

DS3 System Services Protocol – Interim Arrangements

DS3 System Services Implementation Project

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Version 2.0

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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 any future arrangements will be consulted on separately.

Equation 1 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.

Equation 1: Calculation of Trading Period Payments for Interim Arrangements

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

The payment rates are included in the DS3 System Services Statement of Payments. Depending on the service, the Scaling Factor consists of one or more scalar types including the Product Scalar and the Performance Scalar. Product Scalars are defined in the Framework Agreement. The methodology for calculating DS3 System Services Performance Scalars 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 as well as details on the query management and business process for application of Performance Scalars.

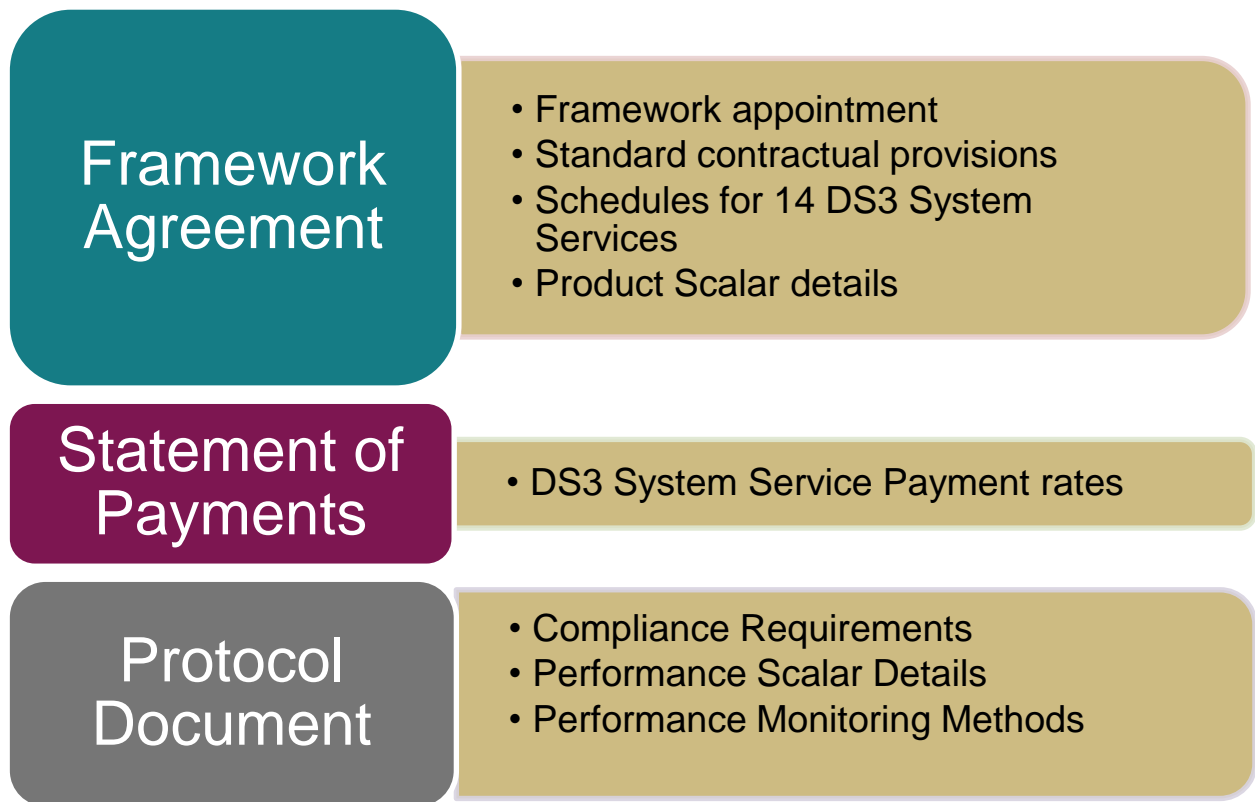


Figure 1: Overview of Framework Agreement and associated documents

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).

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
Synchronous Inertial Response	SIR	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.
Fast Frequency Response	FFR	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.
Dynamic Reactive Response	DRR			
Fast Post-Fault Active Power Recovery	FPFAPR			
Primary Operating Reserve	POR	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.
Secondary Operating Reserve	SOR			
Tertiary Operating Reserve 1	TOR1			
Tertiary Operating Reserve 2	TOR2			
Ramping Margin 1 Hour	RM1	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.
Ramping Margin 3 Hour	RM3			
Ramping Margin 8 Hour	RM8			
Replacement Reserve (De-Synchronised)	RRD			
Replacement Reserve (Synchronised)	RRS			
Steady-State Reactive Power	SSRP			

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 and thresholds.

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 Performance Scalar Calculation Methodology

A Performance Scalar value between 1 and 0, depending on how well a Providing Unit has performed in line with the Performance Assessment methodologies, will be calculated on a monthly basis. This Performance Scalar will be calculated over a number of Events, where enough data is available.

There are two core elements to the DS3 System Services Performance Scalar calculation;

- a) The Monthly Performance Scaling Factor (K_m), and
- b) The Dynamic Time Scaling Factor (V_m).

The Monthly Performance Scaling Factor (K_m)

For every Event, an Event Scaling Factor (Q_i) is calculated based on the Providing Units response in line with the Performance Assessment methodologies. The specifics of how the Event Scaling Factor (Q_i) is calculated are detailed under Section 4.5 of this document.

The Monthly Performance Scaling Factor (K_m) is then calculated using the outcomes of all applicable Performance Assessments undertaken within each calendar month.

Equation 2: Calculation of monthly Performance Scaling Factor (K_m)

$$K_m = \text{AVERAGE } (Q_{im})$$

Where;

m = Month within which the Events occurred

i = the Event number for that month (e.g. Event 1, 2, 3 etc)

Q = the Event Scaling Factor as calculated in line with Section 4.5 of this document.

The Dynamic Time Scaling Factor (V_m)

The Dynamic Time Scaling Factor (V_m) is calculated based on the difference between the month in which the Events occurred and the Scalar Assessment Month in which the DS3 Performance Scalar is being calculated for. The purpose of this is to place more emphasis on the most recent Events. The Dynamic Scaling Factor Element (V_m) is calculated as follows:

Table 2: Calculation of the Dynamic Time Scaling Element 'V'

Number of Months between Event Month and Scalar Assessment Month 'M'	Dynamic Time Scaling Element 'V'
1	1
2	0.8
3	0.6
4	0.4
5	0.2
6+	0

Using this Scaling Factor the maximum duration an Event can impact the Performance Scalar is at most 5 months with the impact lessening each month.

Performance Scalar Calculation (P)

The Performance Scalar 'P' is subsequently calculated based on the sum of the products of the Monthly Performance Scaling Factor ' K_m ' and the Dynamic Time Scaling Element ' V_m ' defined above. It is calculated based on the formula outlined in Equation 3 as one minus the products.

Equation 3: Calculation of DS3 Performance Scalar

$$P = \text{MAX} (1 - \text{SUM} (K_m * V_m), 0)$$

4.3 Performance Categorisation – Interim Arrangements

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.

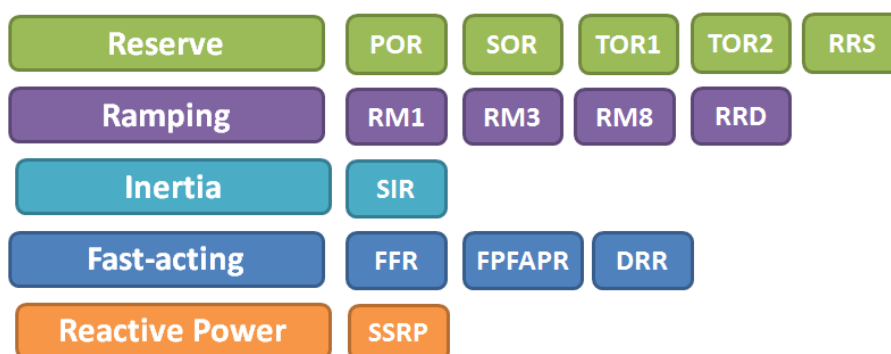


Figure 2 Categorisation of the 14 DS3 System Services for performance monitoring

The philosophy for the Interim Arrangements Performance Monitoring is to assess performance over a number of Events. Table 3 summarises the data sources used for assessment of the Interim Arrangements Performance Scalars.

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 Records Requirements.

Table 3: 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	All Providing Units excluding Demand Side Units (DSUs): EDIL <i>Fail to Sync</i> Instructions	N/A	N/A	N/A

		DSUs: Aggregated SCADA demand data and / or QH Meter Data for each Individual Demand Site (IDS)			
Data Record	A Providing Unit's MW response to any Frequency Event in which the Providing Unit's Expected Response is greater than or equal to 0 MW including tolerances	For All Providing Units excluding DSUs : A Providing Unit's response to a Synchronisation Dispatch instruction For DSUs: A Providing Unit's response to a dispatch instruction as defined in the EirGrid Grid Code Section OC10.4.5.2 / SONI Grid Code Section OC11.10.3	N/A	N/A	N/A
Minimum Data Resolution Requirements	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	For All Providing Units excluding DSUs: EDIL Sync Instructions. For DSUs: QH Metering Data for 12 weeks prior to the dispatch instruction for each IDS and	N/A	N/A	N/A

		Aggregated SCADA demand data			
Minimum Data Record Requirements	1 Data Record per 12 Months	1 Data Record 12 Months	N/A	N/A	N/A
Scalar Assessment Frequency	Monthly in Arrears	Monthly in Arrears	N/A	N/A	N/A

4.4 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 4 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 4: 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

4.5 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 the Event Scaling Factor (Q_i) for each service which in turns feeds into the overall DS3 Performance Scalar.

4.5.1 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 Records Requirements. For Providing Units which do not meet the Minimum Data Records Requirements please refer to Section 4.6 of this document.

Primary Operating Reserve (POR)

4.5.1.1 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**.

4.5.1.2 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 how the Event Scaling Factor (Q_i) will be applied 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.

Multiple Frequency Events

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.

4.5.1.2.1 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.

4.5.1.2.2 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.

4.5.1.2.3 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)

4.5.1.2.4 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.

4.5.1.2.5 Calculation of Achieved Provision of POR:

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

4.5.1.3 Calculation of Event Scaling Factor Q_i for Provision of POR

For each Frequency Event, where the following holds;

- a) the Expected POR Response (inclusive of the POR Inertia Credit) minus the lesser of 10% or 1 MW is greater than or equal to 0 MW; or
- b) the Achieved POR Response is greater than the Expected POR Response (excluding the POR inertia credit tolerances).

Then the **Event Scaling Factor 'Q_i'** is then calculated as follows;

$$\text{Let } S = \frac{\text{Achieved POR Response}}{\text{Expected POR Response (inclusive of the POR Inertia Credit) - MIN (10\%, 1 MW)}}$$

$$\text{If } S \geq 0.9, Q_i = 0,$$

$$\text{If } S \leq 0.7, Q_i = 1,$$

$$\text{Otherwise, } Q_i = (0.9 - S) * 5.$$

Equation 4: Calculation of Event Scaling Factor 'Q_i' for Primary Operating Reserve

This results in a Providing Unit being awarded a Pass should they achieve greater than 90% of their Expected POR response, a Fail if they achieve less than 70% and a Partial Pass should they achieve between 70% – 90%.

Otherwise, a N/A data record will apply to the Providing Unit for the Event.

Secondary Operating Reserve (SOR)

4.5.1.4 *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**.

4.5.1.5 *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 how the Event Scaling Factor (Q_i) will be applied 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.

Multiple Frequency Events

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.

4.5.1.5.1 **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.

4.5.1.5.2 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).

4.5.1.5.3 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**”.

4.5.1.5.4 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”.

4.5.1.6 Calculation of Event Scaling Factor Q_i for Provision of SOR

For each Frequency Event, where the following holds;

- a) the Expected SOR Response minus the lesser of 10% or 1 MW is greater than or equal to 0 MW; or
- b) the Achieved SOR Response is greater than Expected SOR Response.

Then the **Event Scaling Factor ‘ Q_i ’** is then calculated as follows;

$$\text{Let } S = \frac{\text{Achieved SOR Response}}{\text{Expected SOR Response} - \text{MIN}(10\%, 1 \text{ MW})}$$

If $S \geq 0.9$, $Q_i = 0$,

If $S \leq 0.7$, $Q_i = 1$,

Otherwise, $Q_i = (0.9 - S) \times 5$.

Equation 5: Calculation of Event Scaling Factor ‘ Q_i ’ for Secondary Operating Reserve

This results in a Providing Unit being awarded a Pass should they achieve greater than 90% of their Expected SOR response, a Fail if they achieve less than 70% and a Partial Pass should they achieve between 70% – 90%.

Otherwise, a N/A data record will apply to the Providing Unit for the Event.

Tertiary Operating Reserve (TOR1)

4.5.1.7 *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**.

4.5.1.8 *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 how the Event Scaling Factor (Q_i) will be applied 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.

Multiple Frequency Events

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.

Additionally, if the average Frequency over the first 30 seconds of the TOR1 Period has been greater than 49.8 Hz then the performance event will not be assessed and a N/A data record will be applied to the event.

4.5.1.8.1 **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.

4.5.1.8.2 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).

4.5.1.8.3 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**”.

4.5.1.8.4 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”.

4.5.1.9 Calculation of Event Scaling Factor Q_i for Provision of TOR1

For each Frequency Event, where the following holds;

- a) the Expected TOR1 Response minus the lesser of 10% or 1 MW is greater than or equal to 0 MW; or
- b) the Achieved TOR1 Response is greater than Expected TOR1 Response.

Then the **Event Scaling Factor ‘ Q_i ’** is then calculated as follows;

$$\text{Let } S = \frac{\text{Achieved TOR1 Response}}{\text{Expected TOR1 Response} - \text{MIN}(10\%, 1 \text{ MW})}$$

If $S \geq 0.9$, $Q_i = 0$,

If $S \leq 0.7$, $Q_i = 1$,

Otherwise, $Q_i = (0.9 - S) \times 5$.

Equation 6: Calculation of Event Scaling Factor ‘ Q_i ’ for Tertiary Operating Reserve 1

This results in a Providing Unit being awarded a Pass should they achieve greater than 90% of their Expected TOR1 response, a Fail if they achieve less than 70% and a Partial Pass should they achieve between 70% – 90%.

Otherwise, a N/A data record will apply to the Providing Unit for the Event.

Tertiary Operating Reserve 2 (TOR2)

4.5.1.10 TOR2 Performance Scalar

The TOR2 Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for TOR1 (see Sections 4.5.1.7 to 4.5.1.9 for details on the TOR1 Performance Assessment criteria).

Replacement Reserve Synchronised (RRS)

4.5.1.11 RRS Performance Scalar

The RRS Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for TOR1 (see Sections 4.5.1.7 to 4.5.1.9 for details on the TOR1 Performance Assessment criteria).

4.5.2 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 4.6 of this document.

Ramping Margin 1(RM1)

4.5.2.1 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 4.5.2.2.2.

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

4.5.2.2.1 **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.

4.5.2.2.2 **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.

4.5.2.3 Calculation of Event Scaling Factor Q_i for Ramping Margin 1 (RM1)

4.5.2.3.1 Criteria used to determine Event Scaling Factor Q_i for RM1 for all Providing Units excluding DSUs

The Event scaling factor (Q_i) is calculated as follows;

If Sync Instruction = 'Fail', $Q_i = 1$,

If Sync Instruction = 'Pass', $Q_i = 0$.

Equation 7: Calculation of Event Scaling Factor 'Q' for Ramping Margin 1

This results in a unit being awarded a Pass ("0") should they pass a Synchronisation Instruction, and a Fail ("1") should they not.

4.5.2.3.2 Criteria used to determine Event Scaling Factor Q_i for RM1 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 4.5.2.2.2.

A 'Pass' Data Record will be awarded should the DSU adhere to all three of Criteria (iii), (iv) and (v) in Section 4.5.2.2.2.

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 4.5.2.2.2.

For clarity, Criteria (i) and (ii) of Section 4.5.2.2.2 will not be used in the Performance Scalar assessment of DSUs.

The Event scaling factor (Q_i) is calculated as follows;

If Event Response = 'Fail', $Q_i = 1$,

If Event Response = 'Pass', $Q_i = 0$.

Equation 8: Calculation of Event Scaling Factor 'Q' for Ramping Margin 1 - DSUs

This results in a unit being awarded a Pass ("0") should they meet the required performance thresholds for DSUs, and a Fail ("1") should they not.

Ramping Margin 3(RM3)

4.5.2.4 RM3 Performance Scalar

The RM3 Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for RM1 (see Sections 4.5.2.1 to 4.5.2.3 of this document for details on the RM1 Performance Assessment Criteria).

Ramping Margin 8(RM8)

4.5.2.5 RM8 Performance Scalar

The RM8 Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for RM1 (see Sections 4.5.2.1 to 4.5.2.3 of this document for details on the RM1 Performance Assessment Criteria).

Replacement Reserve Desynchronised (RRD)

4.5.2.6 RRD Performance Scalar

The RRD Performance Scalar for the Providing Unit will be set equal to the Performance Scalar calculated for RM1 (see Sections 4.5.2.1 to 4.5.2.3 of this document for details on the RM1 Performance Assessment Criteria).

4.5.3 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.

4.5.4 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

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.

4.5.5 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.

4.6 Providing Units with less than the Minimum Data Records Requirements

Should a Providing Unit fail to meet the Minimum Data Records Requirements outlined in Table 3, the unit is subsequently assessed under the Data Poor Performance Scalar methodology. The purpose of the Data Poor Performance Scalar methodology is to provide a mechanism through which the TSO can apply some form of performance monitoring to a subset of Providing Units who either;

- a) have not been assessed against an Event over a long period of time
- b) have been available during Events, however, due to the application of tolerances their performance is not assessed as their expected response is constantly less than 0 MW.

The Data Poor Performance Scalar is applied as a reducing scalar overtime based on how many months a Providing Unit has gone without providing an assessable response to an Event.

Following 12 months without a Performance Event, the Performance Scalar will begin to tend towards zero over a period of 3 years, with the scalar reducing from 1 to 0.7 over the period of 12 – 30 months and more rapidly from 0.7 to 0 between 30 to 48 months as shown below;

Table 5: Data Poor Performance Scalar Calculations

Months without an event (M)	Performance Scalar Calculation (P)
< 12 Months (M)	$\text{MAX}(1 - \text{SUM}(K_m * V_m), 0)$
$12 \leq \text{Months (M)} < 30$	$0.7 + ((30 - M) * (0.3/18))$
$30 \leq \text{Months (M)} < 48$	$(48 - M) * (0.7/18)$
>48 Months (M)	0

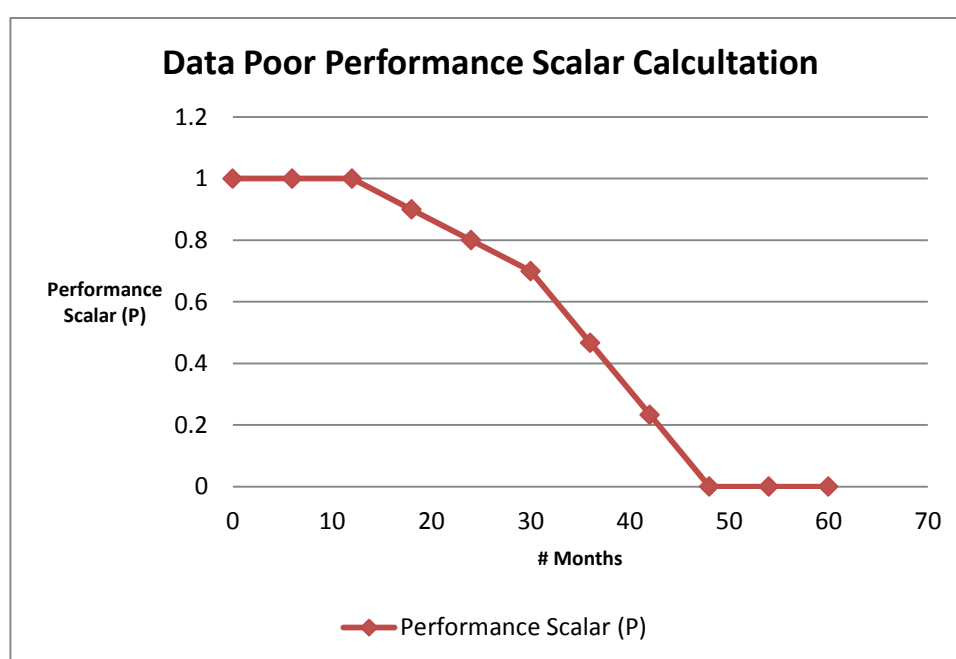


Figure 3: Graphical Representation of Performance Scaling using the Data Poor Scalar Calculation

For any Providing Unit which fails to adhere to the Minimum Data Record Requirements and subsequently enters into the Data Poor Performance Scalar assessment category the unit can rectify their scalar back to 1 through two possible mechanisms;

- An Event occurs whilst the unit is online and provides an assessable response. Upon responding to said Event the unit will automatically return to the normal Performance Scalar calculation mechanism outlined in Section 4.2 with a Performance Scalar based on their response to said Event.

- b. The unit can apply for a Performance Test. Upon submission of an application the Providing Unit will be assessed in line with the High Level Data Poor Performance Scalar business process described in Figure 4. Depending on the TSOs assessment, a Performance Test may be required to reset the Performance Scalar to 1 and month 'M' to 0. Should a test be deemed required by the TSO the specifics will be decided and agreed on a case by case basis. More detail of this including how to apply are outlined in Section 4.7 of this document.

Data Poor Performance Scalar High Level Business Process

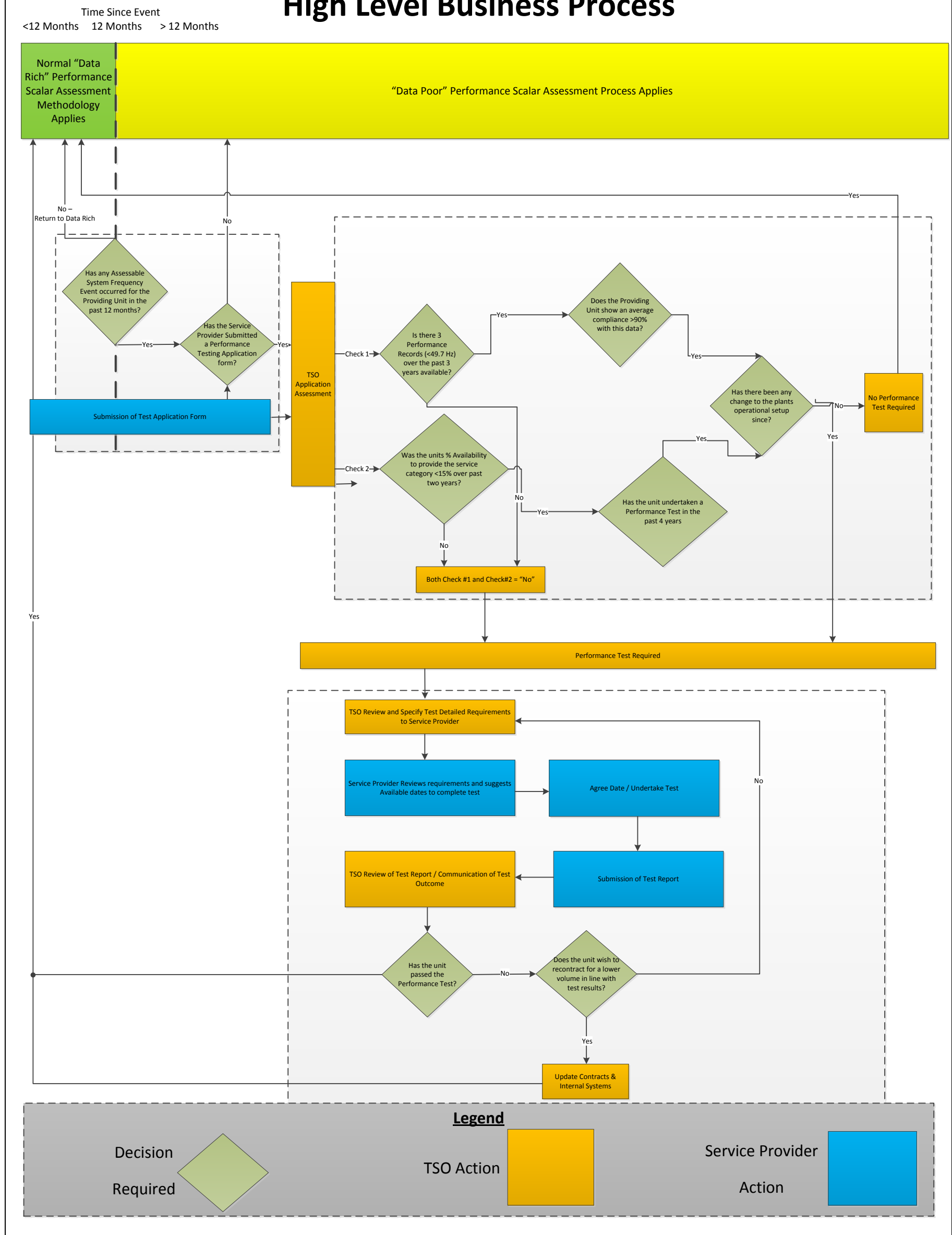


Figure 4: Data Poor Performance Scalar High Level Business Process Flow Chart

4.7 Performance Testing Process

Upon completion of the Performance Test process a Providing Units Performance Scalar may be reset to 1 accordingly. This award will only be allocated once all the necessary work has been completed and any subsequent reports provided and approved by the testing teams within EirGrid and SONI.

The exact requirements for each Performance Test will be agreed with the relevant testing teams within EirGrid and SONI in advance of partaking in a test, including what the unit is required to achieve to warrant the allocation of a successful test result. These requirements can vary slightly depending on the type of Providing Unit, the purpose of the test (is it to account for a lack of data to rectify poor recent performance which has resulted in the Providing Unit making changes to their plant to rectify the issue, and what services the test applies to. Care will be taken when scheduling a test however to try accommodate in line with other tests which may be required by that unit more generally to minimise the amount of testing required as much as possible.

At a high level the following test procedures may be required;

- For POR, SOR, TOR1 and TOR2 – Frequency Injection Testing in line with existing EirGrid or SONI test procedures as applicable compared against the units contracted Schedule 9 reserve curve parameters.
- For RRS/RRD/RM1/RM3/RM8 – A test assessing the units synchronisation and start up through to ramp up to full load output compared against the units TOD and contracted parameters.

Depending on the nature of each test applied for, only a subset of these requirements may actually be required. This will be agreed in advance of undertaking a Performance Test.

To apply for a Performance Test the Service Provider must complete the testing application template found on the EirGrid Group website and submit the form to the relevant email address below as appropriate:

- EirGrid – generator_testing@eirgrid.com
- SONI – performancemonitoring@soni.ltd.co.uk

Following TSO specification of test requirements an earliest available date to conduct the test will be proposed by the TSO. Should the Service Provider prefer to choose an alternative date greater than 1 calendar month from this date to align with other testing required by the Providing Unit or based on their availability then the Data Poor Performance Scalar will continue to decrease during this time difference.

In general, if the Performance Testing process is awaiting actions from the Service Provider (shown in blue in Figure 4 above) then the Data Poor Performance Scalar will continue to deteriorate. If the process is delayed due to constraints by the TSO then the Data Poor Performance Scalar will remain as is during this time period.

4.8 Timelines and Business Process Overview

4.8.1 Overview

The monthly scalar implementation to the Settlement cycle will occur monthly in arrears. For example, a Providing Units performance data up to end of June 2017 will be processed in July 2017 and input into the August 2017 settlement assessment, eventually being paid out in October 2017.

4.8.2 Timelines

All dates are expressed from the end day of the calendar month referred to as D. Performance Data Packs will be issued to all Providing Units, containing details on their DS3 Performance Scalar for the next settlement month along with accompanying data used to calculate the Performance Scalar, within 10 Working Days (D + 10) from D. Following the issuance of these Performance Data Packs Service Providers have another 10 Working Days (D + 20) to raise queries / challenges in relation to the packs themselves. Following D+20, the Performance data issued will be used in the final calculation of the Performance Scalar calculation for the next settlement month unless a query was raised and remains open at D+20. In this instance the specific data records being queried are set to N/A for assessment

(i.e., do not impact on the DS3 Performance Scalar) until such time as the query is resolved. Once the query is resolved the final outcome is then fed into the next monthly DS3 Performance Scalar calculation, with the date of the Event updated to the date the query was resolved and Event becomes binding from.

Service Providers may query aspects of their Performance Data Packs occasionally. However, re-settlement will not take place for previous months where the result wasn't queried within the initial 10 Working Days. The application of the outcome of the query will only be applied going forward into future assessment months. Key timeline millstones of the process are shown in Table 6 below;

Table 6: Key Milestones for Query Management Process

Acronym	Meaning
D_E	Date of Performance Event
$D_E + 3$	Date Operating Reserve report due to issue (details Pass / Fail outcome)
D	Last day of a calendar month
$D + 10_{WD}$	Date of Performance Scalar Data Pack release
$D + 20_{WD}$	Date that Data Pack Queries / Challenges must be raised by

4.8.3 Query / Challenge Process

Service Providers may challenge their Performance Data Packs from time to time for various reasons. Each challenge should be raised by the Service Provider prior to or following issuance of the data pack and no later than $D + 20$ using the Query Template form available on the EirGrid Group website. Service Providers should fill in the Query Template and submit it to the relevant email addresses as appropriate;

- For SONI Providing Units - performancemonitoring@soni.ltd.co.uk
- For EirGrid Providing Units – performancemonitor@eirgrid.com

The TSO will endeavour to resolve all queries following deadline ($D+20$) each month. However, the timeline for challenge resolution depends on the nature of the query. In the event where a valid challenge cannot be resolved within the same month, then that specific data record will be treated as a N/A temporarily for the purpose of

settlement. Once the TSO has reached a conclusion on the query, the final determination will then be updated in the next settlement cycle. The TSO will communicate such final determination to the service provider and the outcome will be implemented D+ 5 following the communication. Note there will be no resettlement of previous months regardless of when the final TSO determination has been reached.

4.8.4 Performance Scalar Data Packs

The Performance Data Packs will be issued to each Service Provider monthly. Their purpose is to provide details of the Performance Scalar values applicable to each Providing Unit each month. The results contained in the packs will then be scheduled for implementation in the next Settlement cycle. Each data pack is Service Provider specific. It is based on information on one or more Providing Unit(s) and consists of the following sheets

- a) a Summary Tab,
- b) a Reserve Data Tab,
- c) a Ramping Tab,
- d) a Glossary.

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);

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 Record 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 Record 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;

“Dynamic Time Scaling Factor (Vm)” refers to the component of the DS3 Performance Scalar calculation which scales the impact of a Providing Units Monthly Performance Scaling Factor (Km) based on the time difference between when the Events occurred and the current Scalar Assessment Month;

“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;

“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

“Event Scaling Factor (Qi)” refers to the assessment of a Providing Units performance to an Event and the application of an associated numeric scaling output between 1 and 0. These values are utilised on a monthly basis to calculate the Monthly Performance Scaling Factor (Km);

“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 49.8 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 April 2018;

“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;

“Monthly Performance Scaling Factor (Km)” refers to the component of the DS3 Performance Scalar calculation which is concerned with a Providing Units compliance with the associated Performance Assessment methodologies averaged over a given Assessment Month;

“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;

“Partial Pass” refers to the scenario where the outcome of a Providing Units Performance Assessment is deemed to be between a lower threshold indicating a Fail Data Record and an upper limit deemed to be a Pass Data Record;

“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 Data Packs” means the reports which get issued on a monthly basis to Service Providers indicating their provisional Performance Scalars for the next Settlement month;

“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;

“Performance Test” refers to the mechanism through which Service Providers can apply to improve their DS3 Performance Scalar and may require an assessment of historical performance data or the implementation of some form of scheduled test of the Providing Unit, as appropriate;

“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);

“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;

“SCADA” means Supervisory control and data acquisition system which is a source of real-time system data collection used by EirGrid and SONI;

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

“Scalar Assessment Month” refers to the Settlement month the Performance Data Packs apply to. This is preceded by performance data up to the preceding month.

“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;