DS3 Prioritisation Ruleset

Annex II
to Enduring Connection Policy – Stage 1

Approved by CRU
March 2018
Ref: CRU/18/060
Executive Summary

Introduction

In its Decision Paper on the Connection Offer Transitional Arrangements, the Commission for the Regulation of Utilities (CRU) directed that certain providers of DS3 System Services will be eligible and prioritised for a connection offer under the non-GPA process until the enduring connection policy is in place. The CRU directed the System Operators (SOs) to develop a process for this prioritisation and submit their proposed process to the CRU for approval in a timely manner.

This paper:

- Outlines the subset of DS3 System Services to be prioritised as required by the Connection Policy Transitional Arrangements ruleset and justification for same;
- Describes the ruleset for prioritising connection offers in the event that there is an over-subscription.

This initial list of qualifying services and associated eligibility criteria would be reviewed and updated if required in accordance with the timelines for the enduring connection policy arrangements.

Methodology

The assessment to identify the sub-set of services to be selected for prioritisation involved a review of TSO studies completed to date, on-going work on the enduring DS3 System Services volumes analysis, the short term aims of the DS3 Programme over approximately the next 2 years, coupled with operational experience.

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¹ CER/16/284
Summary of the Arrangements

Fast Frequency Response (FFR) and Primary Operating Reserve (POR) comprise the initial subset of DS3 System Services to be prioritised.

In addition, the following Maximum Export Capacity (MEC) thresholds will apply:

- Maximum MEC per Offer: MEC will be limited to 100 MW on an individual plant basis;
- Total Cumulative MEC Threshold: Cumulative MEC offered to all DS3-prioritised applicants should not exceed 400 MW.

To be eligible for classification as a DS3-prioritised service provider, the following criteria must be met irrespective of the number of applicants or Total Cumulative MEC Threshold:

- Provision of FFR or POR: The applicant’s plant must be capable of providing either FFR or POR, or both;
- Grid Code: The applicant’s plant must at least meet Grid Code standards (where such standards exist); and
- Proven Technology: Only proven\(^2\) technologies (from a DS3 System Services provision perspective) will be considered.

For the avoidance of doubt these are in addition to the submission of a fully completed generation application form with required documentation and application fee.

In the event that, following application of the eligibility pre-requisites set out above, the amount of MEC being sought by providers exceeds the Total Cumulative MEC Threshold of 400 MW (i.e. there is over-subscription) then further criteria will be required to select applicants for offer processing.

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\(^2\) We have separately established a DS3 System Services Qualification Trial Process which aims to provide potential providers with an opportunity to demonstrate the capabilities of technologies that have not previously delivered system services on our system or a system with similar characteristics to that of the all-island system which we operate. Outputs from the first Qualification Trials are anticipated in Q3 2017. The DS3 System Services Qualification Trial Process Decision Paper can be viewed at the following link:

The criteria set out below, listed in order of precedence of application, will be used to prioritise applicants for offer processing in the event of over-subscription:

Service providers that can provide both FFR and POR services will be prioritised first in accordance with the sub-criteria 1-6 below, followed by providers of FFR only in accordance with the sub-criteria 1-6 below, and then by providers of POR only in accordance with the sub-criteria 1-6 below;

1. Capacity factor of service availability;
   o Service providers that will be available to provide services for at least 4000 hours per year will be prioritised;

2. Service levels as a percentage of MEC;
   o Service providers that can provide volumes of the services at levels which are high relative to their MEC will be prioritised;

3. Provision of service at low MW outputs;
   o Service providers that can provide the services at low MW output levels will be prioritised;

4. Planning permission;
   o Applicants that have obtained relevant planning permission will be prioritised;

5. Date of expiration of planning permission;
   o Applicants whose planning permission expires earlier will be prioritised;

6. Date order of the receipt of connection application.

Further detailed information on how SOs will prioritise applicants for offer processing using these criteria is contained in the main body of the report.

**Applicability of the Arrangements**

These arrangements will apply for new MEC requests only. Existing connected and contracted parties that wish to add new technology that does not drive new MEC can continue to do so under the existing arrangements which are laid out in the Connection Offer Policy and Process Paper (COPP).
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1. Context and Background

In its Decision Paper on the Connection Offer Transitional Arrangements\(^3\), the CRU directed that certain providers of DS3 System Services will be eligible to be prioritised for a connection offer under the non-GPA process until the enduring connection policy is in place. The CRU directed the system operators (SOs) to develop a process for this prioritisation and submit their proposed process to the CRU for approval in a timely manner.

The CRU directed that the SOs take due consideration of the following principles in the design of the prioritisation ruleset:

- the process should aim to minimise, to the extent possible, speculative applications;
- priority connection status shall not apply to new MEC for wind and solar technologies, whether already connected, with contracted connection agreements, or new;
- balance the administrative burden on the system operators and the timely delivery of connection offers for the DS3 System Services qualification trials and the DS3 System Services central procurement; and
- existing connection policy rules continue to apply.

Mindful of these considerations identified for ruleset selection, for the purpose of the transitional connection arrangements the SOs propose that a subset of the overall suite of 14 DS3 System Services be selected as qualifying services.

The TSO considers that the sub-set of services should be selected based on an assessment of the likely scarcity of their provision over the next 2-3 years and the short-term impact on the TSO’s ability to enhance operational policies such as the allowable System Non-Synchronous Penetration (SNSP) level.

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\(^3\) CER Decision Paper on Connection Policy Transitional Arrangements: [http://www.cer.ie/docs/001060/CER16284%20Transitional%20Arrangements%20Decision.pdf](http://www.cer.ie/docs/001060/CER16284%20Transitional%20Arrangements%20Decision.pdf)
2. **Objective**

The objective of this paper is to:

- Outline the subset of DS3 System Services to be prioritised as required by the Connection Policy Transitional Arrangements ruleset and justification for same;
- Describe the ruleset for prioritising connection offers in the event that there is an over-subscription.

We propose that the initial list of qualifying services and associated eligibility criteria would be reviewed and updated if required in accordance with the timelines for the enduring connection arrangements.

3. **Methodology**

The following were key considerations used to inform the development of the DS3 Prioritisation ruleset:

- Target specific DS3 System Services requirements;
- Alignment of the DS3 System Services Procurement Process and Connection Offers for DS3 System Services Prioritisation;
- Alignment of Enduring Connection Policy and Connection Offers for DS3 System Services Prioritisation;
- Avoid pre-empting the outcome of potential future DS3 System Services competitive procurement processes;
- Adopt a technology neutral approach in so far as possible;
- Ensure the offer processing volume is manageable; and
- Prioritise non-speculative applications.

The assessment to identify the sub-set of services to be selected for this measure involved a review of TSO studies completed to date coupled with operational experience.
It was also informed by the on-going work on the enduring DS3 System Services volumes analysis, as well as taking into consideration the short term aims of the DS3 Programme over approximately the next two years and the effect on prioritisation of system services as a result.

The benefits of connecting the eligibility criteria to the expected short-term scarcity of system services are as follows:

- It ensures that the applicants being prioritised are those providing the system services most required by the system and not merely a mechanism to be prioritised over other applicants;
- A defined list of prioritised system services for the purpose of the transitional measures provides clear and transparent eligibility criteria for both applicants and system operators alike;
- The vast majority of connected entities can provide some amount of system services. A defined list of prioritised system services therefore sets the eligibility criteria in a targeted way;

4. **System Services to be Prioritised**

In this section, the rationale for selection of the subset of system services to be prioritised is set out in the context of:

- The on-going work on, and short-term aims of, the DS3 Programme;
- A review of TSO studies completed to date; and
- Our operational experience.
4.1 DS3 Programme

Our ‘Delivering a Secure Sustainable Electricity System (DS3)’ programme seeks to address the challenges of increasing the allowable SNSP up to 75% by 2020 whereby the curtailment of wind would be reduced to approximately 5% per annum.

DS3 is not only making the necessary operational changes to manage more renewable generation, it is also about the evolution of the wider electricity industry and implementing changes that benefit the end consumer.

From the outset, the integration of non-synchronous renewable generation presented a range of challenges previously unseen in the power sector. Through collaboration with the Regulatory Authorities and the wider electricity industry, DS3 has developed a number of innovative and progressive solutions.

The results of the programme are now beginning to deliver benefits to the consumer. On 1 March 2016, the allowable SNSP level was increased from 50% to 55% following the successful conclusion of a 55% SNSP operational trial.

On 9 March 2017, the allowable SNSP level was increased to 60% following a similarly successful operational trial.

In determining the priority subset of system services, it is important to consider the operational changes which are anticipated to occur as a result of the DS3 Programme over approximately the next two years.

On 14th November 2017, the allowable SNSP was increased further to 65% the trial is currently ongoing and is due to finish March 2018. From the ongoing monitoring of the system during the trial it will likely be successful.

As this happens, generation provided by non-synchronous renewables should further increase, with generation from conventional synchronous units decreasing. This change is expected to take place before the new Rate of Change of Frequency (RoCoF) standard of 1 Hz/s is implemented.

Management of RoCoF against a backdrop of lowering inertia is therefore an increasing priority over the next approximately two years and beyond, and as such frequency response and fast frequency response in particular will be of significant importance during this phase of the DS3 Programme.
4.2 Studies Review

While all 14 products under the DS3 System Services framework are necessary to ensure the continued safe and secure operation of the power system, recent studies have highlighted the need for increased fast-acting reserve in the short term to ensure safe and secure operation as the inertia level reduces.

The TSO regularly conducts studies examining different operational scenarios and the resulting impact on transient, voltage and frequency stability. In the Appendix, the results of a number of such studies are set out. These studies were not performed for the purposes of identifying the priority system services for connection offer processing, but provide results and analysis that is informative for such purposes.

It is clear from these studies that to operate the system at increasingly higher levels of SNSP, there is a need for more fast-acting reserve than is currently available to the TSO. This requirement will need to be met via the provision of Fast Frequency Response (FFR) under the DS3 System Services Procurement Framework.

4.3 Operational Experience

Based on our operational experience, Primary Operating Reserve (POR) remains a regular binding constraint on the system and is therefore a significant driver of Dispatch Balancing Costs. As such, an increase in potential providers at this time would provide benefits. It is also anticipated that those providers which are able to provide POR will also be able to provide Secondary Operating Reserve (SOR) and Tertiary Operating Reserve 1 (TOR1), providing an increase in potential providers across the suite of reserve system services.

The FFR service is defined as the additional increase in MW output from a generator or reduction in demand following a frequency event that is available within 2 seconds of the start of the event and is sustained for at least 8 seconds. The POR service is similar in nature but covers response in the 5 second to 15 second timeframe. Being prudent with respect to the nature and characteristic of FRR service provision, the magnitude of MW imbalance required to be managed between 10 and 15 seconds
remains the same irrespective of the level of FFR provided. Consequently, the FFR and POR services cannot be considered as substitutable for each other.

Given the additional benefits that could be provided by new POR providers, we therefore propose to include Primary Operating Reserve (POR) as a priority system service in addition to FFR.

### 4.4 Summary of System Services to be Prioritised

In summary, we propose that FFR and POR would comprise the initial subset of **DS3 System Services to be prioritised**. We propose that this initial list of qualifying services would be reviewed and updated if required in accordance with the system security requirements and/or as we gain further operational experience as the DS3 Programme is delivered.

### 5. DS3 Prioritisation Ruleset

This section sets out:

- The details of applying MEC thresholds as follows:
  - Maximum MEC per offer; and
  - Total Cumulative MEC Threshold.

- The minimum eligibility criteria that must be met to be eligible for classification as a DS3-prioritised service provider, irrespective of the number of applicants or overall cumulative requested MEC;

- The additional criteria to be applied to select applicants for offer processing in the event that, following application of the eligibility pre-requisites set out above, the amount of MEC being sought by providers exceeds the Total Cumulative MEC Threshold.

We propose that this initial prioritisation ruleset would be reviewed and updated if required in accordance with the system security requirements and/or as we gain further operational experience as the DS3 Programme is delivered.
5.1 Maximum MEC per Offer and Total MEC Threshold

The following MEC thresholds will apply:

- **Maximum MEC per Offer**: As TSO, we have a statutory obligation to ensure sufficient services are available at all times to run the system safely and securely. To fulfil this duty we have to ensure that the loss of any one service provider does not cause the system to become insecure. The real-time requirement for POR is currently calculated as 75% of the Largest Single In-feed. For example, if the East-West Interconnector is importing at 500 MW during a trading period, the requirement for POR during that trading period is 375 MW (75% of 500 MW). To date, we have not run the system with units providing more than 100 MW of POR. This typically ensures that no more than approximately 25% of the service requirement is provided by any one unit. Having to cover the loss of a unit providing more than this may become inefficient and uneconomical. It is possible that some new technologies will be able to provide volumes of POR and FFR provision equivalent to their MW MEC value. **For this reason, we propose to limit MEC to 100 MW on an individual plant basis.**

- **Total Cumulative MEC Threshold**: This is the first year of the DS3 Prioritisation process and therefore it is unclear what level of applications will be submitted. Past application processes have resulted in major oversubscriptions e.g. there are currently 30,000 MW of unprocessed applications. In order to ensure that the number of applications to be processed is manageable and offers can be issued in a timely manner the TSO considers it prudent to limit the cumulative MEC offered to all DS3-prioritised applicants to a maximum of 400 MW. The 400 MW threshold is the approximate size of Gate 1, which was the first of the new group processing systems. It is also the approximate size of the traditional largest single generation unit.

We propose that the thresholds set out above would be reviewed in accordance with the timelines for the next steps of the enduring connection arrangements.

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4 As the power system evolves the maximum values will be re-evaluated.
5.2 Eligibility Pre-Requisites

To be eligible for classification as a DS3-prioritised service provider, the following criteria must be met irrespective of the number of applicants or overall cumulative requested MEC:

- **Provision of FFR or POR:** The applicant’s plant must be capable of providing either FFR or POR, or both;

- **Grid Code:** The applicant’s plant must at least meet Grid Code standards (where such standards exist) in terms of capability to provide the service and in terms of the amount of the service to be provided. The applicant’s plant must also be compliant with other Grid Code standards and conditions; and

- **Proven Technology:** Only proven technologies (from a system services provision perspective) will be considered for DS3 Prioritisation. We have established a Qualification Trial Process which aims to provide potential providers with an opportunity to demonstrate the capabilities of technologies that have not previously delivered system services on our system or a system with similar characteristics to that of the all-island system which we operate. We consider that there would be merits to maintaining a separate connection process that would allow service providers using unproven technologies to connect small-scale demonstration plant to the system for the purposes of participating in future Qualification Trial Processes without having to wait for the next batch to be processed. The exact details of future Qualification Trial Processes will be developed through the DS3 System Services Programme.

In addition, in its Decision Paper on the Connection Offer Transitional Arrangements, the CRU directed that “in this transitional phase, wind and solar technologies, whether existing or new, should not be prioritised for connection to provide DS3 system services”. As such, wind and solar applications will not be eligible for classification as

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5 I.e. Any derogations from Grid Code standards relating to the provision of FFR or POR (where such standards exist) in terms of capability to provide the services and in terms of the amount of the services to be provided will not be accepted.

a DS3-prioritised service provider to increase MEC based on increased wind or solar powered output.

5.3 Rulesets to Apply in Event of Over-Subscription

In the event that, following application of the eligibility pre-requisites set out above, the amount of MEC being sought by providers exceeds the Total Cumulative MEC Threshold of 400 MW then further criteria will be required to select applicants for offer processing.

We recognise that there are a number of potential ways that the system services market may evolve over the next few years. As part of the enduring volumes and tariffs analysis currently being conducted, we are assessing a number of different portfolios of service providers in an effort to capture the volume requirements for all potential eventualities. These include:

- **Enhanced Service Provision Portfolio**: In this portfolio, there is increased flexibility and service provision from existing plant, e.g. lower minimum loads. There is relatively little new technology.

- **New Providers Portfolio**: In this portfolio, there are high levels of system service capability from new non-conventional sources.

The portfolio scenarios being examined were developed solely for the purpose of determining volumes for each of the services and do not represent desired, expected or optimal portfolios. Similarly, the portfolio scenarios will have no bearing on the ultimate outcome of the DS3 System Services procurement processes (irrespective of whether regulated tariff arrangements or competitive procurement arrangements are in place) other than informing the volumes to be procured.

The selected DS3 Prioritisation eligibility criteria are such that service providers using new technologies are more likely to be prioritised for a connection offer. This will ensure that the New Providers portfolio described above will remain a possibility. However, it is important to state that this does not preclude these services being provided by existing plant or by conventional technologies.

In the event of over-subscription, we propose to use the criteria set out below to select applicants for offer processing. The process shall be followed until the total cumulative
MEC reaches 400 MW or the closest application below that number. In the event that the Total Cumulative MW Threshold is reached then the threshold shall be deemed to be at the last full application that meets the requirements and falls beneath the threshold. For example, if the number of qualifying applications totals 380 MW and the next application is 30 MW then that application would not be processed as it would exceed the threshold. Another application will not be included that does fall within the threshold. In this case therefore the threshold would be 380 MW.

**Prioritisation Criteria**

Note: the following criteria are listed in order of precedence of application.

**Level 1 Prioritisation**

1. **Service providers that can provide both services will be prioritised over service providers that can provide either FFR or POR**. In the event this is oversubscribed then the following shall apply for projects that can provide both services:
   
a. **Capacity Factor of Service Availability**: Service providers that can demonstrate to the TSO’s satisfaction, as set out in the application form, that they will be available to provide each individual service for at least 4000 hours per year. If the cumulative MEC of applications still exceeds the MEC Threshold of 400MW then:
   
b. **Services Levels as a Percentage of MEC**: Service providers that can provide volumes of both the FFR and POR services at levels which are high relative to their MEC will be prioritised in the following order:
      
      i. Providers with FFR and POR capability volumes (in MW) equal to their MEC i.e. 100%

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7 Obtaining the two services jointly from providers is likely to lead to more efficient and economical system operation relative to a scenario where only one or other of the services can be obtained from each provider.

8 In this case, Availability relates to the “technical realisability” of the services rather than the availability of the plant to generate.
ii. Providers with FFR and POR capability volumes (in MW) greater than or equal to 50% of their MEC;

iii. Providers with FFR and POR capability volumes (in MW) less than 50% of their MEC.

If the cumulative MEC still exceeds the MEC Threshold then:

c. Provision at Low MW Outputs: Service providers that can provide the services at low MW output levels will be prioritised in the following order over others as this will allow for greater “headroom” on the system for renewable generation:

   i. Providers that can provide services at 0 MW output levels;

   ii. Providers that can provide services while operating below 20% of their MEC;

   iii. Other providers.

If the cumulative MEC still exceeds the MEC Threshold then:

d. Planning Permission: Applicants that have obtained relevant planning permission. If the cumulative MEC still exceeds the MEC Threshold then:

   e. Date of Expiration of Planning Permission: Applicants whose planning permission expires earlier will be prioritised. If the cumulative MEC still exceeds the MEC Threshold then:

   f. Date order of the receipt of connection application.

In the event that the Total Cumulative MW Threshold is reached within Level 1 prioritisation or the next application would exceed the Total Cumulative MW Threshold then no further applications will be considered. However if that is not the case then more applications will be considered under Level 2 prioritisation below.
Level 2 Prioritisation

2. Where not all capacity available within the MEC Threshold has been fulfilled under Level 1 Prioritisation then service providers that can provide FFR only shall be considered. In the event this is oversubscribed then the following shall apply for projects that can provide FFR only:

   a. Capacity Factor of Service Availability\(^9\): Service providers that can demonstrate to the TSO’s satisfaction, as set out in the application form, that they will be available to provide FFR for at least 4000 hours per year. If the cumulative MEC still exceeds the MEC Threshold then:

   b. Services Levels as a Percentage of MEC: Service providers that can provide volumes of FFR services at levels which are high relative to their MEC will be prioritised in the following order:

      i. Providers with FFR capability volumes (in MW) equal to their MEC i.e. 100%
      ii. Providers with FFR capability volumes (in MW) greater than or equal to 50% of their MEC;
      iii. Providers with FFR capability volumes (in MW) less than 50% of their MEC.

   If the cumulative MEC still exceeds the MEC Threshold then:

   c. Provision at Low MW Outputs: Service providers that can provide FFR at low MW output levels will be prioritised in the following order over others as this will allow for greater “headroom” on the system for renewable generation:

      i. Providers that can provide FFR at 0 MW output levels;
      ii. Providers that can provide FFR while operating below 20% of their MEC;
      iii. Other providers.

\(^9\) In this case, Availability relates to the “technical realisability” of the services rather than the availability of the plant to generate.
If the cumulative MEC still exceeds the MEC Threshold then:

d. Planning Permission – Applicants that have obtained relevant planning permission. If the cumulative MEC still exceeds the MEC Threshold then:

e. Date of Expiration of Planning Permission: Applicants whose planning permission expires earlier will be prioritised. If the cumulative MEC still exceeds the MEC Threshold then:

f. Date order of the receipt of connection application

In the event that the Total Cumulative MW Threshold is reached within Level 1 and Level 2 prioritisation or the next application would exceed the Total Cumulative MW Threshold then no further applications will be considered. However if that is not the case then more applications will be considered under Level 3 prioritisation below.

Level 3 Prioritisation

3. Where not all capacity available within the MEC Threshold has been fulfilled under Level 1 and Level 2 Prioritisation above, then service providers that can provide POR only shall be considered. In the event this is oversubscribed then the following shall apply for projects that can provide POR only:

a. Capacity Factor of Service Availability\(^{10}\): Service providers that can demonstrate to the TSO’s satisfaction, as set out in the application form, that they will be available to provide POR for at least 4000 hours per year. If the cumulative MEC still exceeds the MEC Threshold then:

b. Services Levels as a Percentage of MEC: Service providers that can provide volumes of POR services at levels which are high relative to their MEC will be prioritised in the following order:

\(^{10}\) In this case, Availability relates to the "technical realisability" of the services rather than the availability of the plant to generate.
i. Providers with POR capability volumes (in MW) equal to their MEC i.e. 100%

ii. Providers with POR capability volumes (in MW) greater than or equal to 50% of their MEC;

iii. Providers with POR capability volumes (in MW) less than 50% of their MEC.

If the cumulative MEC still exceeds the MEC Threshold then:

c. Provision at Low MW Outputs: Service providers that can provide POR at low MW output levels will be prioritised in the following order over others as this will allow for greater “headroom” on the system for renewable generation:

i. Providers that can provide POR at 0 MW output levels;

ii. Providers that can provide POR while operating below 20% of their MEC;

iii. Other providers.

If the cumulative MEC still exceeds the MEC Threshold then:

d. Planning Permission – Applicants that have obtained relevant planning permission. If the cumulative MEC still exceeds the MEC Threshold then:

e. Date of Expiration of Planning Permission: Applicants whose planning permission expires earlier will be prioritised. If the cumulative MEC still exceeds the MEC Threshold then:

f. Date order of the receipt of connection application.

5.4 Applicability of the Arrangements

These arrangements will apply for new MEC requests only. Existing contracted and connected parties that wish to add new technology that does not drive new MEC can continue to do so under the existing arrangements which are laid out in the Connection Offer Policy and Process Paper (COPP).
Appendix I – Summary of Studies

Under the DS3 Programme there is a target to increase allowable levels of operational SNSP. With SNSP increasing and non-synchronous generation replacing conventional synchronous generation, the inertia on the power system will be reduced. At lower levels of inertia the frequency is more susceptible to changes in supply and demand.

While all 14 products under the DS3 System Services framework are necessary to ensure the continued safe and secure operation of the power system, recent studies have highlighted the need for increased fast-acting reserve in the short term to ensure safe and secure operation as the inertia level reduces.

The following studies were not performed for the purposes of identifying the priority system services for connection offers, but provide results and analysis that is informative for such purposes.

A.1 2016 SNSP Study

In late 2016, a study was completed to assess the impact of increasing SNSP on transient, voltage and frequency stability. One conclusion from the study was that in certain situations there was a need for further fast-acting reserve than is currently available to the TSO. Under DS3, this need will be met via the provision of FFR.

Although FFR is defined as a new product, the all-island power system has been provided with a form of fast-acting reserve up until this point. Pumped storage (pumping mode), interconnectors and the Short Term Active Response (STAR) scheme all provide frequency response in timescales analogous to those of the FFR service.

Examining system frequency at 60% SNSP (and with the RoCoF standard remaining at 0.5Hz/s), the model showed three occasions during which the frequency nadir dropped below 48.85Hz. The frequency traces for these occasions are shown below.
In all three cases, following load shedding the frequency rises towards the nominal frequency of 50 Hz. In two cases, excessive load shedding results in the frequency rising above 50 Hz and triggering over frequency relays and causing the loss of generation. While the system remains stable in the study, this frequency ‘bounce’ is not desirable in reality.

The lack of fast-acting reserve was believed to have led to the frequency nadir breaching 48.85 Hz in the model. The conclusion from the study therefore was that in certain scenarios where existing sources of fast-acting reserve were unavailable there was a need for additional fast-acting reserve in order to maintain the secure operation of the system.

This result shows a clear current need for FRR in such circumstances, and as such indicates the need for prioritisation of this service.

### A.2 Reserve Study

A study was completed in 2016 to determine the fast-acting, primary, and secondary reserve requirements which will be required in 2020 when operating at 75% SNSP levels. The analysis focused on the reserves which would be required in order to minimise chances of excess frequency deviations from the loss of a large in-feed.

The study showed significant requirements for FFR with the exact real-time requirement depending on the type of FFR response provided. We therefore consider
it a priority that service providers with FFR capability have the opportunity to connect to meet this increasing FFR requirement.

A.3 RoCoF Alternatives Phase 2 Report
The 2014 CRU decision to approve in principle the RoCoF increase to 1 Hz/s over 500 ms was based on the completion of three strands of work: the generator studies, the TSO-DSO project and the RoCoF alternatives project. The RoCoF alternatives project was seen as “plan B” i.e. were there any possible solutions to solve the RoCoF issue should there be issues with the generator studies and the TSO-DSO project. The aim of the alternative solutions project was to determine the volumes of synchronous and/or synthetic inertia (synthetic inertia is analogous to FFR provision by non-synchronous providers as it is effectively frequency response provided in short timescales) to maintain RoCoF at 0.5 Hz/s. One of the findings of the study was that devices which provide non-synchronous fast frequency response would be beneficial to the TSO provided the devices could inject their full response within 200 ms.
Appendix II – Worked examples

Example 1

In this simple example, six Applicants are assessed for DS3 Prioritisation. The relevant characteristics of each Applicant are shown in Table 1.

<table>
<thead>
<tr>
<th>Applicant</th>
<th>MEC (MW)</th>
<th>FFR (MW)</th>
<th>POR (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicant 1</td>
<td>100</td>
<td>50</td>
<td>50</td>
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<td>Applicant 2</td>
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<td>20</td>
</tr>
<tr>
<td>Applicant 6</td>
<td>100</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 1: Applicants and associated FFR and POR capabilities

The DS3 Prioritisation ruleset states that service providers that can provide both FFR and POR services will be prioritised over service providers that can provide either FFR or POR.

As can be seen in Table 1, only Applicants 1, 4, 5 and 6 can provide FFR and POR. Therefore these Applicants have a higher priority over Applicant 2 and 3.

As the cumulative MEC of Applicants 1, 4, 5 and 6 is 400MW, which is equal to the Total Cumulative MEC Threshold, no further prioritisation criteria need to be applied. The Applicants selected to receive a connection offer under the DS3 Prioritisation ruleset are highlighted in Table 2.

<table>
<thead>
<tr>
<th>Applicant</th>
<th>MEC (MW)</th>
<th>FFR (MW)</th>
<th>POR (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicant 1</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Applicant 2</td>
<td>100</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Applicant 3</td>
<td>100</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>Applicant 4</td>
<td>100</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Applicant 5</td>
<td>100</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Applicant 6</td>
<td>100</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 2: Applicants highlighted in green are selected to receive a connection offer
Example 2

In this more complex example, ten Applicants are assessed for DS3 Prioritisation. The relevant characteristics of the Applicants units are shown in Table 3.

<table>
<thead>
<tr>
<th>Applicant</th>
<th>MEC (MW)</th>
<th>FFR (MW)</th>
<th>POR (MW)</th>
<th>No. of hours per year that Services are available (Hrs)</th>
<th>FFR level as % of MEC (%)</th>
<th>POR level as % of MEC (%)</th>
<th>Output level at which FFR/POR can be provided (MW)</th>
<th>Planning Permission (Yes/No)</th>
<th>Date of Final Grant of Planning Permission</th>
<th>Date order of the receipt of connection application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicant 1</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>5000</td>
<td>50%</td>
<td>50%</td>
<td>20</td>
<td>Yes</td>
<td>13-Feb-14</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 2</td>
<td>100</td>
<td>20</td>
<td>0</td>
<td>6000</td>
<td>20%</td>
<td>0%</td>
<td>5</td>
<td>Yes</td>
<td>16-Mar-16</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 3</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>5000</td>
<td>100%</td>
<td>100%</td>
<td>10</td>
<td>No</td>
<td>N/A</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 4</td>
<td>100</td>
<td>10</td>
<td>0</td>
<td>5000</td>
<td>10%</td>
<td>0%</td>
<td>20</td>
<td>No</td>
<td>03-Apr-17</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 5</td>
<td>100</td>
<td>60</td>
<td>30</td>
<td>6000</td>
<td>30%</td>
<td>30%</td>
<td>30</td>
<td>Yes</td>
<td>N/A</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 6</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>1000</td>
<td>100%</td>
<td>100%</td>
<td>100</td>
<td>No</td>
<td>N/A</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 7</td>
<td>100</td>
<td>30</td>
<td>60</td>
<td>8500</td>
<td>20%</td>
<td>60%</td>
<td>60</td>
<td>Yes</td>
<td>26-Dec-15</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 8</td>
<td>100</td>
<td>0</td>
<td>60</td>
<td>2000</td>
<td>0%</td>
<td>0%</td>
<td>10</td>
<td>No</td>
<td>N/A</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 9</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>8500</td>
<td>100%</td>
<td>100%</td>
<td>0</td>
<td>Yes</td>
<td>N/A</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Applicant 10</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>2000</td>
<td>100%</td>
<td>100%</td>
<td>0</td>
<td>No</td>
<td>N/A</td>
<td>01-Jan-18</td>
</tr>
</tbody>
</table>

Table 3: Applicants and associated FFR and POR capabilities

Step 1

The DS3 Prioritisation ruleset states that service providers that can provide both FFR and POR services will be prioritised over service providers that can provide either FFR or POR.

As can be seen in Table 4, only Applicants 2 and 8 are unable to provide both FFR and POR. As the cumulative MEC of the other eight Applicants exceeds the Total Cumulative MEC Threshold (400 MW), Applicants 2 and 8 (highlighted in red in Table 4) are removed from the DS3 prioritisation process at this point\(^\text{11}\). This results in 800 MW of MEC still remaining, which means that further prioritisation criteria need to be applied to reduce the total MEC below the Total Cumulative MEC Threshold (400 MW).

\(^\text{11}\) If an Applicant is not successful in the DS3 prioritisation process that Applicant can still be processed as part of the 2018 batch and assessed within the wider thresholds for processing (total MW threshold and total offers threshold) and will therefore be subject to the same eligibility and prioritisation criteria as all other applicants.
Step 2

The next step in the process involves assessing whether individual service providers can demonstrate to the TSO’s satisfaction that they will be available to provide each individual service for at least 4000 hours per year. Those that can do this will be prioritised over those that can’t do it.

As can be seen in Table 5, only six of the remaining eight Applicants are available to provide each individual service for at least 4000 hours per year – Applicants 5 and 10 are available for less than 4000 hours per year. As the cumulative MEC of the remaining six Applicants exceeds the Total Cumulative MEC Threshold (400 MW), Applicants 5 and 10 (highlighted in red in Table 4) are removed from the DS3 prioritisation process at this point. This results in 600 MW of MEC still remaining, which means that further prioritisation criteria need to be applied to reduce the total MEC below the Total Cumulative MEC Threshold (400 MW).

---

**Table 4**: Application of Step 1 resulting in removal of Applicant 2 and Applicant 8 from the process

<table>
<thead>
<tr>
<th>Applicant 1</th>
<th>Applicant 2</th>
<th>Applicant 3</th>
<th>Applicant 4</th>
<th>Applicant 5</th>
<th>Applicant 6</th>
<th>Applicant 7</th>
<th>Applicant 8</th>
<th>Applicant 9</th>
<th>Applicant 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEC (MW)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>FFR (MW)</td>
<td>50</td>
<td>20</td>
<td>100</td>
<td>60</td>
<td>30</td>
<td>60</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>POR (MW)</td>
<td>50</td>
<td>0</td>
<td>100</td>
<td>60</td>
<td>20</td>
<td>30</td>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>No. of hours per year that Services are available (Hrs)</td>
<td>5000</td>
<td>1000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>6000</td>
<td>8500</td>
<td>2000</td>
</tr>
<tr>
<td>FFR level as % of MEC (%)</td>
<td>50%</td>
<td>20%</td>
<td>100%</td>
<td>30%</td>
<td>10%</td>
<td>20%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>POR level as % of MEC (%)</td>
<td>50%</td>
<td>0%</td>
<td>100%</td>
<td>60%</td>
<td>20%</td>
<td>30%</td>
<td>100%</td>
<td>60%</td>
<td>100%</td>
</tr>
<tr>
<td>Output level at which FFR/POR can be provided (MW)</td>
<td>20</td>
<td>100</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Planning Permission (Yes/No)</td>
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<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Date of Final Grant of Planning Permission</td>
<td>13-Feb-14</td>
<td>16-Mar-16</td>
<td>N/A</td>
<td>03-Apr-17</td>
<td>N/A</td>
<td>N/A</td>
<td>26-Dec-15</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Date order of the receipt of connection application</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Can provide both FFR and POR?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Connection Policy Transitional Arrangements – DS3 Prioritisation
Step 3

The next step in the process involves assessing whether individual service providers can provide volumes of both the FFR and POR services at levels which are high relative to their MEC. Those that can do this will be prioritised over those that can’t do it. Providers with FFR and POR capability volumes (in MW) equal to their MEC i.e. 100%, receive the highest priority.

As can be seen in Table 6, Applicants 3, 7 and 9 have FFR and POR capability volumes (in MW) equal to their MEC so these Applicants are selected to receive a connection offer. As the cumulative MEC of the three qualifying Applicants is 300 MW and less than the Total Cumulative MEC Threshold (400 MW), further prioritisation criteria need to be applied to bring the total MEC of applicants awarded connection offers up to the Total Cumulative MEC Threshold (400 MW).

---

**Table 5**: Application of Step 2 resulting in removal of Applicant 5 and Applicant 10 from the process

<table>
<thead>
<tr>
<th>Applicant 1</th>
<th>Applicant 2</th>
<th>Applicant 3</th>
<th>Applicant 4</th>
<th>Applicant 5</th>
<th>Applicant 6</th>
<th>Applicant 7</th>
<th>Applicant 8</th>
<th>Applicant 9</th>
<th>Applicant 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEC (MW)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>FFR (MW)</td>
<td>50</td>
<td>20</td>
<td>100</td>
<td>30</td>
<td>10</td>
<td>20</td>
<td>100</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>POR (MW)</td>
<td>50</td>
<td>0</td>
<td>100</td>
<td>60</td>
<td>20</td>
<td>30</td>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>No. of hours per year that Services are available (Hrs)</td>
<td>5000</td>
<td>6000</td>
<td>5000</td>
<td>5000</td>
<td>500</td>
<td>6000</td>
<td>8500</td>
<td>2000</td>
<td>8500</td>
</tr>
<tr>
<td>FFR as % of MEC (%)</td>
<td>50%</td>
<td>20%</td>
<td>100%</td>
<td>10%</td>
<td>20%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>POR as % of MEC (%)</td>
<td>50%</td>
<td>0%</td>
<td>100%</td>
<td>30%</td>
<td>20%</td>
<td>100%</td>
<td>60%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Output level at which FFR/POR can be provided (MW)</td>
<td>20</td>
<td>50</td>
<td>0</td>
<td>20</td>
<td>5</td>
<td>20</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Planning Permission (Yes/No)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Date of Final Grant of Planning Permission</td>
<td>13-Feb-14</td>
<td>16-Mar-16</td>
<td>N/A</td>
<td>03-Apr-17</td>
<td>N/A</td>
<td>N/A</td>
<td>26-Dec-15</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Date of receipt of connection application</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
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<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
</tr>
<tr>
<td>Can provide both FFR and POR?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Both services available ≥ 4000 hours per year?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

---

Connection Policy Transitional Arrangements – DS3 Prioritisation

Page 26
Table 6: Application of Step 3 resulting in qualification of Applicants 3, 7 and 9 to receive a connection offer

Step 4

The next step in the process involves assessing whether individual service providers have FFR and POR capability volumes (in MW) greater than or equal to 50% of their MEC.

As can be seen in Table 7, of the remaining unqualified Applicants, only Applicant 1 has FFR and POR capability volumes (in MW) greater than or equal to 50% of its MEC so this Applicant is selected to receive a connection offer. As the cumulative MEC of Applicants 1, 3, 7 and 9 is 400MW, which is equal to the Total Cumulative MEC Threshold, no further prioritisation criteria need to be applied.
<table>
<thead>
<tr>
<th>MEC (MW)</th>
<th>Applicant 1</th>
<th>Applicant 2</th>
<th>Applicant 3</th>
<th>Applicant 4</th>
<th>Applicant 5</th>
<th>Applicant 6</th>
<th>Applicant 7</th>
<th>Applicant 8</th>
<th>Applicant 9</th>
<th>Applicant 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>FFR (MW)</td>
<td>50</td>
<td>20</td>
<td>100</td>
<td>30</td>
<td>20</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>POR (MW)</td>
<td>50</td>
<td>0</td>
<td>100</td>
<td>60</td>
<td>20</td>
<td>30</td>
<td>100</td>
<td>60</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No. of hours per year that Services are available (Hrs)</td>
<td>5000</td>
<td>6000</td>
<td>5000</td>
<td>5000</td>
<td>500</td>
<td>6000</td>
<td>8500</td>
<td>2000</td>
<td>8500</td>
<td>2000</td>
</tr>
<tr>
<td>FFR level as % of MEC (%)</td>
<td>50%</td>
<td>20%</td>
<td>100%</td>
<td>30%</td>
<td>10%</td>
<td>20%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>POR level as % of MEC (%)</td>
<td>50%</td>
<td>0%</td>
<td>100%</td>
<td>60%</td>
<td>20%</td>
<td>30%</td>
<td>100%</td>
<td>60%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Output level at which FFR/POR can be provided (MW)</td>
<td>20</td>
<td>50</td>
<td>0</td>
<td>20</td>
<td>5</td>
<td>20</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Planning Permission (Yes/No)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Date of Final Grant of Planning Permission</td>
<td>13-Feb-14</td>
<td>16-Mar-16</td>
<td>N/A</td>
<td>03-Apr-17</td>
<td>N/A</td>
<td>N/A</td>
<td>26-Dec-15</td>
<td>N/A</td>
<td></td>
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</tr>
<tr>
<td>Date order of the receipt of connection application</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td>01-Jan-18</td>
<td></td>
</tr>
<tr>
<td>Can provide both FFR and POR?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Both services available ≥ 4000 hours per year?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Service levels as a % of MEC is 100% for both services?</td>
<td>No</td>
<td>Yes - Qualified</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes-Qualified</td>
<td>Yes - Qualified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service levels as a % of MEC is ≥ 50% for both services?</td>
<td>Yes - Qualified</td>
<td>No</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 7:** Application of Step 4 resulting in qualification of Applicant 1 to receive a connection offer