DS3 System Services Protocol – Regulated Arrangements

DS3 System Services Implementation Project

12 December 2017

Version 1.0

Contents

1 Introduction

This DS3 System Services Protocol document is supplementary to the DS3 System Services Agreement. It provides information on Operational Requirements 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 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 Regulated Arrangements only. The approach for any future arrangements will be consulted on separately.

Equation 1, included in the DS3 System Services Agreement, sets out how payment is calculated for each service. Each of the terms is defined in the Agreement.

Equation 1: Calculation of Trading Period Payments for Regulated 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, Locational Scalar, Temporal Scarcity Scalar, Continuous Scalar, Fast Response Scalar, Wattless Scalar and Performance Scalar. All scalars are defined in the Agreement, with two exceptions. The values for the Temporal Scarcity Scalars are set out in Section 6 of this document and the methodology for calculating Performance Scalars is described in Section 5.

This document also specifies the Operational Requirements which must be met by Service Providers contracted to provide DS3 System Services, detailed by service, as well as details on the query management and business process for the application of Performance Scalars.

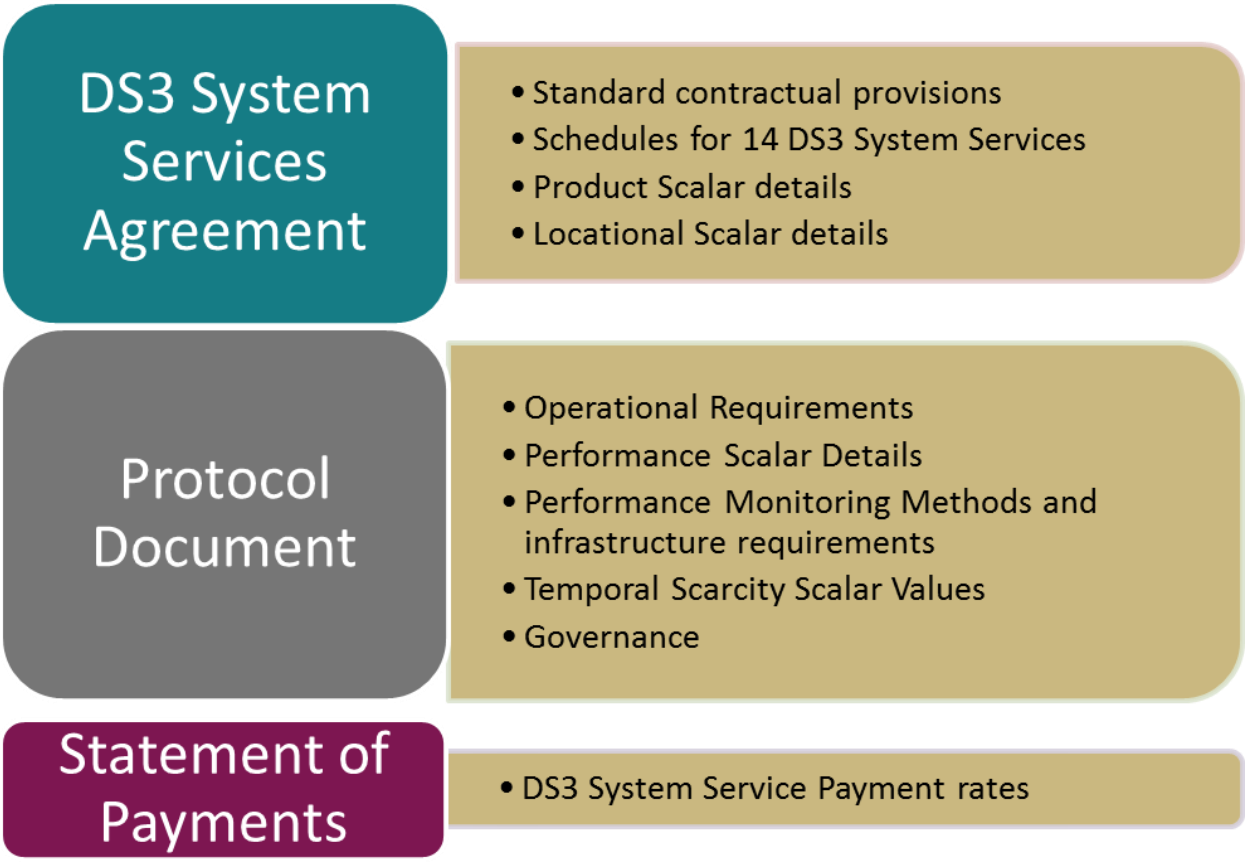

Figure 1: Overview of Agreement and associated documents

1.1 Service Provider Intermediary for a Providing Unit

In circumstances where and to the extent that a Service Provider is acting as an Intermediary for a Providing Unit, the Service Provider shall procure that the Providing Unit complies with the provisions of the Protocol and all references to Service Provider obligations within the Protocol shall be construed in this context.

2 Governance

For the Regulated Arrangements, this Protocol document is a regulated document. The TSOs may propose changes to the Protocol document no more than once every three (3) months. Proposed changes will require the approval of the Regulatory Authorities. Any proposed change to the Protocol document will be subject to industry consultation. The most recent version of this document will be published on the Company's website (www.eirgridgroup.com / http://www.soni.ltd.uk),

3 Operational Requirements

A Providing Unit must meet the relevant Operational Requirements applicable to the DS3 System Services for which it has contracted. The Operational Requirements may be separate from and additional to the technical requirements assessed in the Regulated Arrangements procurement process.

A Providing Unit's compliance with the Operational Requirements may require successful completion of an initial Compliance Test and be subject to ongoing monitoring. The TSO may require a Providing Unit to undergo additional Compliance Tests during the term of the Agreement if performance issues are identified during monitoring. Costs for Compliance Tests shall be borne by the Service Provider.

3.1 General DS3 System Services Operational Requirements

The general Operational Requirements applicable to the provision of DS3 System Services for all Providing Units are set out below. Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

- Where the Providing Unit has been contracted to provide multiple DS3 System Services, the provision of these services simultaneously should not impact on the ability of the Providing Unit to provide any one of those services.
- The Providing Unit's availability declarations must reflect if it can only provide a subset of its contracted services.
- The Providing Unit must be able to declare service availability for contracted DS3 System Services via electronic means in real-time i.e. through EDIL or a real-time signal.
- The Providing Unit must comply with the TSOs' signal list (as may be amended during the lifetime of the Regulated Arrangements.)
- Where a Providing Unit has contracted to provide any of DRR, FPFAPR or FFR, the Providing Unit must have Monitoring Equipment installed on the site that meets the standards set out by the TSO. If the TSO has such Monitoring Equipment installed at the Providing Unit's location, this equipment may be used for the purpose of the provision of Performance Monitoring data for a maximum period of 24 months from 1st September 2018. After this time period, the Providing Unit shall have installed its own Monitoring Equipment for the purpose of providing Performance Monitoring data to the TSOs. The DS3 Performance Measurement Device Standards for Fast Acting Services document can be found on the TSOs' websites (www.eirgridgroup.com / www.soni.ltd.uk)

3.2 General Operational Requirements for FFR, POR, SOR and TOR1

The general Operational Requirements applicable to the provision of FFR, POR, SOR and TOR1 are set out below. Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

- Responses shall be based on Reserve Triggers and not on Rate of Change of Frequency (RoCoF).
- Where the Providing Unit has contracted for more than one of FFR, POR, SOR and TOR1 services the characteristics of the response capability must be consistent across all contracted services. For example, the Providing Unit cannot have dynamic capability in the provision of POR, and static in the provision of SOR.

3.3 Technology Specific Requirements for FFR, POR, SOR and TOR1

This section sets out the Operational Requirements specific to technology types that apply to the provision of FFR, POR, SOR and TOR1. Relevant Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

3.3.1 Wind Farm Power Station (WFPS) – Active Power Control Mode

The following requirements apply to a WFPS Providing Unit in its provision of FFR, POR, SOR and TOR1 when in Active Power Control (APC) Mode:

- For the purposes of settlement, to account for potential short-term variances in availability, a WFPS shall only be considered available to provide FFR, POR and SOR when its calculated headroom is greater than 5% of the Providing Unit's Registered Capacity.
- For the purposes of settlement, to account for potential short-term variances in availability, a WFPS shall only be considered available to provide TOR1 when its calculated headroom is greater than 10% of the Providing Unit's Registered Capacity.
- For the purposes of settlement, the real-time Available Active Power signal from WFPS Providing Units shall be discounted, with the value of the discount to be calculated as follows:

95th Percentile Error (MW) x Skew (%)/100 x 2

Where:

- The absolute 95th Percentile Error of the Available Active Power signal is calculated for each WFPS Providing Unit on a quarterly basis;
- Skew (%) refers to, on average, how often the error is biased such that the Available Active Power signal is greater than the Providing Unit's actual MW output.

- If the Providing Unit is contracted for the provision of FFR, POR, SOR or TOR1 through the use of Emulated Inertia, it can only provide the same services in APC Mode as those provided through the use of Emulated Inertia.

3.3.2 Wind Farm Power Station (WFPS) – Provision of Emulated Inertia

The following requirement applies to a WFPS Providing Unit in its provision of FFR, POR, SOR and TOR1 through Emulated Inertia:

- The Providing Unit's provision of services through the use of Emulated Inertia shall be such that the TSOs can remotely enable / disable the services.

3.3.3 Energy Storage Providing Units

The following requirements apply to an Energy Storage Providing Unit in its provision of FFR, POR, SOR and TOR1:

- The Energy Storage Providing Unit is subject to recharge limitations, which must be agreed by the TSOs.
- The Providing Unit shall provide a real-time signal confirming its remaining charge available.
- The Energy Storage Providing Unit must limit its ramp rates when outside of Frequency Control response mode, with all limits to be agreed by the TSOs.
- A Providing Unit that is unable to operate without recovering its resource until the system frequency has recovered will be classified as having static capability. The exact timeframes shall be agreed by the TSOs.

3.3.4 Demand Side Units / Aggregators

The following requirements apply to DSUs and aggregators in their provision of FFR, POR, SOR and TOR1:

- Aggregators must have the capability to remotely enable/disable services at all Individual Demand Sites (IDSs).
- The Providing Unit's aggregator must stagger load reconnection on IDSs to ensure inrush currents do not cause a spike over the pre event load.
- The Providing Unit shall not declare down its availability in real-time during a Frequency Event, or if it does, the availability shall reflect the MW response provided.

3.4 Provision of the FFR Service

A Providing Unit that has been contracted to provide FFR is classified as having Dynamic Response or Static Response capability.

The TSOs define a Providing Unit's provision of FFR through the application of parametrisable frequency response curves. Depending on a Providing Unit's capability, a response curve for dynamic or static provision of the service applies. All parameters will be set by the TSOs within the agreed contracted capabilities of the Providing Unit.

A Providing Unit's capability determines the design of the Product Scalar for the enhanced provision of FFR, together with the scalar's component values, that are applicable to the Providing Unit.

3.4.1 FFR Provision with Dynamic Capability

The following Operational Requirements apply to a Providing Unit which has dynamic capability to provide FFR. Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

- The Providing Unit must maintain the capability to operate at its Reserve Trigger Capability, which shall have a value between 49.8 Hz and an upper threshold of 49.985 Hz;
- The Providing Unit shall provide its Expected response within 2 seconds of the Frequency falling through its Reserve Trigger. Where the Providing Unit has committed to a faster response than 2 seconds, and is eligible for a FFR Fast Response Scalar greater than 1, the Providing Unit shall provide its Expected response within its FFR Response Time.
- The Providing Unit shall track changes in frequency dynamically;
- A Providing Unit that provides responses in discrete steps shall respond to a Reserve Trigger with at least 10 discrete steps, with no individual step being greater than 5MW; the response shall be provided in a linear, monotonically increasing manner; ideally, all steps will be equal, but a tolerance of 1MW of the average step size, where the average step size is the FFR available volume divided by the number of discrete steps in response, applies.
- The Providing Unit shall be able to operate with a minimum FFR Trajectory Capability of 2 Hz in response to a Reserve Trigger.
- The Providing Unit's provision of POR, SOR and TOR1, if contracted for any of these services, must mirror its FFR response characteristics, i.e. the Providing Unit must have the capability to maintain its response in line with the applicable frequency response curve for the extended timeframes required of POR, SOR and TOR1, as required of the TSOs in response to a Reserve Trigger.
- The Providing Unit shall be able to operate without recovering its resource until the system frequency has recovered (the exact timeframes shall be agreed by the TSOs).
- The Providing Unit shall have Monitoring Equipment to enable the Performance Monitoring of the provision of the service.

- A Providing Unit that cannot provide 90% of its maximum recorded response during the 2 – 10 second timeframe (identified during the Compliance Test process) within 2 seconds of the Frequency falling through the Reserve Trigger shall not be eligible for a FFR Fast Response Scalar value greater than 1.
- A Providing Unit that cannot provide its contracted FFR volume within 1 second of the Frequency falling through its Reserve Trigger shall not be eligible for a Dynamic Trajectory Scalar value greater than 0.2.

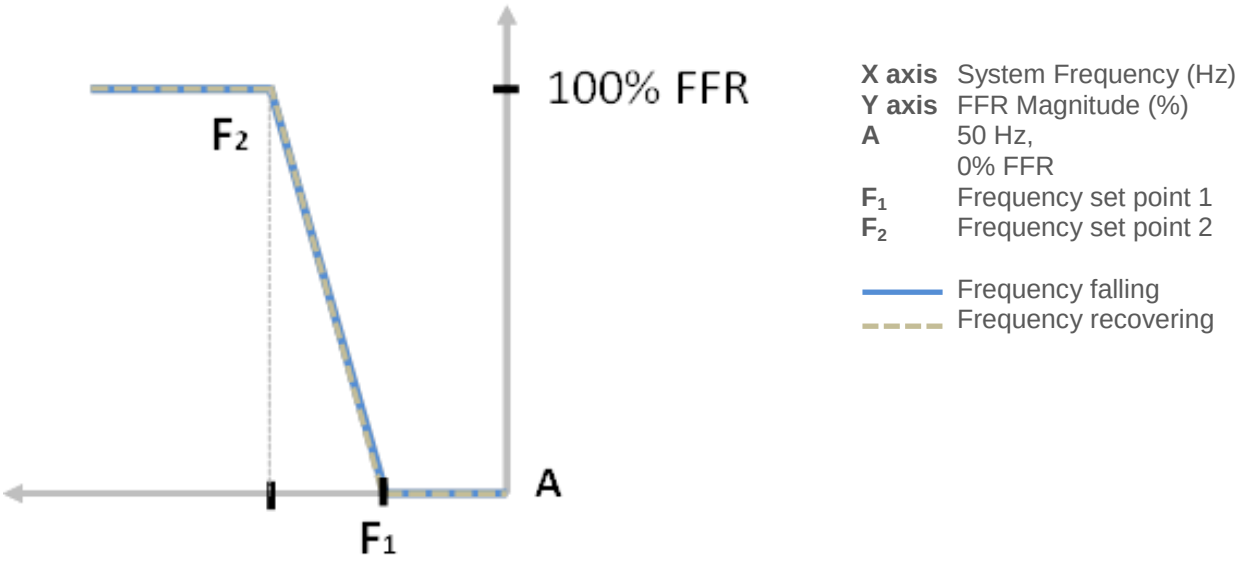

Figure 2: FFR Dynamic Capability Frequency Response Curve.

The frequency response curve in Figure 2 shows a Reserve Trigger, F_1, at which the Providing Unit is required to start adjusting its MW output.

At F_1, the Providing Unit shall provide a response with a specified FFR Trajectory to achieve 100% of its available FFR volume by Reserve Trigger F_2, as required by the system.

The recovery of the Providing Unit, once the frequency begins to revert back to nominal, shall follow the same path as the response.

The TSOs shall define the parameters of the frequency response curve, including the Reserve Trigger and FFR Trajectory, within the agreed contracted capabilities of the Providing Unit.

At times of high frequency, where the Providing Unit wishes to provide an over frequency response, the curve design is the same (the control parameters may differ) except mirrored about the Nominal Frequency.

3.4.2 FFR Provision with Static Capability

The following Operational Requirements apply to a Providing Unit which has static capability to provide FFR. Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs:

- The Providing Unit shall maintain the capability to operate at its Reserve Trigger Capability, which shall have a value between 49.3 Hz and an upper threshold of 49.8 Hz.
- The Providing Unit shall have the capability to respond at a Reserve Trigger with a response not greater than 75MW, which is the maximum allowable MW response for a single discrete step.
- The TSOs have the right to choose to use the Providing Unit's entire FFR available volume at a single Reserve Trigger, or in any number of steps between 1 and the Providing Unit's maximum number of discrete steps.
- The TSOs have the right to use all of the Providing Unit's FFR available volume at its Reserve Trigger Capability.
- The smallest available discrete step in response at any time must be no less than 20% of the MW value of the Providing Unit's largest available step at that time. In the case of a Providing Unit that provides 50MW in one discrete step during an Event, the size of the smallest discrete step shall be no less than 10MW during the same Event.

- The Providing Unit's provision of POR, SOR and TOR1, if contracted for any of these services, must mirror its FFR response characteristics, i.e. the Providing Unit must have the capability to maintain its response in line with the applicable frequency response curve for the extended timeframes required of POR, SOR and TOR1, as required of the TSOs in response to a Reserve Trigger.
- The Providing Unit shall have Monitoring Equipment to enable the Performance Monitoring of the provision of the service.

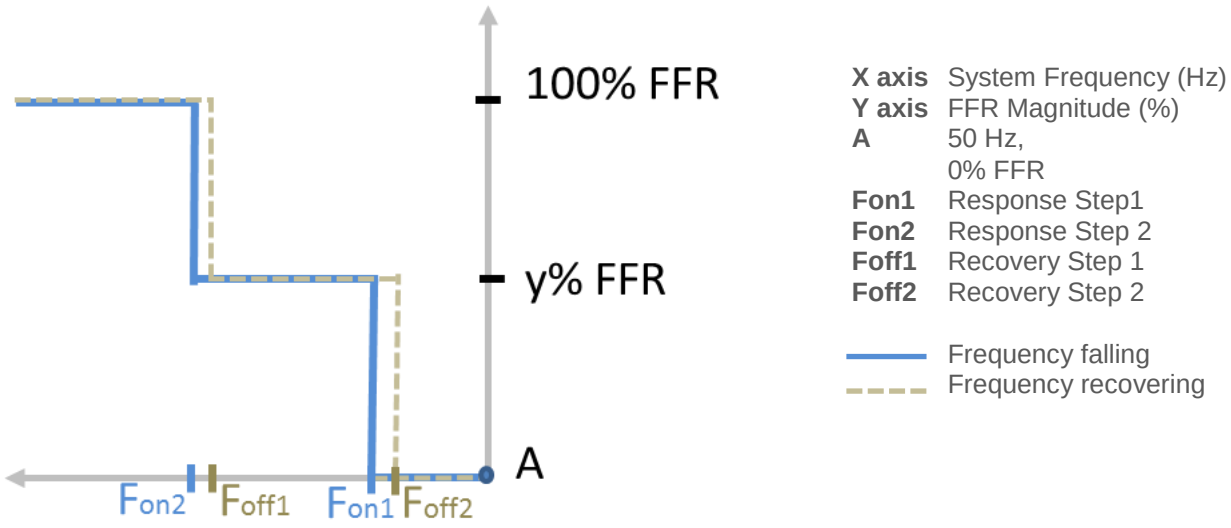

Figure 3: FFR Static Capability Frequency Response Curve

For a Providing Unit that has been classified by the TSOs as having static capability, the response to a Reserve Trigger and the recovery are implemented in multiple steps, i.e. there are multiple Reserve Triggers. For illustration purposes, the curve in Figure 3 shows two Reserve Triggers, F_{on1} and F_{on2}, at which the Providing Unit is required to start adjusting its MW output.

At each of F_{on1} and F_{on2}, and any other required Reserve Triggers, the Providing Unit must provide a response in a discrete step to achieve an agreed MW output.

A Providing Unit with FFR Hysteresis Control shall not retract its response as the frequency recovers through the Reserve Trigger, as agreed by the TSOs.

The TSOs shall define the parameters of the frequency response curve, including Reserve Triggers in response and recovery, within the agreed contracted capabilities of the Providing Unit.

The Providing Unit shall provide its Expected response within 2 seconds of the Frequency falling through each Reserve Trigger. Where the Providing Unit has committed to a faster response than 2 seconds, and is eligible for a FFR Fast Response Scalar greater than 1, the Providing Unit shall provide its Expected response within its FFR Response Time at each Reserve Trigger.

At times of high frequency, where the Providing Unit wishes to provide an over frequency response, the curve design is the same (the control parameters may differ) except mirrored about the Nominal Frequency.

3.5 Operational Requirements for TOR2, RRS, RRD, RM1, RM3 and RM8

The general Operational Requirements applicable to the provision of TOR2, RRS, RRD, RM1, RM3 and RM8 are set out below. Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

- A Providing Unit shall be registered in the Single Electricity Market.

3.6 Operational Requirements for SSRP

The general Operational Requirements applicable to the provision of the SSRP Service are set out below. Providing Units shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

- A Providing Unit shall provide SSRP dynamically over its entire dispatchable power range and not in discrete steps.

3.6.1 Requirements for SSRP with Optional Product Scalars

This section describes the specific Operational Requirements applicable to the provision of the SSRP service where Product Scalars apply. A Providing Unit shall comply with all of these Operational Requirements, unless otherwise agreed by the TSOs.

3.6.1.1 Provision of SSRP with Watt-less MVars

The following Operational Requirements apply to a Providing Unit availing of the Watt-less Scalar:

- The Providing Unit shall be capable of providing the service at 0MW (within a tolerance).

3.6.1.2 Provision of SSRP with Automatic Voltage Regulation

The following Operational Requirements apply to Providing Units availing of the Product Scalar for the provision of SSRP with Automatic Voltage Regulation (AVR):

- The Providing Unit shall have AVR control (tested and approved).
- The Providing Unit shall have a means of declaring that its AVR is on and fully functional, or off; this may be through EDIL or other signalling means.

4 SNSP Forecasting

Following development and implementation of an appropriate system, the TSOs shall publish forecasts of SNSP levels at least 2 hours ahead of real time. The TSOs shall not be liable to the Service Provider or any third party for any loss of profits, loss of use, or any direct, indirect, incidental or consequential loss of any kind that may result from use of its forecasts.

5 Performance Monitoring

A Performance Scalar will be utilised to incentivise the reliable provision of a subset of DS3 System Services. Depending on the given DS3 System Service being monitored, a Providing Unit's performance may be monitored following a Performance Incident.

For those services where a Performance Scalar will not be utilised, alternative measures will be implemented to ensure that the TSO is satisfied that the services are being delivered as contracted.

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).

5.1 Performance Scalar Composition

For the Regulated Arrangements, the Performance Scalar (P) will consist of two (2) components:

- Availability Discount Factor (P_A)
- Performance Incident Response Factor (P_E)

The value of the Performance Scalar will be a multiple of the two (2) components:

$$P = P_A \times P_E$$

P_A will account for the ability of a Providing Unit to accurately forecast its availability to provide System Services. Where the requirement to provide a forecast of availability is not applicable to a service from the commencement of the Regulated Arrangements, the value of this component scalar will be 1.

P_E will be based on a Providing Unit's response to a Performance Incident.

5.2 Availability Discount Factor (P_A)

For the Regulated Arrangements, the P_A component of the Performance Scalar will incentivise a Providing Unit to supply the TSO with an accurate forecast of its availability to provide FFR, POR, SOR, TOR1, TOR2, RRS, RRD, RM1, RM3 or RM8 services.

A Providing Unit contracted to provide any of FFR, POR, SOR, TOR1, TOR2, RRS, RRD, RM1, RM3 or RM8 services will be required, from a date to be determined, but no earlier than 1 year after the commencement of the Regulated Arrangements, to supply a forecast of its availability to provide those services.

It is envisaged that this forecast will be required 6 hours in advance of a given Trading Period, where the submitted forecast covers a period of 6 hours (12 Trading Periods).

A P_A value less than 1 will apply where an ex-post evaluation of a Providing Unit's declared forecasted availability against its actual availability shows an over-forecast or under-forecast of availability to provide a service.

Consideration will be given to the development of the P_A component of the Performance Scalar to factors including, but not limited to, the timing of the calculation of P_A, whether all relevant Trading Periods or a sample of them will be evaluated, the occurrence of forced or scheduled outages, the nature of applicable tolerances, the metric to express the error rate per Trading Period, and the duration of any reduced P_A value to be applied.

The implementation of P_A is dependent on the establishment of adequate systems and processes, by both the TSO and Providing Units, to generate, evaluate and utilise the forecast data. Given the complexity of its introduction, the value of P_A will be set equal to1 for at least the first 12 months following the commencement of the Regulated Arrangements. As requested by the SEM Committee in SEM-17-080, further consultation with industry will be scheduled as the design of this measure is progressed. The finalised design will be subject to regulatory approval.

5.2.1 Pre-Implementation of P_A

In advance of the implementation of P_A, the TSO will begin evaluating availability forecast data from various sources from the commencement of the Regulated Arrangements. This data will not be utilised for the purposes of calculating the Performance Scalar.

The TSO will require that a subset of Providing Units shall manually provide a daily forecast of their availability to deliver any of FFR, POR, SOR, TOR1, TOR2, RRS, RRD, RM1, RM3 or RM8 from the commencement of the Regulated Arrangements.

For this initial period, in advance of the implementation of P_A, a Providing Unit shall provide a once-a-day forecast of availability for a calendar day (D), i.e. a block of 48 Trading Periods, with the forecast required to be submitted to the TSO by 14:00 on the previous calendar day (D-1). The timing of this forecast closely aligns with the provision of physical notifications by market participants under I-SEM arrangements (13:30 on D-1).

This subset includes Providing Units from the following classes of technology, unless otherwise agreed with the TSO: Wind Farms (both in the provision of services via Inertial Emulation and/or Active Power Control), DSUs, Solar, and 'hybrid' Providing Units, which comprise more than one class of technology (if they consist of any of the previous technologies). The TSO reserves the right to require that other classes of technology must also provide the availability forecast as described.

5.3 Performance Incident Response Factor (P_E)

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 Performance Incident.

5.4 Performance Incident Response Factor (P_E) Calculation Methodology

A Performance Incident Response Factor (P_E) 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 P_E value will be calculated over a number of Performance Incidents.

There are two core elements to the Performance Incident Response Factor calculation:

a) The Scaling Factor (K_m); and

b) The Dynamic Time Scaling Factor (V_m).

The Monthly Scaling Factor (K_m)

For every Performance Incident, a Performance Incident Scaling Factor (Q_i) is calculated based on the Providing Unit's response in line with the Performance Assessment methodologies. The specifics of how the Performance Incident Scaling Factor (Q_i) is calculated are detailed in Section 5.6 of this document.

The Monthly 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 Scaling Factor (K_m)

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

Where;

m = Month within which the Performance Incidents occurred

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

Q = the Performance Incident Scaling Factor as calculated in line with Section 5.6 of this document.

The Dynamic Time Scaling Factor (V_m)

The Dynamic Time Scaling Factor (V_m) is calculated based on the time difference (in months) between the month in which the Performance Incidents occurred and the Scalar Assessment Month in which the Performance Incident Response Factor is being calculated. The purpose of this is to place

more emphasis on the most recent Performance Incidents. The Dynamic Scaling Factor (V_m) is calculated as illustrated in Table 1.

Table 1: Calculation of the Dynamic Time Scaling Factor 'V'

Number of Months between Performance Incident Month and Scalar Assessment Month 'M'	Dynamic Time Scaling Factor 'V_m'
1	1
2	0.8
3	0.6
4	0.4
5	0.2
6+	0

Using this Scaling Factor the maximum duration a Perfomance Incident can impact the Performance Incident Response Factor is 5 months with the impact lessening each month.

Performance Incident Response Factor Calculation (P_E)

The Perfomance Incident Response Factor 'P_E' is subsequently calculated based on the sum of the products of the Monthly 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.

Equation 3: Calculation of Performance Incident Response Factor

$$P_E = MAX\ (1 - SUM\ (K_m * V_m), 0)$$

5.5 Performance Categorisation – Regulated Arrangements

The 14 DS3 System Services can be split into a number of categories as shown in Figure 4.

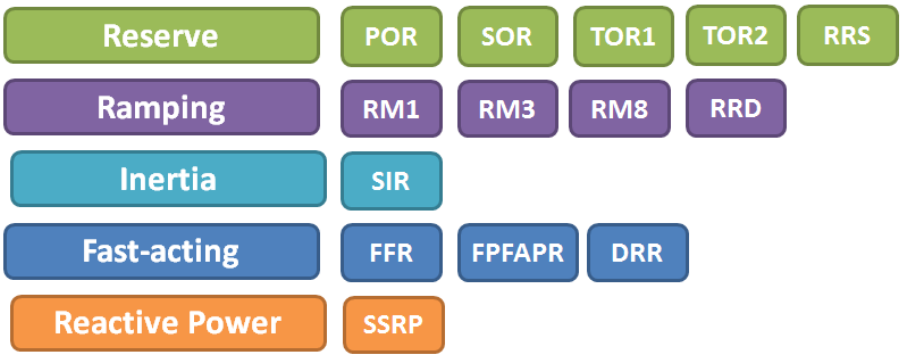

Figure 4: Categorisation of the 14 DS3 System Services for Performance Monitoring

The philosophy for the Regulated Arrangements Performance Monitoring is to assess performance over a number of Performance Incidents. Table 2 summarises the data sources used for assessment of Performance Incident Response Factors.

Performance Incident Response Factors 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 2: Proposed 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 *Fail to Sync* Instructions	Subject to further consultation	N/A	A device recorder to the measurement range and accuracy standards as defined by the

		DSUs: Aggregated SCADA demand data and / or QH Meter Data for each Individual Demand Site (IDS)			TSO
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	**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	Subject to further consultation	N/A	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
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	**All Providing Units excluding DSUs:** EDIL Sync Instructions. **DSUs:** QH Metering Data for 12 weeks prior to the dispatch instruction for each IDS and	Subject to further consultation	N/A	Minimum data resolution of 20 ms

		Aggregated SCADA demand data			
Minimum Data Records Requirement	1 Data Record per 12 Months	1 Data Record 12 Months	Subject to further consultation	N/A	1 Data Record per 12 Months
Scalar Assessment Frequency	Monthly in Arrears	Monthly in Arrears	Subject to further consultation	N/A	Monthly in Arrears (FFR Only)

5.6 Performance Incident Response Factor 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 Performance Incident Scaling Factor (Q_i) for each service which in turns feeds into the overall Performance Incident Response Factor. Following a Frequency Event the performance of the Providing Unit will continue to be assessed for that service when the Frequency Event ends.

5.6.1 Reserve Category

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

For each of the DS3 System Services in this category (POR, SOR, TOR1, TOR2 and RRS) the methods below will be used where a Providing Unit meets the Minimum Data Records Requirement. For a Providing Unit which does not meet the Minimum Data Records Requirement please refer to Section 5.24 of this document.

5.7 Primary Operating Reserve (POR)

5.7.1.1 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**.

5.7.1.2 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 Performance Incident Scaling Factor (Q_i) will be applied to the Providing Unit for the Performance Incident.

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 the output of some Providing Units 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

If one or more subsequent Performance Incidents occur within 5 minutes after the end of the Frequency Event the Providing Unit's response to the subsequent Performance Incident(s) will not be taken into account for Performance Assessment purposes. However, the Providing Unit is expected to provide a response to further Performance Incidents occurring within 5 minutes if it is capable of doing so.

5.7.1.2.1 Calculation of Expected Provision of POR

The Expected POR following a Frequency Event may be derived, as applicable, 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 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 Agreement.

5.7.1.2.2 POR Governor Droop Multiplier Calculation

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

PORGovernorDroopMultiplier = 1 +

$(PORgovernordroopmultiplier\alpha * e^{(-PORGovernordroopmultiplier\beta * nadirtime)})$

(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 Interim arrangements.

5.7.1.2.3 Governor Droop Demanded POR Calculation

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)

5.7.1.2.4 Expected POR Calculation:

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 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 Agreement.

5.7.1.2.5 Calculation of Achieved Provision of POR

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

5.7.1.3 Calculation of Performance Incident Scaling Factor Q_i for Provision of POR

For each Frequency Event, where the following holds true;

a) the Expected POR Response (inclusive of the POR Inertia Credit) minus the greater of 10% of the Expected POR Response or 1 MW is greater than or equal to 0 MW; and

b) The Expected POR Response (exclusive of the POR Inertia Credit) is greater than 0 MW

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

i) If the Expected POR Response (inclusive of the POR Inertia Credit) minus the Achieved POR Response is less than or equal to 1 MW, Then

$$\mathbf{Q_i = 0,}$$

ii) Otherwise;

Let **S** = $\frac{\text{Achieved POR Response}}{\text{Expected POR Response (inclusive of the POR Inertia Credit)}}$

If S >= 0.9, **Qi = 0**,

If S <= 0.7, **Qi = 1**,

Otherwise, **Qi = (0.9 – S)*5**.

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

This results in a Providing Unit being awarded a Pass should it achieve greater or equal to 90% of its Expected POR response, a Fail if it achieves less than or equal to 70% and a Partial Pass in between.

Otherwise, a N/A Data Record will apply to the Providing Unit for the Performance Incident if criteria a) or b) is false.

5.8 Secondary Operating Reserve (SOR)

5.8.1.1 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**.

5.8.1.2 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 Performance Incident Scaling Factor (Q_i) will be applied to the Providing Unit for the Performance Incident.

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

If one or more subsequent Performance Incidents occur within 5 minutes after the

end of the Frequency Event the Providing Unit's response to the subsequent Performance Incident(s) will not be taken into account for Performance Assessment purposes. However, the Providing Unit is expected to provide a response to further Performance Incidents occurring within 5 minutes if it is capable of doing so.

5.8.1.2.1 Calculation of Expected Provision of SOR

The Expected SOR following a Frequency Event may be derived, as applicable, 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.

5.8.1.2.2 Governor Droop Demanded SOR Calculation

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).

5.8.1.2.3 Expected SOR Calculation:

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**".

5.8.1.2.4 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**".

5.8.1.3 Calculation of Performance Incident Scaling Factor Q_i for Provision of SOR

For each Frequency Event, where the following holds true;

a) the Expected SOR Response minus the greater of 10% of the Expected SOR Response or 1 MW is greater than or equal to 0 MW; and
b) The Expected SOR Response is greater than 0 MW;

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

i) If the Expected SOR Response minus the Achieved SOR Response is less than or equal to 1 MW, Then

$$\mathbf{Q_i = 0,}$$

ii) Otherwise;

$$\text{Let } \mathbf{S} = \frac{\text{Achieved SOR Response}}{\text{Expected SOR Response}}$$

If S >= 0.9, **Qi = 0**,

If S <= 0.7, **Qi = 1**,

Otherwise, **Qi = (0.9 – S)*5**.

Equation 5: Calculation of Performance Incident Scaling Factor 'Q_i' for Secondary Operating Reserve

This results in a Providing Unit being awarded a Pass should it achieve greater or equal to 90% of its Expected SOR response, a Fail if it achieves less than or equal to 70% and a Partial Pass in between.

Otherwise, a N/A Data Record will apply to the Providing Unit for the Performance Incident if criteria a) or b) is false.

5.9 Tertiary Operating Reserve (TOR1)

5.9.1.1 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**.

5.9.1.2 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 Performance Incident Scaling Factor (Q_i) will be applied to the Providing Unit for the Performance Incident.

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

If one or more subsequent Performance Incidents occur within 5 minutes after the end of the Frequency Event the Providing Unit's response to the subsequent Performance Incident(s) will not be taken into account for Performance Assessment purposes. However, the Providing Unit is expected to provide a response to further Performance Incidents occurring within 5 minutes if it is capable of doing so.

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.

5.9.1.2.1 Calculation of Expected Provision of TOR1

The Expected TOR1 following a Frequency Event may be derived, as applicable, 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.

5.9.1.2.2 Governor Droop Demanded TOR1 Calculation

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).

5.9.1.2.3 Expected TOR1 Calculation

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"**.

5.9.1.2.4 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"**.

5.9.1.3 Calculation of Performance Incident Scaling Factor Q_i for Provision of TOR1

For each Frequency Event, where the following holds true;

a) the Expected TOR1 Response minus the greater of 10% of the Expected TOR1 response or 1 MW is greater than or equal to 0 MW; and

b) The Expected TOR1 Response is greater than 0 MW;

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

i) If the Expected TOR1 Response minus the Achieved TOR1 Response is less than or equal to 1 MW, Then

$$\mathbf{Q_i = 0,}$$

ii) Otherwise;

$$\text{Let } \mathbf{S} = \frac{\text{Achieved TOR1 Response}}{\text{Expected TOR1 Response}}$$

If S >= 0.9, **Qi = 0**,

If S <= 0.7, **Qi = 1**,

Otherwise, **Qi = (0.9 – S)*5**.

Equation 6: Calculation of Performance Incident Scaling Factor 'Q_i' for Tertiary Operating Reserve 1

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

Otherwise, a N/A Data Record will apply to the Providing Unit for the Event if criteria a) or b) is false.

5.10 Tertiary Operating Reserve 2 (TOR2)

5.10.1.1 TOR2 Event Response Factor

The TOR2 Event Response Factor for the Providing Unit will be set equal to the Event Response Factor calculated for TOR1 (see Sections 5.9.1.1 to 5.9.1.3 for details on the TOR1 Performance Assessment criteria).

5.11 Replacement Reserve Synchronised (RRS)

5.11.1.1 RRS Event Response Factor

The RRS Event Response Factor for the Providing Unit will be set equal to the Event Response Factor calculated for TOR1 (see Sections 5.9.1.1 to 5.9.1.3 for details on the TOR1 Performance Assessment criteria).

5.12 Fast Frequency Response

5.12.1.1 Method of Performance Assessment Fast Frequency Response (FFR)

Performance Assessment of the FFR service will be based on an evaluation of the Providing Unit's performance during a Frequency Event. The assessment of FFR performance is carried out following the Frequency passing through the Reserve Trigger for the Providing Unit at time T=0.

The assessment of FFR performance is carried out during the entire FFR timeframe from T=0 to the end of the **FFR Period** i.e. to T+10 seconds. The additional increase in MW output from the Providing Unit should be sustained for the entire FFR period. The additional response provided in this timeframe must be greater than any loss of energy in the following ten seconds i.e. in the period between T+10 seconds and T+20 seconds.

5.12.1.2 *Measurement Process for Fast Frequency Response (FFR) Performance Assessment*

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

Two assessments will be carried out to calculate the extent of the difference between the Expected FFR and Achieved FFR which will determine how the Performance Incident Scaling Factor (Q_i) will be applied to the Providing Unit for the Performance Incident.

The first assessment determines the Expected FFR at a point in time corresponding to the Providing Unit's contract response time compared to the Achieved FFR. The Expected FFR is then determined for each sample point during the FFR Period and compared to the Achieved FFR. If the Achieved FFR is less than the Expected FFR, the deficit is summated for all the sample points and an average deficit produced.

5.12.1.3 *Calculation of Performance Incident Scaling Factor Q_i for Provision of FFR*

For each Frequency Event, where the following holds true;

a) the Expected FFR Response minus the greater of 10% of the Expected FFR Response or 1 MW is greater than or equal to 0 MW; and

b) The Expected FFR Response is greater than 0 MW

The **Performance Incident Scaling Factor** '**Q_i**' is then calculated as follows:

i) If the Expected FFR Response (inclusive of the FFR Inertia Credit) minus the Achieved FFR Response is less than or equal to 1 MW, Then

$$\mathbf{Q_i = 0,}$$

ii) Otherwise;

Let S1 equal to a point in time assessment at FFR Response Time

$$\text{Let } \mathbf{S_1} = \frac{\text{Achieved FFR at Response Time}}{\text{Expected FFR at Response Time}}$$

And, where S2 is determined for each sample point during the FFR Period and compared to the Achieved FFR. If the Achieved FFR is less than the Expected FFR, the deficit is summated for all sample points and an average deficit produced.

$$\text{Let } \mathbf{S_2} = \frac{\text{Achieved FFR over FFR period}}{\text{Expected FFR over FFR period}}$$

The Performance Incident Scaling Factor, Qi, is calculated as follows:

$$S = S_1\,(0.8) + S_2\,(0.2)$$

If S >= 0.9, **Qi = 0**,

If S <= 0.8, **Qi = 1**,

Otherwise, **Qi = (0.9 – S)*10**.

Equation 7: Calculation of Performance Incident Scaling Factor 'Q_i' for Fast Frequency Response

This results in a Providing Unit being awarded a Pass should it achieve greater or equal to 90% of its Expected FFR response, a Fail if it achieves less than or equal to 80% and a Partial Pass in between.

Otherwise, a N/A Data Record will apply to the Providing Unit for the Performance Incident if criteria a) or b) is false.

5.13 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 5.24 of this document.

5.14 Ramping Margin 1(RM1)

5.14.1.1 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 5.14.1.2.2.

5.14.1.2 Measurement Process for Ramping Margin 1 (RM1) Performance Assessment

5.14.1.2.1 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.

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

Performance Assessment for DSUs will be carried out in accordance with the EirGrid Grid Code Section OC10.4.5.2 and SONI Grid Code Section OC11.10.3.

DSUs are required to meet the five criteria set out in the relevant Grid Code clause. For reference the EirGrid Grid Code states as shown in *italics* below. 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.*

5.14.1.3 Calculation of Performance Incident Scaling Factor Qi for Ramping Margin 1 (RM1)

5.14.1.3.1 Criteria used to determine Performance Incident Scaling Factor Qi for RM1 for all Providing Units excluding DSUs

The Performance Incident Scaling Factor (Q_i) is calculated as follows;

If Sync Instruction = 'Fail', Qi = 1,

If Sync Instruction = 'Pass', Qi = 0.

Equation 8: Calculation of Performance Incident 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.

5.14.1.3.2 Criteria used to determine Performance Incident Scaling Factor Qi 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 5.14.1.2.2.

A 'Pass' Data Record will be awarded should the DSU adhere to all three of Criteria (iii), (iv) and (v) in Section 5.14.1.2.2.

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 5.14.1.2.2.

For clarity, Criteria (i) and (ii) of Section 5.14.1.2.2 will not be used in the Performance Scalar assessment of DSUs.

The Performance Incident Scaling Factor (Q_i) is calculated as follows;

If Event Response = 'Fail', Qi = 1,

If Event Response = ‘Pass’, Qi = 0.

Equation 9: Calculation of Performance Incident 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.

5.15 Ramping Margin 3(RM3)

5.15.1.1 RM3 Event Response Factor

The RM3 Event Response Factor for the Providing Unit will be set equal to the Performance Incident Response Factor calculated for RM1 (see Sections 5.14.1.1 to 5.14.1.3 of this document for details on the RM1 Performance Assessment Criteria).

5.16 Ramping Margin 8(RM8)

5.16.1.1 RM8 Event Response Factor

The RM8 Performance Incident Response Factor for the Providing Unit will be set equal to the Performance Incident Response Factor calculated for RM1 (see Sections 5.14.1.1 to 5.14.1.3 of this document for details on the RM1 Performance Assessment Criteria).

5.17 Replacement Reserve Desynchronised (RRD)

5.17.1.1 RRD Performance Incident Response Factor

The RRD Performance Incident t Response Factor for the Providing Unit will be set equal to the Performance Incident Response Factor calculated for RM1 (see Sections 5.14.1.1 to 5.14.1.3 of this document for details on the RM1 Performance Assessment Criteria).

5.18 Fast Post Fault Active Power Recovery (FPFAPR)

The Performance Scalar for FPFAPR will be set equal to 1 from the commencement of the Regulated Arrangements. This may change during the lifetime of the Regulated Arrangements.

The calculation of the Availability Discount Factor is not applicable to FPFAPR and will be set equal to 1 for the duration of the Regulated Arrangements.

The Performance Incident Response Factor for FPFAPR will be set equal to 1 from the commencement of the Regulated Arrangements. At a future date, to be determined, during the lifetime of the Regulated Arrangements, the TSOs will calculate the Performance Incident Response Factor based on the Providing Unit's response to a Fault Disturbance.

From the commencement of the Regulated Arrangements, Compliance Tests will be carried out from time to time. In accordance with the DS3 System Services Agreement, a Providing Unit is required to accurately reflect its true capability to provide the service.

5.19 Dynamic Reactive Response (DRR)

The Performance Scalar for DRR will be set equal to 1 from the commencement of the Regulated Arrangements. This may change during the lifetime of the contracts.

The calculation of the Availability Discount Factor is not applicable to DRR and will be set equal to 1 for the duration of the Regulated Arrangements.

The Performance Incident Response Factor for DRR will be set equal to 1 from the commencement of the Regulated Arrangements. At a future date, to be determined, during the lifetime of the Regulated Arrangements, the TSOs will calculate the Performance Incident Response Factor based on the Providing Unit's response to a fault disturbance.

From the commencement of the Regulated Arrangements, Compliance Tests will be carried out from time to time. In accordance with the DS3 System Services Agreement, a Providing Unit is required to accurately reflect its true capability to provide the service.

5.20 Steady State Reactive Power (SSRP)

The Performance Scalar will be set equal to 1 from the commencement of the Regulated Arrangements.

At a future date, to be determined, during the lifetime of the Regulated Arrangements, it is envisaged that the TSOs will calculate P_E based on relevant factors, which may include, but are not limited to, an assessment of the reactive power output of a Providing Unit within applicable tolerances, accounting for different modes of operation and AVR.

5.21 Synchronous Inertial Response (SIR)

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

From the commencement of the Regulated Arrangements, compliance assessments will be carried out from time to time. In accordance with the DS3 System Services Agreement, a Providing Unit is required to accurately reflect its true capability to provide the service.

5.22 Data Provision for Performance Assessment of FFR, DRR and FPFAPR

For the Performance Assessment of FFR, DRR and FPFAPR the relevant information shall be provided by the Service Provider's Monitoring Equipment in the format and resolution as defined by the TSO within three working days. **Figure 5** outlines the high level process for data provision for assessment of FFR and Figure 6 outlines the high level process for data provision for assessment of FPFAPR and DRR.

If the TSO has existing Monitoring Equipment installed at the Service Provider's site this may be used to submit data for the purpose of Performance Assessment for a maximum period of 24 months from 1st September 2018. Unless otherwise agreed by the TSO after this time the

Service Provider must have installed its own Monitoring Equipment to the standard set out by the TSO in accordance with the DS3 Performance Measurement Device Standards for Fast Acting Services.

For the period to 28 February 2019, if the unavailability of TSO Monitoring Equipment prevents the Service Provider from submitting the required template for the purposes of Performance Assessment an alternate data source may be used. If a suitable data source is not available, a Performance Incident Scaling Factor with a value equal to the average of that metric for all Providing Units that were expected to respond to the Performance Incident will be awarded to the Service Provider for that Performance Incident. From 1 March 2019, if data to the specified standard is not available following a Performance Incident then the Providing Unit will be considered to have failed to have provided the service and a Fail Record awarded for that Performance Incident.

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

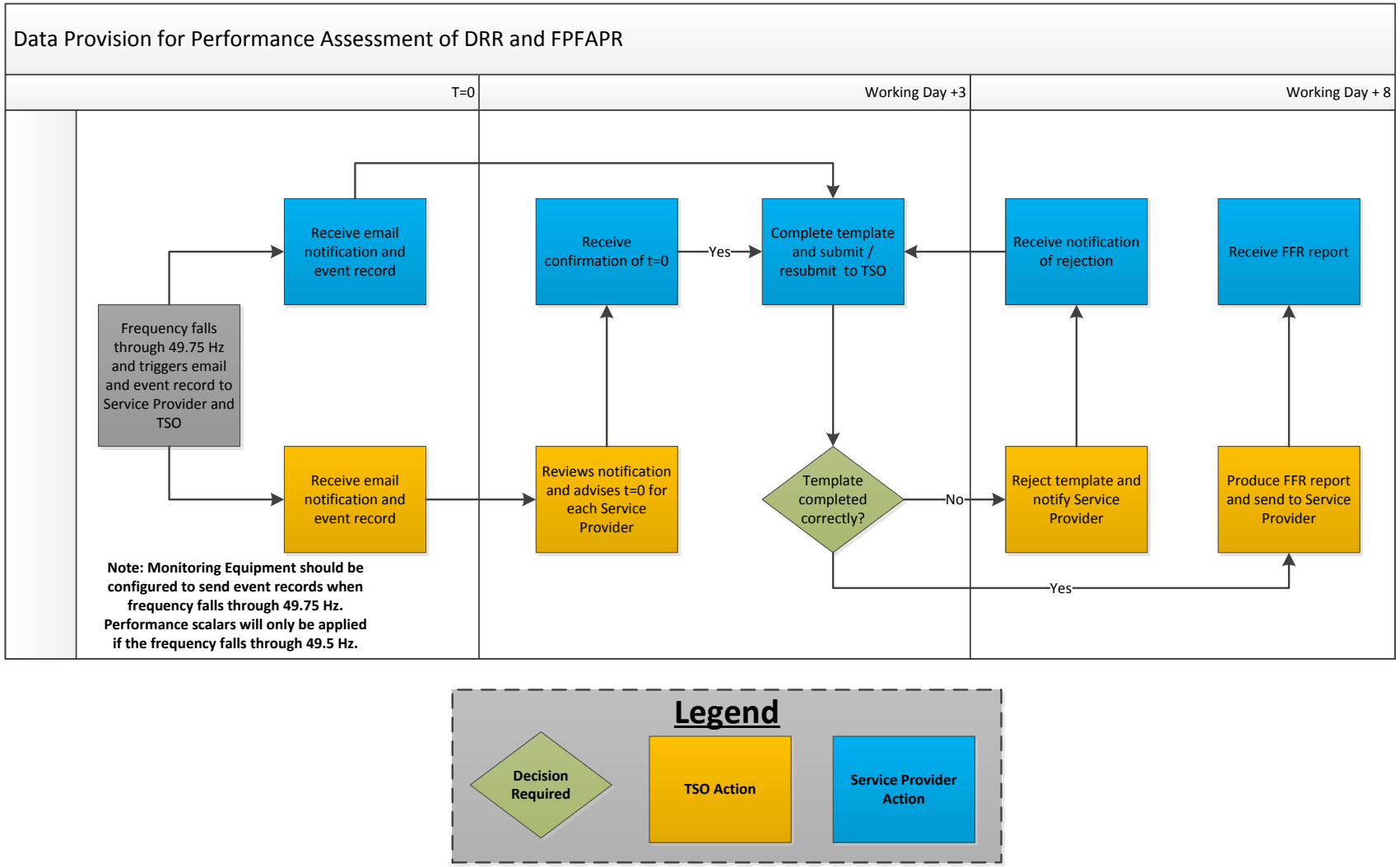

Figure 5: Data Provision for Performance Assessment of FFR

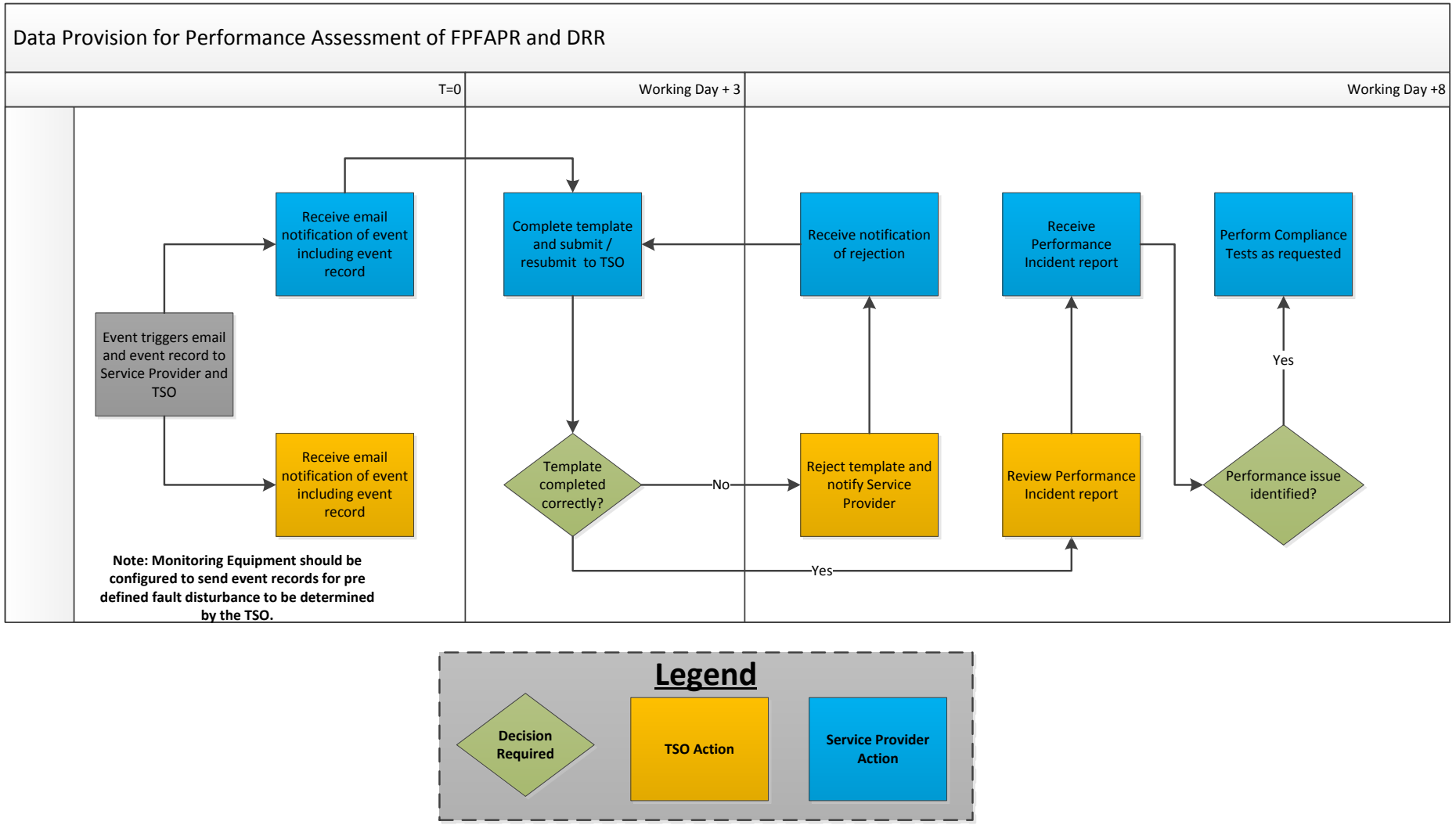

Figure 6: Data Provision for Performance Assessment of FPFAPR and DRR

5.23 Data Provision for Aggregated Sites

For Service Providers that are contracted to provide POR, SOR or TOR1 through the aggregation of multiple sites, the TSO requires aggregated real time SCADA demand data from the Providing Unit, at a resolution of 1 Hz or greater (Time-Stamped and Synchronised to a common time). The TSO also requires this data from the Individual Sites which provide POR, SOR and TOR1 and this should be provided within one Working Day following a Performance Incident or as agreed by the TSO and in a format to be agreed by the TSO.

Service Providers that are contracted to provide FFR through the aggregation of multiple sites, must have Monitoring Equipment for the provision of data to the standard set out by the TSO in accordance with the DS3 Performance Measurement Device Standards for Fast Acting Services.

5.24 Providing Units with less than the Minimum Data Records Requirements

Should a Providing Unit fail to meet the Minimum Data Records Requirement outlined in Table 2, the Providing Unit will be 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 a Performance Incident over a long period of time; or
b) Have been available during Performance Incidents, however, due to the application of tolerances their performance is not assessed as their Expected response is consistently less than 0 MW.

The Data Poor Performance Scalar is applied as a reducing scalar over time based on the number of months a Providing Unit has gone without providing an assessable response to a Performance Incident.

Following 12 months without a Performance Incident, 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 in Figure 7;

Table 3: Data Poor Performance Scalar Calculations

Months without an event (M)	Performance Incident Scaling Factor Calculation (P_E)
< 12 Months (M)	**MAX (1 – SUM(K_m* V_m) , 0)**
12 **<=Months (M)<** 30	**0.7 + ((30 – M)*(0.3/18))**
30 **<= Months (M) <** 48	**(48 – M) * (0.7/18)**
>48 **Months (M)**	**0**

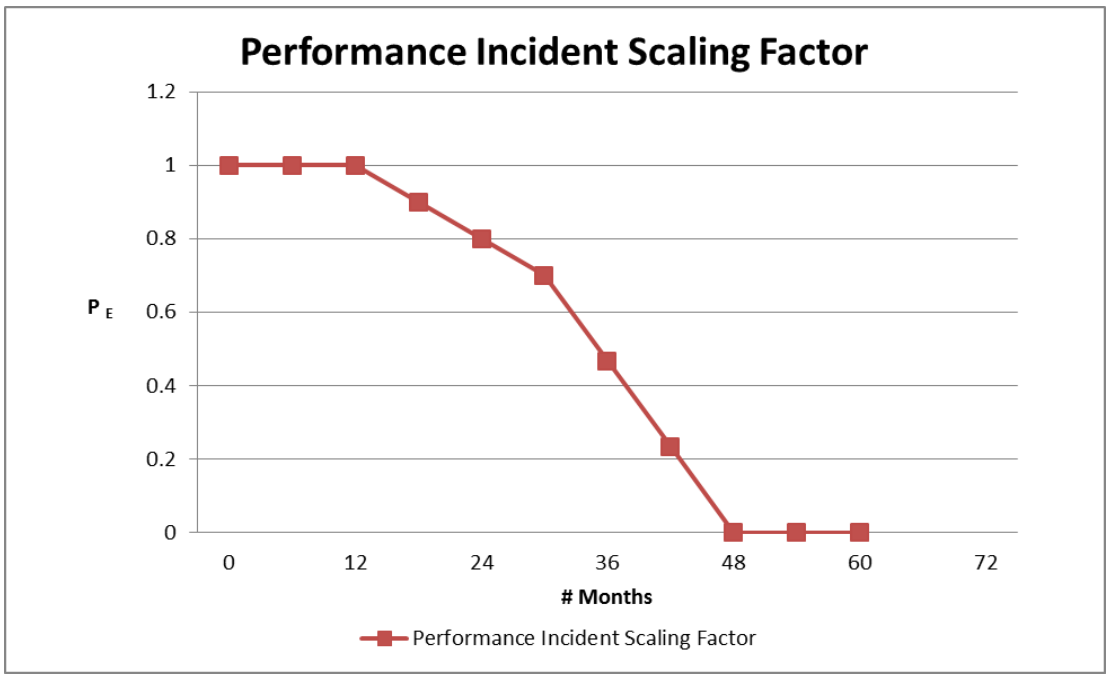

Figure 7: Graphical Representation of Performance Incident Scaling Factor using the Data Poor Scalar Calculation

For any Providing Unit which fails to adhere to the Minimum Data Records Requirement and subsequently enters into the Data Poor Performance Scalar assessment category the Providing Unit can rectify its scalar back to 1 through two possible mechanisms:

- A Performance Incident occurs whilst the Providing Unit is online and provides an assessable response. Upon responding to the Performance Incident the Providing Unit will automatically return to the normal Performance Scalar calculation mechanism outlined in Section 5.4 with a Performance Scalar based on its response to the Performance Incident.
- The Providing 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 illustrated in Figure 8. Depending on the TSO assessment, a Performance Test may be required to reset the Performance Scalar to 1 and month ‘M’ to 0. Should a Performance Test be deemed to be 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 5.25 of this document.

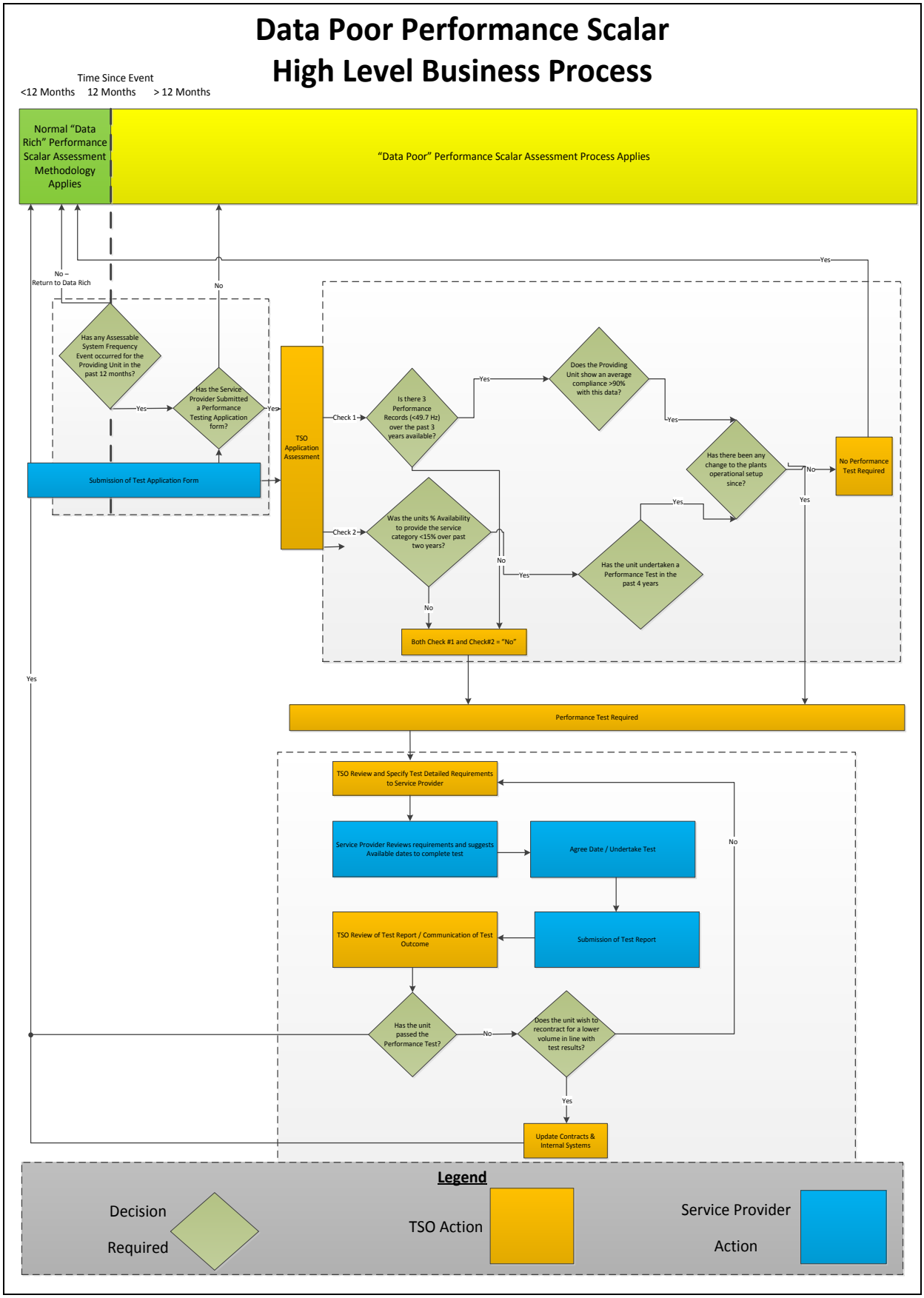

Figure 8: Data Poor Performance Scalar High Level Business Process Flow Chart

5.25 Performance Testing Process

Upon completion of the Performance Test process a Providing Unit's Performance Scalar may be reset to 1. 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 by the relevant testing teams within EirGrid and SONI, including what the Providing Unit is required to achieve to warrant the allocation of a successful Performance Test result. These requirements may vary depending on the type of Providing Unit. The purpose of the Performance Test is to account for a lack of data to rectify poor recent performance which has resulted in the Providing Unit making changes to its plant to rectify the issue. Care will be taken when scheduling a Performance Test however to try to align with other tests which may be required by that Providing Unit.

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

- For FFR, 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 unit's Synchronisation and start up through to ramp up to full load output compared against the Providing Unit's 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 Performance Test requirements an earliest available date to conduct the Performance Test will be proposed by the TSO. Should the

Service Provider prefer to choose an alternative date more 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 period.

In general, if the Performance Testing process is awaiting actions from the Service Provider (shown in blue in Figure 8) 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.

5.26 Performance Monitoring Timelines and Business Process Overview

5.26.1 Overview

The monthly scalar implementation to the settlement cycle will occur monthly in arrears. For example, a Providing Unit's 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.

5.26.2 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 Performance Incident updated to the date the query was resolved and Performance Incident 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 4.

Table 4: 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

5.26.3 Query / Challenge Process

A Service Provider may challenge its Performance Data Pack 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 that 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.

5.26.4 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 Performance Data Packs will then be scheduled for implementation in the next settlement cycle. Each Performance 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) Summary Tab;
b) Reserve Data Tab;
c) Ramping Tab; and
d) Glossary.

5.27 Signal Availability Declarations

A Providing Unit may be required to make a number of declarations when contracted to provide DS3 System Services. The Providing Unit must be able to declare service availability for contracted DS3 System Services via electronic means in real-time i.e. through EDIL or a real-time signal. Table 5 summarises the non-Grid Code EDIL Declarations that a Providing Unit may be required to make. They are referenced in the Agreement as noted in Table 5.

The Providing Unit must be able to declare service availability for contracted DS3 System Services via electronic means in real-time i.e. through EDIL or a real-time signal.

Table 5: 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
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

6 Temporal Scarcity Scalar Values

In accordance with Section 4.1.2 of the Agreement, the values of the Temporal Scarcity Scalar are set out in Table 6.

Table 6: Temporal Scarcity Scalar Values

Service	Temporal Scarcity Scalar Variable in Agreement	Temporal Scarcity Scalar Variable Value
POR	PORTSS1	1
POR	PORTSS2	4.7
POR	PORTSS3	6.3
SOR	SORTSS1	1
SOR	SORTSS2	4.7
SOR	SORTSS3	6.3
TOR1	TOR1TSS1	1
TOR1	TOR1TSS2	4.7
TOR1	TOR1TSS3	6.3
TOR2	TOR2TSS1	1
TOR2	TOR2TSS2	4.7
TOR2	TOR2TSS3	6.3
RRS	RRSTSS1	1
RRS	RRSTSS2	4.7
RRS	RRSTSS3	6.3
RRD	RRDTSS1	1
RRD	RRDTSS2	4.7
RRD	RRDTSS3	6.3
SSRP	SSRPTSS1	1

SSRP	SSRPTSS2	4.7
SSRP	SSRPTSS3	6.3
SIR	SIRTSS1	1
SIR	SIRTSS2	4.7
SIR	SIRTSS3	6.3
FFR	FFRTSS1	0
FFR	FFRTSS2	1
FFR	FFRTSS3	4.7
FFR	FFRTSS4	6.3
FPFAPR	FPFAPRTSS1	0
FPFAPR	FPFAPRTSS2	6.3
RM1	RM1TSS1	1
RM1	RM1TSS2	4.7
RM1	RM1TSS3	6.3
RM3	RM3TSS1	1
RM3	RM3TSS2	4.7
RM3	RM3TSS3	6.3
RM8	RM8TSS1	1
RM8	RM8TSS2	4.7
RM8	RM8TSS3	6.3
DRR	DRRTSS1	0
DRR	DRRTSS2	6.3

7 Glossary

Any defined terms used in the Protocol Document which are not defined in the Glossary, are to be construed under their original definition in the Regulated Agreement

"Achieved" means the actual level of a DS3 System Service which a Providing Unit provides in response to a Performance Incident;

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

"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 a Performance Incident, 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 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;

“Connection Conditions” has the meaning given to it in the Grid Code;

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

“Operational Requirements” means the TSOs’ standards that a Service Provider must satisfy in providing a given DS3 System Service from a given Providing Unit.

“Compliance Test” means the process of assessing that Operational 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 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 Agreement;

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

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

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

“Dynamic Response” has the meaning given to it in the 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 Scaling Factor (Km) based on the time difference between when the Events occurred and the current Scalar Assessment Month;

"Dynamic Trajectory Scalar" has the meaning given to it in the Agreement;

"Distribution System" has the meaning given to it in the Grid Code;

"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;

"Emulated Inertia" means the ability of some Controllable WFPS technologies to provide additional increase in MW Output following a Performance Incident at times when the WFPS is not operating under curtailment.

"Event Recorder" has the meaning given to it in the Agreement;

"Expected" means, in relation to DS3 System Services, the level of response that a Providing Unit is expected to provide in response to a Performance Incident taking account of tolerances where appropriate;

"Fail" means the outcome of a Performance Assessment where the response achieved following a Performance Incident 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;

"Fault Disturbance" has the meaning given to it in the Agreement;

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

“FFR Hysteresis Control” has the meaning given to it in the Agreement;

“FFR Response Time” has the meaning given to it in the Agreement;

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

“FFR Trajectory Capability” has the meaning given to it in the Agreement;

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

“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 the Reserve Trigger. 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” has the meaning given to it in the Agreement;

“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 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;

“Intermediary” has the meaning ascribed to the term in the Trading and Settlement Code;

“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 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 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;

“Pass” means the outcome of a Performance Assessment where the response achieved following a Performance Incident is greater than or equal to an upper threshold representing a percentage of the Expected response;

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

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

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

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

“Performance Incident Scaling Factor (Qi)” refers to the assessment of a Providing Units performance to a Performance Incident 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 Scaling Factor (Km);

“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 Agreement;

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

"POR" has the meaning given to it in the 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 Agreement;

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

"POR Reserve Characteristic" means the POR reserve parameters in Schedule 9 of the Agreement;

"Power System" means the Transmission System or Distribution System;

"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 Agreement;

"Protocol" means this document entitled "DS3 System Services Protocol" as published on the Company's website (www.eirgridgroup.com /www.soni.ltd.uk);

"Providing Unit" has the meaning given to it in the 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" has the meaning given to it in the Agreement;

"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 for all individual MPRNs (Meter Point Reference Number) in Ireland or similarly the Half Hourly metering data for purposes of MPRNs in Northern Ireland;

"Regulated Arrangements" means the arrangements for DS3 System Services from 1 May 2018;

"Regulatory Authority" means the Commission for Energy Regulation for EirGrid Or the Northern Ireland Authority for Utility Regulation for SONI

"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” has the meaning given to it in the Agreement;

“Reserve Trigger Capability” has the meaning given to it in the Agreement;

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

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

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

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

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

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

“SNSP” or “System Non-Synchronous Penetration” has the meaning given to it in the Agreement.

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

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

“Static Response” has the meaning given to it in the 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;

“Synchronised” (and like terms) has the meaning given to it in the Grid Code;

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

“Temporal Scarcity Scalar” has the meaning given to it in the Agreement;

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

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

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

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

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

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

“Trading and Settlement Code” has the meaning given to it in the Agreement;

“Transmission System” has the meaning given to it in the Grid Code;

“Transmission System Operator (TSO)” has the meaning given to it in the Grid Code;

“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 (as applicable);