GC0154: Interconnector Ramping Workgroup

Working group session 7

NGESO

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Agenda

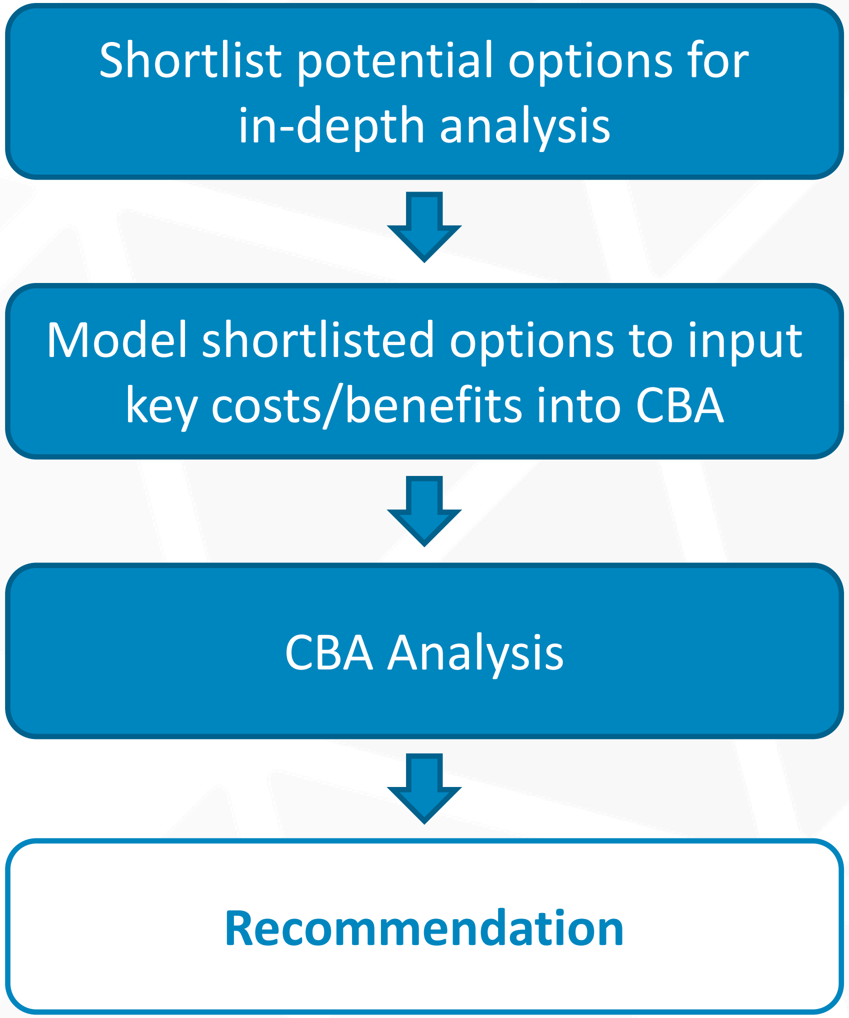
	Agenda Items	
	Introduction	• Team introductions • Project purpose
	Current Assessment	• Outline the impact of ramping rates on interconnectors • Outline the impact of ramping rates on the ESO • Outline other affected parties and associated direct costs to consider within our CBA Framework
	Indicative Methodology	• Review options long list • Share shortlisting process • Outline proposed modelling methodology
	Project outcomes and next steps	• Confirm outputs of this project • Q&A

Introduction

Our purpose

Laying the foundations of our project

- Ofgem has requested NGESO raise a Grid Code modification to include interconnector ramping within GB frameworks to be fully compliant to SOGL Article 119 after EU-Exit
- Current ramping arrangements are causing operational challenges for the control room in managing security of supply and efficient consumer cost
- We have been asked by ESO to conduct a CBA to review potential solutions which can fulfil Ofgem's requirements and relevant obligations under SOGL Article 137 (3)
- This CBA will focus on the costs and benefits of each solution on the following groups: interconnectors, consumers, ESO, EU TSO
- In this project we will:
    - Shortlist the options presented by NGESO through a structured methodology
    - Conduct data modelling and present findings of the costs for each option
    - Build a CBA on a shortlisted options
    - Recommend a solution



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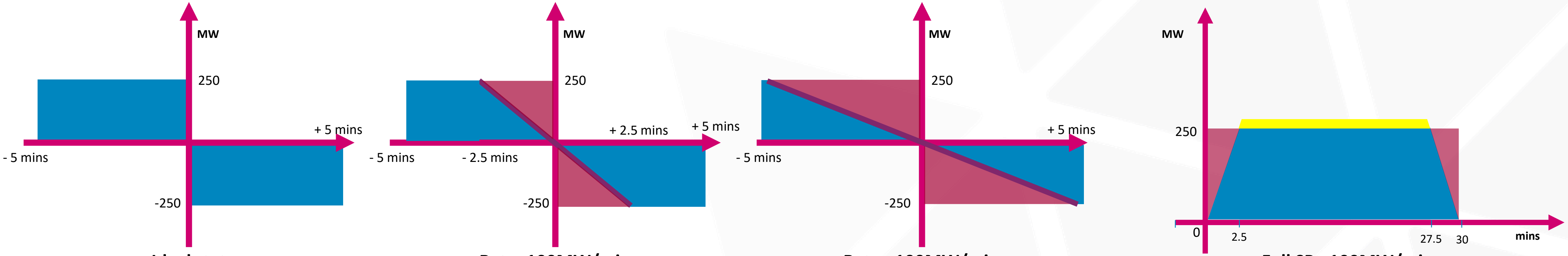
Current Assessment

Background

Providing context of current ramping arrangements

- Continental interconnectors (BritNed, IFA, IFA2, ElecLink, Nemo) currently ramp up to 100MW/min however this is proving to have an adverse impact on the ESO
- The ESO wish to understand the wider impact of reducing interconnector ramping rates (as an option among others) to reduce consumer costs and system risks
- Headline benefit: If interconnector ramp rates are reduced, we expect a drop in ESO balancing costs. This is likely to reduce balancing costs (ESO analysis indicates this may be up to £100m)
- Headline cost: Lower ramping rates reduces energy flows which could lead to lower IC revenues. A lower ramping rate may require interconnectors to ramp longer, and would lower the volume they are able to change which could further affect revenues
- Other costs and benefits: This is complex. There are other stakeholders, including European markets, GB consumers, GB generators, society (via carbon). To understand the best way forward we need to estimate key costs and benefits as well, then work out the net benefit of different options
- Modelling approach: Based on the above it is important to model costs across various parties. This requires a range of modelling tools. We shall mainly use Plexos because it allows us to see the impact of ramp rates on generator dispatch and wholesale prices (which gives us the impact on interconnectors, generators, consumers, and Europe, along with the CO_2 impacts). This will be complimented with bespoke modelling using Excel and other qualitative analysis

Why is fast ramping valuable to interconnectors?



Ideal state | **Rate: 100MW/min** | **Rate <100MW/min** | **Full SP: 100MW/min**

- Technically interconnectors can ramp instantaneously
- Introducing a ramp rate reduces the flow of energy over a settlement period (as shown by red triangles)
- Interconnector revenues are driven by price differentials (between GB and European markets) and volume flow
- Slower ramping reduces volume flow compared to current approach
- Reducing flows may have an impact on price dynamics between GB and connecting markets with resulting impacts of interconnector revenue
- IC may balance their overall commitment by over/under ramp during the settlement period

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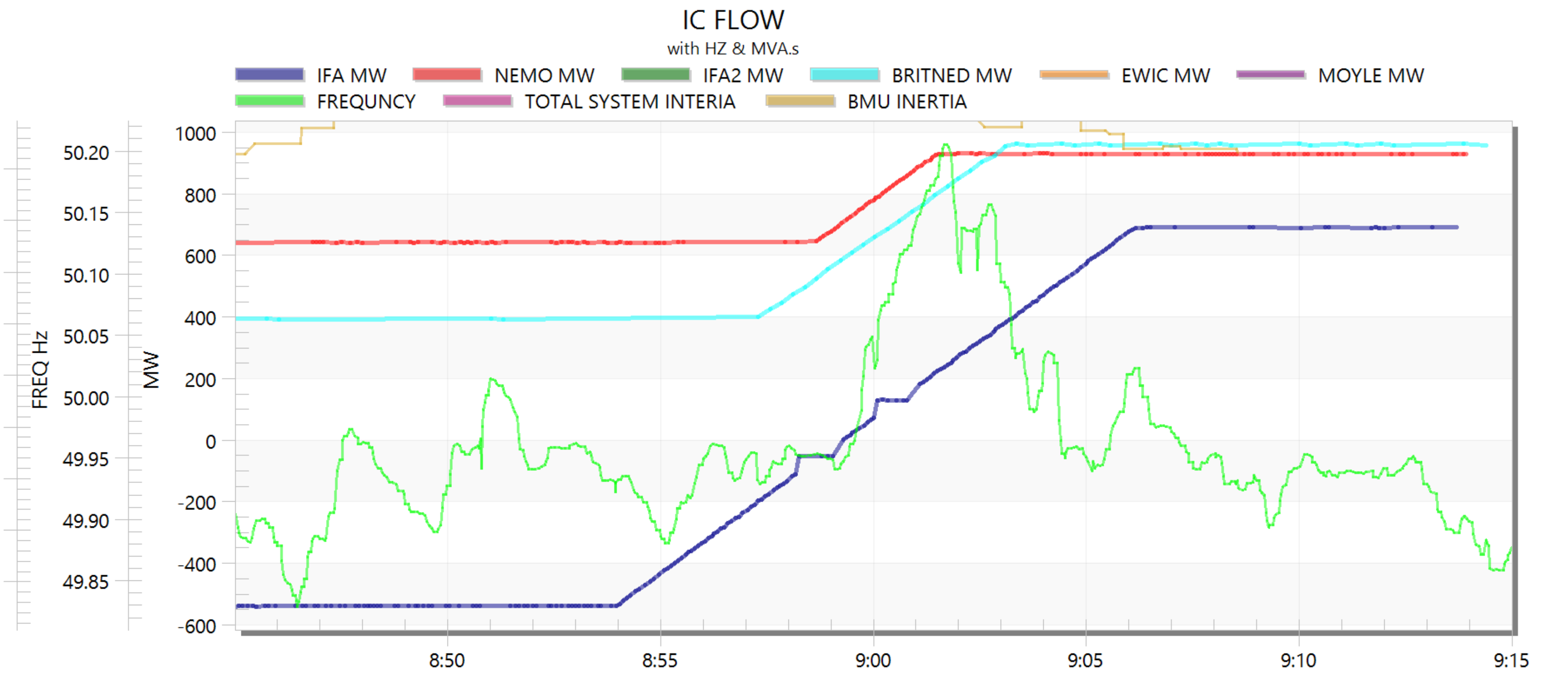
Illustration of ESO's operational challenge

Specific example of challenge with current ramping arrangement



- The GB transmission system is unable to facilitate instantaneous ramping due to its impact on managing system security
- This mirrors other TSOs who restrict ramp rates for similar reasons (e.g. Ireland – 10MW/min and Norway - 30MW/min)

ESO ramp management actions

Mapping various ESO actions to manage interconnector ramping and their associated impacts

Interconnectors		ESO Actions	Impacts

IC ramp

Typical ESO actions to manage anticipated ramping within the system (Normal actions)

Re-positioning BOAs

- Ramps against ramp
- Cover energy imbalance

→ **Potentially set Settlement Period £/MWH**

Additional regulating reserve

- Uncertainty
- Additional Response

→ **Additional balancing costs** | **System security cost**

Additional voltage support

- Requirement during certain system conditions (typically in SE England)

→ **Additional balancing costs**

Only required if normal actions are insufficient (Additional actions)

Frequency control actions

- Short duration
- Potentially high cost

→ **Additional balancing costs** | **System security cost**

CBA framework – base case against shortlisted options

Illustrative: our CBA will determine the flow and magnitude of costs and benefits felt by different parties

Key: ⬇ Negative ⬆ Positive

GB Consumer Costs

		Short term (Day Ahead / Intraday)		Balancing Markets
Interconnectors	⬆⬇	Interconnector flows and revenue	⬆⬇	Interconnector flows and revenue
GB Wholesale Price	⬆⬇	GB DA Wholesale Cost (£/MWH)	⬆⬇	GB Real-time Wholesale Cost (£/MWH)
ESO	⬆⬇	Balancing costs Risk costs	⬆⬇	Balancing costs Risk costs
European Social Costs	⬆⬇	European wholesale market costs	⬆⬇	European wholesale market costs
Regulators		N/A	⬆⬇	Risk cost of system security
Carbon Intensity	⬆⬇	Carbon intensity	⬆⬇	Carbon intensity

Our Methodology

High level methodology

Our CBA will be delivered via the following approach

Shortlist potential options for in-depth analysis

↓

Model shortlisted options to input key costs/benefits into CBA

↓

CBA Analysis

↓

Recommendation

Proposed options

We have refined/clarified the initial options with ESO (where applicable) which we shall shortlist

Overarching Options		Option	Initial options with modifications (*italicised*)
1	Ramp Mgmt Tools	**a) TSO-TSO arrangements**	Use the existing ramp rates in Interconnector agreements and add to the Grid Code. Then arrange a tool that allows for SO-SO trades to counteract the ramp to slow down ramping ***within Balancing Markets*.**
		b) TSO-TSO arrangements	Use the existing ramp rates in Interconnector agreements and add to the Grid Code. Utilise European balancing platforms to allow for optimisation of products in the market when simultaneous fast ramping requires counteraction. ***Additional trading would be informed by day-ahead reference programmes.***
2	Ramping arrangements	**a) Dynamic ramp rate**	Base ramp rate of 50MW allocated to all Interconnectors. Additional ramping to be made available based on day ahead forecasting of up to 250MW with a max ramp rate of 100MW. The additional ramping is based on the rate of change of demand forecast.
		b) Static ramp rate	Change interconnector base rate ramp limit to match generators (50MW/min). ***Evaluate and then further compare effect of alternative rates.***
		c) Static ramp rate (status quo)	Interconnectors currently connected to the system have a ramping maximum of 100MW - continue with this rate. ***This represents our proposed baseline.***
3	Market Based Solutions	**a) Procure increased Frequency response**	ESO to hold sufficient Frequency Response to facilitate up to 100MW/min interconnector ramping. ***This will take into account FRCR policy.***
		b) Base rate set for all IC and a market would be created for IC to participate	Each IC gets a 'banked' 50 MW, and the extra 50 MW is multiplied across the number of ICs, then a market is run for this availability. The IC to choose if they wanted to be in that market. ***As this is a variant of 2a+2b, this option will require further analysis.***
		c) Create a ramping market	ESO to set up a "ramping market" where, based on the day ahead position of trade and risks estimated across ramping transition a volume dependent escalating ramping price is identified reflecting the costs incurred in operating the GB system, which allows the benefits of offsetting that position to be reflected by those offering flexibility to mitigate it whether interconnectors or other providers. ***If shortlisted additional market parameters will be defined.***

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Shortlisting

We shall use a transparent process to agree a shortlist of 2-3 options for detailed modelling

Process

- We will utilise a detailed qualitative analysis framework to shortlist 2-3 options to conduct our detailed CBA
- This will allow detailed analysis to be translated into quantitative scores to allow easy comparison with other options
- This analysis will be presented through “Harvey Balls” scoring to easily communicate with stakeholders
- To conduct analysis, we shall select:
  - Criteria - these are the overall principles which should be used within decision-making
  - Sub criteria - these are the individual statements which we evaluate each option against
  - Sub criteria weighting - this is the weight given to each sub criteria based on the bearing on the criteria

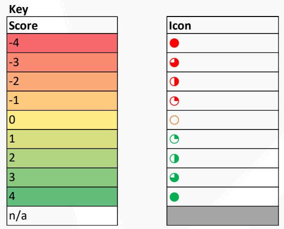

Illustration of scoring

Exemplar Criteria + Sub Criteria	
Adaptability	• Solution adaptable for projected future interconnector additions to GB grid • Embrace new or evolving business models
Consumer fairness	• Limit adverse distribution impacts for consumers
Decarbonisation	• Increase probability of achieving decarbonisation objectives
Deliverability	• Minimise complexities / interdependencies • Minimise market disruption • Minimise implementation cost • Reduce risk of unproven solutions • Expedite implementation
Energy security and system operability	• Ensure sufficient capacity to meet peak demand • Ensure sufficient energy available to manage extended low renewable output • Ensure sufficient energy available to manage extended high renewable output • Manage external shocks and unintended consequences
Financial risks	• Ensure any solution doesn’t expose ESO to excessive financial risk
Interoperability with Europe neighbours	• Ensure solution can be technically adapted by European markets • Ensure our solution is fair to all markets and does not disproportionately preference certain interconnectors • Reduce operational costs on both TSO’s
Contract impacts	• Timeline to alter Operating Procedures • Ease to change external agreements (i.e. external tripartite agreements)
Modelling complexity	• Data availability • Time requirements • Modelling accuracy
Technical viability	• Option can be embedded within current environment

Modelling methodology

We shall model our baseline scenario and shortlisted options using various tools

Modelling

Baseline	**Shortlisted Options**		
Gather data required for analysis (ESO costs etc.)			
Build modelling methodology for each scenario			
Model ESO ramp management costs	Run analysis using agreed methodology		
Use PLEXOS	Use modelling tools such as PLEXOS	Model ESO ramp management costs	Use bespoke tools (where required)
Example outputs: Δ system balancing costs, Δ ESO ramp management costs (e.g. Reserve), Δ wholesale energy price, Δ interconnector flows			

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Our baseline scenario

Proposed modelling tools to establish our baseline

	Baseline	Shortlisted Options		
Modelling	Gather data required for analysis (ESO costs etc.)			
	Build modelling methodology for each scenario			
	Model ESO ramp management costs	Run analysis using agreed methodology		
	Use PLEXOS	Use modelling tools such as PLEXOS	Model ESO ramp management costs	Use bespoke models (where required)
	Example outputs: Δ system balancing costs, Δ ESO ramp management costs (e.g. Reserve), Δ wholesale energy price, Δ interconnector flows			

PLEXOS Baseline

- We have selected 2023-30 as our modelling horizon to model baseline alongside anticipated IC capacity growth
- Exemplar parameters we shall model include the: wholesale costs, IC flows, IC revenues

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ESO Ramp Management Costs Baseline

- We will baseline the ESO Ramp Management Cost using 2022 data utilising ESO expertise
- The associated costs are detailed on next slide

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Options analysis

Proposed modelling tools that we shall draw from to model each option

	Baseline	Shortlisted Options		
Modelling	Gather data required for analysis (ESO costs etc.)			
	Build modelling methodology for each scenario			
	Model ESO ramp management costs	Run analysis using agreed methodology		
	Use PLEXOS	Use modelling tools such as PLEXOS	Model ESO ramp management costs	Where required use bespoke tools
	Example outputs: Δ system balancing costs, Δ ESO ramp management costs (e.g. Reserve), Δ wholesale energy price, Δ interconnector flows			

ESO Costs: Option Analysis

- Future ESO costs will be calculated through interpolating and extrapolating the agreed base data

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PLEXOS: Option Analysis

- PLEXOS will be used to provide CBA inputs on monetised costs
- This may include refining constraints within the Plexos model
- Example outputs from Plexos modelling includes:
  - GB & European wholesale market costs
  - Interconnector flows + revenue
  - Carbon intensity

OR

Bespoke tools

- Elements may require bespoke Excel modelling or qualitative analysis
- E.g., Option 1A and 1B will include elements of alternative modelling if selected at shortlisting stage
- Where modelling is either impractical or nor suitable for cost analysis, qualitative analysis will be used

CBA overview

Design	• We will develop a CBA tool in MS Excel that will take the outputs from the Plexos and Excel modelling and generate the various CBA metrics required • We believe using Excel for the CBA tool is appropriate as it will enable NGESO to update the CBA with new inputs as the options are progressed through the consultation process • The tool will apply the principles of the HMT Green Book which underpins Ofgem's CBAs. For example, costs and benefits would be discounted and adjusted for the relevant regulatory treatment of interconnectors
Key Costs/Benefits	• Costs to GB consumers for different options • Impact on Interconnector of different ramps rates on revenue, costs, etc. • Costs and impact on market activities • Social welfare of GB and EU consumers • While the CBA tool will not provide direct insight of impact of proposed options on ENCC process, it can highlight in parallel with the Baringa team's insight, potential operational and process risks
Framework	• Our CBA will costs based on a) grouped impacted parties and b) relevant timescales • To do this we have initially established which costs are needed within our baseline • Over the next few slides we identify which costs are important to calculate in our Baseline Scenario • We then provide an indicative overview of how various grouped options could lead to **direct** positive/negative costs across the ecosystem

CBA methodology

Understanding NGESO and social costs and benefits through analysing selected options

Baseline | **Shortlisted Options**

CBA

IA
- Input modelled values
- Identify additional negative impacts (i.e. cost of risk) and positive impacts
- Identify distribution of impacts on consumers, GB and European TSOs and the GB wholesale market

Valuation
- Assign monetary costs to any non-monetary cost and benefits
- Identify Net Present Value (/other valuation method) of each option

Selection Process
- Conduct sensitivity analysis
- Consider non-monetary factors

Option selection

Project Outputs and Next Steps

Project Outputs and Next Steps

Our recommendation will be based on our CBA model output

- Our CBA will quantify agreed anticipated costs and benefits of each shortlisted option
- These will be compared against the baseline scenario to calculate if there is value in changing the current ramping arrangements
- Our recommendation will be informed by an additional layer of qualitative analysis based on non-monetised factors and exogenous factors from the model such as operational experience
- Next steps:
  - We shall provide updates to the working group where relevant
  - We plan to share our recommendation and proposed next steps though a report with ESO
  - We would subsequently present back to the working group our findings

