Storage in NOA supplementary note - Methodology 2021

This note supplements the network options assessment (NOA) 2021/22 methodology and covers energy storage in the context of the NOA.

Introduction

As the proportion of generation on the system that is intermittent renewables rises, so does the need of energy storage to mitigate intermittency. The Future Energy Scenarios continue to see a rise in renewables and reflects this rise in storage too. This storage capacity has commercial drivers from intermittency and effectively load shifting to times of high renewable output. As the costs and technological advances in various storage solutions improve, we will see more and more storage facilities installed on the network. . The ESO is continuously looking to refine its process to take advantage of evolving and new technologies to provide the most economic and efficient recommendations for investment in the transmission system.

As well as balancing the energy needs across the system, the ESO continues to see increased potential for energy storage to provide transmission system benefit. The ESO 5-Point Plan to mitigating congestions s investigating how storage can cost effectively help with network constraints. This project is at an early stage in defining the technical and commercial frameworks that would support storage and other technologies in managing the future congestion costs on the system. In developing the approaches through the 5-Point Plan we will be able to ensure that all solutions provide end consumer value, and that they also meet system security requirements.

For bulk power transfers across the national electricity transmission system, the NOA process assesses the cost of ongoing constraints against investment in assets or services to mitigate constraint costs. The assessment seeks the optimum outcome looking some 40 years into the future. This supplementary note explains some of the complexity challenges we have identified for assessing storage in the NOA process. A process that's designed for solutions that provide boundary capacity uplift. As a result, we believe that in the short term a separate process is needed for storage. Once this is tested and proven, we can consider if there is a benefit to integrating storage assessment within the annual NOA cycle.

Challenges

The category of options that have historically been considered in the NOA provide additional boundary capability; either directly or indirectly. Directly, options which deliver new transmission infrastructure, uprate existing circuits, or replace equipment leads to a permanent increase in boundary capability. Indirectly, option such as intertrips allow more of the existing boundary capacity to be used, by providing mechanism to secure circuits in the event of a fault. This provides a consistent uplift in capacity that can be modelled.

Storage projects are different in how they may manage constraints. Storage operates as a demand source as well as generation. They can reduce constraints if they can operate as targeted demand or generation in certain regions, adjusting the power flow between regions and therefore reducing excess flows which lead to constraints. Storage does not provide, of itself, additional boundary capability. There are several complexities that need to be considered:

- **Storage is only useful if it has capacity to act.** In order to absorb power, storage must have headroom in its capacity (battery, lake etc) and can only absorb power until that capacity is full. In reverse, storage can only produce power if it is sufficiently charged. The ability of a storage unit to 'discharge' is dependent on having headroom on the network so it doesn't cause additional constraints. The ability of storage to manage constraints at a given time is therefore a function of the state of charge now and in the future. It does not provide permanent additional boundary capacity.
- **Market signals:** Storage does not currently receive the right signal in the market to effectively manage constraints. Currently as generation / demand, a storage provider sees only the GB market price. This however means that they do not see a price to reflect the locational nature of constraints, and

moreover, in responding to the GB market price arbitrage the storage unit may actually worsen the constraint situation.

- **A new commercial model** will be needed for storage to be effective in managing system constraints, given that the GB market design doesn't provide a robust signal. This model would have to be developed.

For us to model storage consistently with other NOA options, our key modelling tool would need to be able to model storage to operate in an effective way. Currently it models storage as another generator and demand, and so it is dispatched in accordance with the single GB market price. We can model different types of storage, parameterised by their charge rate, discharge rate and capacity. However, the complexities of the storage units discussed above interfaces with the tool:

- Storage does not provide permanent boundary capacity, it cannot be modelled as a boundary uplift like other NOA options. We must therefore consider how else storage could be modelled.

Storage is currently modelled like any other generation / demand, and there is no market signal and no developed future way for us to model storage in the tool in a way that it could be used to manage constraints. This would require, firstly, a clear understanding of the operating model and market signals, and then secondly, developing a mechanism for modelling controllable storage in the tool.

Conclusion

We need to better understand the technical and market structure requirements for storage to provide transmission system benefit and how this can be achieved. This in turn would help us to form a picture of optimal volumes, ratings and locations for storage while testing the economic case and security criteria.

We have concluded that the complexity challenges demand further consideration to help our understanding and develop possible processes. As part of our 5-Point Plan, we are already investigating how storage can cost effectively help with network constraints. Our next steps include engaging with potential storage providers to understand their expected modes of operation and possible costs. While we are developing these aspects, storage as a potential constraint solution will be kept separate from the core NOA process.