

Enduring Auction Capability

15 December 2022

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questions via MS Forms



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Project Overview

Enduring Auction Capability (EAC)

The RII0-2 Business Plan committed ESO to delivering **co-optimised procurement of day-ahead Response and Reserve services**, which would be **scalable** and **extendable** to new services and products



During 2022-23 a consortium of three firms will support ESO deliver the EAC.



The EAC is expected to deliver the following benefits:



Better user experience

- Fewer manual, duplicated processes.
- Increased use of technology to facilitate bidding
- Consistent / standardised user experience



Closer to real-time procurement

- Increased market liquidity & participation
- Increased technology variation (e.g. renewables & demand flexibility)



Consistent procurement route

- Single route to market, replacing interim solutions
- Enhanced transparency of our procurement activities
- Lower costs to move between services
- Reduced duplication of resource for bidding



Connected and co-optimised auctions for ancillary services

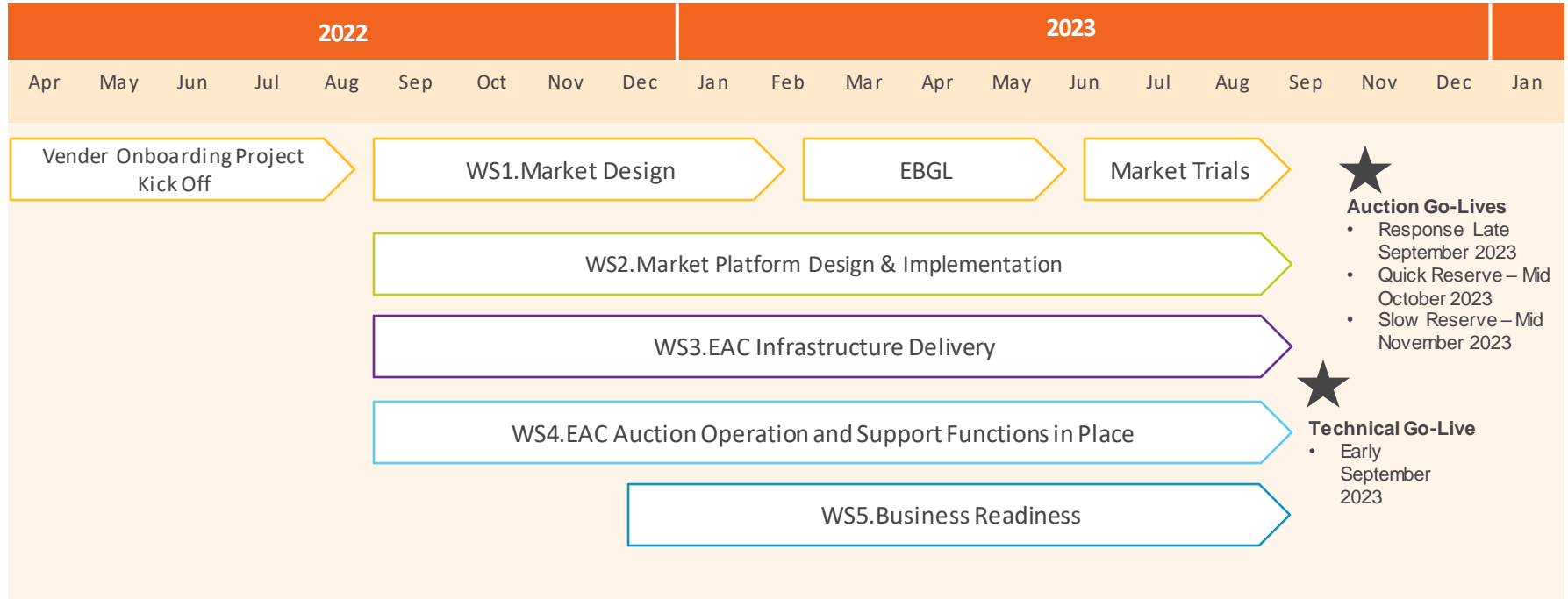
- Efficient markets due to clearer price signals (increased algorithm efficiency)
- Easy access across multiple markets
- Greater diversity in bidding strategies (e.g. curtailable bids)
- Compatibility with downstream systems (e.g. settlement)



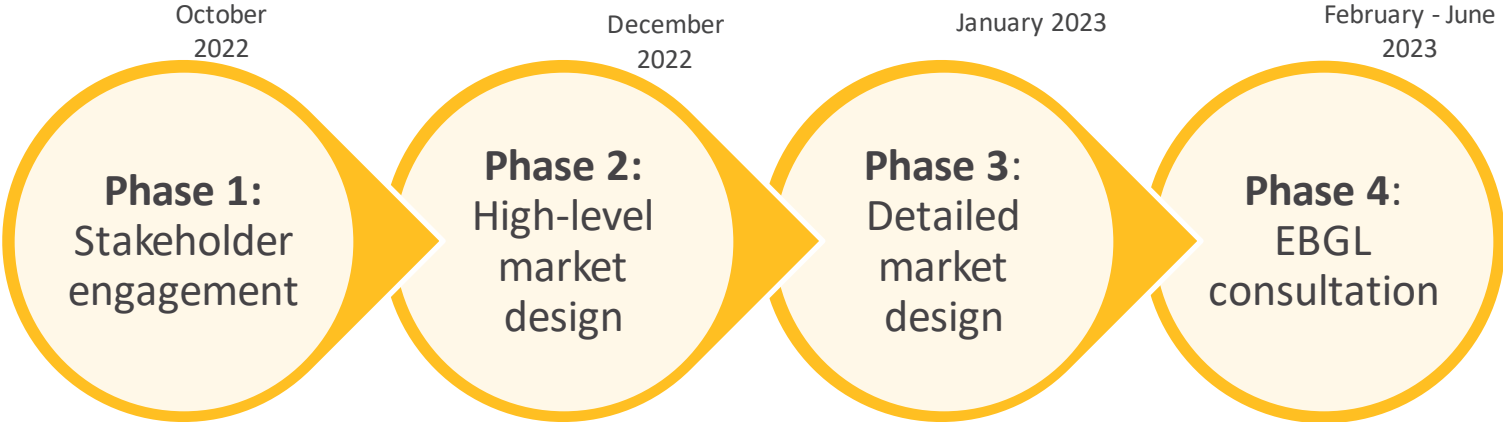
Long-term benefits

- Improved levels of flexibility and configurability to adapt to changes in service procurement
- Accessible to new / future service providers

Delivery Roadmap



Market Design Timeline



Engagement with industry stakeholders throughout

EAC Stakeholder Feedback

EAC Stakeholder Feedback

- Co-creation with industry in the development of the the Market Design
- Engagement activities have included a detailed questionnaire; one to one meetings with providers and Market Forum workshop to gather market participants insights on current and/or future market design.



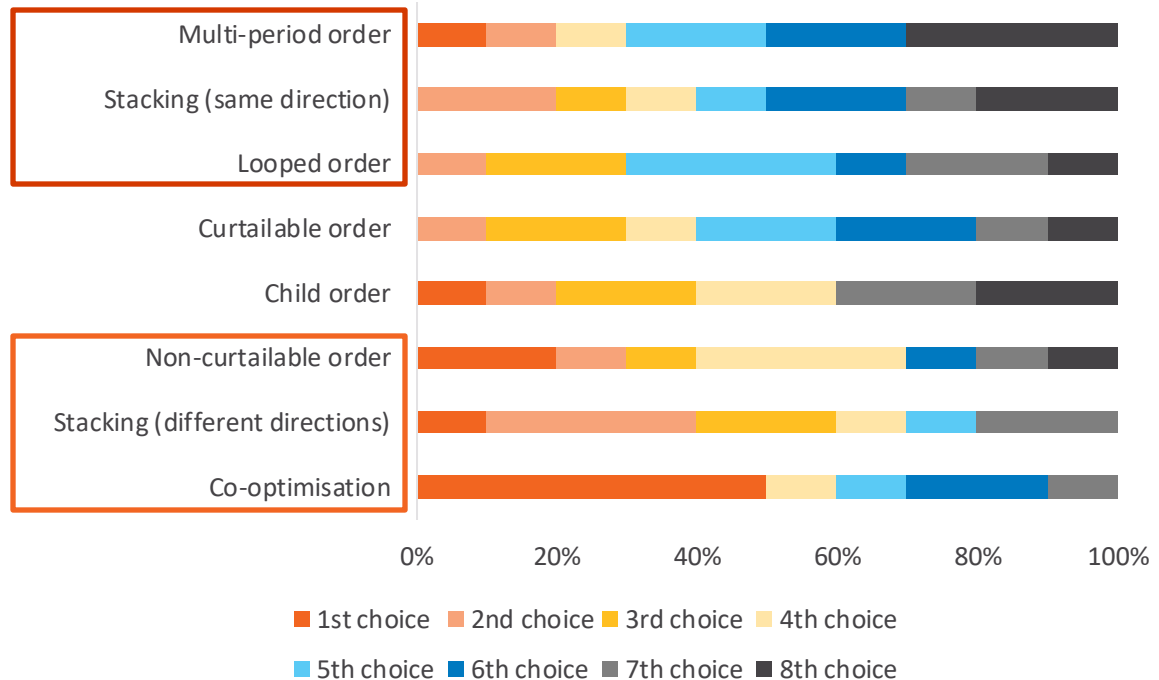
- We received 10 responses and held 8 one-to-ones meetings with interested providers.

EAC Stakeholder Feedback

In the questionnaire, we asked respondents to rank the eight functionalities from highest priority to lowest priority of implementation.

The three least essential functionalities ranked by respondents

The three most essential functionalities ranked by respondents



Auction Functionalities Feedback

Co-optimisation

- Strongly supported by stakeholders
- Results in more efficient pricing, less price volatility, and better optimisation strategy

Parent-child

- Will be good to have multiple child orders per parent, this will increase price discovery and allow more granular tendering
- Will be good to have more power-price pair per unit per EFA

Stacking/splitting

- Stacking/splitting low and high is good and easy to deliver, and leads to better asset optimisation
- Support for stacking/splitting combinations across all services and products

Looped orders

- A very important functionality

Non-curtailable orders

- Preferred than curtailable orders in general

Multi-period orders

- Should be maintained, as it is very useful for some technology types

High-Level Market Design

Evaluation Framework

Objectives of “End-State” Target Market Design

To deliver on ESO’s overall objectives, the Target Market Design of the EAC needs to be consistent with a set of overarching objectives.

Legal & Regulatory Compliance	Compliant with relevant legislative and regulatory framework.
Consumer Value	Results in cost-effective procurement of the services over the long term.
System Need	Procured capacity meets ESO’s requirements for the service (the market design facilitates operational security).
Correct Incentives	Creates clear price signals to incentivise short-term participation and long-term investment.
Fairness	Level playing field for all participants, including sell-side providers and the monopsony buyer.
Efficiency	Results in economic dispatch and efficient use of market assets.
Enabling of Energy Transition	Supports the ESO’s Net Zero targets.
Transparent	Participants have equal access to information; auction results and procurement requirements are visible ex-post.
Enduring	Fit for purpose for future needs.

Evaluation Framework

Assessment Criteria for the Auction's Clearing Algorithm

The auction algorithm will be assessed using a short set of criteria that are suitable for its technical nature. These criteria are directly supportive of the Target Market Design objectives set out in the previous slide.

Facilitates the delivery of Market Design	<ul style="list-style-type: none">• Effectively implements the market design.• Promotes the market design objectives.
Computational efficiency	<ul style="list-style-type: none">• Algorithm is mathematically tractable.• Efficiently finds the optimal market solution within a reasonable time.
Robustness	<ul style="list-style-type: none">• Trusted and reliable price formation and volume decisions.• Resistant to gaming and distortion; if the market has sufficient liquidity, then the clearing results are not highly sensitive to offers from a single participant.
Fairness, transparency and competition	<ul style="list-style-type: none">• Level playing field for all participants ('no undue discrimination').• Price formation and volume decision rules are clear to all parties and known in advance.• Auction processes enable participation from a wide range of providers including small providers.
Scalability and adaptability	<ul style="list-style-type: none">• Can adapt to changes with limited disruption within a reasonable timeframe and includes a degree of scalability (i.e. accommodate new entrants).• Does not actively preclude new functionalities from being implemented at a later date.

Objective Function - Market Welfare Maximisation



- Max satisfaction for all bids (both buy and sell orders)
- A structured and mathematically sound way for pay-as-clear auction or auction with advanced features
- In case there are multiple prices exist (i.e. curves cross with a vertical overlap), the price that minimise the total procurement costs will be selected

Enhanced Auction Capability

	Response /EPEX	STOR /SF	EAC
Co-optimize Sell Order Participants can offer more than one product to the auction. The auction clearing algorithm will accept the offer which clears the market most efficiently.	✗	✗	✓
Mutually Exclusive Order Participant/ ESO may submit multiple orders per unit and delivery period, of which, only one can be accepted	✗	✗	✓
Splitting (Revenue Stacking) More than one product can be delivered by a single unit in the same service window	✗	✗	✓
Co-optimize ESO Requirement ESO can submit more than one set of requirement to the auction. The auction clearing algorithm can choose the combination which clears the market most efficiently.	✗	✗	✓
Overholding The executed volume can exceed ESO's buy order	✗	✓	✓
Curtable Order Participants can self define their curtailability by Minimum Acceptance Ratio	✓	✓	✓
Looped Order Participants can loop more than one product or delivery period into a single offer. All looped offers will have the same acceptance ratio (e.g., taken together, or all rejected).	✓	✗	✓
Parent-child order Participants can define the dependencies of their orders via this function. The acceptance of child order is dependent on the acceptance of its parent order	✓	✗	✓



Challenges with the current design

The current design of Response Services has highlighted several **challenges**...

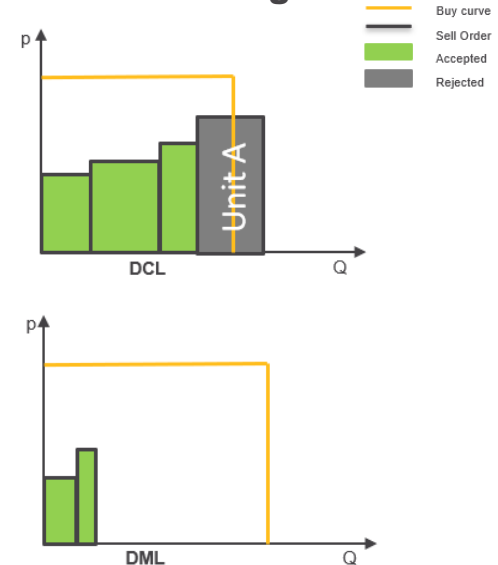
- Providers blind guess where other parties will tender - risk of oversupplying a single market when other markets are left empty
- Limited ability to split capacity and stack revenues across different services
- Limited options available to market participants (e.g., maximum of three orders per unit per delivery period, with only one 'child' allowed for each 'parent' order)



"The proposed arrangement which requires participants to choose which product they would like to participate in, is likely to lead to inefficient procurement. We believe that services will be under or oversubscribed and not all requirements met."

- Market participant

Current Design



Providers have to choose a **single** service to offer (for each unit and EFA period)

Role of co-optimisation and splitting

Splitting / Revenue Stacking

A unit can deliver two or more services simultaneously. But these services cannot be provided using the same MW.

It can split its total capacity into separate portions to provide different products in the same service window:

• **Different direction splitting:** E.g., a 20 MW unit splits its positive and negative capacity to provide 20 MW DCL and 20 MW DMH

• **Same direction splitting:** E.g., a 20 MW unit splits its positive capacity to provide 12 MW DCL and 8 MW DML

Co-optimisation (compatible with service splitting)

Providers can choose to offer more than one ancillary service (among Response and Reserve) into the auction by a single unit in a single service window

The EAC algorithm, chooses which service (or combination of services in case providers choose to split their capacity into multiple services/products) and through what combination of resources, maximise welfare.

Advantages

- Reduced risk of asset stranding, use resource/capacity more efficiently
- Increase market liquidity and competition
- Reduced cost of meeting ESO's need for services
- Single optimisation algorithm
- Compatible with other desirable functions

Potential risks

- Perception of reduced transparency
- Excessive restrictions imposed on bid characteristics, reducing pool of participants and/or increasing bid costs

These risks will be mitigated via:

- Appropriate market design choices
- Onboarding training (e.g. support documentation, mock auctions, etc.)

Co-optimisation Steps (without splitting)

Step 1: Bidding process:

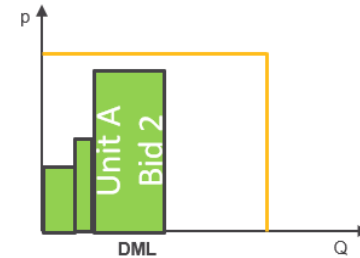
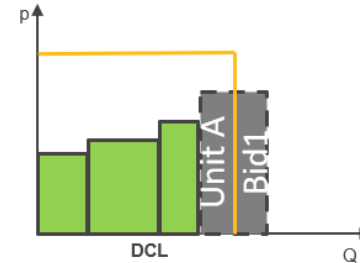
- **More than one service can be offered** into the auction **by a single unit** in a single service period (into the form of separate orders)
- Market participants **explicitly link the corresponding orders** at the bidding stage. Participants set their bidding preferences (e.g. price, volume, services selections etc.).
 - ➔ If splitting is **not allowed** by market rules, this link must be made via **mutually exclusive constraints**, preventing the procurement of several services via the same unit.

- Market participants **no longer need to estimate which service is the most valuable**

Step 2: Market clearing

- Auction algorithm maximises the total social welfare across products and delivery periods
- Auction results satisfy the constraints linking the orders of a single unit (e.g. mutually exclusive constraints under the form “accept order X or order Y”)

Co-optimisation



- Providers can offer for **more than one service**. The auction clearing algorithm selects the (single) service that best optimises the market

Co-optimisation Steps (with splitting)

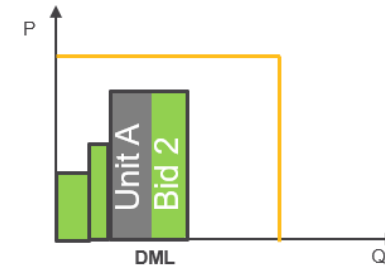
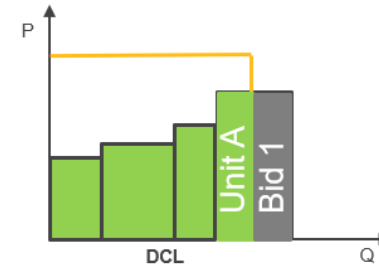
Step 1: Bidding process:

- **More than one service can be offered** into the auction **by a single unit** in a single service period (into the form of separate orders)
- Market participants **explicitly link the corresponding orders** at the bidding stage. Participants set their bidding preferences (e.g. price, volume, services selections etc.).
 - ➔ If splitting is **allowed** by market rules, market participants can* enable this functionality by using the **splitting feature**, allowing to split the capacity of a same unit over different services for a same delivery period.
- Market participants **no longer need to estimate which service is the most valuable**

Step 2: Market clearing

- Auction algorithm maximises the total social welfare across products and delivery periods
- Same unit can be accepted in more than one markets but the total acceptance ration cannot exceed 100% if splitting in the same direction.

Co-optimisation with splitting



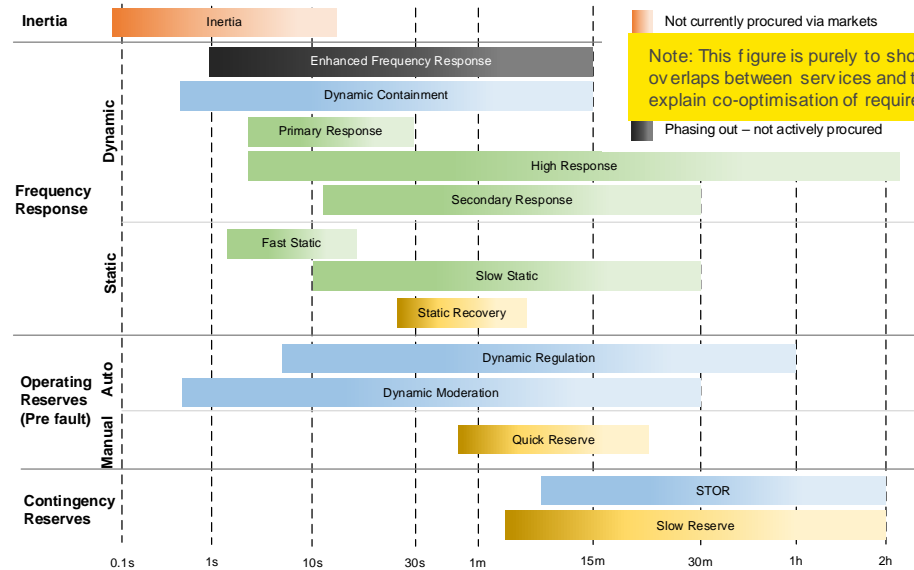
The sum of acceptance ratios of Bid 1 and Bid 2 cannot exceed 100%



*With splitting allowed, participants still have the possibility to use the "no-splitting" functionality, via mutually exclusive constraints.

Co-optimize ESO Requirement

- Some ESO requirements are interdependent. i.e., the requirement of a service depends on the amount already procured of other services for the same service window.
- Co-optimising ESO requirements means explicitly considering these interrelations when constructing the buy-orders.
- Note that, although EAC unlocks this additional capability, other ESO systems will need to be updated before we can actively use this feature.

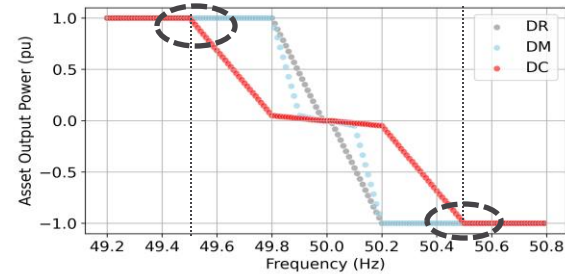


A degree of substitutability is present between **some** of the products.

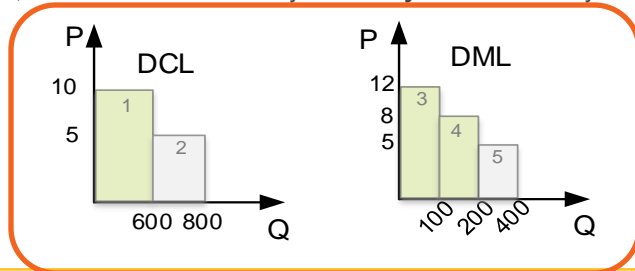
Co-optimize ESO Requirement

- For instance, Dynamic Moderation (DM) and Dynamic Containment (DC), present **some degree of substitutability**, particularly in the post-fault region (see Figure on the right).

- Most or all DCL can be substituted with DML. Special consideration for DML upper limit, due to e.g., stability reasons.
- Only a portion of the DML requirement can be met by DCL, indeed there is a minimum value of DML that must be procured and cannot be substituted by DCL.



- In the EAC, this will be modelled by **Mutually Exclusive** buy-order blocks.

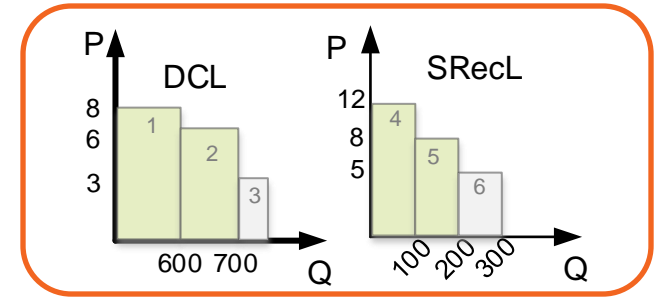
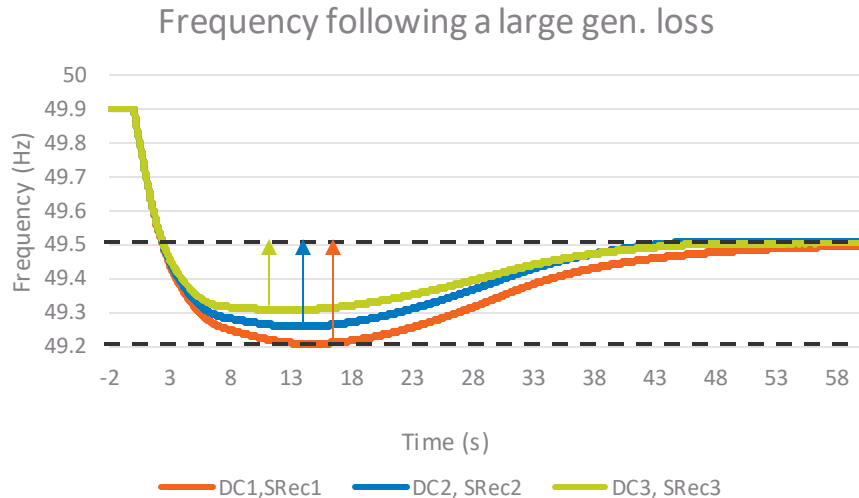


To achieve co-optimisation of ESO requirements it is only necessary to set **block order 2** as **mutually exclusive** with **block order 5**.

In this example, from the system's point of view the last 200 MW of the DCL requirement are equivalent to the last 200 MW of the DML requirement.

Co-optimize ESO Requirement

- Products in the development stage such as **Static Recovery**, may also present co-optimisation opportunities for ESO.
- For illustration purposes, following a large generation loss, and for the same system conditions (demand, inertia)



To achieve co-optimisation of ESO requirements it is only necessary to set **block order 3** as **mutually exclusive** with **block order 6**.

Note that Static Recovery is still in development phase, and this example only highlights potential benefits from co-optimisation of requirements.

Market Design Overview (1/2)

Market Design (Day 1)

Auction Frequency	<ul style="list-style-type: none">• Daily, day-ahead auction. Frequency Response and Reserve services will be procured in a single, simultaneous auction.
Services and Products	<ul style="list-style-type: none">• Frequency Response Services: Dynamic Containment (DC), Dynamic Moderation (DM), and Dynamic Regulation (DR)• Reserve Services: Quick Reserve, Slow Reserve• Low-frequency (LF) and High-frequency (HF) products are procured for each service separately
Delivery Period	<ul style="list-style-type: none">• Frequency Response: by EFA block• Quick Reserve: 2 hours• Slow Reserve: 1 x 8 hour block (23:00 to 7:00); 8 x 2 hour blocks
Auction Clearing	<ul style="list-style-type: none">• Selection of accepted bids/offers is by welfare maximisation• Participant offers may be “paradoxically rejected”• “Overholding” is explicitly allowed (cleared quantity may exceed ESO bid quantity)

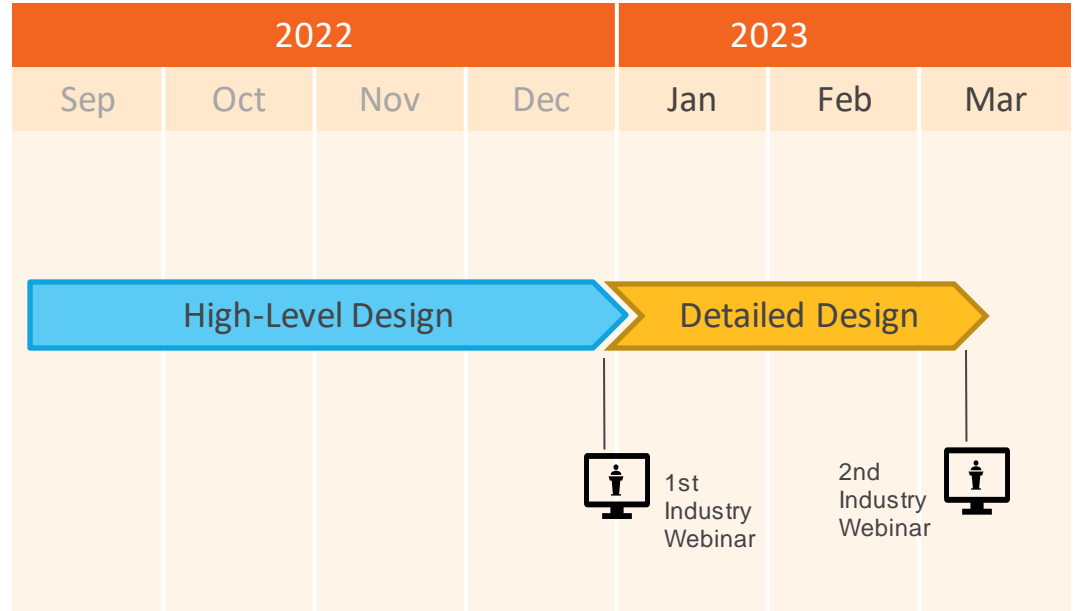
Market Design Overview (2/2)

Market Design (Day 1)

Splitting	<ul style="list-style-type: none">• Splitting will be supported from Day-1 in EAC. The scope to be shared in the later stage.
Co-optimisation	<ul style="list-style-type: none">• Participants can offer a choice of products to the auction. The auction clearing algorithm will accept the offer which clears the market most efficiently.• Co-optimisation across response and reserve (in line with business plan commitment to market).
Settlement of Availability	<ul style="list-style-type: none">• All procured capacity will be settled “pay-as-clear”
Settlement of Utilisation	<ul style="list-style-type: none">• Frequency Response: no payment for energy utilisation• Reserve: providers will bid energy price into Balancing Market systems or ASDP

Market Design Next Steps

- Market participants can schedule 1-2-1s with the team to provide further feedback on the High-level Design
- Detailed Design work will commence shortly and carry on into 2023
- Further industry webinar and workshops will be held to share aspects of Detail Design



Q&A

Please submit your questions via
MS Forms:



Close

- Webinar slides, recording and Q&A will be published on the [Future of Balancing Services](#) webpage
- If you have any questions or would like to arrange a 1-2-1, please contact us: box.futureofbalancingservices@nationalgrideso.com
- Please give us feedback on today's webinar by completing a quick survey – scan the QR code or click the link in the chat

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