Susgen Response to Ofgem EHVDC Consultation

23rd June 2021

1. Background information

Questions answered:

1. *Do you agree that meeting the technical requirement with the two proposed HVDC links is appropriate?*
2. *Do you agree with our initial conclusions on the cost benefit assessment and the appropriateness of the options taken forward?*
3. *Do you agree that on the balance evidence including CBA, recent FES and NOA documentation, that these investments appear low regret?*
4. *Are there any additional factors that we should consider as part of our Initial Needs Case assessment?*

Response provided by Harry Sturgess (harry.sturgess@susgen.com), Market Analyst at Susgen, on behalf of Susgen and in partnership with Alcemi.

Susgen is a funder and partner to sustainable energy development companies, including Alcemi, which is developing large-scale transmission-connected battery storage projects in the UK.

A single response is provided below, aiming to comment on all of the above questions. The response focuses on the urgent need to consider large-scale electricity storage as an alternative to new transmission lines in managing constraint costs, via a full assessment of the system cost savings that storage solutions bring. While much of the response is applicable to any storage technology, some is specific to battery storage as this is where our knowledge lies.

2. Summary

To answer the question of whether it is appropriate to take the two proposed HVDC links forward, all possible solutions should be investigated, including electricity storage. The only solutions analysed as part of the INC outlined by Ofgem in this consultation are new transmission lines, including onshore and offshore. It may well be the case that it is cost effective for much of the new infrastructure to take the form of transmission lines, but the potential benefits of storage as an alternative to transmission lines should be assessed before £3.4bn of future consumers' money is committed to this EHVDC project.

While National Grid ESO has announced that its 5-point plan to manage system constraints includes investigating commercial models for storage, it has also recently noted (download (nationalgrideso.com)) that storage will not feature in the NOA until a greater understanding has been gained of how storage could help manage constraints.

NGESO will also be commissioning a project for external consultants to assess how effective storage could be at managing constraints (Energy Storage Technical Feasibility Assessment | National Grid ESO). This assessment process should be fast-tracked and the conclusions considered by Ofgem before any decisions on the EVHDC links are taken.

Following this, if potential benefit is found from using storage to manage constraints, as we expect will be, a commercial mechanism should be created to facilitate this, and the EHVDC project considered in light of these findings. It is key that this process happens quickly – as Ofgem notes in the consultation, delays in providing solutions to manage constraints cause hundreds of millions of pounds of increases in consumer costs.

Network and balancing costs are forecast to rise significantly over the coming years, and expectations of constraint volumes have increased in the latest NGESO ETYS report, so the cost of delays to deploying solutions has increased further. On this note, we would emphasise the inappropriateness of taking conclusions from modelling based on FES 2017, given the extent to which the scenarios have changed.

It is vital that all potential solutions are investigated fully as quickly as possible in order to minimise cost increases to consumers. These investigations should consider potential consumer benefits arising from earlier asset deployment, from the flexibility provided by more modular deployment, and from the increased reliability of alternative solutions. Evidence from the performance to date of the Western HVDC link shows how unreliable new subsea HVDC links can be.

Battery storage technology is available, high levels of performance have been demonstrated, there is a strong development pipeline, and there is keen investor interest in storage assets. If the right commercial incentives are provided then the industry is ready to deploy the type of projects that can help reduce system costs.

3. Explanation of the use of storage to manage constraints

There are broadly two different ways in which storage could help to manage thermal constraints on the transmission system.

The first is in an 'N-1' back-up / intertrip-style arrangement, which makes use of the ability of storage assets, particularly batteries, to respond rapidly in the event of the loss of a transmission circuit. This allows the SO to operate the system closer to maximum capacity and so maximise power flows across congested transmission boundaries, reducing constraint costs (see p3 of this Fluence white paper for a description of how this can work).

Required storage duration is not typically longer than 1h for this application, as this is very broadly the timescale by which the SO can take actions to manage the generation mix to account for the loss of transmission. This application is being opened up in GB via the Constraint Management Pathfinder; it fits into the NOA process because it increases the boundary capability at the relevant transmission system boundary.

The second application involves storage assets actively time-shifting the transmission of energy that would otherwise have been curtailed. In the UK this could involve storage assets located in Scotland absorbing excess wind energy at times of high wind output, then exporting it once the constraint is relieved, either due to increased local demand, reduced renewable output or a combination of the two. In this way costs are saved and renewable generation is not curtailed unnecessarily. Optimal storage duration for this energy shifting application will vary depending on network capacity and demand and generation profiles, and in most places a mix of durations is likely to be useful in addressing the constraints. This may also result in a range of storage technologies being used.

This application is not currently considered by the NOA process, as it does not increase boundary transfer capability directly. In our view, if a solution reduces the costs incurred at a particular boundary and minimises the curtailment of renewable energy then it should be considered as an alternative. There does not seem to have been any robust analysis of the system benefits of this type of solution in GB, as evidenced by the fact that NGESO is commissioning the analysis project referenced above.

4. Benefits of using storage vs new transmission lines

The key potential benefit that storage has is that it is an economically efficient solution to managing variable renewable output. The variability of renewable output means that meeting transmission requirements exclusively through 'always-on', single-function transmission lines will always be a suboptimal solution, leaving either redundant infrastructure or excess constraint costs (both paid for by consumers).

A certain level of continuous boundary transfer capability is necessary in order to account for energy storage capacity limitations, but there has been no quantification of the benefits of using storage above this level, or where this level should lie.

More specifically, there are a range of advantages that storage (battery storage in particular) has:

- Cost – battery storage costs have fallen rapidly over recent years and are projected to continue to fall over the coming decade. The two 2 GW EHVDC lines are expected to cost £1.3bn and £2.1bn, or £650k/MW and £1050k/MW on a capacity-normalised basis. At this level of CAPEX per MW, storage assets of up to 6-8h duration (duration meaning ratio of energy storage capacity in MWh to power in MW) are likely to be possible by the time the proposed EHVDC lines are energised.

  From our own analysis, some of the highest levels of constraint occur in windows of a few hours, so storage assets of these durations would be able to reduce constrained volumes significantly. The numbers above are not intended to provide a like-for-like cost comparison between the solutions, as the capabilities of each are different (and constraint management revenue would not need to cover the full capital costs of storage assets, as discussed in the 'Other revenue streams' bullet below), but they do give a rough indication of what is possible.

- Speed of deployment – storage projects can go from origination to commissioning in as little as three years, while the proposed EVHDC links have timelines of up to a decade, and there is already a significant storage development pipeline in place. If a commercial mechanism were introduced for storage projects, it could provide significant consumer savings in the years before the EVHDC links are commissioned, and adds optionality on when to build future upgrades (see Fluence white paper for a discussion on the value of this).

  Alcemi is developing 500 MW+ storage projects in Scotland with grid connection agreements in place from 2025 (see the TEC Register) – significantly earlier than the EHVDC EISDs.

- Modularity / targeted deployment – large volumes of storage can be deployed via multiple assets in particular locations, rather than through committing to individual £1-2bn projects that result in huge sunk costs for the consumer; projects can also be augmented over time. Modularity also positively impacts availability and reliability as there is no single point of failure (see 'High reliability' point below).

- Other revenue streams – storage assets can access other revenue streams, so revenues from constraint management would not have to cover the full CAPEX costs. For example, storage assets can gain Capacity Market payments, which should be stackable with constraint management agreements as the different services are not likely to be called upon at the same time. Storage can also access revenues from the wholesale markets and balancing services when not required for managing constraints.

- Lower consenting risks – battery storage assets use relatively little land and so have much lower consenting risk than transmission line infrastructure.

- Minimal cost/time overrun – there is much more limited potential for cost overruns for storage asset deployment than for large HVDC infrastructure projects.

- High reliability – storage assets have demonstrated high availability and reliability – data from the Gresham House Energy Storage Fund's portfolio shows average uptime of 98.8%; in contrast, the Western HVDC link has been plagued by outages since coming online fully in 2018. Batteries in general have operated reliably in the new Dynamic Containment service, helping to protect the system from several significant low frequency events.

- System operability benefits – storage does not have the system operability issues and associated balancing costs that come with large HVDC links (e.g. reactive power levels, voltage limits, sub-synchronous resonance). These wider costs need to be assessed and included in the cost benefit analysis.

- Increased competition – there is currently significant competition among storage asset developers and investors as capital is directed towards the renewable energy sector; in addition, the commercial mechanism could be set up so that competition post-contract means service costs are lower if there is over-deployment of storage (this will of course need to be balanced with providing enough certainty for investments to be made).

5. Existing barriers to deploying constraint-focused storage

While over 1 GW of new battery storage has been deployed in the UK over the past few years and there is a significant pipeline in development, the majority of this deployment has been 0.5-2h duration storage and has not been in constrained locations. Storage will not be effective at managing constraints unless a targeted mechanism is introduced, for the following reasons:

1. Complexity/uncertainty of modelling future revenues – a business case for storage assets addressing constraints is reliant on location-specific revenues from the balancing mechanism, which are highly complex to model, uncertain and volatile. This results in high return requirements for investors, or alternatively, a preference for unconstrained locations once the whole business case, including network charges, is considered.

2. Limited asset duration – the balance between future revenues and costs still points investors towards 1-2h duration assets for the most viable financial returns; a targeted constraint management revenue stream or contract that rewards longer durations (e.g. 4h, 8h, 16h) would be necessary for investors to commit to such projects.

3. Unhelpful locational charging signals – TNUoS charging actively disincentivises locating storage assets where they could be most useful, and are not cost-reflective in their application to flexible storage assets as they are to other generators.

6. Conclusion

Storage has the potential to help manage constraint costs effectively and reduce overall system costs, but barriers exist that result in exclusively short-duration storage assets being built, largely in unconstrained locations. Proposals from the TOs identified in this consultation all take the form of new transmission lines, and while such projects are almost certainly necessary to some extent or in some areas, storage needs to be considered as an alternative, especially to the more marginal transmission projects. The process of assessing the potential of storage to reduce constraint costs should be fast-tracked in order for projects to begin to have an impact on consumer costs in the coming years as constraint volumes increase. Only then can Ofgem be sure that the EHVDC projects are low regret.

7. Supporting resources

- National Grid ESO – 5-point plan to manage constraints - Our 5-point plan to manage constraints on the system | National Grid ESO
- National Grid ESO - *Storage in NOA supplementary note* - download (nationalgrideso.com)
- National Grid ESO – *Energy Storage Technical Feasibility Assessment* - Energy Storage Technical Feasibility Assessment | National Grid ESO
- TEC Register - Reports and registers | National Grid ESO
- Fluence White Paper - *Building Virtual Transmission: Critical Elements of Energy Storage for Network Services* - Download the Building Virtual Transmission White Paper (fluenceenergy.com)
- Fluence White Paper – *Transmission & Distribution: Using Real Option Pricing Models to Value Energy Storage Optionality in T&D Investment Deferral* - Download the T&D Deferral White Paper (fluenceenergy.com)
- Gresham House – *Gresham House Energy Storage Fund 2020 Annual Report* - Gresham-House-Energy-Storage-Fund-plc-Annual-Report-2020-1820-27.4.21.pdf (greshamhouse.com)