Frequency Response Requirements Update

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nationalgridESO

Contents

Introduction

We procure Frequency Response services to manage system frequency within Security and Quality of Supply Standard (SQSS) limits around 50Hz. The services support us in managing frequency both on a second-by-second operational basis (regulation) and in post-fault situations where there is a sudden loss of generation or demand from the system which creates a mismatch between demand and supply. To contain a fall in frequency we require an injection of active power or reduction in demand to correct the deviation. Conversely, to contain high frequency scenarios we require a reduction in active power or increase in demand to return frequency to the normal range.

System inertia is reducing and this, combined with increased variation in supply and demand, means that system frequency is more volatile and more unpredictable. This requires a step change in how we manage frequency through both our response and reserve services.

To manage a system with lower levels of inertia we need faster acting dynamic frequency response products to secure our system in the event of any credible system loss. In 2025 we expect to see credible losses that are larger than today, for example new nuclear, interconnectors and offshore wind. In addition, the number of possible losses will increase. We will be procuring a combination of our new response services Dynamic Containment (DC), Dynamic Moderation (DM) and Dynamic Regulation (DR) to manage these system needs.

Our end state is to meet our dynamic pre and post-fault frequency response needs with the new suite of dynamic products (Containment, Moderation and Regulation), we are currently in a period of transition where both old and new frequency response products are being procured at the same time, and we know that a successful transition to our new services relies on clear and timely signals to the market to facilitate growth and competition.

This document provides more details of how we intend to transition to our new services, as well as indicative requirements based on our current assumptions regarding system needs and delivery timeframes. For longer-term requirements, please take a look at our Operability Strategy Report.

Today vs Target State

Design of new frequency response services is informed by our needs 'pre-fault' and 'post-fault'.

Pre-fault services manage frequency during times of normal operation when frequency is in the 'operational range' (49.8Hz – 50.2Hz):

- The purpose of these services is to manage frequency whilst it is close to the target (e.g. 50Hz).
- These services will be active (delivering) when frequency is within the operational range.
- A continuously delivering but 'slow' service is suitable for managing general imbalance.
- A 'fast' but not continuous service is required to manage larger imbalances and demand/generation swings resulting from variable output of intermittent generation, rapidly ramping interconnection and rapid demand pick-ups.
- These services should fully deliver when frequency reaches the boundary of the operational range (past this point the post-fault service will be active).

Post-fault services are required when frequency moves outside of the operational range, this can occur, as the name implies, because of a sudden fault such as the rapid loss of a large generator:

- The objective of this service is to contain frequency within statutory limits for a range of loss sizes.
- Delivery will only be required when frequency is outside of the operational range.
- The product will need to respond proportionally to deviation in frequency, to avoid the risk of overcorrections.
- Rapid delivery will be necessary to ensure that frequency can return to the operational range within the rules set out in our licence condition (the service must be fast).
- The expected delivery of this service will be infrequent as for the majority of the time the frequency will be within the operational range.

Pre-fault frequency response

Today – we rely on a range of products to meet our needs, including monthly tendered FFR (dynamic and static), legacy Enhanced Frequency Response (EFR) contracts and mandatory frequency response (MFR).

Target – we aim to meet our needs using Dynamic Regulation and Dynamic Moderation while retaining the option to instruct additional MFR when required until DC, DM & DR can be procured intra-day.

Post-fault frequency response

Today – we rely on Dynamic Containment to meet our needs, with some additional services including static response on interconnectors, secondary-only static procured through monthly FFR and some mandatory services.

Target – DC will be our primary market for meeting post-fault needs supported by products developed under the Quick Reserve programme.

Quantity of pre-fault frequency response

The amount of pre-fault frequency response (in MW) that we need varies over time.

Today – our pre-fault needs are for a minimum of 550MW of Primary, Secondary, High (PSH) dynamic response which delivers within a deviation of ± 0.5hz. This quantity is based on the current mix of products and our operational policy. It is met via a mixture of monthly FFR and real-time MFR.

Target – the new suite of pre-fault products is more efficient, the speed and rate of delivery of DR/DM combined compared to PSH/MFR means they are more efficient at providing pre-fault control, and therefore we expect that our minimum requirement will be 300MW, split between Dynamic Regulation and Dynamic Moderation compared to 550MW of PSH/MFR today.

The delivery parameters of our new suite of dynamic services are illustrated in Figure 1.

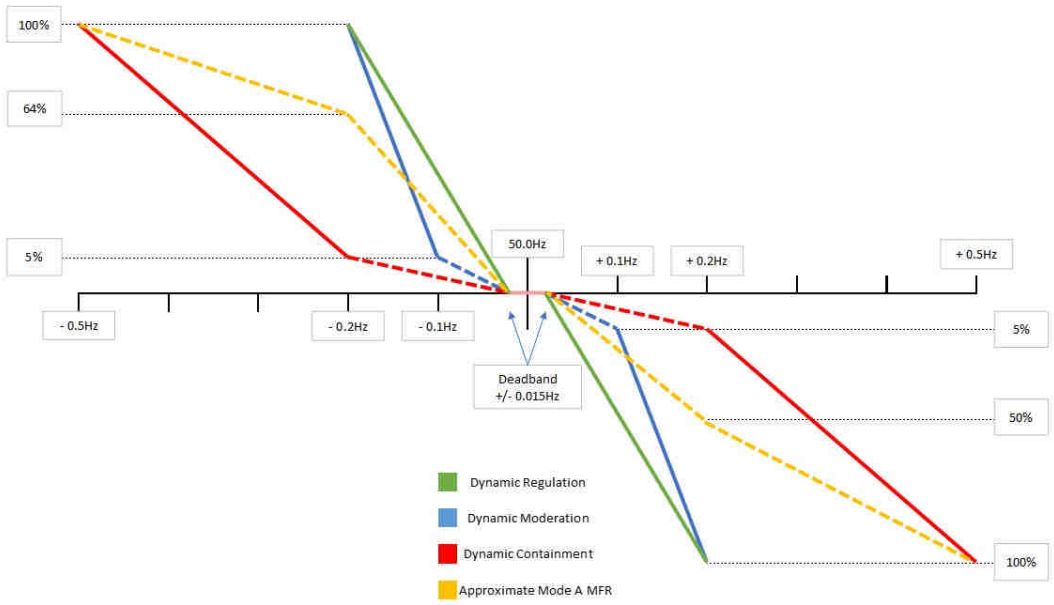


Figure 1: Comparison of New Dynamic Services and Mode A MFR

Phasing-out monthly FFR tenders

Our goal is to replace the monthly tender process with more flexible and transparent daily auctions for frequency response, we have already implemented day ahead procurement with DC and in early 2022 we also plan to procure DM and DR via day-ahead auctions.

The phasing-out of monthly Dynamic FFR will lag slightly behind the phasing-in of daily auctions for DM and DR. The lag is required to allow us to complete assurance on the new services, for reasons of system security, performance, procurement/process robustness, and to allow for delivery of disarming and frequency measurement specification.

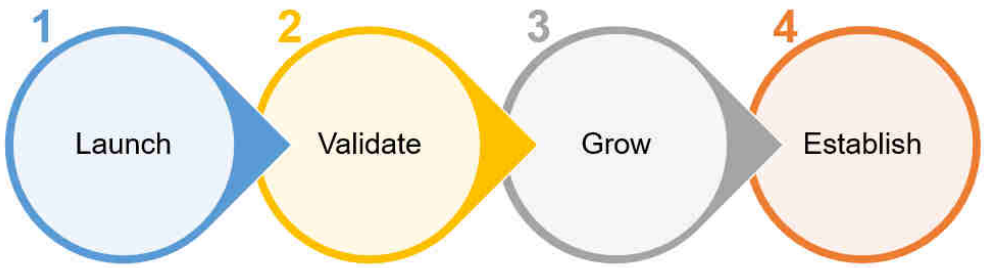
We are changing several factors at the same time: product, procurement, and process. It is therefore prudent to build in some contingency to deal with unforeseen impacts.

Mandatory frequency response (MFR) will remain in our toolkit during this transition and until such a time when DC, DM & DR can be procured intra-day. We will keep you updated with our plans and progress on this separate milestone.

Finally, the delivery of quick reserve is critical to the closure of the monthly FFR static service, and we will continue to engage on this development via reserve reform. We believe sharing dependencies gives more transparency on what needs to happen for the monthly tenders to cease. We welcome feedback on this.

Transition to DR & DM

Please refer to Dynamic Moderation page and Dynamic Regulation page for details related to the new suite of products.



1. Launch

DR and DM will each be introduced with a volume cap of 100MW to allow for a safe, controlled launch whilst the ESO monitor the impacts of introducing faster-acting, more efficient services onto the system. We will continue to buy primary secondary and high firm frequency response (FFR) during 2022 to ensure the system needs are being met, whilst we review the performance of the new services, taking feedback from ESO operational teams and industry stakeholders and making changes where necessary. We will reduce the volume of dynamic FFR procured on a staged basis. This staged process will begin when the volume caps are removed from the DM and DR services. We aim to launch the services on the EPEX platform in March 2022 for DR and DM in April 2022 respectively. The first auctions are planned to take place 14 days after launching onto the platform. The first DR auction is planned for 8 April and the first DM auction is planned for 6 May.

2. Validate

During an initial review period (we estimate around 6 months based on our learning from reviewing performance monitoring following the launch of DC), we will look to validate the performance of the products on the live system. During this time, procured quantities of DR and DM will remain capped at 100MW and there will not be a corresponding reduction of the quantity of monthly FFR that we buy.

There are several dependencies that need to be met before we completely cease the procurement of the monthly Dynamic FFR tender. Which includes:

- Assurance on the performance of the services – we previously communicated the concerns around the risk of oscillations with the DR service and we will be closely reviewing the performance of the new service from go-live.
- Full delivery of disarming and frequency measurement specification - which are two key deliverables under response reform that the ESO will be prioritising in 2022.
- A performance monitoring rules review, to support maximum participation whilst ensuring that the services meet operational requirements.

Developments to the service design of DM/DR will require a formal consultation under the Energy Balancing Regulations (three months duration). We expect to launch the next consultation later this year.

3. Grow

Once the full functionality for the above has been delivered, we expect to increase the volume caps on DM and DR, which will enable a stepped decrease in the Dynamic FFR volume procured in the monthly FFR tenders

4. Establish

The final stage in product transition sees monthly Dynamic FFR largely or completely phased-out and all pre-fault needs being met via daily auctions of DR and DM.

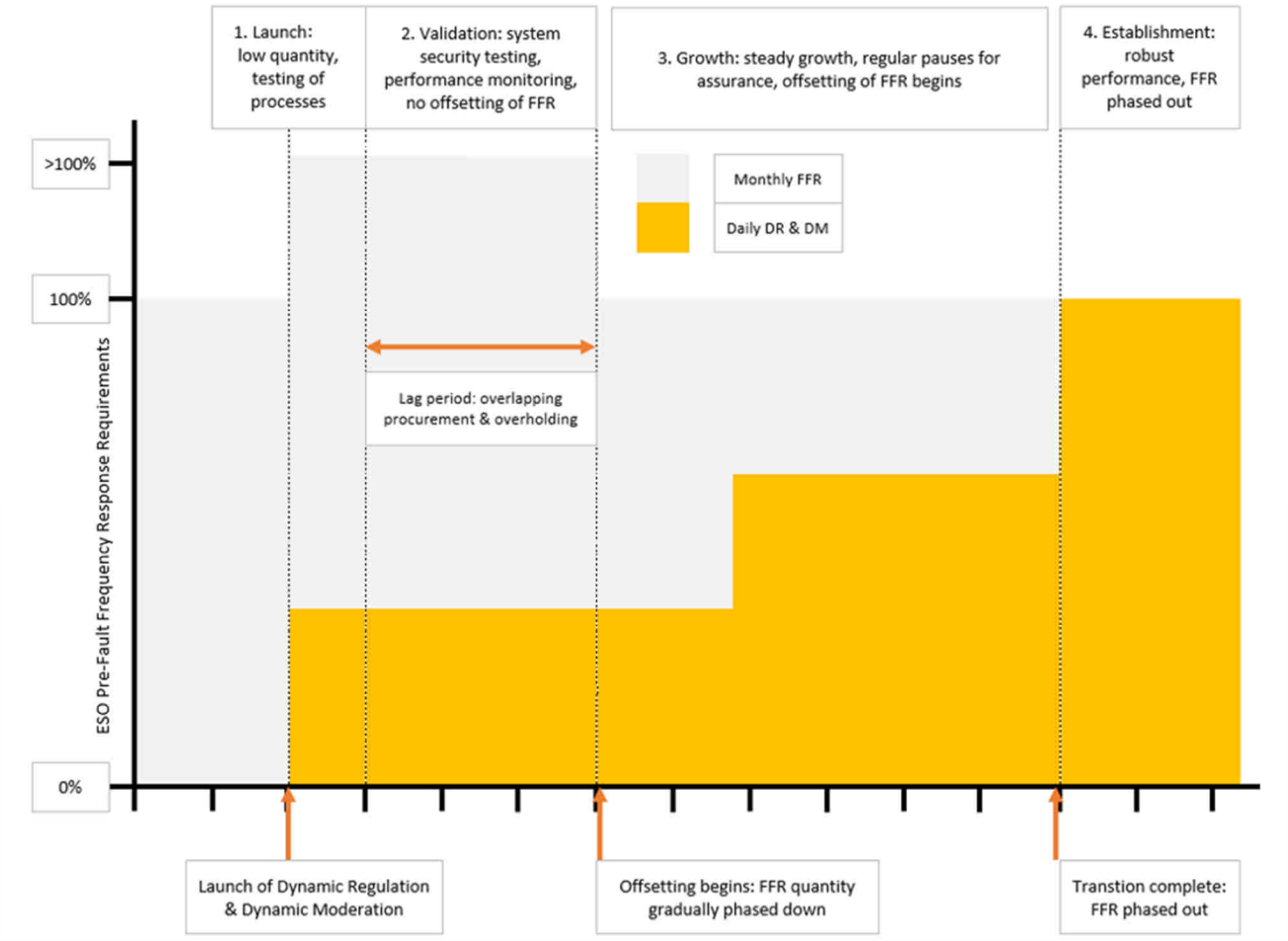


Figure 2: Illustrative Transition Plan For Phasing Out Monthly Dynamic FFR

The image above is illustrative and shows the key steps and approximate timeline of the transition plan. This will be a learning process for both buyer and seller, and changes to the timeline should be expected as we wind-down a well-established market (monthly FFR) and replace it with new services and a relatively new procurement method.

We will continue to use the Market Information Report and other forums such as the Operational Transparency Forum to update stakeholders on our latest plans and progress.

DM & DR Requirements

Indicative Requirements

During an initial period of around 6 months, we will look to validate the performance of the products on the live system. This means that procured quantities will be capped at 100MW and that there will not be a corresponding reduction of the quantity of monthly FFR that we buy.

Once the dependencies described in the validate phase of the transition plan above are delivered, we expect to increase the volume cap on DM and DR. This will enable a stepped decrease in the dynamic Primary, Secondary, High (PSH) FFR volume procured in the monthly tenders.

Our initial modelling suggests that the volume required to replace buying FFR and MFR for pre-fault control is 150MW of DR and DM under current conditions. The exact amount required will change with each EFA as inertia, demand and demand/generation volatility change. However, the range is still expected to be within 150-300MW in the medium term.

Stage	Details	When	DR (MW)	DM (MW)	PSH (MW)
1	Launch	First auctions planned for April and May respectively	100	100	300-550
2	Meeting the dependencies required to lift the volume cap	~ 6 months after launch*	150	150	150-300
3	On passing further assurance tests whilst offsetting PSH	~1-3 months after entering stage 2	>150	>150	0-150

Figure 3: Indicative DR and DM Requirements
**linked to the outcome of performance monitoring review*

During Stage 1, we will test the new services both concurrently and in isolation to provide adequate assurance regarding the performance of the new services and interaction with the legacy services. Once we are satisfied that the performance meets with our quality standards, and that we have met the other criteria described above, we will transition to Stage 2 where we will increase the cap of the volumes we procure and further reduce the volumes of PSH procured through the monthly FFR tender. We will then undertake further tests at higher volumes of the service to allow progression into Stage 3 where we will lift the cap to sufficient volumes to enable phasing out dynamic FFR procurement entirely.

We believe this stepped approach will mitigate the risk of over reliance on a new product through the reduction of PSH requirements too quickly, which could result in frequency management issues, whilst allowing time for both buyer and seller to adapt to the new services.

How will we determine the buy order for DM and DR?

The “buy order” describes the upper limits of capacity (MW of DM and DR response services) and price (£/MW/h of response) that NGESO is willing to procure for a given period via the auction. As described above the volumes required are stable within each of the deployment stages. The price limits for DM and DR will be set based on the alternative cost of procuring minimum dynamic PSH.

Market competition should ensure that the clearing price of the auction is reflective of the cost of provision of the service. This only holds during times when the market is fully competitive, when not competitive the price cap is there to signal the potential value of participation whilst preventing market exploitation. At launch the market is not expected to be fully competitive so the price cap will be designed to reflect the current value of the cost of the alternative actions, which is currently MFR.

We will use a model to calculate the forecast cost of procuring the minimum dynamic requirement, on a per EFA block basis. The model uses both short term historic data and forward price data to produce a continuous dynamic cost forecast. We will use this forecast along with the ratio of how much each service offsets MFR to create the relative price caps for each service.

Dynamic Containment Requirements

This section provides information on requirements for Dynamic Containment Low Frequency (DC-LF) and Dynamic Containment High Frequency (DC-HF). These requirements are indicative and subject to change.

DC-L Requirements for 2022

Figure 4 presents an indicative view of our expected requirements for the DC-L service. This is split into 200MW volume bands which can be seen in the top middle section of the graphic. For each month the % of time we expect the DC-L requirements to fall within the associated band (based on current assumptions) for each EFA block is represented by the shading of the associated cells as described at the bottom of figure 4.

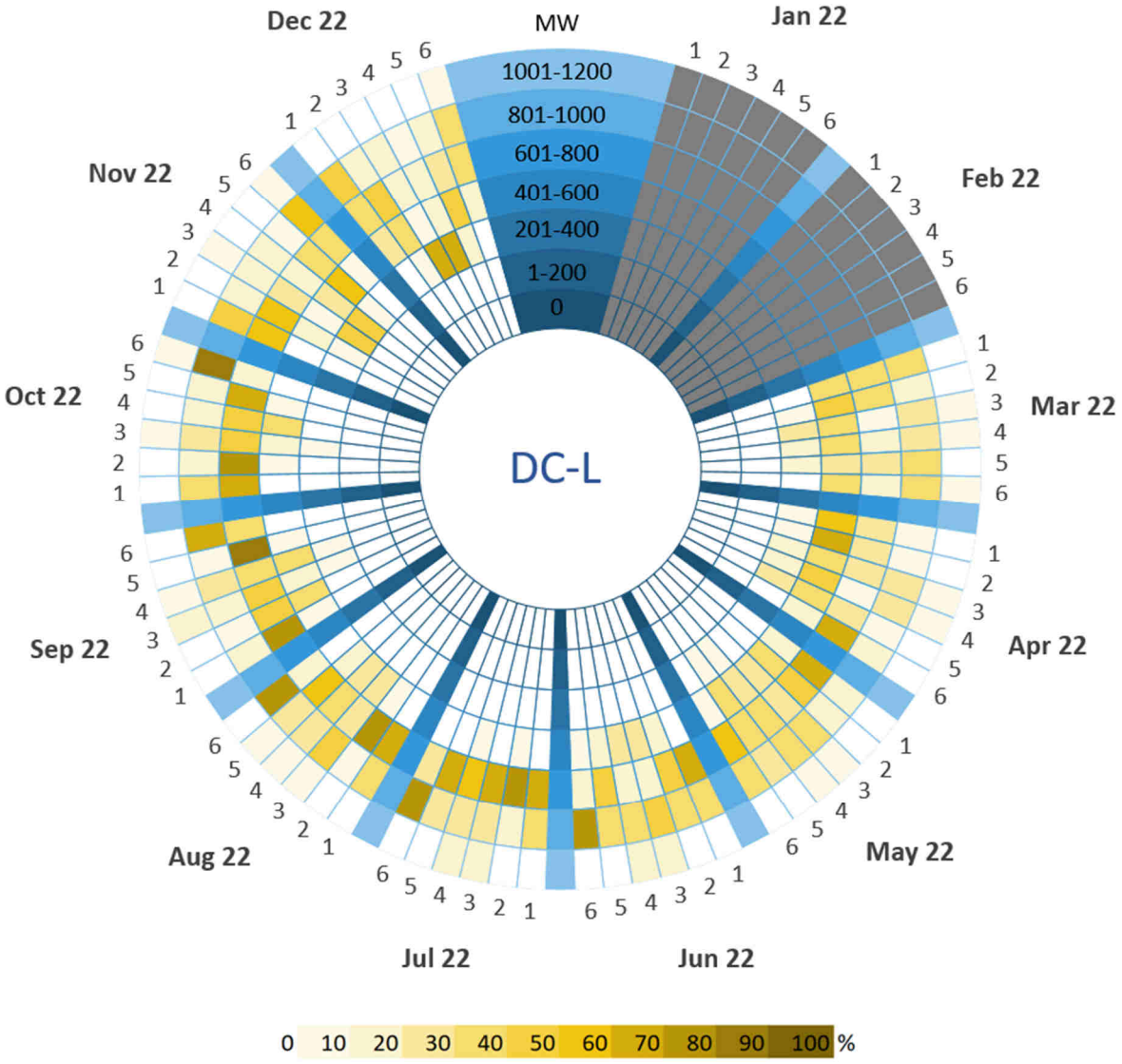


Figure 4: Indicative DC-L Requirements 2022

For example, in July 2022, the shading in the 801-1000MW band in EFA 6 suggests that our requirement will be at this level ~80% of the time, and ~20% of our requirements (indicated by the lighter shade) between 601-800 MW.

These indicative volumes are driven by our expectations for demand, inertia and infeed loss sizes (including progress in the ALoMCP), and also reductions in the contracted volumes of legacy services (Enhanced Frequency Response).

DC-H Requirements for 2022

Figure 5 presents an indicative view of our expected requirements for the DC-H service. This is split into 200MW volume bands which can be seen in the top middle section of the graphic. For each month the % of time we expect the DC-H requirements to fall within the associated band (based on current assumptions) for each EFA block is represented by the shading of the associated cells as described at the bottom of figure 5

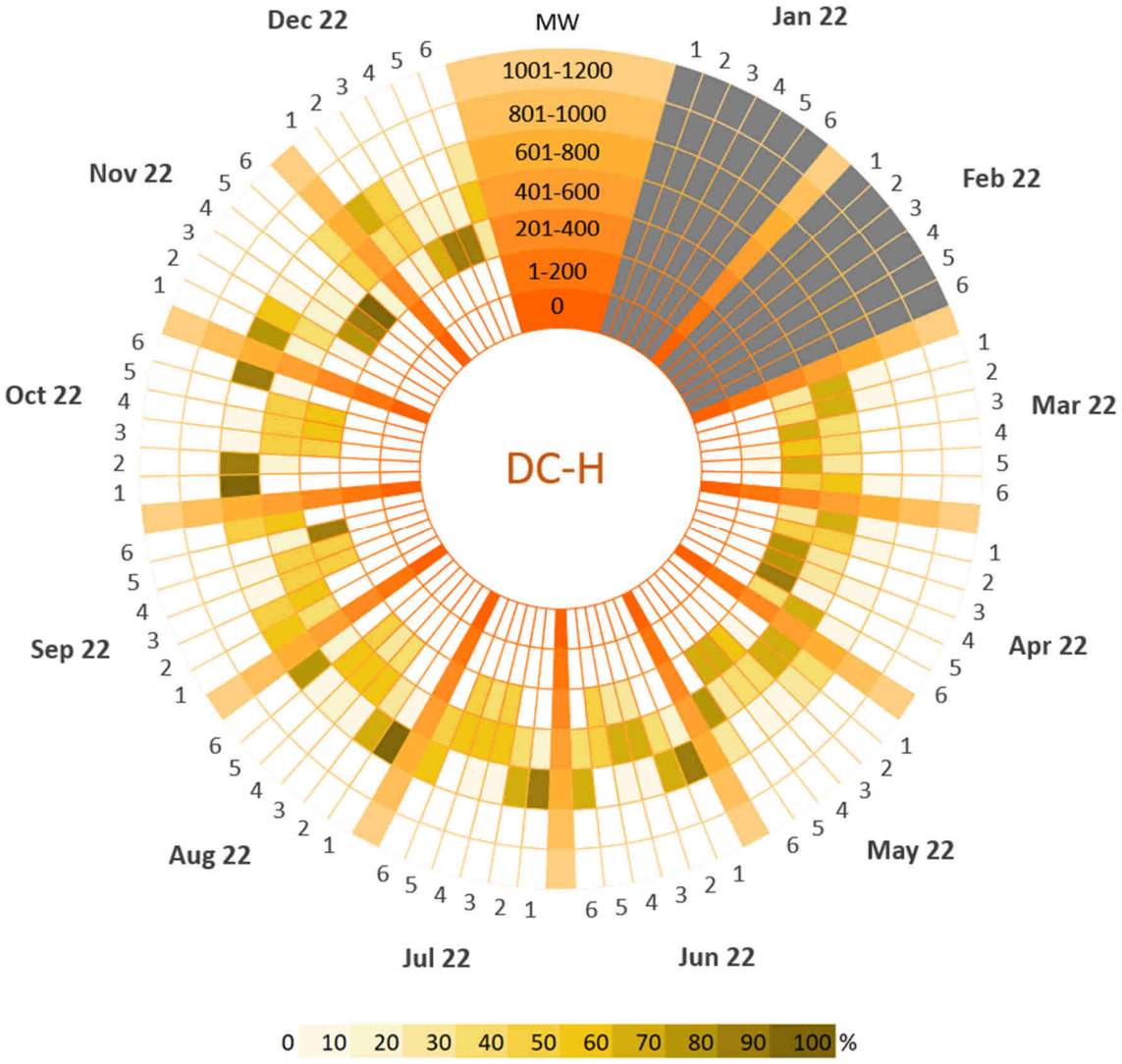


Figure 5: Indicative DC-H Requirements 2022

For example, in July 2022, the shading in the 601-800MW band in EFA 1 suggests that our requirement will be at this level ~90% of the time, with around 10% of our requirements (indicated by the lighter shade) between 401-600 MW.

The DC-HF requirements in Figure 5 are indicative requirements based on our expectations for demand, inertia and outfeed loss sizes in 2022. We aim to buy enough DC-HF to manage the largest outfeed losses on the system. The peak requirement generally occurs during lower demand/inertia EFA blocks