DS3 System Services Protocol – Regulated Arrangements & Fixed Contracts (Volume Capped)

DS3 System Services Implementation Project

Consultation Paper

~~12 December 2017~~
~~Version 1.0~~

EIRGRID SONI

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** **& Fixed Contracts (Volume Capped)** 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~~ three exceptions. ~~The values for the Temporal Scarcity Scalars are set out in Section 6 of this document and t~~The methodology for calculating **Performance Scalars** is

described in Section 5 of this document~~5~~, the methodology for calculating **Availability Performance Scalars** is described in Section 6, and the values for the **Temporal Scarcity Scalars** under the **Regulated Arrangements** are set out in Section 7.

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**.

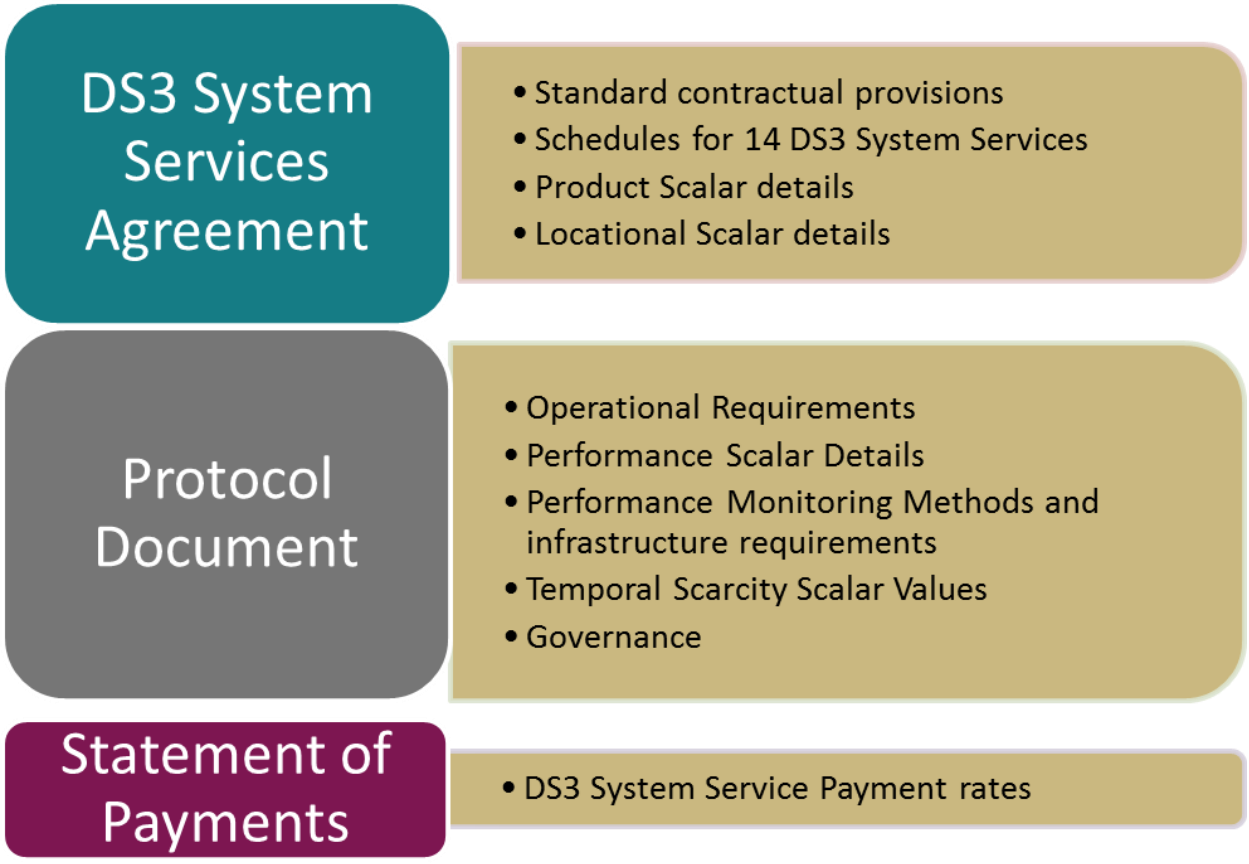


Figure 1: Overview of Agreement and associated documents

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**,~~ tThis **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 / 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 be updated to reflect the unit's real-time availability for all ~~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~~ **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).
- Where **Providing Unit** sites are unmanned, the **Providing Unit** shall have the capability to remotely enable/disable each contracted service individually.

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 **Dd~~d~~ynamic Response~~capability~~** in the provision of **POR**, and **Ss~~s~~tatic Response** 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~~ **Wind Farm Power Station (WFPSs)** ~~WFPS~~ and **Solar PV Providing Unit~~s~~** in their~~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~~ **Providing Unit** shall only be considered available to provide **FFR, POR and SOR** when its **Cc~~c~~alculated Hh~~h~~eadroom** 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~~ **Providing Unit** shall only be considered available to provide

TOR1 when its **Cc~~c~~alculated H~~h~~eadroom** 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 relevant ~~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**~~ **Active Power**~~**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 **R~~r~~echarge L~~l~~imitations**, 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 **Ff~~f~~requency** 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**. In the event that a **Service Provider** becomes aware of issues related to under delivery in real-time the **Providing Unit** shall declare down all affected ~~product~~service volumes by the relevant amount~~, or if it does,~~ the **Providing Units** Real-time **SCADA** availability values shall reflect the MW response provided in all cases.

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 parameterisable **Ff~~f~~requency R~~r~~esponse C~~c~~urves**. 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~~ that has **D~~d~~ynamic Response** 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 49.80 Hz and an upper threshold of 49.985 Hz, or an upper threshold of 50.00 Hz for synchronous units;
- The **Providing Unit** shall provide its **Expected** response within 2 seconds of the **Transmission System 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 **F~~f~~requency** 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 5 MW; the response shall be provided in a linear, monotonically increasing manner; ideally, all steps will be equal, but a tolerance of 1 MW 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 **Ff**~~f~~**requency Rr**~~r~~**esponse Cc**~~c~~**urve** 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 **Transmission Ss**~~s~~**ystem Ff**~~f~~**requency** 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. Monitoring requirements are detailed in Section 5.27.
- ~~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 **Transmission System 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 **Transmission System Frequency** falling through its **Reserve Trigger** shall not be eligible for a **Dynamic Trajectory Scalar** value greater than 0.2.~~

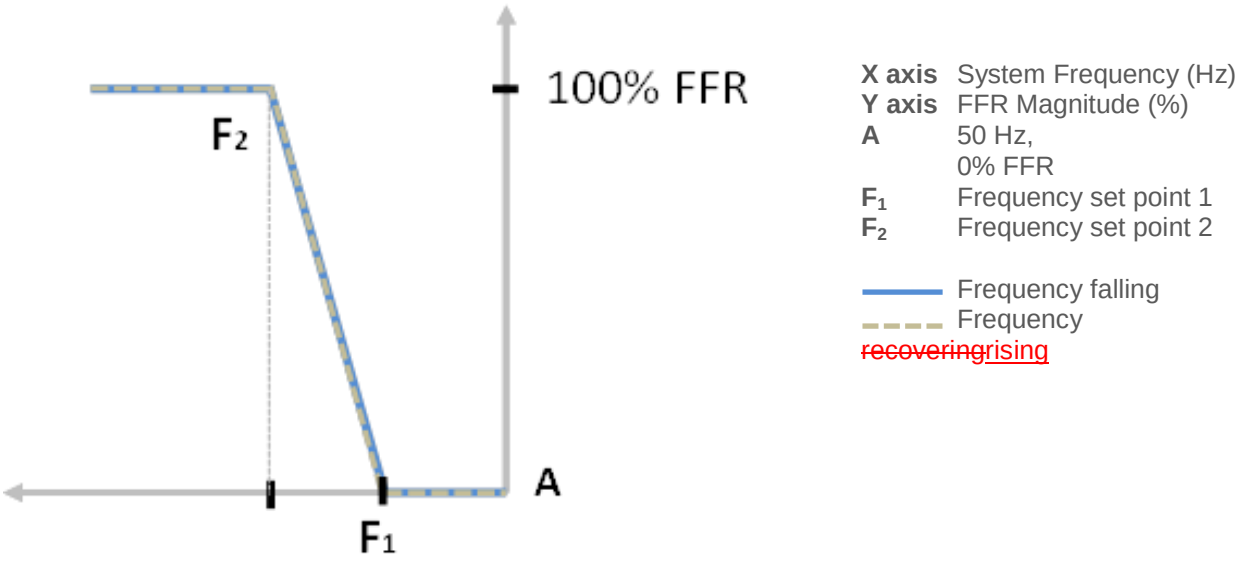


Figure 2: FFR Dynamic Capability Frequency Response Curve.

The **Ff~~f~~requency Rr~~r~~esponse Cc~~c~~urve** 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 **Providing Unit** should provide a linear response to changes in **Transmission System Frequency** as indicated in Figure 2.

~~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 **Ff~~f~~requency Rr~~r~~esponse Cc~~c~~urve**, including the **Reserve Trigger** and **FFR Trajectory**, within the agreed contracted capabilities of the **Providing Unit**.

At times of high **Ff~~f~~requency**, where the **Providing Unit** ~~wishes to~~is ~~provide~~ providing 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 **S~~s~~tatic Response** 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 75 MW, 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 50 MW in one discrete step during a~~n~~ **Frequency Event**, the size of the smallest discrete step shall be no less than 10 MW during the same **Frequency 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 **F~~f~~requency R~~r~~esponse C~~c~~urve** 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. Monitoring requirements are detailed in Section 5.27.

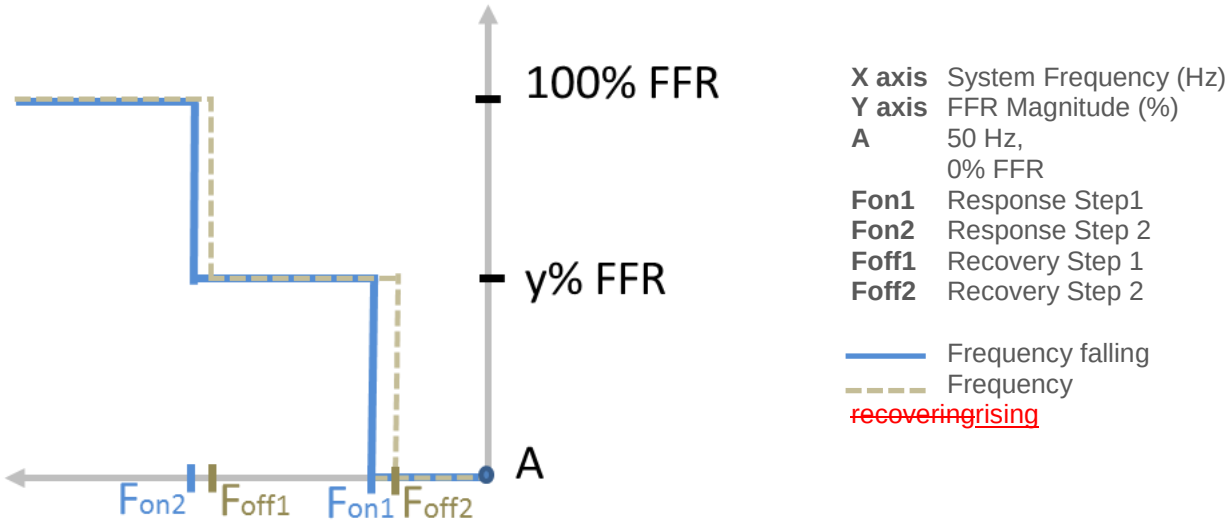


Figure 3: FFR Static Capability Frequency Response Curve

For a **Providing Unit** that has been classified by the TSOs as having **Sstatic Response** 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 **Ffrequency** recovers through the **Reserve Trigger**, as agreed by the **TSOs**.

The **TSOs** shall define the parameters of the **Ffrequency Rresponse Ccurve**, including **Reserve Triggers** in response and recovery, within the agreed

contracted capabilities of the **Providing Unit** that are specified in Schedule 9 of the **Agreement**.

The **Providing Unit** shall provide its **Expected** response within 2 seconds of the **Transmission System 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 **Ff~~f~~requency**, where the **Providing Unit** ~~wishes to~~is ~~provide~~ providing an over frequency response, the **Frequency Response C~~c~~urve** 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~~ 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 0 MW (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~~ declare 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).

The methods below will be used where a **Providing Unit** meets the **Minimum Data Records Requirement** for the relevant service. For a **Providing Unit** which does not meet the **Minimum Data Records Requirement** please refer to Section 5.25 of this document.

5.1 Performance Scalar Composition

~~For the Regulated Arrangements, t~~The **Performance Scalar**[1] (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:

$$P = P_A \times P_E$$

[1] Note that in the Fixed Contracts (or Volume Capped) Arrangements, this Scalar is called the Event Performance Scalar in order to differentiate it from the Availability Performance Scalar

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 or a period of time equal to the timeframe of the service (whichever is greater) in advance of ~~a~~ the given **Trading Period**, where the submitted forecast ~~covers~~ will cover a period of 6 hours after the start of the given **Trading Period**. The forecast must also account for production availability in the horizon period for **Ramping Margin** services, to be specified for each service. ~~(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~~ 24 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 Farm~~s~~ Power Stations** (both in the provision of services via ~~Inertial Emulation~~**Emulated Inertia** and/or **Active Power Control**), **DSUs**, **Solar PV**, 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 will be calculated on a monthly basis (where values less than 1 will result in reduced payment). ~~, 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~~6 months ~~(6)~~ and reflects how the **Providing Unit** has performed in line with the **Performance Assessment** methodologies.

For each month, *m*, There are two core elements to the **Performance Incident Response Factor (P_E)** calculation:

a) The **Monthly 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. A Q_i of 0 represents a **Pass** and a Q_i of 1 represents a **Fail**, whilst other values between 0 and 1 represent **Partial Passes**. ~~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)

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

Where;

m = Month within which the **Performance Incidents** occurred

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

Q = the **Performance Incident Scaling Factor (Q_i)** ~~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 (P_E)** is being calculated. The purpose of this is to place more emphasis on the most recent **Performance Incidents**. The **Dynamic Time Scaling Factor (V_m)** is calculated as illustrated in Table 1.

Table 1: Calculation of the Dynamic Time Scaling Factor ('Vm)'

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~~ approach the maximum duration a **Performance Incident** can impact the **Performance Incident Response Factor (P_E)** is 5 months with the impact ~~lessening~~ reducing each month.

Performance Incident Response Factor Calculation (P_E)

The **Performance 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~~ **Factor ('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

~~5.4.1~~5.5.1 Regulated Arrangements

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

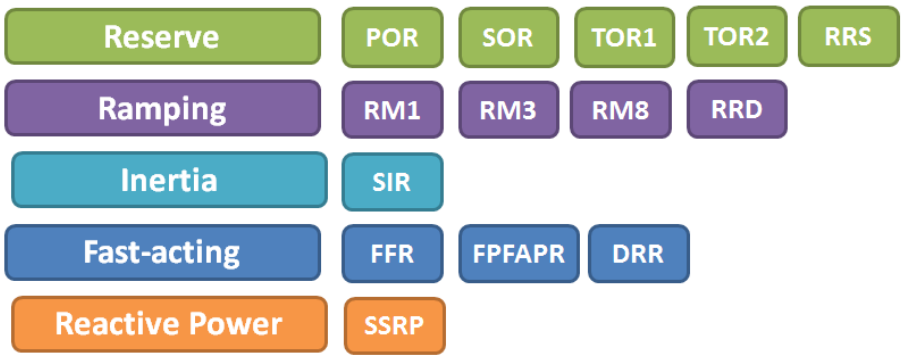


Figure 4: Categorisation of the 14 DS3 System Services for Performance Monitoring

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** ***(P_E)***. Note, whilst **TOR2** and **RRS** are categorised as reserve services (as per Figure 4) it is more appropriate to assess both using the methodology developed for **Ramping Margin** services, see Table 2.

Performance Incident Response Factors (P_E) 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 CategoryPerformance Assessment Methodology				
	Reserve	**Ramping**	**Reactive**	**Inertia**	**Fast-acting**
Services Per Category	POR SOR TOR1 TOR2 RRS	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 **DSUs:** Aggregated SCADA demand data and / or QH Meter Data for each Individual Demand Site	Subject to further consultation	N/A	A device recorder to the measurement range and accuracy standards as defined by the TSOstandard set out by the TSO in the DS3 Performance Measurement Device Standards for Fast Acting Services

		(IDS)			
Data Record	A Providing Unit's MW response to any Performance Incident from T - 5 to T + ~~3~~60, where T is the Time Zero of the Performance Incident. ~~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 Performance Incident from T - 5 to T + 60, where T is the Time Zero of the Performance Incident. ~~Frequency Event in which the Providing Unit's Expected Response is greater than or equal to 0 MW including tolerances~~
Minimum Data Resolution Requirement~~s~~	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 Aggregated SCADA demand	Subject to further consultation	N/A	Minimum data resolution of 20 ms

		data			
Minimum Data Records Requirement	Report at least 1 Performance Incident Scaling Factor every 12 Months ~~Data Record per 12 Months~~	Report at least 1 Performance Incident Scaling Factor every 12 Months~~1 Data Record 12 Months~~	Subject to further consultation	N/A	Report at least 1 Performance Incident Scaling Factor every 12 Months~~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)

5.5.2 Fixed Contracts (Volume Capped) Arrangements

The **Performance Monitoring Methodology** for the **Fixed Contracts (or Volume Capped) Arrangements** are as per those in place for the **Regulated Arrangements** described in Section 5.5.1. However ~~The key difference in this case is that~~ only five **System Services** (**FFR, POR, SOR, TOR 1** and **TOR 2**) are covered under the **Fixed Contracts Arrangements**.

5.6 Reserve Performance Incident Response Factor Calculation Methods and Assessment Criteria per Service

~~5Performance 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 (Qi) 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 Performance Assessment

For **Performance Monitoring** the reserve category assessment methods are applied for **FFR, POR, SOR** and **TOR1**. This assessment is performed based on the MW response of the **Providing Unit** to a **Frequency Event** that has been classed as a **Performance Incident**.

For each of the **DS3 System Services** subjected to a **Performance Assessment** 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 5.25 of this document.

~~**5.5**~~

~~**5.6**~~**5.7 Definition of a Frequency Event**

This section defines **Frequency Events** with respect to **Performance Monitoring** and how they relate to **Performance Incidents** and service assessment.

5.7.1 Definition of a Frequency Event and Performance Incident

A **Frequency Event** is an event where the **Transmission System Frequency** experiences a **Significant Frequency Disturbance** in excess of the **Frequency Event Threshold.** A **F~~f~~requency eEvent** is therefore deemed to have occurred if the **Transmission System Frequency** falls below 49.7 Hz or rises above 50.3 Hz.

Unless otherwise stated in this document, any **Frequency Event** will be deemed to be a **Performance Incident** and the **Providing Unit's** performance will be assessed for all **Frequency** reserve services that it was expected to provide.

5.7.1.1 Determining the Time Zero of a Performance Incident

The **Time Zero** (T) for a **Frequency Event** is the time at which the **Frequency** first passes through the **Reserve Trigger** of the **Providing Unit**. All **Frequency** reserve services will be assessed relative to this **Time Zero**.

For all **Providing Unit's** that have a **Reserve Trigger** higher than 49.8Hz the **Time Zero** shall be determined as being the time when the **Transmission System Frequency** first passes through 49.8Hz. A **Frequency Event** is solely described by this **Time Zero** and it has no specific duration.

The **Time Zero** (T) is used to determine the assessment periods for each **Frequency** reserve service and each **Frequency** reserve service shall be assessed for each **Performance Incident**, unless otherwise specified in this **Protocol**.

5.7.1.2 Pre-Event Frequency and Output

The **Pre-Event Frequency** is defined as the mean of the **Transmission System Frequency** between T-1.5 seconds and T-0.5 seconds from **Time Zero**. Where there is a significant variation in the **Transmission System** Frequency during this time, the **Pre-Event Frequency** will be defined as the mean of the **Transmission System Frequency** between T-60 seconds and T-30 seconds from **Time Zero** as the first recourse.

The same approach will be applied to determine a **Providing Unit's Pre-Event Output.**

~~*5.6.1.1*~~*5.7.1.3 Multiple Frequency Events*

On the power system, it is possible that a series of generator trips or other such events can happen over a period of seconds or minutes, complicating the assessment of reserve service provision. The following principles shall be applied in carrying out **Performance Assessments** of multiple **Frequency Events**:

a. A **Frequency Event** will only be classed as a new **Performance Incident** if it occurs at a time where the **Transmission System Frequency** has continuously remained above 49.9 Hz (or below 50.1Hz for a high **Frequency Event**) for at least thirty seconds since the **Time Zero** of a prior **Frequency Event.**

b. After the **Transmission System Frequency** experiences a **Significant Frequency Disturbance** (i.e. when it first goes beyond the **Frequency Event Threshold**) it may continue to rise and fall above the **Frequency Event Threshold**. These threshold crossings do not constitute another **Frequency Event** unless the **TSO** can attribute this change in **Frequency** to a **Significant Discrete Change** on the power system.

c. In order to carry out **Performance Assessments**, the assessment period in question needs to be free from interruptions (i.e. other **Significant Frequency Disturbances**). In practice, this means that **FFR** and **POR** should always be assessable, but the assessment of **SOR** and **TOR1** could be affected if, for example, the frequency were to recover above 49.9Hz for 30 seconds and then drop below the **Frequency Threshold** before the **SOR** or **TOR1** timeframes had elapsed.

d. If a **Static Response Providing Unit** (specifically **DSUs**, **WFPS**, and **Energy Storage Providing Units**) has depleted or exhausted its reserve capability during the first **Frequency Event**, its performance will not be assessed during any subsequent events (up to 15 minutes after the first **Frequency Event**). If applicable, such providers are required to declare all impacted services down or unavailable through **EDIL** or a real-time signal no later than 15 minutes from **Time Zero** of the initial **Event.**

~~5.7~~5.8 Primary Operating Reserve (POR)

~~5.7.1~~5.8.1 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 ~~for a~~ **Performance Incident** ~~during a Frequency Event. The assessment of POR performance is carried out~~ at a point in time corresponding to the ~~Nadir Frequency~~ maximum frequency deviation during the time range of T+5 to T+15 seconds, i.e. the **POR Period**.

~~5.7.2~~5.8.2 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/negative rate of change of **Transmission System Frequency** at ~~T+5 seconds~~ the assessment time.

The basis for calculating the **Expected POR** is the ~~anticipated~~ **Expected Providing Unit** response to the **Transmission System Frequency** ~~reduction~~deviation. The ~~increase~~ change 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~~ **Transmission 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.**

5.8.2.1 Measurement Process for Primary Operating Reserve (POR) Performance Assessment

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 "**Maximum POR Frequency Deviation**~~**Nadir** Frequency~~", being the ~~minimum~~ largest deviation in Frequency from nominal during the **POR Period**;

4) The "~~Nadir~~ **POR Assessment Time**", being the time of the maximum **Frequency** deviation from nominal in the **POR Period**, ~~at which the minimum Frequency occurs during the POR Period~~ with reference to the **Providing Unit's** T=0 for the event; ~~to the start of the Frequency Event;~~

5) The "~~Nadir~~ **POR 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 **POR Assessment Time** ~~Nadir Time~~;

7) The output of the **Providing Unit** (in MW) at the **POR Assessment Time** ~~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 **Error! Reference source not found.**~~5.5.1.2.2~~;

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/negative rate of change of **Frequency** at the **POR Assessment Time** ~~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's** "**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**.

5.8.2.2 POR Governor Droop Multiplier Calculation

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

POR Governor Droop Multiplier = 1 +

(**POR Gg**~~o~~**overnor Dd**~~r~~**roop M**~~m~~**ultiplier Alpha**~~α~~ * exp(-**POR Governor Dd**~~r~~**roop M**~~m~~**ultiplier Beta**~~β~~ * **Nn**~~a~~**dir Tt**~~i~~**me** Assessment $_{POR}$)),

(~~W,~~where exp 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.

~~*5.7.2.1*~~*5.8.2.3 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 **Maximum POR Frequency Deviation** ~~Nadir Frequency Delta~~ (Hz) divided by the **Declared Governor Droop** (PU) times the **POR Governor Droop Multiplier** (PU) times the **Nominal Frequency** (50 Hz)

~~5.7.2.2~~5.8.2.4 *Expected POR Calculation:*

The **Expected POR** is the **Expected** ~~increase~~ change from the **Pre-Event Output** ~~from~~ by the **Providing Unit** at the ~~Nadir Frequency~~**POR Assessment Time** 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 **Maximum POR Frequency** ~~Deviation~~~~Nadir Frequency in~~**Deviation** 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**.

~~5.7.2.3~~5.8.2.5 *Calculation of Achieved Provision of POR*

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

~~5.7.2.4~~5.8.2.6 *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~~

For each **Performance Incident**, where the **Expected POR** response (inclusive of the **POR Inertia Credit**) is greater than or equal to 1 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~~

~~$Q_i = 0$,~~

~~ii) Otherwise;~~

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

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** (Q_i=0) 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.

If the **Expected POR** response (inclusive of the **POR Inertia Credit**) is less than 1 MW~~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~~5.9 Secondary Operating Reserve (SOR)

~~5.8.1~~5.9.1 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 the entire time range of T+15 to T+90 seconds, i.e. the **SOR Period**.

~~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**.~~

~~5.8.2~~5.9.2 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~~of 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.~~

~~5.8.2.1~~5.9.2.1 *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 Controlle**r 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.

~~5.8.2.2~~5.9.2.2 *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).

~~5.8.2.3~~5.9.2.3 *Expected SOR Calculation:*

The **Expected SOR** is the ~~increase~~ change from the **Pre-Event Output** ~~from~~ made by 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**".

~~5.8.2.4~~5.9.2.4 *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**".~~

~~5.8.2.5~~5.9.2.5 *Calculation of Performance Incident Scaling Factor (Qi) ~~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;~~

For each Performance Incident, where the **Expected SOR** response is greater than or equal to 1 MW ~~T~~then the **Performance Incident Scaling Factor** (~~'~~**Qi**~~'~~) 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~~

~~$Q_i = 0$,~~

~~ii) Otherwise;~~

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

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** (**Qi** = 0) 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.

If the **Expected SOR** response is less than 1 MW~~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~~5.10 Tertiary Operating ~~Reserve~~ Reserve 1 (TOR1)

~~5.9.1~~5.10.1 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 the ~~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**.

~~5.9.2~~5.10.2 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.~~

~~5.9.2.1~~5.10.2.1 *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.

~~5.9.2.2~~5.10.2.2 *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).

~~5.9.2.3~~5.10.2.3 *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"**.

~~5.9.2.4~~5.10.2.4 *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"**.~~

~~5.9.2.5~~5.10.2.5 *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;~~

For each Performance Incident, where the Expected TOR1 Response is greater than or equal to 1 MW ~~T~~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~~

~~$Q_i = 0$,~~

~~ii) Otherwise;~~

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

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.~~

If the **Expected TOR1** response is less than 1 MW a N/A **Data Record** will apply to the **Providing Unit** for the **Performance Incident**.

~~**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~~5.11 Fast Frequency Response (FFR)

~~5.12.1~~5.11.1 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~~ for a ~~Frequency~~ **Performance Incident**~~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 for the T=0 to T+10 seconds period (the **FFR Period**) and for the T+10 seconds to T+20 seconds period.~~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~~ MW response from the **Providing Unit** should be sustained for the T=0 to T+10 seconds ~~entire FFR~~ period. The ~~additional~~ energy (MWs)~~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.

~~5.12.1.1~~5.11.1.1 *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 performance of the Providing Unit. ~~extent of the difference between the Expected FFR and Achieved FFR which~~ The product of these assessments 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~~ compares that to the **Achieved FFR** for each sample point. ~~If the Achieved FFR is less than the Expected FFR, the deficit is summated for all the sample points and an average deficit produced.~~

The second assessment compares the **Achieved FFR Response** provided in the T=0 to T+10 seconds period with any energy recovery in the T+10 seconds to T+20 seconds period.

Notwithstanding the methodology used in the determination of **Time Zero** for the purposes of **Performance Assessment**, the **FFR Response Time** will be assessed for each **Providing Unit** utilising the **Providing Units** individual **Reserve Triggers** and not the response from **Time Zero.**

~~5.12.1.2~~5.11.1.2 *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 'Qi'** 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

$$Q_i = 0,$$

ii) Otherwise;

For each **Performance Incident**, where the maximum **Expected FFR Response** during the **FFR Period** is greater than or equal to 1 MW the **Performance Incident Scaling Factor** ('**Qi)'** is calculated as follows:

Let S_1 be equal to an assessment of each sample point during the T=0 to T+10 seconds period. If the **Achieved FFR Response** is equal to the **Expected FFR Response** at each sample point, within applicable tolerances, then a **Pass** (S_1=1) is awarded for S_1. Otherwise a **Fail** is awarded (S_1=0).

At each **Sample Point**, a tolerance of the maximum of 10 % of the **Expected** response at the sample point or 1 MW applies, where the tolerance cannot be a negative value.

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

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

Let S_2 be equal to an assessment of the volume of energy recovered in the T+10 to T+20 seconds period. If the additional response provided in the T=0 to T+10 seconds period is greater than the loss of energy in the T+10 seconds to T+20 seconds period, then a **Pass** (S_2=1) is awarded for S_2. Otherwise a **Fail** is awarded (S_2=0).

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

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

$$S = S_1 * S_2$$

If S = 1, **Qi = 0**,

If S = 0, **Qi = 1**,

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

The **Providing Unit** must attain a **Pass** for both S_1 and S_2 in order to attain an overall **Pass** for S for the **FFR Response** to a **Performance Incident**.

If the **Expected FFR Response** is less than 1 MW, an N/A **Data Record** will apply to the **Providing Unit** for the **Performance Incident**.

~~5.13~~5.12 Ramping Category Performance Assessment

For **Performance Monitoring** of the **Ramping Margin** category of services, **Ramping Margin Performance Assessment** methods are applied for ~~The Ramping Category for Performance Monitoring includes~~ **TOR2**, **RRS**, **RM1, RM3, RM8 and RRD**.

Once an enduring assessment methodology is developed, ~~A~~a similar method of **Performance Assessment** will be employed for each of these **DS3 System Services**. Until such a method is developed, **TOR2**, ~~and~~ **RRS**, ~~will continue to inherit the TOR1 Performance Incident Scaling Factor, where available, and~~ **RM3**, **RM8** and **RRD** will ~~continue to inherit~~use the **RM1 Performance Incident Scaling Factor (Q_i)** that is based upon an **EDIL 'Fail to Sync' Instructions** ~~Fail to Sync~~ assessment. If a **Performance Incident Scaling Factor (Q_i)** is not available to inherit then a **Pass** will be awarded for the relevant **Performance Incident.**

The methods below for each of the **DS3 System Services** ~~in this category (RM1, RM3, RM8 and RRD)~~ subjected to a **Ramping Margin Performance Assessment** 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~~5.25 of this document.

5.13 Tertiary Operating Reserve 2 (TOR2)

5.13.1 TOR2 Performance Incident~~Event~~ Response Factor

The **TOR2 Performance Incident~~Event~~ Response Factor** for the **Providing Unit** will be set equal to the Event **Response Factor** calculated for ~~TOR1~~**RM1** (see Sections 5.10.1~~5.7.1.1~~ to 5.10.2.5~~5.7.1.3~~ for details on the **RM~~TOR~~1 Performance Assessment** criteria).

5.14 Replacement Reserve Synchronised (RRS)

5.14.1 RRS Event Response Factor

The **RRS Performance Incident~~Event~~ Response Factor** for the **Providing Unit** will be set equal to the **Performance Incident ~~Event~~ Response Factor** calculated for **RM~~TOR~~1** (see Sections 5.10.1~~5.7.1.1~~ to 5.10.2.5~~5.7.1.3~~ for details on the **RM~~TOR~~1 Performance Assessment** criteria).

5.15 Replacement Reserve Desynchronised (RRD)

5.15.1 RRD Performance Incident Response Factor

The **RRD Performance Incident Response Factor** for the **Providing Unit** will be set equal to the **Performance Incident Response Factor (P_E)** calculated for **RM1** (see Sections 5.16.1 to 5.16.3 of this document for details on the **RM1 Performance Assessment Criteria**).

~~*5.14*~~*5.16* Ramping Margin 1 (RM1)

~~5.14.1~~5.16.1 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 5.16.2.2~~5.14.1.2.2.~~

~~5.14.2~~5.16.2 Measurement Process for Ramping Margin 1 (RM1) Performance Assessment

~~5.14.2.1~~5.16.2.1 *Measurement Process for Ramping Margin 1 (RM1) Performance Assessment for all Providing Units except DSUs*

The **Providing Unit** will be performance assessed using the **EDIL 'Fail to Sync' Instructions** ~~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.

~~5.14.2.2~~5.16.2.2 *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.*

~~5.14.3~~5.16.3 Calculation of Performance Incident Scaling Factor (Qi) for Ramping Margin 1 (RM1)

~~5.14.3.1~~5.16.3.1 *Criteria used to determine Performance Incident Scaling Factor (Q_i) 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_i)’ 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.

~~5.14.3.2~~5.16.3.2 *Criteria used to determine Performance Incident Scaling Factor (Q_i) for RM1 for DSUs*

For a **DSU** to achieve a ‘**Pass**’ it is required to comply with some of, but not all of the criteria outlined in Section 5.16.2.2~~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 5.16.2.2~~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 5.16.2.2~~5.14.1.2.2~~.

For clarity, Criteria (i) and (ii) of Section 5.16.2.2~~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_i)’ 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~~5.17 Ramping Margin 3 (RM3)

~~5.15.1~~5.17.1 RM3 Performance Incident~~Event~~ Response Factor

The **RM3 Performance Incident~~Event~~ Response Factor** for the **Providing Unit** will be set equal to the **Performance Incident Response Factor (P_E)** calculated for

RM1 (see Sections 5.16.1~~5.14.1.1~~ to 5.16.3~~5.14.1.3~~ of this document for details on the **RM1 Performance Assessment Criteria**).

~~5.16~~5.18 Ramping Margin 8 (RM8)

~~5.16.1~~5.18.1 RM8 Performance Incident~~Event~~ Response Factor

The **RM8** ~~-~~**Performance Incident Response Factor** **(P_E)** for the **Providing Unit** will be set equal to the **Performance Incident Response Factor** **(P_E)** calculated for **RM1** (see Sections 5.16.1~~5.14.1.1~~ to 5.16.3~~5.14.1.3~~ of this document for details on the **RM1 Performance Assessment Criteria**).

~~**5.17 Replacement Reserve Desynchronised (RRD)**~~

~~**5.17.1 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 5.12.1.15.14.1.1 to 5.12.1.35.14.1.3 of this document for details on the **RM1 Performance Assessment Criteria**).~~

~~5.18~~5.19 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** (P_A) is not applicable to **FPFAPR** and will be set equal to 1 for the duration of the **Regulated Arrangements**.

The **Performance Incident Response Factor** **(P_E)** 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** **(P_E)** 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~~5.20 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 (P_A) is not applicable to **DRR** and will be set equal to 1 for the duration of the **Regulated Arrangements**.

The **Performance Incident Response Factor** (P_E) 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** (P_E) based on the **Providing Unit's** response to a **F~~f~~ault D~~d~~isturbance**.

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~~5.21 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~~5.22 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~~5.23 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.

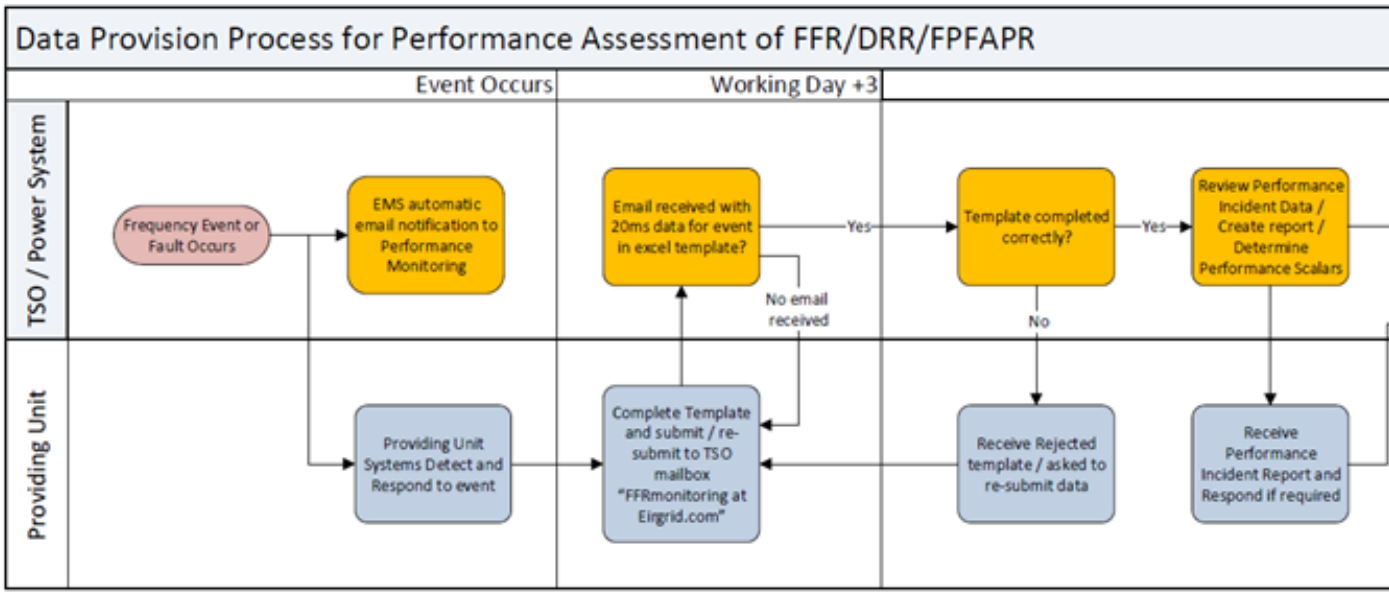


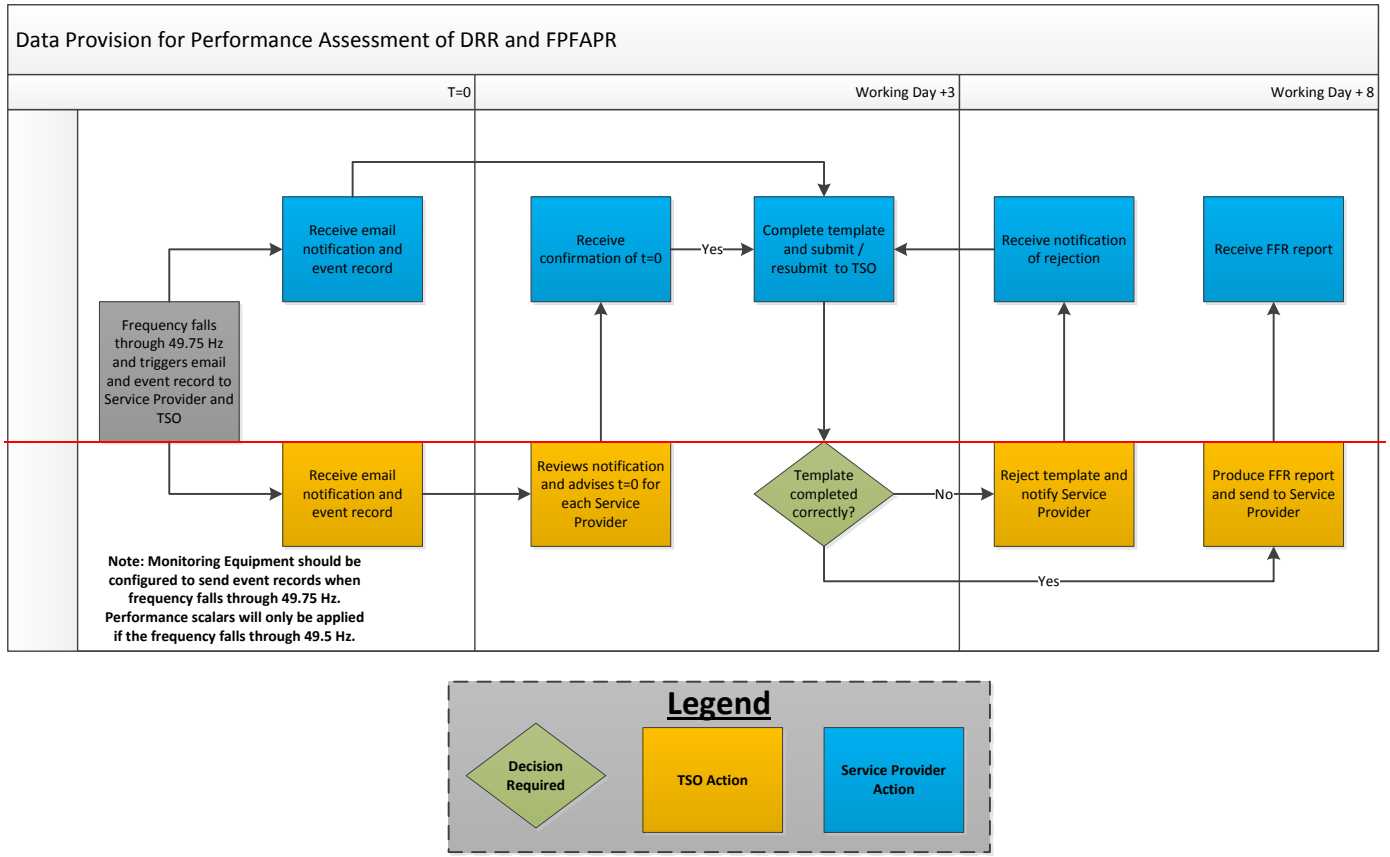
Figure 5~~Figure 5~~ outlines the high level process for data provision for assessment of **FFR**, ~~and Figure 6 outlines the high level process for data provision for assessment of~~ **FPFAPR** and **DRR**.

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** (Q_i) 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 will be 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 **Aagreement**.



Note: This is the previous figure 5 from the current version of the Protocol Document Outlining the process for DRR and FPFAPR performance assessment. This will be replaced with the below process harmonising DRR and FPFAPR performance assessment with FFR assessment.

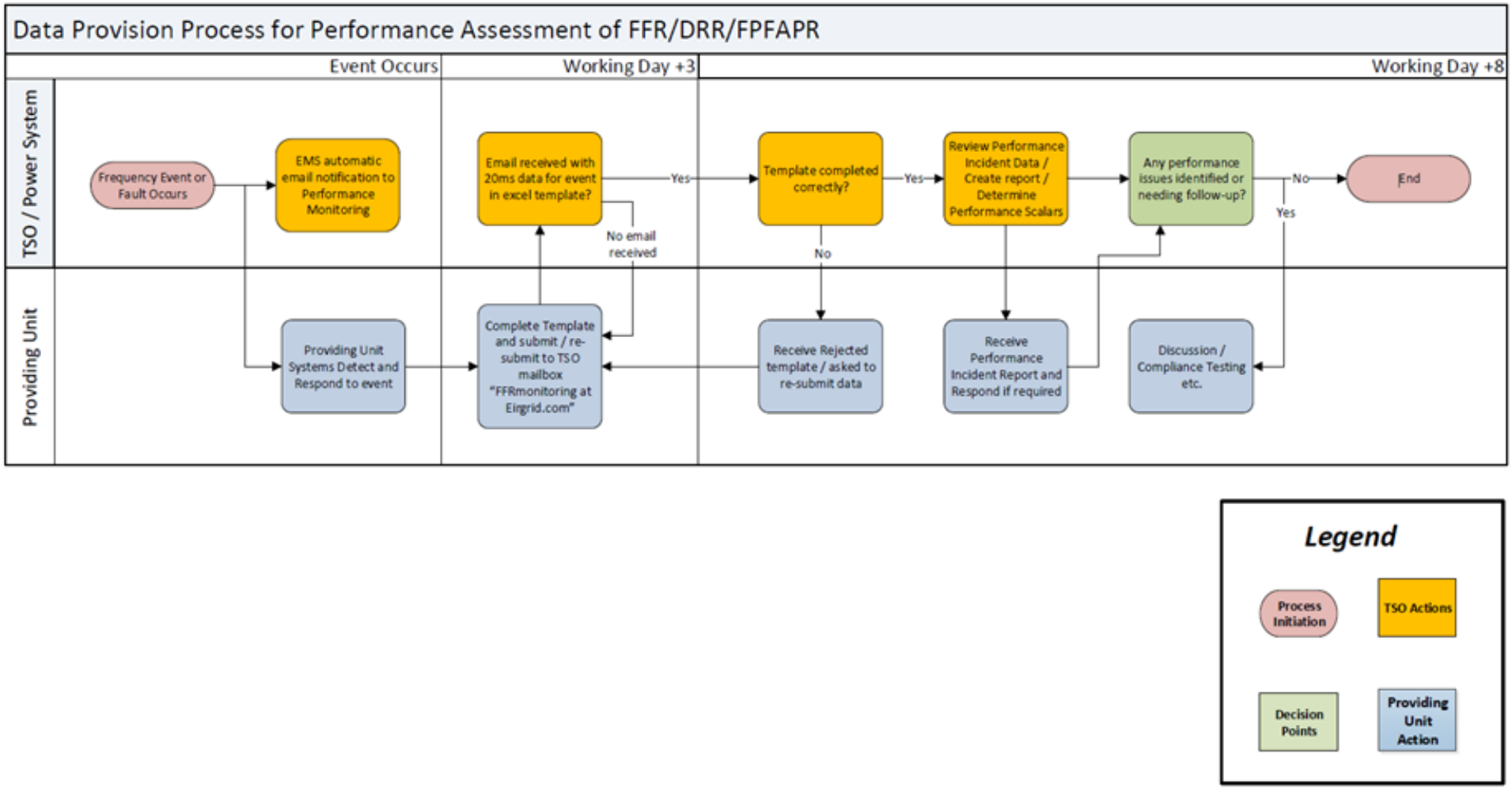
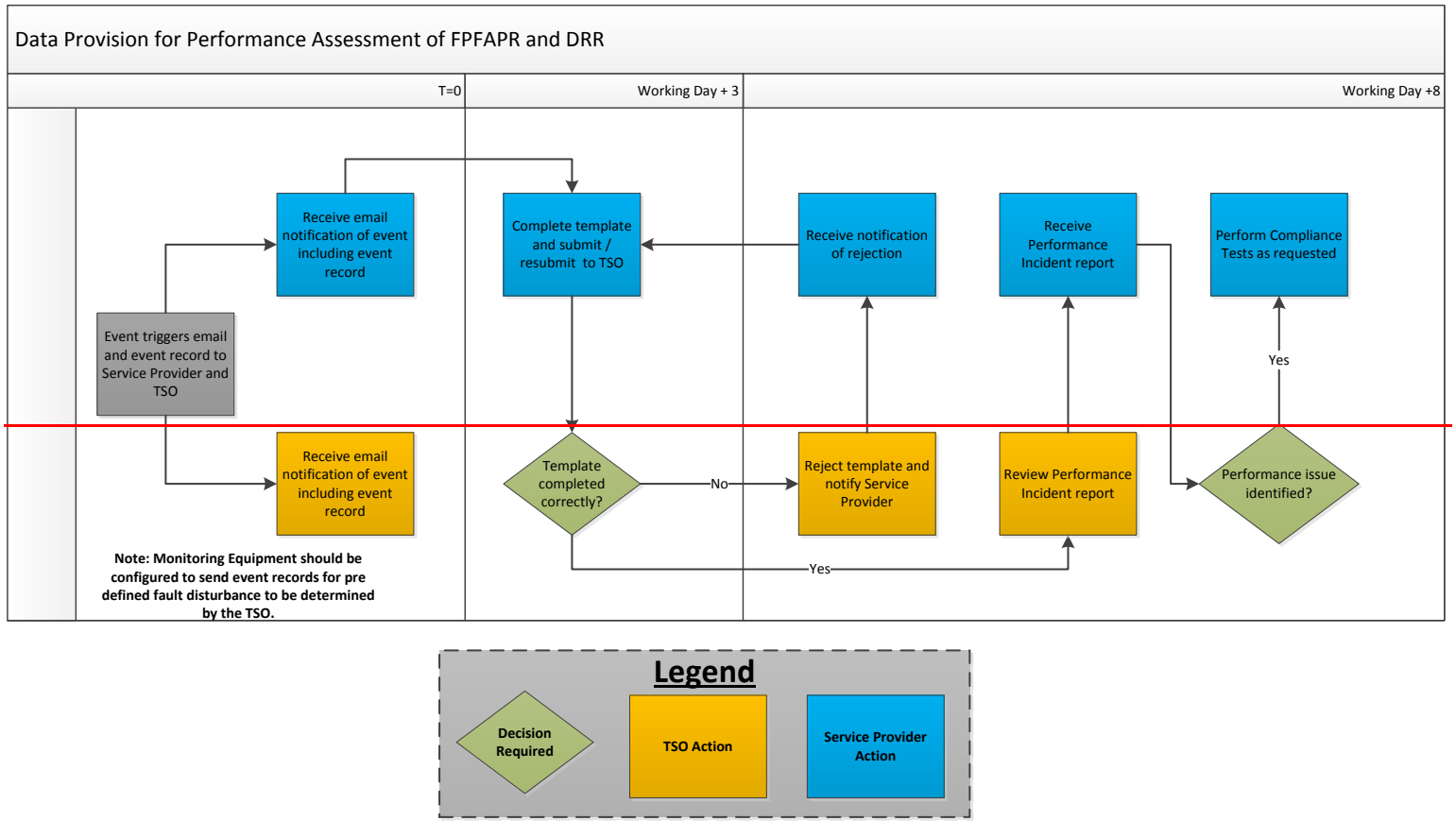


Figure 5: Data Provision for Performance Assessment of FFR / DRR / FPFAPR



Note: This is the previous figure 6 from the current version of the Protocol Document Outlining the process for FFR performance assessment. This will be replaced with the above process harmonising DRR and FPFAPR performance assessment with FFR assessment.

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

~~5.23~~5.24 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 Demand 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~~5.25 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~~Table 23~~, 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~~1 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 76~~;

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**

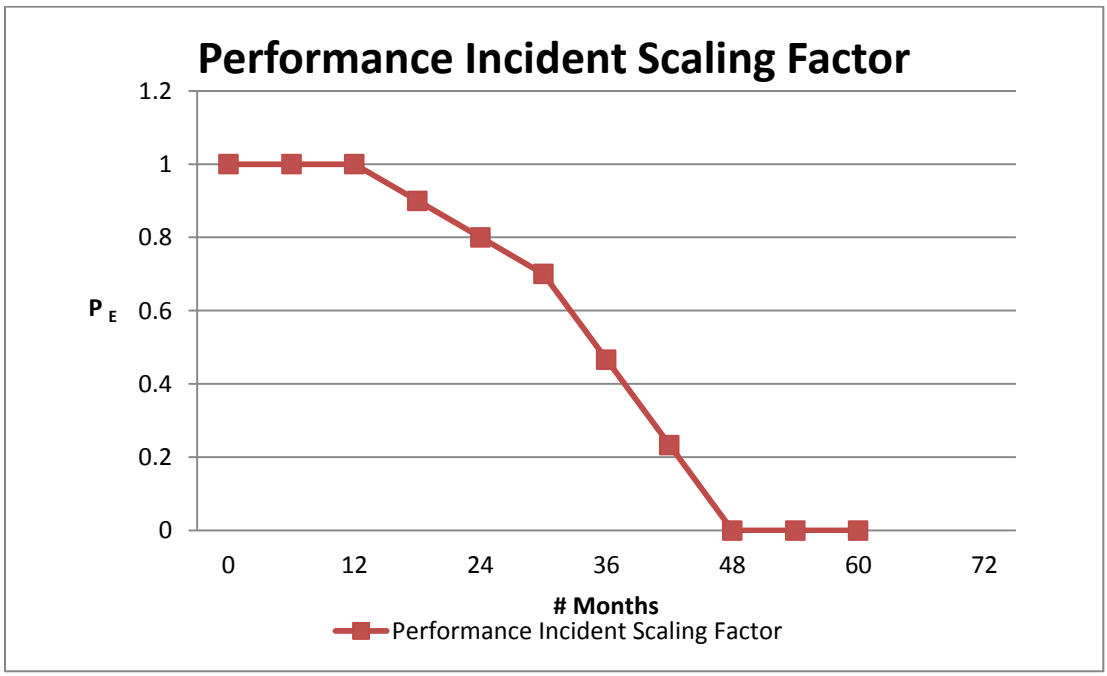


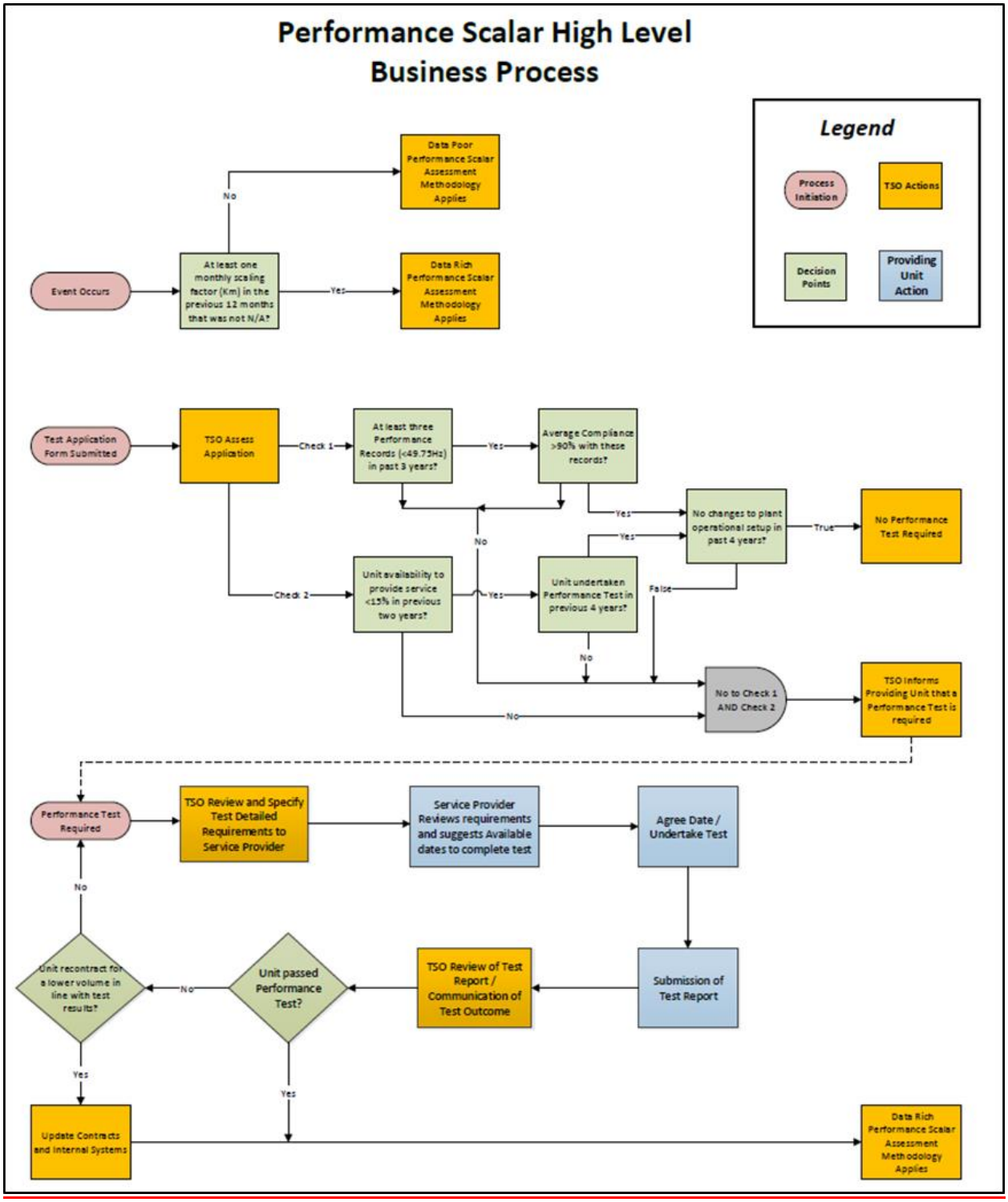
Figure ~~76~~: Graphical Representation of Performance Incident Scaling Factor using the Data Poor Scalar Calculation

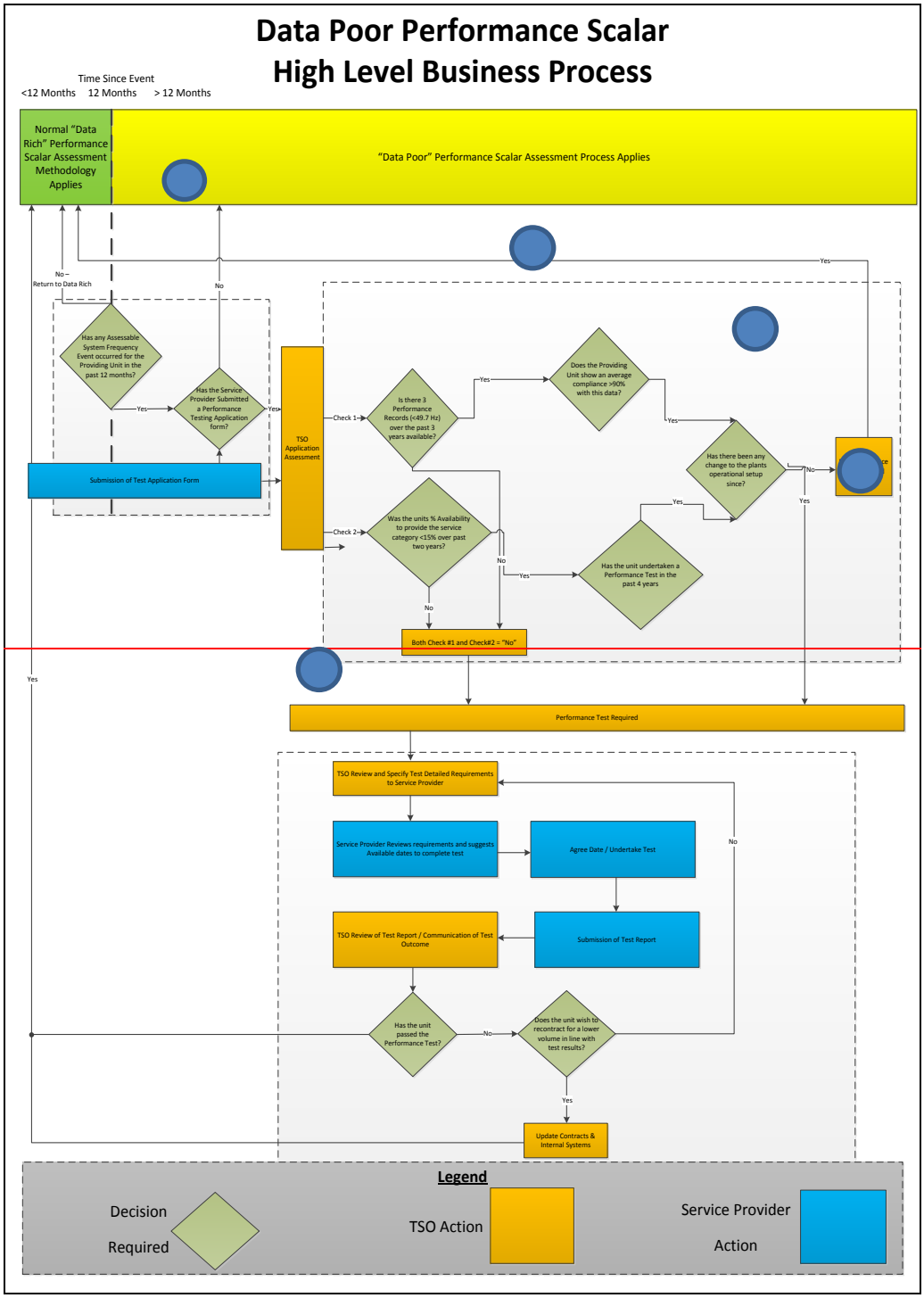
For any **Providing Unit** ~~which~~ that fails to adhere to the **Minimum Data Records Requirement** and subsequently enters into the **Data Poor Performance Scalar**

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 hHigh lLevel **Data Poor Performance Scalar** business process illustrated in figure 78. 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 5.255.26 of this document.


Performance Scalar High Level Business Process
Legend
Process Initiation
TSO Actions
Decision Points
Providing Unit Action
Event Occurs
At least one monthly scaling factor (Km) in the previous 12 months that was not N/A?
No
Yes
Data Poor Performance Scalar Assessment Methodology Applies
Data Rich Performance Scalar Assessment Methodology Applies
Test Application Form Submitted
TSO Assess Application
Check 1
Check 2
At least three Performance Records (<49.75Hz) in past 3 years?
Average Compliance >90% with these records?
Unit availability to provide service <15% in previous two years?
Unit undertaken Performance Test in previous 4 years?
No changes to plant operational setup in past 4 years?
True
False
No Performance Test Required
No to Check 1 AND Check 2
TSO Informs Providing Unit that a Performance Test is required
Performance Test Required
TSO Review and Specify Test Detailed Requirements to Service Provider
Service Provider Reviews requirements and suggests Available dates to complete test
Agree Date / Undertake Test
Submission of Test Report
TSO Review of Test Report / Communication of Test Outcome
Unit passed Performance Test?
Unit recontract for a lower volume in line with test results?
Update Contracts and Internal Systems
Data Rich Performance Scalar Assessment Methodology Applies



Note: This is the ~~old~~previous figure 7 from the ~~previous~~ current version of the Protocol Document Outlining the process for Data Poor Performance assessment. This will be replaced with the revised process above.

Figure ~~8~~7: Data Poor Performance Scalar High Level Business Process Flow Chart

~~5.25~~5.26 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 and~~,~~ 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~~ **Frequency Response C~~c~~urve** parameters.
- For **TOR2, RRS~~,/~~ RRD, ~~/~~RM1, ~~/~~RM3 and ~~/~~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~~ Generator_Testing@soni.ltd.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 ~~Figure 8~~7) 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~~5.27 Performance Monitoring Timelines and Business Process Overview

~~5.26.1~~5.27.1 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 month M~~of June 2018~~7 will be processed in month M+1~~July 2018~~7 and input into the M+2~~August 2018~~7 settlement assessment, eventually being paid out in M+4~~October 2018~~7.

~~5.26.2~~5.27.2 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 p~~P~~erformance 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
$D_E + 5_{WD}$	Date Operating Reserve report due to issue (details Pass/Fail outcome)
D	Last day of 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~~5.27.3 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~~5.27.4 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~~5.28 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	Primary Operating Reserve	Secondary Operating Reserve	Tertiary Operating Reserve 1	Tertiary Operating Reserve 2	Ramping Margin 1 Hour	Ramping Margin 3 Hour	Ramping Margin 8 Hour
EDIL Acronym	FFR	POR	SOR	TOR 1	TOR 2	RM1	RM3	RM8
Description	Fast Frequency Response in MW	Primary Operating Reserve in MW	Secondary Operating Reserve in MW	Tertiary Operating Reserve 1 in MW	Tertiary Operating Reserve 2 in MW	Ramping Margin 1-3 Hours in MW	Ramping Margin 3-8 Hours in MW	Ramping Margin 8-16 Hours in MW
Agreement term	Declared FFR	Declared POR	Declared SOR	Declared TOR1	Declared TOR2	Declared RM1	Declared RM3	Declared RM8

Declaration	Replacement Reserve Synchronised	Replacement Reserve Desynchronised	Steady State Reactive Power	Dynamic Reactive Response	Fast Post Fault Active Power Recovery	Automatic Voltage Regulation	Current Fuel
EDIL Acronym	RRS	RRD	SSRP	DRR	FPFAPR	AVR	FUEL
Description	Replacement Reserve Synchronised in MW	Replacement Reserve Desynchronised in MW	Steady State Reactive Power in MVAr	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 RRS	Declared RRD	Declared SSRP	Declared DRR	Declared FPFAPR	Declared Automatic Voltage Regulator Status	No standalone term – used in average Availability calculation

6 Availability Performance Monitoring

In the **Fixed Contracts Arrangement**, the inclusion of an **Availability Performance Scalar** was recommended by the **TSOs** and approved in SEM-18-049. The value of the **Availability Performance Scalar** will depend on the **Total Availability Factor** – this relationship is as per the above decision paper, and outlined in the Schedule 2 of the Fixed Contracts, contracts as per the table below:

Total Availability Factor	Availability Performance Scalar
<60%	0%
≥60% <70%	25%
≥70% <80%	50%
≥80% <90%	70%
≥90% <95%	85%
≥95% <97%	95%
≥97%	100%

6.1.1 Availability Performance

The **Total Availability Factor** will be calculated for each calendar month and will apply to all payments in that month. It will be based on the **Total Available Volume** versus the **Total Contracted Volume** considered over a period of 12 months.

The **Total Availability Volume** for each month *M* will be the sum of the **Total Availability Volume** for each trading period within that month. The **Total Contracted Volume** for each month *M* will be the sum of the **Total Contracted Volume** for each trading period within that month.

A **Total Availability Factor** for each month will then be calculated as follows:

Total Availability Factor = $\sum_{M=1}^{12} \left(\frac{(\text{Total Availability Volume})_M}{(\text{Total Contracted Volume})_M} * \text{Monthly Weighting}_M \right) * 100\%$,

where M=1 means the first full calendar month preceding the date for which the **Availability Performance Scalar** applies (one month ago), M=2 means the second full calendar month preceding the date for which the **Availability Performance Scalar** applies (two months ago), etc.

The **Monthly Weightings** are set as per the following table.

M – (Number of Months preceding Scalar Assessment Month)	Monthly Weighting
1	0.120
2	0.120
3	0.112
4	0.104
5	0.096
6	0.088
7	0.080
8	0.072
9	0.064
10	0.056
11	0.048
12	0.040

~~6~~7 Temporal Scarcity Scalar Values

In accordance with Section 4.1.2 of the **Agreement**, the values of the **Temporal Scarcity Scalar** (TSS) are set out in Table 6. Note that for the **Fixed Contracts Arrangements**, each service will be allocated a single TSS value, based on forecasted **SNSP** values. This single TSS value will apply to each period regardless or actual **SNSP** for that period.

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~~8 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;

"Active Power" has the meaning given to it in the Grid Code

"Active Power Control" has the meaning given to it in the Grid Code;

"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;

"Automatic Voltage Regulation or **AVR"** has the meaning given to it in the Agreement;

"Availability" has the meaning given to it in the Grid Code;

"Availability Performance Scalar" means a multiplicative factor which may be

used to adjust the payment for a given DS3 System Service to reflect a Providing Unit's historical Available Volumes for the provision of DS3 System Services;

"Available Active Power" The maximum Active Power which a Providing Unit could export at a given time in the absence of any constraint or curtailment;

"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 5.9.2.3~~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 5.10.2.5~~4.6.1.8.3~~;

"Calculated Headroom" is the difference between a unit's Available Active Power and the Active Power provided;

"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 or DSU" 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 Performance Measurement Device Standards for Fast Acting Services" refers to documents published on the TSO websites, which set out the Monitoring Equipment requirements necessary to provide fast acting services.

"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 (K_m) 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.

"Energy Storage" means the capture of energy for the purposes of consumption at a later time;

"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 Eexpected 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;

"Fixed Contracts Arrangement" has the meaning given to it in the Fixed Contract Agreement;

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

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

“FFR Period” means the time period after the instant of a Frequency Event that FFR is expected to be provided. The FFR period is taken to be between T+0 seconds to T+10 seconds after a Frequency Event where T=0 is the instant of the Frequency Event. The period between T+10 seconds and T+20 seconds is also assessed as per the ~~product~~service definition.

“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 Transmission System Frequency experiences a Significant Frequency Disturbance where System Frequency falls below or rises above the Frequency Event Threshold. A Frequency Event will not be classed as a Performance Incident if it occurs at a time where the Transmission System Frequency has not continuously remained above 49.9 Hz (or below 50.1Hz for a high Frequency Event) for at least thirty seconds since the Time Zero of another Frequency Event that was classed as a Performance Incident. ~~The Frequency Event is described by a Time Zero (T=0 seconds) for each Providing Unit and this is the time at which the Transmission System Frequency movesd beyond the Reserve Trigger of the Providing Unit. 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/Zenith” ~~means the point at which the minimum Frequency occurs during the POR period~~ is the minimum/maximum frequency observed in the immediate aftermath of the Significant Frequency Disturbance. The Frequency at this point is referred to as the “Nadir/Zenith Frequency” and the “Nadir/Zenith Time” ~~means~~ is the time at which the Frequency Event Nadir/Zenith occurs;

“Frequency Event Threshold” a deviation in Transmission System Frequency of 0.3 Hz, or as determined by the TSOs, The deviation is referenced from Nominal Frequency (50 Hz) and if exceeded denotes that a Frequency Event has occurred;

“Frequency Response Curve” means the set of parameters which define the frequency response characteristics of the providing unit

“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 5.8.2.3~~4.6.1.2.3~~, 5.9.2.2 ~~4.6.1.5.2~~ and 5.10.2.2~~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;

"Individual Demand Site" has the meaning given to it in the Grid Code;

"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 **Error! Reference source not found.**~~4.6.1.2.1~~ of this document;

"Inertial Response" has the meaning given to it in Section **Error! Reference source not found.**~~4.6.1.2.1~~ of this document;

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

"Maximum POR Frequency Deviation" has the meaning given to it in Section

5.8.2.1 of this document;

“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 (K_m)” 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 Response Factor (P_E)" means the evaluation of a Service Provider's delivery of a given DS3 System Service following a Performance Incident.

"Performance Incident Scaling Factor (Q_i)" 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 (K_m);

"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;

"POR Frequency Delta" has the meaning given to it in Section **Error! Reference source not found.** 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;

"Phasor Measurement Unit or **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 Assessment Time" has the meaning given to it in Section **Error! Reference source not found.** of this document;

"POR Governor Droop Multiplier" has the meaning given to it in Section **Error! Reference source not found.**~~5..2.24.6.1.2.2~~ 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 FFR, POR, SOR and TOR1 performance of a Providing Unit, the average MW output of the Providing Unit during the period ~~60 -~~between 1.5 seconds to 0.5~~30~~ seconds before ~~the start of a Frequency Event relative to the~~ Time Zero. ~~for the Frequency Event~~;

"Pre-Event System Frequency" means the average Frequency of the Power System during the period between 1.5~~60~~ seconds to 0.5~~30~~ seconds before Time Zero;~~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 49.70~~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 **Error! Reference source not found.**~~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;

"Recharge Limitations" are restrictions on when a Providing Unit can begin to recover the energy it expended by providing a service and may also include limitations on the rate of recharge (MW/s) and volume recharged (MWs) in a given period. These limitations shall be agreed with the TSO by each Providing Unit;

"Registered Capacity" has the meaning given to it in the Grid Code;

"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;

"Ramping Margin" has the meaning given to it in the Agreement;

"Ramping Margin 1 or **RM1"** has the meaning given to it in the Agreement;

"Ramping Margin 3 or **RM3"** has the meaning given to it in the Agreement;

"Ramping Margin 8 or **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;

"Signal List" is a list of signals, published by the TSO that identifies the signals which each provider is required to provide for the purposes of System Services provision;

"Significant, Discrete Change" in the context of a Frequency Event a Significant, discrete change is a subsequent deviation of system Frequency, following the initial Frequency Event where the change in system Frequency is shown to be attributed to a secondary disturbance.

"Significant Frequency Disturbance" a deviation in Transmission System Frequency in excess of the Frequency Event Threshold, which denotes that a Frequency Event has occurred.

"Single Electricity Market" has the meaning given to it in the Agreement;

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

"Solar PV" has the meaning given to it in the Grid Code;

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

"SOR Period" means the time period after the instant of a Frequency Event that SOR is expected to be provided. The SOR period is taken to be between T+15 seconds to T+90 seconds after a Frequency Event where T=0 is the instant of the Frequency Event;

"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;

"Steady-State Reactive Power" or "SSRP" 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;

"System Services" 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" has the meaning given to it in Section 5.7.1.1 of this document;~~means the time at which the frequency first passes beyond the reserve trigger of the Providing Unit after a Significant Frequency Disturbance~~

"Time Zero Availability" means the MW level declared by a Providing Unit to be available at the ~~start~~ time zero of a Frequency Event (T=0);

"Time Zero Declared" means the amount of reserve (either FFR, POR, SOR or TOR1) declared to be available by a Providing Unit at the time zero ~~start~~ of a Frequency Event (T=0);

"TOR1" has the meaning given to it in the Agreement;

"TOR1 Period" means the time period after the instant of a Frequency Event that TOR1 is expected to be provided. The TOR1 period is taken to be between T+90 seconds to T+300 seconds after a Frequency Event where T=0 is the instant of the Frequency Event;

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

"TOR2" has the meaning given to it in the Agreement;

"Total Availability Factor" has the meaning given to it in the Fixed Contract Agreement;

"Total Available Volume" has the meaning given to it in the Fixed Contract Agreement;

"Total Contracted Volume" has the meaning given to it in the Fixed Contract 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);

“Wind Farm Power Station” has the meaning given to it in the Grid Code;