Capita Response to the National Infrastructure Commission's Call for Evidence

Electricity Interconnection and Storage

Q2. What are the barriers to the deployment of energy storage capacity?

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Introduction

The National Infrastructure Commission is to carry out independent and unbiased assessments of the UK's long-term infrastructure needs, including a specific study on how the UK can better balance electricity supply and demand. Below is Capita's response to one set of questions relating to the barriers to the deployment of energy storage capacity.

Capita Plc is interested in supporting the development of a low carbon economy in the United Kingdom. Capita is already heavily involved in the UK energy industry, primarily by running the top-level control software behind the UK's largest existing battery storage facility in Leighton Buzzard and establishing and managing the smart metering data and communications infrastructure for the GB roll-out of smart meters. Capita has an active CSR policy and has been recognised and listed in the FTSE4Good Index for 14 years.

The NIC is interested in ensuring the energy market and operators manage an effective supply, but they are also tasked with assessing how the UK will remain competitive in this area in comparison to other G20 countries. This means that the key characteristics of the national electricity supply can be described as the following:

- Secure, stable and safe from failures
- As low carbon as possible
- Available at low cost to consumers
- As far as possible self-sufficient (as per the remit for the NIC)

To reduce its carbon footprint, the UK is investing significantly in renewable energy, which causes some new difficulties for maintaining system stability. Due to the reduced control over the energy source (wind and solar) and reduced system inertia provided by these generators, a greater proportion of renewable energy generation is making system balancing more difficult. This will be seen in a decrease in frequency stability in the electricity signal. In order to pursue the low carbon economy, it is important to invest in technologies such as energy storage that enable the effective use of more renewable energy sources. At the same time the cost of batteries has reduced sufficiently, which means it is now possible to build Grid scale energy storage capacity that can respond very quickly to imbalances in supply and demand, providing the potential for frequency response services that have previously been unavailable. The lower costs of energy storage technologies open up the possibility of building assets dedicated to providing balancing services, rather than balancing activity purely being an ancillary service for an asset built primarily for a different purpose. Such assets can offer a high availability, providing a greater certainty for system stability. They also have an advantage over the use of Interconnectors, because it can help the UK be more self-sufficient and competitive amongst the G20 members.

Are there specific market failures/barriers that prevent investment in energy storage that are not faced by other 'balancing' technologies? How might these be overcome?

Pricing structures & uncertainty

There is currently limited price information available for balancing-only services, which makes investment decisions for constructing purpose-built assets more difficult. Generally, the business cases for non-purpose-built assets are not predicated on balancing service prices, and so they have already made investment decisions based on more predictable revenues. This isn't possible for investing in dedicated assets, so to take advantage of the greater speed of response and availability these new technologies can offer, there should be greater transparency on expected market prices.

Part of the issue is that the value of fast response balancing services is not clear; no exhaustive end-to-end business case is available that describes exactly the intention for its use. Being able to respond to imbalances quickly should support a more stable network better than slower responses, but it is not yet clear if such a service would replace existing services or be additional to them. The uncertainty of the future demand adds risk to the investment of these assets. Moreover, the value of the generation/absorption capability of energy storage might change under different conditions, but it is unclear if the price will change to reflect this. For example, in low demand periods, generators are paid to constrain their output, but instead, an energy storage asset could absorb excess energy and then use it in high demand periods. This would likely save the consumer money, but the price might not reflect this system benefit. It would help to improve the visibility of potential price-points and mechanisms.

Contract lengths

The last major 'balancing technology' facility built in the UK, the Dinorwig hydro-electric facility, was a multi-hundred-million pound investment made by the state on a business case with a long payback period. Currently, there is a call for more investments to be made nationally, but for contracts that are being let only for short periods. Since the predictable revenue period is so much shorter than the life of the assets being built, capital expenditure will be amortised over the contract term, meaning the short contract durations will artificially inflate costs significantly. In order to address this, longer-term contracts should be let.

Regulation & charges

Energy storage investments face significant regulatory uncertainty around charges and obligations, particularly for larger scale facilities. This is one of the most significant market barriers that is solely in the control of regulators and network operators, and should be addressed with urgency. National Grid and Ofgem should be supported in fast-tracking the update of regulation, but also in providing clarity on short term exemptions for assets to be built within the next two years.

Some mandatory requirements set out within the existing regulation are counter-intuitive for the new technologies providing new balancing services. For example, assets with a large generation capability are required to provide continuous output through a wide range of system frequencies. This makes sense for a generator sourcing its energy from carbon-based materials, but a battery will have a finite capacity before needing to recharge. Enforcing this requirement would require the batteries to be oversized, adding unnecessary cost to the consumer. The new frequency response services are also described differently to mandatory frequency response criteria, but it is not clear if the service description supersedes the regulation.

Battery storage technology will also respond to high frequency (generation higher than demand) in a different way to traditional FFR suppliers, in that instead of reducing output, it absorbs energy from the grid and acts like an increase in demand. Even though the facility would only be storing energy to be released later, under existing regulations, the facility would become a consumer of energy, requiring it to pay both for the supply of electricity, but also consumption tariffs such as use of system charge, the climate levy and feed in tariffs These are not required to be paid by traditional suppliers, and causes an unnecessary barrier on energy storage. As these charges will also be paid by the end consumer, this will lead to a double recovery and artificially increase the operational cost of storage facilities. In summary, frequency response criteria designed quite sensibly for generators, aren't necessarily appropriate for such fast response, short-duration facilities.

It is particularly worth exploring the application of the climate levy more fully. Energy storage facilities are to be built specifically to enable the UK to move towards a reduced carbon footprint and reduce the human impact on the climate, and yet because they currently need to fit with existing regulation, they would be charged as an end user. It is counter intuitive to place a charge designed to reduce the UK's carbon footprint, on technologies that also reduce the carbon footprint. This creates an unnecessary barrier, and increases the cost to consumers for this development.

Planning permission

Another area of uncertainty is on obtaining planning permission for these investments. There is no current definition of asset class for energy storage, so these facilities risk being classed as large scale generation in spite of the characteristic differences. In particular, for battery-based technology, there are no large chimneys releasing by-products, the noise levels are lower and the equipment could largely be contained, and look less 'industrial' than a large generator. A balancing service is also of a national benefit that is being requested with some urgency, and so a national fast-tracked planning process would be a significant benefit. The NIC should look at ways to speed up the planning approval process for large scale storage projects.

Site availability

But even before seeking planning permission, there is a limited availability of suitable sites for large storage facilities. This is driven by both the physical land requirement and also the capacity of the electricity network local to the intended connection point. Mothballed generators, often designed to use carbon-based fuels, are included in calculations to understand network capacity, meaning they can prevent other assets connecting even if they are not expected to use the capacity allocated to them. Energy storage can be provided by new technologies, meaning it is appropriate for new companies to enter the market, but they won't necessarily own existing land near connection points. Owners of that land are not incentivised to sell, and so suitable sites could remain unused. Given the national interest in energy storage, the NIC could look into ways to develop a "use it or lose it" approach to plots that meet the criteria for new balancing services.

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.)

One of the important factors of developing and investing in new technology is ensuring best value for the consumer. The requirement for a national balancing service capacity could be satisfied by multiple small storage assets or fewer large storage assets, but at Capita we believe smaller storage devices would represent poor value to the consumer. Using fewer larger facilities would benefit from significant economies of scale, particularly by reducing the cost of grid connections and sites.

Energy storage provided by battery technology can be used for multiple services, and when connected at a distribution level, it can be deployed to provide stacked services that can benefit local priorities as and when required. However, to support the national system stability through frequency response services, it is advantageous to connect onto the transmission network, as this improves availability and alignment to national priorities. Distribution Operators could choose to prioritise local requirements over national requirements at any given time, which risks diminishing the value of the assets employed to the National Grid. Equally investors may choose to stack services when connected at the DNO level to drive maximum ROI, supporting DNOs with specific local challenges through services such as peak shaving and voltage support. This could further limit the reliability of balancing services for National Grid

Distribution Operators have expressed concern over installing fast responding balancing assets near consumers, as they could cause high rates of change of voltage. This could at best cause a DNO to limit the use of the asset for frequency response to protect local security of supply, or at worse could cause inconsistent supply for a consumer. This issue is reduced if the asset is connected at a transmission level, due to the increased distance from consumers and the higher network voltage at the point of connection.

While we recognise that domestic services will play their part, wholesale changes to the UK energy landscape will be required. The UK will need to rollout smart metering, time of use tariffs and have more intelligent customer interaction before domestic balancing services will be fully viable. Only when smart metering is rolled out will we be able to determine if they change consumer behaviour. Along this path, there will likely need to be better understanding on how to regulate domestic services, before they can be designed into the national balancing strategy.

In the near future a large scale energy storage facility (potentially 100MW+) connected to the transmission network delivering dedicated balancing services would be valuable in securing resilient and cost-effective infrastructure. This should be complemented by smaller scale (~10MW) facilities on distribution networks providing non-dedicated services, and supporting local requirements. It is difficult to determine the scale required in the future, however it is generally agreed that the amount of storage on the network will need to increase significantly to meet some of the challenges on in the near future such as decreasing system inertia and larger potential infeed losses.