Sharing first draft of the Market Design Framework (MDF) assessment for the Constraints Collaboration Project (CCP)

May 2024

ESO

Introduction

Introduction: Agenda

Contents	Facilitator	Time
Introduction	Becky Hart	09.30 – 09.45
Demand for Constraints	Alifa Starlika	09.45 – 10.45
Coffee break	N/A	10.45 – 11.00
Constraints Management Markets (CMM), including the Big Friendly Battery	Gus Clunies-Ross and Dave Phillips	11.00 – 12.30
Lunch break	N/A	12.30 – 13.15
Extended Intertrip Scheme	George Hunt	13.15 – 14.15
Flexible Assets to Support Capacity Increase	George Hunt	14.15 – 15.15
Closing and next steps	Alifa Starlika	15.15 – 15.30

Introduction: Objective

Objectives of today’s workshop

1. To give an overview of the first draft of MDF assessment

2. To explain assessment methodology and assumptions to be applied

3. To provide industry the opportunity to ask questions

Introduction: Housekeeping

Key asks for the workshop

- This is a show and listen – please share your ideas to improve the proposals (where needed)
- Constructive criticism – this is still an **initial** assessment for challenge and review
- Be interactive and actively contribute to the discussion
- Relax and enjoy the workshop!

Workshop Norms	*Listen to each other*	*Engage in the process*	*Know what to let go*	*No question too stupid*	*Defer judgement*	*Seek clarity*	*Put your phone out of reach!*

Options to be assessed

Overview of market-based solutions based on identified themes

1. Constraints Management Markets (CMM)

1A. Demand for Constraints

- **amp CLEAN ENERGY** – Increasing demand for power in constrained areas for electrification of heat
- **eneus energy** – Flex PtX to produce green H_2 and related derivatives
- **Statkraft** – Demand signal product
- **ScottishPower** – Incentivising new discretionary demand (H_2 production and electricity storage)
- **Flexitricity** – 'COOLER HEATING' – commercial heat loads as responsive assets
- **sse Business Energy** – Long-term constraint management contracts (incentivising new demand)

1B. CMM – Long Term (Multi years to decade ahead)

- **TEL the energy landscape** – Constraints management markets (CMMs)
- **SCOTTISH FUTURES TRUST** – Long term contract to manage a portion of the forecast constraint volumes
- **sse Business Energy** – Competitively allocated season ahead constraint management availability contracts
- **EDF** – Long-term auction of excess wind

1C. CMM – Short Term (Day to week ahead)

- **ZENOBĒ** – Pre gate closure constraint management product using scheme 7 trade
- **sse Business Energy** – Competitively allocated short-term constraint management contracts (D-7)
- **EDF** – Discounted demand turn up
- **EDF** – Weekly generation turn down market
- **Flexitricity** – The 'Big Friendly Battery' for ~8 hours duration

2. Increasing how much can flow over boundaries

2A. Extended intertrip scheme

- **FIELD** – Extended intertrip scheme
- **ZENOBĒ** – Intertrip scheme utilisation
- **sse Business Energy** – Enhance utilisation of the transmission network
- **Eku** – Battery for constraints: Reducing the line rating from 10 to 3 mins

2B. Flexible assets to support capacity increase

- **FIELD** – Grid booster
- **ZENOBĒ** – Transfer booster
- **Kona Energy** – Paired storage systems across key boundaries
- **ZENOBĒ** – Flexibility for Active Network Management (ANM) zones and Generation Export Management (GEMS)

Key

- Demand for Constraints
- CMM – Long term
- CMM – Short term
- Increasing how much can flow over boundaries

Assessment criteria using the ESO Market Design Framework (1/5)

Market Design Objectives

Efficient Dispatch

Meets balancing service needs in real time using the optimal combination of supply and/or demand side resources

Efficient Investment

Gives investors sufficient certainty over revenues to obtain financing, ensuring future system requirements are met by the right technology mix in the right location

Value for Money

Selects outcome that are in the best interest of current and future customers

Market Design Principles

Efficient Dispatch:
- Competition (Short Run)
- Locational Signals in Dispatch

Efficient Investment:
- Competition (Long Run)
- Locational Signals in Investment
- Investability

Efficient Dispatch and Efficient Investment:
- Coherency
- Transparency
- Whole Energy System Flexibility

Value for Money:
- Net Consumer Benefits / Least Cost*
- Practicality / Deliverability
- Adaptability

Constraints

We are looking for market-based solutions that can be implemented and deliver results in the short term (<5 years)

* To be assessed by an external consultant

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Key Efficient Dispatch | Efficient Investment | Value for Money | Prioritised criteria

Assessment criteria using the ESO Market Design Framework (2/5)

Principles	Explanation and Rationale	Assessment Metrics
Competition (Short Run)	**What:** The solution creates a market in which multiple current or potential participants seek to offer better terms (prices and quantities) than those offered by other participants, which is open to all providers technically capable of providing the service	*What is the number and MW of existing capable providers?* *What is the market share of the three largest providers?* *How many technically capable providers are included and excluded by eligibility rules?*
	Why: Ensures service eligibility does not unduly discriminate against particular technologies	
Locational Signal in Dispatch	**What:** The solution provides insight to market participants on what's the value of their actions to the system in terms of location and incentivises dispatch that meets system requirement	*Would the proposal send sufficiently accurate and granular signals by time and location?*
	Why: Demonstrates ability to reduce overall volume of ESO actions and delivers value for money to consumers	

Assessment criteria using the ESO Market Design Framework (3/5)

Principles	Explanation and Rationale	Assessment Metrics
Coherency	**What:** The procurement methods enable market participants to make decisions about where to bid, which are efficient for both the market participants and the system, across all ESO and non-ESO markets (e.g. Wholesale and DSO markets) **Why:** Ensures the solution's procurement decisions are efficient and aligned with the evolution of ESO markets and other markets	*Will this solution be consistent with the procurement of other ESO services?* *How does this solution align with DSO's markets?*
Transparency	**What:** Information is provided to market participants and procurement decisions are made in a clear and predictable way **Why:** Demonstrates ability to minimise information asymmetries and uncertainty around ESO's decision making	*How much information about forecasting for the service can be shared?* *How will the ESO publish the service rules and methodology to ensure clarity for participants?*
Whole Energy System Flexibility	**What:** Market design should incentivise market participants of all sizes (both supply and demand) to act flexibly where it is efficient to do so. It should also promote greater coordination across traditional energy system boundaries, to enable effective optimisation across the system as a whole **Why:** Ensures the solution enables effective optimisation across the energy system as a whole	*Does this support an integrated, whole-system approach across different energy vectors (vendors/sectors/actors)?*

Key Efficient Dispatch Efficient Investment

Assessment criteria using the ESO Market Design Framework (4/5)

<table>
<tr><th>Principles</th><th>Explanation and Rationale</th><th>Assessment Metrics</th></tr>
<tr><td rowspan="2">Competition
(Long Run)</td><td>What: The solution creates a liquid market through multiple players that can offer competitive terms (prices and quantities)</td><td rowspan="2">How many providers could participate in this service in future?</td></tr>
<tr><td>Why: Ensures the solution enables price discovery and reduce overall cost to consumers in the long run</td></tr>
<tr><td rowspan="2">Locational Signal
in Investment</td><td>What: The solution ensures that capacity is constructed and that services are procured in the right places</td><td rowspan="2">Does the proposal provide a locational investment signal, to support development of new assets, which can help with either demand or generation useful for system operation?</td></tr>
<tr><td>Why: Demonstrates value that encourage investors to invest in new generation or storage assets, demand or sources of flexibility to build an optimised electricity system that accurately reflects the value of generation and demand to the system</td></tr>
<tr><td rowspan="2">Investability</td><td>What: Market design must drive the significant investment in technologies needed to deliver our objectives and deliver investment signals which market participants and investors can respond to and rely on</td><td rowspan="2">What is the contract length?

Will the proposal provide revenue certainty for providers?</td></tr>
<tr><td>Why: Demonstrates ability to generate revenue to attract financing or investment</td></tr>
</table>

Assessment criteria using the ESO Market Design Framework (5/5)

Principles	Explanation and Rationale	Assessment Metrics
Net Consumer Benefits / Least Cost	**What:** The costs to consumers do not outweigh the benefits conferred by the procurement method **Why:** Ensures the solution reduce overall costs to consumers	*What is the net consumer benefit of the solution? (does the solution generate savings to end consumer bills?)*
Practicality / Deliverability	**What:** Changes to market design should be practical to implement, transition to and operate within designated timeframes and seek to minimise disruption during the transition, taking account of the highly complex and integrated nature of the power system **Why:** Demonstrates ability to deliver in short term	*Does the procurement method require ESO to increase its operational capabilities?* *Will the solution require changes in industry systems or processes?*
Adaptability	**What:** Market design should be adaptive, responsive to change, and robust to uncertainty. The solution should also be flexible to changes in balancing service requirements and the technology mix **Why:** Demonstrates ability to keep up with dynamic market and regulatory changes	*How often is ESO able to adjust the volumes procured for this service?* *Does it present any challenges to future decarbonisation, or decentralisation?* *Will the service be compatible with compatible with planned or potential changes to market design?*

Key ■ Value for Money

Demand for Constraints
(09.45 – 10.45)

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Policy Option 1A: Demand for Constraints

1A

	Demand for Constraints
Description	A commercial service contract which offers reduced cost electricity in certain locations to incentivises new sources of demand. This could deliver benefit by reducing the volume of renewable curtailment as well as delivering the value back to consumers.
Possible Contract Lengths	The longer the duration of the contract, the stronger the investment signal for new demand to be located north of the constraints. A contracting period of 10 years is ideal for investor requirements given alignment with debt repayment terms. The contract would include a 'sunset clause' which would end the contract early if zonal market reforms are introduced. This would insulate market participants from price volatility.
Possible Value/Price/Costs	Industry suggested the payment structure considers a split tariff arrangement with two elements to promote competitiveness: £/MW per annum demand payment to service provider for capacity installed; and £/MWh utilisation payment to National Grid ESO for electricity consumed from curtailed energy. Industry proposals indicated that demand payment with the range £30k and £60k per MW per annum and a utilisation payment directly related to the scale of availability payment would be of an appropriate scale.
Possible Volumes	An agreed annual volume could be set at proportion of the forecast constraints (e.g. 50% of the time we have constraints per year or 1,500 hours in 2030 and 2,500 hours in 2035). Volumes could be adjusted following forecast updates. In parallel, the new demand facility must report their availability to take on the forecasted curtailed electricity volume in advance (e.g. 36-hour notice to allow scheduling). If less electricity was consumed than allocated, there would be penalties that participants must pay.
Who Could Participate	New electricity demand behind the constraints to support the development of new flexible demand, achieving sustainability goals through additionality. The new, additional, flexible demand should be 1 MW minimum for the BM to be able to dispatch and could be in the form of electrolysis facility, data centres, large electric boiler, and vector shifting from gas to electricity. ESO would need to investigate the criteria for additionality required by law.
Where It Would Be Active	North of Scottish boundaries (e.g. B6).
Lead Time	Could be relatively short - service launch should be achievable within two years. ESO would need to put in place the capability to dispatch, settle, and structure the contract, parallel to industry ensuring their plant can come online in time.

Disclaimer: these proposals have been sourced from organisations above and the template does not indicate any endorsements or firm commitment for future commercial opportunities from the ESO

Quantifying the Net Consumer Benefit

Scope of our analysis

Modelling horizon 2025-2035, in line with options to be introduced in <5 years

Simple quantitative modelling, using the B6 boundary as 'proof of concept'.

Supplemented by qualitative whole system benefit assessment

Thermal constraints only. Indirect system services implications out of scope.

Overarching methodology

- We focus on the **net impact on the total consumer bill**. This includes both impacts on constraint management costs in the BM/option under consideration, as well as on wholesale market and renewable support scheme costs. **Greenhouse gas (GHG) emission impacts** are also identified.
- We compare costs under each option to a 'status quo' counterfactual. Under policy option 1A., benefits include:

Avoided BM constraint costs – largely offset by additional renewable support scheme costs

Revenue from selling excess electricity otherwise curtailed (reducing rest of consumers' bills)

GHG reductions, e.g., from additional electrified demand / reduced demand for other vectors

We would like your input

Key inputs and assumptions to determine costs/benefits under policy option 1A. Demand for Constraints

Assumption/Input	Approach
Assumption: Demand additionality	• Demand treated as **additive relative to the counterfactual**, i.e., does not represent a change in location, or an intertemporal shift of consumption. • No additional demand outside constrained hours
Input: Demand archetypes and volumes	• **Types of flexible demand** expected to participate would need to meet additionality requirements and be able to come forward within the modelling horizon. Proposing to rely on: (a) electrolysis, (b) district heat with thermal storage, (c) flexible I&C demand. • **Available flexible capacity (MW in a given hour) and volumes over the year (number of hours):** Drawing on FES scenario assumptions. • **Procured capacity:** No more than say 75% of available flexible capacity and no more than say 50% of forecasted annual hours of constraints over the 10-year period – set to provide upfront certainty.
Input: Payment structure and price	• Demand pay a **fixed £/MWh** to consume a given volume. *Sensitivity: Availability payment structure* • Starting point: Fixed price **must be cheaper than CfD strike price/RES cPPAs commercially available** but higher than SRMC. • To consider: interactions with other schemes, such as the Hydrogen Production Business Model support.

Draft Market Design Framework Analysis: Demand for Constraints

Proposed by:		amp, eneus energy, Statkraft, ScottishPower, Flexitricity, sse Business Energy
Proposal		**Demand for Constraints**
I. Efficient Dispatch	Competition (Short Run)*	**Limited existing providers for the service, however there is potential for providers to relocate in advance of the launch of the service**. In future, there is sufficient diversity in the range of technologies (e.g., data centres, hydrogen electrolysers and industrial processes) and providers to prevent a dominant market being held by a single provider, or group of providers.
	Locational Signals in Dispatch	**Long term contract with a payment mechanism formulated based on availability and utilisation would give a locational signal in dispatch.** Most of these proposals involve ESO contracting with new demand years in advance with long duration contracts. Utilisation cannot be predicted that far in advance, therefore locational signals in dispatches are partially met. Dispatch would be location and time dependent, depending on where and when the relevant constraint(s) are active. Further information on the availability and details of variable demand flexibility to be delivered as a service, rather than simply new fixed sources of (large) demand, is required for this scheme to score green.
II. Efficient Dispatch and Investment	Coherency*	**Strong alignment with ESO services and the level of coherency with DSO markets depends on the detailed technical design of the service.** This proposal would act as long-term revenue support mechanism so it does not overlap with procurement of existing ESO services and poses no coherency issues with our current markets. In terms of DSO markets, where new demand is transmission connected, the impact on DSO network and market operation would be minimal.
	Transparency	**Information could be provided in a clear and predictable way.** The proposals showcase that they can be facilitated to provide transparency and minimise asymmetric information. The ESO would be able to provide information to market participants in the form of long-term forecasts for constraints.
	Whole Energy System Flexibility	**Nature of long-term contract suggests limited ability to maintain optionality**. This proposal provides longevity of support (10 years) to benefit investment decisions for individual projects focusing on emerging technologies. However, longer term contract would inhibit the ability of the scheme to keep their options open for emerging technology that comes along the way. Accessibility is also considered to be moderate given the requirement for the demand to be new.
III. Efficient Investment	Competition (Long Run) *	**Strong potential for good long-run competition with a range of technology types (e.g. data centres, hydrogen electrolyser) able to participate.** Within these technology types there is potential for replacement of gas with electricity and sources of entirely new demand.
	Locational Signals in Investment	**Strong potential to incentivise new, flexible demand in constrained areas.** Assuming a contract length of 10 years with a sunset clause for any REMA related market changes, this will provide locational signals for investment for new sources of demand.
	Investability	**Long-term contracts may favour investments by providing a more stable flow of returns.** This scheme would provide a medium to long-term revenue stream and build investor confidence for new flexible demand, encouraging investment in constrained areas. The guarantee of a low power price for new flexible demand also de-risks the project sufficiently to attract private financing.
IV. Value for Money	Net Consumer Benefits*	**N/A - will be assessed by Baringa**
	Practicality*	**Requires multiple new ESO capabilities to be practical to operate**. New contract managing capabilities as well as to dispatch, settle, and operationally forecast the response; new methodology for co-optimising the operational use of very different tools with differing constraint value across varying cost impacts. This is likely to add high operating complexity with high integration impact on ENCC Strategy/Operational process & systems. A significant risk common to DfC proposals is the lack of clarity about baseline load vs. flexible loads, so as to be practical for ENCC or DNOs to operate, also ensuring for the industry that their plant can connect greater demand concurrently. Dispatch must also be locationally definitive. An advantage is that most proposals focus on larger, locationally definitive assets.
	Adaptability	**The 'lock-in' risk of long-term contracts limit adaptability.** To effectively incentivise new demand may require guaranteed volumes, and so it may be difficult to adjust volumes down once contracting has been completed. The possibility of zonal/locational pricing in future market reforms could be addressed through a sunset clause in contracts for this service, but if national pricing persists ESO may need to maintain this scheme until the required network build out is delivered. This scheme supports future decarbonisation by encouraging electrification of industry, but does not mitigate the need for gas turn up ahead of constraints to meet demand.

How do you feel about this draft assessment?

Level of Alignment: Low (1) Moderate (2) High (3) * Prioritised criteria

Constraints Management Market: Long Term

11.00 – 12.30

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Policy Option 1B: Constraints Management Markets (long-term)

TEL the energy landscape | SSE Business Energy | EDF | Scottish Futures Trust | Flexitricity

1B	Constraints Management Markets
Description	A constraint market offers the ESO to contract for flexibility with generators and demand in advance of real time, thereby reducing the volume of higher cost actions required by ESO last minute in the BM. These markets can be run by contracting volume months in advance.
Possible Contract Lengths	Flexible based on market requirements – for long-term contracts the volume would probably be contracted through options or availability. Proposed contract lengths include 12 months (or seasonal) run at Y-1 or Y-4. Although it presents higher gaming risk, most savings are expected from nominating volumes ahead of most day ahead (DA) markets.
Possible Value/Price/Costs	Significant value could be achieved from generation turn down (t/d) if/when unsubsidised assets join the market. Demand turn down and generation turn up (t/u) and turn down would deliver value through increased competition if bid prices were lower than counterfactual (BM actions). Consumer savings would be achieved for demand turn up based on delta between CMM service price and the service provider purchase price of the additional units of energy. Balancing Reserve uses similar DA market alternative to BM action, with significant estimated savings (£639m over 2024 – 2027).
Possible Volumes	Utilising demand and generation turn down and turn up would allow gigawatts of volumes to be eligible (**Industrials & Commercials**, domestic, **wind**, EVs, heat, etc). CMM target volume could be set at proportion of forecast constraint volume (e.g., if forecast constraint is 2TWh then we secure 1.5TWh through Y-1 auction), or up to forecast plus error/uncertainty using options if justified by favourable pricing compared to actions closer to real time which could include a short-term CMM (e.g., if low options price then for forecast range of 1.5-2.5TWh we could secure 2 or 2.5TWh).
Who Could Participate	All forms of generation or demand on either side of the boundary with appropriate metering at a level to demonstrate service delivery, which can provide flexibility either through shifting or increasing or decreasing their energy flows. For long-term contracts, the investment signals could support the creation of new, flexible assets.
Where It Would Be Active	Potential for national participation. Majority of volume/opportunity for participation behind the constraint is expected to be in Scotland (B6). Broad geographical area would be eligible for participation in reducing replacement energy costs either through demand turn down or generation turn up secured ahead of BM action counterfactual.
Lead Time	For long-term contracts there may be limited initial participation given the potential for longer-term investment in the creation of new flexible demand through the building or adaptation of assets. Service launch should be achievable within two years but this could be reduced to potentially within 12 months with a simplified design and organisational prioritisation.

Disclaimer: these proposals have been sourced from organisations above and the template does not indicate any endorsements or firm commitment for future commercial opportunities from the ESO

Quantifying the Net Consumer Benefit

Scope of our analysis

Modelling horizon 2025-2035, in line with options to be introduced in <5 years

Simple quantitative modelling, using the B6 boundary as 'proof of concept'.

Supplemented by qualitative whole system benefit assessment

Thermal constraints only. Indirect system services implications out of scope.

Overarching methodology

- We focus on the **net impact on the total consumer bill**. This includes both impacts on constraint management costs in the BM/option under consideration, as well as on wholesale market and renewable support scheme costs. **Greenhouse gas (GHG) emission impacts** are also identified.
- We compare costs under each option to a 'status quo' counterfactual. Under policy options 1B. And 1C., benefits include:

Avoided BM constraint costs – primarily avoided mark-up costs as CMM procurement costs similar

GHG reductions, where turn up of thermal generation is reduced compared to the BM counterfactual

Any unintended consequences, e.g., gaming risks, reduced DA/ID liquidity etc. captured qualitatively or through sensitivities where possible

We would like your input

Key inputs and assumptions to determine costs/benefits under policy option 1B. Long-term CMM

Assumption/Input	Approach
Assumption: Mark-ups	• Mark-up based on historically observed values under the counterfactual of BM procurement. Reduced mark-up when procured earlier in CMMs. • We will draw on experience from the provision of other services outside the BM and ESO expertise to develop reduced mark-up assumptions.
Input: Demand and generation bid and offer stack	• **Simple bid/offer stack** for turn-up/turn-down service provision, with volumes as per BM stack under the counterfactual. • *Sensitivity: Volumes from parties unable to participate in the BM, e.g., DSR that requires earlier notification, changing the bid/offer stack composition. Drawing on evidence of additional volumes from the Local Constraint Market (LCM) experience.*
Input: Availability and utilisation fees	• **Availability and utilisation components, drawing on the provision of other system services** • **Prices based on opportunity costs** (and any mark-up assumptions). *Sensitivity: Seasonal price differences reflected through different products* • Using markets from provision of other services as proxies – e.g., reserve markets, primarily STOR given similarities in expected lack of co-delivery revenue stacking opportunities.
Input: Volumes procured and utilisation of different providers	• **Procured capacity:** Set to X% of forecasted annual/seasonal constraints, avoiding excessive procurement to reduce market liquidity impacts. • **Utilisation of different resources depending on forecast duration of constraint** as well as their relative cost.

Draft Market Design Framework Analysis: Constraints Management Markets (long-term)

Proposed by:		TEL, SSE Business Energy, EDF, Scottish Futures Trust, Flexitricity
Proposal		**Constraints Management Markets (long-term)**
I. Efficient Dispatch	Competition: Short Run*	**Broad eligibility has potential for large volumes** across a range of technology types; limits undue concentration of market power. Variety of price mechanisms and cost bases could boost competitive offers.
	Locational Signals in Dispatch	**The different proposals offer a range of reasonable to poor locational signals in dispatch.** The simpler long-term contract proposals with the provider obligated to being active/available for a pre-agreed number of hours per year does not give locational signals in dispatch, as constraint locations and durations cannot be predicted accurately this far in advance. However, the proposal for competitively allocated season-ahead constraint managing contracts does send locational signals in dispatch, as the ESO is specifically buying contracts featuring availability and utilisation components in shorter-timescales.
II. Efficient Dispatch and Investment	Coherency*	**The policy option is coherent with DFS and DSO markets although there is risk of competition between ESO and DSO markets**. The service would not be coherent with reserve and could split the market due to similar requirements. Interaction with distribution networks and ANM zones would need to be included in the service design to achieve coherency.
	Transparency	**The proposals indicate transparent delivery,** with information on service rules and methodology being established and provided to market participants in a collaborative and clear way. Ahead of time forecasts could help to set appropriate procurement targets and ensure that information is provided in predictable way that minimises information asymmetries and uncertainty around decision making.
	Whole Energy System Flexibility	**Some whole system inclusion**. Long term contracts increase ESO's flexibility to maintain optimality, keeping options open for emerging technology; Accessibility remains moderate given the short timescales it allows for assets to ramp up/down to be able to provide their services. However, long term CMMs may be limited in their ability to benefit investment decisions in whole energy system emerging technologies.
III. Efficient Investment	Competition: Long Run*	**Competition is boosted by growth of flexible assets** including residential flexibility, transmission and distribution connected battery storage and electric vehicles the long-run (more so than Short Term CMMs) Higher number of wind farms/distributed generation should also improve long-run competition – with generators especially further enhanced when some generation assets begin to roll off their CfD schemes.
	Locational Signals in Investment	**A constraints management market would be active for a certain constraint(s), providing a clear indication for location of investment.**
	Investability	**Moderate degree of investability given its short timescales and reliability of revenue arrangements.** Assuming a contract length of 12 months or seasonal, long term CMM would provide confidence over future revenue or cost streams. This scheme could be important in securing debt or equity to finance initial construction, and as such they could provide a useful investment-timescale incentive to locate in particular areas. It is however less likely for a capital intensive asset to recoup their initial investment solely through this scheme due to the form of contract which still includes a risk that utilisation is not called for.
IV. Value for Money	Net Consumer Benefits*	N/A - will be assessed by Baringa
	Practicality*	**Extended capability would be needed to enable practical use.** these needs span across multiple areas: new ESO forecasting of MW pull-back, to enable operators to make effective decisions across a variety of new longer-term market timescales; compensating metered imbalances; new geospatial mapping to avoid clashes with sub-constrained areas; substantial integration with control room systems and configuring of operational forecasts; commercial co-optimisation of long term contracts vs. BM to ensure value-add. Embedded MW relies on more capable DSO/DNO operations, planning tools and systems.
	Adaptability	**Partially adaptable due to multi-year procurement and delivery cycle.** The need to provide more certainty a year or more ahead and securing that availability limits the volume flexibility for this service. The possibility of zonal/locational pricing in future market reforms could be addressed through a sunset clause in these contracts, but if directions of Markets Reform trends toward national evolution ESO may need this scheme until required network build out is delivered. Proposal supports future decarbonisation, encouraging electrification of demand and addressing constraints, but unclear if this may mitigate gas turn up in front of constraints to meet demand.

How do you feel about this draft assessment?

Disclaimer: We reserve the right to review and amend all provisions within the document for any reason and in particular to ensure that proposals provide value for money

Level of Alignment: Low (1) Moderate (2) High (3) * Prioritised criteria

Constraints Management Market: Short Term

11.00 – 12.30

Policy Option 1C: Constraints Management Markets (short-term)

TEL the energy landscape | sse Business Energy | EDF | ZENOBĒ | Flexitricity

1C

	Constraints Management Markets
Description	A constraint market offers the ESO to contract for flexibility with generators and demand in advance of real time, thereby reducing the volume of higher cost actions required by ESO last minute in the BM. These markets can be run in the short-term at day-ahead of the constraint.
Possible Contract Lengths	Short term CMM could utilise firm 30 min contract blocks nominated at the day ahead (DA) of the constraint. Although it presents higher gaming risk, most savings are expected from nominating volumes ahead of most DA markets.
Possible Value/Price/Costs	Significant value could be achieved from generation t/d if/when unsubsidised assets join the market (e.g., if we gain access to non-BM generation which have lost access to CfDs). Demand t/d and generation t/u and t/d would deliver value through increased competition if bid prices were lower than counterfactual (BM actions). Consumer savings would be achieved for demand t/u based on delta between CMM service price and the service provider purchase price of the additional units of energy. Balancing Reserve uses similar DA market alternative to BM action, with significant estimated savings (£639m over 2024 – 2027). Current LCM also provides strong reference for costs and value.
Possible Volumes	Would also be highly dependent on service design but utilising demand and generation t/d and t/u would allow gigawatts of volume to be eligible (Industrials & Commercials, **domestic**, wind, **EVs**, **heat**, etc). Short-term CMM could be used independently as a solution to constraint management or in combination with solutions for other time horizons such as long-term CMM and DfC providing us with potentially lower cost long-term secured volume to meet high certainty forecasted requirement and this option nearer to real time when the forecast is more certain.
Who Could Participate	All forms of generation or demand on either side of the boundary with appropriate metering at a level to demonstrate service delivery who are able to provide flexibility either through shifting or increasing or decreasing their energy flows. Whilst it could be used to improve the investment case for new assets these would likely require stronger signals such as a long-term CMM.
Where It Would Be Active	Potential for national participation. Majority of volume/opportunity for participation behind the constraint is expected to be in Scotland (B6). Broad geographical area would be eligible for participation in reducing replacement energy costs either through demand t/d or generation t/u secured ahead of BM action counterfactual.
Lead Time	The lead time for implementing the scheme could be relatively short but would need to be discussed further. Service launch should be achievable within two years but this could be reduced to potentially within 12 months with a simplified design and organisational prioritisation.

Quantifying the Net Consumer Benefit

Scope of our analysis

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Simple quantitative modelling, using the B6 boundary as 'proof of concept'.

Supplemented by qualitative whole system benefit assessment

Thermal constraints only. Indirect system services implications out of scope.

Overarching methodology

- We focus on the **net impact on the total consumer bill**. This includes both impacts on constraint management costs in the BM/option under consideration, as well as on wholesale market and renewable support scheme costs. **Greenhouse gas (GHG) emission impacts** are also identified.
- We compare costs under each option to a 'status quo' counterfactual. Under policy options 1B. And 1C., benefits include:

Avoided BM constraint costs – primarily avoided mark-up costs as CMM procurement costs similar

GHG reductions, where turn up of thermal generation is reduced compared to the BM counterfactual

Any unintended consequences, e.g., gaming risks, reduced DA/ID liquidity etc. captured qualitatively or through sensitivities where possible

We would like your input

Key inputs and assumptions to determine costs/benefits under policy option 1C. Short-term CMM

Assumption/Input	Approach
Assumption: Mark-ups	• Mark-up based on historically observed values under the counterfactual of BM procurement. Reduced mark-up when procured earlier in CMMs. • We will draw on experience from the provision of other services outside the BM and ESO expertise to develop reduced mark-up assumptions.
Input: Demand and generation bid and offer stack	• **Simple bid/offer stack** for turn-up/turn-down service provision, with volumes as per BM stack under the counterfactual. • *Sensitivity: Volumes from parties unable to participate in the BM, e.g., DSR that requires earlier notification, changing the bid/offer stack composition. Drawing on evidence of additional volumes from the Local Constraint Market (LCM) experience.*
Input: Utilisation fee	• **Utilisation fee based on opportunity cost** including expected DA price (and any mark-up assumptions). • Using markets from provision of other services as proxies – e.g., reserve markets, primarily STOR given similarities in expected lack of co-delivery revenue stacking opportunities.
Input: Volumes procured and utilisation of different providers	• **Procured capacity:** Set to X% of forecasted day-ahead constraints. *Sensitivity: Used in conjunction with 1B., utilised only during very tight periods.* • **Utilisation of different resources depending on forecast duration of constraint** as well as their relative cost.

Draft Market Design Framework Analysis: Constraints Management Markets (short-term)

Proposed by:		TEL, SSE Business Energy, EDF, Zenobē, Flexitricity
Proposal		**Constraints Management Markets (short-term)**
I. Efficient Dispatch	**Competition: Short Run***	**Broad eligibility has potential for large volumes** across a range of technology types; limits undue concentration of market power. Variety of price mechanisms and cost bases could boost competitive offers.
	Locational Signals in Dispatch	**The proposals satisfy locational signals in dispatch,** giving both volume and location signals varying by time when the constraints are active. For the market to work, the ESO must give quality volume, time and location signals.
II. Efficient Dispatch and Investment	**Coherency***	**The policy option is coherent with DFS and DSO markets although there is risk of competition between ESO and DSO markets**. The service would not be coherent with reserve and could split the market due to similar requirements. Interaction with distribution networks and ANM zones would need to be included in the service design to achieve coherency.
	Transparency	**The proposals indicate transparent delivery,** with information on service rules and methodology established and provided to market participants in a clear, collaborative way. Ahead of time forecasts would be able to be provided to set appropriate procurement targets and ensure that information is provided in predictable way that minimises information asymmetries and uncertainty around decision making.
	Whole Energy System Flexibility	**Short term contracts lack longevity required** to drive emerging whole system technology investment decisions and the short timescale for assets to ramp up/down may make it harder for wider flexibility to access. Conversely, short term agility can increases ESO's flexibility to maintain optimality, keeping our options open for emerging technology and supporting whole systems potential.
III. Efficient Investment	**Competition: Long Run***	**Competition is boosted by growth of flexible assets** including residential flexibility, transmission and distribution connected battery storage and electric vehicles the long-run (more so than Short Term CMMs) Higher number of wind farms/distributed generation should also improve long-run competition – with generators especially further enhanced when some generation assets begin to roll off their CfD schemes.
	Locational Signals in Investment	**A constraints management market would be active for a certain constraint, providing a clear indication for location of investment**
	Investability	**The impacts of existing generation subsidy schemes and not cost correcting metered imbalances for all demand participants could severely inhibit the investability for many potential providers.**
IV. Value for Money	**Net Consumer Benefits***	**N/A - will be assessed by Baringa**
	Practicality*	**New capability needed across multiple areas**: Capabilities needed are broad, spanning ESO forecasting of MW pull-back; compensating metered imbalances; new geospatial mapping to avoid clashes with sub-constrained areas; substantial integration with control room systems and configuring operational forecast tools; commercial co-optimisation of long term contracts vs. BM to ensure value-add; added capabilities for DSO/DNO planning and operational tools and systems. DNOs may also need new industry process for forward investment in headroom plus Primacy processes to operate increased flexibility. For Big Friendly Battery diverse aggregation of flex would still need precise forecasting per-GSP/ potentially lower network levers to enable DNO/DSO operability, still reliably delivering location-specific MW.
	Adaptability	**Partially adaptable.** Ability for eligible assets to deliver in one or more service windows allows greater flexibility of volumes. The possibility of zonal/locational pricing in future market reforms could be addressed through a sunset clause in contracts for this service, but if the direction of Markets Reform goes towards national evolution ESO may need this scheme until the required network build out is delivered. Proposal supports future decarbonisation by encouraging electrification of demand and addressing constraints, but unclear if this may mitigate gas turn up in front of constraints to meet demand.

DRAFT

How do you feel about this draft assessment?

Disclaimer: We reserve the right to review and amend all provisions within the document for any reason and in particular to ensure that proposals provide value for money

Level of Alignment: Low (1) Moderate (2) High (3) * Prioritised criteria

Extended intertrip scheme

13.15 – 14.15

Extended intertrip scheme

Eku | sse Business Energy | ZENOBĒ | FIELD

2A

Extended intertrip scheme	
Description	Intertrip schemes enable the ENCC to facilitate more power to flow on the existing transmission infrastructure pre-fault, thus reducing the amount of generation being curtailed pre-emptively when the expected flow exceeds the current capability of the circuits. Existing constraint management intertrip scheme could be further enhanced by increasing the largest infeed loss limit to allow for a greater quantity of generation to be armed. This in turn would contribute to the increase in the effective boundary capacity by consequences of faults and flow uncertainty. In addition, EKU suggest reducing the line rating from 10 minutes to 3 minutes or less on specific boundaries could see up to a 40% increase in transmission capacity.
Possible Contract Lengths	Contract lengths suggested in the proposals range from 1 to 10 years, with 4 years targeted to provide trade-offs of flexibility for ESO and allowing new investment for developers.
Possible Value/Price/Costs	Field Energy indicated that greater utilisation of the existing B6 Constraint Management Intertrip Service could save an additional £100m/year, after factoring in the costs of increasing inertia, response and reserve; while EKU assume savings in costs of constraints of up to £100m/GW/year via utilising new battery capacity on boundaries. Payment structures would follow the existing intertrip service being made up of an arming fee (£11/MWh in 2023/24) which the ESO pays when the user is armed and an intertrip fee which is made up of either a Tripping Fee (£/trip) when the user is tripped (~200ms) following a network fault or a De-loading Fee (£/de-load) when the user performs a de-load action (ranging from seconds to minutes post fault). Potential saving from this scheme will be the difference between arming fee and the cost from the Balancing Mechanism.
Possible Volumes	Field Energy suggested increasing the largest infeed limit to 2.3 GW would require an additional 200 GW.s of inertia to be procured and could prevent an additional 0.9TWh/year (c. 14.75% of total constraints volume in 2023) of renewable energy being curtailed when compared to the existing intertrip scheme. Currently the ENCC is arming arm up to 1.2GW, but will seek to contract with capacity at least double this to enable competition and account for the reduced load factor of wind.
Who Could Participate	Open to new and existing generators that are able to meet the technical requirements of the Constraint Management Intertrip Service.
Where It Would Be Active	The ESO constraint management intertrip service currently operates and aims to reduce network congestion costs in the Anglo-Scottish boundary (B6) and the East Anglian (EC5) region. The proposals are targeted at enhancing the existing intertrip schemes and can be extended to other areas of with large thermal constraint volumes.
Lead Time	Could take approximately up to 3 years to implement. This would be dependent on availability of new or existing sites to provide the service, and detailed stability analysis by the ESO of increasing the largest infeed loss limit.

Disclaimer: these proposals have been sourced from organisations above and the template does not indicate any endorsements or firm commitment for future commercial opportunities from the ESO

Quantifying the Net Consumer Benefit

Scope of our analysis

Modelling horizon 2025-2035, in line with options to be introduced in <5 years

Simple quantitative modelling, using the B6 boundary as 'proof of concept'.

Supplemented by qualitative whole system benefit assessment

Thermal constraints only. Indirect system services implications out of scope.

Overarching methodology

- We focus on the **net impact on the total consumer bill**. This includes both impacts on constraint management costs in the BM/option under consideration, as well as on wholesale market and renewable support scheme costs. **Greenhouse gas (GHG) emission impacts** are also identified.
- We compare costs under each option to a 'status quo' counterfactual. Under policy option 2A., benefits include:

Avoided BM constraint actions and costs – partly offset by intertrip scheme costs and increased LIL

GHG reductions, due to avoided pre-emptive curtailment/turn up of thermal generation in the BM

As noted, any technical implications are out of scope.

We would like your input

Key inputs and assumptions to determine costs/benefits under policy option 2A. Extended Intertrip scheme

Assumption/Input	Approach
Assumption: Arming and tripping periods	• **Arming when tightness is expected** – e.g., when flows over the B6 boundary reach 70% of the capacity. Drawing on ESO expertise to quantify appropriate security standard. *Sensitivity: 'Curve' of arming; arming different volumes at different %s.* • **No tripping** in our modelling horizon
Input: Appropriate % increase in the largest infeed loss (LIL) to enable extended intertrip	• **Increased LIL assumption:** Increasing LIL to 1.6 GW – equivalent to the upcoming Hinkley Point C unit 1. *Alternative: notional 2GW assumption* • **Volumes and cost of additional system services procurement** associated with increased LIL - inertia, frequency response and reserve. Drawing on ESO expertise on volumes needed and on recent procurement to quantify. • **Implied facilitated increase in B6 boundary capability** when armed – drawing on existing pathfinder schemes and ESO expertise to determine. Reduction in BM action volumes calculated in line with increase in capability.
Input: Arming and tripping fees	• Drawing on evidence from **existing intertrip scheme and pathfinders**.

Draft Market Design Framework Analysis: Extended intertrip scheme

Proposed by:		Eku, sse Business Energy, ZENOBĒ, FIELD
Proposal		Extended intertrip scheme
I. Efficient Dispatch	Competition (Short Run)*	**Limited available sources in the short term challenge liquidity and may reduce competition:** Sources of inertia are decreasing, which results in there being limited available sources to support the proposal of increasing the largest infeed loss. As a result delivering this service before adequate assets are available has the potential to not only fail to achieve liquidity but also significantly reduce competition in other markets. Additionally, to increase system inertia to support and increased LIL would significantly reduce the liquidity for the service and negatively impact competition. It is noted that there are no eligibility rules which appear to exclude technically capable providers.
	Locational Signals in Dispatch	**Moderate alignment with locational signals in dispatch**: The proposals do not directly send locational signals for dispatch and are more aligned to increasing participation and investment in intertrip providers and reviewing existing system operating standards and procedures. However, increasing the number of intertrip providers can increase liquidity in the market for providers to submit arming fees and increase competition to drive down the £/MW arming rates.
II. Efficient Dispatch and Investment	Coherency*	**High interdependencies with existing ESO services pose challenge to coherency:** This service would need be procured in a co-optimised event with response, inertia and reserve to ensure it is coherent. The risk of curtailment in this solution may also prevent assets from providing DSO services, potentially impact the liquidity in DSO markets. However, the risk is considered to be low so it may be manageable for DSO operators.
	Transparency	**Strong track record of existing scheme providing transparent information.** The proposals indicate adequate transparency levels through the provision of complete service rules and methodology, as well as forecast information to establish requirements for procurement windows. Through the development phase a review of existing datasets that provide a view on the arming and disarming of units contracted could be undertaken to allow for greater transparency on reasons for arming and utilisation of units, in addition to ensuring decisions for contracting units can be made in a replicable way, taking advice from industry on how best to facilitate greater information provisions.
	Whole Energy System Flexibility	**Moderate scale of whole energy system flexibility**: Annual procurement proposed for the extended intertrip scheme suggests ability to maintain optionality, while a longer contract length (.g. 4 years) provides capability to hedge effectively. Advantageous aside, there is limited evidence on how this scheme could promote greater coordination across traditional and new energy system vectors, to enable effective optimisation across the system as a whole.
III. Efficient Investment	Competition (Long Run) *	**National deployment of battery assets ensure adequate competition for increased service requirements:** There is an additional 4GW of assets that could be connected in Scotland by the end of 2026. However, with increasing penetration of renewables, stability on the system is forecast to continue to decline and the cost procuring additional inertia could be significant. However, if provided with adequate notice additional volume could be procured through a competitive tender.
	Locational Signals in Investment	**Strong alignment with locational signals in investment:** The proposals would allow for the product design to tackle a specific boundary constraint and therefore clearly indicates a location signal for investment. This locational signal would be delivered through the procurement method and ensure that capacity is constructed, and services are procured in the right places.
	Investability	**Moderate scale of investability:** Assuming revenue model for extended intertrip scheme is similar to the current Constraint Management Intertrip Service (CMIS) with Arming Price Caps and Intertrip Fees set on an annual cycle, this scheme alone does not present long term revenue certainty for service providers. However, it does present an additional opportunity for small scale revenue provided revenue stacking is permitted.
IV. Value for Money	Net Consumer Benefits*	**N/A - will be assessed by Baringa.**
	Practicality*	**Track-record of existing scheme may improve practicality:** The proposals evidence that the procurement method is practical to implement, transition and operate. There will be an element of new capabilities being required to implement the service, with general operation already somewhat aligned with existing intertrip operation. There is a need for the ESO to undertake studies into the related risks including additional transmission connected and/or embedded generation tripping; as well as consider the overall risk appetite for full utilisation of the service. Also needs process to ensure sufficient Reserve available.
	Adaptability	**Annual contracting and ability to adjust armed volumes suggests higher degree of adaptability:** The proposals indicate that the procurement method is flexible to changes into market requirements and the evolving technology mix due to there being no eligibility rules which appear to exclude technically capable providers. For the expansion of the intertrip, contracts could be signed annually with the possibility to seek longer contract periods as necessary. During operation, the proposals would allow for armed volumes to be altered during each settlement period according to the forecasted constraint event. This provides volume flexibility and means that costs more closely reflect actual constraint events.

DRAFT

How do you feel about this draft assessment?

Level of Alignment: Low (1) Moderate (2) High (3) * Prioritised criteria

Flexible assets to support capacity increase

14.15 – 15.15

Flexible assets to support capacity increase

FIELD Kona Energy ZENOBĒ

2B Flexible assets to support capacity increase

Description	Increasing and/or more effectively coordinating energy storage assets around the constraint boundary to allow boundary transmission infrastructure to be run closer to maximum capacity, reducing curtailment volumes. This could be achieved by freeing up storage capacity behind the constraint to better manage short term peaks in generation, or by creating storage capacity in front of the constraints to provide contingency in the case of a fault occurring.
Possible Contract Lengths	Options requiring new storage assets to come online would need contract lengths of at least 1 year. Industry prefers a long term contract (T-4), providing greater investment signals, increasing market liquidity, and reducing the financing costs and the cost to the end-consumer.
Possible Value/Price/Costs	Payment for the service was proposed to be a combination of availability and utilisation, which could be priced at around £10/MWh assuming that this service is "stackable" with as many other revenue streams as possible. A few suggested pricing could be set in a dynamic way depending on the contract length.
Possible Volumes	Some organisations suggested 250 MW of energy storage for constraint alleviation for at least two hours in Scotland (B6) would be available for this scheme. The service could be utilised around 10% - 25% of the year during periods of highest wind or when a constraint is active, as this is likely to have small opportunity costs to batteries/storage providers. The longer the service period is, the higher the prices that batteries would factor in for the lost opportunity cost of other markets.
Who Could Participate	Open to all new and existing assets located near constrained boundaries.
Where It Would Be Active	Initially in areas of large constraint volumes (e.g. B6), but could also be deployed in front of the constraints to support effective capacity increase.
Lead Time	Could be relatively short - 1 to 2 years would be achievable. Longer lead times if expansion of storage assets is required to increase the capacity of the scheme.

Disclaimer: these proposals have been sourced from organisations above and the template does not indicate any endorsements or firm commitment for future commercial opportunities from the ESO

Quantifying the Net Consumer Benefit

Scope of our analysis

Modelling horizon 2025-2035, in line with options to be introduced in <5 years

Simple quantitative modelling, using the B6 boundary as 'proof of concept'.

Supplemented by qualitative whole system benefit assessment

Thermal constraints only. Indirect system services implications out of scope.

Overarching methodology

- We focus on the **net impact on the total consumer bill**. This includes both impacts on constraint management costs in the BM/option under consideration, as well as on wholesale market and renewable support scheme costs. **Greenhouse gas (GHG) emission impacts** are also identified.
- We compare costs under each option to a 'status quo' counterfactual. Under policy option 2B., benefits include:

Avoided BM constraint actions and costs – at least partly offset by booster scheme costs

GHG reductions, due to avoided curtailment/turn up of thermal generation in the BM

As noted, any technical implications are out of scope.

We would like your input

Key inputs and assumptions to determine costs/benefits under policy option 2B. Flexible Assets to Support Capacity Increase

Assumption/Input	Approach
Assumption: Utilisation duration	• **2-hour utilisation**. I.e., utilised during short constrained periods. *Sensitivity: 4-hour utilisation? (May be too costly)* • Batteries need to charge/discharge ahead of time to be available – sufficiently early notification required.
Input: Volume procured and utilisation	• **Volume procured sized to cover say at least half of constrained flows during constraint periods lasting 2 hours or less, 50% of the time**. • **Implied facilitated increase in B6 boundary capability** when utilized – reduction in BM action volumes calculated in line with increase in capability. • Utilised during all short constrained periods, as long as utilisation fee is lower than BM action cost under the counterfactual
Input: Availability and utilisation fees	• **Compensating for lost wholesale market arbitrage revenue** – during utilisation and ahead of utilisation (to get into the right state) and potentially following utilisation (as may have missed out on most optimal half hour to charge/discharge from an arbitrage perspective). • Starting assumption: Loss of ~x% arbitrage revenue, in line with % of **days** utilised on to reflect potential need for inefficient charging/discharging around utilisation.

Draft Market Design Framework Analysis: Flexible Assets to Support Capacity Increase

Proposed by:		Kona Energy, ZENOBĒ, FIELD
Proposal		**Flexible Assets to Support Capacity Increase**
I. Efficient Dispatch	Competition (Short Run)*	**Limited available sources in the short term due to liquidity achieved in other battery provided response markets**. There is limited surplus battery volume to deliver this service in Scotland, with the majority of the volume operated by a small number of providers. Significant volume improvements could be achieved with participation from hydro, although with only two hydro plants this would not significantly improve market power. Therefore, delivering this service before adequate battery assets are available can challenge market liquidity and also significantly reduce competition in other markets.
	Locational Signals in Dispatch	**Moderate alignment with locational signals in dispatch**. Whilst the proposals for paired storage systems and 'transfer booster' have merit in being able to reduce the amount of curtailed generation, they do not offer locational signals in dispatch: the paired storage system is a specific technical solution requiring locational signal in investment to support the long-term contract; and the transfer booster which flexes to charge/discharge in line with wind gusts/outputs is looking for a contract award at T-4 to T-1. If the market for the service from the deployed assets were to be T-1 to DA, then it would be within the capability of ESO to forecast and communication locational time-phased volume requirements.
II. Efficient Dispatch and Investment	Coherency*	**Service would be coherent with ESO services and can further bring forward assets that could help deliver response/reactive services**. In terms of alignment with DSO markets, the level of coherency with DSO network and market operation depends on the detailed technical design of the service. If this service is designed as an optional service, procured at day-ahead, this would minimise the impact of DSO markets and improve coherency. From a revenue stacking point of view, the commitment windows are key. Since these proposals focus on batteries connected either side of the transmission constraint, rather than distributed generation connected to distribution networks, it is unlikely to pose coherency challenges with DSO networks.
	Transparency	**Information could be provided in a clear and predictable way.** The proposals indicate that market design would be able to clearly outline the eligibility, frequency of procurement, lead time, product duration, payment structure and clearing principles. A competitive tender process is proposed, and this would allow procurement decisions to be made in a clear and predictable way to minimising uncertainty around ESO's decision making. Timing and content included in forecasts should be prioritised to ensure suitable levels of transparency, minimising gaming risks and to enable greater participation and competition.
	Whole Energy System Flexibility	**Service lacks long term support options for emerging technology mix.** Highly desirable to maintain optimality given short-term contracts offered. Nevertheless, this service alone is unlikely to provide long term support for emerging technologies and tend to be more exclusive towards batteries/storage providers, limiting accessibility of other energy vectors to participate.
III. Efficient Investment	Competition (Long Run) *	**Potential for good levels of new assets in the future but competition levels could be hindered by asset ownership**. Battery deployment projections indicate an additional 4GW of assets could be connected in Scotland by the end of 2026, provided by a dozen asset owners although the majority of this volume would be owned by one organisation. National deployment of battery assets is forecast to exceed 10GW with a diverse ownership which should ensure adequate competition.
	Locational Signals in Investment	**Strong alignment with location signals in investment**. The service would be relating to a specific boundary constraint, so this will provide a clear indication for location of investment, ensuring that capacity is constructed and that services are procured in the right places.
	Investability	**Nature of service highlights lack of long-term investment signals.** The use of flexible assets to support transmission and distribution networks is expected to create additional revenue streams, or battery / storage providers, as network congestion caused by increasing renewable penetration will require greater grid reinforcement and release interventions. Long term revenue certainty would be determined by the contract and with this in place revenue certainty could be provided. However, it is noted that the potential exclusivity nature of the service could deter investor interest.
IV. Value for Money	Net Consumer Benefits*	**N/A - will be assessed by Baringa**
	Practicality*	**Delivery of service is expected to have implementation complexities and require new ESO capabilities**. New capabilities may be needed to interface the service with ESO control systems. A primary concern with the battery asset based proposals is how state of charge of assets will be managed and investigations into the battery control system configurations in order to charge and discharge at the correct rates to support management of the constraint. In addition Zenobe proposed further utilisation of Active Network Management (ANM) Zones/Generation Export Management Scheme (GEMS) and this would bring additional complexities due to the ESOs limited control in these areas. Upon assessment of this proposal it is likely that new capabilities and system integrations would be needed, as well as further investigations into the interactions raised regarding the enhancement of ANMs/GEMs to instruct energy absorption from batteries.
	Adaptability	**Service shows moderate levels of adaptability to changing balancing service level requirements**. Armed volumes can be altered during each settlement according to the forecasted constraint event, with a short lead time, presenting alignment with Adaptability. Additionally, this option would increase effective boundary capacity, which would allow more (otherwise curtailed) energy to flow across the constrained boundary and decrease the amount of gas turn up ahead of the constraint during a curtailment period, contributing to decarbonisation of the system. In the case of market reform, locational pricing if implemented, would replace the need for this service. This has the potential to create stranded assets if new storage is built behind constraint boundaries specifically to provide this service.

DRAFT

How do you feel about this draft assessment?

Level of Alignment: Low (1) Moderate (2) High (3) * Prioritised criteria

Closing and next steps

ESO