Date	Email title	Question	Baringa Response	ESO Response
16/05/2023	Emails after WG11- feedback for Baringa ono the playback		Hi All, We thank the GCWG for their questions and have provided our responses to specific points below – indicating where some are a consequence of the GCWG process and/or not for us to answer. As noted at GCWG 11 our CBA is a best attempt of modelling a complex question, which will not perfectly capture every operational aspect in intricate detail but we believe provide a reasonably robust order of magnitude assessment; and there are qualitative elements where we provided a high level view based on insight and information available to us. Equally as noted, GCWG member will have wider considerations to the scope of our CBA, and wider insight they can bring forward should they choose to provide a refined view of our assessment and modelling which is based on publicly available data. If GCWG members have their own data or analysis which they could share to evidentially demonstrate that any element of our CBA – quantitative or qualitative – should be amended, then this would be important to table at the GCWG to inform the further deliberations of the GCWG in determining its recommendation for the Grid Code Panel and Ofgem. Appendix also attached from Baringa to this email.	
	Overall comments	The focus of the CBA appears uneven, with the outputs presented by Baringa implying a less detailed assessment of options 1A and 3.2 as compared with option 2B. The assumptions for all options need to be consistent in order to be comparable.	For presentational purposes, example analysis was provided in the slide pack to demonstrate the impact on flows and prices for option 2B vs our counterfactual. The same analysis was undertaken across all options, and each treated with the same level of rigour from the modelling to the CBA assessment.	
		Significantly more detail is required on the approach taken to Baringa's evaluation of the impact of different options on GB balancing costs, which is a critical output of this CBA.	Additional detail on our approach was provided at GCWC 11. In addition to this see our comments below on our Balancing Cost approach, alongside further detail provided in Appendix A.	
	Shortlisting Options	Please confirm why the increased reserve option (3.2) was not included in this analysis?	As advised by the ESO at GCWG 10, reviewing Response and Reserve does not sit in the scope of this work. A workstream exists within the ESO working on a Response and Reserve review. For this reason, we determined this option out of scope.	
		Please confirm the rationale for the difference in the approach to assessing the ramp management (1A) and dynamic ramp (3.1) options. Our understanding is that interconnector ramp rates would be required to reflect prevailing system conditions under both options, and so would in practice result in the same ramping limits being imposed, even if the assumed starting point for 1A is 100MW/min and for 3.1 is 50MW/min. As such, the significant difference in the approach taken for each option is unclear.	We provided these methodologies at GCWC 10 for the working group and welcomed comments up to 5 days after the session. Based on feedback from our shortlisting process, we offered the opportunity for working group members to vote on their preferred option and from this we developed the 1A approach supported by additional information from a Working Group member. To remain impartial, we further modelled the dynamic option as agreed by the working group, based on the ramp rates agreed with the ESO. Therefore, any perceived difference could be more a fact of phrasing – it could be rephrased at 100MW/min when a dynamic ramp rate may be beneficial, however reduced to 50MW/min when the ramp rate was not expected to be beneficial to demand movement.	
	Balancing Costs	We understand that the GB balancing cost savings output indicated by this CBA is based on an assessment of the difference in the volume of ESO balancing actions taken on the half hour compared with those on the hour - could Baringa please confirm what proportion of this difference (and thus associated balancing costs) has been assumed to result from interconnector ramping, and on what basis?	Our method directly derives an allocation estimated as attributable to interconnector ramping as explained in the WG sessions. The basis of our method for Repositioning, Response, Frequency Control, and other energy actions is based on the delta between hourly and half-hourly data. Reserve is calculated differently, as explained at GCWC 11.	
		We also note references to Appendix A, B and C throughout these slides – could these please be provided to the Workgroup for review, together with the detail of any other inputs and assumptions used in the CBA.	Please see Appendixes attached. We hope these provide some of the additional detail that the GCWG has indicated it would welcome from us on our CBA work.	
		We note that actual NGESO balancing costs attributable to interconnector ramping for 2022 do not appear to have been used in this analysis – could Baringa please confirm why this is the case and, if known, provide this figure for the Workgroup's review.	We used 2022 data from various public databases to develop a methodology applicable to estimating Balancing Costs attributed to interconnector ramping. There is no "actual" reported 2022 Balancing Costs attributed to managing interconnector ramping. In addition, as our CBA is a forward look, an assessment of 2022 was not part of the analysis. The overall 2022 Balancing Costs data itself is available publicly.	
		The cost of equivalent balancing actions taken by connected EU system operators does not appear to have been taken into account in this CBA. Could Baringa please confirm that this is the case and clarify the reason for this omission.	We assessed the cost of equivalent balancing actions in GB using a bespoke methodology but not for the rest of Europe. The assessment focussed on the Balancing Costs for GB only with a wider assessment of the impact on connected European markets, focussing on Socio-Economic Welfare analysis. The bespoke nature of the balancing arrangements used in other jurisdictions means that it was not possible to apply the GB methodology to other countries in a meaningful way in the time available.	
	Results and welfare figures	We note Baringa's reference to indirect changes in interconnector revenue arising from wider changes in the market (slide 10), including '***participant views of the value of interconnector capacity***' – could Baringa please clarify how has been assessed?	We considered wider impacts on interconnector revenue and concluded it would have a relatively low impact. If Interconnector parties have data which would indicate otherwise, we would encourage they share it within the GCWG.	
		Could Baringa please confirm our understanding that the welfare impacts provided are primarily based on (a) an assumed change to interconnector flows resulting from a lower ramp rate, and (b) consequential changes to wholesale market prices.	We have isolated the impact of the different ramping rates and modelled these accordingly. Welfare impacts are calculated by taking the delta between the alternative ramp rate options and the baseline modelled option (100MW/min). As part of the welfare impacts, we have evaluated the total impact of this change in ramping rate on several different modelled components. These are unique for producer, consumer, and IC welfare. The main component of producer welfare is generator wholesale market revenue which is a function of the wholesale price and volume sold. The main component of consumer welfare is the cost of electricity (a function of the wholesale price) and the main component of interconnector welfare is the interconnector revenue which is a function of the wholesale price and interconnector flows (accounting for losses).	
		We have previously raised a concern that a reduction of the ramping rate could lead to ramping spill (i.e. ramping cannot finish in the dedicated ramping window) and consequently this might cause significant imbalance in the next period. In the worst case, this could mean that the relevant interconnector(s) might not be able to help GB meet its winter peak due to slow ramping if there is a ramp immediately before and after. Can Baringa please confirm that this ramping spill and slow ramping (including any impact on wind curtailment) has been considered.	We didn't capture imbalances due to ramping spill. However, if Interconnector parties have data which would indicate otherwise, we would encourage they share it within the GCWG.	
		Could Baringa please confirm our understanding that the cost to interconnectors of covering the higher imbalance resulting from a lower ramp rate has not been included in this analysis	As minuted from GCWG10, Baringa sought input/data from Interconnector parties to help us provide an estimate of this, but none was provided in the timeframe of our work. If Interconnector parties have data which would indicate otherwise, we would encourage they share it within the GCWG.	
		Slide 10 refers to different sensitivities used – could Baringa please confirm what these sensitivities are, as well as the assumptions and inputs on which they are based.	We included a sensitivity on Balancing Costs. This was to examine the switching value – as such there were no assumptions guiding this. We have done this on all information to hand and best endeavours; (b) we recognise there are some specific costs we have not fully captured and encourage ESO and Interconnector parties to share further data and insights within the GCWG if they believe this materially impacts on our CBA outcomes.	
		Assessment for Implementation Cost, Impact on Interconnector investment and Security of Supply was conducted and defined in the CBA? In Baringa's response, could the following please be addressed: •IC Investment: regarding the Impact to IC investment, from the Working group's perspective, we would expect solutions which are less restrictive to IC flexibility to further support IC and wind and wider renewables investment and options that are more restrictive, such as 2B which restricts IC flexibility and creates imbalance, risk to cause further harm to interconnector investments. We would like to further understand why that has not been reflected? •Security of supply: The working group would like to further understand why the security of supply impact to EU nations as a result of static ramping has not been considered? A limitation of IC flexibility unaligned with EU countries could generate significant operational issues with EU security of supply. Furthermore, whilst understanding there is great difficulty in modelling future supply concerns (with varying geopolitical factors coming into play), we do feel the qualitative response and use of System Operator-informed risk is insufficient in evidencing this. •Implementation costs: We do not see why specific options would require an improved level of IT and especially not "major IT changes". Currently, we have a large suite of services with both NG and EU ESOs to facilitate their system operations and security of supply in both countries. This requires further investigation but is not seen as a major issue	If Interconnector parties have data which would indicate otherwise, we would encourage they share it within the GCWG. •We have not modelled the change in investment, across generation or interconnection, as a result of the ramping change. Instead, we keep capacity static between the model runs. Given the small, modelled impact of the change in ramp rate on interconnector revenue, as discussed with the WG, our inference was that this would not lead to a material change in investment appetite or future investment decisions. If interconnector owners have insight which would indicate otherwise, we would encourage they share this with the GCWG. •Our PLEXOS model captured redispatch required as needed to meet European demand securely. Our report reflects the ESO guidance provide as the GB's accountable party for GB energy security of supply. We refer the GCWG to the ESO to discuss why it presents this view, including as part of the inception of the vires of the GCWG scope of consideration. •As previously discussed with the WG we are not suitably placed to provide a comment on the detailed IT situation for each of and between the ESO and Interconnectors. If Interconnector parties have data which would indicate otherwise, we would encourage they share it within the GCWG.	
		Similarly, in relation to CO2 emissions savings: Dynamic and ramping management should both encourage further IC and intermittent wind development, vs. the static. From our understanding and perspective, we would expect CO2 savings to be higher for option 1A & 3.1 compared to 2B. Would it be possible to share what has happened / been assumed to drive this conclusion or adapt it?	The modelling isolated the impact of the change in ramp rate, all else being equal, we assessed the impact of the ramp rate change, and the rest of our modelling assumptions stayed the same. This allowed for a like for like comparison to allow an accurate assessment of the impact of each model option. Our capacity assumptions across the generation mix and interconnectors have been kept consistent to allow for a constant basis of comparison. Without this consistency, we would not have been able to compare across the different modelling options and comment on the welfare impacts, etc. We agree that if the change in ramp rate had an impact on investment decisions for renewables, then this could drive a further impact on CO2 emissions, but we confirm that this is not reflected in the current analysis.	
	Additional questions captured by call with IC 23/24 May 2023			
		Q1. Please confirm the rationale for the difference in the approach to assessing the ramp management (1A) and dynamic ramp (3.1) options. Our understanding is that interconnector ramp rates would be required to reflect prevailing system conditions under both options, and so would in practice result in the same ramping limits being imposed, even if the assumed starting point for 1A is 100MW/min and for 3.1 is 50MW/min. As such, the significant difference in the approach taken for each option is unclear. Are the assumptions for each option the same / like for like?	Please note our previous response: "We provided these methodologies at GCWC 10 for the working group and welcomed comments up to 5 days after the session. Based on feedback from our shortlisting process, we offered the opportunity for working group members to vote on their preferred option and from this we developed the 1A approach supported by additional information from a Working Group member. To remain impartial, we further modelled the dynamic option as agreed by the working group, based on the ramp rates agreed with the ESO. Therefore, any perceived difference could be more a fact of phrasing – it could be rephrased at 100MW/min when a dynamic ramp rate may be beneficial, however reduced to 50MW/min when the ramp rate was not expected to be beneficial to demand movement." We can further confirm that the modelling assumptions used are the same across all options analysed.	
		Q2. Please can you share the raw data which was used to calculate the input for imbalance into the PLEXOS model?	We understand this question to specifically concern interconnector imbalances. We did not utilise any raw data to calculate interconnector imbalance costs as this data was not readily available. As such, within our CBA imbalance costs were not considered. We highlighted at GCWC11 that it was both viewed as not material and would need to be dramatic to change the CBA outcomes – if interconnector parties or the ESO have data to indicate as such, we encourage they share it within the GCWG. If the question concerns energy imbalances, our PLEXOS model simulates the day ahead markets, so any imbalances due to real time availability are not considered. The use of day ahead modelling has previously been discussed in previous GCWGs.	
		Q3. Can the raw data be shared to understand how balancing costs were assumed for IC ramping only	Please see Appendix B Slide 11 from the previous document sent to the Working Group for our methodology. Raw data used to build our Balancing Cost methodology can be found from the following sources: •https://data.nationalgrideso.com/ •Balancing | BMRS (bmreports.com) •https://data.eleclink.co.uk •ENTSO-E Transparency Platform (entsoe.eu) •RNP | Cross-border Overview (unicorn.com)	
		Q4. How were replacement energy costs accounted for and what data do we have to support this?	Our PLEXOS modelling accounts for any temporary deficit in energy caused by the slower ramp rate with costs as part of our CBA within the producer welfare. These sit within generation costs.	
		Q5. Have the interconnectors been classified as zero carbon in this study?	The change in dispatch between model runs, as a result of change in flows across each interconnector, will have a carbon impact in the importing and exporting country. This change in carbon output is captured by our modelling.	
		Q6. How were the IT impacts calculated- is there anyway to quantify them at all?	This was based on high level understanding of systems between ESO and interconnectors. The ESO and interconnectors will have best understanding of their own systems and the costs of potential changes of different options.	
20/06/2023	Email after WG 13	In the CBA we have the impression there is no differentiation made between ramping upwards or ramping downwards while we would expect this to require different balancing actions/means. Would you be able to provide any views/feedback on this please?	The issue is linked to ramping overall, not specifically with ramping up or down. It varies with system conditions. So depending on the system conditions, ramping has an impact. So against demand has an impact, up or down, and also if ramping is inline with demand but faster than demand this can cause an imbalance. Actions are taken to manage this using the tools we have available. These tools were shared in	
		What is the exact issue with the ramping up and how does NGESO currently address this via balancing actions or plan to address this towards the future? E.g. is it due to the differential ramp rate of generation there are timing effects causing imbalances or is it due to demand not following NGESO's profile which causes imbalances?	As Above	
		What is the exact issue with the ramping down and how does NGESO currently address this via balancing actions or plan to address this towards the future? E.g. is it due to the differential ramp rate of generation there are timing effects causing imbalances or is it due to demand not following NGESO's profile which causes imbalances?	As Above	
		Out of the box: Could it be considered to have a differential ramp rate for ramping up versus ramping down?	As mentioned above, it's not specifically linked to ramping up or down so this is not in the ESO proposal	
		Secondly, on the balancing costs: Is it possible to get more details on the additional reserve calculations (slide 13 of the Appendix) please? (We assume this is one of the main cost drivers).	The Control Room needs to procure additional reserve capacity for IC ramping due to uncertainty of when the ramp will be happening. The current methodology of setting reserve requirements includes for example: plants unavailability and failure, demand changes and deviations from the forecast and wind changes from the forecast. When the Control Room receives the final reference programme from an interconnector or Final Physical notification at 60 minutes before the move, they will assess if they need additional reserve to manage the ramping safely to keep frequency within operational boundaries. At this stage, the control may already use reserve capacity for everyday uncertainty of demand or wind and control room need to create more reserve capacity by synchronised more generation. The costs of synchronising additional generation (offers in ESO dataset) at short notice is main costs component. The remaining generation on the system has to be re-balance to ensure the frequency is still within operational boundaries, therefore, control room will issue many bids and offers to balance the system to them moment when the IC is moving MWs at the hourly gate and control room need to increase/decrease generation with 1 minute accuracy to keep frequency close to 50Hz. Once the IC finish the hourly change, the control room still need to re-balance the system from bring additional reserve capacity on the system. The larger the size of the swings, therefore the larger imbalance will be created on sec-by-sec basis when IC is moving therefore we need access to more reserve MWs to close the imbalance. And therefore we need to start taking actions earlier to synchronised additional plants which may have longer notice to deviate from zero.	

		How does Baringa price in the additional reserves/frequency support? (We have the impression the reserve volumes are always assumed to get activated at the Day Ahead market price).	Firstly, the reserve volumes are not activated at DA market price. The reserve units are just units in Balancing Mechanism which have space between PN (Physical Notification) and MEL (Maximum Export Limit) or headroom. If we do not have enough generation with spare headroom, the Control Room needs to synchronised additional units to access their headroom as reserve. The reason why we using plants headroom as reserve is speed of reaction to Control Room instruction - as per current BM rules and Notice to Offer (increase generation) or Notice to Bid (reduce generation), the units need to able to start ramping up or down within 2 minutes, which is flexible enough to response to any imbalances. The units have to submit their dynamic parameter including prices from 24 hours ahead up to 60 minutes ahead the delivery, therefore the unit can change the price up 60 minutes to delivery, therefore generator frequently are increasing the prices intraday as ESO are residual balancer and we have only units in BM to use to keep system balanced. Therefore, units will include scarcity pricing in their Bid and Offer pricing as well as generator can predict when we will be needing to synchronised more units in response to rapid change of demand so they increase their prices. The only reserve we are procuring outside intraday BM (Balancing Mechanism) is STOR or Short term operating reserve which is procured mainly to secure our largest loss and maintain the output till we can get the faulted generator back online. We procure this service at day ahead before delivery and we are awarding the units availability payments at day ahead stage for reserving the unit capacity to ESO in response to the largest loss event. However, if those STOR units will be dispatched on the day, they will also be awarded utilisation payment, which is costs of the offer in BM (since this service is dispatched in BM) and the offer prices can be change hourly by generator up 60 minutes before delivery. ESO needs more frequency control services to manage IC ramping at hourly gate and the units which can be utilised as frequency control support are those that can achieve output quickly for example: pump storage units in spin-gen or spin-pump mode, optional fast reserve units (with full delivery within 2 minutes), batteries and units instructed in Mandatory Frequency Response mode (mode where the unit output is proportional to frequency deviation from 50Hz). All costs of Control Room actions are published by ESO using ESO data portal.	
		As a general note, we wanted to understand how the balancing costs/volumes are attributed to interconnector ramping by looking at the 2022 data. A material amount of ramps were most likely caused by the commercial trading induced by NGESO, and in parallel with these trades, NGESO will most likely have made other balancing actions to address these constraints. In general a big flow reversal will impact the balancing actions of NGESO irrespective of ramping (e.g. reserve dimensioning, …), how can it be assured these costs/volumes were not attributed to ramping? In both cases there will be a correlation with the ramp changes but the costs/volumes are not related to the ramps.	Baringa have answered this question previoulsy. Please note the response. We used 2022 data from various public databases to develop a methodology applicable to estimating Balancing Costs attributed to interconnector ramping. There is no "actual" reported 2022 Balancing Costs attributed to managing interconnector ramping. In addition, as our CBA is a forward look, an assessment of 2022 was not part of the analysis. The overall 2022 Balancing Costs data itself is available publicly.	