Fast Frequency Response (FFR), Primary, Secondary and Tertiary Reserve (POR, SOR, TOR1)

System Services

Test Report for Performance Scalar Reset

WFPS

Unit Name

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# Document Version History

Revision 1.0 published 22 December 2021

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version** | **Date** | **Comment** | **Name** | **Company** |
| 0.1 | Insert date | Minor version (v0.1) - First submission for review and approval | Insert name | Insert company |
| 1.0 | Insert Date | Revised to version 1.0 following approval by EirGrid, SONI. | Insert Name | Unit Company Name |

# Introduction

The Unit shall submit the latest version of this test report template as published on the EirGrid or SONI websites[[1]](#footnote-2).

The report shall be developed for technical and non-technical readers and shall follow the agreed test programme. The report is submitted to [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com) or [generator\_testing@soni.ltd.uk](mailto:generation-outages@soni.ltd.uk) as appropriate.

Submission of this document is required if a Unit does not have and existing FFR, POR, SOR or TOR1 contract or is making changes or updates to any of the effected parameters.

To complete the report, the Unit shall have either:

1. Recorded frequency response data as per the test procedure agreed with EirGrid, SONI; or
2. Performance Data showing frequency response capability.

Any issue with meeting any requirements or completing this report, please contact [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com) or [generator\_testing@soni.ltd.uk](mailto:generation-outages@soni.ltd.uk) as appropriate.

# Abbreviations

HV High Voltage

MW Mega Watt

MEC Maximum Export Capacity

kV kilovolt

Hz Hertz – unit of frequency

AAP Available active power

POR Primary Operating Reserve

SOR Secondary Operating Reserve

TOR Tertiary Operating Reserve

FFR Fast Frequency Response

WFCS Wind Farm Control System

DMOL Design minimum operating level

# WFPS Data

|  |  |
| --- | --- |
| WFPS Name | WFPS to Specify |
| WFPS Location | WFPS to Specify |
| WFPS connection point | HV Bushings of T101 in XX 110kV station |
| WFPS connection voltage | WFPS to Specify |
| Installed Turbine type, MW size and quantity | WFPS to Specify |
| Contracted MEC | WFPS to Specify |
| Registered Capacity | WFPS to Specify |
| Limiter applied to Exported MW | WFPS to Specify |
| Limiter applied to AAP | WFPS to Specify |
| DMOL | WFPS to Specify |

# System Services definitions

The definitions referenced in this document are for indicative purposes only. In the event of inconsistency between the definitions in this document and those in the DS3 System Services Agreement, the definitions in the DS3 System Services Agreement shall prevail.

## Fast frequency response (FFR)

FFR is defined as the additional increase in MW output from a unit or a reduction in demand following a frequency event that is available within two seconds of the start of the event and sustainable for at least eight seconds afterwards.

The extra energy provided by the MW increase, in the timeframe from the FFR response time to 10 seconds **shall be greater** than any loss of energy in the ten-to-twenty second timeframe afterwards due to a reduction in MW output. The energy provided and drawn should be compared to the pre-event output.



Figure 1: Example graph showing the additional power provided to, and drawn from, the grid

As shown in the diagram above, in order to be eligible for FFR the amount indicated by the blue hatched area (Power provided) must be greater than the green hatched area (Power drawn).

Please note there are performance monitoring standards that apply for DS3 System Services and specific requirements for FFR. Further detail is available in the DS3 Performance Measurement Device Standards for Fast Acting Services document.

## Operating Reserve (POR, SOR & TOR1)

### Operating Reserve

Operating Reserve is defined as the additional MW output provided from Generation plant, reduction of Active power transfer to an external system or increase of Active power transfer to the Transmission system by interconnectors, or reduction in Customer demand, which must be realisable in real time operation to contain and correct any potential Transmission system deviation to an acceptable level.

### Primary Operating Reserve (POR)

Primary Operating Reserve (POR) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) where the nadir occurs between 5 and 15 seconds after an Event.

### Secondary Operating Reserve (SOR)

Secondary Operating Reserve (SOR) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 15 to 90 seconds following an event.

### Tertiary Operating Reserve band 1 (TOR1)

Tertiary Operating Reserve (TOR1) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 90 seconds to 5 minutes following an event.

## Inertial Emulation

Emulated Inertia means the ability of some Controllable WFPS technologies to provide additional increase in MW Output following a Performance Incident at times.

The response through emulated inertia shall be in addition to the MW provided through frequency response without emulated inertia.

## Hysteresis

FFR Hysteresis Control is defined in the DS3 System Services Agreement and means: the capability of a Providing Unit to deliver a response at a particular Reserve Trigger as the frequency falls and not to withdraw its initial provided response as the frequency recovers through the Reserve Trigger.

For each static step: as the frequency recovers, the provision of the service shall be withdrawn at a frequency specified by the TSO for that step that is greater, i.e. closer to nominal, than the corresponding Reserve Step Trigger.

For each static step: as the frequency recovers, the withdrawal of the provision of the service must be identical in both MW volume and response time to that provided at the corresponding Reserve Step Trigger when providing the service.

# Assessment

The assessment methodology is in line with that used for Performance Monitoring, as set out in the latest version of the DS3 System Services Protocol, and the supplementary ‘Note to customers who are contracted to provide FFR (DS3 System Service Contract)’, which gave further detail on the FFR assessment methodology.

# Test Results

## Summary

Testing was completed on [DATE].

*[Insert comment on the results, highlighting any issues encountered in performing the test or in analysing the results.]*

*[Insert Report summary]*

*[Include any relevant test notes here, relating to how the test was carried out or to any specific conditions encountered during the test.]*

*[Any abnormal behaviour during the test (spikes, dips, unusual vibrations, etc.) shall be noted and documented. The reasons behind these shall be detailed along with any corrective actions taken and what its effects are on the unit and/or the result. If possible a clear graph of the issue shall also be presented.]*

*[WFPS does (not) have the ability to provide Inertial Emulation.]*

## FFR, POR, SOR, TOR1 Results

The following table shows the test results, using assessment methodology and pass criteria in line with the latest DS3 System Services Protocol.

These tables will be repeated for each test condition – *i.e.* if the test was carried out with Emulated Inertia enabled and disabled. All tests carried out for the purpose of data poor scalar reset shall be presented and assessed. *i.e.* any failed tests shall not be omitted.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test Condition: *e.g.* APC ON (40% Reg Cap) Frequency Response ON, Emulated inertia OFF | | | | |
|  | **Achieved Volume** | **Available Volume** | **Contracted Volume** | **Result (pass/fail)** |
| **FFR** | See table below | See table below |  |  |
| **POR** |  |  |  |  |
| **SOR** |  |  |  |  |
| **TOR1** |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Unit Parameters (FFR)** | | |
| Pre-Event Output |  | MW |
| Contracted FFR |  | MW |
| Available Headroom |  | MW |
| FFR Response Time |  | Sec |
| Frequency Trigger |  | Hz |
| Trajectory |  | Hz |

|  |  |
| --- | --- |
| **Unit Performance (FFR)** | |
| Initial FFR Expected within Response Time |  |
| Max FFR Achieved within Response Time |  |
| % Initial FFR Achieved within Response Time |  |
| % Time FFR Achieved & Sustained to 10 sec |  |
| Energy Provided > Recovered | **Yes / No** |
| FFR Performance Assessment | **Pass / Partial Pass / Fail** |

## Graphs of results

*Insert full plots of the results demonstrating the frequency response of the unit. Graphs should be clear and highlight all relevant values and time periods, including levels. All Graphs should be clearly labelled and easy to read.*

*FFR-POR should be displayed in one graph, and SOR-TOR1 displayed in a separate graph, for clarity.*

*Graphs should clearly show the MW value prior to frequency event, expected response and the values acquired using the assessment methodology for each service e.g. average MW achieved over the SOR timeframe. Available Active Power should be included in all graphs.*

*Graph should be a time series plot with Power and Frequency on the y axis and time on the x axis.*

*Include any relevant test notes here, relating to how the test was carried out or any specific conditions encountered during this test***.**

1. <http://www.eirgridgroup.com/> or <http://www.soni.ltd.uk/> [↑](#footnote-ref-2)