SSE response to the National Infrastructure Commission call for evidence, January 2015

About SSE

SSE (formerly Scottish and Southern Energy) is a UK-listed and based utility with a core focus on the energy markets in Great Britain, plus Ireland.

It is the broadest based energy company operating in the UK with interests in the production, transmission, distribution and supply of electricity and gas. SSE's core purpose is to provide the energy people need in a reliable and sustainable way.

SSE is one of the largest companies investing in the UK's energy infrastructure. In the five years to March 2018 it has plans to invest £5.5bn, net of disposals, in low carbon sources of energy and the infrastructure to support it. SSE's geographical focus is the markets in GB and Ireland, where it employs over 20,000 staff. The scale of SSE's investment and operations makes a significant contribution to the UK's economy; in 2014/15 independent research found that SSE made a contribution of £8.8bn to the UK's GDP.

SSE welcomes the opportunity to respond to the National Infrastructure Commission's (NIC) call for evidence.

Executive Summary

The UK requires significant energy investment in the coming years to ensure consumers continue to have access to the secure, clean and affordable energy supplies they depend upon. SSE welcomes efforts to provide energy investors with clarity and certainty and supports the aims that the NIC is working toward in its terms of reference. In this submission SSE addresses the areas of consideration in part four of the terms of reference, relating to energy infrastructure:

The case for large-scale energy storage in the UK's energy strategy

Storage technologies offer a broad range of benefits to the UK electricity system. The different characteristics and benefits of available storage types means there is no one type e.g. small-scale, bulk, or specific technology, that is most appropriate for all parts of the UK's electricity system e.g. at a transmission, distribution or domestic level. Different types of storage, at different scales, will be required.

Bulk energy storage will be an important part of this mix. It has the potential to play a crucial balancing role in the UK's energy mix, with the unrivalled volume provided by bulk storage technologies being particularly important when there are large shifts in renewable generation output.

However, the market framework does not currently support investment in new bulk storage. SSE therefore considers there to be merit in Government exploring how this could be unlocked.

Interconnection has a role but the cost/benefits must be considered

Analysis of the benefits and risks of greater interconnection to the UK has, to date, been limited in scope. SSE believes that without robust analysis interconnection may negatively impact the UK's efforts to encourage investment in other areas. SSE believes it is important that interconnection be viewed as access to capacity, rather than providing capacity itself, and that this is reflected in Government policy and support.

Market distortions in relation to embedded generation and demand side measures need to be addressed

While demand side response can increase flexibility of the electricity system it is important that a differentiation is made between true load shifting and embedded generation. The latter currently benefits from avoiding levies that support government policies (Capacity Mechanism, Renewables Obligation, Feed-in-Tariff, Contracts for Difference and Energy Company Obligation) and could displace more efficient transmission generation. SSE does not believe that the current distortions in favour of these resources are helpful from a societal and system-level perspective.

Independence of the System Operator

Some industry participants have expressed concerns that the way in which the System Operator (SO) is currently set-up within National Grid Electricity Transmission Ltd (NGET), part of National Grid plc, could create conflicts of interest, which could in turn impact on commercial decision making. Any perception that this is the case is likely to influence potential investors. Greater independence of the SO could help allay these concerns.

Other areas: the importance of the Carbon Price Floor in delivering energy investment

SSE has consistently been a supporter of carbon pricing, at both a UK and EU level, as the most efficient way to decarbonise the economy. SSE believes the Carbon Price Floor is the key plank in the UK's long-term energy policy. It underpins a number of existing policy mechanisms and has the potential to minimise future interventions by supporting the delivery of current government objectives, for example relating to the delivery of high efficiency new build CCGT, the phase out of coal-fired generation by 2025 and the economic case for increasing levels of interconnection and storage. SSE therefore believes that the NIC should consider the role and importance of the Carbon Price Floor in the delivery of cost-effective, low carbon energy infrastructure.

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?

- **What role can changes to the market framework play to incentivise this outcome:**
  - **Is there a need for an independent system operator (SO)? How could the incentives faced by the SO be set to minimise long-run balancing costs?**
  - **Is there a need to further reform the "balancing market" and which market participants are responsible for imbalances?**

Some industry participants have expressed concerns that the way in which the **System Operator (SO)** is currently set-up within National Grid Electricity Transmission Ltd (NGET), part of National Grid plc, could create conflicts of interest. This was an issue that was also raised during the development of the Electricity Market Reform (EMR) programme, and NGETs role as the EMR Delivery Body.

These concerns ultimately stem from the fact that National Grid plc is a listed company with a requirement to maximise returns for investors. Whilst recognising that this must be done within the constraints of the Electricity Act and its licence obligations, this requirement will naturally drive National Grid and its subsidiaries to influence any arrangements to best meet that outcome. Potential examples include:

- National Grid is subject to incentive mechanisms on its electricity and gas TO and SO functions and gas DNO, where it is exposed to significant upside if it performs well. There is therefore a risk that decisions will be influenced to maximise overall incentive upside opportunity.
- In its role as the EMR Delivery Body National Grid could choose to favour transmission rather than generation investment through EMR; or try to skew parameters to bias transmission investment, particularly investment in mainland England & Wales.
- National Grid has a number of commercial arms, creating a risk that SO decisions could be to the advantage of NGET affiliated businesses. For example, following the conclusion in March 2015 of Ofgem's consultation on integrated transmission planning and regulation (ITPR), the regulator gave National Grid extra responsibilities including to appraise major investment options and assess the value of potential additional interconnection to other countries. National Grid has a significant commercial interest in interconnection, which directly competes with electricity generation assets both in the electricity market and the Capacity Market auction, which National Grid also sets the parameters for.

Looking forward, the increased connection of inflexible and variable generation (renewables/interconnection/nuclear) is likely to require new methods of balancing the system.

National Grid as System Operator has already proposed two new ancillary services to deal with these issues. It is important that interaction between the suite of ancillary services and other influences such as network charges and the Capacity Market are fully understood. In addition, National Grid's commercial arm has already noted its interest in owning and operating storage assets to balance the system if regulations are changed. This would mean National Grid could in effect tender itself as a provider.

SSE would emphasise that there is no evidence to suggest that National Grid has acted inappropriately in any way; and there are clearly a number of safeguards in place to prevent this from happening. However, the perception that there are conflicts of interest which could impact on commercial decision making is likely to influence potential investors. Greater independence of the SO could help allay these concerns.

The electricity market has recently been through a number of significant changes which will impact its operation, including the actions of market participants in the **'Balancing Market'**.

These changes, namely the Electricity Balancing Significant Code Review (EBSCR) and Electricity Market Reform (EMR), were developed over a number of years and involved significant consultation. The EBSCR is designed to ensure that market participants are fully exposed to the costs of imbalance, thereby sharpening the financial incentive for them to take appropriate balancing actions. This, in theory, will reduce overall system costs for consumers. The Capacity Market introduced through EMR, as well as the Supplemental Balancing Reserve (SBR), is designed to ensure secure electricity supplies at the lowest cost to the consumer.

However none of these mechanisms have yet been properly tested (with the EBSCR only formally introduced in November 2015), and their full impacts on the market and each other are not yet understood. SSE therefore believes it is too early to tell whether any further change is needed in this area. In addition it is important to note that the UK appears to on the right track to meet the criteria of the European Target Model.

To what extent can demand-side management measures and embedded generation be used to increase the flexibility of the electricity system?

Traditionally Demand Side Management (DSM) has described the reduction of electricity demand at times of system peak, which usually occurs in the early evening. By reducing peak demand the use of expensive or carbon intensive marginal plant can be avoided, as can the requirement to reinforce distribution and transmission networks if their capacity is close to being reached. Since the 1970s DSM via off peak meters and tariffs such as Economy 7 have helped re-distribute significant electric heating load from millions of homes and businesses.

More recently, in line with the growth of variable renewable generation, Demand Side Response (DSR) has been discussed as a key demand management measure available to help balance the electricity system. DSR addresses supply and demand imbalances by actively:

- reducing consumption at times of supply shortage – this could include the DSM measures described above, or for example, it could include the use of behind the meter generation such as 'embedded generation' e.g. on site diesel back-up generators at large industrial sites;
- increasing consumption when inflexible and low carbon output is over-supplying – this could include charging hot water stores;
- fast switching to provide system frequency response – this has been demonstrated by using dynamically operated new electric storage heaters;
- shifting consumption to optimise the use of network capacity – SSEPD has created constraint Management Zones to incentivise localised load shifting.

SSE sees potential for DSR to operate at different levels of the electricity system, both as a provider of short-term system flexibility and within distribution networks where it can ease constraints. For example as a DNO SSEPD is exploring innovative solutions in the Assisting Communities Connect to Electrical Sustainable Source (ACCESS) project, which is investigating the dynamic capabilities of new electric heaters to track output from low carbon generation.

Despite the benefits that DSR can bring it is crucial that the full impact of different types of DSR are evaluated in order to ensure that unintended consequences are avoided and consumers are not disadvantaged.

For example, as embedded generation can lower net consumption on the transmission system it is often classified as DSR. Under the current market arrangements DSR derived from embedded

generation is able to avoid charges which other forms of generation are exposed to. This benefit, according to Frontier Economics, distorted the result of the recent Capacity Market auction by providing diesel generators and reciprocating engines with an advantage over larger, more efficient forms of generation such as new CCGTs; and will ultimately cost customers an additional £50m.

Frontier Economics state that the key incentive given to embedded generation is in how transmission charges (TNUoS) are structured. Without the revenue from avoiding these 'TRIAD periods' it is estimated that embedded units would require £55/kW from the Capacity Market, over three times the last auction clearing price. The problem is that transmission charges are currently not cost reflective, for example they do not consider that the majority of network costs have already been incurred and are therefore sunk costs, rather than being avoidable.

When embedded generation is 'behind the meter' it also benefits from helping a small sub-set of largely industrial customers avoid levies that support government policies (including the Capacity Mechanism levy, Renewables Obligation, Feed-in-Tariff scheme, Contracts for Difference and Energy Company Obligation). Whilst this benefits a small sub set it raises costs across the board, as the policy costs remain the same but are paid for by a smaller pool of customers.

The current benefits available to embedded generation therefore create an un-level playing field with transmission generation; correspondingly the first two Capacity Market auctions cleared over 2 GW of new embedded capacity eligible for 15-years of payments. This represents well over 50% of the new build capacity cleared in the Capacity Market so far. Without changes to the regulatory framework this situation is likely to continue, to the detriment of new build CCGTs and existing thermal generation.

Despite owning embedded generators and being able to invest in similar new assets, SSE does not believe that the current distortions in favor of these resources are helpful from a societal and system-level perspective. SSE recommends an independent review is conducted into the interaction of charges and incentives that are afforded to different types of capacity.

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

SSE is supportive of the deployment of storage across the electricity system. However SSE's main focus is currently large scale/bulk storage, and the detail below outlines its views on this area.

SSE owns and operates a 300MW pumped storage site at Foyers, and has planning consent for a new site at Coire Glas. This has the potential to provide up to 600MW capacity and 30GWh storage. The Coire Glas project is currently being considered by the European Commission for inclusion on the Projects of Common Interest list.

Currently the market does not provide investors with the necessary certainty to develop large scale energy storage capacity. Due to the existing market structure future revenues for large scale storage are extremely uncertain. Together with the large capital investment requirements, long lead times, and complex construction requirements this means projects are not currently viable.

In 2015 SSE commissioned Baringa to complete an assessment of the economic case for new pumped storage projects. This considered the potential for pumped storage to derive earnings from operating in the wholesale energy market and by bidding into the capacity and balancing markets. The report concluded that the revenue stream for new pumped storage plants is:

a) highly uncertain; and
b) there is a significant risk that potential revenues may not be sufficient to cover a plant's costs.

The uncertainty is amplified by the lack of long-term contracts in the ancillary services market; the fact that pumped storage projects often face substantial transmission charges; and that pumped storage projects are exposed to losses and BSUoS costs on both pumping and generation.

SSE therefore supports the Government's stated intention to work with Ofgem to consider how to best overcome current barriers to increasing deployment of energy storage capacity, including bulk storage.

SSE also supports the initial approach taken by the Government to establish what a 'least regret' level of energy storage for the UK's system would be; and how much of that capacity may be delivered through simple changes to the existing regulatory framework.

Looking further ahead at bulk storage specifically, it is likely that further work to overcome the issues of revenue uncertainty will also be necessary. In this context, SSE considers the investment case and characteristics of bulk storage to be similar to that of interconnection projects.

In terms of characteristics interconnectors provide a way to manage fluctuations in supply and demand and may provide opportunities for shared use of flexible, low carbon energy:for example a stated benefit of the proposed NSN link is that it enables access to bulk pumped-hydro storage in Norway. These benefits can also be delivered by the development of new bulk storage, but with the additional advantage that the UK could benefit from the wider welfare benefits that the development of large infrastructure projects brings. Just as many of the characteristics of interconnection and bulk storage are comparable, so too is the investment case, where for both the greatest barrier to investment is revenue uncertainty rather than absolute revenue expectation. However, there is not a level playing field for investment between the two technologies, with bulk storage being exposed to TNUoS and BSUoS charging and transmission losses, all of which interconnectors are exempt from. Furthermore the Cap and Floor Mechanism available to some Interconnector projects reduces the risk of investment.

SSE therefore considers there to be merit in Government exploring the potential for introducing a cap and floor arrangement for bulk storage in line with that which already exists for interconnectors. Such an arrangement can balance the requirement to provide greater certainty of investment to developers whilst also affording protection to consumers.

What is the most appropriate scale for future energy storage technologies in the UK? (i.e. transmission network scale, the distributed network or the domestic scale.)

Storage technologies offer a broad range of benefits to the UK electricity system including through:

- Increasing the effectiveness of renewables and other low carbon technologies through closer matching of supply and demand;
- Enabling more efficient system operability and supporting a diversified electricity system at a lower overall cost;
- Providing a range of balancing services to the System Operator (for example Frequency Response; Fast Reserve; Black Start; Reactive Power); and
- Facilitating the potential for avoided costs in, for example, developing additional peaking plant and additional network upgrade investment)All of these system benefits should also lead to lower overall costs for consumers.

The different characteristics and benefits of available storage technologies means there is no one type e.g. domestic, bulk, network connected, that is most appropriate for all parts of the UK's electricity system. Different types of storage, at different scales, will be required to achieve all of these benefits. SSE therefore recommends the government adopts a broad focus when looking at storage, and how it can best be deployed.

In terms of bulk storage specifically It is important to note that, at present, the volume and duration of storage provided by technologies connected to the transmission network cannot be rivaled by smaller units on an aggregated basis. By way of context, the maximum storage potential of Coire Glas (30GWh) is equivalent to the daily electricity demand requirements of approximately 350,000 UK homes. Given the core objective in developing storage is to maintain overall system adequacy, the ability of transmission connected storage to provide such significant storage volumes should not be overlooked. This will become increasingly important as deployment of renewable technologies increase and there are larger shifts in renewable generation output. Furthermore there are additional benefits in terms of overall system stability from the significantly longer run hours of large scale storage compared to other solutions.

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

The European Commission (EC) has set a non-binding target for each member state to have at least 10% of installed capacity via interconnection by 2020. This is due to the perceived benefits they bring to Europe and the EC's desire to have an internal energy market[1].

Three main benefits are identified by the EC with respect to interconnection, which are:

- Increasing Europe's security of supply
- Providing more affordable prices in the internal market through greater competition and efficiency
- Helping sustainable development and decarbonsing the energy mix by accommodating more variable renewable energy

Currently the UK benefits from 4.2 GW of electricity interconnection with Ireland, France and Holland. Whilst this is less than the 10% target set by the EC, over 8 GW of new interconnection is either under construction or being considered by the Regulator OFGEM. If completed this would significantly surpass the 10% level.

The economic rationale for interconnector investment, whether projects are merchant or regulation based, is to take advantage of price arbitrage opportunities between jurisdictions, which should reflect the marginal cost of generation and differences in electricity demand. In theory this allows overseas capacity to directly compete with GB generation in order to lower consumer costs. However, interconnection enjoys certain economic benefits over GB based capacity. These include:

- Access to OFGEM's 'cap and floor' mechanism which underpins investment in interconnection by providing a consumer-guaranteed minimum level of return;
- The avoidance of a host of charges, including transmission (TNUoS) and balancing charges (BSUoS), which ultimately raises costs to other users.

As a result of the above there is not a level playing field in the wholesale electricity market, nor are there economic signals to ensure optimal system-wide investment. For example, the removal of TNUoS charges to interconnectors has meant there is no locational price signal; therefore an interconnector could be sited to the benefit of the developer, but lead to longer term increased customer costs.

Increased levels of interconnection have widespread impacts on the electricity system which need to be considered alongside the widely accepted potential benefits noted above. For example interconnection is now permitted to participate in the Capacity Market alongside 'firm', reliable capacity. This may reduce the costs of the Capacity Market for consumers, as interconnectors will generally be cheaper than new electricity generation. However, interconnectors do not provide firm domestic de-rated capacity and there is significant uncertainty of how reliable the capacity will be from interconnectors in future years. Furthermore, the levels of interconnection predicted for the 2020s is sufficient to replace GB's existing coal fleet; this undermines the investment case for new build gas-fired generation, as well as the economics of existing stations.

There is therefore a balance between the recently stated policy objective to encourage new build CCGT and the currently ambitious development of new interconnection, which is yet to be fully appreciated. This view was echoed by PA Consulting who recently stated that as the level of interconnection increases, fewer new thermal plants will be built.[2]

[1] http://ec.europa.eu/priorities/energy-union/docs/interconnectors_en.pdf
[2] http://utilityweek.co.uk/news/will-more-interconnection-damage-uk-generation/1186753#.VozttfmqnWo

In particular SSE believes the current targets set for interconnection are somewhat arbitrary and a one size fits all approach across Europe is inappropriate given the different circumstances of member states. Going forward SSE recommends that an evidence based approach, which takes account of the full impacts of interconnection on the electricity system, is followed when evaluating the needs case for new interconnectors.

4. Further area of consideration: the importance of the Carbon Price Floor in underpinning the UK's energy investment strategy

SSE has consistently been a supporter of carbon pricing, at both a UK and EU level, as the most efficient way to decarbonise the economy. It was supportive of the introduction of the Carbon Price Floor, and continues to be a leading proponent of EU ETS reform.

SSE believes the Carbon Price Floor is the key plank in the UK's long-term energy policy. It underpins a number of existing policy mechanisms and has the potential to minimise future interventions by supporting the delivery of current government objectives. Examples include:

- The delivery of high efficiency new build CCGT
- The phase out of coal-fired generation by 2025
- The transition away from subsidies for low carbon generation to market based and/or cost competitive mechanisms
- The continued delivery of large volumes offshore wind at reduced cost

SSE therefore wishes to see the Carbon Price Floor extended beyond 2020. The instrument should also be designed in a way that sends out robust, reliable investment signals to UK energy infrastructure.

Summary

As a UK based utility SSE is seeking an energy investment environment that delivers the secure, clean and affordable energy supplies that homes and businesses depend upon.

This submission outlines SSE's views on the considerations in the NIC's call for evidence. It also highlights the importance of the Carbon Price Floor to the UK's energy investment strategy.

SSE invites further discussions with the NIC about this agenda and the contents of this submission.

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