GC0154

Incorporation of interconnector ramping requirements into the Grid Code as per SOGL Article 119

Meeting 4

16th June 2022

nationalgridESO

Objectives and Timeline

Sally Musaka – National Grid ESO Code Administrator

Timeline for GC0154 as of 23 May 2022

Milestone	Date	Milestone	Date
Proposal Presented to Panel	16 December 2021	Panel sign off that Workgroup Report has met its Terms of Reference	27 October 2022
Workgroup 1 – (discussion of the proposal) and solution (what has changed), agree timeline and review terms of reference	18 January 2022	Code Administrator Consultation	31 October 2022- 30 November 2022
Workgroup 2 (finalise solution to be consulted on, agree alternatives and agree Workgroup Consultation questions)	17 February 2022	Draft Final Modification Report (DFMR) issued to Panel	07 December 2022
Workgroup 3(agree terms of reference and narrow down solutions)	17 March 2022	Panel undertake DFMR recommendation vote	15 December 2022
Workgroup 4 (narrow down the 10 solutions)	**16 June 2022**		
Work group 5(finalise workgroup consultation questions, and solutions)	21 July August 2022	Final Modification Report issued to Panel to check votes recorded correctly (5 working days)	19 December 2022
Workgroup Consultation (15 Working Days)	09 August 2022–31 August 2022	Final Modification Report issued to Ofgem	09 January 2023
Work group 6- Assess Work group consultation responses, raise alternatives and vote on alternatives	14 September 2022	Ofgem decision	TBC
Workgroup 7- Finalise solution(s) and legal text, agree that Terms of Reference have been met and Review Workgroup Report	29 September 2022	Implementation Date	10 working days after Ofgem decision
Workgroup 8- Hold Workgroup Vote	07 October 2022		
Workgroup Report issued to Panel (5 working days)	19 October 2022		

Workgroup Responsibilities

Sally Musaka – National Grid ESO Code Administrator

nationalgridESO

Expectations of a Workgroup Member

- Contribute to the discussion
- Be respectful of each other's opinions
- Language and Conduct to be consistent with the values of equality and diversity
- Do not share commercially sensitive information
- Be prepared - Review Papers and Reports ahead of meetings
- Complete actions in a timely manner
- Keep to agreed scope

Your Roles

- Help refine/develop the solution(s)
- Bring forward alternatives as early as possible
- Vote on whether or not to proceed with requests for Alternatives
- Vote on whether the solution(s) better facilitate the Code Objectives

Action Number	Action	Owner	Due by	Status
1	To check if the costs modelled in relation to imbalance charges can be shared with the workgroup	Monne D	10 May 2022	Open
2	The ESO to provide some evidence of costs associated with IC ramping- **Slides 9-13**	Antonio and Lijia	End of April 2022	Open
3	Collaboration space for ESO and Workgroup members	Louise T	10 May 2022	Open
4	Review the definition of EA with Ben Marshall – **see slide 7**	Tom I	April 2022	Open
5	ESO to review ramping including BMUs consider this with the FPNs and PNs recorded – **See slide 7**	ESO	10 May 2022	Open
6	Can ESO share some costs relating to Pre and Post Gates actions – **See slide 8**	ESO	16 June 2022	Open

Working Group Action Log Review

17th Feb: Review the definition of EA

- Included within the Grid Code BC2.9.6, applied to interconnectors only

BC2.9.6 Emergency Assistance to and from External Systems

(a) An Externally Interconnected System Operator (in its role as operator of the External System) may request that The Company takes any available action to increase the Active Energy transferred into its External System, or reduce the Active Energy transferred into the National Electricity Transmission System by way of emergency assistance if the alternative is to instruct a demand reduction on all or part of its External System (or on the system of an Interconnector User using its External System). Such request must be met by The Company providing this does not require a reduction of Demand on the National Electricity Transmission System, or lead to a reduction in security on the National Electricity Transmission System.

(b) The Company may request that an Externally Interconnected System Operator takes any available action to increase the Active Energy transferred into the National Electricity Transmission System, or reduce the Active Energy transferred into its External System by way of emergency assistance if the alternative is to instruct a Demand reduction on all or part of the National Electricity Transmission System. Such request must be met by the Externally Interconnected System Operator providing this does not require a reduction of Demand on its External System (or on the system of Interconnector Users using its External System), or lead to a reduction in security on such External System or system.

17th Feb: ESO to review ramping including BMUs consider this with the FPNs and PNs recorded

- This work is out of scope for this working group

Operational Analysis

Recap: Current pre-gate and post-gate tools available

Tool	Use
Repositing all plants	Post-gate
Trading	Pre-gate
Response	Post-gate
Short Term Reserve	Post-gate
SO-SO Trade	Post-gate
Slow ramp (limited ICs only)	Post-gate

17th Feb: Can the ESO share some costs related to post and pre gate actions?

- Within our operational analysis we have presented the costs, for example, repositioning of plants or response, by illustrating example costs with and without large ramps
- For some tools i.e. slow ramp, we are not able to provide costs due to the commercial sensitives involved

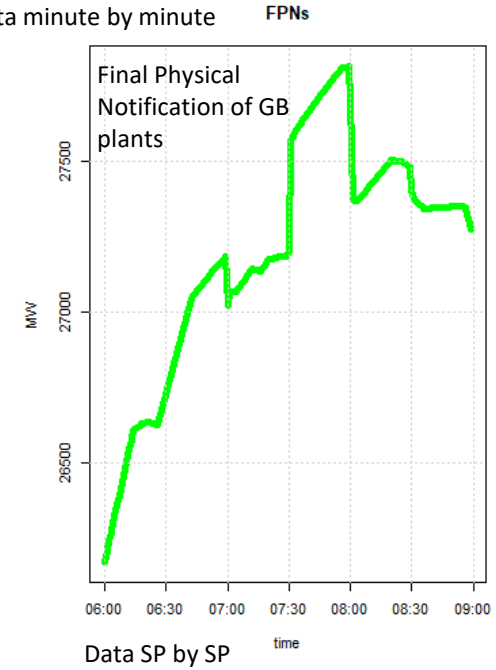
Operational Analysis – Costs of repositioning all the plants

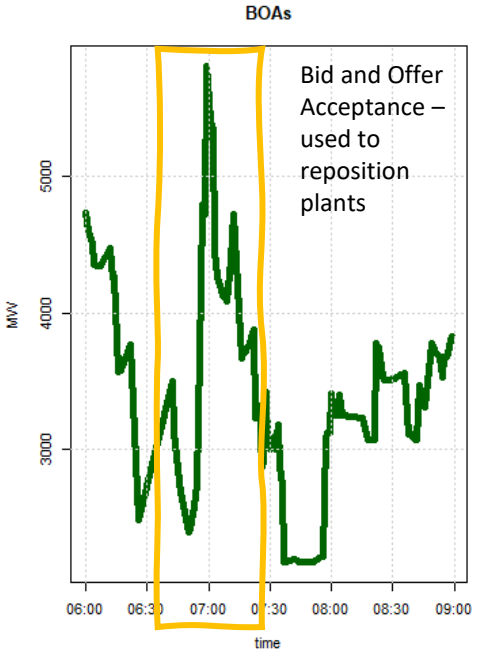
Example of 24th March 2022 07:00

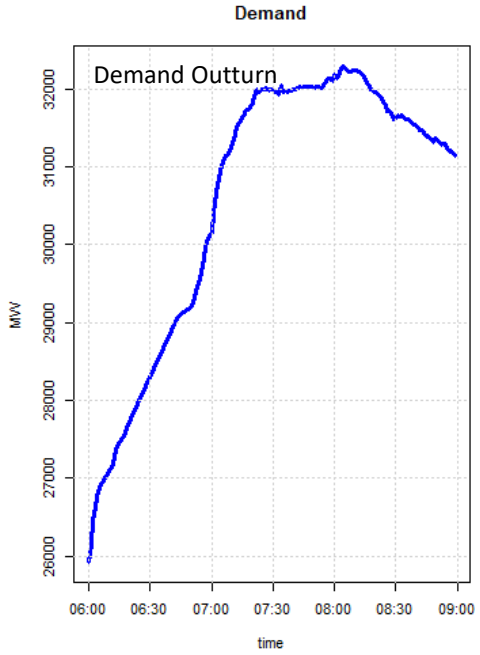
Close to 7:00 am – we can see the highest volume of Bid and Offer Acceptance close to IC ramp before gate change

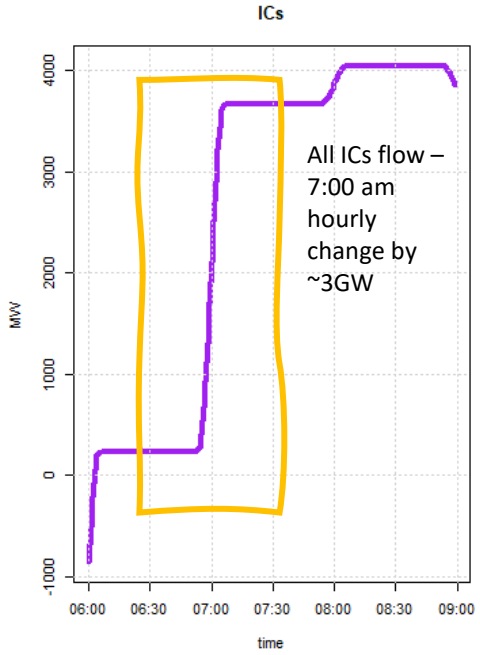
The high volume of BOA taken has a direct influence on high Energy Imbalance Costs for this Settlement Period as well as Frequency Control Costs

Data minute by minute

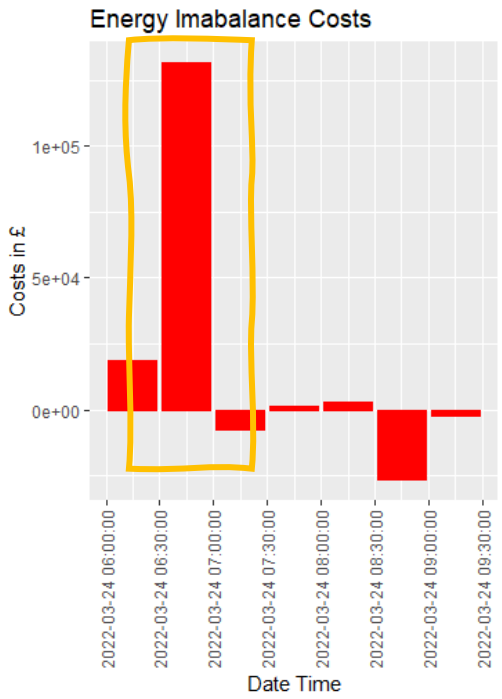


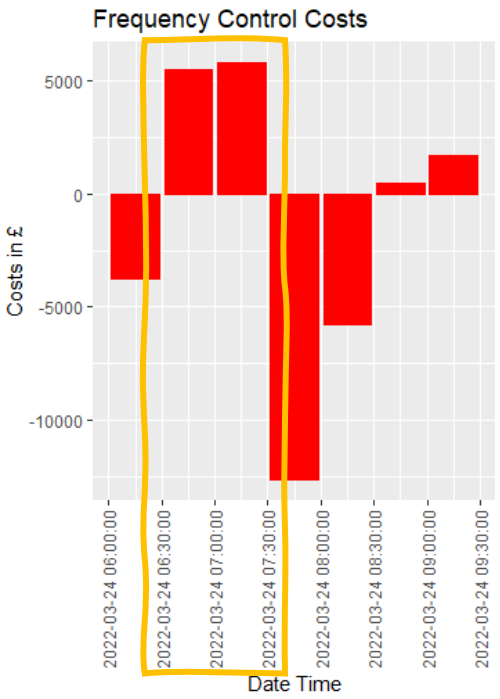


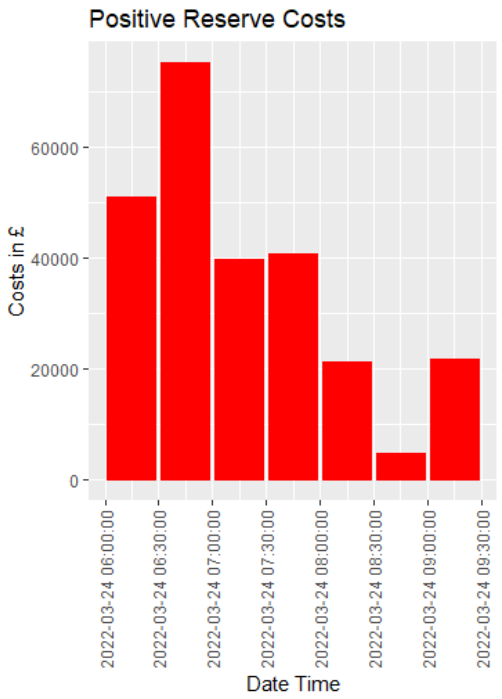


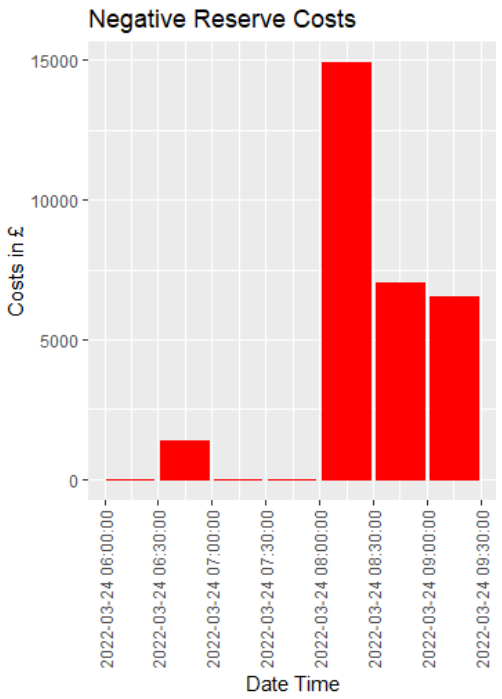


Data SP by SP







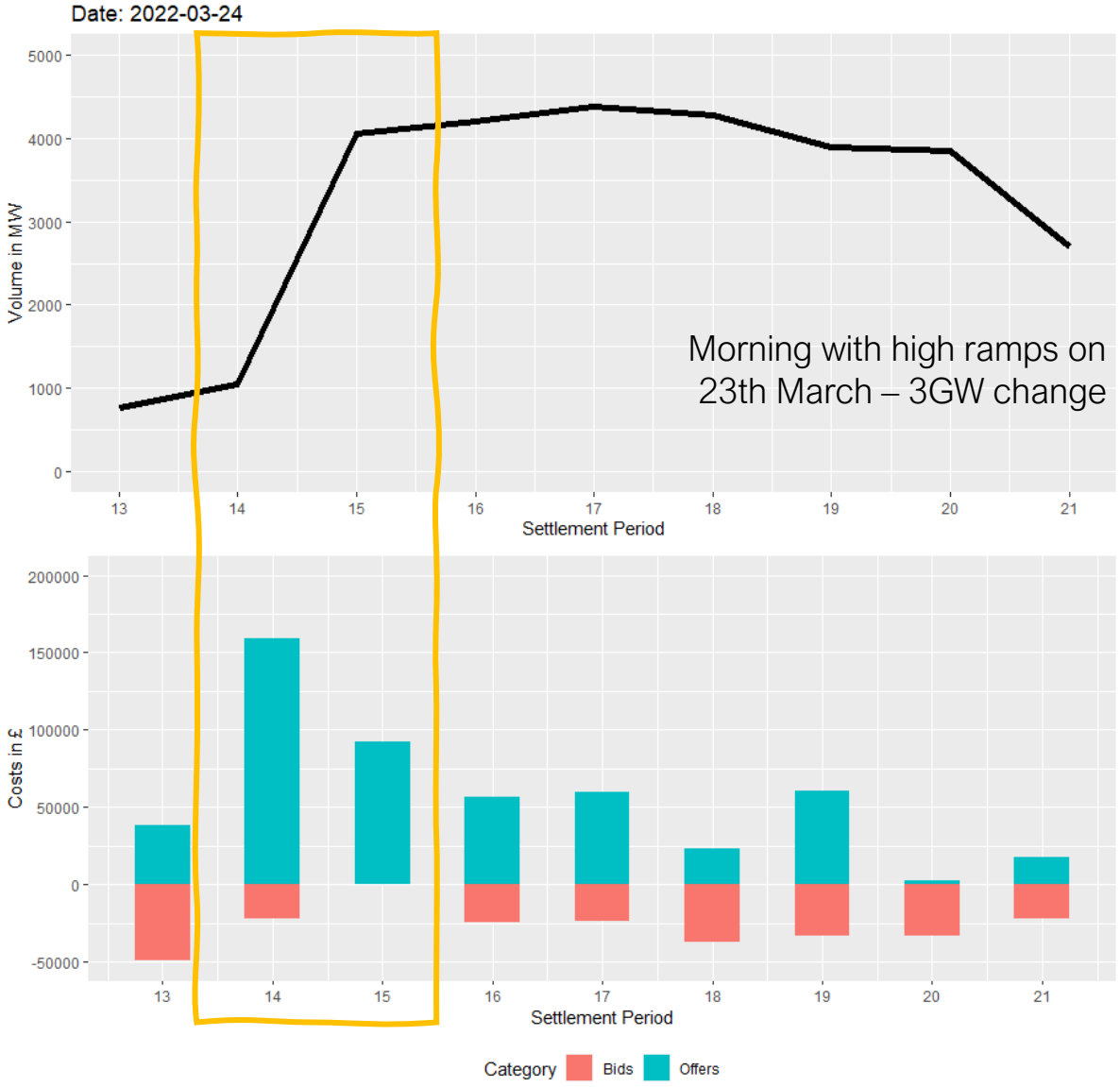


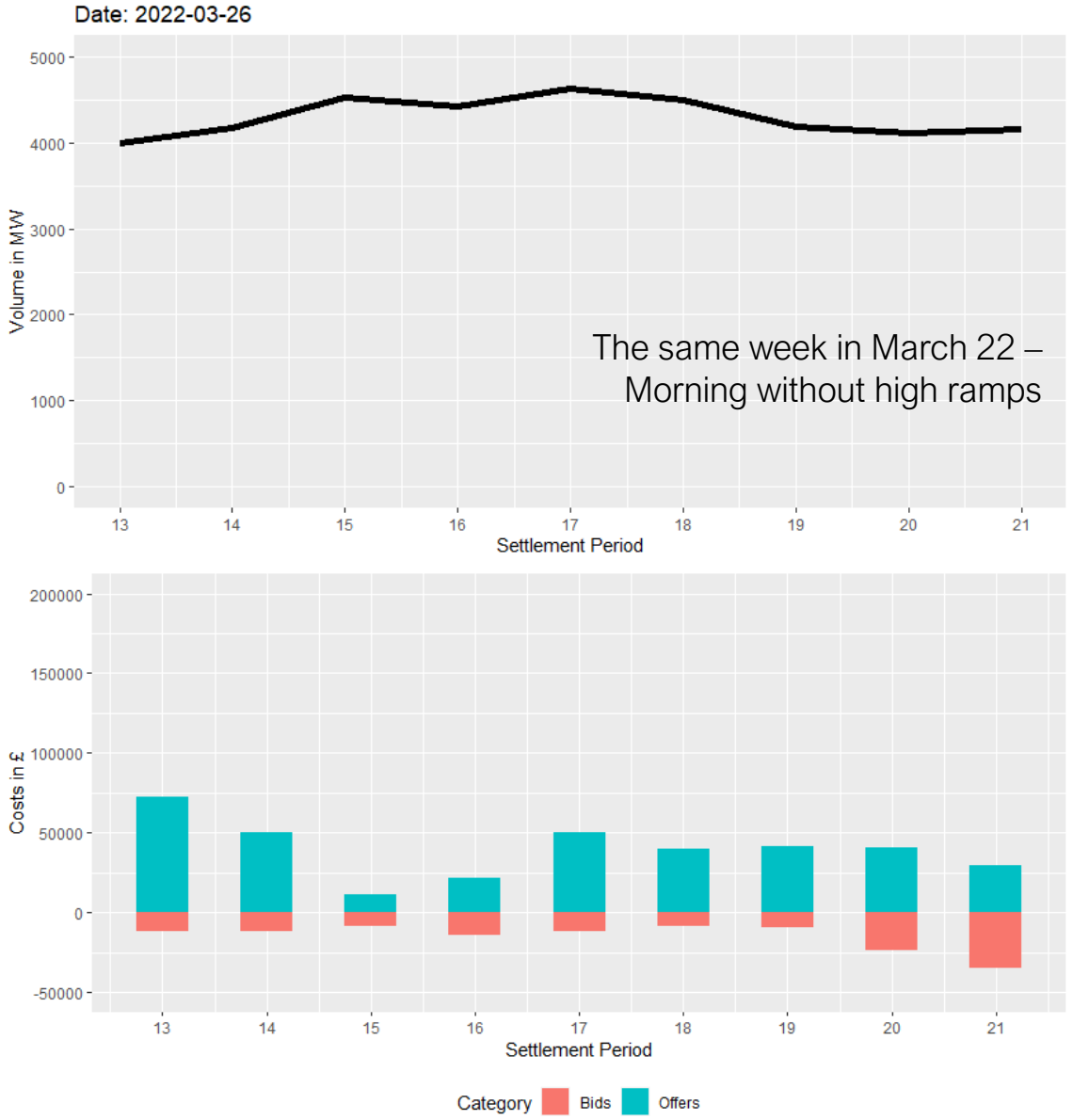
Costs data available on ESO Data Portal

Bid and Offer Data is available on ESO Data Portal & BMRS (Elexon)

Operational Analysis – Costs of repositioning all the plants

Example of BOA costs with large Ramping and without large Ramping



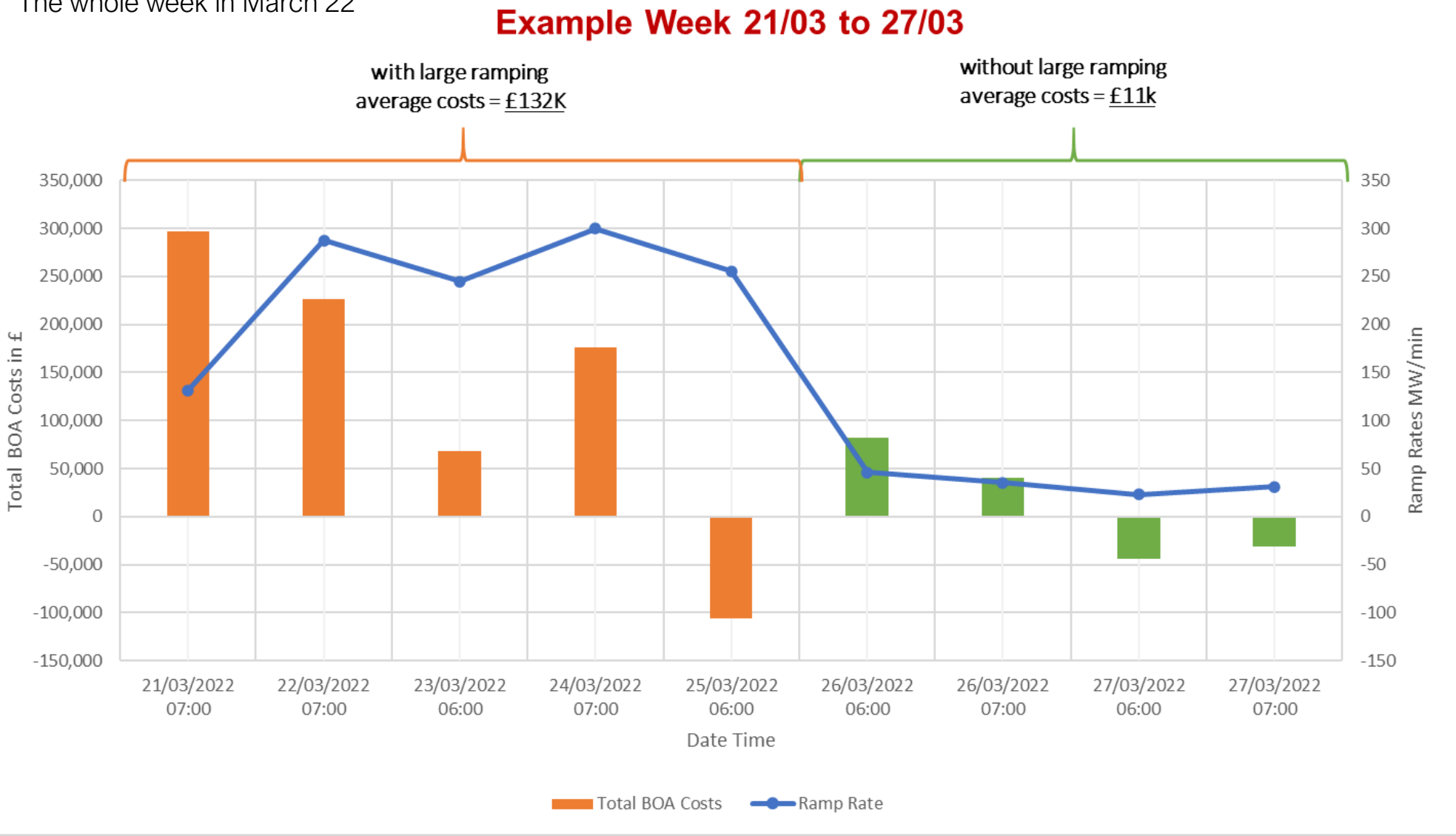


Bid and Offer Data is available on ESO Data Portal & BMRS (Elexon)

Operational Analysis – Costs of repositioning all the plants

Example of BOA costs with large Ramping and without large Ramping

The whole week in March 22

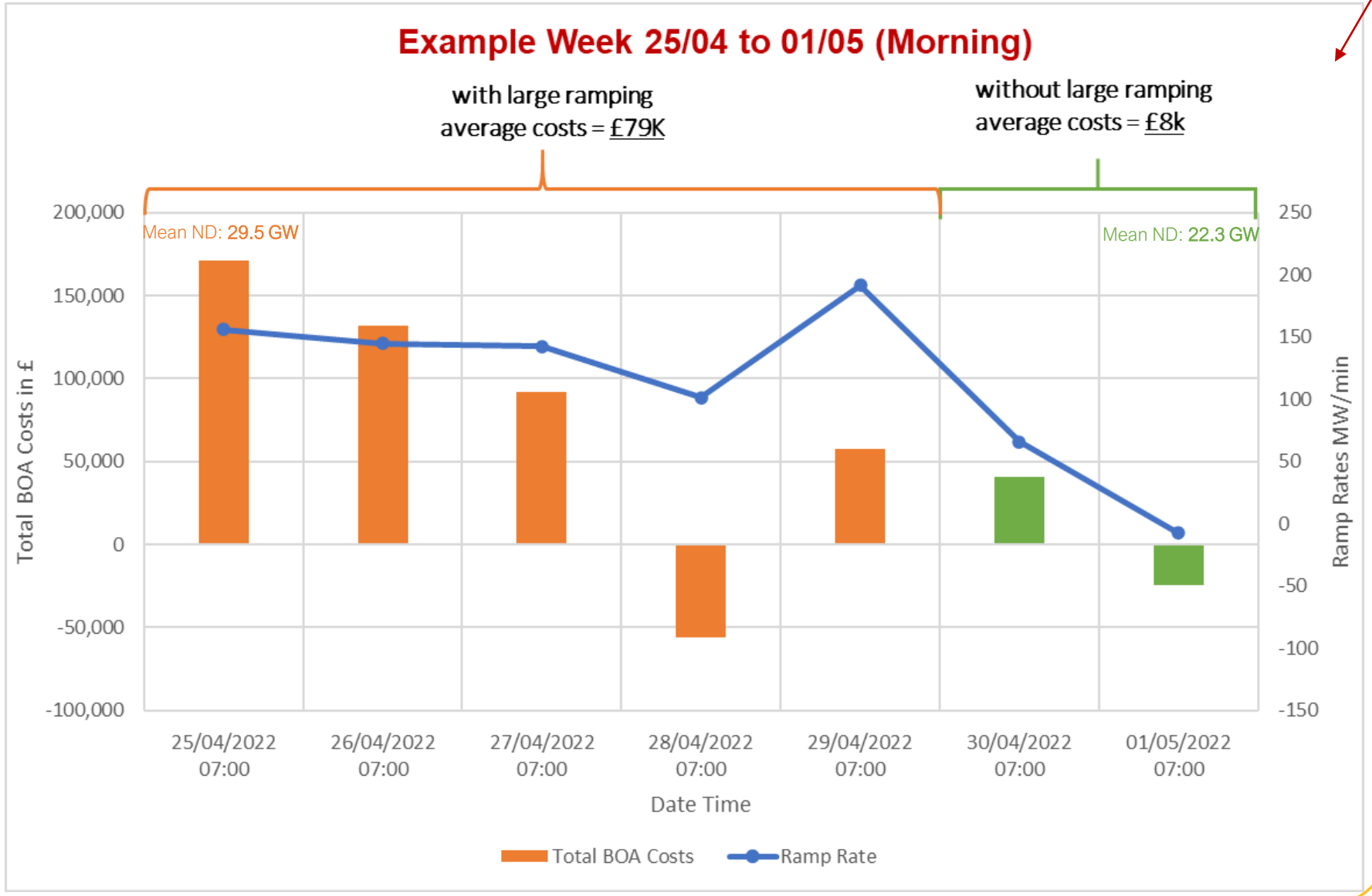


Operational Analysis – Costs of repositioning all the plants

Bid and Offer Data is available on ESO Data Portal & BMRS (Elexon)

Wind during the week: Low (between 1-3 GW)

Example of BOA costs with large Ramping and without large Ramping

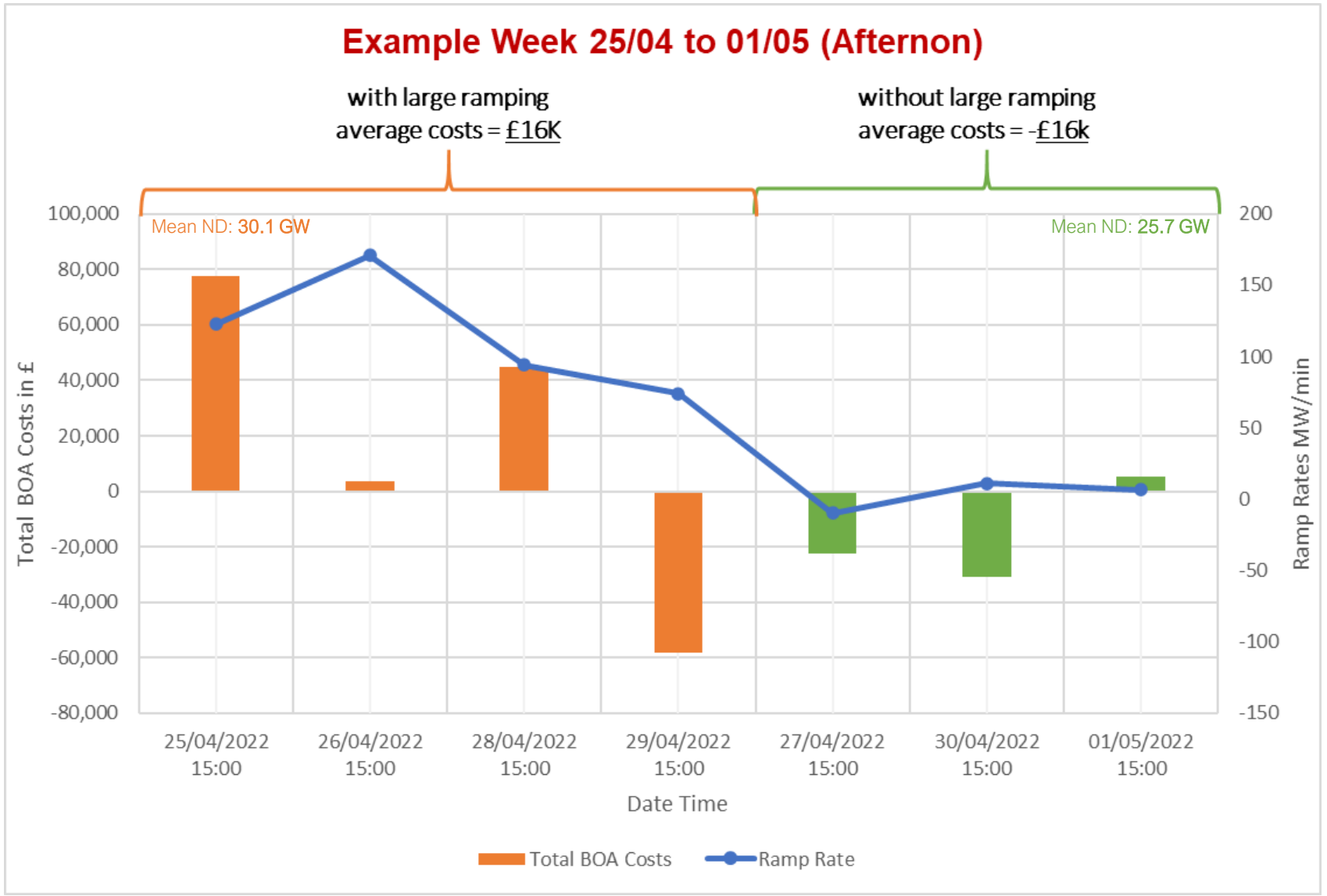


Operational Analysis – Costs of repositioning all the plants

Bid and Offer Data is available on ESO Data Portal & BMRS (Elexon)

Wind during the week: Low (between 1-3 GW)

Example of BOA costs with large Ramping and without large Ramping



Market forum questions

Stakeholder Question: Would it be appropriate to get a briefing from this markets reform activity as part of GC0154 as the changes they are considering may have some bearing on the work group activity?

Market forum questions

Question on email	Response from ESO
Slide 23 “Short notice of interconnector profile changes Interconnector ramping (especially compounding with multiple ICs)” https://www.nationalgrideso.com/document/247316/download	We are reviewing our reserve products based on the facts presented at the markets forum. IC profile changes being one of these scenarios. This highlights further our need to address the operational driver we have at the ESO and the reason we are seeking to find a solution fit for the future.
Slide 28 “Detailed modelling on ramping restrictions, over-delivery, window cross-over periods	This ramping modelling was not specifically for IC and was looking purely at frequency simulation. This modelling was related to the Slow Reserve Consultation only (please see the summary document for the slow reserve here)
Slide 8 “Status quo market design is causing storage and interconnector behaviour that aggravates grid constraints” https://www.nationalgrideso.com/document/247306/download	This is linked to the work being done to consider nodal pricing- therefore resulting in different wholesale prices by location and view that this will reduce constraints. A full consultation will be available to review shortly. The decision will be made by BEIS. There are no changes to any technical requirements. (press release and report download)

Preferred ESO Solutions (In scope)

Option 1 - Dynamic

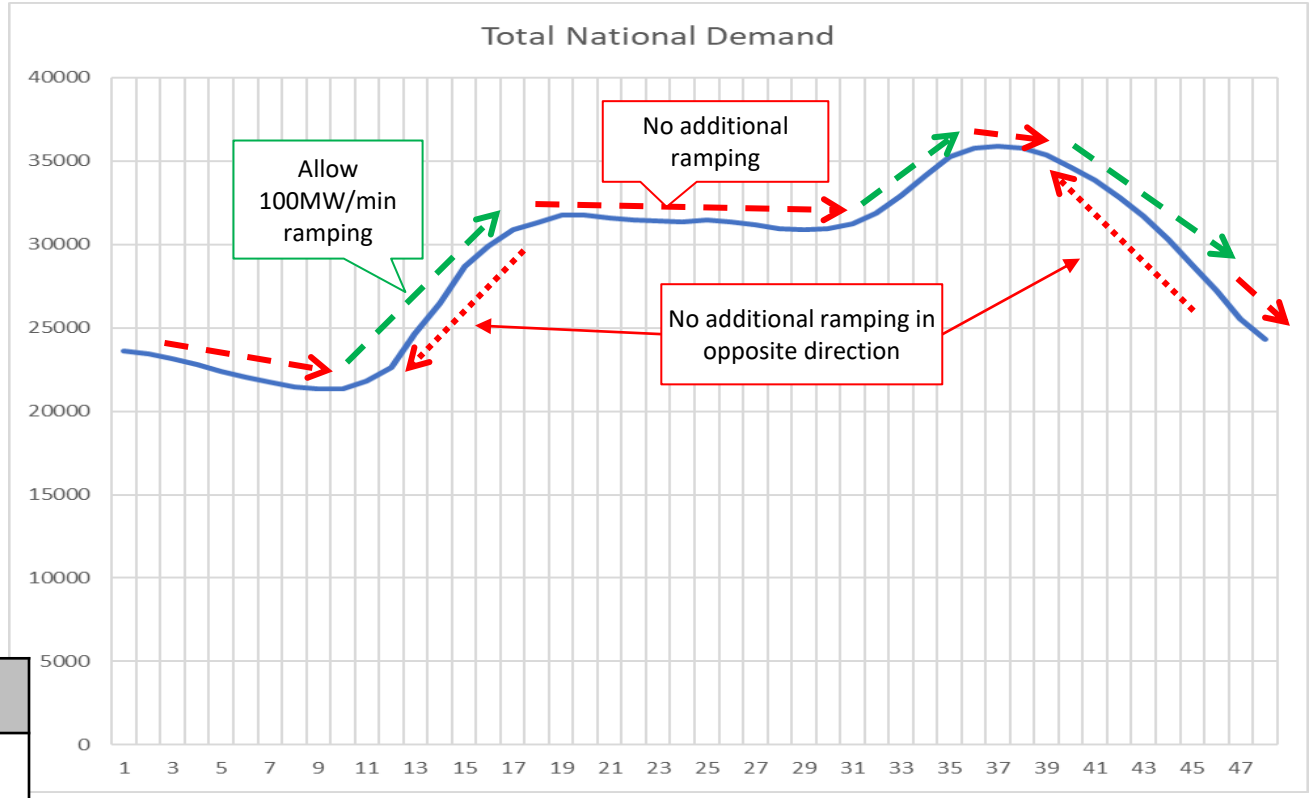
- Preferred NGESO option
- Allows control over ramping with a pre agreed process
- Applied base rate value to ramping using dynamic tool to release additional ramping based on rate of change in demand share
- Resilient for the future
- Risks- not tested

Option 2- Static

- Reduces ramp rate at all times not just when operational challenges exist
- Same ramp rate as BMU
- More of an interim solution to allow for testing

ESO Recommended Solution - Dynamic ramp rate

- Process to manage ramping when met by system needs
- Base ramp rate to be applied to IC at all times with increased ramp rates to be made available if system conditions allow
- We would allow for IC to ramp slower than the base rate at all times
- IC should follow base ramp rate when moving opposite to demand direction

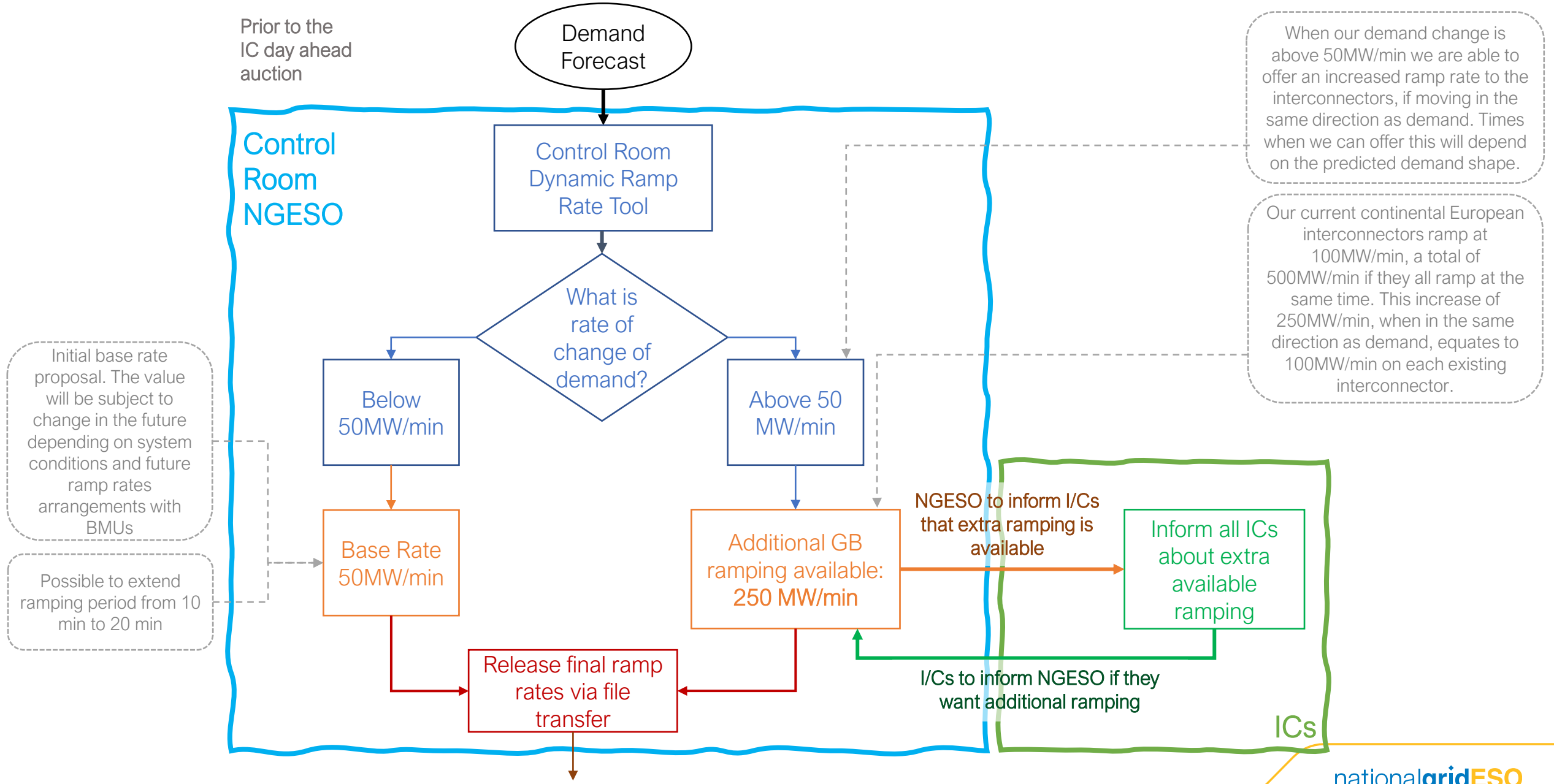


Data	Why?
Base Rate Value **50 MW/min**	As per BMU restrictions within the Grid Code
Additional available ramping cap of **100MW/min**	As per current arrangements
Additional GB ramping made available when rate of demand change is >50MW/min: **250 MW/min**	Our current continental European interconnectors ramp at 100MW/min, a total of 500MW/min if they all ramp at the same time. This increase of 250MW/min, when in the same direction as demand, equates to 100MW/min on each existing interconnector.
Notice for IC for extra ramping available:	Prior to the interconnector day ahead auctions

Advantages

- Resilient for the future
- Allows the control room to work with a pre agreed process set out in the code
- Have more flexibility to manage cost in the control room which in turn is a benefit to the end consumer
- The process can be a relatively simple file transfer

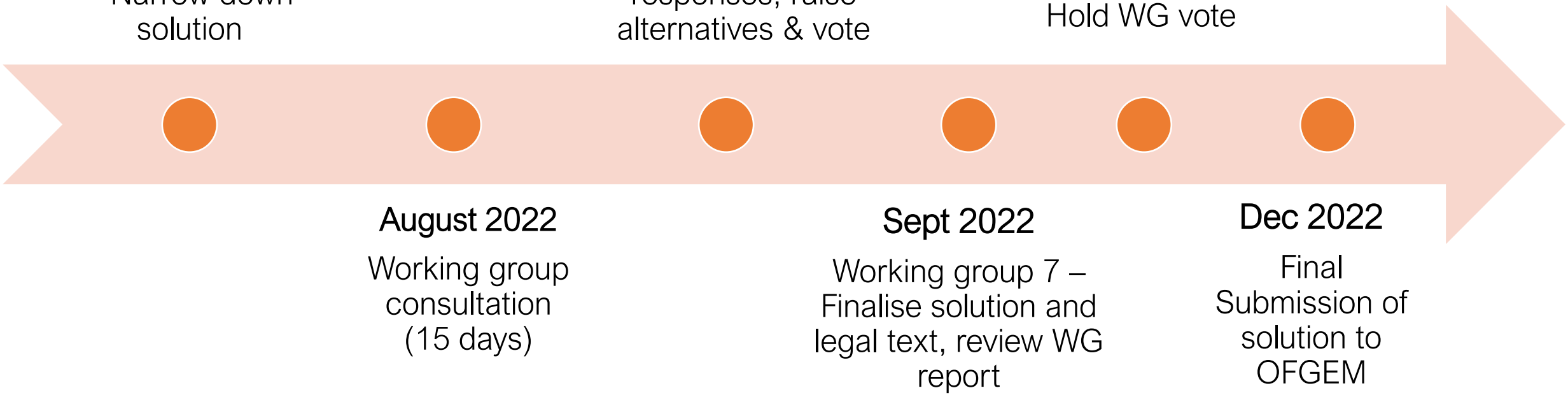
Dynamic ramp rate Process Flow Diagram



What questions do we still have?

Open questions	Mitigations
• What is the solution impact on the control room and IT systems? • Impacts to the remote end TSOs? • Emergency protocol if forecasting demand change is uncertain? • How we intend to integrate into the future balancing system?	• Potential for a phased approach of implementation to support transition • Plan in place to seek feedback with remote TSO after workgroup • Make ESO data transparent • Plan in place to begin impact assessment to internal ESO IT system • Ongoing conversations with IT about future impact assessments

Summary of Next Steps



(May be subject to change)

Annex

Assumptions

The aim is to map the requirements of Article 119 to the Grid Code as requested by Ofgem.

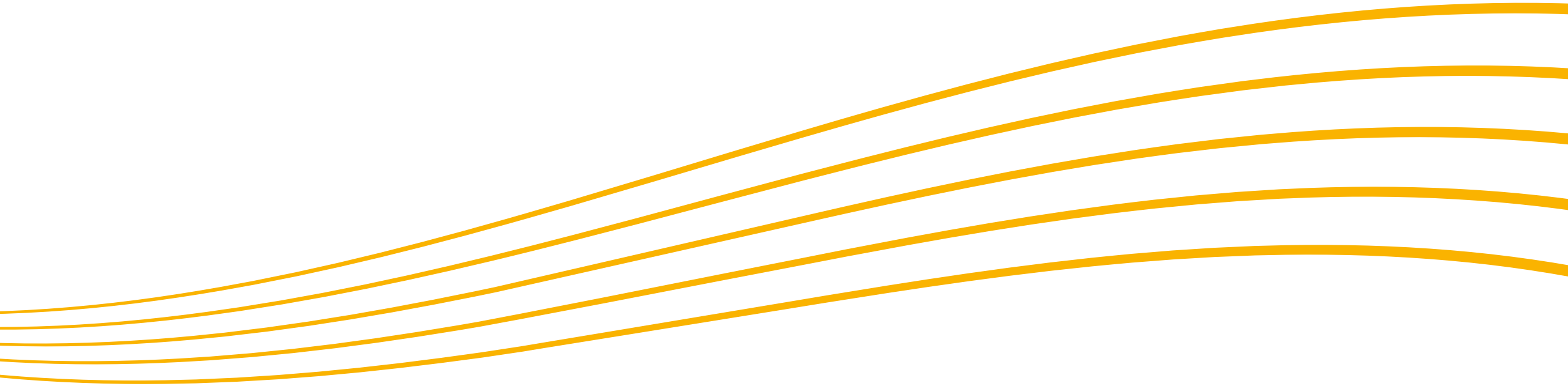
This will require the ESO and stakeholders to work collaboratively to find a solution that aligns with the text which has been written and approved.

The solution needs to consider the requirements of the transmission system now and be resilient enough for the future.

Cross –border ramping is a shared decision with the remote end EU System Operator. Therefore, their involvement and coordination with this process is key to ensure a mutually acceptable solution.

Ramping for BMUs is not in scope of this modification

SOGL Articles to review



Ramping restriction for active power output - Article 119 (c)

LFC block operational agreements

1. By 12 months after entry into force of this Regulation, all TSOs of each LFC block shall jointly develop common proposals for:

   (a) where the LFC block consists of more than one LFC area, FRCE target parameters for each LFC area defined in accordance with Article 128(4);

   (b) LFC block monitor in accordance with Article 134(1);

   (c) ramping restrictions for active power output in accordance with Article 137 (3)* and (4)

*outstanding action

Text taken from the SOGL

Ramping restriction for active power output
Article 137 (3) & (4) of SOGL

	Code mapping
3. All connecting TSOs of an HVDC interconnector shall have the right to determine in the LFC block operational agreement common restrictions for the active power output of that HVDC interconnector to limit its influence on the fulfilment of the FRCE target parameter of the connected LFC blocks by agreeing on ramping periods and/or maximum ramping rates for this HVDC interconnector. Those common restrictions shall not apply for imbalance netting, frequency coupling as well as cross-border activation of FRR and RR over HVDC interconnectors. All TSOs of the GB synchronous area shall coordinate these measures within the synchronous area.	
4. All TSOs of an LFC block shall have the right to determine in the LFC block operational agreement the following measures to support the fulfilment of the FRCE target parameter of the LFC block and to alleviate deterministic frequency deviations, taking into account the technological restrictions of power generating modules and demand units: (a) obligations on ramping periods and/or maximum ramping rates for power generating modules and/or demand units; (b) obligations on individual ramping starting times for power generating modules and/or demand units within the LFC block; and (c) coordination of the ramping between power generating modules, demand units and active power consumption within the LFC block.	BC1.A.1.1

Highlighted to show gap to close

Text taken from the SOGL

LFC Block Operational Methodology for Article 119 (1) (c)

A119 Methodology text to map to codes	Supporting paper reference
1. Rules for ramping restrictions on the active power output of each HVDC interconnector between a LFC Block of another synchronous area and the GB LFC block, in accordance with SOGL Article 137(3):	N/A
a. The ESO, and the connecting TSOs supervising a LFC block of an HVDC interconnector shall have the right to determine common ramping restrictions in the form of ramping periods and/or maximum ramping rates and shall enter into agreement with the TSOs responsible for operating the interconnector, to determine the processes and mechanisms by which these restrictions will be put in place. These ramping restrictions shall not apply to imbalance netting, frequency coupling, cross-border activation of FRR or cross-border activation of RR. These ramping restrictions shall not apply to any service aimed at maintaining or returning one of the connected electricity systems to a normal system state.	The ESO has sought to maintain simplicity of application in that compliant regimes already exist on all GB connecting HVDC interconnectors, where the ramping restrictions and manner in which they are applied is agreed and defined in the operational agreements

Text taken from the LFC block operational agreement

LFC Block Operational Methodology for Article 119 (1) (c)

A119 Methodology text to map to codes	Supporting paper reference
b. The ramping restrictions for each interconnector shall be applied in a non-discriminatory manner. The ESO shall ensure alignment of ramping restrictions between all HVDC interconnectors linking the same two synchronous areas, taking into account the technical capabilities of each HVDC interconnector;	The ESO wants to demonstrate that all interconnector parties are being treated fairly, but highlights that rules between different synchronous areas may differ as ramping-restrictions imposed from another synchronous area may, if more onerous that those sought by the ESO, result in different rules for those particular interconnectors.
c. A summary of the ramping-restrictions to be applied to HVDC interconnectors connecting to the GB LFC Block, shall be published by the ESO on its website at least one week before the rules are enforced, in accordance with the obligations in SOGL Article 8;	Transparency and fairness is demonstrated by publishing a summary of the ramping-restrictions being applied to GB interconnectors on the internet.

Text taken from the LFC block operational agreement

LFC Block Operational Methodology for Article 119 (1) (c)

A119 Methodology text to map to codes	Supporting paper reference
d. The ESO, in order to prevent the GB LFC block from entering into an emergency state, may restrict equitably the ramp rates of GB interconnectors between GB and the same connecting synchronous areas, in coordination with the affected national TSOs and affected interconnector operators according to the terms referred to paragraph (a) of this Article;	There is a need to be able to reduce the ramping-rates being applied to interconnectors when there is a current need or anticipated situation which, without action, would result in Great Britain entering an emergency state. Under these circumstances, the ESO will follow procedures to be determined in the operational agreements between parties to apply reduced ramp-rates to all market-based transfer programs on all the affected interconnectors.
e. Within 30 calendar days of an incident which restricted one or more of the HVDC interconnectors, under the process referred to in paragraph (d), the ESO shall prepare a report containing an explanation of the rationale, implementation and impact of this action and submit it to the relevant regulatory authority in accordance with Article 37 of Directive 2009/72/EC and neighbouring TSOs, and also make the report available to all significantly affected system users.	For transparency purposes, the ESO will publish information on the circumstances leading up to the need to reduce ramping-rates and the actions followed until operations were returned to normal ramping-rules.

Text taken from the LFC block operational agreement

Possible solutions discussed (Not in scope)

Not in scope for GC0154	Justification
Working with ESO, to understand how the new technology (i.e. battery) and new market design can help ESO manage ramping for ICs and other generation assets	Manages ramp rates but does not solve root ramping problem, fits more so into balancing services programme of work.
Effective utilisation and design of additional services with ICs and other technologies	Does not solve root ramping problem
Change of GB wholesale market design and IC capacity market which might be the enduring solution	High complexity, would require market reform, timescales not aligned with OFGEM/ESO expectations
Establish cross border Frequency response on all borders through the ICs	Would provide assistance to manage ramping but not necessarily solving the problem.
Change to a 5 minute settlement period to address the root cause.	Exemption already in place for 15 min ISP under EBR. This would involve total change of market design which is not in scope for this mod.
Create a market for ramp rates.	High complexity, would require market reform/lengthy process, also may seek to solve swings rather than ramp rates.
NGESO set a maximum ramp rate for each period of the day and then interconnectors bid for the use of this ramp rate.	High complexity, requires creating a market for ramp rates leading to same reasons not in scope as above.
Changes to the GB wholesale market design to be more compatible with cross border capacity market	Major change to the GB market – potential long term solution but not in scope with OFGEM or ESO expectations for solution timescales
Change cross border capacity markets	Complex to change and implement, requires holistic European agreement

Possible solutions discussed (In scope)

In scope for GC0154	Justification
Dynamic ramping rate - based on an assessment, NGESO will decide if any ramp rate limit needs to be amended	Provides a flexible, dynamic ramping solution to ensure ICs are given the max ramp rate possible (reduces imbalance compared to other options). Allow IC to move with system needs and capability providing future system resilience.
Apply a reduced static interconnector ramp rate limit	Provides a simple interim solution to the problem, providing the same ramp rates as BMUs. However, would require reviewing as the system changes and not a future resilience solution
Include current bespoke ramping arrangements, as they are, in the Grid Code BC1.A1.1	Provides compliance within Grid Code, however does not solve the operability problem, so lacks future resilience as security of supply is threatened Maintains current high costs and operational challenges due to IC ramping and aggravates with new IC. Also has the potential to create disparity within generation mix. Least preferred NGESO option.
Develop additional services with the interconnector and EU Transmission System Operators (TSOs) to mitigate ramping e.g. slow or delay	An additional service could be use in conjunction with other options to meets compliance and operational needs in addition to a commercial service to the IC. However. additional services are in scope of other NGESO work streams (TCA/Ancillary services)
A dynamic overall ramping rate, is only derived based on a verified market condition if above market solution doesn't work	This would allow more control over ramping across different periods with a pre agreed process. However, this does not provide NGESO enough time to manage the ramping issues (i.e. if IC gates reduce to 1hr), especially with increasing connecting IC.
Stagger ramping windows so only 1 or 2 ICs are ramping in the same period. this reduces the combined IC ramp rate meaning all ICs could continue to utilise 100MW/min. To reduce the imbalance exposure, ICs could move to a value such that the "area under the curve" is the same volume as the volume in the Market energy block	This would work with our current systems and energy market, by allowing for smoother ramping profile and allow for reduced ramping imbalance costs, however is not a future proofed solution due to the increasing IC numbers and may not fit with European markets.
Codifying the current IC ramping limit of 100 MW/min.	This suits compliance, but does not address the operational issues and therefore not future resilient, due to the increasing number of interconnectors.
Apply current BMU ramping rates to the interconnectors as per BC1.A.1.1	Provides compliance within Grid Code and provides parity across all GB connected generation units. However, is not a future proof solution as we would lose the benefit of faster ramping. This could also lead to an increased cost to GB consumer, due to imbalances created, whilst not being reflective of future generation mix.

Summary and Next Steps