

# **DS3 System Services Protocol – Interim Arrangements**

DS3 System Services Implementation Project

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3 August 2016

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## 1 Introduction

This DS3 System Services Protocol document is supplementary to the DS3 System Services Framework Agreement. It provides information on compliance and Performance Monitoring requirements that need to be satisfied by Service Providers and their respective Providing Units as part of the DS3 System Services contractual arrangements. It is one of two supplementary documents referenced in the main framework agreement, the other being the DS3 System Services Statement of Payments. An overview of the documents is given in Figure 1.

This version of the Protocol document and the associated governance arrangements for changes to the document apply to the Interim Arrangements only. The approach for the Enduring Arrangements will be consulted on separately as part of the Enduring Contract consultation.

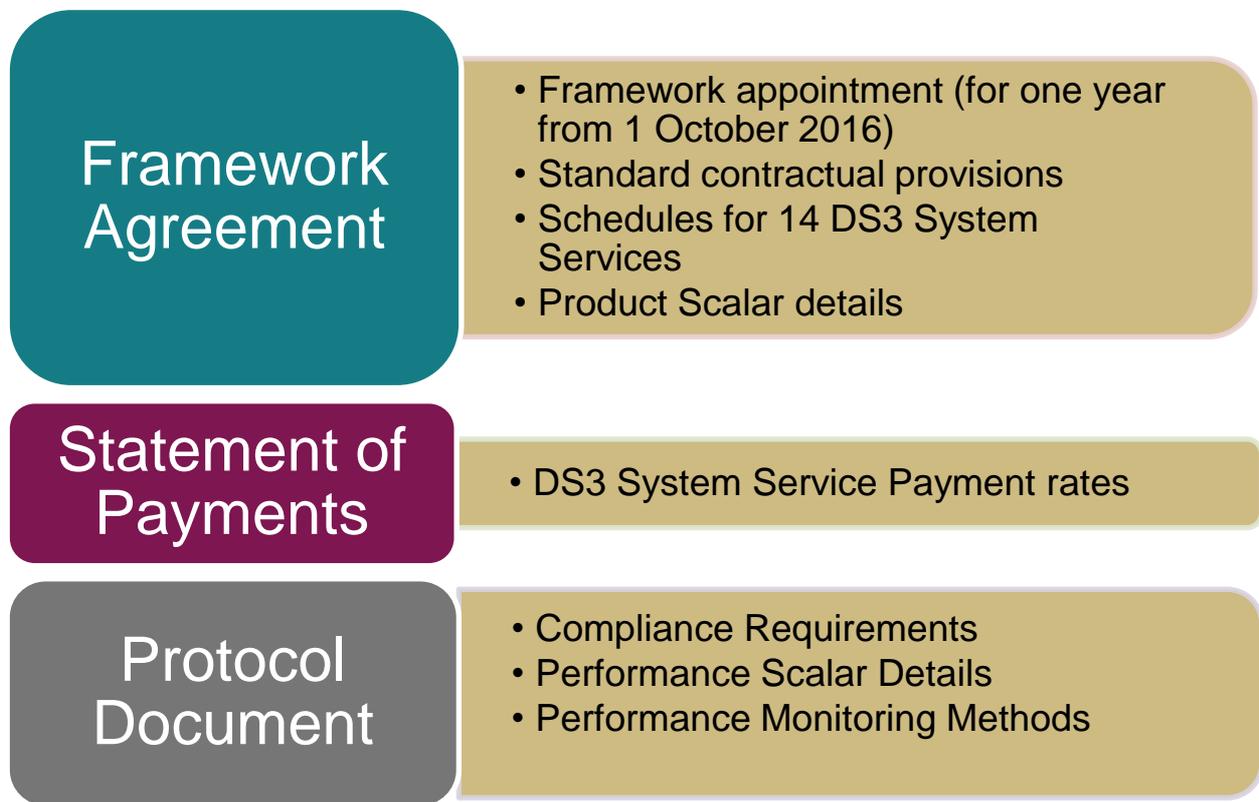
The equation below, included in the DS3 System Services Framework Agreement, sets out how payment is calculated for each service. Each of the terms is defined in the Framework Agreement.

***Trading Period Payment = Available Volume × Payment Rate × Scaling Factor × Trading Period Duration***

The payment rates will be included in the DS3 System Services Statement of Payments once finalised and following the Interim Tariffs consultation.

Depending on the service, the Scaling Factor consists of one or more scalar types including the Product Scalar and Performance Scalar. Product Scalars are defined in the Framework Agreement. The methodology for calculating DS3 System Services Performance Scalars on a service by service basis is included in this document.

This document also specifies the Compliance Requirements which must be met by Service Providers contracted to provide DS3 System Services, detailed by DS3 System Service.



**Figure 1:** Overview of Framework Agreement and associated documents

## 2 Governance

For the Interim Arrangements, this Protocol document is a regulated document to which the TSOs may propose changes on a quarterly basis (end December, end March, end June and end September) which will require the approval of the Regulatory Authorities. It will not be subject to industry consultation except where a material change is proposed. The most recent version of this document will be published on the Company’s website ([www.eirgridgroup.com](http://www.eirgridgroup.com)).

For the Enduring Arrangements, we envisage that the governance of the Protocol document will be different. It may be more appropriate to consult annually on the Performance Scalar methodology. However, for the Interim Arrangements, this approach is not deemed to be suitable given that these arrangements will only last for one year.

### **3 Compliance Requirements**

Compliance Requirements, in the context of this Protocol document, means the assessment to determine that a Service Provider satisfies the TSOs' criteria for providing a given DS3 System Service from a given Providing Unit. This document will not exhaustively detail test procedures. The relevant departments in EirGrid and SONI will handle DS3 System Service testing procedures. Compliance Requirements on a per DS3 System Service basis are presented in Table 1.

Please note that the Compliance Requirements set out in this paper are separate from and in addition to the technical requirements assessed in the Interim Arrangements procurement process.

**Table 1: DS3 System Services Compliance Requirements**

System Service	Acronym	Compliance Requirements for Existing Harmonised Ancillary Service Providers using existing contract values	Compliance Requirements for Existing Harmonised Ancillary Service Providers proposing to use revised contract values	Compliance Requirements for New Providers that have not previously provided Harmonised Ancillary Services equivalent to DS3 System Service
<b>Synchronous Inertial Response</b>	<b>SIR</b>	Must be a Synchronous Machine. H Constant must be confirmed.	Must be a Synchronous Machine. If proposing to change H Constant, the change must be confirmed with TSO.	Must be a Synchronous Machine. H Constant must be confirmed with TSO.
<b>Fast Frequency Response</b>	<b>FFR</b>	Services will be procured through trials for Interim Arrangements. Compliance Requirements to be determined as part of trials.	Services will be procured through trials for Interim Arrangements. Compliance Requirements to be determined as part of trials.	Services will be procured through trials for Interim Arrangements. Compliance Requirements to be determined as part of trials.
<b>Dynamic Reactive Response</b>	<b>DRR</b>			
<b>Fast Post-Fault Active Power Recovery</b>	<b>FPFAPR</b>			
<b>Primary Operating Reserve</b>	<b>POR</b>	Compliance assessment will be based on historical data. No additional testing will be required.	Compliance assessment will be based on historical data if it exists for newly proposed contract values (revised either up or down). Outside of these values, additional Frequency Injection Testing or testing using Dispatch instructions as appropriate may be required as determined by the TSO.	Compliance assessment based on Frequency Injection Testing or testing using Dispatch instructions as appropriate may be required as determined by the TSO.
<b>Secondary Operating Reserve</b>	<b>SOR</b>			
<b>Tertiary Operating Reserve 1</b>	<b>TOR1</b>			
<b>Tertiary Operating Reserve 2</b>	<b>TOR2</b>			
<b>Ramping Margin 1 Hour</b>	<b>RM1</b>	Compliance assessment will be based on historical data. No additional testing will be required.	Compliance assessment will be based on historical data if it exists for newly proposed contract values (revised either up or down). Outside of these values, additional testing may be required involving Dispatch instructions as determined by the TSO.	Compliance assessment based on testing involving Dispatch instructions may be required as determined by the TSO.
<b>Ramping Margin 3 Hour</b>	<b>RM3</b>			
<b>Ramping Margin 8 Hour</b>	<b>RM8</b>			
<b>Replacement Reserve (De-Synchronised)</b>	<b>RRD</b>			
<b>Replacement Reserve (Synchronised)</b>	<b>RRS</b>			
<b>Steady-State Reactive Power</b>	<b>SSRP</b>			

## **4 Performance Monitoring**

Performance Monitoring, in the context of DS3 System Services, means a method to determine whether a specified DS3 System Service has been delivered in the required manner and within the specified timelines.

Depending on the given DS3 System Service being monitored, a Providing Unit's performance may be monitored following a Dispatch instruction or a transient event and/or a fault disturbance.

The most appropriate source of information available to the TSOs for Performance Assessment will be used (which will include metering, SCADA, Phasor Measurement Units (PMUs) and Event Recorders as appropriate and available).

For Demand Side Units which are contracted to provide POR, SOR or TOR1 the TSOs require real time SCADA demand data from the aggregated sites providing the service, at a resolution of 1 Hz or greater (Time-Stamped and Synchronised to a common time). The TSOs also require this data from the Individual Demand Sites which provide the DS3 System Service and this should be provided by the aggregator within one Working Day following an Event or as agreed with the TSO and in a format to be agreed with the TSO.

The TSOs also reserve the right to install additional Monitoring Equipment for the purpose of performance monitoring, where Monitoring Equipment is defined in the Framework Agreement and referenced in Clause 5.1 of that agreement.

### **4.1 Performance Assessment**

In the context of DS3 System Services, Performance Assessment means the evaluation of a Service Provider's delivery of a given DS3 System Service following a Dispatch instruction or a transient event and/or a fault disturbance (i.e. an Event), as appropriate to the given DS3 System Service.

## 4.2 Pass Rate Methodology

The Pass Rate methodology is based on a simple binary assessment of a Providing Unit's performance following an Event. The Providing Unit's Achieved response is calculated and compared to its Expected value, allowing for Applicable Tolerances where appropriate. If the Achieved response is greater than or equal to the Expected value then the DS3 System Service is deemed to have delivered the service ("Pass"), and if less than the Expected value, to have not delivered the service ("Fail").

The percentage of Events that the Providing Unit passed within the Assessment Period is calculated to give the Providing Unit's percentage Reliability. This value determines the Performance Scalar using a straight line equation based on the SEM-14-108 decision, where:

IF Reliability  $\leq$  50%, **Performance Scalar** = 0

IF Reliability  $\geq$  90%, **Performance Scalar** = 1

IF Reliability  $>$  50%,  $<$ 90% **Performance Scalar** = (Reliability – 50%)/ (90%-50%)

**Reliability (%)** =  $\text{Count}_{n \text{ events}} (\text{IF } [\text{Achieved Response} \geq \text{Expected}]) / n$

**Expected** = Level of service response expected including Applicable Tolerances where appropriate

**Achieved** = Level of service response deemed to be provided

### Worked Example of Pass Rate Methodology

Assuming performance is based on the last 10 Data Records and the Providing Unit passed 7 of these 10 Events.

**Reliability (%)** =  $7/10 = 70\%$

**Performance Scalar** =  $(70-50)/(90-50) = 0.5$

### 4.3 Performance Scalars – Interim Arrangements

This section outlines the Interim Arrangements for Performance Scalars.

The 14 DS3 System Services can be split into a number of categories as shown below in Figure 2. This categorisation is based on grouping DS3 System Services with similar Performance Assessment methodologies.



**Figure 2:** Categorisation of the 14 DS3 System Services for performance monitoring

The overall philosophy for the Interim Arrangements Performance Monitoring is to assess performance over a number of Events to develop a Performance Scalar.

To develop meaningful Performance Scalars, it is important that performance is based on a sufficient number of Data Records. In this regard, we believe that a Performance Scalar should only be based on an individual Providing Unit's performance once there are a sufficient number of Data Records available with which to calculate it. Where a minimum number of Data Records are not available i.e. the Minimum Data Record Requirements are not met, it will be necessary to use alternative approaches to develop a Performance Scalar for each Providing Unit.

We believe that performance should also be assessed based on the most recent data available where possible. To account for this, there will be an upper limit (Data Backstop Limit) on the number of Data Records needed to develop a useful Performance Scalar and a cut-off time (Data Backstop Timeframe) after which data becomes no longer relevant for the assessment of performance.

These concepts are defined in the following section in more detail.

#### 4.4 Methodology for Interim Performance Scalars

Table 2 summarises the methodology for calculating the Interim Performance Scalars. Definitions of the terms used in the table are given on page 12.

Performance Scalars will be calculated on an individual Providing Unit basis for all those DS3 System Services for which the Providing Unit has satisfied the Minimum Data Record Requirements.

**Table 2:** Proposed Interim Performance Scalar Calculation Methodology

Definition	DS3 System Services Category				
	Reserve	Ramping	Reactive	Inertia	Fast-acting
Services Per Category	POR SOR TOR1 TOR2 RRS	RRD RM1 RM3 RM8	SSRP	SIR	FFR DRR FPFAPR
Data Source	Event Recorder data / 1 Hz SCADA depending on what is available	<p><b>All Providing Units excluding Demand Side Units (DSUs):</b> EDIL <i>Fail to Sync</i> Instructions</p> <p><b>For DSUs:</b> Aggregated SCADA demand data and / or QH Meter Data for each Individual Demand Site (IDS)</p>	N/A	N/A	N/A

<b>Data Record</b>	A Providing Unit's MW response to any Frequency Event in which the Providing Unit's Expected Response is >0 MW	<p><b>For All Providing Units excluding DSUs :</b> A Providing Unit's response to a Synchronisation Dispatch instruction</p> <p><b>For DSUs:</b> A Providing Unit's response to a Dispatch instruction as defined in the EirGrid Grid Code Section OC10.4.5.2 and SONI Grid Code Section OC11.10.3</p>	N/A	N/A	N/A
<b>Minimum Data Resolution Requirements</b>	1 Hz SCADA data for the individual Providing Unit / aggregated SCADA demand signal over relevant sites of the DSU providing the service with a latency of no more than 5 seconds	<p><b>For All Providing Units excluding DSUs:</b> EDIL <i>Fail to Sync</i> Instructions.</p> <p><b>For DSUs:</b> QH Meter Data for 12 weeks prior to the dispatch instruction for each IDS.</p>	N/A	N/A	TBC
<b>Minimum Data Record Requirements</b>	5 Data Records	5 Data Records	N/A	N/A	N/A
<b>Data Start date</b>	31 <sup>st</sup> October 2014	31 <sup>st</sup> October 2014	N/A	N/A	N/A

<b>Data Backstop Limit</b>	Last 10 Data Records or 1 month's data (if more than 10 data records in one month)	Last 10 Data Records or 1 month's data (if more than 10 data records in one month)	N/A	N/A	N/A
<b>Data Backstop Timeframe</b>	24 month rolling timeframe	24 month rolling timeframe	N/A	N/A	N/A
<b>Scalar Assessment Frequency</b>	Monthly in Arrears	Monthly in Arrears	N/A	N/A	N/A

**Definitions**

- **Data Source:** The source of the data used to collect Data Records used in the calculation of a Providing Unit's Performance Scalar.
- **Data Record:** Performance evidence for each DS3 System Service, gathered from a Data Source, which will have a value of Pass or Fail, used to determine a Performance Scalar.
- **Minimum Data Record Requirements:** the minimum number of Data Records for a given Providing Unit deemed sufficient to calculate a Performance Scalar based on the Providing Unit's data alone. Providing Units that meet the **Minimum Data Record Requirements** are classified as "Data Rich", those that do not are classified as "Data Poor".
- **Minimum Data Resolution Requirements:** The minimum time sampling and high level technical requirements for data to be deemed suitable for use in Performance Monitoring of a DS3 System Service.
- **Data Start Date:** The earliest possible date from which Data Records can be used to calculate Performance Scalars. Any Data Records prior to this date will not be considered for Performance Scalar calculations.

- **Data Backstop Limit:** The maximum number of Data Records used to calculate a Performance Scalar (for Data Rich scenarios only). The principle behind this is that Performance Scalars should be based on the most recent Data Records available within a reasonable timeframe. However, if there are more than 10 Data Records for a given Providing Unit providing a given DS3 System Service in a given month, all Data Records for that month will be used in determining the Performance Scalar.
- **Data Backstop Timeframe:** The cut-off date beyond which historical Data Records are no longer deemed to be relevant for use in the calculation of a Providing Unit's latest Performance Scalar.
- **Scalar Assessment Frequency:** The frequency with which a Performance Scalar will be recalculated.

## 4.5 Signal Declarations

A Providing Unit may be required to make a number of EDIL Declarations when contracted to provide DS3 System Services. These include both EDIL Declarations specified in the Grid Code and additional Declarations not specified in the Grid Code. Table 3 summarises the non-Grid Code EDIL Declarations that a Providing Unit may be required to make. They are referenced in the Framework Agreement as noted in the table.

**Table 3:** EDIL Declarations for DS3 System Services (other than those defined in the Grid Code)

Declaration	Fast Frequency Response	Ramping Margin 1 Hour	Ramping Margin 3 Hour	Ramping Margin 8 Hour	Dynamic Reactive Response	Fast Post Fault Active Power Recovery	Automatic Voltage Regulation	Current Fuel
EDIL Acronym	FFR	RM1	RM3	RM8	DRR	FPFAPR	AVR	FUEL
Description	Fast Frequency Response in MW	Ramping Margin 1-3 Hours in MW	Ramping Margin 3-8 Hours in MW	Ramping Margin 8-16 Hours in MW	Ability to provide Dynamic Reactive Response	Ability to provide Fast Post Fault Active Power Recovery	Ability to Act Under AVR	Current Fuel Being Used
Framework Agreement term	Declared FFR	Declared RM1	Declared RM3	Declared RM8	Declared DRR	Declared FPFAPR	Declared Automatic Voltage Regulator Status	No standalone term – used in average Availability calculation

## 4.6 Performance Scalar Calculation Methods and Assessment Criteria per Service

This section describes for each DS3 System Service, the method by which the performance of a Providing Unit will be measured and the method by which that assessment will be used to calculate a Performance Scalar.

### 4.6.1 Reserve Category

The Reserve Category for Performance Monitoring includes: POR,SOR,TOR1,TOR2 and RRS.

The methods below for each of the DS3 System Services in this category (POR,SOR,TOR1,TOR2 and RRS) will be used where Providing Units meet the Minimum Data Record Requirements. For Providing Units which do not meet the Minimum Data Record Requirements please refer to Section 4.7 of this document.

#### *Primary Operating Reserve (POR)*

##### **4.6.1.1 Method of Performance Assessment Primary Operating Reserve (POR)**

Performance Assessment of the POR service will be based on an evaluation of the Providing Unit's performance during a Frequency Event. The assessment of POR performance is carried out at a point in time corresponding to the Nadir Frequency during the time range of T+5 to T+15 seconds, i.e. the **POR Period**.

##### **4.6.1.2 Measurement Process for Primary Operating Reserve (POR) Performance Assessment**

The Expected POR and the Achieved POR will be calculated for the Providing Unit.

The extent of the difference between the Expected POR and Achieved POR will determine whether a Pass or a Fail will be awarded to the Providing Unit for the Event.

For Synchronous Providing Units, if the Frequency Event Nadir occurs before the start of the POR Period the POR performance will be assessed at T+5 seconds

taking into account the Inertial Response of the Providing Unit reacting to the positive rate of change of Frequency at T+5 seconds.

The basis for calculating the Expected POR is the anticipated Providing Unit response to the Frequency reduction. The increase in the Providing Unit output is driven by the governor response and is limited by the sustained loading ability of the Providing Unit. In the initial phase of the POR Period it is recognised that some Providing Unit Outputs may lag behind the theoretical droop determined response due to the physical reaction of the unit to a power system Frequency change. To compensate for this, the assessment uses the POR Governor Droop Multiplier which decays to a value of one over time, the value during the POR Period determined from the POR Governor Droop Multiplier Alpha and the POR Governor Droop Multiplier Beta.

If the Achieved POR response is less than the Expected POR response after the application of the Applicable Tolerance a POR Fail is recorded, assuming the Expected POR response is greater than 0 MW. Otherwise, a POR Pass is recorded. If the Expected POR response is less than or equal to 0 MW neither a Pass nor Fail will be assigned to the Event.

Where a Frequency Event has occurred while the Providing Unit was Synchronised to the power system, the Providing Unit response to any further Frequency Event occurring within 5 minutes after the end of the Frequency Event will not be taken into account for settlement purposes.

#### **4.6.1.2.1 Calculation of Expected Provision of POR**

The Expected POR following a Frequency Event is derived from:

- 1) The Pre-Event Output of the Providing Unit;
- 2) The Pre-Event System Frequency;
- 3) The “Nadir Frequency”, being the minimum Frequency during the POR Period;

- 4) The “Nadir Time”, the time at which the minimum Frequency occurs during the POR Period with reference to the start of the Frequency Event;
- 5) The “Nadir Frequency Delta”, being the difference between the Pre-Event System Frequency and the minimum Frequency during the POR Period;
- 6) The “Providing Unit Output Delta”, being the change in the Providing Unit Output from the Pre-Event Output to the Providing Unit Output at the Nadir Time;
- 7) The Output of the Providing Unit (in MW) at the Nadir Time;
- 8) The Time Zero Availability;
- 9) The POR Reserve Characteristic;
- 10) The Time Zero Declared POR;
- 11) The Declared Governor Droop;
- 12) The Governor Droop Demanded POR;
- 13) The “POR Governor Droop Multiplier” being the multiplier calculated, where applicable, under paragraph 4.6.1.2.2;
- 14) The Providing Unit Frequency / Capacity Function (if applicable);
- 15) The Unit Load Controller settings, if applicable. If a Unit Load Controller is in service during the Frequency Event the Pre-Event System Frequency and Pre-Event Output of the Providing Unit will be determined using the Unit Load Controller settings;
- 16) The Providing Unit “Inertia Response” being the MW change in the Providing Unit’s output due to a positive rate of change of Frequency at the Nadir Time or if the Frequency Event nadir occurs before the start of the POR Period at T+5, as set out in Schedule 9 of the Framework Agreement; and
- 17) The Providing Unit “Inertia Response Calculation Tolerance” being the Providing Unit’s specific MW value applied to compensate for

the calculated accuracy of Inertia Response, as set out in Schedule 9 of the Framework Agreement.

**4.6.1.2.2 The POR Governor Droop Multiplier, where applicable, is calculated as:**

$$\text{PORGovernorDroopMultiplier} = 1 + (\text{PORgovernordroopmultiplier}\alpha * e^{(-\text{PORGovernordroopmultiplier}\beta * \text{nadirtime})})$$

(Where e is the exponential function)

For the avoidance of doubt, the POR Governor Droop Multiplier will only be applicable to those Providing Units to which it previously applied in the Harmonised Ancillary Services (HAS) arrangements.

**4.6.1.2.3 The Governor Droop Demanded POR is calculated as the product of:**

the Governor Droop Providing Unit Related Capacity (MW) and the Nadir Frequency Delta (Hz) divided by the Declared Governor Droop (PU) times the POR Governor Droop Multiplier (PU) times the nominal Frequency (50 Hz)

**4.6.1.2.4 The Expected POR is the increase from the Pre-Event Output from the Providing Unit at the Nadir Frequency and is calculated as the minimum of :**

- a. The POR value determined from the POR Reserve Characteristic outlined in Schedule 9 of the Framework Agreement in conjunction with:
  - i. the Providing Unit Pre-Event Output; and
  - ii. the Providing Unit Time Zero Availability;.
- b. The difference between the Providing Unit Pre-Event Output and the Providing Unit Time Zero Availability. This value will be adjusted by the Providing Unit Frequency / Capacity Function at the Nadir Frequency in accordance with the Connection Conditions in the Grid Code, if applicable.

- c. The Governor Droop Demanded POR.
- d. The Time Zero Declared POR .

minus the Inertial Response and the Inertia Response Calculation Tolerance (to the extent that the Providing Unit is a Synchronous Providing Unit), as set out in Schedule 9 of the Framework Agreement.

#### **4.6.1.2.5 Calculation of Achieved Provision of POR:**

The Achieved POR following a Frequency Event is equal to the Providing Unit Output Delta.

#### **4.6.1.3 *Criteria used to determine if POR performance is assessed as Pass or Fail***

Pass/ Fail assessment will be based on whether a Providing Unit fails to achieve a POR response within an Applicable Tolerance range from the POR Expected value.

A '**PASS**' will be awarded for a Frequency Event where the Achieved POR is greater than or equal to the POR Expected Value – (**Maximum** ([10% of POR Expected Value], [1 MW])) **AND** (POR Expected  $\geq$ 0MW)

A '**FAIL**' will be awarded for a Frequency Event where the Achieved POR is less than the POR Expected – (**Maximum** ([10% of POR Expected Value], [1 MW])) **AND** (POR Expected  $\geq$ 0MW)

#### *Secondary Operating Reserve (SOR)*

#### **4.6.1.4 *Method of Performance Assessment Secondary Operating Reserve (SOR)***

Performance Assessment of the SOR service will be based on an evaluation of the Providing Unit's performance during a Frequency Event. The assessment of SOR performance is carried out during the entire SOR time range of T+15 to T+90 seconds, i.e. the **SOR Period**.

#### **4.6.1.5      *Measurement Process for Secondary Operating Reserve (SOR) Performance Assessment***

The Expected SOR and the Achieved SOR will be calculated for the Providing Unit.

The extent of the difference between the Expected SOR and Achieved SOR will determine whether a Pass or a Fail will be awarded to the Providing Unit for the Event.

The Expected SOR is determined for each sample point during the SOR Period and compared to the Achieved SOR. If the Achieved SOR is less than the Expected SOR, the deficit is summated for all the sample points and an average deficit produced. If a deficit remains after the application of the Applicable Tolerance a SOR failure is recorded.

Where a Frequency Event has occurred while the Providing Unit was Synchronised to the power system, the Providing Unit response to any further Frequency Event occurring within 5 minutes after the end of the Frequency Event will not be taken into account for settlement purposes.

##### **4.6.1.5.1      Calculation of Expected Provision of SOR**

The Expected SOR following a Frequency Event is derived from –

- 1) The Pre-Event Output of the Providing Unit;
- 2) The Pre-Event System Frequency;
- 3) The Time Zero Availability;
- 4) The SOR Reserve Characteristic;
- 5) The Time Zero Declared SOR ;
- 6) The Declared Governor Droop;
- 7) The Governor Droop Demanded SOR;
- 8) The Providing Unit Frequency /Capacity Function (if applicable);
- 9) The Unit Load Controller settings, if applicable. If a Unit Load Controller is in service during the Frequency Event the Pre-Event System

Frequency and Pre- Event Output of the Providing Unit will be determined using the Unit Load Controller settings.

**4.6.1.5.2 The Governor Droop Demanded SOR is calculated by reference to each sample point during the SOR Period, as the product of :**

the Governor Droop Providing Unit Related Capacity (MW) and the sample point Frequency delta (Hz) divided by the Declared Governor Droop (PU) times the nominal Frequency (50Hz).

**4.6.1.5.3 The Expected SOR is the increase from the Pre-Event Output from the Providing Unit at each sample point during the SOR Period and is calculated as the minimum of:**

- a) The SOR value determined from the SOR Reserve Characteristic in conjunction with;
  - i. the Providing Unit Pre–Event Output and
  - ii. the Time Zero Availability;
- b) The difference between the Providing Unit Pre–Event Output and the Time Zero Availability. In the case of a CCGT only, this value will be adjusted by the Providing Unit Frequency/Capacity Function at each sample point Frequency, if applicable;
- c) The Governor Droop Demanded SOR;
- d) The Time Zero Declared SOR .

The sample point Expected SOR values are averaged over the SOR Period to give the “**Average SOR Requirement**”.

**4.6.1.5.4 Calculation of Achieved Provision of SOR**

The Achieved SOR following a Frequency Event will be calculated for each sample point during the SOR Period as the Providing Unit MW Output minus the Providing Unit Pre-Event Output.

If the Achieved SOR is less than the Expected SOR, at a sample point, a deficit of SOR is recorded. SOR deficits averaged over the SOR Period produce the “Average SOR Deficit”.

#### **4.6.1.6**      *Criteria used to determine if SOR performance is assessed as Pass or Fail*

Pass/ Fail assessment will be based on whether a Providing Unit fails to achieve a SOR response within an Applicable Tolerance range from the Expected SOR value.

A ‘**PASS**’ will be awarded for a Frequency Event where the Achieved Provision of SOR is greater than or equal to the SOR Expected Value – (**Maximum** ([10% of SOR Expected Value], [1 MW])) **AND** (SOR Expected Value  $\geq$  0MW)

A ‘**FAIL**’ will be awarded for a Frequency Event where the Achieved Provision of SOR is less than the SOR Expected Value – (**Maximum** ([10% of SOR Expected Value], [1 MW])) **AND** (SOR Expected Value  $\geq$  0MW)

#### *Tertiary Operating Reserve (TOR1)*

##### **4.6.1.7**      *Method of Performance Assessment Tertiary Operating Reserve 1(TOR1)*

Performance Assessment of the TOR1 service will be based on an evaluation of the Providing Unit’s performance during a Frequency Event. The assessment of TOR1 performance is carried out during the entire TOR1 time range of T+90 seconds to T+300 seconds, i.e. the **TOR1 Period**.

##### **4.6.1.8**      *Measurement Process for Tertiary Operating Reserve 1(TOR1) Performance Assessment*

The Expected TOR1 and the Achieved TOR1 will be calculated for the Providing Unit. The extent of the difference between the Expected TOR1 and Achieved TOR1 will determine whether a Pass or a Fail will be awarded to the Providing Unit for the Event.

The Expected TOR1 is determined for each sample point during the TOR1 Period and compared to the Achieved TOR1. If the Achieved TOR1 is less than the Expected TOR1, the deficit is summated for all sample points and an average deficit produced. If a deficit remains after the application of the Applicable Tolerance a TOR1 failure is recorded.

Where a Frequency Event has occurred while the Providing Unit was Synchronised to the power system, the Providing Unit response to any further Frequency Event occurring within 5 minutes after the end of the Frequency Event will not be taken into account for settlement purposes.

#### **4.6.1.8.1 Calculation of Expected Provision of TOR1**

The Expected TOR1 following a Frequency Event is derived from:

- 1) The Pre-Event Output of the Providing Unit;
- 2) The Pre-Event System Frequency;
- 3) The Time Zero Availability;
- 4) The TOR1 Reserve Characteristic;
- 5) The Time Zero Declared TOR1 ;
- 6) The Declared Governor Droop;
- 7) The Governor Droop Demanded TOR1.
- 8) The Providing Unit Frequency / Capacity Function (if applicable);
- 9) The Unit Load Controller settings, if applicable. If a Unit Load Controller is in service during the Frequency Event the Pre-Event System Frequency and Pre- Event Output of the Providing Unit will be determined using the Unit Load Controller settings.

**4.6.1.8.2 The Governor Droop Demanded TOR1 is calculated by reference to each sample point during the TOR1 Period, as the product of:**

the Governor Droop Providing Unit Related Capacity (MW) and the sample point Frequency delta (Hz) divided by the Declared Governor Droop (PU) times the nominal Frequency (50 Hz).

**4.6.1.8.3 The Expected TOR1 following a Frequency Event is the increase from the Pre-Event Output from the Providing Unit at each sample point during the TOR1 Period and is calculated as the minimum of:**

- a) The TOR1 value determined from the TOR1 Reserve Characteristic in conjunction with;
  - i. the Providing Unit Pre-Event Output and
  - ii. the Time Zero Availability;
- b) The difference between the Providing Unit Pre-Event Output and the Time Zero Availability. In the case of a CCGT only, this value will be adjusted by the Providing Unit Frequency/Capacity Function at each sample point Frequency, if applicable;
- c) The Governor Droop Demanded TOR1;
- d) The Time Zero Declared TOR1.

The sample point Expected TOR1 values are averaged over the TOR1 Period to give the “**Average TOR1 Requirement**”.

**4.6.1.8.4 Calculation of Achieved Provision of TOR1**

The Achieved TOR1 will be calculated for each Sample Point during the TOR1 Period as the Providing Unit MW Output minus the Providing Unit Pre-Event Output.

If the Achieved TOR1 is less than the Expected TOR1, at a sample point, a deficit of TOR1 is recorded. TOR1 deficits averaged over the TOR1 Period produce the “**Average TOR1 Deficit**”.

#### **4.6.1.9**      *Criteria used to determine if TOR1 performance is assessed as Pass or Fail*

Pass/ Fail assessment will be based on whether a Providing Unit fails to achieve a TOR1 response within a defined Applicable Tolerance range from the Expected TOR1 value.

A **'PASS'** will be awarded for a Frequency Event where the Achieved Provision of TOR1 is greater than or equal to the TOR1 Expected Value – (**Maximum** ([10% of TOR1 Expected Value], [1 MW])) **AND** (TOR1 Expected Value  $\geq$  0MW)

A **'FAIL'** will be awarded for a Frequency Event where the Achieved Provision of TOR1 is less than the TOR1 Expected Value – (**Maximum** ([10% of TOR1 Expected Value], [1 MW])) **AND** (TOR1 Expected Value  $\geq$  0MW)

Additionally, if the average Frequency over the first 30 seconds of the TOR1 Period has been greater than 49.8 Hz then neither a PASS or FAIL Data Record will be assigned for that Event.

#### Tertiary Operating Reserve 2 (TOR2)

##### **4.6.1.10**      *TOR2 Performance Scalar*

The TOR2 Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for TOR1 (see Sections 4.6.1.7 to 4.6.1.9. for details on the TOR1 Performance Assessment criteria).

#### Replacement Reserve Synchronised (RRS)

##### **4.6.1.11**      *RRS Performance Scalar*

The RRS Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for TOR1 (see Sections 4.6.1.7 to 4.6.1.9. for details on the TOR1 Performance Assessment criteria).

## 4.6.2 Ramping Category

The Ramping Category for Performance Monitoring includes: RM1, RM3, RM8 and RRD. A similar method of Performance Assessment will be employed for each of these DS3 System Services.

The methods below for each of the DS3 System Services in this category (RM1, RM3, RM8 and RRD) will be used where Providing Units meet the Minimum Data Record Requirements. For Providing Units which do not meet the Minimum Data Record Requirements please refer to Section 4.7 of this document.

### *Ramping Margin 1 (RM1)*

#### **4.6.2.1 Method of Performance Assessment for Ramping Margin 1 (RM1)**

Performance Assessment of the RM1 service will be based on an evaluation of the Providing Unit's ability to follow a Synchronisation Dispatch instruction, for all Providing Units which are not DSUs. For Providing Units which are DSUs performance will be assessed as outlined in Section 4.6.2.2.2.

#### **4.6.2.2 Measurement Process for Ramping Margin 1 (RM1) Performance Assessment**

##### **4.6.2.2.1 Measurement Process for Ramping Margin 1 (RM1) Performance Assessment for all Providing Units except DSUs**

The Providing Unit will be performance assessed using the Fail to Sync process as outlined in EirGrid and SONI Grid Codes Section SDC2.A.4. A summary description of this process is given below:

1. The TSO sends a Synchronisation Dispatch instruction to a Providing Unit,

*e.g. "Time 1300 hours. Unit 1, Synchronise at 1600 hours" .*

2. The Providing Unit accepts the Synchronisation Dispatch instruction (unless the Providing Unit has given notice to the TSO under the provisions of SDC2.4.2.10 regarding non-acceptance of dispatch instructions).

3. If the Providing Unit has not Synchronised 15 minutes after the Start Synchronising Time the TSO will issue a **Failure to Follow Notice to Synchronise** instruction. Otherwise, a **Synchronisation Confirmation Notice** will be sent by the Providing Unit.

#### 4.6.2.2.2 Measurement Process for Ramping Margin 1 (RM1) Performance Assessment for DSUs

Performance Scalar calculation of DSUs will be assessed in accordance with the EirGrid Grid Code Section OC10.4.5.2 and SONI Grid Code Sections OC11.10.3.

Within this section, DSUs are required to meet the five criteria. For reference the EirGrid Grid Code refers to these as shown in *italics* below whilst the SONI Grid Code uses similar text with the exception that “quarter-hour Meter period” becomes “half-hour Meter period”;

*A Demand Side Unit shall be deemed compliant with a Dispatch Instruction if:*

*(i) the Demand Side Unit MW Response to the Dispatch Instruction is achieved in the Demand Side Unit MW Response Time and maintained until the subsequent Dispatch Instruction or until the Maximum Down-Time of the Demand Side Unit has elapsed; and*

*(ii) the Demand Side Unit Performance Monitoring Percentage Error is less than 5% for each full quarter-hour Meter period of the Demand Side Unit MW Response for 90% of the last ten Dispatches or 90% of the Dispatches in a three-hundred and sixty-five day period*

*or*

*the Demand Side Unit Performance Monitoring Error is less than 0.250 MWh for each full quarter-hour Meter period of the Demand Side Unit MW Response in 90% of the last ten Dispatches or 90% of the Dispatches in a three-hundred and sixty-five day period; and*

*(iii) the Demand Side Unit Performance Monitoring Percentage Error is less than 10% for each full quarter-hour Meter period of the Demand Side Unit MW Response*

*or*

*the Demand Side Unit Performance Monitoring Error is less than 0.250 MWh for each full quarter-hour Meter period of the Demand Side Unit MW Response; and*

*(iv) the Demand Side Unit Performance Monitoring Percentage Error is on average less than 5% for each full quarter-hour Meter period of the Demand Side Unit MW Response*

*or*

*the Demand Side Unit Performance Monitoring Error is on average less than 0.250 MWh for each full quarter-hour Meter period of the Demand Side Unit MW Response; and*

*(v) the Demand Side Unit SCADA Percentage Error is less than 5% or the Demand Side Unit SCADA Error is less than 0.250 MWh.*

#### **4.6.2.3 Criteria used to determine if RM1 performance is assessed as Pass or Fail**

##### **4.6.2.3.1 Criteria used to determine if RM1 performance is assessed as Pass or Fail for all Providing Units excluding DSUs**

The Pass/Fail assessment will be based on whether a Providing Unit fails to Synchronise within the 15 minute period following the Synchronising Start Time outlined in the Synchronisation Dispatch Instruction.

A '**PASS**' will be awarded for an Event where a **Synchronisation Confirmation Notice** is issued and accepted by the TSO.

A '**FAIL**' will be awarded for an Event where a **Failure to Follow Notice to Synchronise Instruction** is issued.

##### **4.6.2.3.2 Criteria used to determine if RM1 performance is assessed as Pass or Fail for DSUs**

For a DSU to achieve a '**PASS**' it is required to comply with some of, but not all of the criteria outlined in Section 4.6.2.2.2.

A '**Pass**' Data Record will be awarded should the DSU adhere to all three of Criteria (iii),(iv) and (v) in Section 4.6.2.2.2. A '**Fail**' Data Record will be awarded should the

DSU fail to satisfy one or more of Criteria (iii),(iv) or (v) as outlined in Section 4.6.2.2.2.

For clarity, Criteria (i) and (ii) of Section 4.6.2.2 will not be used in the Performance Scalar assessment of DSUs as they are accounted for inherently through the Pass Rate Methodology outlined in Section 4.2 of this document.

#### *Ramping Margin 3(RM3)*

##### **4.6.2.4**      ***RM3 Performance Scalar***

The RM3 Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for RM1 (see Sections 4.6.2.1 to 4.6.2.3 of this document for details on the RM1 Performance Assessment Criteria).

#### *Ramping Margin 8(RM8)*

##### **4.6.2.5**      ***RM8 Performance Scalar***

The RM8 Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for RM1 (see Sections 4.6.2.1 to 4.6.2.3 of this document for details on the RM1 Performance Assessment Criteria).

#### *Replacement Reserve Desynchronised (RRD)*

##### **4.6.2.6**      ***RRD Performance Scalar***

The RRD Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for RM1 (see Sections 4.6.2.1 to 4.6.2.3 of this document for details on the RM1 Performance Assessment Criteria).

### **4.6.3 Fast-acting Category**

The three new fast-acting DS3 System Services (FFR, FPFAPR and DRR) will not be subject to Performance Monitoring during the Interim Arrangements. These services will be procured through the Qualification Trial Process.

For the Interim Arrangements the following values will apply to the respective Performance Scalars of FFR, FPFAPR and DRR:

FFR Performance Scalar = 1

FPFAPR Performance Scalar = 1

DRR Performance Scalar = 1

#### **4.6.4 Reactive Power Category**

The Steady State Reactive Power (SSRP) service will not be subject to Performance Monitoring at the start of the Interim Arrangements. Once a Providing Unit contracted to provide SSRP has satisfied the relevant Compliance Requirements, it will be entitled to payment for provision of the service in accordance with the terms outlined in Schedule 3 of the Framework Agreement. At the start of the Interim Arrangements, the following value will apply to the SSRP Performance Scalar:

SSRP Performance Scalar = 1

The TSOs are currently developing an enhanced performance monitoring tool which will be available during the Interim Arrangements which could be used to Performance Monitor the SSRP service. An introduction of Performance Monitoring for the SSRP service would be preceded by an industry consultation on the Performance Monitoring methodology. For clarity, the SSRP Performance Scalar will remain equal to 1 until such time as new Performance Monitoring arrangements for SSRP are agreed following consultation and implemented.

#### **4.6.5 Inertia Category**

The Synchronous Inertial Response (SIR) service will not be subject to Performance Monitoring during the Interim Arrangements. Once a Providing Unit contracted to provide SIR has satisfied the relevant Compliance Requirements, it will be entitled to payment for provision of the services in accordance with the terms outlined in Schedule 4 of the Framework Agreement.

#### 4.7 Providing Units with less than the Minimum Data Record Requirements

Should a Providing Unit fail to meet the Minimum Data Records Requirements outlined in Table 2, a Data Poor Performance Scalar, based on a combination of the Providing Unit's own data and the Industry Average Performance, will be used to calculate its Performance Scalar. Mathematically, this can be described as below;

$$\text{Industry Average Performance (R)} = P / (P + F)$$

$$\text{Industry Average Performance Scalar (S)} = \text{Minimum [1, Maximum[0, (R-0.5)/ (0.9-0.5)]]}$$

$$\text{Data Poor Performance Scalar (D)} = \text{if } [(n < M), (\sum_{i=1}^n X_i) + (M-n)x(S)] / M]$$

Where the single letter acronyms are explained in Table 4 below.

**Table 4: Acronyms used for Data Poor Performance Scalar Calculation.**

Description	Acronym
Total Number of Pass Data Records over the Data Backstop Timeframe	P
Total Number of Fail Data Records over the Data Backstop Timeframe	F
Data Backstop Timeframe	T
Industry Average Performance	R
Industry Average Performance Scalar	S
Data Poor Performance Scalar	D
Number of Data Records available for a Providing Unit	n
Minimum Data Records Requirement	M
Index for Individual Data Record	i
Individual Data Record Result "Pass"(1) or "Fail"(0)	Xi

For example, with a Minimum Data Records Requirement of five Data Records, a Providing Unit with two Data Records will have its Performance Scalar based on its own performance for its two Data Records, while the additional three Data Records required to satisfy the Minimum Data Record Requirements will be based on the Industry Average Performance Scalar. This can be seen in the worked example in Table 5 below.

**Table 5: Worked Example of the Weighted Industry Average Calculation**

Minimum Data Record Requirements ( <b>M</b> )	5
Industry Average Performance Scalar ( <b>S</b> )	0.8
No. of Providing Unit Events Recorded ( <b>X</b> )	3 ( 2 x <b>Pass (P)</b> , 1 x <b>Fail (F)</b> )

$$\text{Data Poor Performance Scalar} = \frac{2(1)+1(0)+2(0.8)}{5} = 0.72$$

For the avoidance of doubt, the Industry Average Performance is calculated on a per DS3 System Service basis and includes all Data Records over the entire Data Backstop Timeframe and is independent of any Technology Categorisation.

#### 4.8 Testing / Re-testing of Providing Units

For a new Providing Unit, two ('Pass') Data Records, which contribute to the calculation of its Performance Scalar, can be awarded upon completion of the relevant testing procedures. This is to account for the fact that a new Providing Unit will not have had an opportunity to contribute to an Industry Average Performance and allows it to achieve a Performance Scalar based on its actual performance in a shorter timeframe.

A similar approach can be applied where an existing Providing Unit intends to make improvements to its plant to achieve more consistent performance. Upon completion of the relevant testing procedure, the award of two ('Pass') Data Records can also be made. In this scenario, the proposed improvements to be completed and details of testing arrangements required must be agreed

with the TSO in advance of any work taking place and will depend on the TSO being satisfied of reasonable proof of work to improve performance. This attempts to offer an incentive for existing Providing Units to improve their performance by affording them the opportunity to improve their Performance Scalar.

For the avoidance of doubt, historical Data Records for these Providing Units will continue to contribute to the calculation of their Performance Scalar along with Data Records assigned by passing the agreed testing procedure.

This arrangement will apply to the Interim Arrangements and will be reviewed ahead of the Enduring Arrangements.

## **Appendix 1: References to the Protocol in the DS3 System Services Framework Agreement**

The following appendix details references made to this Protocol document in the DS3 System Services Framework Agreement.

### **3.2 Compliance with the Grid Code, Distribution Code and Protocol**

3.2.1 The Service Provider shall, during the term of this Agreement, comply with the Grid Code, Distribution Code and the Protocol as appropriate as it relates to the provision of the DS3 System Services, (including declaring to the Company any inability to comply with the applicable Operating Parameters), subject to any derogations granted to the Service Provider by the Regulatory Authority.

## **4 Payment**

### **4.2 Payments**

4.2.1 In consideration of the provision of the DS3 System Service(s) pursuant to this Agreement the Company shall pay the Service Provider the payments (“**DS3 System Service Payments**”) as calculated in accordance with the Schedule(s) relating to the Relevant DS3 System Service(s) provided always that the Service Provider has passed all Compliance Requirements as set out in the Protocol.

## **5 Monitoring and Metering**

5.1 The Company may use, or install in accordance with the Protocol, Metering Equipment and Monitoring Equipment to ensure that the Service Provider is complying with its obligations to provide the Relevant DS3 System Services from the Providing Unit both in accordance with the Grid Code or Distribution Code or the Protocol where applicable and in accordance with the terms of this Agreement.

**“Compliance Requirements”** has the meaning given to it in the Protocol;

**“Fail”** has the meaning given to it in the Protocol;

**“Pass”** has the meaning given to it in the Protocol;

**“Performance Assessment”** has the meaning given to it in the Protocol;

**“Performance Scalar”** means a multiplicative factor which adjusts the payment for a given DS3 System Service to reflect a Providing Unit’s delivery of a given DS3 System Service as determined in accordance with the provisions of the Protocol;

**“Protocol”** means the document entitled “DS3 System Services Protocol” as published on the Company’s website ([www.eirgridgroup.com](http://www.eirgridgroup.com));

## Glossary

**“Achieved”** means the actual level of a DS3 System Service which a Providing Unit provides in response to an Event;

**“Applicable Tolerance”** means in relation to a DS3 System Service, the amount a Providing Unit’s Achieved response is allowed to vary from its Expected response and still be considered as a ‘Pass’. If this Applicable Tolerance is exceeded for an Event, the Performance Assessment will be deemed a Fail;

**“Assessment Period”** means the time period over which a Performance Scalar is calculated. It is dependent on a number of criteria including the Data Start Date, Data Backstop Timeframe and the Data Backstop Limit;

**“Availability”** has the meaning given to it in the Grid Code;

**“Available Volume”** has the meaning given to it in the Framework Agreement;

**“Average SOR Deficit”** has the meaning given to it in Section 4.6.1.5.4;

**“Average SOR Requirement”** has the meaning given to it in Section 4.6.1.5.3;

**“Average TOR1 Deficit”** has the meaning given to it in Section 4.6.1.8.4;

**“Average TOR1 Requirement”** has the meaning given to it in Section 4.6.1.8.3;

**“Category of System Service”** means the grouping of a number of DS3 System Services based on similar performance assessment methods;

**“Company”** has the meaning given to it in the Framework Agreement;

**“Compliance Requirements”** means the assessment to determine that a Service Provider satisfies the TSOs’ criteria for providing a given DS3 System Service from a given Providing Unit.

**“Compliance Test”** means the process of assessing that Compliance Requirements are satisfied;

**“Data Backstop Limit”** means the maximum number of Data Records used to calculate a Performance Scalar (for “Data Rich” scenarios only);

**“Data Backstop Timeframe”** means the cut-off point beyond which historical Data Records are no longer deemed to be relevant for use in the calculation of a Providing Unit’s latest Performance Scalar;

**“Data Poor”** means a classification for Providing Units which do not meet the Minimum Data Records Requirements;

**“Data Poor Performance Scalar”** means the Performance Scalar calculation methodology to be used if a Providing Unit is deemed to be Data Poor. It consists of a combination of the Providing Unit’s own data records and the Industry Average Performance;

**“Data Record”** means performance evidence for each DS3 System Service, gathered from a Data Source, which will have a value of Pass or Fail, used to determine a Performance Scalar;

**“Data Rich”** means a classification for Providing Units which meet the Minimum Data Records Requirements;

**“Data Source”** means the source of the data used to collect Data Records used in the calculation of a Providing Unit’s Performance Scalar;

**“Data Start Date”** means the earliest possible date from which Data Records can be used to calculate Performance Scalars. Any Data Records prior to this date will not be considered for Performance Scalar assessment calculations;

**“Declared”** has the meaning given to it in the Framework Agreement;

**“Declaration”** has the meaning given to it in the Grid Code;

**“Demand Side Unit”** has the meaning given to it in the Grid Code;

**“Demand Side Unit Performance Monitoring Error”** has the meaning given to it in the EirGrid Grid Code and SONI Grid Code;

**“Demand Side Unit Performance Monitoring Percentage Error”** has the meaning given to it in the EirGrid Grid Code and SONI Grid Code;

**“Demand Side Unit SCADA Percentage Error”** has the meaning given to it in the EirGrid Grid Code and SONI Grid Code;

**“Dispatch”** has the meaning given to it in the Framework Agreement;

**“DRR”** has the meaning given to it in the Framework Agreement;

**“DS3 System Services”** has the meaning given to it in the Framework Agreement;

**“EDIL”** means Electronic Dispatch Instruction Logger;

**“EDIL ‘Fail to Sync’ Instructions”** means a Providing Unit’s adherence to the Synchronisation Dispatch Instruction process as defined in the Grid Code;

**“Enduring Arrangements”** means the arrangements for DS3 System Services from 1 October 2017;

**“Event Recorder”** has the meaning given to it in the Framework Agreement;

**“Event”** for the purposes of DS3 System Services means an incident after which a Service Provider’s delivery of a given DS3 System Service is evaluated. Depending on the service being assessed an Event can be any of the following:

- A Dispatch instruction
- A Frequency Event as defined in this Glossary

**“Expected”** means, in relation to DS3 System Services, the level of response that a Providing Unit is expected to provide in response to an Event taking account of tolerances where appropriate;

**“Fail”** means the outcome of a Performance Assessment where the response achieved following an Event is less than the expected response taking account of tolerances where appropriate;

**“Failure to Follow Notice to synchronise”** has the meaning given to it in the Grid Code;

**“FFR”** has the meaning given to it in the Framework Agreement;

**“FPFAPR”** has the meaning given to it in the Framework Agreement;

**“Framework Agreement”** means the document titled DS3 System Services Framework Agreement including all applicable Schedules, and Appendices as may be amended and/or supplemented by agreement of the Parties;

**“Frequency”** has the meaning given to it in the Grid Code;

**“Frequency Event”** means an occasion when the power System Frequency falls through 49.5 Hz. The start of the Frequency Event is referred to as time zero (T=0 seconds) and is timed from the Frequency falling through 49.8 Hz. The Frequency Event ends when the Frequency rises back above 49.5 Hz;

**“Frequency Event Nadir”** means the point at which the minimum Frequency occurs during the POR period. The Frequency at this point is referred to as the **“Nadir Frequency”** and the **“Nadir Time”** means the time which the Frequency

Event Nadir occurs;

**“Frequency Injection Testing”** means a type of testing in which frequency step changes are injected into a Providing Unit to assess its MW output response;

**“Governor Droop”** has the meaning given to it in the Grid Code;

**“Governor Droop Demanded”** means, in relation to POR, SOR or TOR1, the level of provision of POR, SOR or TOR1 expected to be achieved by a Providing Unit governor action calculated in accordance with sections 4.6.1.2.3, 4.6.1.5.2 and 4.6.1.8.2 of this document;

**“Governor Droop Providing Unit Related Capacity”** means the machine capacity relating to the operation of the Frequency control system of a Providing Unit;

**“Grid Code”** means the EirGrid Grid Code for Providing Units residing in Ireland and the SONI Grid Code for Providing Units residing in Northern Ireland unless explicitly stated otherwise;

**“H Constant (Inertia Constant)”** means a parameter inherent to all synchronous machines measured in MWs/MVA. The H constant of a Providing Unit can be found in Schedule 9 of the Framework Agreement;

**“Harmonised Ancillary Services (HAS)”** means the mechanism of procuring ancillary services in Ireland and Northern Ireland preceding DS3 System Services;

**“Industry Average Performance”** means the number of “Pass” Data Records calculated as a percentage of the total number of Data Records of all Providing Units for a given DS3 System Service over the full Assessment Period. This value is used in the calculation of an Industry Average Scalar;

**“Industry Average Scalar”** means the Performance Scalar associated with the Industry Average Performance;

**“Inertia Response Calculation Tolerance”** has the meaning given to it in Section 4.6.1.2.1 of this document;

**“Inertial Response”** has the meaning given to it in Section 4.6.1.2.1 of this document;

**“Interim Arrangements”** means the arrangements for DS3 System Services from 1 October 2016 to 30 September 2017;

**“Minimum Data Records Requirement”** means the minimum number of Data Records deemed sufficient for a given Providing Unit to calculate a performance scalar based on the Providing Unit’s data alone. Providing Units that meet the Minimum Data Record Requirements are classified as “Data Rich” Those that do not are classified as “Data Poor”.

**“Minimum Data Resolution Requirements”** means the minimum time sampling and high level technical requirements for data to be deemed suitable for use in performance assessment of a DS3 System Service;

**“Monitoring Equipment”** has the meaning given to it in the Framework Agreement;

**“Nadir Frequency”** has the meaning given to it in Section 4.6.1.2.1 of this document;

**“Nadir Frequency Delta”** has the meaning given to it in Section 4.6.1.2.1 of this document;

**“Nadir Time”** has the meaning given to it in Section 4.6.1.2.1 of this document;

**“Nominal Frequency”** will for the purpose of this document be considered to be 50Hz;

**“Pass”** means the outcome of a Performance Assessment where the response achieved following an Event is greater than or equal to the expected response taking account of tolerances where appropriate;

**“Pass Rate Methodology”** has the meaning given to it in Section 4.2 of this Protocol document;

**“Payment Rate”** has the meaning given to it in the Framework Agreement;

**“Performance Assessment”** means the evaluation of a Service Provider’s delivery of a given DS3 System Service following an Event;

**“Performance Monitoring”** means a method to determine whether a specified DS3 System Service has been delivered in the required manner and within the specified timelines;

**“Performance Scalar”** means a multiplicative factor which adjusts the payment for a given DS3 System Service to reflect a Providing Unit’s delivery of the service as determined in accordance with the provisions of this document;

**“PMU”** means Phasor Measurement Unit and is a Monitoring Equipment device which can be used to measure a number of DS3 System Services;

**“POR DS3 System Services Reserve Characteristics”** means the specific POR reserve data parameters outlined for a DS3 System Service in Schedule 9 of the Framework Agreement;

**“POR Period”** means the time period after the instant of an Event that POR is expected to be provided. The POR period is taken to be between T+5 seconds to T+15 seconds after an Event where T=0 is the instant of the Event;

**“POR”** has the meaning given to it in the Framework Agreement;

**“POR Governor Droop Multiplier”** has the meaning given to it in Section 4.6.1.2.2

of this document;

**“POR Governor Droop Multiplier Alpha”** means, in relation to POR, the Operating Parameter set out in Schedule 9 of the Framework Agreement;

**“POR Governor Droop Multiplier Beta”** means, in relation to POR, the Operating Parameter set out in Schedule 9 of the Framework Agreement ;

**“POR Reserve Characteristic”** means the POR reserve parameters in Schedule 9 of the Framework Agreement;

**“Pre-Event Output”** means, in relation to the assessment of POR, SOR and TOR1 performance of a Providing Unit, the average MW output of the Providing Unit during the period 60 seconds to 30 seconds before the start of a Frequency Event;

**“Pre-Event System Frequency”** means the average Frequency of the Power System during the period 60 seconds to 30 seconds before the start of a Frequency Event;

**“Product Scalar”** has the meaning given to it in the Framework Agreement;

**“Protocol”** means this document entitled “DS3 System Services Protocol” as published on the Company’s website ([www.eirgridgroup.com](http://www.eirgridgroup.com));

**“Providing Unit”** has the meaning given to it in the Framework Agreement;

**“Providing Unit Frequency / Capacity Function”** means the decrease in MW Output of a Providing Unit below its Registered Capacity during a period in which the system frequency is below 49.5 Hz, such decrease being no more than pro rata with any decrease below nominal frequency;

**“Providing Unit Output Delta”** has the meaning given to it in Section 4.6.1.2.1 of this document;

**“QH Metering Data”** means the Quarterly Hourly meter data received from the MRSO for all individual MPRNs (Meter Point Reference Number) in Ireland or similarly the Half Hourly metering data for purposes of MPRNs in Northern Ireland;

**“Reliability”** means the number of “Pass” Data Records calculated as percentage of the total number of data records for a given DS3 System Service over the assessment period. This value is used in the calculation of a Performance Scalar and gives an assessment of how often a Providing Unit achieves its Expected response;

**“Reserve Trigger Frequency”** has the meaning given to it in the Framework Agreement;

**“RM1”** has the meaning given to it in the Framework Agreement;

**“RM3”** has the meaning given to it in the Framework Agreement;

**“RM8”** has the meaning given to it in the Framework Agreement;

**“RRD”** has the meaning given to RR(De-synchronised) in the Framework Agreement;

**“RRS”** has the meaning given to RR(Synchronised) in the Framework Agreement;

**“Sample Point”** means a single data point which is used along with multiple other data points in the development of a Performance Assessment;

**“Scalar Assessment Frequency”** means the frequency with which a Performance Scalar will be recalculated;

**“Scaling Factor”** has the meaning given to it in the Framework Agreement;

**“Service Provider”** has the meaning given to it in the Framework Agreement;

**“SOR”** has the meaning given to it in the Framework Agreement;

**“SOR Reserve Characteristic”** means the SOR reserve parameters in Schedule 9 of the Framework Agreement;

**“Synchronisation Confirmation Notice”** means the process in which a Providing Unit communicates to the TSO that Synchronisation has occurred and the TSO issues a new dispatch instruction accordingly;

**“Synchronisation Dispatch Instruction”** means a dispatch instruction issued by the TSO to a Providing Unit with due regard for the Synchronising Start up time (for cold, hot, warm states) declared by the Generator as a Technical Parameter. The instruction will follow the form, for example:

*“Time 1300 hours. Unit 1, Synchronise at 1600 hours”.*

In relation to an instruction to Synchronise, the **Start Synchronising time** will be deemed to be the time at which **Synchronisation** is to take place;

**“Synchronous Providing Unit”** has the meaning given to it in the Framework Agreement;

**“Time Stamped and Synchronised to a common time”** means, in relation to received data, consistent with what is recorded within internal EirGrid systems;

**“Time Weighted Average”** has the meaning given to it in the Framework Agreement;

**“Time Zero Availability”** means the MW level declared by a Providing Unit to be available at the start of a Frequency Event (T=0);

**“Time Zero Declared”** means the amount of reserve (either POR, SOR or TOR1)

declared to be available by a Providing Unit at the start of a Frequency Event (T=0);

“**TOR1**” has the meaning given to it in the Framework Agreement;

“**TOR1 Reserve Characteristic**” means the TOR1 reserve parameters in Schedule 9 of the Framework Agreement;

“**TOR2**” has the meaning given to it in the Framework Agreement;

“**Trading Period Duration**” has the meaning given to it in the Framework Agreement;

“**Trading Period Payment**” has the meaning given to it in the Framework Agreement;

“**Technology Categorisation**” means the grouping of Providing Units into subsets based on similarities in their technical properties;

“**Unit Load Controller**” means a device used to regulate the generation level of a Providing Unit (when it is operating so that its generation level is varied automatically to compensate for variations in the Frequency of the power system) to ensure as far as possible that it does not exceed or fall short of previously set limits;

“**Working Day**” means a weekday which is not a public holiday or bank holiday in Ireland or Northern Ireland;