

SUBMISSION FROM NATIONAL GRID

Executive Summary

- National Grid is committed to helping the UK move to a low carbon economy. Our role puts us at the heart of one of the greatest challenges facing our society, supporting the creation of new sustainable energy solutions for the future and developing an energy system that can underpin our economic prosperity in the 21st century. We are committed to applying our expertise to help meet this challenge.
- National Grid owns the high-voltage electricity transmission system in England and Wales. Through a well-planned development and maintenance programme, our network continues to be extremely resilient. Over the next decade, we are investing around £20 billion to ensure that our electricity and gas networks continue to provide safe and reliable energy supplies to customers, as well as future-proofing against significant security and weather events.
- In addition, as the National Electricity Transmission System Operator, National Grid is responsible for co-ordinating and directing power flows across the transmission system in Great Britain, which at 99.99995% is the most reliable network in Europe. We are responsible, in accordance within an agreed set of security standards, for ensuring that we balance electricity generation and demand consumption in real time whilst also maintaining a stable level of voltage control. We take our obligations to secure the electricity network very seriously, continuously monitoring, future generation, and demand via our Future Energy Scenarios and System Operability Framework, designed to provide greater clarity on the likely system impacts of our scenarios.
- In the event of a sudden shock, such as an instantaneous loss of generation, we have thoroughly tested plans and procedures in place to ensure the network balancing frequency does not fall outside of the statutory limits stipulated in our licence and industry operating codes.
- Shifts in the way energy is used, the need to manage ageing infrastructure and a changing energy supply mix all drive a need for investment. In particular, investment in networks to connect new sources of power and gas is a priority for ensuring security of supply as the country moves towards a low carbon economy. Part of that challenge is ensuring that new power sources, whether from nuclear, wind and other renewables are connected to the electricity transmission network in order to carry the electricity to where it is needed. Much of the new electricity generation will be in the coastal areas, or offshore, where there is currently very little existing transmission infrastructure. Therefore, a stable investment framework is essential for minimising the costs of financing these investments.
- Energy efficiency should be a core part of long-term infrastructure planning, as domestic and wider energy efficient measures require effective planning. An active demand side will play an important role in meeting the challenge of delivering energy affordably and sustainably, and will reduce the need for investment in generation and networks. To encourage greater demand side participation there needs to be a clear, stable policy framework that is supported

by delivery mechanisms that enable smart technology and initiatives to drive greater consumer awareness and participation.

Questions

1. Supply and whether there is sufficient generation to meet demand, in particular to the end of the decade. *What role will new generation that is under construction, or has been consented play?*

1.1. The electricity transmission network is operated on a whole GB basis and therefore any generation adequacy issues are, in the vast majority of cases, the same for Scotland as they are for the rest of GB. However, we do consider specific risks in sub-regions of the system.

Electricity demand security of the transmission network is reviewed annually and considers transmission network capability, generation and demand levels. The annual assessment is carried out in line with agreed industry standards¹ and the analysis is carried out cooperatively, by the relevant transmission owners for their area of the transmission system, through the Joint Planning Committees. This is published annually through industry documents such as the Electricity Ten Year Statement.²

1.2. Scotland currently (winter 2014/15) has a 3GW positive differential between the secure transmission capability and the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS) requirement. With the closure of Longannet and unavailability of Peterhead this could be reduced to ~1.5GW. However, on completion of the Western Link, the transmission system will have 2.5GW more capability compared to the SQSS requirement. The detail of this against the industry agreed demand security review is shown in Figure 1 below.

1.3. A number of fossil fuel plants are expected to close in the coming years, due to a combination of environmental legislation, age and profitability. Consequently, it is predicated that, ahead of the introduction of the Capacity Market in 2018/19, electricity supply margins will be tighter. There are a number of tools that can be utilised to mitigate some of the risk, such as National Grid's Demand Side Balancing Reserve (DSBR) and Supplementary Balancing Reserve (SBR) products and DECC's Demand Side Response (DSR) Transitional Arrangements.

1.4. However, it is vital that timely new plant is built to replace these closing plants. There are a number of mechanisms in place to support low carbon generation that will help deliver the required capacity and along with new interconnectors, new fossil fuels such as gas plant will be required to ensure security of supply into the future.

1.5. Interconnection with Europe can play an important role in delivering security of supply, as it gives GB access to generation diversity across Europe. With the introduction of Market Coupling, the flow of energy will be determined by

¹ [National Electricity Transmission System Security and Quality of Supply Standard](#)

² [Electricity Ten Year Statement](#)

relative prices and should ensure energy goes to where it is needed most i.e. the market with the highest prices. By 2019/20, interconnectors will be able to participate in the Capacity Market which should provide greater confidence that both existing and any new interconnectors (a number of which have been granted a Cap and Floor regime by Ofgem) will deliver energy to GB.

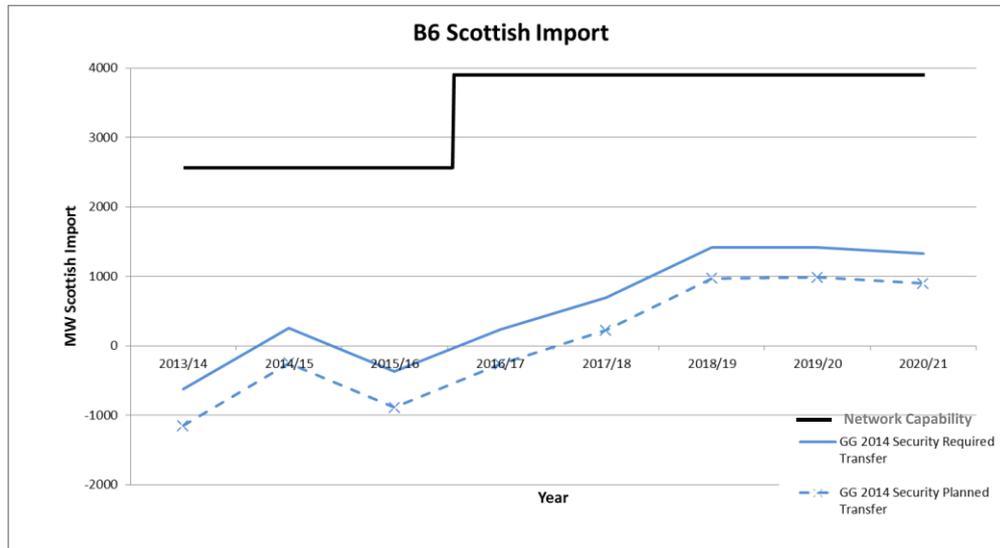


Figure 1- Demand Security Assessment for Scotland against industry standards

The Scottish Government aims to have a “largely decarbonised electricity system by 2030”. What does this mean in practice, and are there sufficient tools in place to bridge the move from fossil fuels to renewables?

- 2.1. We introduced our System Operability Framework (SOF)³ in 2014 to provide a holistic view for our stakeholders of how radical changes in the energy landscape, identified in our Future Energy Scenarios (FES),⁴ impact future system operability. The SOF process assesses existing network performance, identifying the root causes of incidents and constraints observed on the system in recent years, and highlights potential new changes in system dynamics in future years based on system studies.
- 2.2. Moving to a low carbon generation mix, while achievable, does produce new challenges in particular around intermittency, system balancing, and general system operability. Some of these issues can be addressed through existing technology and tools but in addition, new technologies e.g. storage will need to play a part.
- 2.3. With the introduction of Electricity Market Reform (EMR) there are support mechanisms in place to help deliver both low carbon capacity and security of supply. Other tools and technologies as described above may be required to ensure system resilience.

³ <http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/System-Operability-Framework/>

⁴ <http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Future-Energy-Scenarios/>

- 2.4. To further facilitate the development of the transmission networks, to meet requirements such as the move to a largely decarbonised electricity system, the introduction of new transmission system planning processes and approaches have been developed through the Integrated Transmission Planning and Regulation (ITPR) review. From roughly the end of 2015/16, a Network Options Assessment (NOA) planning process and publication will be introduced for the whole of the Great Britain transmission network. The NOA will involve greater coordination between the system operator and transmission owners, facilitating decision making on transmission reinforcements, to enable ambitions in the electricity market to be realised economically and efficiently. The NOA will be broadly similar to National Grid's Network Development Policy, which received significant commendation from Ofgem when consulted upon and introduced in 2013. Shifts in the way energy is used, the need to manage ageing infrastructure and a changing energy supply mix all drive a need for investment, particularly as the country moves towards a low carbon economy.
- 2. How predictable peak demand is at present, and how is this likely to change in the coming decade. *In particular, what impact will the development of demand side response have? What could be done to improve developments in this area?***
- 3.1. Over the last decade peak demand has become more difficult to predict due to a number of factors:
- Increasing drive towards energy efficiency reduced demand across all sectors.
 - The 2008/9 recession, also reduced demand across all sectors.
 - Changing consumer behaviour, including the relationship between energy prices and energy usage and increased awareness of environmental issues, such as reduction carbon footprints.
- 3.2. These factors led to uncertainty over the future direction of peak demand, which contributes to the difficulty in predicting peak demand.
- 3.3. Given the uncertainties around the economic recovery and future make-up of the economy, levels of green ambitions and future energy prices we see demand in general, and in particular peak demand, being as challenging to predict as it has been over the last decade.
- 3.4. Our annual Electricity Ten Year Statement aims to provide clarity and transparency on the potential development of the GB Transmission system for a range of scenarios (referenced above). Our Future Energy Scenarios also has more detail around peak demands, as well as implications for the future energy mix. This includes detailed network analysis, which enables National Grid to identify strategic gas and electricity network investment requirements for the future.

- 3.5. DSR takes mainly two forms. The first shifts or reduces demand, which has the effect of reducing peak demand. The second is in the form of back up generation, such as backup generators.
- 3.6. Either higher underlying peak demand or high peak pricing will likely drive heavy take up of DSR. There is likely to be an increasing role for DSR into the future, which could help to reduce peak demand that would otherwise need to be met by conventional forms of generation, such as gas or coal plants, and so reduce the overall levels and costs of conventional generation required to meet peak demand. There are a number of support mechanisms in place to encourage greater participation of demand side products such as DSR, TA (Transitional Arrangements) and CM (Capacity Mechanism).
- 3.7. As the System Operator, we are responsible for balancing the system in the final hour before real-time. This role is called residual balancing and occurs after the market has closed. It accounts for less than 3% of energy transactions in the market. Our transmission licence obliges us to do this in a manner which represents the best value for money for consumers. This includes a range of generation and demand side services where it is economic to do so. We continue to assess and develop new commercial services to do this role more economically in the best interests of consumers.
- 3.8. More than 97% of all traded actions go through suppliers, which is where there is substantial opportunity to increase demand side participation in the electricity market. Suppliers have direct relationships with customers, they have the ability to incentivise the demand community to shift demand away from peak periods, e.g. through time of use tariffs or procuring DSR services from intermediaries, or engage in more permanent demand reduction. We also see a role for smart technology and energy systems; smart grids, meters and appliances. Any reduction in peak demand would reduce the need for investment in peaking generation plant.
- 3.9. In order to successfully encourage greater demand side participation in the future, there needs to be a clear stable policy framework that is supported by delivery mechanisms, as well as pricing signals and communication initiatives to drive greater consumer awareness and participation. There is however a need for clear policy direction with respect to demand side products, particularly the consideration as to whether they should be subject to the same commercial framework as generation or whether more specific arrangements should be developed. Whilst the establishment of a level playing field is important, more general policy direction specific to demand side may prove beneficial in the short term to ensure the deployment of technologies in a timely manner.
- 3. A number of new transmission network projects are currently under construction or being planned. *What role will these have in securing electricity supplies, and where should future investment be directed? What role might the distribution network, and a single European electricity market play in securing supplies?***

- 4.1. There are significant reinforcements planned on the electricity transmission network to facilitate Scotland's long-term ambitions with respect to green energy and targets. Many of these investments will also contribute significantly to the security of demand within Scotland at times of low wind and during generation maintenance periods.
 - 4.2. Some of these key reinforcements are the Western Link and Beaulieu-Denny which will both be complete by 2017. Pre Western HVDC Link, 2.6GW (almost half of the 5.4GW Scottish peak demand) can be supported from England and Wales and post Western Link this will be as high as 75% of peak demand. Pre Beaulieu-Denny and Western HVDC Link, 65% of the demand in the north of Scotland, on the Scottish Power to Scottish Hydro Electric boundary, can be secured by the transmission system. Following the completion of this work the transmission system will be able to supply wholly the demand in this area.
 - 4.3. In the future, the transmission network owners will continue to review the network requirements in the Scottish network areas. Should any investment be required because of this work, this would be taken forward through the appropriate process within the current regulatory frameworks.
- 4. A number of significant changes to the electricity market have recently been finalised and are being put in place to ensure competition and cost reflective prices for consumers. *Are policies such as the Capacity Mechanism under Electricity Market Reform adequate, and what other long term signals might be necessary to ensure security of supply?***
- 5.1. The first Capacity Market auction took place in December 2014, a total of 65GW of capacity qualified to participate in the auction against a target of 48GW. The auction itself successfully procured 49.3GW of capacity for delivery in 2018/19. This was achieved at a cost of £19.40/kW, a further 2.5GW of capacity will be procured in an auction that will take place one year ahead of the delivery year allowing additional opportunity for fine tuning of the requirements for 2018/19 as well as providing an additional route to market for demand side response.
 - 5.2. The successful outcome of the 2014 auction ensured that for the 2018/19 delivery year there will be adequate capacity available on the network to meet peak demand. The EMR policy objectives and the design of the capacity mechanism clearly set out the Government's commitment to ensure security of supply and how this would be achieved through the Capacity Market.
 - 5.3. Security of Supply is continually monitored and reported to Government on a regular basis, in addition to an annual report that provides a view of Electricity Capacity Adequacy and informs Government of the required volume of capacity to be procured in subsequent auctions. These reports are published and available to the market. Further regular reporting of forecast future market conditions coupled with information and analysis of current market behaviours could provide additional, useful information to the market which in turn could help to ensure security of supply.

5. Any other matters concerning security of supply that you would like to bring to the Committee's attention.

5.1 A review of the security of supply within Scotland has recently been conducted by National Grid Electricity Transmission, Scottish Hydro Electric Transmission (SHET) and Scottish Power Transmission (SPT). The information has been published on National Grid's website.⁵

5.2 The analysis focused on three key periods of operation over the course of a year when the system could expect to be stressed by generation and demand scenarios; these were winter and summer peak and also a summer minimum condition. The areas of the network that were reviewed were north of England, England to Scotland boundary and internal boundaries in Scotland including the one between the transmission owners SHET and SPT.

5.3 The analysis was also carried out over three discrete points in the future. These three points were relative to reinforcements that are currently planned to reinforce areas of the network. These major reinforcements were Series and Shunt compensation (completion assumed Q4 2015), Western Link (completion assumed Q4 2016) and Beaulay-Denny upgrade (completion assumed Q4 2015). The boundaries that were assessed are shown in Figure 2 below.

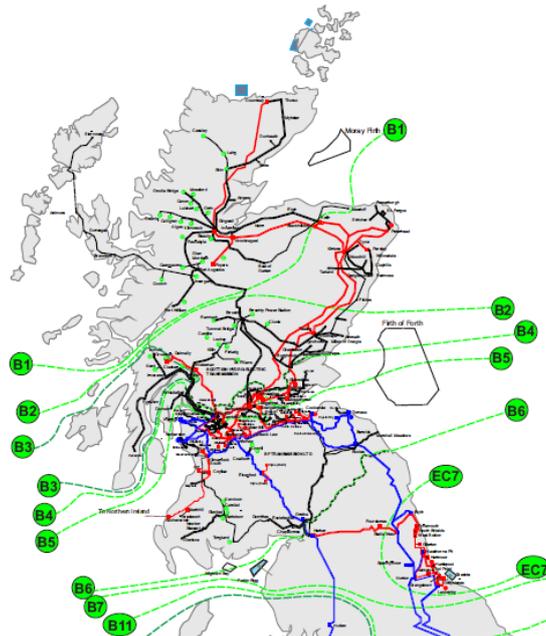


Figure 2 – Geographic boundary map of transmission system in Scotland and North England

5.4 These boundaries are assessed as part of each Transmission owners licence and are continually reviewed together as part of the Joint Planning Committee. In respect of Scottish security of supply, we intend to review the

⁵ <http://www2.nationalgrid.com/UK/Services/Balancing-services/System-security/Transmission-Constraint-Management/Transmission-Constraint-Management-Information/>

transmission requirements to support demand security biennially and discuss it in the relevant industry information documents.

5.5 The analysis that was undertaken took all of the generation shown in Figure 3 and took sensitivities off to stress test the system. This analysis was carried out by removing key generation plant such as Longannet and Peterhead and then taking out at least one other key power station within each sensitivity study. The generation sensitivities were taken on the key conventional plant shown in Figure 3 below. These were; Hunterston, Torness, large pump storage units in Scotland and some key units in England. The stress test involved a no-wind situation and only limited Hydro as a consistent background for all of the analysis.

5.6 Stress testing of the network occurred over different demand points throughout the year and with varied prevailing network conditions, different generation backgrounds and fault conditions on the network. In total, some 140 sensitivity backgrounds were analysed each including a varying number of key transmission faults at a time; meaning that over 1000 potential scenarios were analysed in determining the network capacity.

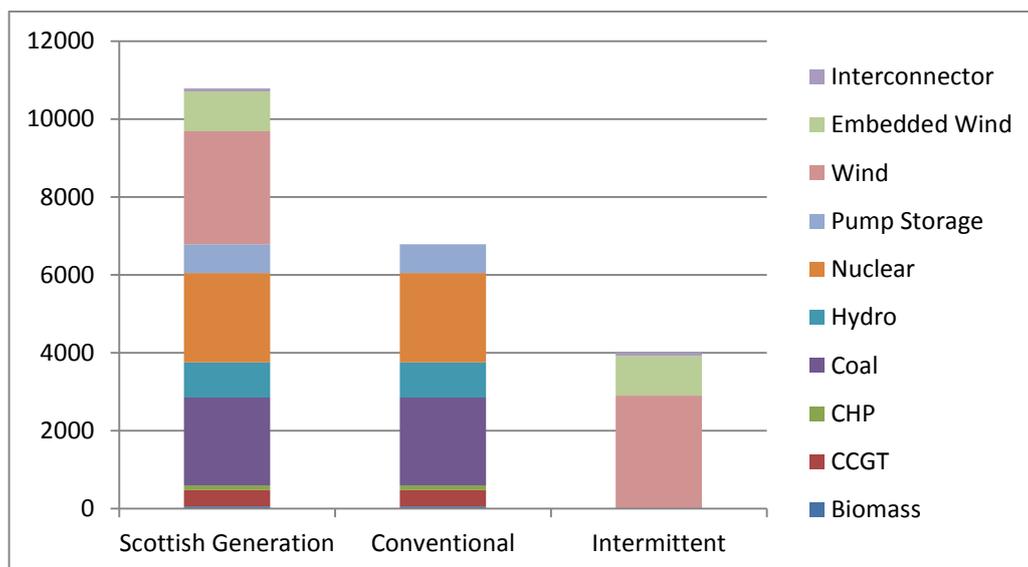


Figure 3 – Current generation volumes within Scotland by Plant Type

5.7 As a result of the work undertaken by the transmission owners, in advance of the key network reinforcements, a new contract to ensure Scottish demand security and ability to operate the network has been placed with Peterhead by National Grid as system operator and further investments in the network have been identified by the three transmission owners.