Response to National Infrastructure Commission’s Call for Evidence on Electricity Interconnection and Storage

Introduction

This paper provides Northamptonshire Enterprise Partnership’s response to the National Infrastructure Commissions’ (NIC) call for evidence on electricity interconnection and storage. This has been developed with expert technical support from Peter Brett Associates and with significant input from business and public sector partners.

Specifically, this paper seeks to address four main questions posed by the NIC relating to, with each question considered in turn:

- Balancing of grid in terms of supply and demand;
- Barriers to the deployment of energy storage;
- Appropriate level of electricity interconnection; and
- Lessons learnt from international best practice regarding balancing supply and demand.

Northamptonshire has an ambitious and comprehensive growth strategy, with the aim of delivering approximately 70,000 new jobs and 80,000 new homes by 2031. The recent ‘Utility Infrastructure Study’ undertaken by PBA on behalf of NEP, established that energy security is critical to enabling Northamptonshire’s continued growth. This can be achieved through a number of mechanisms not least enabling embedded generation and storage within the Northamptonshire electrical network.

The key limitations to industrial growth in the region are from a lack of available electricity infrastructure which is discouraging new businesses from investing in the region. For example, following the award of Enterprise Zone (EZ) status in August 2011, Northampton Borough Council undertook a programme of engagement with businesses within the boundary of the EZ. The results of the engagement highlighted a lack of power as the primary constraint to the expansion of several strategic businesses. As such, a bid was made into the Local Infrastructure Fund (LIF) and was successful in achieving a loan to install additional cabling into the EZ. The additional power has or will enable the expansion of existing large key businesses that will increase their workforces significantly. These expansions would not have been possible without the additional power supply.

It is not clear whether the planned delivery of energy will enable Northamptonshire to deliver on its plans for jobs and homes, or whether the existing infrastructure will cope with the increased demand placed on it.

There is a good 33kV network throughout Northamptonshire, however, following discussions with Western Power Distribution (WPD), two district/borough areas in particular will require upgrade and reinforcement works to accommodate the estimated demand in the near future, depending on specific location and time frames for delivery. These areas have a high number of housing planning permissions, the delivery of which may be inhibited by supply challenges.

Therefore in formulating these responses we have focussed on Northamptonshire’s energy needs in order to consider how national policy can create a secure and balanced supply of energy within Northamptonshire and the opportunities for the area to profit directly from investment into generation and distribution.

1. What changes may need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers, over the long-term?

Introduction

1.1 We consider that in order for the appropriate balancing of supply and demand, several key changes could be made to the electricity market which would have an overall economic benefit to consumers overall and specifically to the Northamptonshire region.

Strategic Position of Northamptonshire

1.2 Northamptonshire plays a strategic role in electrical interconnection as it acts as a lynchpin between northern/midland power generation and south eastern consumption. It therefore has the potential to act as a ‘bridge’ for geographically disaggregated generation and demand.

1.3 Regionally, Northamptonshire can maximise its location as it is “perfectly positioned at the heart of the country and the crossroads of the rail and road network, providing a premier location for inward and local investors”.

1.4 The energy business sector is expansive and outward-facing in that businesses generally tend to sell services nationally, meaning that Northamptonshire’s central location is ideal for companies working across England and the UK. The County also benefits from large infrastructure investment from key companies such as Cosworth, Carlsberg, and Travis Perkins. NEP in its role, working with government, can unlock Northamptonshire’s growth potential to create one of the most entrepreneurial and fastest growing places in the country

1.5 The key to achieving this bridging role is by strengthening both power generation assets and networks within key areas such as Northamptonshire, thereby creating excess electricity and the means to export it. This could be achieved through new embedded generation as well as energy storage, and better management of demand side response. Our suggested mechanisms for removing barriers to these technologies are outlined in our responses to Questions 2 and 3.

1.6 The transmission losses associated with any export of power from an area such as Northampton to London would be significantly smaller than power transmitted over a larger distance (e.g. from larger power stations in Yorkshire). This would not only have benefits in terms of CO_2 savings from transmission losses, but increasing efficiencies could also drive down prices for consumers.

1.7 Sharing power more specifically across areas of higher and lower demand could be further incentivised by Government by formally recognising the role of places such as Northamptonshire, as being key to supplying energy in areas of high use (e.g. London) and directing further investment to strengthen power generation and networks assets. Although areas in the south east of the country and closer to centres of demand benefit from lower grid connection costs, these areas could be further prioritised in any future government or National Grid plans for future investment. Although, National Grid already shows areas in need of grid strengthening, these are based on current capacity, rather than on future growth plans. There is therefore a need for more proactive, rather than reactive, planning. Northamptonshire would not only be situated ideally to support centres of large demand (e.g. London and Birmingham) but also inward investment and its ambitious plans for growth.

1.8 These factors have attracted many large companies to the area (e.g. Travis Perkins and Booker Group PLC). Furthermore, a key ambition of the NEP is to substantially grow key industries such as logistics and high performance technologies. In turn these larger companies have large energy demands and therefore offer the potential for demand side response and more efficient energy management.

1.9 A low carbon energy opportunities and heat mapping study for local planning areas across the East Midlands was published in 2011[1], which reviewed the physical geography of the region for the deployment of renewable technology. The report highlighted that with the exception of Northampton, onshore wind forms the greatest technical resource potential. According to the report, key opportunities include:

- Onshore Wind: the greatest potential is found within Daventry, East Northamptonshire, Kettering and South Northamptonshire
- Biomass: Daventry, South Northamptonshire ,Kettering and East Northamptonshire – in particular potential from energy crops and agricultural arisings
- Small-scale hydropower- there are many potential sites in East Northamptonshire
- Northampton: as an urban authority, there is significant potential for EfW, sewage gas and waste wood

1.10 Despite this, a key constraint to the Northamptonshire area is the lack of suitability of the network to support generation. WPD advised that there are generation connections within Northamptonshire, but there have been a number of issues with the connections and flows back to the Primary Substations, and buffers needed to be used.

Role of an Independent System Operator (ISO)

1.11 An ISO could be beneficial for the UK electricity market, as well as for Northamptonshire. Adequate network capacity for Northamptonshire is critical to enable growth within the region if the ambitious plans for growth are to be realised. Information from WPD indicates that at least 2 areas in Northamptonshire are at capacity in terms of their 33kv network. One of the key areas limiting growth is the reactive nature, long timescales, prescriptive processed and often prohibitively expensive costs associated with reinforcement works undertaken by National Grid or the District Network Operator (DNO) – WPD. For example, information from WPD indicates that a new Primary

[1] http://www.emcouncils.gov.uk/Renewable-Energy-Study

Substation would be in the region of £5m and would take 2 to 4 years to install, which may include other time constraints beyond the control of a DNO.

1.12 33kV cabling can take months to install depending on whether there are 3rd party land issues, and the length of cable route. 132kV cabling can take 5 years to install depending on whether there are 3rd party land issues and the length of cable route. Overhead lines (33kV and 132kV) usually take longer due to public perception and 3rd party negotiations, and 132kV OHL cost approximately £1.2m per tower.

1.13 It is possible that the layers of complexity could be removed by an ISO. In terms of evidence in practice, the US uses ISOs to govern electricity distribution in several states. New York in particular has seen large economic benefits following the consolidation of the electricity market management into one ISO[2]. However, any ISO should promote the following:

- **Reliability -** The ISO responsibilities should include coordinating short-term operations such as reactive peaking plant to ensure reliability while supporting the competitive spot market.

- **Independence -** The governance structure and incentives for the ISO should be designed to ensure that no one subset of the market participants is allowed to control the criteria or operating procedures.

- **Equity -** Access to and pricing of services should be applied to all market participants without distinction as to customer identity or affiliation.

- **Unbundling -** Services should be unbundled when possible for acquisition from the competitive market and for utilisation by the market participants; and

- **Efficiency -** Operating procedures and pricing of services should support an efficient, competitive market for electricity. Attributable costs should be paid by the responsible parties. There should be no cost shifting to other parties – for example generators shifting costs to distributors. Joint costs should be allocated fairly with minimal impact on efficient incentives. Pricing and access rules should reinforce efforts to mitigate market power in generation. An ISO should identify constraints on the system and be able to take operational actions to relieve those constraints.

1.14 Despite this, to allow such an ISO would require a major rewrite of current guidance and would be a fundamental change in the way that the industry operates as a whole, and would not be a small or simple undertaking. In addition EU pricing rules would also need to be considered which could constrain the way ISO would operate especially in enabling early market trading in the UK when compare to the US electrical market. This could create more complications than the approach is trying to resolve.

1.15 Furthermore, issues encountered by DNOs are often related to a lack of up-front funding and pre-investment in assets, so they are unable to plan proactively for new development. Rather than the introduction of an ISO it might be beneficial for OFGEM, together with NG and DNOs to work more proactively and find solutions to pre-development investment.

Balancing future supply and demand

1.16 In order to achieve Northamptonshire' ambitious plan for growth, early engagement between National Grid, DNOs and Local Authorities is essential. This could be achieved through an ISO or alternatively, and probably more realistically (at least in the short term) through a nominated representative of the DNO.

1.17 Ensuring the ISO's functionality will need overseeing to ensure effectiveness. OFGEM's role in this would be critical.

1.18 There is a need for better forward planning from grid operators to enable a proactive and joined up approach to meeting the demands for new development, rather than reacting to each proposal in turn. In this way, National Grid (for large scale infrastructure requiring a 400kV connection) or the DNO (for smaller scale grid reinforcement) would be better prepared for a likely 'pipeline' of projects which are proposed in the area and could target infrastructure upgrades to selected key areas.

[2] http://www.ksg.harvard.edu/hepg/Papers/NYISO_Analysis_0307.pdf

1.19 There is a good 33kV network throughout Northamptonshire, however, following discussions with WPD, two areas in particular will require upgrade and reinforcement works to accommodate the estimated demand in the near future, depending on specific location and time frames for delivery.

1.20 It was also noted that the existing 132kV Overhead Lines (OHL) are currently at capacity and a new tower line from Grendon to satisfy demand requirements within Northamptonshire, may be required in the future.

1.21 Currently, Objective 3.5- Energy and Environmental Sustainability of the NEP Strategic Economic Plan[3] focuses specifically on the delivery of power to deliver sustainable growth. This outlines the need for funding to be provided to assist the development and reinforcement of power distribution in the county in relation to a number of specific issues. The SEP references key large-scale projects being developed by partners relating to energy including Kettering Energy Park, a CHP scheme within Northampton, and proposed Smart Grid trials.

1.22 Within Northampton Borough Council's development plan documents, consideration is given to strategic policies for steering and shaping development, together with strategic site allocations. There are also detailed supplementary planning guidance documents regarding e.g. five year housing land supply, and waste provision. Similar documents have also been prepared for other districts of the County. However, there appears to have been scant input from National Grid or DNO's as to how future strategic development would be supported in terms of grid capacity.

1.23 This is in contrast to e.g. waste policy in the borough, which has been planned with waste operators and alongside regional growth strategies and identified suitable areas for further waste provision and waste derived fuel. Waste provision is therefore written into local policy; just like electricity provision could be, given the right input from DNOs.

1.24 The WPD Long Term Development Strategy (LTDS) is in the public domain and illustrates WPD's proposed capital investment programme for the next 5 years.

1.25 Ultimately WPD will only respond to actual financially backed orders from developers and will rarely construct and forward fund new infrastructure for speculative development.

1.26 WPD are restricted by OFGEM and can only improve their network where there is a customer demand. Once a major investment plan has been agreed then the costs are shared between WPD and the developer/s.

1.27 For example, two areas in Northamptonshire have recently had upgrade works completed but this was customer lead and all additional capacity has been allocated.

1.28 One possibility for regulating this early engagement is through OFGEM, who could ensure that there is a 'Duty to Cooperate' put in place between DNO and the Local Authority. With this duty to cooperate clear open lines of communication should be achieved to ensure strategic growth plans are clearly monitored allowing resilience in the DNO's forward planning.

1.29 There is clear evidence that this does not happen at the moment, as stated above, WPD will only respond to actual financially backed orders from developers and will rarely construct and forward fund new infrastructure for speculative development. As stated in the introductory section of this report, this expansion of the EZ in Northamptonshire was only achieved through forward funding from the LIF. However, this is not unique to WPD, but a common issue with DNOs.

1.30 The advantage of this approach is that prospective developers coming into Northampton would not only have a clearly defined area for strategic development, but this would also benefit from DNO who is already primed to deliver the required network upgrades to enable development.

1.31 In addition this platform would also allow early infrastructure costs to be understood which could form Development Infrastructure Funds to be established reducing land development cost burdens.

[3] http://www.northamptonshireep.co.uk/resources/uploads/files/20131219%20Northamptonshire%20Final%20Draft%20SEP.pdf

The Benefits of Demand Side Response

1.32 NEP and partners have recognised the value of reducing energy demand across Northamptonshire as a key part of promoting economic growth.

1.33 Regional and local demand side response will release utility network capacity. In turn this will not only enable cheaper and faster connections for strategic land development growth but will also attract businesses looking for secure expansive grid capacity for their operations.

1.34 In addition demand side response also has the attractive proposition of reducing costs associated with buying energy in the first instance. This reduces domestic and commercial overheads and frees up money that would have otherwise have gone out of the region and to the national energy markets.

1.35 The above benefits are recognised at a national level with a range of regulatory measures set by OFGEM, DECC and CLG associated with energy demand reduction.

1.36 At a regional level, a challenge facing the Distribution Network Operator (DNO) Western Power is to balance the peaks from the generation of electricity supply with consumer demand peaks[4]. This issue is complicated by the increase of intermittent low-carbon renewable energy such as onshore wind and solar PV energy generation.

1.37 These techniques include 'smart grid connection agreements' combining monitoring and control supply and consumption, with additional active network management (ANM) if necessary. This will include connection offers with curtailment agreements during peak hours. Smart grids should also be used as a means of managing forecast in increased demand using existing electrical connection infrastructure to the best effect and minimum cost.

1.38 Whilst strictly speaking this is a supply and capacity issue, reducing demand on the grid network at peak periods to distribute energy will ensure the networks are balanced, allowing more effective future connection opportunities.

1.39 It is understood that connection of more sustainable energy generation[5] is a major strategic issue for WPD and Northamptonshire. The network is well equipped to deal with additional electricity demand; however for those wishing to generate electricity the opportunities are quite limited.

1.40 Trials of such DSR mechanisms, such as Southern Electric Power Distribution in partnership with local businesses in Bracknell, have shown as much as 20% peak grid demand can be released[6].

1.41 The University of East Anglia has also benefited significantly from DSR. They have installed a system which measures the local frequency of the mains across campus. When frequency is too low it can shed some of its load within two seconds. If frequency goes too high, then it can add load.

1.42 The system has an accurate electricity meter that is measuring everything so it can prove to National Grid that the event is really happening. National Grid then pays the University who are now actually generating a steady income, just for operating their utilities slightly differently[7].

1.43 Whilst there are clear advantages for demand side energy reduction, it is our view that demand reduction needs better regulation. It is currently only incentivised through negawatt (i.e. amount of energy saved) and therefore somewhat reflects focus onto the point the system fails. Currently, economics of demand reduction are not enticing enough.

1.44 A better approach could be to treat Negawatts as a commodity which can be traded. In this way large electricity consumers could see a direct benefit to the amount of energy saved. The value of Negawatts could be set higher for peak periods of electricity demand. This would encourage consumers to reduce their electricity use during peak periods through e.g. altering factory shift patterns. In addition potential subsidies or tax breaks could be added to the Negawatt regime to make the economics of demand reduction even more attractive.

[4] http://www.nnjpu.org.uk/docs/NN%20JCS%20PRE%20SUBMISSION%20IDP%202015.pdf

[5] http://www.nnjpu.org.uk/docs/NN%20JCS%20PRE%20SUBMISSION%20IDP%202015.pdf

[6] http://www.thamesvalleyvision.co.uk/our-trials/understanding/

[7] http://www.powerresponsive.com/viewpoints/where-dsr-is-a-matter-of-degree/

1.45 By reducing demand at peak times, the grid could benefit from a more steady state rate of consumption throughout the day, in turn leading to less stresses and less risk of ‘brown outs’. It should be noted though that any demand side reduction mechanisms should not be taken out of the control and/or agreement of the use, which may cause detrimental economic impact on their business activities. A supplier led restriction on supply, for example, would impact economic competitiveness for a region.

1.46 Additionally, time of use tariffs could also be rolled out for smaller commercial and residential consumers. A concerned and more urgent approach to smart metering and regulation to enable Time of use tariffs could significantly impact demand profiles, reducing peak problems and enhancing the potential viability of local or regional storage solutions. British Gas is currently exploring the potential for rolling out these tariffs and the other ‘big five’ energy companies will likely follow suit.

1.47 However, despite this, as stated previously in this document, the evidence from Northampton is that the pressure is from growth on historic and outdated infrastructure.

1.48 The recent launch of the System Operability Framework (SOF) by National Grid has highlighted the vital role which DSR will play in the future UK energy market. Together with battery storage, and smart grids, they offer the potential for grid balancing and carbon reduction as well as cost savings for large businesses.

1.49 WPD are operating a smart grid at Corby, where there is a priority list of generation connections onto the network, and which has been successful in achieving a more balanced grid. However, they are unable to offer the availability of any further connections at the current time. Therefore, further network analysis must be undertaken to use DSR effectively without putting at risk existing operability.

Embedded Generation

1.50 Embedded generation also has a key role to play in balancing supply and demand. The role of embedded generation should be to ensure that the local distribution network benefits from additional capacity, particularly at peak times to maintain the position closer to existing operating margins.

1.51 Smaller peaking plan type generators (e.g. <20MW) outputting into the local distribution network reduce the need for the DNO to draw supply from the National Electricity Transmission System (NETS), helping to increase security of supply in the local network and reduce the risk of blackouts. This in turn supports the national grid.

1.52 It is National Grid policy to operate with a supply margin (i.e. supply capacity exceeding demand at all times). This margin is essential in seeking to eliminate, as far as possible, the risk of power shortages and blackouts, when there is an unexpected demand or sudden loss of supply. In common with many areas of the UK, a number of renewable energy schemes are operating or proposed in Northamptonshire, delivering intermittently to the local grid. Onshore wind is the predominant installed technology in Northamptonshire with a total of 8 projects and an installed capacity of 91.3MW. This is closely followed by solar photovoltaics, with 11 operational projects and a total installed capacity of 88.2MW.

1.53 In developing flexible generation assets (e.g. small peaking plants which can be rapidly started up or shut down) which connect directly to local or regional networks, local and regional consumption can be more easily balanced and stresses taken off the National Grid. Furthermore, with embedded generation usually installed at or close to a connection point (e.g. DNO 33kV substation) much of the transmission losses traditionally associated with exporting power from large power stations on the national 400kV network are significantly reduced, leading to greater efficiencies.

1.54 A major benefit of delivering embedded low carbon energy solutions is the ability for them to release capacity on the National Grid 400kv system. Releasing grid capacity will support economic growth both in terms of physical growth of towns but also offers significant attraction to high energy demand business sectors such as data centres. The opportunity to connect at a low price to a secure power network is extremely attractive to many sectors, which in turn will support the diversification of Northamptonshire’s economy.

1.55 However, balancing and demand side response are tools for network management but not the end answer. They need to be strategically planned rather than openly incentivised otherwise we will see similar ‘technology rushes’ as with solar over the last 5 years. As a point of evidence, the recent round of capacity market auctions saw around 1.9GW of new capacity achieving a successful auction clearing price[8], Most of this new

[8] https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/2015%20T-4%20Capacity%20Market%20Provisional%20Results.pdf

capacity was fast response diesel plant, which in turn has led to negative press surrounding diesel farms and the need for a re-think on how capacity is structured.

1.56 They also need to be backed up by strengthening of existing networks. It was noted by WPD in recent consultation that the network in Northamptonshire was not designed to take multiple isolated small generation sites, but for single large power stations that filter load down through the voltages and across the country. Therefore, the plant/assets connecting these isolated sites are not ideally located or sized to accommodate these generated flows.

1.57 Furthermore, a full network analysis with fault diagnosis to establish the appropriate degree of back-up to be provided is required. As the volume of embedded generation increases the current practice of matching it one for one with transmission back-up is no longer cost effective, and based upon probability of failure within the distribution network a lower proportion of back up will be appropriate. The actual figure will depend upon the type and number of embedded generation units on the system, the demand profile, any demand reduction possible, and the acceptable probability of a power failure in terms of occurrences or minutes per year.

2. What are the barriers to the deployment of energy storage capacity?

2.1 Energy Storage offers significant potential to reduce carbon emissions from generation by using more of the available energy from intermittent generation sources such as wind and solar. It also offers the potential to deliver a more balanced grid as power can be delivered as and when needed in order to 'fill gaps' when other technologies cannot generate or to reinforce the grid at times of peak demand.

2.2 Despite this, the technology is still in its relative infancy in the UK; especially for large scale applications (pumped hydro storage excluded which is very site specific). To date there are around 20 such installed systems in the UK. Though storage can provide numerous grid services, there are a number of factors that restrict its current deployment.

2.3 Probably the most significant barrier to deployment currently is high capital costs, particularly for larger scale geological storage systems. In comparison to other technologies used for grid balancing, such as embedded diesel fired peaking plant (around £500,000 per MW installed capital cost) and demand side response (£1000's per MW very low capital costs) the cost of storage at (£millions per MW on average) is significantly higher.

2.4 Potential storage owners are therefore reluctant to consider the deployment of resources until they can be assured a predictable revenue stream.

2.5 Currently there is a lack of clarity surrounding the functional classification of energy storage. If managed correctly, storage can be used to provide simultaneous services across different classifications of: generation; transmission; and distribution and discrepancies in market rules and regulations across a large number of differing markets.

2.6 At present, storage in the UK is classed as 'generation' and therefore is incentivised through open market trading, or scheme such as the Capacity Mechanism, where they are competing with traditional forms of generation, despite their wider potential application and benefits.

2.7 Furthermore, one of the main ways to maximise storage potential is by combining it with other intermittent technology types (e.g. wind and solar), or by developing storage capacity adjacent to substations – to maximise the available substation capacity. However, as storage is defined as 'generation', a DNO such as Western Power Distribution cannot own generation on their own network and so they cannot take responsibility for strategic grid management through their own assets.

2.8 Ultimately this could create a market failing as ultimately the DNO are in the best place to utilise electrical storage to balance their network, so therefore should really be in the position to dictate need and geographic preference.

2.9 Revenue compensation mechanisms in the different market environments present a barrier to the further deployment of energy storage resources. These mechanisms are oriented towards the evaluation of traditional power system technologies and may not appropriately compensate energy storage resources for the services they are capable of providing. Restructured markets base pricing on the generation costs of the marginal unit, which is appropriate for generators that have significant operating costs but creates a difficult situation for capital intensive and low operating cost resources like energy storage.

2.10 To overcome these issues it is suggested that storage should be treated as its' own category of energy and allow it to benefit from multiple revenue streams, which will both provide a more certain and stable income for investors and alleviate the high capital costs by providing greater returns. Any categorisation of storage could also remove the block on DNOs taking ownership of such projects.

2.11 Alternatively, mechanisms could be introduced which facilitate partnerships between DNOs and regional/local authorities to plan and structure storage within network and within Local Development Frameworks, then auction off as an asset. They will have a relatively high value as not only will need have been established but an element of planning security would be achieved through having the assets within a local plan.

2.12 A key aim of National Grids SOF is to roll out more storage projects and to test hybrid battery storage and renewable generation projects in an effort to further balance the grid. This could be a key growth area for Northamptonshire to maximise the generation potential of its existing renewable assets

2.13 At present, the most appropriate scale for implementing storage is at the local / regional level and a lot of this is likely to be through battery storage projects. This is simply because of recent advances in technology through increased efficiency and storage which has been somewhat driven by the electric vehicle market.

2.14 In terms of larger scale storage systems, the path to viability includes further research, development and testing before they can be considered as 'proven'.

2.15 At present, larger, national or international storage projects (excluding pumped hydro) are not viable in terms of capital investment, relative infancy of technology and transmission losses associated with exporting electricity over large distances.

2.16 This situation is set to alter slightly with greater advances in technology for MW scale battery storage.

2.17 Increasing local and regional storage capacity, alongside embedded generation will help with grid balancing and evening out peaks in energy demand.

3. What level of electricity interconnection is likely to be in the best interests of consumers?

3.1. Increased interconnection is a clear goal of European energy policy. Typically, interconnectors are seen as positive infrastructure as they increase competition, reduce market reserve requirements and facilitate renewable energy as grids can be balanced over large distances with different weather systems and time zones.

3.2 Interconnectors derive their revenues from congestion charges. European legislation governs how capacity is allocated. It requires all interconnection capacity to be allocated to the market via market based methods, i.e. auctions. It also includes specific conditions on how revenues are used.

3.3 Despite this, factors such as different market structures, operational rules and market strategies of power suppliers have a significant influence on cross-border trading. Any expansion of interconnectors therefore requires harmonization of common technical standards codes or guidelines in the areas of Planning and Design, System Operation and Maintenance.

3.4 This is likely to require the cooperation between governments and other stakeholders in order to achieve maximum benefits from interconnection operation.

3.5 Furthermore, capital costs of interconnection are high, and in most cases are undertaken by specialist developers (e.g. National Grid Interconnector Holdings (NGIH)). Although the returns can be significant, the level of initial investment and rules on revenue streams means that it is often difficult for financial advantages to be felt outside of the specialist company.

3.6 Key to developing successful interconnectors is to generate a stable and predictable price for the consumer.

3.7 Any planned increase in international interconnections is likely to have a moderate benefit to Northamptonshire. Although it may increase security of supply, this will be true for the country as a whole. It is also unlikely to result in increases to local or regional electricity infrastructure.

3.8 The potential benefits of Northamptonshire forming strategic supply arrangements to the south east of the UK has been highlighted in our response to Question 1. Although this is not an interconnector by definition, this type of arrangement would be likely to result in more benefits on a regional scale.

4. What can the UK learn from international best practice in terms of dealing with changes in energy technology when planning to balance supply and demand?

4.1 Although the UK has historically been one of the first to adopt new technologies in an effort to meet increasing energy demands, a better structured and more fixed, constant energy policy direction is required. This will in turn give confidence to developers and investors of consistent financial returns over the long term.

4.2 The majority of planning applications for energy developments last for 25 years, and represent a significant capital investment in planning and front end engineering design. However, the current UK position is that energy policy is subject to change over much shorter timescales. For example, within the last three years there have been significant changes to the Feed in Tariff (specifically affecting solar and wind farms), Renewable Obligation Certificates (specifically affecting biomass and wind farms), and the Electricity Market Reform (EMR).

4.3 The EMR programme contains a significant amount of complexity including rapid change in subsidy support for renewable energy projects and significant ambiguity on guaranteeing investment returns especially associated with the CfD.

4.4 It should also be noted amendments to the Renewable Obligation Order have also been recently tabled which has included the removal of onshore wind support through the RO from 31 March 2016, a year early than expected.

4.5 Further uncertainty has also been raised by mixed messages on fracking and the recent announcement by the Energy Secretary in support of more gas fired generation.

4.6 Therefore, although the government is providing a number of schemes to support renewable and non-renewable energy projects, the current lack of consistency creates an environment of long term investment uncertainty and complicates the ability of developers to accurately forward plan their projects and investments.

4.7 Other European countries such as Germany have a more committed long term energy policy.

4.8 Taxation on energy in Scandinavian countries is extremely high to support their federal electricity systems. Taxing unabated consumption is not necessarily a bad thing. Stable consistent energy pricing, even at a high p/kw allows business to plan effectively.

4.9 In Germany, security of supply is one of the cardinal objectives of the Government's energy policy, along with affordability and environmental compatibility. Section 1 of the Energy Industry Act (EnWG) establishes the principle of guaranteeing a reliable, attractively priced, consumer-friendly, efficient and environmentally compatible supply of electricity to the public that is increasingly based on renewable energy resources.

4.10 Under the amended Energy Industry Act (EnWG) (amendment dated 20 December 2012 and promulgated in the Federal Law Gazette. I p. 2730), new regulations aimed at guaranteeing the electricity supply came into force on 28.12.2012. These regulations offer solutions for sustaining the power supply in the short term without pre-determining the long-term roadmap for a workable future design for the electricity market to promote the energy transition and to facilitate the necessary integration of the renewable energies into the market. They include:

- an obligation to give 12 months advance notice of the intention to shut down any power plant and a ban on shutting the plant down before the end of the 12 months;
- the option of paying at cost price to keep power plants that are vital to the system on line;
- measures to ensure the operation of important gas power plants in the event of supply bottlenecks;
- A statutory instrument to systematize the existing practice of contracting for reserve power plants; it should also be possible to install new reserve capacities on a limited scale in justified particular cases.

4.11 The 2011 amendment of the Energy Industry Act obliges the German transmission grid operators to draw up a power balance and submit it to the Economic Affairs Ministry (BMWi) every year (Section § 12 para. 4 and 5). At the same time it entitles the grid operators to obtain the information they need for drawing up the power balance from lower-level network operators, power generators and end consumers.

4.12 The report officially submitted in September 2014 on the power balance presents the national power balances for 2013 to 2017. In the report the transmission grid operator predict an assured capacity surplus in the region of 8.8 to 10.3 GW in the years 2014 - 2017. Last year, too, there was adequate generating capacity available.

The surpluses mean that demand can be reliably met by the generating capacities available in Germany even in the potentially most critical situation of the year.

4.13 Within the last decade the construction of distributed generating installations has been increasing, especially as a result of subsidization under the Renewable Energy Sources Act (EEG) and the Combined Heat and Power Act (KWK-G). As the output from the major part of these low-capacity distributed energy resources (DER) cannot be controlled by the grid operators, there is risk even in the short to medium term of not being able to keep the grid system balanced. That means that in extreme cases situations can occur in which more power is being fed into the grid than is needed to meet demand and for exporting. In these situations, infeed from DER needs to be appropriately reduced by means of some sort of control feature.

4.14 Against this backdrop, the Economic Affairs Ministry has commissioned a consortium, made up of Consentec GmbH, Aachen, and Ecofys Germany GmbH, Berlin, to carry out "Studies into the need for more far-reaching system control to maintain the system balance." The study is intended to help assess whether and, if so, when construction of further non-controllable distributed energy resources, especially photovoltaic, heat-and-power co-generation and biomass installations, might lead to problems in balancing the grid.

4.15 Sweden is divided into four bidding areas from bidding area Lulea SE1 in the north to bidding area Malmö SE4 in the south. The price of electricity in each bidding area is determined by supply and demand of electricity and transmission capacity between bidding areas. In northern Sweden more electricity is produced than is needed, in southern Sweden it is the opposite. Therefore a large amount of electricity is transported from north to south Sweden.

4.16 Therefore, the power reserve consists of contracts with both electricity producers who can quickly increase production and large consumers of electricity who can temporarily cut back on consumption.

4.17 It is suggested that a similar system could be employed in the UK in order to balance supply and demand. As already set out in our response to Question 1, the role of Northamptonshire in any such ‘power trading’ arrangement is likely to be key given its strategic geographical location.

Conclusions

This report provides NEP’s response to the NIC call for evidence on electricity interconnection and storage.

Specifically, the following topics have been addressed:

- Balancing of grid in terms of supply and demand;
- Barriers to the deployment of energy storage;
- Appropriate level of electricity interconnection; and
- Lessons learnt from international best practice regarding balancing supply and demand.

Northamptonshire has an ambitious and comprehensive growth strategy over the next 15 years, which will bring an increased electricity demand and subsequent strengthening of both generation and transmission assets.

The key limitations to industrial growth in the region are from a lack of available electricity infrastructure which is discouraging new businesses from investing in the region.

Coupled with this, there is a current lack of collaboration between National Grid, the DNO and local authorities on delivering electrical infrastructure to meet growth plans, and instead, the DNO in particular is reactive to new development, rather than being proactive.

Within this response we have highlighted a number of ways in which this situation could be improved, including better regulation by OFGEM.

Furthermore, we have also suggested how changes in national policy regarding storage, grid balancing and interconnectors could benefit the Northamptonshire region as well as the UK as a whole.

Finally, we have provided examples of best practice from other European countries which could benefit the electricity market in the UK as a whole and in turn region such as Northamptonshire.