

14th August 2009

Operating the Electricity Transmission Networks in 2020 – Centrica Response

Dear Sir / Madam,

Thank you for the opportunity to respond to the above consultation. As the largest domestic supplier of gas and electricity, we fully recognise the need to ensure an efficient, economic and effective network with which to meet our customer's and the UK's electricity demands. We are pleased that National Grid are thinking about and consulting industry on the changes that may affect the transmission network out to 2020, and welcome the opportunity to feed in our views and experiences into National Grid's future plans.

As an integrated energy company, the future development of the network is a key issue. We have consulted internal stakeholders from across our business, including generation, supply, metering and new energy. Overall, we agree with the majority of analysis and conclusions drawn by National Grid throughout the consultation, in which we have identified three primary factors that will need more in depth consultation and analysis moving forward:

1. Volume of intermittent generation

As wind generation replaces more conventional generation, this adds additional complexity to balancing and ensuring security of supply. The variable nature of wind will have considerable consequences for how the network is managed, and will require accurate and innovative forecasting and modelling. Operating margins, STORR, plant availability and flexibility requirements are just a few examples of aspects of network operation that will be affected with greater wind generation volumes.

2. Managing costs

The consequences of variable wind generation will inevitably increase network management costs, with greater reserve requirements, more flexible plant and increases in the volume of balancing actions all carrying a cost burden. Coupled with the need to invest in demand side developments such as demand side management, smart grids, embedded generation and electric vehicles, it is clear that managing the costs of such sweeping change will be a key requirement to ensure a smooth transition.

3. Changes to the balancing and network operations

Along with the changes in balancing and network operations as a result of increased wind generation, there will also be changes as a result of balancing services offered by demand. Electric vehicles as storage and demand side management could play a key role in balancing the network, and a smarter communications network carrying more information will enable new techniques and efficiencies in network management. We believe much more research and analysis should be carried out to identify the true potential of all sectors of demand to be able to contribute to balancing and network operations.

We respond to the specific questions posed under each chapter in the consultation below.

[Chapter 5: Developments in Electricity Generation & Demand](#)

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Chapter 5. Developments in Electricity Generation and Demand

Wind Generation

Q1. How do National Grid's observations align with your experience or modelling of wind generation?

As more and more wind assets replace existing thermal plant and gain a greater share of the UK's energy mix, we recognise the growing need for effective and accurate wind forecasting and modelling to ensure system balance.

The observations presented by National Grid centre around "persistence forecasting." From our experience, we have found this method of forecasting to be accurate primarily in the short/medium term, up to 4-6 hours ahead. National Grid should consider and possibly test existing and new methods for different time horizons while wind generation is still relatively low.

A technique commonly used by Centrica to examine errors in wind forecasting is to look at a day ahead MAPE (Mean Absolute Percentage Error):

$$\text{Absolute \% Error} = \frac{(\text{Forecast output} - \text{Actual Output})}{\text{Plant availability}}$$

It is important forecasts and models contain as much up to date data as possible surrounding current plant status and output, using as close to real time wind farm data as possible. It will be important for National Grid to procure such data to track performance and enable improved forecasting and modelling accuracy. This would help mitigate the impact of particular weather systems in parts of Great Britain such as a settled period of high pressure which may have not been fully incorporated into original modelling and forecasting.

As wind begins to play a greater role in the balancing mechanism, and wind forecasting becomes more important, new ways of managing and utilising wind farms and wind farm data such as SCADA data may need to be considered. We suggest that National Grid should consider plausible alternative market arrangements than those which are currently in place, which may be more effective with a greater wind influence. For example, a central player (such as National Grid) could take responsibility for all aggregated wind forecasting and balancing activities, with appropriate commercial arrangements in place with wind generators so the central player can take on the imbalance risk associated with wind.

Use of best practise will also help improve modelling of wind generation going forward. Spain is a particular example of using real time data and innovative control techniques to ensure the system remains balanced with high fluctuations in wind output. Texas in the USA is an example of high wind energy penetration that is located away from the demand centres. This would have some parallels to the expected UK market in 2020. Centrica, through its subsidiary Direct Energy has a major presence in Texas, and we would be happy to work with National Grid to investigate how wind generation is forecasted and modelled in that part of the world.

Q2. Are we correct in assuming that wind generation is controllable enough to assist in operating the networks?

There are a number of factors that will determine if and when wind generation is used to operate and balance the networks. The primary two are technology and economics. From our experience, the current rotary and mechanical components in a wind turbine do not respond well to rapid and numerous changes in operation, as could potentially be expected if it was being used to balance the system. As National Grid states however, technological developments have made and are still making wind turbines more flexible and controllable, with developments in managing inertia and turbine degradation for example. Therefore it is fair to say as more and more wind generation connects onto the network, these assets may be controllable enough to assist in operating the network.

However, we believe the technological capacity to do so will be outweighed by the economics required to turn down a wind generator. The incentives on wind farm generation such as ROCs, the high initial investment in building a wind farm and zero fuel cost would mean that it would require a high price to turn down. Additionally, it is not yet clear how component wear would be accelerated by partially loading wind turbines, but we can assume that increased maintenance and repair costs due to excessive brake use on the turbines for example would inflate costs even more. Environmental and/or political pressures may also exist to maintain full loading. Therefore, we believe that any significant use of controlling wind generation would be uneconomical and unviable.

An additional point to consider is the technical specification and warranty terms of current operational wind farms. The parameters in the technical specifications for the turbines may include specific limits or restrictions on operational use. By operating them in a manner in which they were not originally designed, there may arise conflicts between operators and manufacturers of wind turbines should technical problems occur.

Supercritical Coal

Q3. Should National Grid assume that Supercritical Coal generators will provide some flexibility in operation which will assist in operating the networks?

No comments.

New Nuclear Generation

Q4. Should we assume that nuclear generators will continue to concentrate on base load operation?

We do agree that nuclear generators will for the most part operate at base load. As with wind generation, the technology may develop [or exist?] to enable a more flexible operation, however as National Grid states, the economic considerations make this unlikely.

Generators in France in particular often see their nuclear plants being controlled to balance the system due to the penetration of nuclear energy. Although still an undesirable and uneconomical use of nuclear plant, we believe that if National Grid is looking to use additional plant to help them operate and balance the network, there may be some merit in using nuclear.

The recent report "Energy security: a national challenge in a changing world" produced by Malcolm Wicks at the request of the government sets out an aspiration that nuclear generation should make up 35-40% of the UK's energy by 2030. If these sorts of aspirations are to come to fruition, it will be important for nuclear to add some degree of flexibility in the future.

Carbon Capture and Storage (CCS)

Q5. Is it likely that Carbon Capture plant will impose material restrictions on the operation of electricity generating plant?

The scale of any impact from CCS will depend on how rapidly and in what volumes the technology is rolled out. Generally we believe that post-combustion CCS on CCGT plants is a prohibitively expensive form of carbon abatement, making it unlikely to be widely taken up and have any material impact on generating plant. Relating to coal, we also believe there is a greater inherent inflexibility that comes with CCS.

The government also envisages rewarding CCS plants on the basis of tonnes abated which relates directly to MWh produced, so as with nuclear and wind there is likely to be a significant price to pay for accessing any flexibility that these plants may have.

Tidal Generation

Q6. Are there other aspects of tidal or marine technologies that we should consider further at this stage?

As a costly and currently underdeveloped method of electricity generation, we believe there are not and major aspects of the technology to consider at this stage.

Gas Fired Generation

Q7. Are there other restrictions we should consider in developing a view on gas fired generator flexibility?

Aside from the CCS issues mentioned in question Q5, we believe National Grid have considered the primary restriction which is lower load factor gas fired generation and a consequence of a greater need for flexibility. As stated, this could in turn have an impact of CCGT operations and maintenance, and the underlying economics of this generation type. The move to lower load factors with more flexible running will mean a need for these plants to capture high prices when they are running, else their fixed costs (which may also increase) won't be met. Availability of plant may also become a greater risk as the number of starts and/or outages increase the down time for some gas fired generators.

The impact of increased gas fired flexibility may also have knock on effects into the gas network, and we suggest a more in depth look into the relationship between the gas and electricity networks to greater understand how fundamental changes in one may affect the other.

Trends

Q8. What is your view of future electricity demand growth?

Our views on electricity demand growth are somewhat aligned with those of National Grid, however we do foresee a number of circumstances that may cause a gradual increase in demand above the 60GW predicted up to 2020. National Grid offsets increased demand through economic growth with increased energy efficiency measures, and offsets the increased use of electricity in transport and applications such as heat pumps through embedded generation. Up to 2020 and beyond there is still significant uncertainty, with demand growth driven by a number of factors, primarily government policy in areas such as heat pumps and electric vehicles.

The one factor we can consider with a degree of predictability and confidence in an increase in demand through economic and technological growth. The population, amount of I.T infrastructure and demand for electronic goods will continue to increase as has been demonstrated in previous years, especially as we emerge out of recession and into growth. Factors such as distributed generation and take up of energy efficiency measures are events in which we have no real foresight as to their take up and future prevalence, and so it is a risk to assume they will offset economic growth coupled with the potential for take up of electricity in transport going forward. Electric vehicles have the potential to demand a vast amount of green energy, and we would suggest there is an even larger role for National Grid to play in forecasting central demand and liaising with key future demand influencers such as the Department for Transport.

The impact of climate change should also be considered. We already see heavy swings in peak and off peak consumption in summer and winter. Subtle changes in temperature and weather conditions could also have a material impact on the amount of electricity consumed, and should be factored into any forecasting as an additional demand driver.

Demand Side Developments

Q9. Are there other developments which will change the way that electricity will be consumed in 2020 that we should consider?

The 3 developments identified by National Grid (smart metering, electric vehicles and embedded generation) are the key drivers which will change the way electricity is consumed in 2020. Smart metering and a more sophisticated communications infrastructure is very much the precursor and foundation for mass embedded generation, electric vehicles, time of day tariffs and other developments. Being able to offer tariffs that can capitalise on greater consumer demand elasticity, reducing peaks through charging of electric vehicles at night and demand side management are all potential advantages of smart metering. This would create the capacity to encourage consumers and other stakeholders to actively participate in their energy supply.

In terms of the drivers that will affect these developments, the role of government may have a key part to play. Economic drivers through technological development will generally tend to steer the changes in the way electricity is consumed, however, as has been seen with the mandate of smart meters for 2012, the government (Labour or Conservative) will play a key role in providing an incentive framework to effect the way electricity is consumed, placing commercial pressure on industry players to follow certain paths.

Smart Metering and the Smart Grid

Q10. Do you share our view that distribution companies, suppliers, aggregators and ourselves will also value and compete for demand side services?

We do agree that distribution companies, suppliers, aggregators and National Grid will value and compete for demand side services, which will also be a key tool in managing wind intermittency. We see suppliers naturally progressing into ESCO's (Energy Service Companies) as they compete for a customer relationship which will be increasingly about the additional service offered on top of an energy supply, not just the supply itself. In a very price sensitive market, this offers suppliers a means of differentiation and competitive advantage outside of the normal price and customer service factors.

The customer data itself will be at the centre of demand side services, influencing the entire process from efficiency and insulation to appliance management. Active demand management will provide all parties with valuable information with which to base their operations on, and through the data will help target investment towards the best commercial opportunities.

There will be a role for a central communications network, providing continuity of communications between suppliers and other industry players. Transferring a customer from one supplier to another is currently a relatively costly process, and with additional data and demand side services potentially also being transferred as customers seek best value for money, this continuity of communications is required to ensure a smooth transition. Customer should have a choice in who they share their data with, developing demand side interaction with the market.

Demand side services benefit the operations of most industry parties, and so competition for those services is a natural occurrence in a competitive free market environment, helping drive innovation in this area

Electric Vehicles in "Gone Green"

Q11. Are our assumptions around the number of electric vehicles reasonable?

The number of electric vehicles that will be on the roads in 2020 is difficult to predict, and we believe more development of the assumptions on the charging of vehicle batteries is needed to make an informed judgement.

We believe the roll out of electric vehicles will depend heavily on the response of industry to national and international government policy. In the period January 2008 to October 2008, 156 “all electric” vehicles were sold in the UK, with 1100 (0.004%) currently on British roads. With the motor vehicle industry being dominated by large international manufacturers which are currently significantly impacted by the recession, we believe the appetite to take advantage of the commercial opportunities in supplying electric vehicles globally will only be high if the necessary incentives are put in place for both supply and demand.

Q12. Is it valid to assume that electric vehicle charging will be coordinated via a smart grid or something similar and will react to price signals?

Yes it is valid to assume charging will need to be coordinated and react to price signals as this will be a primary driver in delivering mass electric vehicle take up. Convenience may also play a role in terms of charging times and locations. Current industry commentary on pricing seems to suggest that domestic prices may continue to rise into the future, as network and green investment takes hold. With the increasing concern of fuel poverty, consumers need to have confidence and be assured that owning and charging an electric vehicle will be a cost efficient investment.

Appropriate tariffs and metering will also need to be in place to maximise the commercial and carbon value of electric vehicles, in place at homes, office and other public locations. The transition from fossil fuelled to electric cars in this respect will be vitally important, and a coordinated approach between industry players such as National Grid and the Department for Transport will be important.

With the capacity for smoothing out demand peaks, balancing, and storage, it also essential that any substantial electric vehicle presence is coordinated via a smart grid. This would ensure efficient use of the network. Without it and without sufficient price signals, we could see an increase in peak demand as consumers charge their car up when they get in from work, reacting to convenience rather than price.

This type of technology could also be implemented for smaller size but larger scale electrical items such as charging mobile phones and laptops. The model of charging items based on price signals is one that is key, and we believe the opportunities arising from it will necessitate its development.

Development of Embedded Generation

Q13. Do you foresee a greater or lesser role from embedded and distributed generation than we have assumed?

Generally we believe the figure of 15GW of embedded generation to be realistic, with the presence of 8GW of small scale wind, biomass, tidal, and solar. However, we would question whether 3.5GW of solar is realistic.

The incentives to construct these projects as opposed to simply taking clean energy off the grid need to be very favourable, and the role of embedded and distributed generation will be contingent on government policy. The amount of solar power assumed on homes particularly stands out as being overly optimistic. A more accurate assumption would include a more varied mix of generation as opposed to apportioning 44% of this type of generation to solar. Even if these types of projects were mandated as part of any new housing developments, 80% of the housing stock needed up to 2050 is already built.

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Chapter 6. Reserve and Operating Margin

Operating Reserve Requirement in “Gone Green”

Q14. Is our anticipated improvement in wind forecasting performance at 4 hours ahead achievable?

We do believe an improvement from 10% (rms) of capacity to 6% (rms) at 4 hours ahead is achievable, however a more dynamic challenge may be more appropriate, targeting forecasting performance based on industry developments and technological advances. If a greater level of wind forecasting performance is achievable, this should be strived for. New arrangements such as a central player to manage all forecasting and balancing as suggested in Q1 may help to improve forecasting performance further.

Q15. Do you have any views on our projected Short Term Operating Reserve requirement under “Gone Green?”

We are happy that that the “Gone Green” view on future STORR is reasonable. What stands out is that in average wind conditions, the 4 hour STORR requirement will double from 4GW to 8GW. Increases in STORR requirements will also inevitably increase costs to National Grid, and this places an even bigger priority on reducing wind forecasting errors to ensure only the minimum amount of STORR is required.

Please refer to our answer to Q7 regarding CCGT flexibility.

Q16. Do you have any views on our projected volumes, prices and costs for STORR under “Gone Green?”

We believe the volumes, prices and costs for STORR are difficult to project, and will be sensitive to market fluctuations and the price being prepared to pay for flexibility. Greater emphasis should also be placed on the marginal cost of low load factor plant, as high energy volumes may be needed for short durations.

We do want to keep overall costs and consequently prices for our customers as low as possible, and the projected increase in total STORR costs from £311m in 2010/11 to £690m in 2025/26 is a concern. Again we reiterate the need for reduced wind forecasting errors to minimise cost increases.

Implications of Low Wind Periods for Operating Margin Analysis

Q17. Is National Grid’s current view that low wind events across Great Britain need to be considered when evaluating electricity operating margins reasonable?

We agree that low wind events should be considered when evaluating electricity operating margins. With a larger wind reliance and times of settled high pressure (cold weather but no wind), operating margins will inevitably become tighter. This is amplified by the fact that research referred to in the consultation suggests that the probability of low wind output at times of peak demand is considerable. If a greater geographical spread of wind generation can be achieved, the impact on operating margins can be reduced. We believe a wind generation output assumption of up to 15% of capacity is also reasonable.

Other factors that may coincide with low wind events will also need to be considered. These include loss of conventional plant due to trips or outages, and the effect of interconnectors as wind conditions vary across Europe.

Operating Margin in “Gone Green”

Q18. Are our generator availability assumptions reasonable for application to analysis of future operating margins?

We agree that the assumptions on generator availability are in general reasonable, New nuclear with the next generation reactors and other advancements will not see the availability problems currently seen on the existing fleet. It is also correct to assume offshore wind will have a lower availability than onshore due to greater restrictions on maintenance and repair, however we question an availability of 85% which seems pessimistic. The ageing of existing conventional plant may also warrant more attention, as we believe there is scope for small reductions in availability as a consequence of age, contrary to the assumptions in the consultation.

Q19. We would welcome comments from market participants on how they expect to manage periods of low wind generation output and whether this an important consideration for them.

Periods of low wind generation are a very important consideration for Centrica. Being a significant investor in offshore wind developments, we are keen for our customers to have clean renewable energy available to them.

The ability for market participants to balance their positions will become more difficult in periods of low wind. We are moving into nuclear energy, and also investing in conventional CCGT generation in order to effectively minimise the risk of low wind periods. We believe a diversified wind portfolio will also help in this respect. We will inevitably (along with other market participants) be exposed to high costs as flexible plant and the open market are utilised to cover low wind generation periods. This is very important as operating margins become squeezed as mentioned previously.

As an integrated energy company, our supply presence will also help mitigate the effects of low wind periods, as we invest in smart metering and demand side management services with the potential to dynamically manage our downstream and upstream activities.

Q20. Are we correct to highlight the importance of wider European issues in electricity operating margin analysis?

It is correct to consider wider European issues in electricity operating margin analysis. This is primarily through greater interconnection with Europe. As operating margins become tighter due to outages, low wind periods or plant closure, importing through European interconnections may provide a more cost efficient alternative, especially if European output is exceeding demand due to more favourable wind conditions for example. Conversely, exporting during periods of high output may also help to smooth the generation profile. This may put a larger focus on TSO-TSO balancing across interconnectors, and lead to more developments in harmonisation of European standards and policy.

European gas issues should also be considered. In periods of low wind, flexible CCGT plant will very much be dictating the operating margins achieved. If the gas they are using to generate with is particularly scarce or excessively priced due to supply risk (e.g. Russia – Ukraine disputes), this will put even more pressure on electricity operating margin.

Q21. Are there further technical solutions for maintaining operating margins which we have no mentioned here?

We believe the primary solutions have been identified

Q22. Do you think National Grid's view of future operating margins is useful and do you have views on how this should be presented?

National Grid's view of future operating margins are very useful, as it could help feed into longer term investment decisions and make the future economics of contractual or asset investment more visible. We would welcome regular updated views based on latest research and experience, and also comparisons with other countries to utilise best practise.

Operating at Minimum Demands in "Gone Green"

Q23. Are our assumptions regarding the level of electricity demand during the minimum demand periods reasonable?

The assumption that minimum demand will be seen during the summer months at around 4:30am at the weekends and bank holidays is reasonable. However the extent to which this occurs may reduce going forward. We mentioned previously a potential future ability to smooth the daily demand profile if consumers are exposed to and then can react to price signals. It would be reasonable to suggest that these same drivers could reduce the gap between peak and minimum demand in longer term time horizons, between summer and winter for example. The use of air conditioning may increase as global warming and climate change alters temperatures, and the use of energy for transportation will also possibly remain constant throughout the year.

National Grid may also want to consider the behaviour of consumers with distributed generation during low demand periods. The consultation mentions that generators take the opportunity in these periods to conduct maintenance and repairs. It may be reasonable to assume that consumers would do the same, or cease to generate to save any marginal costs. At this point they may start taking energy from the grid, potentially impacting National Grid's negative reserve requirement.

In periods of significant minimum demand, energy storage could also play a prominent role as inflexible plant such as wind and nuclear seek to run despite the demand not being there. Energy storage however is still unproven, and will most likely be prohibitively expensive.

Q24. Are our generation availability assumptions for minimum demand periods reasonable?

We believe the availability assumptions are reasonable, as maintenance and repairs to plants are carried out. It will be important however to consider whether the assumptions are based on today or future scenarios. With traditional baseload plant possibly being used more flexibly, additional outages and maintenance may be required, affecting overall availability.

Q25. Is our central assumption regarding wind generation bid prices related to ROCs reasonable?

We do agree that wind generators will want to recover any lost revenues and ROCs if being constrained off. This could result in bid prices in excess of £100/MWh. This price would also need to factor in any return to service time and accelerated component deterioration. With both wind and nuclear offering some sort of flexible capability, the economics of both are what will decide which is curtailed the majority of the time.

Q26. Is it reasonable to assume that minimum demand periods will be managed using interconnectors and wind generation in preference to the curtailment of nuclear generation?

It is reasonable to assume that using interconnectors will be a preference to the curtailment of nuclear generation. It will be important to understand the profiles and demand characteristics of neighbouring countries, as many operate in similar time zones (+/- 1/2 hours) and may also be experiencing periods of low demand when we are looking to export. Countries with a high penetration of pumped storage will provide flexibility in this respect.

We currently envisage wind generation will generally be the preference for curtailment versus nuclear due to its faster response times and ability to quickly meet energy needs once demand begins to grow again. However, as mentioned in Q4, experience in Europe and France in particular tell us nuclear generation can provide a degree of flexibility and potentially be curtailed. A figure of 4.1 GW of nuclear curtailment in 2020 compared with 22.1GW of wind may need to be adjusted for more nuclear depending on the extent to which nuclear generation grows in the UK.

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Chapter 7. Operating the Networks

Real-Time Energy Balancing

Q27. Do you agree with National Grid's view of increased balancing activity in the future due to variation in market length?

We do accept that the number of balancing activities and the Net Imbalance Volume (NIV) are likely to increase due to future variations in market length. Wind farms in particular will find it challenging to balance half hourly positions due to the somewhat unpredictable nature of wind. We accept the analysis conducted on the correlation between the standard deviation of NIV, and the number of instructions issued, resulting in the future number of bid offer acceptances (BOAs) increasing from 320 in 2010 to 1000 in 2020. This may have an adverse affect on the flexible plant being used as variations in their output will increase significantly, and as stated in the consultation, National Grid will need to be able to accommodate this increase in actions.

Ramping

Q28. Do you agree with National Grid's view that ramping effects will impact on operation of the networks?

We do agree that ramping effects will have an increasing impact on the operation of the networks. Although the demand profile may be smoothed slightly through demand side management and reactions to price signals, the potential for large swings in wind generation put a significant ramping burden on the network. The analysis suggests that there could be a 50% swing in wind output within 2 hours. Given the expected increase in wind generation, it will be important to have secured enough plant capable of responded to high ramping requirements. We also agree that a reduction in the time between instruction and required response will go some way to helping deal issue. An important note is that the consultation states the currently ramping is at its maximum rate at the morning pick up, meaning a significant increase in plant capable of the required ramp rates will be required heading towards 2020.

Q29. Do you believe that a new approach is required in the development of System Operator to generation or demand control point interfaces for 2020?

It is clear that a new approach will be required by 2020 in order to effectively manage the significant changes that will happen in the behaviour of consumers and generators alike. Demand control should be fully explored and compared with other options. With the System Operator (SO) now also balancing flexibility along with frequency and voltage, there could also be a greater role for automation of systems and controls as the burden on SO increases.

Generator Flexibility

Q30. Are there any specific factors which suggest that adequate flexibility will not be available to National Grid for use in operating the networks in 2020?

We cannot currently foresee any specific factors which suggest there will not be adequate flexibility in 2020. As mentioned previously, we believe there is the opportunity to extract greater flexibility from wind

and nuclear generation. Our concern is the cost of that flexibility as more and more traditionally inflexible plant connects to the network, and will seek much higher prices for being curtailed, with increases in the number of BOAs and the NIV.

A longer term consideration than 2020 is the investment in future conventional plant to provide the flexibility that will be lost as the current fleet reaches the end of its life. Flexible operating means recovery on initial investment becomes more challenging due to lower load factors. Consequently high prices will be needed in order to incentivise flexible investment moving forward.

Network Management

Q31. The combined challenge of: 1. ensuring the networks are operated safely and securely against a background of generation variability; whilst, 2. getting more from existing infrastructure; suggests to us that control, communication and information systems have a greater part to play in controlling flows across the transmission networks. Are there alternative approaches which should be considered?

We agree that control, communication and information systems will play a substantial role in controlling flows across transmission networks, aiding the network management activities mentioned in the consultation such as forecasting of generation and demand, bulk power transfer and voltage control.

A more probabilistic approach for managing security of supply may also provide more opportunities in transmission control, with the GBSQSS Fundamental Review hopefully delivering some of these. Real time automation of artificial limits on transmission lines and greater flexibility with line temperature will help the transmission system run more effectively, and we believe there are opportunities to roll out “smarter” developments on the transmission system to extract more from it, still within GBSQSS limits.

Embedded Generation

Q32. What criteria should National Grid use in developing any requirements for information regarding embedded generation? Are there other ways of obtaining this information?

Information from embedded generation will need to be consistent, and National Grid will need to consider the frequency of information they require. Management of embedded generation is also a factor for consideration, with options including National Grid having direct control, or generators/suppliers supplying aggregated data to National Grid for example.

As the network of information between homes, smart grids, suppliers, embedded generation and the SO grows, greater consideration will also be needed for the security of the network. The expansion of the broadband network in the UK has meant more information is available for theft from hackers and similar criminals. As information, data flows and automated controls increase across the electricity network, the scope for unlawful activity also increases.

Black Start

Q33. Are there additional options that National Grid should consider to maintain a Black Start capability?

We agree that as the mix of generation type changes out to 2020, new and diverse black start service will need to be procured, potentially including wind, supercritical coal, interconnectors and storage technologies. We do believe however that more conventional generation services and interconnectors will provide the most economic and viable source of black start capability. The variability of wind means it will not be a consistent source of black start capability, meaning enough black start will be needed to cover low wind periods, effectively removing wind as an option.

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8. Balancing Services

Future Service Providers

Q34. Are we correct in assuming that new interconnectors will be able to meet some of our Balancing Services requirement?

We do believe that new interconnectors should be able to meet some balancing requirements. With a more integrated European grid, this will enable power to be flowed across Europe from areas of high generation and low demand, to areas with a high demand and not necessarily the capacity to meet it. The developments of such capabilities and the UK's opportunity to fully realise the advantages of greater connection to the European grid may well be dependent on incentives and European legislation promoting investment moving forward. The scale of the opportunity will also depend on the time taken to construct new interconnectors. Also, balancing activities most often take place in periods of high or low demand, and we often see European countries experiencing similar demand conditions at similar times, reducing the impact of any interconnection.

Electric Vehicles

Q35. What is your view on the potential of electric vehicles to provide balancing and other energy services?

We do believe there is great potential in using electric vehicles to provide balancing and other energy services. As we have stated in this consultation, energy storage could prove a key tool in running and efficient network, and electric vehicles have potential to fulfil a large proportion of that storage requirement.

There are a couple of considerations however. Consumer confidence will be key in the take up of electric cars and "smarter" living in general. It is hard to predict how the initial technologies will develop to permit large scale roll out of electric vehicles.

There is also the need to ensure that the facility/technical ability for interactions between electric vehicles and smart grids is present from the onset to avoid any need for expensive retrofitting later on. Similarly, the ability to accommodate advancements in software and hardware engineering to allow patches or updates to be downloaded to the smart home infrastructure will be key.

Another consideration is that a significant number of people do not have parking at their property, and park on roadsides or in communal parking areas. This will add extra complexity to the financial arrangements for energy services and balances derived from electric vehicles.

Potential for New Demand Management Services

Q36. How much of the electricity demand in Great Britain do you think could be regarded as discretionary or deferrable and hence available for use as a Balancing Service or other energy service?

We believe there is scope for using discretionary demand for balancing services, with demand side management playing a key role in system balancing moving forward. We believe much more research and analysis should be carried out to identify the true potential of all sectors of demand to be able to provide these services. Of the initial analysis presented, we feel the figure of 75% availability is very optimistic. With approximately a quarter of available potential in air conditioning, during winter when it is likely air conditioning units will be switched off, there would need to be 100% availability on all other appliance types (refrigeration, electric vehicles etc), something that is very unlikely. The volume and take up of smart domestic appliances may also be dependent on government policy, and is difficult to predict.

We are encouraged however by the fact that half of the technical GW potential is in industrial air conditioning and refrigeration, and as the consultation suggests, can be accessed through existing energy management infrastructure. This can provide the platform for developing the infrastructure of demand management in electric cars and domestic appliances for example, and would urge continued utilisation and development of existing capabilities going forward.

Q37. What specific actions should National Grid take to facilitate Balancing Services from demand-side providers while maintaining the required quality and volume of service?

Demand side providers of balancing services will need a transparent incentive to take up the service. Communication and engagement with industrial providers and suppliers will be important to jointly develop solutions to National Grid's requirements. These requirements for balancing services may include timescales, volume and frequency, and will enable suppliers to develop tariffs to meet the customers needs. Multi year contracts may also be necessary to support investment.

Storage Technologies

Q38. Are there further aspects of storage or other storage technologies we should consider when looking forward to 2020?

The primary storage technologies such as batteries, flywheel, compressed air and pumped storage have been appropriately considered. How and when storage technologies become viable on a large commercial scale may well depend on the applications that are found in which to utilise them. The obvious application for battery technology is electric vehicles, and it is the growth and take-up of the applications that will determine the commercial viability of the storage technology. If additional large scale applications for storage technologies can be developed, storage capacity will undoubtedly grow towards 2020. National Grid could stimulate further investment by helping to identify future storage requirements.

Generation

Q39. What are the prospects for the provision of Balancing Services from new OCGTs or other back-up generation?

We do agree that OCGTs do have the capability to provide balancing services. The economics of new build OCGTs may be driven by the pricing of long term contracts with National Grid for balancing services.

Applicability of Technologies to Different Balancing Services

Q40. Is our mapping of technology to Balancing Services reasonable?

Yes the mapping appears reasonable.

Meeting the Future Requirement

Q41. Is the statement of National Grid's view of long term Balancing Services requirement useful to industry stakeholders, and; Q42. What period should a long term Balancing Services Requirement statement cover?

Yes we would find such a statement useful, as visibility of future reserve requirements would help feed into the economics of new investment by generators and other industry players. Tying it in with investment means the time period should cover a period of at least 10 years, covering aspects such as planning. Modelling of considerations such as operating margin can also be improved longer term due to more information.

Q43. What changes to the current reserve products would better encourage the provision of reserve services, and; Q44. What actions would ensure that procurement of reserve services does not impact adversely on efficient operation of the wholesale energy markets?

We agree that there needs to be a diverse range of reserve services to give stronger guarantees of stable supplies and services. We also accept the fact that some new technologies and/or services will be developed with National Grid as the only customer. Consequently it is reasonable to assume that such developers would seek commitment in the form of revenue streams and multi year contracts from National Grid to fully commercialise the developments. We also believe National Grid should be actively seeking joint venture and R&D opportunities.

Reserve and balancing services themselves are of course a necessity with the current UK market design. These in turn will affect the wholesale energy market by being a contributing factor in price, and placing commitments on certain generators that may alter their behaviour. This effect will only increase out to 2020 with the number of balancing actions. It is important that the costs of reserve and balancing actions are accurately and appropriately fed into imbalance prices so that correct incentives are maintained on market participants.

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Conclusion

In conclusion, we acknowledge the great challenge ahead as the industry progresses through a significant period of change, and also see a great deal of opportunity going forward in energy efficiency, low carbon and security of supply.

The transmission network will provide the structure with which the UK can move to a low carbon economy. Energy will become an even bigger part of everybody's lives, as consumers become more engaged and active with their energy, and technology develops to help them do that.

Managing the costs of the changes that will take place moving towards 2020 is a particular concern. The consultation has outlined a number of considerations that will increase industry costs, from an increased STORR and reserve requirement to additional and potentially more expensive balancing actions. A "smarter" network is very desirable, however the cost of the journey to get there, as well as the cost of the consequences of a changing network and generation structure will need to be carefully managed to ensure the required investment is obtained, and consumers are signed on.

Finally, I would like to reiterate our thanks to National Grid for the timely and proactive work thus far undertaken in this area.

For any queries or questions please do not hesitate to contact me,

Kind Regards,



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