Langeled and BBL respectively.

Regulation of gas infrastructure facilities requires them to have some form of regulated third party access (rTPA), although exemptions can be granted. Regulated TPA does not necessarily mean set tariffs, as prices can be set by other market mechanisms, such as auctions.

In considering whether an exemption to TPA rules should be granted Ofgem has to consider the following criteria:

- investment must enhance competition in gas supply and security of supply;
- risk attached to new investment means that it would not proceed unless an exemption is granted;
- infrastructure must be legally separate from relevant system operators;
- charges are levied on infrastructure users; and

- exemption is not to the detriment of competition.

As can be seen in Table 2 the vast majority of the new infrastructure has been granted TPA exemptions, especially the gas storage projects. However, there are often terms attached that mean the exemption is only for a limited amount of time. For example, the BBL pipeline exemption was granted in 2005 and applies until 2 December 2016 in respect of 1.15mcm/hr forward capacity and until 2 December 2022 for 0.6mcm/hr but does not apply to physical or non-physical reverse flow.

Table 2 – GB gas facilities with TPA exemption

		nTPA	Exempt
Interconnectors	BBL		✓
	IUK		✓
Gas storage	Rough	✓	
	Hornsea	✓	
	Avonmouth		✓
	Glenmavis		✓
	Partington		✓
	Hatfield Moor		✓
	Humbly Grove		✓
	Hole House Phase 1&2		✓
	Holford		✓
	Aldborough (SSE)		✓
	Aldborough (Statoil)		✓
	Holford		✓
	Caythorpe		✓
	Saltfleetby		✓
LNG	Dragon	✓	
	South Hook	✓	
	Grain	✓	

A system of negotiated Third Party Access (nTPA) exists for the historical gas storage in GB. This allows storage operators and users to negotiate terms and tariffs for access to storage facilities within a set of regulatory guidelines such as non-discrimination and transparency (as opposed to the alternative of regulated TPA where terms and tariffs are set, or approved explicitly, by the regulator). All new storage facility developers in GB that have applied for exemptions from nTPA requirements, have had them granted by Ofgem, thereby providing the storage operator with additional latitude in the setting of access terms and tariffs. Exemptions have been granted on the basis that the establishment of the proposed facility in the market will not affect the operation of an economically efficient GB gas market.

The additional flexibility afforded by the granting of a TPA exemption in terms of contracting for capacity and the setting of tariffs is usually very important to the facility developer. For example, financing will often be arranged with banks on the basis of long term sale of capacity at the facility via bilateral contracts.

The presence of a TPA exemption therefore often represents a critical requirement for the viability of any proposed storage project. Any uncertainty surrounding whether a TPA exemption might be granted, or, in the case of facilities (or proposed facilities) already holding an exemption, any uncertainty around the continued validity of the exemption, could therefore represent a very serious regulatory risk for the project developer. This situation was recently brought into focus when Ofgem announced that it was considering withdrawing the TPA exemption for the Caythorpe field. The exemption had originally been granted to Warwick Energy (the original developer) prior to the acquisition of the project by Centrica. Centrica, which had already stopped construction and was re-considering its FID, and has stated that following Ofgem's decision, FID approval is less likely to happen.

It should also be noted that views on the appropriate regulation regime to be applied differs between regulators. For example, Belgium's regulator, CREG, in its response to Ofgem regarding the Isle of Grain exemption stated 'CREG is fundamentally opposed to total exemptions. Third party access (including transparency, UIOLI provisions, etc.) should always apply. If necessary, exemptions could apply to the tariff regulation, creating a kind of negotiated TPA. It seems essential to us that the regulator keeps ex-ante control on access rules.' It went on to say '… the CREG view is that long-term contracts associated with a long-term tariff control in a regulated framework is a preferable solution'.

3.2.2 Storage development delays

In contrast to the massive expansion in import capacity, there was relatively limited new storage capacity, despite them being granted TPA exemption. This can be explained by two factors:

- the long delays for projects in the planning process, adding to the risk and cost of development ; and
- the expectation of lower market spreads as a result of the flexibility provided through LNG imports and the additional import capacity, which has resulted in difficulties raising finances.

In particular planning has held up many developments, illustrated in Table 3 below. This shows a list of the storage projects that were listed in the TYS published in 2005. The table then gives the status of the same projects classified according to the normal development phases in the TYS 2009. It also shows the dates when planning permission has been granted, if applicable.

The most noticeable feature of the projects listed in Table 3 is that none had met the timescales quoted in 2005. Instead, only a few had been completed and are in operation after many years of delay. Even achieving planning permission does not mean the project will progress. For example, Portland obtained planning in 2008 but is still awaiting full FID because of the credit crunch and lack of available credit.

Caythorpe has a very chequered history. It achieved planning and was reported as being in the construction phase but has since moved back into the awaiting FID following its purchase by Centrica and possible changes in its TPA exemption by Ofgem.

In every case the development times anticipated in 2005 proved to be overly optimistic.

Table 3 – Storage Projects in Ten Year Statements

Project	Planning Granted	TYS 2005 Status	Projected operation date 2005	TYS 2009 Status	Projected operation date 2009	Slippage
Aldbrough	Feb 2000	Construction	2007/08	Construction	2009/10	2+ years
Holford	May 2004	Awaiting FID	2008/09	Construction	2011/12	3 years
Stublach	Jun 2006	Conceptual	2009	Construction	2013/14	4 years
Caythorpe	Feb 2008	Conceptual	2007	No FID		>5 years
Portland	May 2008	Conceptual	2008	No FID		>5 years
Albury I		Conceptual	2008/09	No PA made		>6 years
Saltfleetby	Sep 2010	Conceptual	2009	Awaiting PP		>5 years
Albury II		Conceptual	2010	No PA made		>5 years
Fleetwood		Conceptual	2009/10	Awaiting PP		>6 years
Welton		Conceptual	2008/09	Not listed		–
Bletchingley		Conceptual	2009	Not listed		–

Source: National Grid Ten Year Statements 2005, 2009 and Pöyry

3.3 Efficiency of market delivery

There are three challenges to the efficiency of market delivery – the timely notice of market prices, the timeliness of the investment and the mix of the investment delivered. Some specific concerns have been raised about the functioning of the market in this regard:

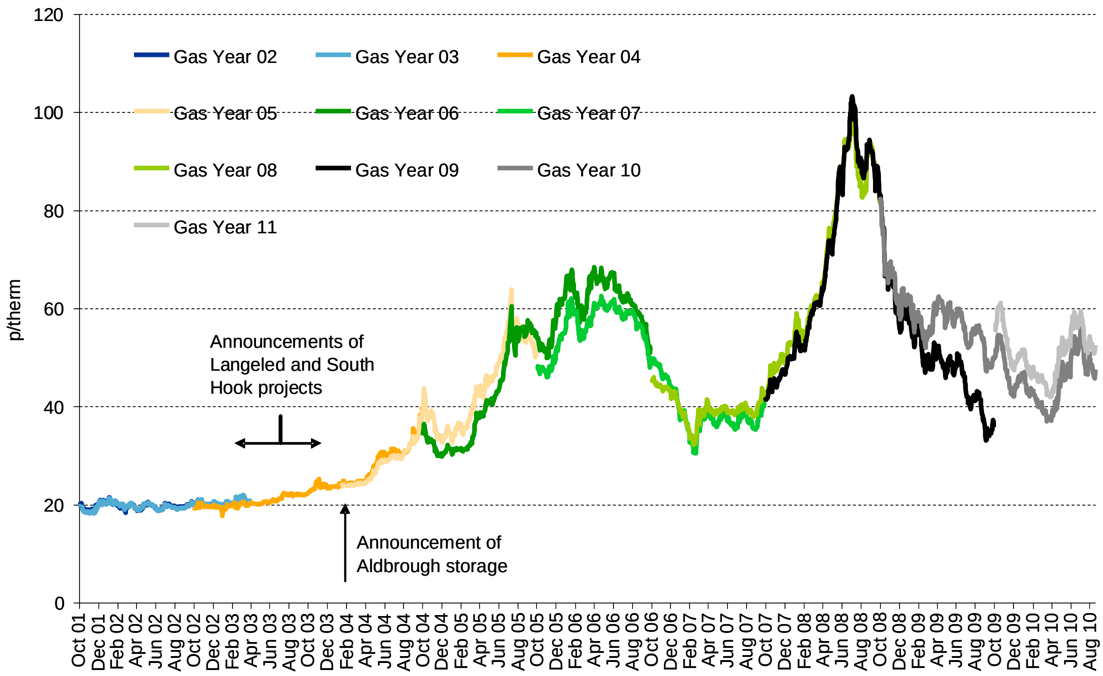
- the market did not provide sufficient price signals to indicate that new infrastructure was required;
- some investment arrived 'too late' to prevent market tightness and price spikes and did not anticipate the supply-demand shocks that materialised (especially the rapidity of UKCS decline); and
- there has been insufficient investment in flexibility of supply (notably storage) and that this is a failure of the market.

3.3.1 Forward Prices

A critical investment signal is that of forward market prices. However, whilst the forward market curve provides an indication of future prices, it only runs out to three years ahead. Most infrastructure projects would require longer-term price signals before a commitment to commence is given or finance could be raised. Medium to long-term market price forecasts based on market fundamentals are often used for this reason.

The forward curves over the last decade are shown in Figure 6. Notwithstanding the above comments, it can be seen that the forward market price was rising at the time when a number of investment announcements were made. We can see that the market did respond to potential supply gaps through increased prices which in turn influenced investment decisions e.g. Langeled, South Hook LNG and Aldbrough storage projects coincided with the beginning of a trend of increasing gas prices.

Figure 6 – Forward gas prices since 2001



Source: Heren

3.3.2 *Timeliness of investments*

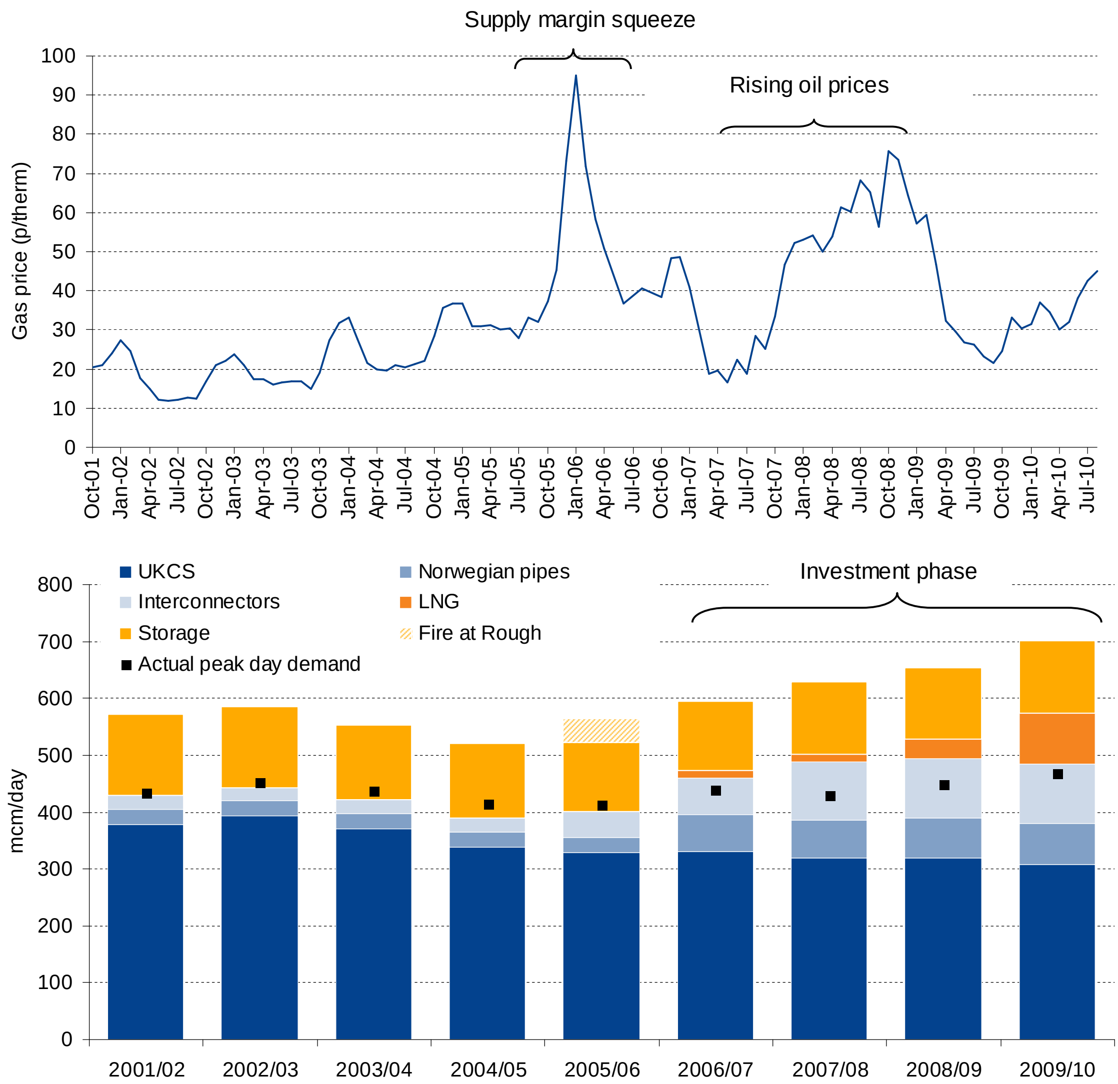
Not only should a well-functioning market deliver investment, it should do so in a timely manner in order that supply shortfalls are avoided so that security of supply can be maintained. An indication that the market has not delivered investment in a timely manner would be increased gas prices, gas price spikes and involuntary interruption of demand in winter.

The timeliness is particularly important as many of the projects require significant capital outlay to build, take many years to progress from conception to operation even with a fair wind. There are many risks that could interrupt this process and it is very hard to alter course once a project has moved to construction phase. Even after becoming operational there can be further issues, especially if other connecting infrastructure or reinforcement is delayed. A current example is that of the Tirley compressor required for full capacity utilisation of the Milford Haven LNG regas terminals, details of which are described in Annex B.4.

In order to determine the timeliness of GB market investments we will look at the changing gas capacity margin over the last 10 years, alongside the gas market price. The gas capacity margin is the difference between the peak gas supply capacity and the peak day gas demand. When the difference between the supply capacity and peak demand is small the capacity margin is said to be 'tight', winter prices are likely to increase, and the risks of a security of supply breach are greater.

Figure 7 illustrates the GB capacity margin between 2001/2 and 2009/10, based upon the peak deliverability from the UKCS, import pipelines, LNG facilities and gas storage and the actual peak day demand. This also shows the corresponding monthly Heren gas index.

Figure 7 – Monthly Heren indices and historical capacity margins



Source: Heren, National Grid Ten Year Statements, Pöyry assumptions

Up until 2005, the decline in UKCS production gradually reduced the capacity margin and led to a supply 'squeeze' and higher gas prices. This had been foreseen by the market and plans had already been announced for significant new gas importation infrastructure from the early 2000s, as outlined in Section 3.2. These investments were market driven, primarily by the growing GB 'supply gap' and expectations of attractive gas prices for the producers.

During the 2005/06 gas year, the Isle of Grain LNG re-gasification facility was due to commission before the winter, and a doubling of import capacity through IUK was also planned. However, the Isle of Grain commissioning was delayed and continental gas suppliers remained tied to contractual obligations in their home markets limiting the availability of imports through the interconnector. This meant there was a lack of information to the market short of gas as to what supplies could or would be made available from continental sources and storage.

This tight market was further aggravated by a number of short-term incidents, which, given the market sentiment, resulted in some very high gas prices. The short-term factors and the market response are discussed in more detail in Section 3.4.1. However, once the planned investments were in operation and the Langeled pipeline from Norway was commissioned, in October 2006, the capacity margin recovered and prices returned to moderate levels during the 2006/07 winter.

Broadly speaking, therefore, the market delivered the required infrastructure investment in a timely fashion. The uncertainty associated with the precise timing of the UKCS decline, coupled with some delays to the planning and consents process, led to delivery slightly later than would have been ideal, but the GB system continued to provide reliable supplies to consumers during the period.

In addition, changes have been made to improve transparency in energy security of supply information. The Joint Energy Security of Supply (JESS) working group was established by DTI and Ofgem in July 2001. In addition to DTI and Ofgem, it also involved representatives from National Grid and the Foreign and Commonwealth Office. JESS was established to assess risks to Britain's future gas and electricity supplies. It established a series of indicators to monitor security of supply in relation to gas and electricity for a time horizon of at least seven years ahead. The seventh and final JESS report was published in December 2006.

Building upon the work of JESS, the 2007 White Paper ('Meeting the Energy Challenge: A White Paper on Energy') made a commitment to introduce a new information service relating to security of supply; the Energy Markets Outlook (EMO) report. This was an annual report prepared jointly by DECC and Ofgem, which superseded the JESS report. It was first produced in 2007 and the latest version (the third since its inception) was published in December 2009. It presents analysis and scenarios for future energy supply, over a 15 year time horizon, highlighting risks to security of supply and key influences. It spans a range of energy sources including electricity, gas, coal, oil, nuclear fuel and renewables.

3.3.3 Mix of investment

As described above, the market has delivered in a broadly timely fashion across a range of types of infrastructure – connecting pipelines, LNG regasification and gas storage.

Getting the right mix of energy infrastructure investment correct will require all of the signals to work efficiently. The opportunity to develop new LNG liquefaction terminals in Qatar and supply LNG to the South Hook regasification terminal will be driven not just by the supply and demand position, but by other financial considerations and development opportunities for Qatar.

The relatively low level of additional gas storage capacity delivered has been the result of firstly the tortuous planning process and more recently the market's perception that gas price spreads have been insufficient to justify the investment, partly due to the proposed additional infrastructure dampening peak price signals. This has led to many proposed storage projects continually deferring their dates for Financial Investment Decision.

3.4 Short-run prices and market resilience

The delivery of new investment is driven by shifts in the underlying fundamentals and the anticipated impact this will have on price and volume exposure. In the short-run, since capacity cannot be added to the system over short timeframes, any short-term shocks must be dealt with by existing system resources. In these cases the spot price acts as a signal for changes in gas production and consumption decisions. There have been several periods where such market adjustment has been crucial to maintain security and the following sections examine how the market performed in each case.

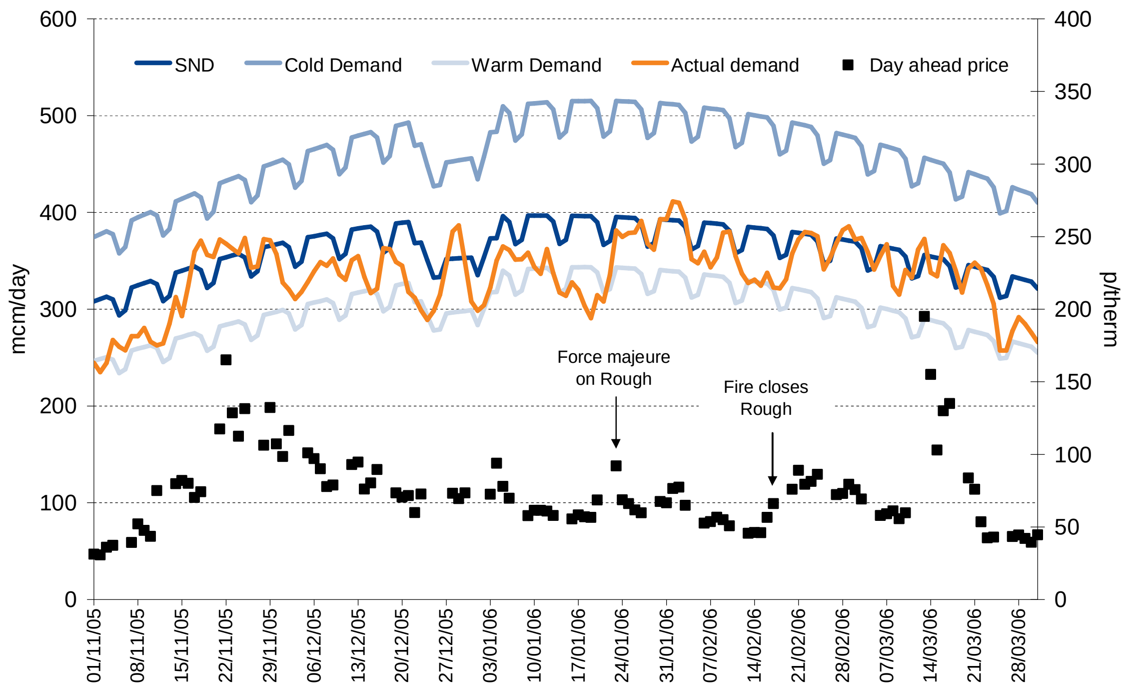
3.4.1 Incidents at Rough during 2005/06 winter

Figure 8 shows the seasonal normal demand, the theoretical 1-in-20 cold demand and the 1-in-20 warm demand alongside the actual demand from November 2005 to March 2006. The cold spell in November 2005 can be seen clearly, although demand was nowhere near 1-in-20 cold levels.

The very high prices seen in November 2005, over 170p/therm at times, caused great concern in many quarters including Government, industry and consumer bodies and led to some intensive energy industrial users ceasing production.

The severe price spikes during this period show how sensitive the gas market was to cold weather and how market sentiment led to prices well above what seemed ‘reasonable’. As this cold spell occurred at the start of the winter, the market prepared for the risk of further cold spells and prices were pushed up for the remainder of the winter.

Figure 8 – Gas demand and day-ahead gas prices during winter 2005/06



Source: National Grid, Heren

On 23 January 2006, following an offshore incident, Centrica Storage declared force majeure on Rough. Gas prices soared and the day-ahead market closed at over 90p/th. When Rough service was restored, prices quickly fell back down to below 60p/th. However, on 16 February 2006, Centrica Storage again declared force majeure on Rough, this time due to a fire offshore. The impact on gas prices was felt within days as the spot price rose from 50p/th to 80p/th.

In March 2006, another unexpected period of cold weather was experienced which, when combined with the continued unavailability of Rough, led to NGG NTS issuing a formal balancing warning to the market. This resulted in gas trading at up to 255p/th within day and a day-ahead price approaching 200p/th.

At the time that these extremely high prices were being seen in the GB gas market, no LNG supplies were available to the GB market. Assuming Norwegian pipelines were at full capacity, the only additional source of gas, once the limited short and mid-range storage were used up, was via the interconnector from Belgium. At the time, prices in GB were much higher than those on the Continent and gas flow was expected to follow the price signal. However, the Continental gas market was less liberalised than it is today and suppliers were tied to supply contracts in their home markets which made the contractual risk too great for them to capitalise on the high GB prices, despite having gas in storage. This was not understood well in GB at the time and, to some extent, fears persist that Continental suppliers lack the commercial flexibility to react to short-term shocks.

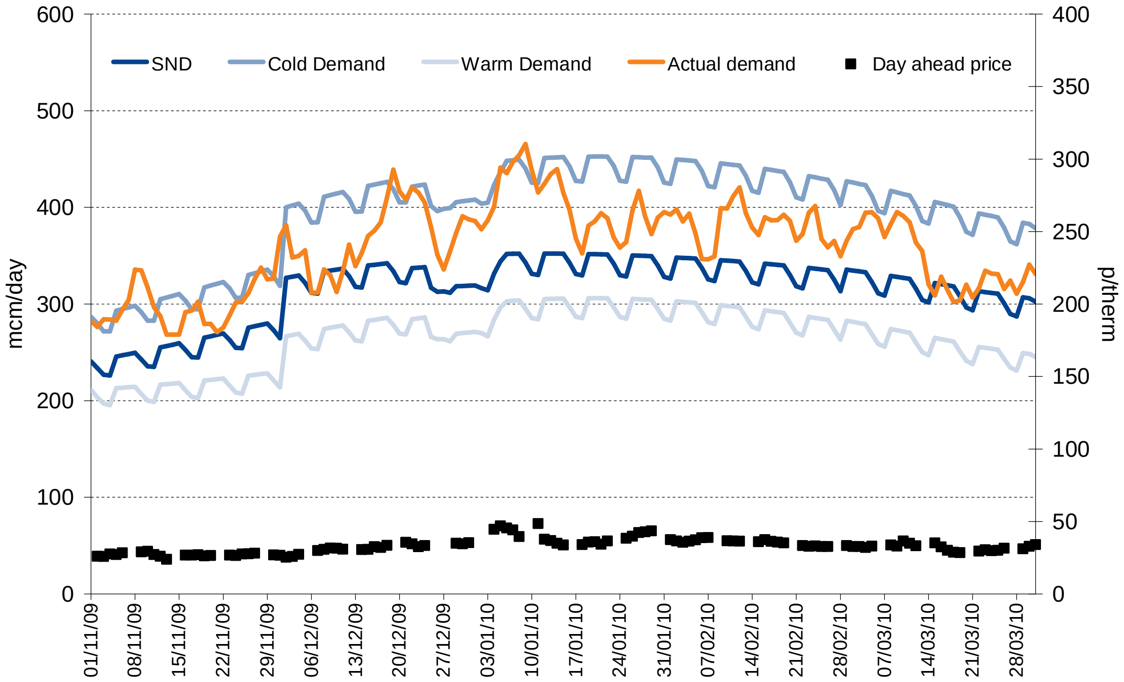
Thus, the role of interconnectors is important. The winter of 2005/06 highlighted that market prices can be impacted where there is a different value on security and different regulations on the flexibility of gas to move between markets. There is also a distinction to be made between the markets not being liquid and liberal and having a higher opportunity cost.

3.4.2 The cold winter of 2009/10

During December 2009 and January 2010, GB experienced one of its longest periods of sustained low temperatures for a number of years. For example, the week beginning 4 January experienced 7 out of the 16 coldest days in the last 14 years.

Figure 9 shows the seasonal normal demand, the theoretical 1-in-20 cold demand and the 1-in-20 warm demand alongside the actual demand from November 2009 to March 2010. It is very interesting to compare these demand levels and prices with those seen in the winter of 2005/06 and shown in Figure 8. The winter of 2009/10 was much more severe than any weather seen in 2005/06 and yet prices remained much lower and much less volatile despite a number of offshore disruptions adding to the levels of concern and resulting in balancing alerts.

Figure 9 – Gas demand and day-ahead gas prices during winter 2009/10



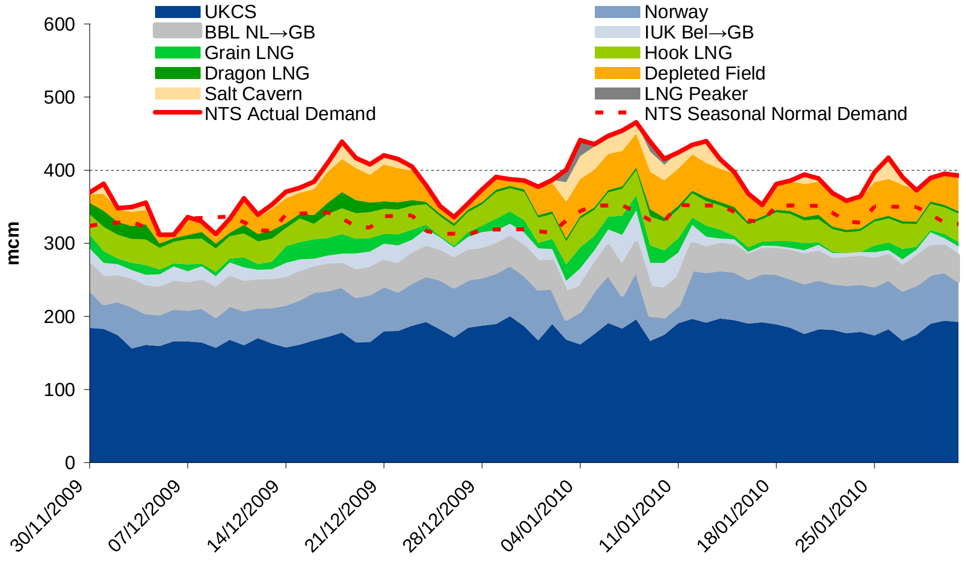
Source: National Grid, Heren

Despite the press headlines of potential major gas shortages, the GB gas market reacted as planned and without any major volume or price disruption. There was sufficient gas supply to meet demand throughout the winter, although it is worth recording the following points:

- Gas Balancing Alerts (GBAs) were issued for gas days 4, 7, 9 and 11 January 2010, due to Norwegian supply disruptions and very high GB demand, but expired at the end of each day as more than adequate gas supplies were forthcoming from alternative sources.
- A record demand of 465mcm occurred on 8 January, which is 35% higher than seasonal norms.
- Despite there being no long term fixed dedicated contracts into GB, LNG provided significant volumes over the whole period providing regular delivery of cargoes.
- National Grid DNOs (East Anglia, East Midlands and North West) undertook localised transportation constraint interruptions for seven I&C interruptible consumers on 4 January, rising to 107 on 7 January. All supply was returned on 10 January.
- 80mcm of LNG peak storage was used during January 2010.

During the 2010 winter, gas supplies were available from Norway, the Netherlands, Belgium and via three LNG re-gasification terminals. Some of the short-run LNG storage capacity had closed since 2005 but more mid-range storage had been built, which more than substituted. Figure 10 shows how all these sources of gas were utilised during the coldest period from December 2010 to January 2011.

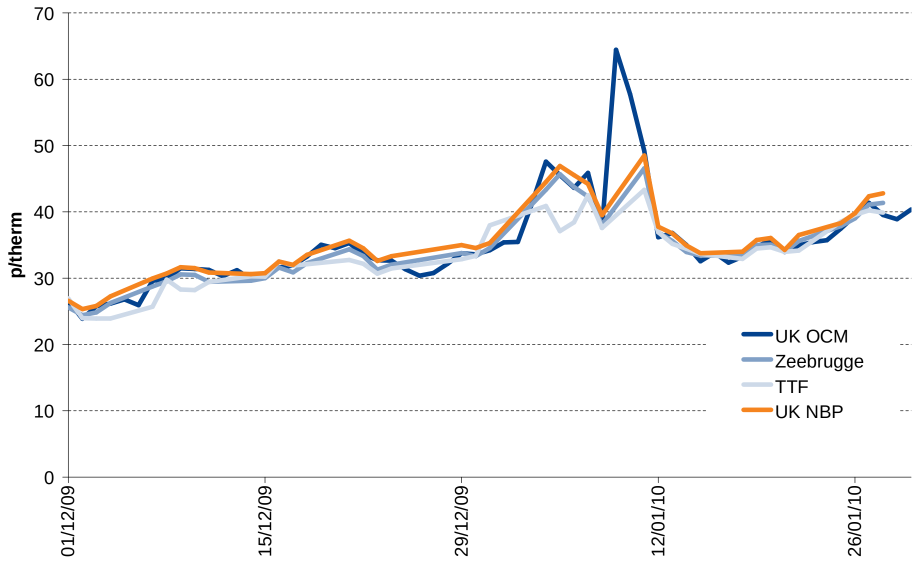
Figure 10 – GB gas supply & demand in December 2009 & January 2010



Source: Pöyry analysis of National Grid data

The market prices experienced in Belgium and the Netherlands, alongside those in GB during this period, are shown in Figure 11. These demonstrate that GB was a sufficiently attractive market for both pipeline and LNG imports and although there was a very brief price spike in OCM prices in early January, NBP prices remained only just above and very much in line, with continental spot markets. It can be seen from Figure 10 that the price differential, however small, was sufficient to encourage gas flows to the GB market through both the BBL and IUK interconnectors.

Figure 11 – Market prices in December 2009 & January 2010



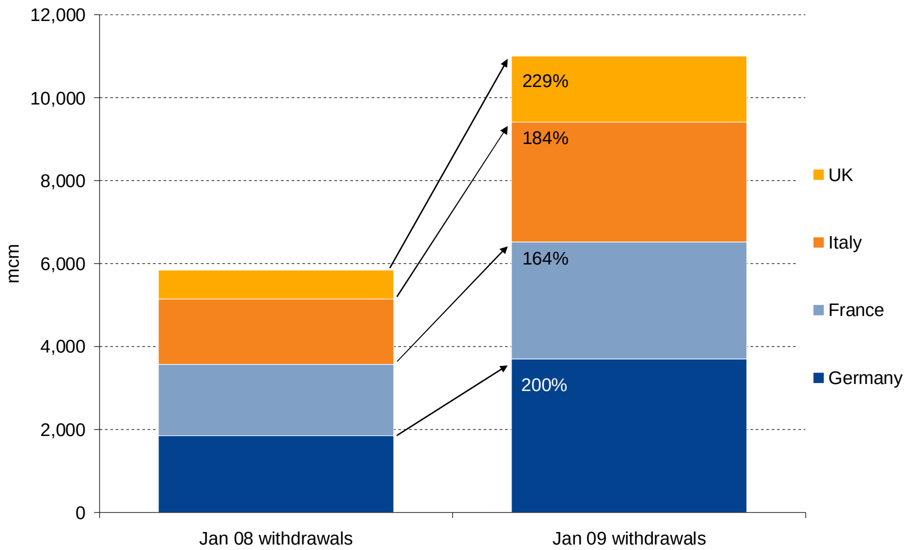
Source: Platts

3.4.3 January 2009 Ukraine crisis

The disruption of gas supplies to Europe via Ukraine in January 2009 resulted in shortages of gas in many countries in Southern and Eastern Europe. Germany, France and Italy were all called upon to access gas from storage and many pipelines around Europe changed their normal direction of flow from east-to-west, to, west-to-east. Figure 12 shows the increase in withdrawals from the Germany, France and Italy, which have ample gas storage as well as from GB.

The gas demand in each state was similar in both the month of January 2008 and January 2009, so the huge increase in withdrawals from storage clearly results from the disruption.

Figure 12 – Withdrawals from storage during January 2008 and 2009



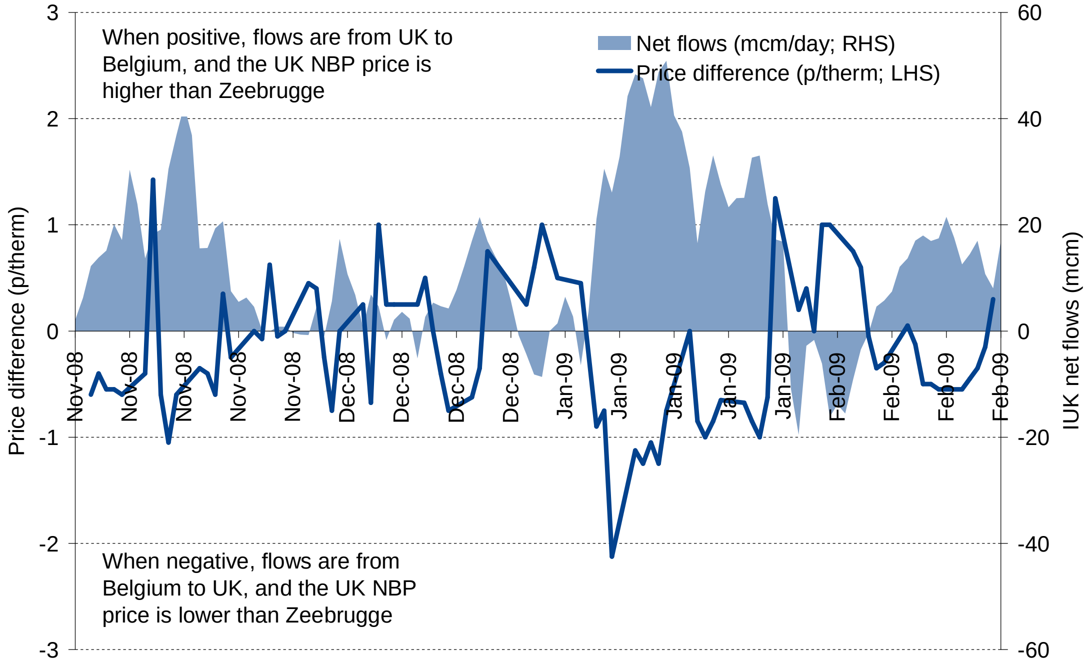
Source: Eurostats

The additional flows from west-to-east and the gas flowing out of Rough storage in GB had an impact on the GB interconnector with Belgium, which, within days, moved from importing gas to GB to record levels of export flows.

Figure 13 shows the utilisation of the interconnector with Belgium (IUK) during the Ukrainian crisis, and the price differential between the two markets. The interconnector with the Netherlands (BBL) is not shown as it is uni-directional and imports gas to GB under a long-term contract, so variations in price differentials did not influence flows.

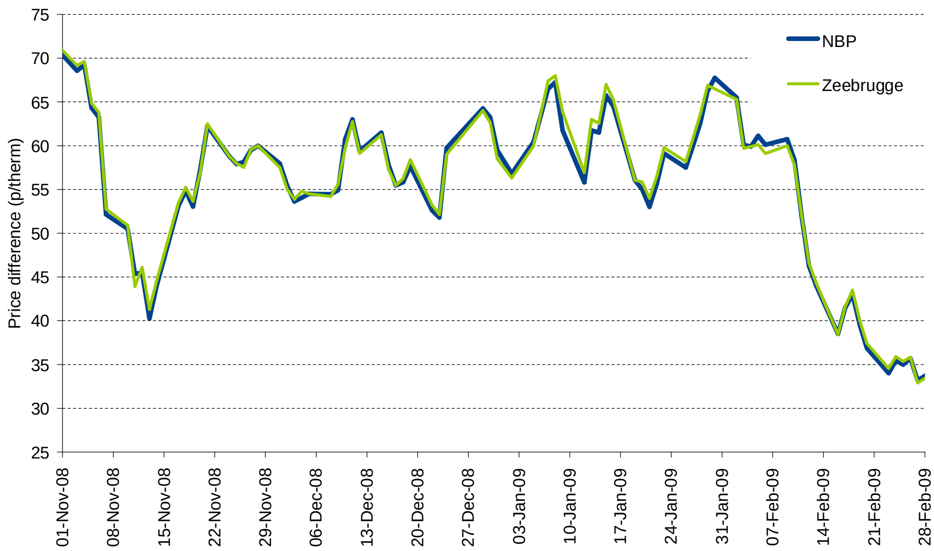
Under normal conditions we would expect IUK to be in import mode during January and make a significant contribution to the GB supply/demand balance. However, even though IUK experienced record levels of exports, the GB supply/demand was not unduly affected as other supplies were readily available from Norway, LNG and storage. Neither were absolute prices severely affected at the time, as illustrated in Figure 14 which shows Zeebrugge and NBP prices. As can be seen, there was not a significant price spike compared to the Rough fire in 2006 and the differential between the market prices was not great.

Figure 13 – IUK flows and the price differential



Source: IUK, Heren

Figure 14 – Day-ahead Zeebrugge and NBP prices



Source: Heren

3.5 Summary of performance

In setting out to assess the performance of the market arrangements to date, we identified two main indicators – the investment response in the long-term and the operation of short-term market price signals to affect production and consumption decisions in response to shocks to supply and demand.

The overall response of the market to a decreasing capacity margin was good, with many projects being brought on line after 2005. Pipeline and interconnector projects have been most successful in reaching completion with minimum delays, though short-term tightness in the market was experienced in the winter of 2005/6. This new capacity in itself represents the current annual demand of Britain and we have moved into a position of strong capacity margins.

The gas supply system was recently challenged with the coldest winter in over 30 years and came through with no issues of note and almost no change to wholesale prices.

The process of gaining planning approval, third party access exemption and financing can be a complex and lengthy process. Despite this, the market has delivered some new storage capacity which has added to the overall capacity margin and flexibility of the system.

There are still some areas of concern, covering the uncertainties around when GBAs are announced and how this is perceived by the short-term market and potential lack of access to gas supply on the Continent through the interconnectors which have different systems and are at various stages of liberalisation, and LNG.

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4. FUTURE SECURITY OF SUPPLY CHALLENGES

The GB gas market has delivered significant additional infrastructure in response to anticipated market changes and has proved to be very resilient during the recent cold winter of 2009/10. However, the underlying fundamentals of the GB gas market and the global market are continuing to evolve, altering the risks facing suppliers in the GB market and the diversity and flexibility in the supply position required to maintain current security of supply standards. New investment will be needed and the question is whether the current market can deliver this new infrastructure in as efficient a manner as it has in the initial transition from net exporter to net importer.

Following the gas supply chain diagram in Figure 1 on page 8, the main changes that are anticipated are in two broad areas:

- gas supply – the reliability of potential supply sources as import dependence increases and the ability of GB suppliers to access competitively priced contracts in unfamiliar markets; and
- gas demand – the less predictable and volatile pattern of demand that suppliers will need to meet as sector profiles are influenced by the low-carbon transition.

Though the GB now imports around a third of its gas, by 2020 this is expected to increase to over 70%. This increase in imports will place growing reliance on new producers and there are perceived risks with this situation;

- GB has limited long-standing relationships or contractual agreements with many of the key gas sources post-2020, although most of the capacity at the LNG terminals is booked under long-term contracts with some of the major GB shippers.
- The balance of gas supply will reside in a smaller number of sources, giving rise to market power concerns.
- A growing proportion of global gas reserves will be in countries that are considered less politically stable than our current import partners.
- The LNG market, that offers a key source of diversity in supply, is relatively immature and illiquid.

At the same time, the drive in GB and EU energy policy to tackle climate change is adding much uncertainty to the future gas system while exacerbating the need for additional flexibility. In particular, the expected increase in intermittent power generation will result in much more volatile gas demand from the power sector, potentially requiring additional flexibility to ensure the resilience of the gas transmission system. But this low-carbon transition is also increasing uncertainty over future gas demand and adding to the risk for potential investors. Further background can be found in our review of the role of gas as part of the transition to a low carbon world for Oil and Gas UK, published in September 2010[6].

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[6] www.ilexenergy.com/pages/Documents/Reports/Gas/481_Oil&GasUK_Gas_Future_Fuel_v1_0.pdf

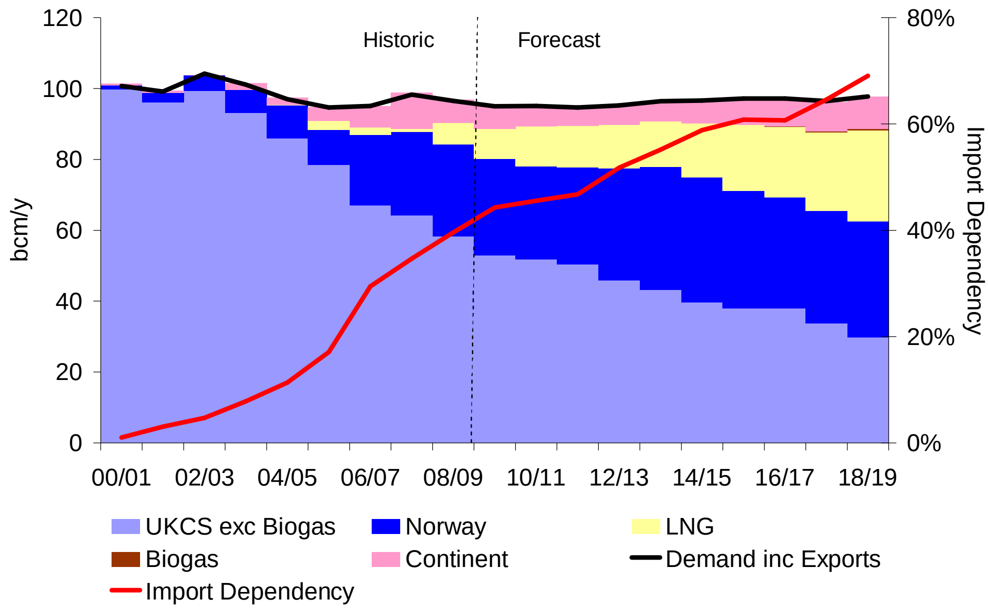
These new risks have attracted the attention of policy makers and led to much scrutiny of GB's potential future gas security. DECC commissioned Pöyry to undertake studies[7] which considered GB's gas security of supply as a result of these developments in gas markets. Drawing on this analysis, we now consider how these risks may affect the market.

4.1 Supply issues

4.1.1 Import dependence

National Grid's 2009 TYS projects import dependence to increase to over 70% by the end of the current decade, as shown in Figure 15. Import dependence is not of itself an issue, though the inevitable reliance on long supply lines will affect the risk and impact of disruptions to supplies, and influence the level of supply diversity and flexibility that the system requires to deliver security.

Figure 15 – Base case annual supply to GB



Source: 2009 TYS, National Grid

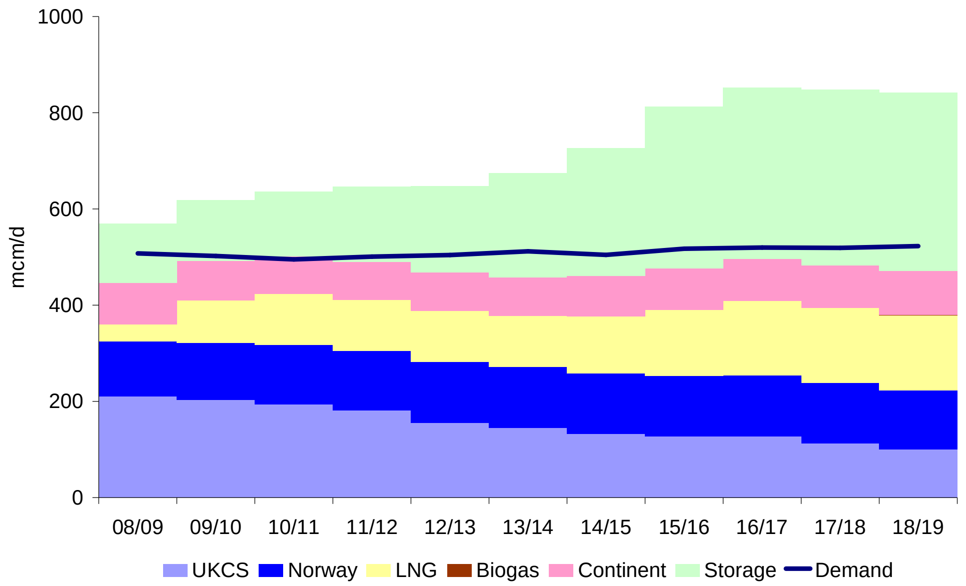
This flexibility does not exist at present. Figure 16 reproduces another chart from the 2009 TYS with projected peak supply capacity. It includes all proposed new capacity that is either under construction or for which the projects are well-advanced in terms of planning, securing financial backing and commitment from major shippers.

The additional flexibility is reliant on the successful development of new storage facilities. The 2009 TYS includes over 8bcm of new storage capacity and an additional 244mcm/day of storage deliverability.

7 www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/markets/gas_markets/gas_markets.aspx

These figures are in excess of the projected increment in storage capacity modelled by Pöyry in our recent studies for DECC. These indicated an incremental storage requirement of between 2 and 6bcm and additional deliverability of 85 to 150mcm/day out to 2020. With this additional investment the Pöyry analysis showed that the GB gas system continued to be resilient to combinations of extreme weather and infrastructure outages with little or no risk of physical interruptions to firm supply and/or significant price spikes.

Figure 16 – Projected GB peak day demand and supply capacity



Source: 2009 TYS, National Grid

However, the general message is clear – additional flexibility will be required as LNG replaces the UKCS as a baseload source of gas in the GB market.

The bulk of imports are expected to be met by additional Norwegian gas and LNG – there is limited growth in overall continental gas imports, though this may also reflect capacity constraints. Though the GB has a long and well-established relationship with Norway, the reliance on LNG and Continental imports masks risks above and beyond lengthening supply chains.

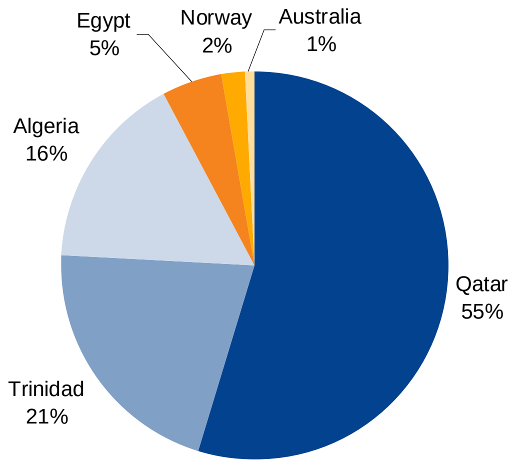
- The LNG market is relatively immature and includes a different set of players now, and in the future.
- Though Continental imports do not increase, indigenous production is falling and the reliance of the EU as a whole on imported gas, especially from Russia, is rising.

4.1.2 LNG supplies

As Figure 15 shows, the current expectation is that LNG imports will provide 20% to 30% of GB demand by the end of the current decade. GB's growing demand for LNG is part of the current rapid expansion in global LNG demand, driven primarily by declines in indigenous gas production (e.g. in Europe) and increases in demand for gas in locations with limited indigenous supplies and/or no pipeline supplies (e.g. China and India). So there will be competitors for LNG supplies and questions around the availability and price of LNG in the future.

GB now has significant LNG re-gasification capacity and attracted 10.4bcm of imports in 2009, compared to 1.1bcm in 2008. Qatar was by far the largest single source of LNG flowing to GB in 2009, providing 55% of this volume, but there was a diverse range of sources (shown in Figure 17).

Figure 17 – Sources of LNG imports to GB in 2009



The ability to attract future LNG in the volume projected in many of these studies relies on the continued development of the global LNG market. Historically it has operated on the basis on long term 'destination specific' contracts, but it is now becoming more flexible, both in terms of contract duration and destination, giving rise to significant LNG volumes (referred to as 'divertible') whose destination is predominantly determined by prevailing LNG spot market prices.

The developing global LNG market is therefore relatively unconstrained, although it generally operates in two major regions for transportation (shipping) cost reasons, a Pacific Basin and an Atlantic Basin. Pacific Basin sources (e.g. Australia and Indonesia) will generally supply to Pacific Basin demand destinations (e.g. Japan and China), and Atlantic Basin supply sources (e.g. Algeria and Trinidad) will generally supply to Atlantic Basin demand destinations (e.g. Europe and the US).

The growing LNG production in the Middle East is something of an exception to this market definition and supplies both Atlantic and Pacific Basins.

Figure 18 summarises Pöyry's analysis for DECC of potential LNG volumes available to GB. It excludes LNG volumes from the Pacific Basin (which would be unlikely to be shipped to GB due to the higher shipping costs). The analysis categorises the LNG volumes potentially available to GB as follows:

- divertible (the contracts allow the LNG supply destination to be readily changed);
- portfolio (the LNG destination is determined by a seller operating on a portfolio basis i.e. non destination-specific); and,

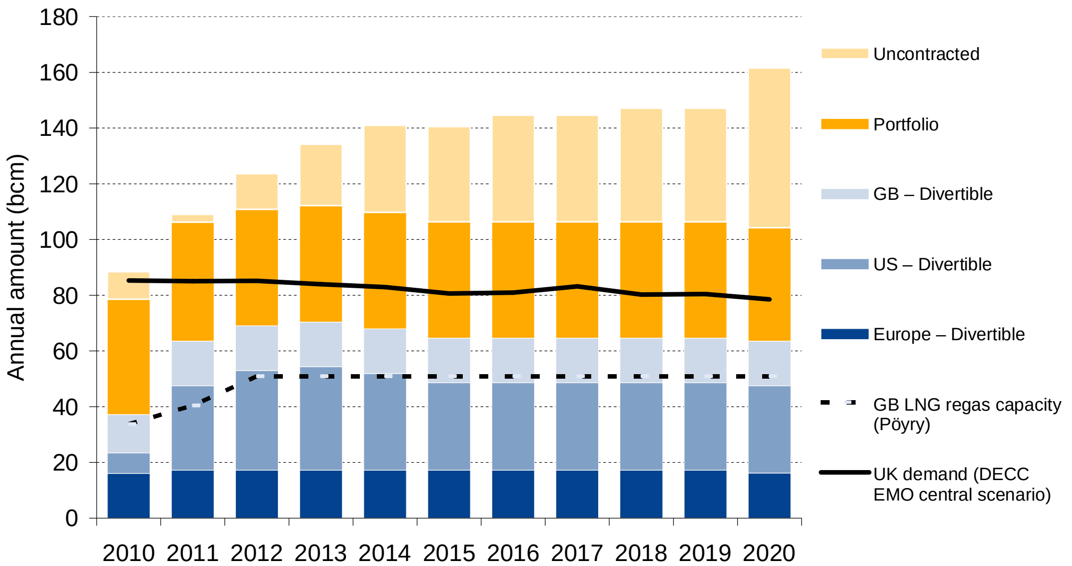
- un-contracted.

It also shows projections of total GB demand and GB re-gasification capacity. This shows that the potentially tradable volumes of LNG exceed total projected GB demand over the period, and also exceed projected GB re-gasification capacity by an even greater margin. On this basis, the report for DECC concluded that, whilst the global LNG market is still a developing market, GB should be able to attract the required LNG volumes going forward. This conclusion rests primarily on the recent rapid expansion in global LNG liquefaction capacity, and the development of the associated spot LNG market.

As US unconventional gas production increases, US demand for LNG decreases, making additional volumes available to other destinations, including GB. This reflected the general inference that increases in global unconventional gas production should have a positive impact on the GB's gas supply security.

Whilst it was recognised that LNG producers could be influenced by political and geopolitical factors, this appears to have had no material effect to date on LNG supplies to GB, which had been substantial during 2009 and 2010. Nevertheless, the study also suggested that the development, and maintenance, of a good long term relationships with LNG producers would be key to mitigating this risk alongside market responses.

Figure 18 – LNG volumes potentially accessible to GB by region



Note: LNG liquefaction capacity in operation or under construction in February 2010

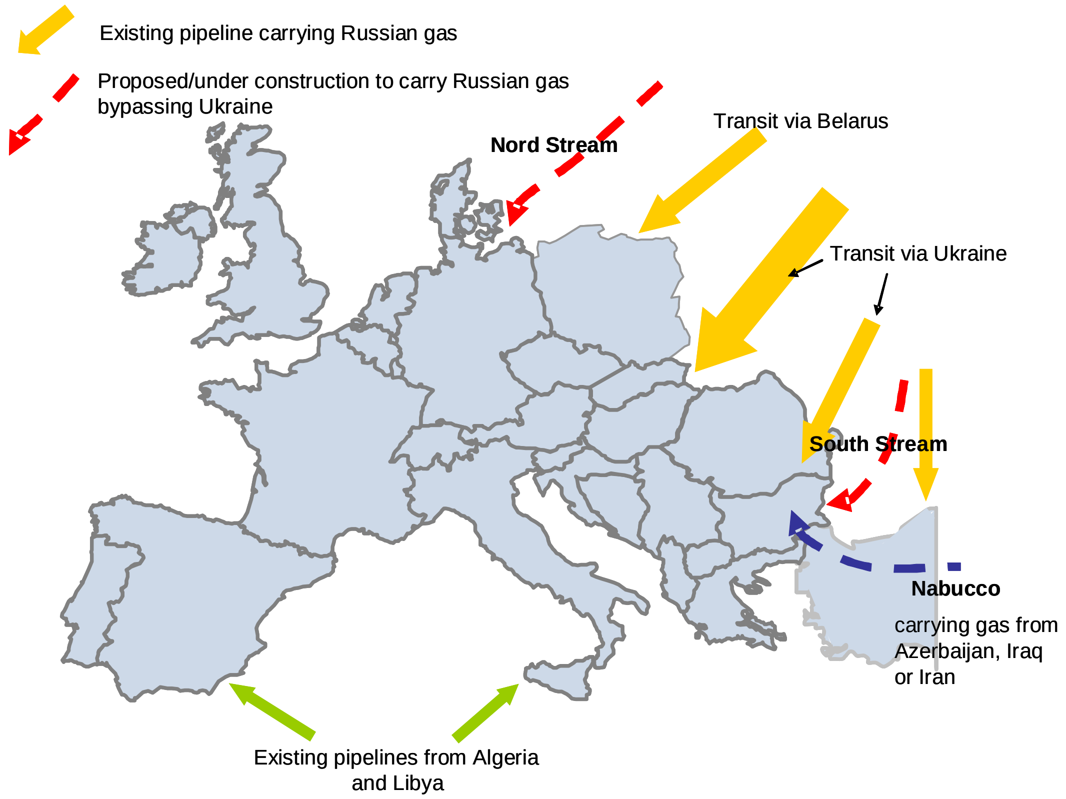
4.1.3 Longer haul pipeline supplies

Our imports of gas from Norway come a short distance and are considered to be at a low risk of disruption for political or other reasons. But as Europe's indigenous reserves are in decline, gas will inevitably come from more remote sources in the longer-term. For gas to arrive in GB from Continental interconnectors the rest of continental Europe needs to receive the gas. Figure 19 shows the points of entry and routes imported gas takes into Europe, including some new pipelines which are planned or under construction.

Russia is a key gas source for Europe and, rightly, attracts the most discussion around the 'stability' of its gas supplies, a concern based primarily on the disruptions to supplies destined for Europe via Ukraine. Ukraine is currently the main route taken by Russian gas and many countries rely on pipelines which cross Ukraine.

There are many potential causes of disruptions to, or at least the unpredictable nature of, Russian gas exports to Europe. These include its ability to achieve its indigenous gas production targets and control its own domestic gas demand. However, it is the political issues with transit countries, including Ukraine and Belarus, which have so far had the largest impact upon Europe.

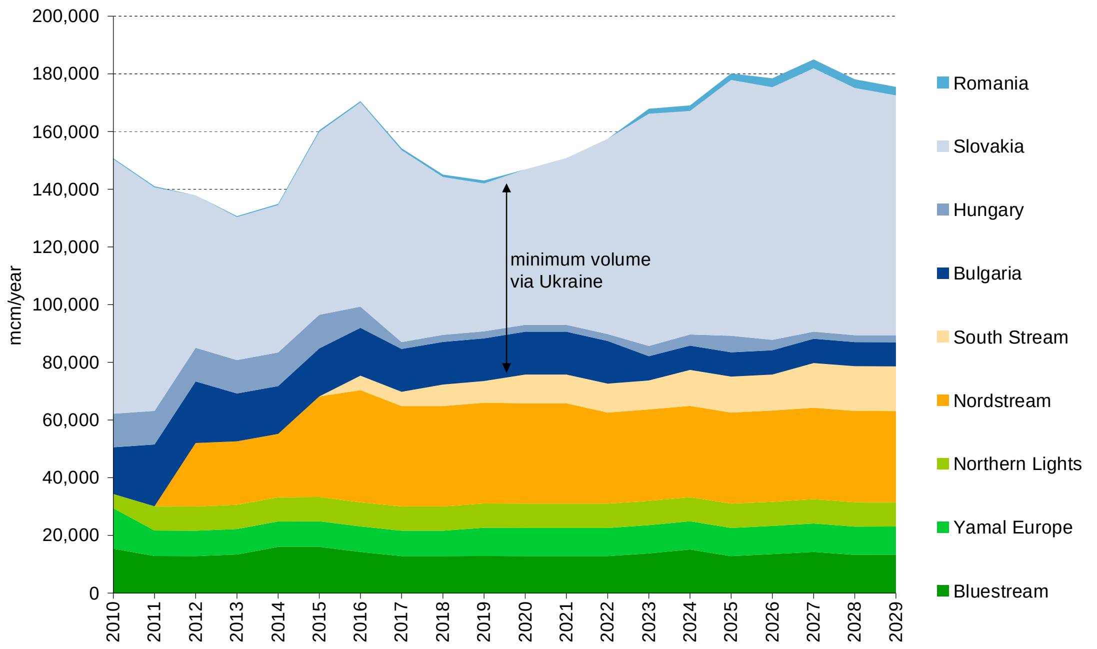
Figure 19 – Pipeline gas imports from outside Europe



In order to overcome its political difficulties, Gazprom (the Russian gas monopoly) has had a policy to bypass these transit states for some time. The Nord Stream and South Stream projects (shown on Figure 19) represent an evolution in Russian strategic thinking in gas, with neither Gazprom nor the Kremlin concealing the real reason for their implementation. Though couched in the diplomatically acceptable vocabulary of the diversification of supplies, Gazprom's primary aim is to create alternative (direct) outlets for its gas to European markets. Gazprom's preparedness to invest in costly new routes highlights the fact that European markets continue to take centre-stage in Gazprom's strategic thinking, and the monopoly continues to see Western Europe as its main customers in the long-term.

Much focus is on the Nord Stream pipeline project, the completion of which will bring most comfort for those NW European gas markets affected by the last Ukraine crisis. Though this will go a long way to improve the security of Russian gas supplies, the size of the pipeline capacity across Ukraine will not be totally substituted. Figure 20 shows the projected routes which Russian gas could take to Europe to meet its current contractual obligations, and even with all of Nord stream's capacity utilised, Ukrainian flows are still substantial. Declining flows from existing fields are compensated by new supplies from Yamal and Shtokman. The position of Nord Stream will, however, mean NW Europe will still be able to receive gas during a dispute with either Ukraine or Belarus.

Figure 20 – Projected Russian gas flows via different routes to Europe



4.1.4 Gas storage

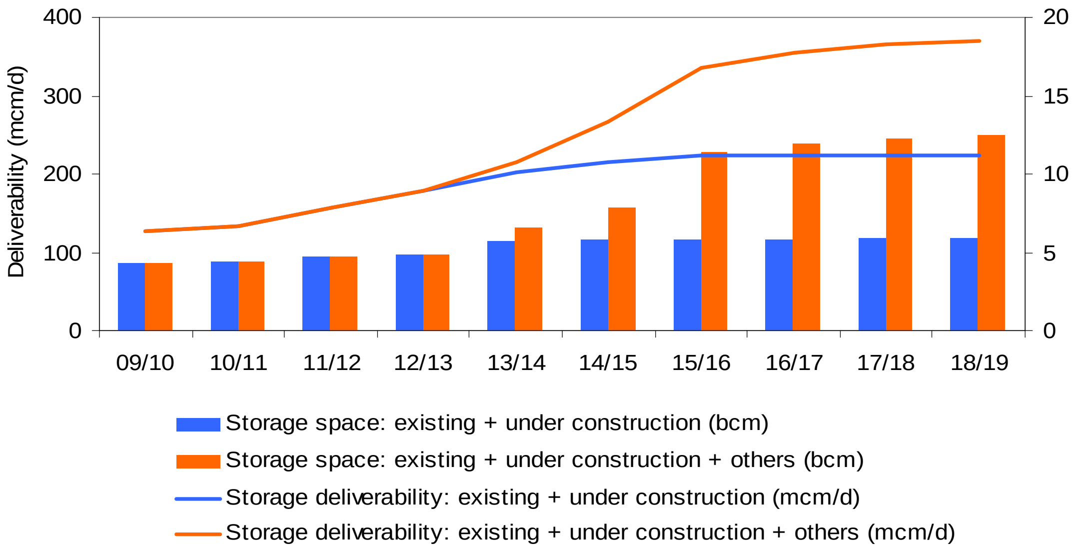
In future, as the discussion on intermittency has indicated, the desired flexibility is expected to be provided by mid and short-range storage, together with more commercial interruption. The volume of additional storage capacity is uncertain, but new capacity is required. Though some of this is already under construction, as shown in Figure 21, this will not meet all our requirements and whatever market arrangements are in place will need to incentivise some of those that are well-advanced in terms of planning, securing financial backing and commitment from major shippers.

The requirements for new storage projects are driven primarily by the project developer's perception of the value that can be derived from the facility. The criteria for investment in storage have evolved in recent years and this trend is likely to continue into the future. The key drivers of this evolution are:

- Seasonal gas spreads – the spread of seasonal (winter, summer) gas prices has been the historical basis for valuing gas storage facilities. However, with the recent narrowing of such spreads, partly as a result of the current global gas supply glut, and the increasing influence of gas demand (and price) volatility, this rather simple approach to storage valuation is likely to replaced with a more complex approach in future.

- Gas demand (and price) volatility – in order to meet the needs of the energy (electricity and gas) networks underpinning intermittent power generation, future GB gas demand is likely to be become significantly more volatile than at present. Consequently, gas price volatility is also likely to increase. This will affect the approach used for valuing gas storage facilities, as fast-cycle facilities, such as salt caverns, become more valuable.
- European market interaction – as European gas markets continue to liberalise, this will enhance inter-market gas trading. As a result, storage valuation will need to take greater account of the potential interaction with other European gas markets, and to take account of the other storage facilities within close proximity.
- Competition from other flexibility sources – gas storage may face increased competition from other sources of flexibility in the GB market, particularly demand-side management, and from interaction with worldwide LNG arbitrage opportunities.

Figure 21 – Projected GB storage capacity



Source: 2009 TYS, National Grid

4.1.5 Other challenges

In addition to the security of supply issues discussed above there are a number of other challenges that need to be considered, such as;

International relationships

With an increasing need to import gas from around the world and with a market structure that does not automatically support the requirements for long-term take-or-pay contracts it will be vital for the government to be a leading voice in support of strong regulation across Europe and for bilateral relationships. This was recognised in the Wick's review of energy security in August 2009 which recommended that the government prioritise Norway, Qatar and Saudi Arabia as the most significant bilateral relationships to our energy security. These should be built on a broad base including diplomatic, development and cultural collaboration. Pursuing such an approach for our key gas sources, including LNG, was recommended in our studies for DECC earlier this year.

Gas Quality

Another area that the Pöyry DECC studies identified that may require action during the next decade or so is gas quality. When delivering gas into pipelines that supply consumers it must meet a quality specification, including the Wobbe Index (WI), which is a measure relating to the heating, or calorific, value of the gas. The WI of supplied gas can vary significantly, depending on the source and how much the hydrocarbons are removed before entering the gas distribution network.

Across Europe there is a wide range of acceptable WI, with GB having a narrow range defined in its Gas Safety (Management) Regulations (GS(M)R). This is primarily as a result of the continuing need to supply to older gas appliances.

European supplies with lower WI have included the South Morecambe gas field in the East Irish Sea and the Groningen gas field in the Netherlands. Delivery of these to consumers can be handled either by blending with richer gas supplies, as happened at Lupton for South Morecambe, or by operating a separate low CV gas pipeline network, as is the case in the Netherlands, North-west Germany, Belgium and North-east France. Other supplies, such as some Norwegian gas, LNG and Russian supplies from the Nord Stream pipeline, will often have a WI which is unacceptably high for GB's requirements.

For LNG it is necessary to reduce the WI of delivered LNG by ballasting with nitrogen. All GB's re-gasification terminals have been equipped with nitrogen ballasting facilities. Isle of Grain, Dragon and Teesside Gasport have sufficient ballasting to be able to accept LNG from most sources. South Hook has installed a reduced nitrogen ballasting capability (on the basis that it will be receiving 'lean' Qatari LNG), and therefore cannot accept higher Wobbe LNG, e.g. Oman or Pacific Basin LNG, without a re-gasification capacity reduction.

Use of nitrogen ballasting adds extra cost to the gas supplied, but has not been material and LNG importers can still make a reasonable margin. As an example, at Dragon the £20m cost for the ballasting facility translates (over 15 years for the 6bcm terminal capacity) to an additional cost of less than 0.2 p/th at 50% load factor.

Given this position, gas quality is unlikely to be a material constraint on LNG flows to GB. However, looking forward blending in Belgium may be a problem for Fluxys following the introduction of the expected higher CV gas from Nord Stream and the continued decline in low CV Dutch reserves. As such there is a risk that the UK-Belgium Interconnector will not accept any such out of specification gas. It is also not clear who has responsibility for resolving the issue as Fluxys currently performs the service for the benefit of all IUK shippers whereas Ofgem is responsible for the gas quality specification.

Currently there is no change planned in GB specification until 2020. However, some of the energy efficiency measures being delivered, including the recent boiler scrappage scheme, might mean a faster replacement than previously assumed and potentially allow this date to be brought forward.

The Pöyry DECC studies recommended that the situation on gas quality be kept under review and assessed on a regular basis.

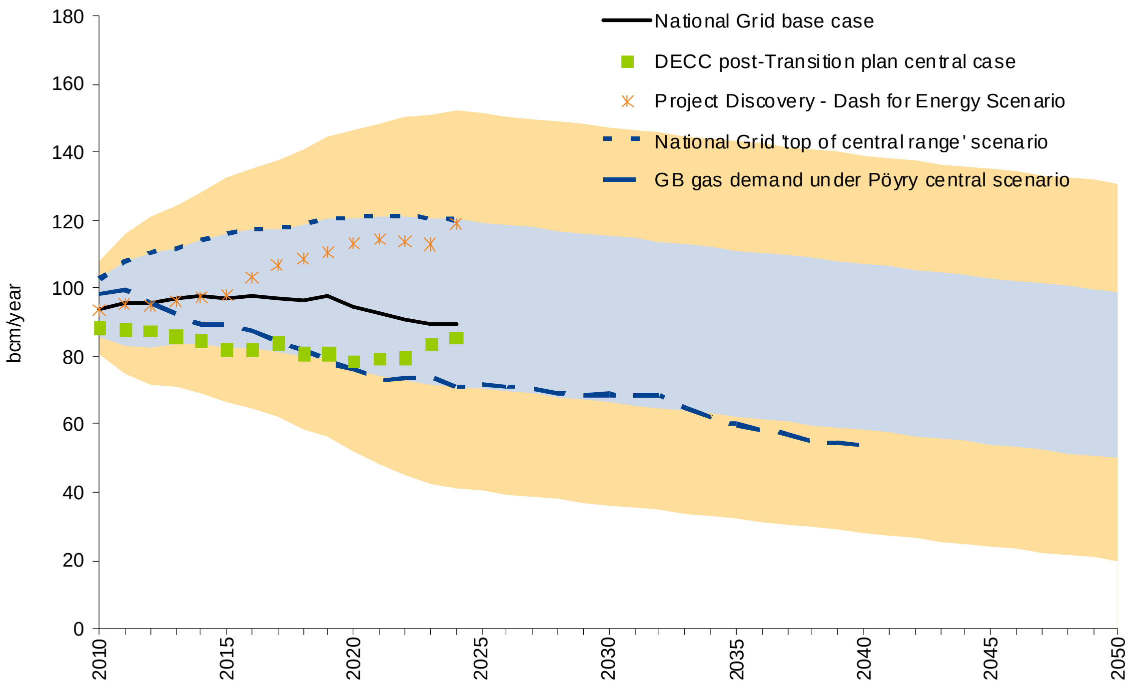
4.2 Demand issues

Changes to demand are anticipated both at the annual level and in terms of the profile and predictability of demand by sector.

4.2.1 Total GB gas demand

Any demand reductions through energy efficiency measures and renewables should be expected to lead to improvements in GB's supply security, increasing the buffer inherent in current infrastructure. However, as Figure 22 shows, the path to a low-carbon energy system is increasing the uncertainty over future GB gas demand. The projections reflect long-term scenarios from DECC and Ofgem alongside the central and outer ranges, published by National Grid in their 2009 TYS, where they extend to 2024. The ranges have then been projected to 2050.

Figure 22 – GB annual gas demand projections



Source: DECC, National Grid, Ofgem and Pöyry

Such uncertainty adds to the risk for potential project developers and continued policy risk may delay viable developments. In this way, lack of transparency over future demand conditions can increase the risk to, or cost of, security of supply in the medium-term. To address this it will be important for government to state clearly its policy direction and provide a more stable environment for market participants to assess the investment signals in the gas market.

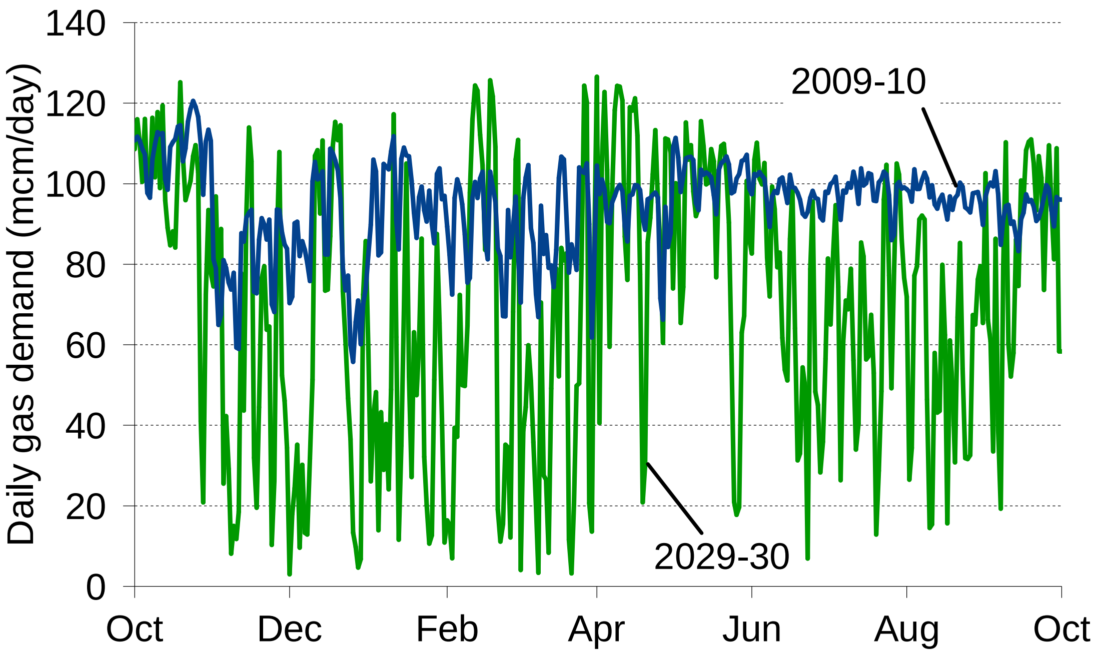
4.2.2 Power generation and the impact of intermittency

As the GB energy sector decarbonises, the use of gas will change by sector. Most notably, as intermittent generation provides a growing proportion of our electricity generation requirements, the load factors and operating patterns of conventional generation will become more variable. This was one of the key conclusions of a 2009 Pöyry study [8] quantifying the challenge to the GB and Irish electricity markets in a world of high wind.

Gas-fired generation would, in part, be required to 'pick up the slack' when the wind is not blowing. To investigate this further, in 2010 Pöyry undertook a follow-up study which modelled the potential effect of intermittent wind generation on within-day gas demands for the power sector. Figure 23 provides for the same weather pattern a comparison of the daily gas demand in the power sector in 2009/10 and projected forward to 2029/30, which has assumed a significant amount (43GW) of wind generation on the GB system.

This analysis shows that there is a significant increase in the daily volatility of gas demand and that there are also significant swings in demand across the year – far greater than has been the case in the past. This shift from historic demand patterns in power generation would be dampened somewhat by the requirements for gas from residential, commercial and industrial customers, which are driven mainly by temperature and periods of shutdown over weekends and holidays.

Figure 23 – Evolution of power sector gas demand in GB markets



The study also modelled the potential gas sources used to meet demand under these conditions. Figure 24 shows the projected gas sources for the modelled years 2020 and 2030. The scenario shown is based on relatively high deployment of wind generation, meeting the 2020 target and continuing beyond it, combined with further build of gas-fired CCGTs. Several features of the picture painted by Figure 24 are of note: in this scenario, while demand is slightly lower than now, it is much more volatile than in the past; against declining UKCS supply, Norway, interconnector flows and LNG account for a far greater

8 'Impact of intermittency: how wind variability could change the shape of the British and Irish electricity markets', Pöyry, July 2009

share; and, finally, storage plays a far more important role, both for seasonal variations and balancing the additional daily variability caused by the wind.

Looking more closely at the potential future use of storage, the study concluded that the timescales over which storage is required to switch from injection to production will reduce, driven primarily by the increasingly volatile demand and the reduced flexibility of future supply sources. This is illustrated in Figure 25, which shows the results of the gas storage modelling and how differing types of storage facility behave in different ways depending on their rates of injection and withdrawal.

Figure 24 – GB daily supply mix in 2019/20 and 2029/30

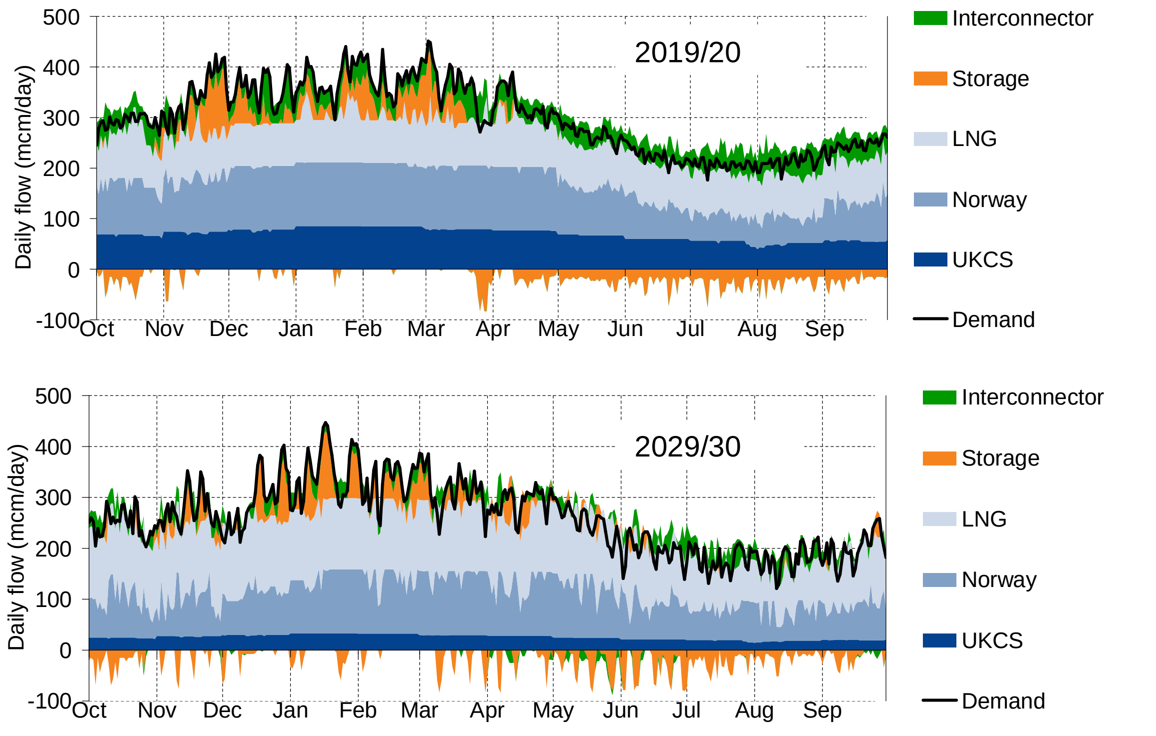
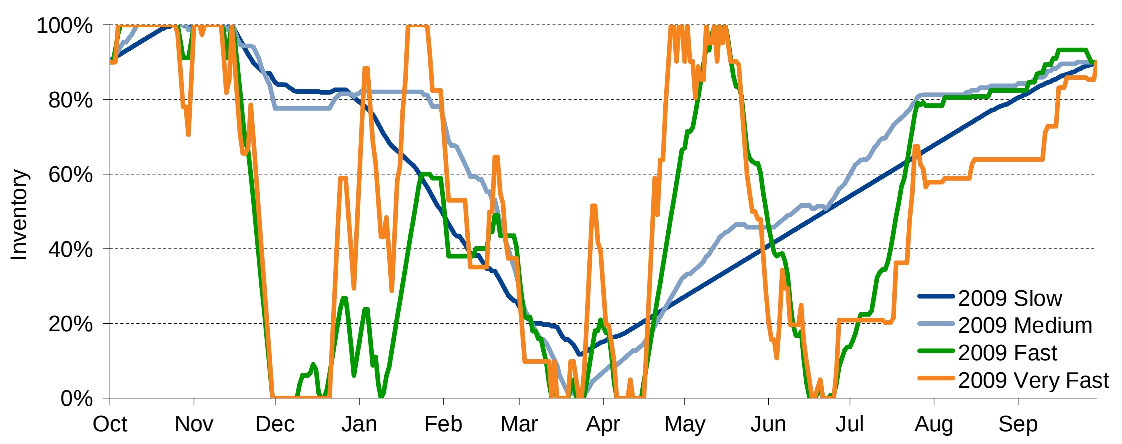


Figure 25 – Projected future utilisation of gas storage facilities



A further conclusion was that storage revenues for fast-cycle storage facilities, e.g. salt caverns, which are able to respond in similar timescales to the wind intermittency, would increase as more wind generation is built. However, seasonal storage (for example Rough) is unable to capture so much of this value.

Given the conclusion from this study that the gas system will need to operate, and balance, over shorter timescales, this could also lead to requirements for additional demand-side gas products, e.g. an increasing demand for new forms of interruptible contract. In order for such fast-cycle storage and/or demand-side products to be delivered to meet the requirements of future intermittent gas demand, one of the key questions will be whether the appropriate investment signals will be generated by the market going forward.

4.3 Regulatory risks

Within our security of supply study on GB for DECC we noted that regulatory changes can introduce another source of risk and to such examples are discussed next.

4.3.1 Removal of NTS interruptible capability

From October 2012, a modification to the Uniform Network Code, will introduce a new transportation regime for exit capacity from the NTS. This modification introduces a new 'off peak' transportation product, largely designed to replace the current interruptible product. However, the new product has to be bid for in an auction process on a daily basis, at the day-ahead stage, and National Grid will have some discretion on the levels made available to the market on a daily basis. There are a number of issues about the new process:

- The mechanics of applying for the 'firm' product are clearly laid out in the modification, but the mechanism for applying for the 'off peak' product still has to be defined.
- Pricing mechanisms are still subject to consultation, but propose that the daily interruptible capacity auctions will have a reserve price set to zero.
- Both firm and interruptible sites will have to pay for the SO and TO exit commodity charges, where as currently NTS interruptible sites don't have to pay the latter.

The process for obtaining the new 'off peak' product is currently considered to be more risky, complex and time intensive than the present interruptible product (which has guaranteed availability and pricing discount). It could be expected that NTS sites that have interruptible transportation at present, and who have the option of converting to firm transportation in the new regime, will do so, with the consequence that they will decommission their backup capability. The long-term requirement for DSR is therefore not possible to value or procure. Once this backup capability has been removed it will prove very hard to reinstate. Indeed transporters in distribution networks are reinforcing their pipeline networks to remove transportation constraints when they fail to procure sufficient off-peak contracts to meet any local constraint issues.

This change could therefore result in the loss of some demand-side flexibility which currently exists in the market, and which would go against some of the conclusions reached elsewhere in this report, namely that there may be an increased requirement in the future GB gas market for demand-side response products.

4.3.2 Entry Capacity substitution

In December 2009, following a lengthy industry development and consultation process, Ofgem approved an approach, proposed by NGG, for entry capacity substitution. Entry capacity substitution is designed to allow 'spare' entry capacity at one terminal to be moved to another terminal with greater demand, thereby increasing the efficient use of capacity and avoiding unnecessary additional infrastructure costs. Substitution was identified by Ofgem as an important future market feature, given the changes being experienced to gas import points to GB.

Under the proposed substitution approach (the 'retainer' approach), where shippers foresee a potential future demand for capacity at a particular terminal, they are able to pay a 'retainer' on the entry capacity, which will prevent the specified quantity of entry capacity from being substituted away. The proposed approach also features the use of exchange rates, which determine the ratio of capacity which can be substituted away from a terminal. The exchange rates are capped at a rate of 3:1, i.e. 'new' substituted capacity must represent at least one third of the original capacity being substituted. The capping is designed to provide a 'soft landing' for the industry, reducing the risk of large-scale, and unanticipated, 'capacity destruction' between terminals.

Whilst market participants were broadly supportive of the principle of entry capacity substitution and the efficient use of entry capacity, there were significant concerns around the development process and the final option approved by Ofgem. Parties were concerned that other (preferred) options had not been fully considered in Ofgem's Impact Assessment, and that, in particular, the impact on wholesale gas prices had not been fully evaluated.

Most importantly for this study, a number of parties were concerned that the proposed approach could (only) lead to the reduction of commercial entry capacity available to GB shippers, thereby potentially constraining physical gas flows in the GB network and increasing risks to supply security. Clearly, the extent of any such reduction to supply security would be directly linked to the extent to which the substitution mechanism is used in practice.

4.4 Conclusions

The GB gas market is entering a new period of transformation with growing import dependency, long-term reliance on more remote and sometimes less politically stable sources of gas, and potential fundamental shifts in the patterns of gas demand. Maintaining the security and resilience of GB gas supplies in these circumstances is going to require further investment and innovation in the industry to provide sufficient and timely flexibility in supply through demand-side and supply-side (i.e. storage) measures.

In Section 3, the market assessment indicated that the market had delivered limited new storage facilities, though this has had no detrimental impact on security as the interconnectors and LNG facilities have provided more than sufficient extra flexibility.

Price signals offer the best way to decide on the value of investment and it is therefore important that market price signals efficiently reflect the value of gas at a point in time. Sharper incentives should give a full value of flexibility.

The GB gas market has a good record in terms of the timescales required for the delivery of new infrastructure. It is notable that those items of infrastructure that have been delivered most closely to the originally planned timeframes, namely Norwegian sub-sea pipelines and the other GB interconnectors, have had the least interaction with the GB onshore planning regulations. Where plans for new infrastructure are required to comply with the onshore regulations e.g. gas storage facilities and onshore connecting pipelines to LNG terminals, the project development timescale has typically been extended by a number of years, and often has been the subject of a public enquiry.

It is clearly important that the planning and permitting processes for new GB gas infrastructure are made as efficient as possible. This will be important in the future as the GB market is likely to continue to need additional storage facilities.

The recent abolition of the Infrastructure Planning Committee, and the plan to incorporate its functions back into Government, has caused uncertainty and concern among market commentators. It is important that clarity is achieved on the required processes going forward, and that any revised planning approach facilitates an accelerated timeframe for the approval of new storage facilities.

The additional flexibility afforded by the granting of a TPA exemption in terms of contracting for capacity and the setting of tariffs is usually very important to the facility developer. For example, financing will often be arranged with banks on the basis of long term sale of capacity at the facility via bilateral contracts. Any uncertainty surrounding whether a TPA exemption might be granted, or, in the case of facilities (or proposed facilities) already holding an exemption, any uncertainty around the continued validity of the exemption, could therefore represent a very serious regulatory risk for the project developer.

Clarity on the regulatory process for the granting of exemptions and their potential withdrawal could therefore be critical in ensuring the establishment of new storage facilities, which, in turn, could affect GB's overall level of gas supply security.

Demand side response can provide a strong contribution to security of supply and recent changes may result in less being available to the market. In order to stimulate the necessary investment in demand-side products it may be necessary to provide sharper incentives for gas shippers to balance and/or provide a mechanism where this benefit is appropriately recognised.

As GB increasingly imports its gas from a wider range of potential sources, specific approaches could be adopted to maximise the reliability of gas supplies to GB. This could include development of enhanced long term relationships with producer countries, such as Qatar and Norway, and active promotion of EU liberalisation and European gas market integration.

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5. POTENTIAL OPTIONS FOR CHANGE

The principal conclusion we have drawn from our analysis and from the observed market reaction to system stresses described in Sections 3 and 4, is that the GB gas market is now relatively resilient to adverse supply shocks, even under severe weather conditions. In order for this position to be maintained into the future the key requirement will be that the GB market continues to respond to changes which might affect its supply/demand position (covering both annual and peak dimensions) and delivers the appropriate market adjustments, whether this be in the form of additional physical infrastructure or changes to the underlying market arrangements. There are no fundamental, or compelling, reasons to believe that this will not be the case going forward.

Notwithstanding the broadly positive conclusion in relation to GB's gas security of supply, at a more detailed level, there are future changes to current arrangements might be required to address the following concerns:

- Requirements for additional short-term flexibility, to meet increasingly volatile future gas demand – potentially in the form of:
  - additional demand-side products, e.g. interruptible contracts; and
  - fast-response gas storage facilities.
- Ensuring the GB regulatory system does not unduly hinder the market changes required to preserve future gas supply security, such as:
  - more efficient planning and permitting processes for new infrastructure; and
  - clarity on application of TPA exemptions to gas storage facilities.
- Facilitation of longer term market development processes which increase likelihood of future gas flows to GB through:
  - development of enhanced long term relationships with producer countries, such as Qatar and Norway; and
  - EU liberalisation and gas market integration.

We will next discuss a range of potential policy options that could address these concerns, assessing their suitability before identifying a short-list that policymakers might wish to consider for future gas market arrangements.

5.1 Potential policy options

In considering the potential policy options to review we have include proposals recently suggested UK policymakers. We have focused specifically on the proposals included in DECC's Gas Security of Supply policy statement, published in April 2010, as this is the most detailed and comprehensive and also covers options proposed by Ofgem, plus options considered as part of our work for DECC this summer. We have also chosen this wider set of options for completeness rather than just consider the more limited draft provisions proposed for the forthcoming Energy Bill.

We have constructed the following list of potential policy options, categorised as follows:

- Enhancing market performance;
  - improved information flows and co-operation between GB and Norwegian ISOs;
  - improving information flows between Ofgem and the holders of shipper interruptible contracts about demand-side response; and

  - introducing a market surveillance system.
- Refining Pricing signals;
  - non-emergency cash-out revisions;
  - emergency cash-out revisions;
  - VOLL compensation for interrupted firm customers; and
  - enhanced demand-side participation / required contract structure offers.
- Defined security standards;
  - modifications to existing security standards;
  - supplier security statements;
  - security of supply obligation for suppliers;
  - obligation on CCGTs to have distillate back-up facilities; and
  - strategic LNG cargoes offshore.
- Facilitating market operation;
  - planning process; and
  - infrastructure access arrangements.

Each policy option has been assessed qualitatively against a pre-defined set of criteria that mirror public sector impact assessment frameworks:

- Impact on consumers – likely price impacts from changes in costs and volatility in the market. This includes direct and indirect costs of implementation.
- Impact on security – improvements in investment levels, or flexibility (e.g. active demand-side) as a consequence of the change.
- Complexity – the simplicity and transparency in the arrangements, along with the time to implement.
- Impact on competition – the effect on competition in infrastructure, wholesale and retail markets.
- Risks and unintended consequences – covering any other potential effects.

A summary assessment of the options considered is provided in Table 4. The assessment uses a traffic light system to show each option's contribution against the criteria identified above. A more detailed assessment of each policy option against the criteria is contained in Annex C.

Table 4 – Summary assessment of policy options

		Impact on consumers	Impact on security	Complexity	Impact on competition	Risks and unintended consequences
Enhancing market transparency	Improved TSO information flows	Green	Amber	Amber	Amber	Amber
	Demand-side response information flows	Amber	Amber	Amber	Amber	Amber
	Market surveillance system	Amber	Amber	Amber	Amber	Amber
Refining pricing signals	Non-emergency cash-out revisions	Amber	Green	Red	Red	Amber
	Emergency cash-out revisions	Amber	Amber	Red	Red	Amber
	VOLL compensation for firm supply interruption	Red	Green	Red	Amber	Red
	Enhanced demand-side participation	Amber	Green	Amber	Amber	Amber
Defined security standards	Modification to existing security standard	Amber	Green	Amber	Red	Red
	Supplier security statements	Amber	Amber	Amber	Amber	Red
	Security of supply obligation	Red	Amber	Amber	Red	Red
	CCGT back-up distillate obligation	Amber	Green	Green	Amber	Red
	Strategic LNG cargoes offshore	Amber	Amber	Amber	Amber	Red
Non-market barriers	Planning process	Green	Green	Green	Amber	Amber
	Infrastructure access arrangements	Green	Amber	Amber	Green	Amber

Red signifies a negative assessment, Amber signifies an ambiguous or potentially negative assessment, Green signifies a positive assessment.

5.2 Short-listed policy options

The assessment of potential policy options presented above and in Annex C illustrates the trade-off that governments must make when intervening to change the market. Any benefit in terms of improved security must be cost effective – consumers must be willing to bear the cost of providing them with a more secure gas supply.

Our assessment of the impacts is only qualitative, though it is informed by more thorough quantitative analysis published by DECC earlier this year. Its main conclusion is that there is no need to fundamentally change the market arrangements at this point in time. In fact, some of the more radical suggestions may have adverse impacts on security of supply and costs. However, this does not mean that no action should be taken by policymakers – we have identified potentially beneficial interventions in three main areas:

- Enhancing market operation – improving the length of time in traded products and efficiency of the current pricing mechanism to signal the value of security and encourage the delivery of more flexibility in supply.

- Providing a clear policy framework – addressing existing policy uncertainties that delay investment and reducing the impact of non-market barriers to investment such as the planning process.
- Reducing external market risks – working to ensure global market developments reduce the scale of risks that are outside the control of GB market players.

This set of incremental changes to the GB gas policy framework – some of which are already being pursued – should result in the necessary market response to maintain a secure, reliable gas supply to GB consumers for many years to come.

5.2.1 Enhancing market operation

Though the market is functioning well, the increased need for supply flexibility makes continued efforts to improve price signals and develop liquidity crucial. The value of flexibility is in being able to arbitrage price differentials across time, whether these are seasonal spreads, intra-day spreads or within-day volatility. Furthermore, since there are several types of flexibility that shippers may look to access, the efficiency of short-term prices is important for an efficient mix of flexibility options to be delivered – it may not be in the best interests of the market to have idle storage assets if demand-side response can deliver an equivalent service at lower cost.

Investment decisions also require confidence in future scenarios in order to adequately manage the risks. The markets currently do not offer 10 year traded products and so it lacks the necessary width required for 25 year investment decisions, although a limited number of long-term gas supply contracts have been done using NBP as the pricing mechanism.

Efficient price signals require:

a) strong, deep liquid markets with a wide range of participants;

b) certainty of a liquid market into the future, with sufficient width and based on market fundamentals;

c) prices that reflect the true value of interruptions/imbalances; and

d) transparent and openly accessible information on market conditions.

Our assessment suggests that more formal requirements such as gas security obligations may be counter-productive. Not only may the system be complex to implement and monitor, but the cost to consumers may be disproportionately high and spot market liquidity may be impaired. Policy attention can more productively focus on two aspects of the current market framework:

- Better marginal price signals – review of the potential benefits and risks from modifying the cash-out price arrangements to provide more efficient signals during times of market tightness should be progressed.
- More active demand side participation – when we are looking for flexibility, the demand-side may offer a more cost-effective alternative to physical infrastructure in some circumstances (as identified in the Pöyry security of supplies studies for DECC in 2010). The power generation sector has historically provided significant and valuable DSR. Exploring the potential for more interruption and to maintain existing levels is likely to require increased incentives for both large consumers and suppliers to consider this as a viable source of flexibility. The wider provision of intelligent meters may allow I&C consumers and their suppliers to offer more DSR going forward.

5.2.2 Providing a clear, stable policy framework

Uncertainty in the policy framework increases the risk for investors and can lead to delays in major infrastructure delivery. We want investors to respond quickly to market requirements and maintain security of supply at a low cost to consumers. Such an environment requires:

- clear definition of gas security standards and responsibilities of market participants;
- a reduction in non-market barriers to investment; and
- consistent and proportionate regulation of new infrastructure.

With the introduction of a new gas security regulation by the European Union there is an opportunity for the government to review the current gas security standards and clearly define the desired security standard and the resilience that it feels is appropriate for the market to achieve.

Our review of new infrastructure delivery highlighted the barriers raised by the vagaries of the planning system in increasing costs and delaying timely deployment of commercially viable projects. The Coalition's decision to shelve/abolish the Infrastructure Planning Commission adds to the uncertainty for major projects. Urgent action is needed to ensure that the steps that have already been taken in relation to streamlining planning, for example the development of National Policy Statements and the priority treatment of nationally significant energy infrastructure projects, continue to be supported.

Finally, we recognise that, across Europe, the large infrastructure expansion has been greatly facilitated by the granting of TPA exemptions to underwrite investment and encourage entry. These exemptions do not preclude regulatory involvement during the period or when the exemptions expire and we believe that the long-term position is best served by consistent and proportionate regulatory oversight of assets that have, or have had, TPA exemption.

5.2.3 Active external policy focus

One of the implications of increased import dependence is a greater exposure to developments in global gas markets that are outside the direct control of GB market players and policy makers. While markets can respond to these risks, they have limited scope to influence their materiality – this can only be achieved through active policy efforts. We have identified two main areas of policy focus here:

- developing and enhancing strategic relationships with producer countries; and
- continued support for the effective implementation of the Third Energy Package measures and further progress on liberalisation and development of liquid wholesale gas markets on the Continent.

These are areas that the incumbent and previous governments have raised as important, as is evidenced by the following quotes:

'The Government should prioritise Norway, Qatar and Saudi Arabia as the most significant bilateral relationships to our energy security. Relationships built on a broad base including diplomatic, development and cultural collaboration will provide a firm basis on which to pursue our energy security goals' – Wicks Report – August 2009.

'The Government continues to promote open and integrated EU gas markets to provide the UK with access to additional gas within a wider competitive EU market' – DECC – Gas Security of Supply Policy Statement – April 2010.

‘At the ONS conference in Stavanger in August 2010, DECC Minister for Energy, Charles Hendry stressed the importance of co-operation between the UK and Norway, noting that Norway’s gas pipeline infrastructure was crucial for the UK and that he would be keen to explore further with the Norwegians additional pipeline infrastructure’. – Platts European Gas Daily, 25 August 2010.

We therefore recommend that further efforts should be made on these issues.

ANNEX A – GAS SECURITY OF SUPPLY STANDARDS ACROSS EUROPE

Country	Security of Supply Standard
Belgium	The TSO, Fluxys, has a mandated public service obligation (PSO) to be able to supply all uninterruptible customers in the case of severe temperatures that would occur based on the winter of 1962/3 or 5 consecutive days with temperature < -11ºC. For this purpose Fluxys maintains reserved "strategic storage" (gas and capacity), which are charged to users through transmission tariffs.
Denmark	TSO is obliged to procure storage capacity to meet demand of non-interruptible customers at 60-days at normal winter temps, 3-days at -14ºC (equivalent to 1 in 50 peak day). Shippers required to keep a certain % of gas storage during winter months. Shippers are required to procure sufficient storage capacity to meet demands of non-interruptible customers
France	Shippers supplying domestic & public interest customers are required to withstand a loss of main supply for a 6-month period under normal weather conditions, to ensure supplies for both a 1-in-50 winter and an extremely cold period – a 3-day 1-in-50 period. Ensure availability to alternative sources (storage, short-term contracts, LNG, etc.)
Germany	Suppliers have a legal requirement to take reasonable steps as prudent operators to ensure security of supply for their customers under normal and exceptional conditions, with severe penalties for failure. This obligation is discharged via contracts with TSOs and storage operators/providers.
Italy	Approx 40% of storage is reserved for Strategic Storage, whose release is controlled by the ministry. Additionally there is a legal obligation on each importer to maintain 10% of its import requirements in storage (minimum quantity specified by Ministry for Industry each year).
Netherlands	Shippers must have contracts in place to meet demand of small customers down to -9ºC. The TSO, GTS, is required to protect supplies to small customers during extremely cold winters. It procures storage gas to meet their increased demand when temperatures drop below -9ºC (down to -17ºC). Shippers pay for the above arrangements through a PSO tariff.
Spain	Shippers cannot source >60% of portfolio from any one country. Shippers to gas distributors must maintain 35-days supply

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ANNEX B – SUMMARY OF GB GAS INFRASTRUCTURE INVESTMENT

B.1 Investment in pipelines and interconnectors

A range of new and/or expanded gas pipeline and interconnector capacity has been constructed since 2005. All import capacity, its commissioning date, and, where possible, the date each project was announced, is shown Table 5. Although we have looked into when these projects were first announced, considerable analysis would have been undertaken before these dates.

A total of 62bcm/year of gas capacity has been added through the development of pipeline and interconnector infrastructure since 2005.

Table 5 – Pipelines and interconnectors to GB

Pipeline / interconnector	Import capacity	Commissioning date	Announcement date
Vesterled (Norwegian into St Fergus via old Frigg pipeline)	10 bcm/year	1999	n/a
IUK (interconnection with Belgium)	8 bcm/year 16 bcm/year 23 bcm/year	1998 2005 2006	1992
BBL (interconnection with NL)	14 bcm/year	2007	2004
Langeled (Norwegian into Easington)	23 bcm/year	2006	2003
Tampen Link (Norwegian into St Fergus via Flags pipeline)	10 bcm/year	2007	2005

B.2 Investment in LNG re-gasification

The GB gas market has also seen significant investment in LNG re-gasification terminals in three major developments. These investments, shown in Table 6, took slightly longer to become operational than the pipeline projects but have delivered a total of 47bcm/year since 2006.

Table 6 – GB regasification capacity (bcm/yr)

Re-gasification terminal	Import capacity	Commissioning date	Announcement date
Isle of Grain	4.4 bcm/year 13 bcm/year 20 bcm/year	2006 2008 2010	2002
South Hook	10.5 bcm/year 21 bcm/year	2009 2010	2003
Dragon	6 bcm/year	2009	2004
Gasport (Teesside via direct injection ships)	4 bcm/year	2007	2006

B.3 Investment in storage facilities

Gas storage provides an important source of flexibility for the GB gas market. The large depleted field Rough storage facility provides seasonal storage whereby gas injected in summer is withdrawn over the winter period when gas demand (and prices) are higher. Salt cavern storage provides a more flexible storage product to the market and is used largely in response to shorter-term price signals.

The planning and approval process for GB storage projects can be a lengthy process, in excess of five years. Those projects that have been successful in recent years are shown in Table 7.

Table 7 – GB storage facilities – existing and financially approved (mcm)

Storage facility	Storage capacity	Commissioning date	Announcement date
Hole House (salt cavern)	55	2001	1995
Humbly Grove (depleted field)	280	2005	2003
Hatfield Moor (depleted field)	116	2007	1999
Aldbrough (salt cavern)	420	2009	2003

There is an additional 16bcm of storage projects at various stages of development. Holford and Stublach are in construction, a further 5 bcm is awaiting financial investment decisions and 1.8bcm is waiting for planning permission. The rest are still at concept stage.

B.4 Case study – development of the South Hook LNG terminal

This project was announced in the same year as the Langeled pipeline, 2003, but took twice the amount of time to become operational, which it did in 2009. It is a joint venture between Qatar Petroleum and ExxonMobil and the terminal was built to re-gasify LNG from the Qatargas II LNG plant in Qatar.

The project was originally projected to come on line before the 2008/09 winter but finally commissioned in Q3 2009. Some of the delay was due to problems commissioning the liquefaction plant in Qatar and the re-gasification terminal finally commissioned using LNG from elsewhere. The planned LNG train from Qatar is now in operation and regularly supplies South Hook.

Although planning permission for the terminal, on the site of a former Esso refinery, was relatively straight forward, there have been issues concerning the connection between both LNG terminals at Milford Haven and the NTS.

To connect the new LNG terminals and to reinforce the existing national gas transmission system, two new pipelines have been built. The pipelines, from Milford Haven to Aberdulais and from Felindre to Tirley in Gloucestershire are complete. However, to enable the pipelines to operate at full capacity, a new pressure reduction installation is needed near Tirley. A planning application was submitted in 2006 and rejected and the Council's decision was upheld following an appeal in 2007, although the Secretaries of State acknowledged the national importance of its construction.

Following this rejection, another site was found and a further planning application was submitted in December 2008 to Tewkesbury Borough Council. This was rejected in February 2010 and following an appeal, a local public inquiry commenced in July 2010. If planning permission is granted, construction will take approximately 15 months.

This story of planning problems illustrates that planning problems can delay any element of an infrastructure project. Although the lack of pipeline capacity has not caused any constraints as yet, it is possible it may be a problem in future, especially as South Hook's second phase is now complete and Dragon LNG also has the potential to increase its capacity.

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ANNEX C – POLICY OPTION DETAILED ASSESSMENT

C.1 Enhancing market transparency

These potential measures originate from the DECC April 2010 Gas Security of Supply Statement, and cover the following elements:

C.1.1 Improved information flows and co-operation between GB and Norwegian ISOs

Improved information flows and co-operation between GB and Norwegian ISOs	This would involve improved information flows being implemented between National Grid and Gassco (the Norwegian ISO), with a view to facilitating the early notification of any supply issues, thereby allowing remedial action to be taken as early as possible. A relatively informal protocol could be agreed between National Grid and Gassco which enabled each party to notify the other of system flow issues. If a more formal arrangement was deemed appropriate, then such a system could involve Gassco informing National Grid within, say one hour, of becoming aware of a supply issue. The trigger for such a notification would be an assessment that the potential loss of supply to GB would exceed a pre-defined level. This initial notification could be followed by Gassco issuing to NG an updated Daily Flow Notification (DFN) based on updated notifications made by Gassco shippers.

Criterion	Qualitative assessment	Ranking
Impact on consumers	May reduce daily balancing cost, with minor impact on consumers. Relatively low implementation costs.	
Impact on security	May improve overall security level and reduce costs for dealing with short-term gas shortages/emergencies. Minimal impact on long-term security.	
Complexity	Should be relatively simple and transparent.	
Impact on competition	Should be limited impact on wholesale competition as all players are notified of supply issues at the same time.	
Risks and unintended consequences	Minimal impact.	

C.1.2 Improving information flows between Ofgem and the holders of shipper interruptible contracts about demand-side response

Improving information flows between Ofgem and the holders of shipper interruptible contracts about demand-side response	This measure would be designed to provide Ofgem with consolidated information from suppliers about the total level of potential demand-side response (covering both transporter and supplier interruptible volumes) present in the GB gas market. One option would be for Ofgem to conduct a market survey of gas suppliers to assess the potential volumes present, whilst preserving commercial confidentiality. The option would not actually increase the amount of commercial interruption available (but could lead to further measures that would do this).	
Criterion	**Qualitative assessment**	**Ranking**
Impact on consumers	Potential minor reduction in consumer costs. Minimal implementation costs.	
Impact on security	Likely to have minimal impact, but could form the basis for further measures e.g. the development of other demand-side options.	
Complexity	Should be relatively simple and transparent (subject to commercial confidentiality considerations).	
Impact on competition	Likely to have minimal impact.	
Risks and unintended consequences	Risk of not obtaining any new, or useful, information may make the exercise not worthwhile.	

C.1.3 Introducing a Market Surveillance System

Introducing a Market Surveillance System	This measure would build upon the current Gas Balancing Alert (GBA) mechanism, and essentially operate further in advance of the day. Enhanced information provision by National Grid for the total GB gas system was put in place for winter 2009/10, whereby 5-day demand and supply forecasts are now produced and additional information is provided about the availability of gas from storage. These arrangements, together with any further measures deemed necessary, could be built into a Market Surveillance System that would operate on a 5-day ahead basis.	
Criterion	**Qualitative assessment**	**Ranking**
Impact on consumers	May lead to minor reduction in shipper balancing costs, with consequential small reduction to consumer costs. Moderate implementation costs (primarily IT).	
Impact on security	Should improve overall security level for short-term supply/demand problems.	
Complexity	Should be relatively simple and transparent. May require 12 to 18 months for implementation, dependent on IT complexity.	
Impact on competition	Should be limited impact on wholesale competition as all players are notified of supply/demand issues at the same time.	
Risks and unintended consequences	Given the uncertainty of weather forecasts 5 days ahead, could lead to unnecessary balancing actions.	

C.2 Refining Pricing signals

The next two measures originate from the DECC April 2010 Gas Security of Supply Statement and Ofgem's Project Discovery. Both have now been included in Ofgem's potential Significant Code Reviews letter of 12 August 2010.

C.2.1 Non-emergency cash-out revisions

<table>
<tr><td>Non-emergency cash-out revisions</td><td colspan="2">This measure would involve revising the current price setting approach for shipper cash-outs. Currently, shippers are cashed out on the basis of the more penal price when comparing the system marginal price (SMP) of National Grid's buy/sell actions on the On-the-day Commodity Market (OCM) with the system average price (SAP) of all OCM transactions plus or minus an amount representing the value of flexibility. In the event that there are no National Grid balancing actions on the OCM on the day, then shippers are cashed out at SAP plus or minus the flexibility value correction. The flexibility value correction was determined on the basis of 2002 Hornsea gas storage prices which were much lower than current prices, and therefore provides a reduced incentive to balance than is currently appropriate.

Under this measure, the cash-out arrangements would be changed so that the flexibility value correction would be set dynamically, thereby sharpening incentives, and in the event that there are no National Grid balancing actions on the day, OCM marginal prices would be used for cash-out instead of the current SAP-based price.

National Grid has raised the related Network Code modification (Mod 333) in which National Grid would calculate the default cash-out price based on the operational cost of resolving imbalances (updated on an annual basis).</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Could increase consumer prices if it led to suppliers contracting for additional gas/flexibility. Moderate implementation cost (Network Code and IT).</td><td></td></tr>
<tr><td>Impact on security</td><td>Should improve overall security level and investment signals.</td><td></td></tr>
<tr><td>Complexity</td><td>Depending on the detailed solution, could be relatively complex (and, potentially, opaque). May require around 12 months to implement, dependent on IT complexity.</td><td></td></tr>
<tr><td>Impact on competition</td><td>Could discriminate against shippers with less diverse or predictable customer portfolios e.g. smaller and/or new entrant shippers.</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>Minimal impact</td><td></td></tr>
</table>

C.2.2 Emergency cash-out revisions

<table>
<tr><td>Emergency cash-out revisions</td><td colspan="2">Currently, under emergency conditions shippers are cashed out at SAP for over-deliveries and at SMP for under-deliveries (as described in more detail in Section 2.2.2). These SAP and SMP prices are those that applied at the start of Stage 2 of a Gas Deficit Emergency.

The objective of this measure is to modify the approach to cash-out to provide additional incentives for shippers to provide gas to balance their outputs, and potentially to deliver additional gas to assist in relieving the system gas deficit. This could potentially be achieved by setting SMP buy on the basis of NGG buy transactions on the OCM during the emergency i.e. a very high price, and by setting SMP sell also to a high price (basis to be determined) to incentivise shippers to over-deliver.</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Could increase consumer prices if it led to suppliers contracting for additional gas/flexibility, although this would be unlikely given the low probability of an emergency occurring. Moderate implementation cost (Network Code and IT).</td><td></td></tr>
<tr><td>Impact on security</td><td>May improve overall security level and investment signals (dependent on the level chosen for new cash-out price), although shippers may regard emergencies as low probability events and therefore make no provision for additional gas supplies.</td><td></td></tr>
<tr><td>Complexity</td><td>Depending on the detailed solution, could be relatively complex (and, potentially, opaque). May require around 12 months to implement, dependent on IT complexity.</td><td></td></tr>
<tr><td>Impact on competition</td><td>Could discriminate against shippers with less diverse or predictable customer portfolios e.g. smaller and/or new entrant shippers.</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>Minimal impact</td><td></td></tr>
</table>

C.2.3 VOLL compensation for interrupted firm customers

This potential measure originated from Ofgem's Project Discovery and was included in Ofgem's potential Significant Code Reviews letter of 12 August 2010

VOLL compensation for interrupted firm customers	The measure would involve compensating firm customers whose supply is interrupted at a price set at the Value of Lost Load (VOLL). The mechanism for calculating VOLL would need to be determined, but could be based on an estimate, by sector of the economy, of the Gross Value Added (GVA) that would be lost if firm customers were interrupted.	
Criterion	**Qualitative assessment**	**Ranking**
Impact on consumers	Potentially significant impact on consumers as gas suppliers pass on the cost of insuring against the VOLL exposure.	
Impact on security	Minimal improvement to overall security level due to rare occurrence, and probable reluctance of players to invest on this basis.	
Complexity	Depending on the agreed approach for calculating VOLL, could be relatively complex and opaque.	
Impact on competition	Could have positive or negative impact dependent on how suppliers adapt to VOLL exposure.	
Risks and unintended consequences	Potential for setting VOLL at the wrong level. Potential for VOLL to change over time. Likely to lead to the perverse effect of interrupting customers not belonging to the errant gas supplier(s).	

C.2.4 Enhanced demand-side participation via SO-based auction

There are a number of potential options for encouraging additional demand-side response in the gas market.

An additional option would be to allow end-users to bid into the On-the-day Commodity Market (OCM). This was an option considered in an earlier Pöyry study[9] on gas supply security for DECC, and had the greatest potential benefit to improving security of supply amongst all of the options considered and was recommended for further consideration should the volumes of I&C distillate backup decrease rapidly.

<table>
<tr><td>Enhanced demand-side participation via SO-based auction</td><td colspan="2">The objective of this measure is to increase the potential demand-side response in the gas market via an SO-conducted auction for additional interruption (this would provide supply/demand interruption capability lost with the recent Network Code Mod 90/195AV, which removed transporter interruptible status). This could be achieved via the following approach:

(i) Introducing an auction to provide a demand side insurance incentive that shippers would adopt in relation to their I&C sites – this arrangement would be independent of the transporters’ needs for capacity constraint interruption;

(ii) The level of required volumes would be set for a fixed period, say 5 years, by the SO based on its forecast severe annual and peak supply and demand position.</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Minimal impact on consumers. Moderate implementation cost.</td><td></td></tr>
<tr><td>Impact on security</td><td>Could potentially contribute (reinstate) a significant level of daily interruption capacity</td><td></td></tr>
<tr><td>Complexity</td><td>Moderate complexity – may require 12-24 months for implementation.</td><td></td></tr>
<tr><td>Impact on competition</td><td>None expected.</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>Risk that I&C customers and their shippers may not recognise insurance value, and therefore take-up could be limited.</td><td></td></tr>
</table>

9 www.ilexenergy.com/pages/Documents/Reports/Gas/114_GBGasSecurityOfSupply_200910_v0_4.pdf

C.3 Defined security standards

These measures originate from the DECC April 2010 Gas Security of Supply Statement.

C.3.1 Modification to existing Supplier Security Standard

<table>
<tr><td>Modification to existing Supplier Security Standard</td><td colspan="2">Consideration would be given to modifying the existing supplier obligation to provide continuous supply to domestic customers during a 1-in-50 winter, with the objective of providing a higher level of overall supply security in the GB gas market and in a way which reflects the changing risks being experienced in the market.

For example, the current standard could be modified to include a greater proportion of the gas supply population e.g. to include all firm customers, and/or to include a measure of interruption to current gas infrastructure i.e. to be consistent with the EU N-1 gas security regulation, although such a measure may not be as robust as a 1-in-50 winter.</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Higher level of security should increase investment, which will lead to higher costs for consumers. Moderate implementation cost.</td><td></td></tr>
<tr><td>Impact on security</td><td>Would be designed to provide increased level of security</td><td></td></tr>
<tr><td>Complexity</td><td>Would be no more complex than the current regime.</td><td></td></tr>
<tr><td>Impact on competition</td><td>May impact wholesale market liquidity</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>Likely to be onerous to monitor effectively.</td><td></td></tr>
</table>

C.3.2 Supplier Security Statements

<table>
<tr><td>Supplier Security Statements</td><td colspan="2">Supplier information about winter supply arrangements would be provided to the regulatory authorities, thereby allowing the regulator to take a holistic view of the total market, and flag up any potential issues to the market in advance of the following winter. The regulator would publish the aggregated supply picture. The obligation to provide information would apply to suppliers of all customer sectors – however the security assessment would focus on retail (domestic and, potentially, small medium enterprise (SME)) customers.

The data collected could cover customer demand volumes by sector, supply volumes, demand-side flexibility volumes and how shortfalls would be addressed. The data would indicate how the supplier intends to meet the 1-in-20 peak day and 1-in-50 severe winter requirements.</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Relatively low implementation cost.</td><td></td></tr>
<tr><td>Impact on security</td><td>Unlikely to encourage suppliers to make additional provision for additional security, subject to nature of sanctions for non-compliance.</td><td></td></tr>
<tr><td>Complexity</td><td>Could be some ambiguity around supplier information. Would not be fully transparent to the market because of commercial sensitivity.</td><td></td></tr>
<tr><td>Impact on competition</td><td>May impact wholesale market liquidity</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>If it is unclear how the information may be used, this could create regulatory uncertainty. In addition, if the position reported is unclear as potential of spot gas supplies are not included it may give a false picture on the security status.</td><td></td></tr>
</table>

C.3.3 Security of supply obligation for suppliers

<table>
<tr><td>Security of supply obligation for suppliers</td><td colspan="2">This measure would take the form of an obligation placed on retail suppliers (potentially via the use of Supplier Obligation Certificates) to continue to supply, certainly to domestic customers and potentially to small and medium enterprises as well, in the event of severe weather or disruption to an external supply (N-I infrastructure test). The form of such an obligation would be consistent with the recently agreed EC Security of Gas Supply Regulation.

The obligation could be discharged by suppliers via a range of potential actions, such as:
Maintain storage stocks to meet the obligation for their domestic customers
Contract with other owners to storage capacity to meet the domestic supply obligations
Demonstrate that they have appropriate upstream supply contracts that would provide the required guaranteed supplies
Demonstrate that they have adequate demand-side response contracts in place with large customers.</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Moderate increase on domestic (and SME) consumer prices. Moderate implementation costs, dependent on Ofgem’s audit approach, and the frequency with which suppliers are required to provide the necessary compliance evidence.</td><td></td></tr>
<tr><td>Impact on security</td><td>Moderate impact likely, subject to Ofgem’s enforcement approach.</td><td></td></tr>
<tr><td>Complexity</td><td>Likely to be quite complex, and not very transparent, given the potential confidentiality considerations.</td><td></td></tr>
<tr><td>Impact on competition</td><td>Likely to increase prices disproportionately for the domestic sector. May artificially inflate the price of market flexibility.</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>May reduce traded spot gas, driving suppliers to long-term contracts in order to demonstrate compliance with the obligation.</td><td></td></tr>
</table>

C.3.4 *Obligation on CCGTs to have distillate back-up facilities*

This was an option considered in the Pöyry study on gas supply security for DECC, and had a potential benefit to improving security of supply, reflecting the probability analysis that showed it being used once in every 3 years. It was recommended for further consideration should the volumes of CCGT distillate backup decrease through any decommissioning of existing facilities or insufficient new power stations being fitted into the future. Distillate backup is also required for black-start capability and is recompensed via the electricity market arrangements.

<table>
<tr><td>Obligation on CCGTs to have distillate back-up facilities</td><td colspan="2">This measure would require existing CCGTs capable of using distillate as fuel to hold back-up supplies, which they could switch to in the event of a tight gas market. The proposal would not require existing facilities, or planned new facilities, without back-up capability to install such capability. This limitation is proposed in recognition of the fact that requiring back-up capability to be newly fitted could lead to the CCGT becoming uneconomic.

It is assumed that the costs of the back-up supplies would be recharged back to the market, as opposed to being picked up by government.</td></tr>
<tr><th>Criterion</th><th>Qualitative assessment</th><th>Ranking</th></tr>
<tr><td>Impact on consumers</td><td>Minor consumer price increase as a result of distillate costs being recharged back to the market.</td><td></td></tr>
<tr><td>Impact on security</td><td>Significant impact likely, but may be constrained by distillate restocking capability for CCGTs.</td><td></td></tr>
<tr><td>Complexity</td><td>Relatively simple and quick to implement, if limited to CCGTs with existing capability.</td><td></td></tr>
<tr><td>Impact on competition</td><td>May have a distorting effect on competition if costs are charged back to electricity / gas markets.</td><td></td></tr>
<tr><td>Risks and unintended consequences</td><td>Restocking large volumes of replacement distillate could put strain on the distillate distribution chain if required for a longer term period, as the stock of barges and road/rail tankers does not have the spare capacity to maintain flows for more than a few days without affecting the distribution of heating oil and distillate.

However, if insufficient capacity is available it will have a negative impact on gas security.</td><td></td></tr>
</table>

C.3.5 Strategic LNG cargoes offshore

Strategic LNG cargoes offshore	This measure would involve the Government procuring (or obliging a central body such as NGG to procure) one or more tankers of LNG at the start of each winter and keep it/them offshore ready for immediate supply delivery, or for sale into the market after the worst of the winter had subsided. This is, in effect, a form of temporary strategic storage. The LNG could be brought to market by the holder (government or NGG) auctioning the LNG into the GB market, probably via the OCM. The auction revenues could be offset against the LNG purchase cost and the tanker rental cost. This approach was used by Spain in 2003/4 and 2005/6, although the size of the GB market would limit the contribution an LNG tanker could contribute.	
Criterion	**Qualitative assessment**	**Ranking**
Impact on consumers	Probably minor impact on consumer prices, as costs would need to be recharged to the market.	
Impact on security	Would provide effective insurance against short-term (two or three days) supply issues, but would not address longer term issues.	
Complexity	Need to define frequency and guidelines for use of the facility.	
Impact on competition	May have minor impact inflating wholesale gas market prices.	
Risks and unintended consequences	If the auction process was entirely open, then foreign parties could bid, and the LNG might end up being delivered outside GB.	

C.4 Non-market barriers

C.4.1 Planning process

Planning process	This measure would involve undertaking a critical review of the planning process as it applies to energy infrastructure projects, in the light of the current Government's plan to abolish the Infrastructure Planning Commission. It would also involve implementing an active monitoring, and potentially intervention, system in relation to the progress of projects through the planning system. This should serve to alert policymakers (DECC, Ofgem) to issues relating to key projects, and facilitate decision-making and the resolution of issues.	
Criterion	**Qualitative assessment**	**Ranking**
Impact on consumers	By bringing forward timely investment in storage, should reduce the risk of price spikes feeding through to consumer prices.	
Impact on security	Should assist allow the GB gas market to react more quickly and bring on additional infrastructure (storage, LNG regasification, interconnectors) in shorter timescales.	
Complexity	Objective is to reduce the complexity of the current process.	
Impact on competition	Reducing the elapsed timescale of the planning process should assist in the development of competition between different forms of infrastructure.	
Risks and unintended consequences	Minimal.	

C.4.2 Infrastructure access arrangements

Infrastructure access arrangements	The objective of this measure would be to ensure that the GB regulatory regime governing access to infrastructure (interconnectors, storage and LNG) supports the development of competition and allows security of supply to be maintained. This would require the development (by Ofgem and other relevant policy markers) of a set of guidelines for the GB market addressing current market issues, including the following ▪ TPA exemptions – clarity should be provided by Ofgem as to the current and potential future criteria that will be used in granting, not granting, and withdrawing TPA exemptions for all forms of infrastructure (interconnectors, storage and LNG regasification). In particular, guidance should be provided on the potential treatment of infrastructure access once the term of an exemption has expired, e.g. the circumstances under which an exemption could be extended or replaced by an alternative regime e.g. TPA.. ▪ Application of TPA – clarity should be provided on the circumstances under which a TPA regime would be appropriate for infrastructure access, and the conditions, features and requirements that would apply within such a regime.	
Criterion	**Qualitative assessment**	**Ranking**
Impact on consumers	Should facilitate a more efficient investment regime for new infrastructure, leading to potential reductions in consumer costs.	
Impact on security	Should provide regulatory stability that will facilitate investment in new facilities, and reduce the risk of over-investment.	
Complexity	The measure should add clarity and reduce complexity.	
Impact on competition	Clarity on the access arrangements should facilitate investment in new infrastructure thereby fostering competition.	
Risks and unintended consequences	If too many TPA exemptions are made then this may prevent the new capacity being made available to the rest of the market and/or to new entrants. Ensuring the UIOLI provisions are enforced and available in practice will be critical.	

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