Show and Listen:

Sharing Storage Based Solutions for the Constraints Collaboration Project

7 March 2024

ESO

Introduction

Introduction: Agenda

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Battery for Constraints by EKU Energy	5 mins
Extended Intertrip Scheme and Grid Boosters by Field Energy	5 mins
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Introduction: Objective

Objective of today’s show and listen

1. To give an overview of storage-based solutions proposed by the industry

2. To provide industry the opportunities to have their say and ask questions

Storage-based Solutions for Thermal Constraints

Summary of storage-based solutions for thermal constraints

Project Name	Organisation	Overview of Solution	Solution is intended to	Page
1. Battery for constraints	Eku Energy	Eku Energy’s solution focuses on a means to reduce the line rating from 10 minutes to 3 minutes or less on specific boundaries. Their proposal is to implement a complimentary solution on the load side of a fault in the form of a battery or other fast responding generation that could, similarly to an intertrip, be armed and instantly activated via a point-to-point communication in the case of a fault and thereby export power and reactive power.	• Reduce overall costs to consumers • Increase effective network capacity	7
2a. Extended Intertrip Scheme	Field Energy	Field Energy proposed that the ESO explores the possibility of gradually increasing the LIL up to 2.3GW - Field Energy estimate this would require 200GW.s of inertia.	• Increase effective network capacity • Reduce overall volume of ESO actions	9
2b. Grid Boosters		Field Energy proposed virtual transmission schemes using storage. The 'grid-booster' concept increases the pre-fault capacity of the line and limits curtailment of generators, wasted renewable energy and associated replacement energy actions.	• Reduce overall costs to consumers • Increase effective network capacity	10
3. The ‘Big Friendly Battery’ – Combined batteries to create long duration B6 constraint alleviation	Flexitricity	Flexitricity Ltd have proposed the ‘Big Friendly Battery’ idea and this would use co-operation to create an effective long-duration battery using existing and soon-to-be-commissioned capacity north of B6.	• Reduce overall costs to consumers • Reduce overall volume of ESO actions	12

1. Battery for constraints (1/2)

Date: 15/02/2024
Organisation: Eku Energy

Areas of Discussion	Feedback
Overview	• *Eku Energy's solution focuses on a means to reduce the line rating from 10 minutes to 3 minutes or less on specific boundaries. Their proposal is to implement a complimentary solution on the load side of a fault in the form of a battery or other fast responding generation that could, similarly to an intertrip, be armed and instantly activated via a point-to-point communication in the case of a fault and thereby export power and reactive power.* • *This proposed solution aims to: reduce overall costs to consumers and increase effective network capacity.*
Value to ESO Market Design Framework	• ***Value to the consumer (Value for Money):*** *The increase in transmission capacity by up to 40% will reduce the total cost of the system and the value of 1 GW additional capacity Eku Energy provides could result in cost saving of £100m/GW/yr. These savings will be passed through to the consumer through: 1) Increased flow of renewable energy 2) Increased utilisation of existing transmission network – reducing transmission costs that could be passed to consumers through TNUoS; 3) High security fault management solution decreases balancing reserves and actions needed during periods of overloading– reducing balancing costs for constraints; 4) Integration of more short-term low carbon flexibility on the system increases system stability and security of supply - decreasing balancing and electricity costs.* • ***Value to the control room (Efficient Dispatch):*** *The control room won't have to focus on re-establishing the balancing reserves during outages on the power system. This is achieved because the increased transmission capacity reduces the periods of overloading as well as decreases the need for activating bids and offers in the balancing mechanism pre-fault as a precaution. Having certainty of fault management in the location needed will reduce complicated contingency plans that the control room would need to make.* • *In addition, having the solution that includes power and voltage support at the same time means less actions need to be taken by the control centre post-fault, enabling the control room to only focus on re-dispatching generation to return to stable operations.* • *Finally, utilising a designated battery rather than the dynamic response suite means the NESO is no longer constrained to providing re-dispatching services in 10 minutes. This opens up the option for the control centre to have more time to redispatch, allowing lower cost and higher efficiency.* • ***Value to the provider (Efficient Investment):*** *This solution, coupled with long term contract enable efficient investment, particularly if there are strong locational signals. Also, by allowing the service provider to participate in other markets, it will create the opportunity for a merchant upside. The network service opportunities will attract investment and if paired with support for a quicker grid connection, this would allow investors to invest in assets that can operate at the right time and place to help lower overall system costs.* • ***Carbon saving value* (helps 2035 target)*:*** *For 1 GW additional transmission capacity from a 1 GW BESS, it may be able to replace the need for a CCGT operating 50% of the time below the B6 constraint. If so, around 1.5MtCO_2 emissions could be saved.*

1. Battery for constraints (2/2)

Date: 15/02/2024
Organisation: Eku Energy

Areas of Discussion	Feedback
Impact and Implementation	• ***Additional value to the system:*** *BESS for constraints can also provide system-strength, stability, inertia, frequency, electricity restoration (black start) and energy balancing to ensure a high security of supply.* • ***Potential challenges with implementation*** *include designing the contract/service to determine the highest benefit option for the lowest cost, updating the control room and ensuring timely delivery prior to line upgrades and reform.* • ***Contracting period:*** *Proposed T-3 or T-4, but it depends on the amount of generation needed, the specific location, and the potential of existing sites to provide the service. This could be explored first, and if there were enough sites, a T-1 option would be sufficient for wiring a connection.* • ***Contract length:*** *Ideal contract tenure is 4 years – this would incentivise new builds and also offer the NESO flexibility and enough time to align grid buildout timings and market reform.* • ***Prices:*** *set through a competitive tender. The exact format of the pricing is flexible and can be a combination of: Fixed yearly price combined with set parameters for arming each year; and additional arming /utilisation priced separately.* • ***Lead time:*** *vary - tendering and contracting could be done by end of 2024. For existing assets, this could then be live by end of 2025. If building new assets, it is expected that a solution could be available within 2-4 years of contracting, depending on grid connection & construction.*

2a. Extended Intertrip Scheme

Date: 29/02/2024
Organisation: Field Energy

Areas of Discussion	Feedback
Overview	• *Proposed the ESO to explore the possibility of gradually increasing the LIL up to 2.3GW - Field Energy estimate this would require 200GW.s of inertia.* • *Proposed solution aims to: Increase effective network capacity; Reduce overall volume of ESO actions.*
Value to ESO Market Design Framework	• ***Value to the consumer (Value for Money):*** *Increasing the LIL would increase the size of the intertrip capacity and thus limits curtailment of generators and wasted renewable energy. For example the cost of the B6 intertrip service arming fees for 1700 MW reduced significantly in 2024 and is now no more than £5.8m / year. Field Energy expect that increased LIL would increase the cost savings to >£700m / year.* • ***Value to the control room (Efficient Dispatch):*** *Less wind curtailment and associated energy balancing actions and increased system resilience.* • ***Value to the provider (Efficient Investment):*** *Field Energy suggested that this solution allows wind to continue to be constructed in regions with the best resources thereby producing the lowest energy costs whilst deferring the cost of new network build.* • ***Carbon saving value* (helps 2035 target)*:*** *Field Energy's analysis found that the existing intertrip service is saving about 1.1 $MtCO_2$/year of renewable energy per year from being wasted (67% reduction compared to no intertrip). The savings could increase to 1.4 $MtCO_2$/year (85% saving) by increasing the LIL.*

Impact and Implementation	• ***The solution could provide other wider system benefits that reduce cost to the consumer and increase system security***
	   ○ *Greater system resilience for multiple generator / HVDC system faults ;*
	   ○ *Increasing the largest infeed limit would allow larger grid connections with minimal increase in grid costs and so reduce the LCOE of the windfarm; this benefit would be seen through lower CfD auction prices which would pay back to the consumer.*
	• ***Potential challenges with implementation:*** *Increasing the LIL requires increasing holding of inertia, response and reserve, all of which used to be costly. Additionally, the existing intertrip communications system would need to extend to include more windfarms in Scotland.*
	• ***Contracting period:*** *Field Energy suggested procurement of the intertrip service remains annual to allow time to install the required communication links with publication of armed systems in advance of all day-ahead markets. With inertia, response and reserve all moving to DA markets, increasing the LIL could be achieved on a DA basis. If a higher LIL is chosen then procuring for the longer term (i.e. six or 10 year contracts) could achieve a lower cost per unit of inertia.*
	• ***Contract length:*** *Annual for intertrip; varying timescales for inertia, response and reserve.*
	• ***Prices:*** *Continue as normal using DA markets, except to increase inertia volumes to match the chosen LIL.*
	• ***Lead time:*** *Subject to ESO's analysis of increasing the LIL. This analysis should cover the post-fault stability of the B6 and other boundaries.*

2b. Grid Boosters

Date: 29/02/2024
Organisation: Field Energy

Areas of Discussion	Feedback
Overview	• *The 'grid-booster' enables the ESO to increase the pre-fault power flow up to the maximum limit of the line (either thermal/stability depending on the location) without also having to increase the LIL limit and the associated increase in cost that would bring through higher inertia and response holding. In parallel, this service limits curtailment of generators, wasted renewable energy and associated replacement energy actions.* • *This proposed solution aims to: reduce overall costs to consumers and increase effective network capacity.*
Value to ESO Market Design Framework	• ***Value to the consumer (Value for Money):*** *Field analysis suggested that the existing intertrip service is saving ~£600m/year and that that could be increased to ~£800m/year (87%) if 3.6GW of grid booster service was procured (in addition to the existing intertrip) after factoring in the costs of the additional wind farms with intertrips and the batteries providing the symmetric turn-up service.* • ***Value to the control room (Efficient Dispatch):*** *Less wind curtailment and associated energy balancing actions. Field Energy estimate the existing intertrip service is saving about 3.2TWh/year of renewable energy from being wasted (68% reduction compared to no intertrip). The savings could increase to 4.8TWh/year (98%) using grid boosters.* • ***Value to the provider (Efficient Investment):*** *This service would allow wind to continue to be constructed in regions with the best resources thereby producing the lowest energy costs whilst deferring the cost of new network build.* • ***Carbon saving value*** **(helps 2035 target)*:*** *Increases the use of zero carbon energy sources and reduces the use of gas generation (both self-dispatch and for balancing actions). The existing intertrip service is saving about 1.1MtCO_2/year of renewable energy per year from being wasted (67% reduction compared to no intertrip). The savings could increase to 1.7 MtCO_2/year (98% saving) by using a grid-booster service.*

Impact and Implementation	• ***Potential challenges with implementation*** *include the need to for a new intertrip communications system for activating batteries armed to ramp quickly and ability to stack revenue with other services (e.g Capacity Market, inertia, reactive power, wholesale services when not armed).*
	    • *The cost of batteries providing the service would to increase with the duration of time the service is required. The longer the duration, the higher opportunity cost needed to be factored in its price. With stacking, Field Energy expect that batteries could offer this service for £10/MW/hour.*
	    • *The greatest challenge is likely to be in ensuring that the batteries will respond quickly enough to avoid a drop in system frequency.*
	    • *A benefit of this proposal is that it can be tested with minimal stress to the system.*
	• ***Contracting period:*** *Likely to be T-1 or day ahead. Initial longer term Y-4 contracts may be required until there is sufficient liquidity.*
	• ***Prices:*** *Should be set through tender.*
	• ***Lead time:*** *Trial service could be operational within 12 months with a full scale service within 2 years; the limiting step is likely the intetrip communications network which is within the remit of NGET.*

Discussion

How can we make sure that this is value for money for the consumer?

How can we make sure that this is technology neutral, promoting competition and accessible to as many customers as possible?

How will this make it easier for the ESO to efficiently plan and operate the system?

What changes are required to deliver this solution?

Pros/Cons

3. The ‘Big Friendly Battery’ – Combined batteries to create long duration B6 constraint alleviation

Date: 29/02/2024
Organisation: Flexitricity Ltd

Areas of Discussion	Feedback
Overview	• *Flexitricity Ltd have proposed the ‘Big Friendly Battery’ idea and this would use co-operation to create an effective long-duration battery using existing and soon-to-be-commissioned capacity north of B6. Thermal constraints on B6 are often active for several hours, restricting the usefulness of short-duration batteries in alleviating it. Existing and near-completion batteries in Scotland amount to at least 800MWh of storage capacity, with a further 4,800MWh to be added within two years and these batteries are generally sized for 1.5-2 hours of delivery at maximum power. By working together and consuming at lower power, these batteries could provide over 700MW of constraint alleviation for at least eight hours.* • *This proposed solution aims to: Reduce overall costs to consumers and Reduce overall volume of ESO actions*
Value to ESO Market Design Framework	• ***Value to the consumer (Value for Money):*** *Flexitricity’s analysis suggests that delivering this service at 700MW for an eight-hour period of constraint on B6 would save the consumer approximately £450,000 on each event, with the net benefit could be around £40m on an annual basis (used on 100 days/year), passes to consumer through BSUoS.* • ***Value to the control room (Efficient Dispatch):*** *Reduced curtailment would result in less balancing actions. The service would become a highly responsive and controllable constraint-management resource, providing a means of attracting batteries out of NIV-chasing and into the BM.* • ***Value to the provider (Efficient Investment):*** *This service would provide immediate revenue for making best use of available renewable energy which can be simultaneously stacked with certain other services, providing revenue resilience and supporting investability for future projects.* • ***Carbon saving value* (helps 2035 target)*:*** *Flexitricity’s analysis suggests 5,600MWh of zero-carbon energy is stored per event, for later consumption, thus reducing fossil burn. If used for 100 days/year this amounts to 560GWh of additional renewable energy in the GB system. In addition if an equal-and-opposite service were deployed, the carbon benefit would increase as less thermal replacement energy in England and Wales would be required.*
Impact and Implementation	• ***Potential challenges with implementation:*** *Flexitricity expect the challenge to be purely contractual. It is possible that multiple battery operators could work together to provide an effective long-duration "big friendly battery", but Flextricity suggest that it may be easier for ESO to construct a service and purchase centrally. Providers would then effectively be agreeing to have a low state of charge at a particular time of day, and to commence charging at 15-20% of full power on instruction from ENCC.* • ***Contracting period:*** *Service procured at Day-ahead, at a specific sequence of settlement periods of around eight hours duration.* • ***Prices:*** *Set using the EAC, or alternatively using a combination of DCMR and DA EPEX prices in the short-term.* • ***Lead time:*** *Project could be commenced immediately as is purely contractual. Lead time would be driven by administrative setup.*

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Pros/Cons

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