DS3 System Services Protocol – Volume Capped Arrangements

DS3 System Services Implementation Project

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EIRGRID SONI

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1 Introduction

This **DS3 System Services Protocol** document is supplementary to the **DS3 System Services Fixed Contracts Agreement,** which applies to services procured through the **Volume Capped** procurement process**.** 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 Volume Capped** contractual arrangements. 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 **Volume Capped** arrangements only. The approach for any future arrangements will be consulted on separately.

Equation 1 sets out how payment is calculated for each **DS3 System Service**. This equation is also included in Schedule 2 of the **DS3 System Services Fixed Contracts Agreement.** Each of the terms is defined in the **Agreement**.

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

Equation 1: Calculation of Trading Period Payments for Volume Capped arrangements

The payment rates are included in the **DS3 System Services Fixed Contracts Agreement**. For each of the **DS3 System Services** contracted for in the Agreement, the **Scaling Factor** consists of a combination the **Temporal Scarcity Scalar**, **Availability Performance Scalar,** and **Event Performance Scalar**, with the **Fast Response Scalar** also applied to **FFR**. The **Temporal Scarcity Scalar and Fast Response Scalar** are defined in the **Agreement**. The methodology for calculating the **Event Performance Scalars** is described in Section 4 of this document, and the methodology for calculating **Availability Performance Scalars** is described in Section 5.

This document also specifies the **Operational Requirements** which must be met by **Service Providers** contracted under the **Volume Capped** arrangements, detailed by service, as well as details on the query management and business process for the application of both **Performance Scalars**.

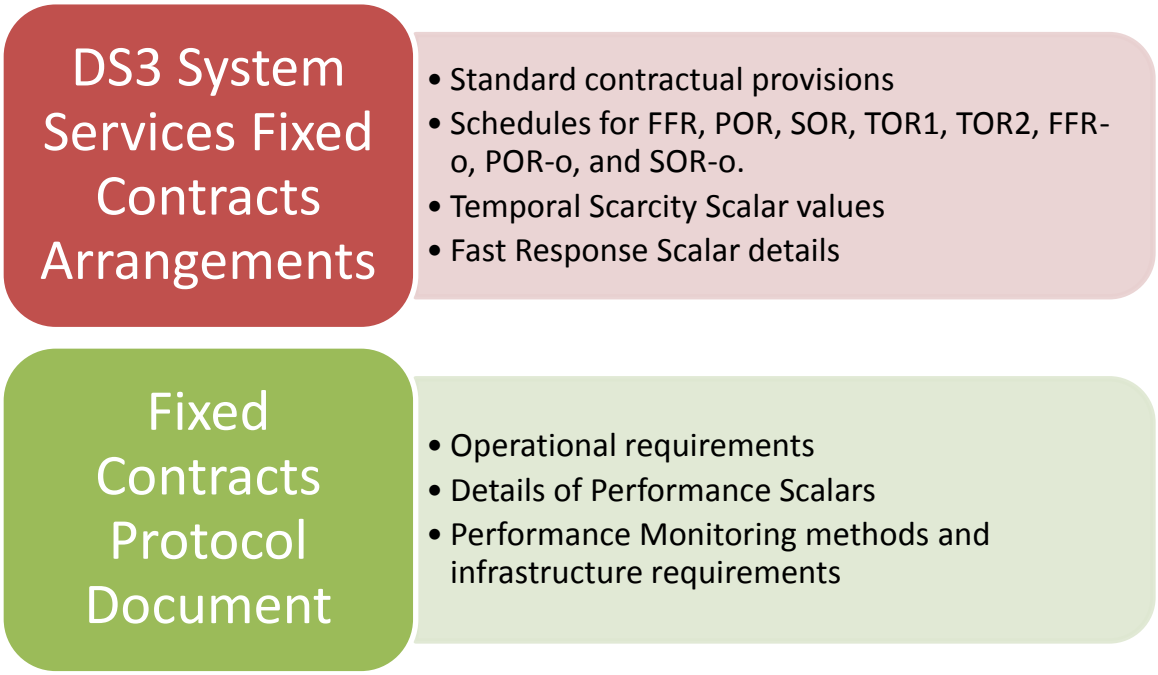

Figure 1: Overview of Agreement and associated documents

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

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

3 Operational Requirements

A **Providing Unit** must meet the relevant **Operational Requirements** applicable to the five **DS3 System Services** and three **OFR Services** for which it has contracted. The **Operational Requirements** may be separate from and additional to the technical requirements assessed in the **Volume Capped** 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. Any reasonable 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 **FFR, POR, SOR, TOR1, TOR2, FFR-o, POR-o,** and **SOR-o** for all **Providing Units** are set out below. **Providing Units** shall comply with all of these **Operational Requirements**, unless otherwise agreed by the **TSOs**.

- The **Providing Unit's Availability Declarations** must be updated to reflect the unit's real-time **Available Volume** for all of its contracted services. These declarations therefore should reflect the **Providing Unit**'s generation and their remaining energy storage (where applicable). The declarations should also reflect any network limitations on service provision, bearing in mind the firm status of the **Providing Unit**'s **Connection Agreement**.
- The **Providing Unit** must declare service **Available Volumes** for contracted **FFR, POR, SOR, TOR1, TOR2, FFR-o, POR-o,** and **SOR-o** via electronic means in real-time i.e. through **EDIL** or a real-time signal.
- The **Providing Unit's** provision of **POR**, **SOR, TOR1**, and **TOR2** must mirror its **FFR** response characteristics, i.e. the **Providing Unit** must have the capability to maintain its response in line with the applicable **Frequency Response Curve** for the extended

timeframes required of **POR, SOR, TOR1,** and **TOR2**, as required by the **TSOs** in response to an **Under-Frequency Reserve Trigger**.

- The **Providing Unit's** provision of **POR-o** and **SOR-o** must mirror its **FFR-o** response characteristics, i.e. the **Providing Unit** must have the capability to maintain its response in line with the applicable **Frequency Response Curve** for the extended timeframes required of **POR-o** and **SOR-o** as required by the **TSOs** in response to an **OFR Trigger**.
- The **Providing Unit** must comply with the **TSOs**' **Signal List** (as may be amended during the lifetime of the **Volume Capped** arrangements.)
- The **Providing Unit** must have **Monitoring Equipment** installed on the site that meets the standards set out by the **TSO.**
- The **Providing Unit** shall have installed its own **Monitoring Equipment** for the purpose of providing **Performance Monitoring** data to the TSOs for all services. The DS3 Performance Measurement Device Standards for Fast Acting Services document can be found on the TSOs' websites[1].

3.2 General Operational Requirements

The general **Operational Requirements** applicable to these arrangements 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 **Under-Frequency Reserve Triggers** and **OFR Triggers** and not on Rate of Change of Frequency (RoCoF).
- The **Providing Unit** must maintain the capability to operate at its **Under-Frequency Reserve Trigger Capability**, which shall have an upper threshold of 49.80 Hz;

[1] See http://www.eirgridgroup.com/site-files/library/EirGrid/DS3-Performance-Measurement-Device-Standards-for-Fast-Acting-Services.pdf for the latest version at the time of this document

- A **Dynamic Response** is required for all services, and the **Providing Unit** shall track changes in **Frequency** dynamically;
- All **Providing Units** shall comply with existing requirements regarding **SEM** registration[2].
- All units must be capable of responding to a **Dispatch Instruction** issued via EDIL.

3.3 Technology Specific Requirements

This section sets out the **Operational Requirements** specific to technology types. **Providing Units** shall comply with all of these **Operational Requirements**, unless otherwise agreed by the **TSOs**.

3.3.1 Energy Storage Providing Units

The following requirements apply to an Energy Storage Providing Unit:

- The **Providing Unit** shall provide a real-time signal confirming its remaining charge available.

3.3.2 Demand Side Units / Aggregators

The following requirements apply to **DSUs** and aggregators:

- 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 Output**.
- The **Providing Unit** shall not declare down its **Available Volumes** in real-time during a **Frequency Event,** except in the event that a **Service Provider** becomes aware of issues related to under-delivery in real-time. In this case, the **Providing Unit** shall declare down

[2] See for example Trading & Settlement Code Part B, Section B6

all affected service volumes by the relevant amount. The **Providing Units'** Real-time **SCADA Available Volume** values shall reflect the MW response provided in all cases.

3.4 FFR Service Requirements

Providing Units shall comply with all of these **Operational Requirements** relating to **FFR**, unless otherwise agreed by the **TSOs**.

- The TSOs define a **Providing Unit's** provision of **FFR** through the application of parameterisable **Frequency Response Curves**. All parameters will be set by the **TSOs** within the agreed contracted capabilities of the **Providing Unit**.
- The **Providing Unit** shall provide its **Expected** response within 0.3 s of the **Transmission System Frequency** falling through its **Under-Frequency Reserve Trigger**. Where the **Providing Unit** has contracted for a faster response than 0.3 s, the **Providing Unit** shall provide its **Expected** response within its **FFR Response Time**.
- A **Providing Unit** that provides responses in discrete steps shall respond to an **Under-Frequency 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 applies to the average step size, where the average step size is the **FFR Available Volume** divided by the number of discrete steps in response.
- The **Providing Unit** shall be able to operate with an **FFR Trajectory Capability** of 300 mHz in response to an **Under-Frequency Reserve Trigger.**

The curve design for this response during the FFR timeframe will be as per Figure 2~~Figure 2~~.

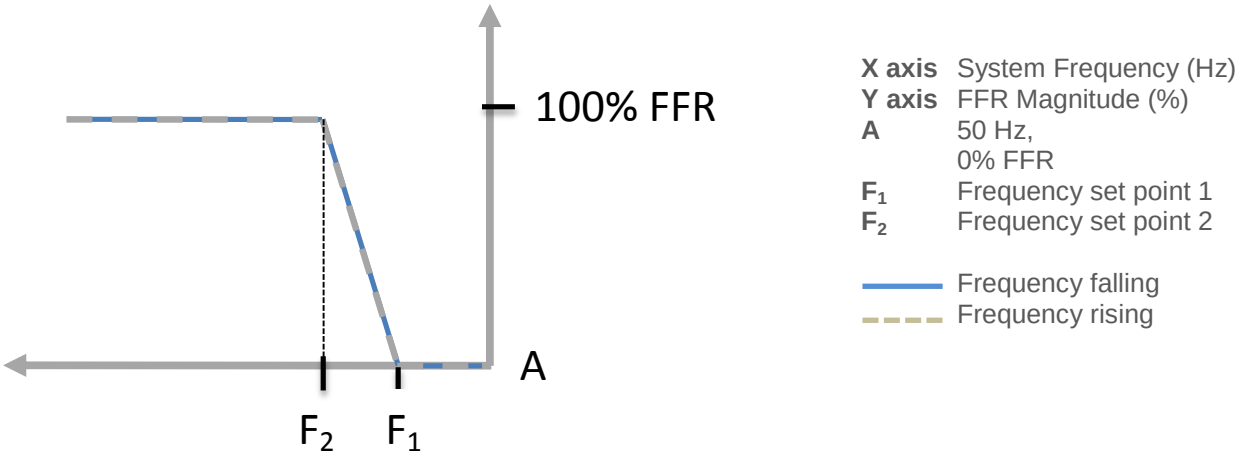

Figure 2: FFR Dynamic Capability Frequency Response Curve.

The **Frequency Response Curve** in Figure 2 shows a **Reserve Trigger**, F_1, at which the **Providing Unit** is required to start adjusting its MW output. At F_1, the **Providing Unit** shall provide a response with a specified **FFR Trajectory** to achieve 100% of its available **FFR** volume by **Reserve Trigger** F_2, as required by the system.

The **Providing Unit** should provide a linear response to changes in **Transmission System Frequency** as indicated in Figure 2. The **TSOs** shall define the parameters of the **Frequency Response Curve**, including the **Under-Frequency Reserve Trigger** and **FFR Trajectory**, within the agreed contracted capabilities of the **Providing Unit**.

3.5 Provision of the FFR-o service

At times of high **Frequency**, a **Providing Unit** will provide an **Over Frequency Response (OFR).** **Providing Units** shall comply with all of these **Operational Requirements** relating to **o-FFR**, unless otherwise agreed by the **TSOs**.

- The TSOs define a **Providing Unit's** provision of **FFR-o** through the application of parameterisable **Frequency Response Curves**. All parameters will be set by the **TSOs** within the agreed contracted capabilities of the **Providing Unit**.
- The **Providing Unit** must maintain the capability to operate at its **OFR Trigger Capability**, which shall have a lower threshold of 50.20 Hz;

- The **Providing Unit** shall provide its **Expected** response within .30 s of the **Transmission System Frequency** falling through its **OFR Trigger**.
- A **Providing Unit** that provides responses in discrete steps shall respond to an **OFR 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-o Available Volume** divided by the number of discrete steps in response, applies.
- The **Providing Unit** shall be able to operate with an **FFR-o Trajectory Capability** of 300 mHz in response to an **OFR Trigger.**

The curve design for this response during the FFR timeframe will be as per Figure 3.

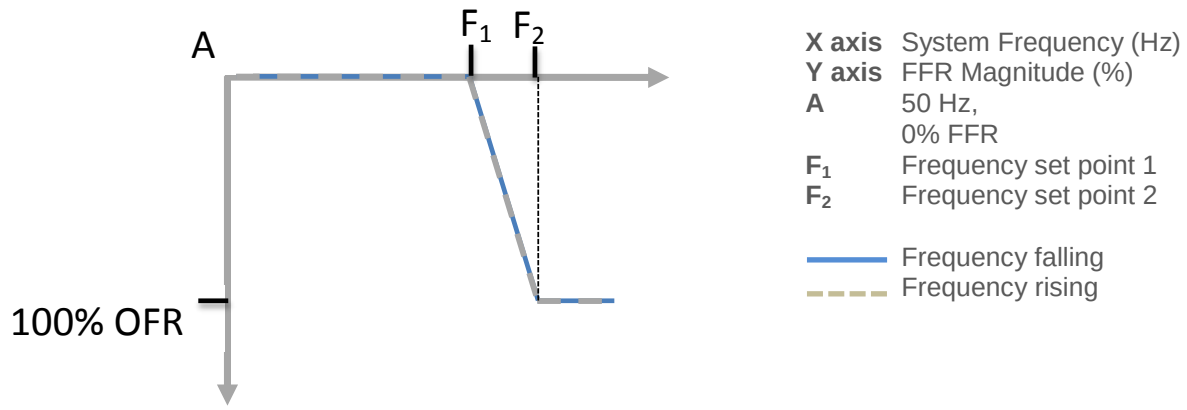

Figure 3: OFR Dynamic Capability Frequency Response Curve.

At F_1, the **Providing Unit** shall provide a response with a specified **FFR-o Trajectory** to achieve 100% of its **FFR-o Available Volume** by **OFR 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 3.

The **TSOs** shall define the parameters of the **Frequency Response Curve**, including the **OFR Trigger** and **FFR-o Trajectory**, within the agreed contracted capabilities of the **Providing Unit**.

4 Performance Monitoring

An **Event Performance Scalar** will be utilised to incentivise the reliable provision of **FFR, POR, SOR, TOR1,** and **TOR2**. An **Availability Modifier** will perform a similar function in incentivising the reliable provision of **OFR Services** (see section 4.4.1). A **Providing Unit's** performance may be monitored following a **Performance Incident**.

The most appropriate source of information available to the **TSOs** for **Performance Assessment** will be used. Providing Units must have a **Phasor Measurement Units (PMU)**, but other data sources (such as **SCADA**, and **Event Recorders**) may be used for specific services.

4.1 Event Performance Scalar Composition

The Event Performance Scalar[3] (P) is set to be equal to the Performance Incident Response Factor (P_E)

$$P = P_E$$

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

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**.

4.2 Availability Modifier Composition

The Availability Modifier (P) is set to be equal to the Performance Incident Response Factor (P_E)

$$P = P_E$$

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

In the context of **OFR Services**, **Performance Assessment** means the evaluation of a **Service Provider's** delivery of a given **OFR Service** following a **Performance Incident**.

[3]We note the redundancy of this equivalence, however it is maintained to allow for comparison and change tracking against the Regulated Arrangements Protocol document

4.3 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). This P_E value will be calculated over 6 months 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).**

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

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

where

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

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

Q = the **Performance Incident Scaling Factor (Q_i)**

Equation 2: Calculation of Monthly Scaling Factor (K_m)

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

4.3.3 Performance Incident Response Factor Calculation (PE)

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 Factor (V_m)** defined above. It is calculated based on the formula outlined in Equation 3~~Equation 3~~.

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

Equation 3: Calculation of Performance Incident Response Factor

4.4 Performance Categorisation

4.4.1 DS3 System Services

POR, POR-o, SOR, SOR-o and **TOR1** will be assessed as Reserve-type services. **TOR2** will also be assessed as a Reserve-type service when utilised as part of an extended response following the **Frequency** passing through the **Under-Frequency Reserve Trigger**, otherwise it will be treated assessed as a Ramping type Service. **FFR** and **FFR-o** will be assessed as fast-acting services.

Performance Monitoring will be assessed over a number of **Performance Incidents**. Table 2 summarises the data sources used for assessment of **Performance Incident Response Factor *(P_E)*.**

Table 2: Proposed Performance Scalar Calculation Methodology

Definition	Performance Category		
	Reserve	Ramping	Fast-acting
Services Per Category	POR, POR-o SOR, SOR-o TOR1 TOR2	TOR2	FFR, FFR-o
Data Source	A device recorder to the standard set out by the TSO in the DS3 Performance Measurement Device Standards for Fast Acting Services / 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	A device recorder to the standard set out by the TSO in the DS3 Performance Measurement Device Standards for Fast Acting Services

		QH Meter Data for each Individual Demand Site (IDS)	
Data Record	A Providing Unit's MW response to any Performance Incident from T - 5 to T + 300, where T is the Time Zero of the Performance Incident.	**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	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.
Minimum Data Resolution Requirement	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	All Providing Units excluding DSUs: EDIL Sync Instructions. DSUs: QH Metering Data for 12 weeks prior to the dispatch instruction for each IDS and	Minimum data resolution of 20 ms

	seconds	Aggregated SCADA demand data	
Scalar Assessment Frequency	Monthly in Arrears	Monthly in Arrears	Monthly in Arrears

4.4.1 Over-Frequency Response

The three **OFR Services** required under these arrangements – **FFR-o**, **POR-o**, and **SOR-o** – will be measured as per the equivalent under-frequency **DS3 System Services** (i.e. **FFR**, **POR**, and **SOR**), as defined by the speed and duration of response required. The requirements laid out in Section 4.4.1 will apply.

For **Performance Monitoring** of **OFR Services**, an **Availability Modifier** takes the place of the **Event Performance Scalar**. The **Availability Modifier** is applied in the calculation of the **Availability Performance Scalar**, where it reduces the **Available Volume** for each of the **OFR Services**.

4.5 Performance Incident Response Factor

This section describes 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.

4.5.1 Reserve Category Performance Assessment

For **Performance Monitoring,** the reserve category assessment methods are applied for **FFR, FFR-o, POR, POR-o, SOR, SOR-o**, and **TOR1**, and also **TOR2** in specific cases. This assessment is performed based on the MW response of the **Providing Unit** to a **Frequency Event**.

4.6 Frequency Events

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

4.6.1 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 Frequency Event is therefore deemed to have occurred if the Transmission System Frequency falls below 49.7 Hz or rises above 50.3 Hz.

Any **Frequency Event** will be deemed to be a **Performance Incident** and the **Providing Unit's** performance will be assessed for all **DS3 System Services** and **OFR Services** that it was expected to provide.

4.6.1.1 *Determining the Time Zero of a Frequency Event*

The Time Zero (T) for a **Frequency Event** is the time at which the **Frequency** first passes through the **Under-Frequency Reserve Trigger** (or **OFR Trigger**) of the **Providing Unit**. All **DS3 System Services** and **OFR Services** will be assessed relative to this **Time Zero**.

The **Time Zero** (T) is used to determine the **Assessment Periods** for each **Frequency Reserve Service** and each relevant **Frequency Reserve Service** shall be assessed for each **Performance Incident**.

4.7 Primary Operating Reserve (POR) and POR-o

4.7.1 Method of Performance Assessment for POR and POR-o

Performance Assessment of the **POR** and **POR-o** services will be based on an evaluation of the **Providing Unit's** performance for a **Performance Incident** during the entire time range of T+5 to T+15 seconds, i.e. the **POR Period**.

4.7.2 Measurement Process for POR and POR-o Performance Assessment

The **Expected POR** (or **Expected POR-o**) and the **Achieved POR** (or **Achieved POR-o**) will be calculated for the **Providing Unit**. The difference between the **Expected POR** (or **Expected POR-o**) and **Achieved POR** (or **Achieved POR-o**) will determine the **Performance Incident Scaling Factor (Q_i)** of the **Providing Unit** for the **Performance Incident**.

The **Expected POR** (or **Expected POR-o**) is determined for each sample point during the **POR Period** and compared to the **Achieved POR** (or **Achieved POR-o**).

4.7.2.1 *Expected POR and POR-o Calculation*

The **Expected POR** (or **Expected POR-o**) is the expected change from the **Pre-Event Output** by the **Providing Unit** at each sample point during the **POR Period** and is calculated as the minimum of:

1) The **POR Trajectory Requirement** (or **POR-o Trajectory Requirement**).
2) The **Time Zero Declared POR** (or **Declared POR-o**).

The sample point **Expected POR** (or **Expected POR-o**) values are averaged over the **POR Period** to give the "**Average POR Requirement**" (or "**Average POR-o Requirement**").

4.7.2.2 *Achieved POR and POR-o Calculation*

The **Achieved POR** following a **Frequency Event** will be calculated for each sample point during the **POR Period** as the **Providing Unit Output** minus the **Providing Unit Pre-Event Output**. Then the **Average Achieved POR** is calculated as the average of these **Achieved POR** values.

The **Achieved POR-o** following a **Frequency Event** will be calculated for each sample point during the **POR Period** as the **Providing Unit Pre-Event Output** minus the **Providing Unit Output**. Then the **Average Achieved POR-o** is calculated as the average of these **Achieved POR-o** values.

4.7.2.3 *Calculation of Q_i for the Provision of POR*

For each **Performance Incident**, where the **Average POR Requirement** is greater than or equal to 1 MW, the **Performance Incident Scaling Factor** (**Q_i**) is calculated as follows;

*If the **Average POR Requirement** minus the **Average Achieved POR** is less than or equal to 1 MW and the **Average Achieved POR** divided by the **Average POR Requirement** response is greater than or equal to 0.5, then;*

$$Q_i = 0,$$

Otherwise;

$$\textit{Let } \mathbf{S} = \frac{\text{Average Achieved POR}}{\text{Average POR Requrement}}$$

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

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

Otherwise, **Qi = (0.9 – S)*5**.

Equation 4: Calculation of Q_i for POR

This results in a **Providing Unit** being awarded a **Pass** (**Q_i**=0) should it achieve greater or equal to 90% of its **Average POR Requirement**, a **Fail** if it achieves less than or equal to 70% and a **Partial Pass** in between.

4.7.2.1 *Calculation of Q_i for the Provision of POR-o*

For each **Performance Incident**, where the **Average POR-o Requirement** is greater than or equal to 1 MW, the **Performance Incident Scaling Factor** (**Q_i**) is calculated as follows;

*If the **Average POR-o Requirement** minus the **Average Achieved POR-o** is less than or equal to 1 MW and the **Average Achieved POR-o** divided by the **Average POR-o Requirement** response is greater than or equal to 0.5, then;*

Q_i =0,

Otherwise;

$$\textit{Let } \mathbf{S} = \frac{\text{Average Achieved POR}-\text{o}}{\text{Average POR}-\text{o Requrement}}$$

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

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

Otherwise, **Qi = (0.9 – S)*5**.

Equation 5: Calculation of Q_i for POR-o

This results in a **Providing Unit** being awarded a **Pass** (**Q_i**=0) should it achieve greater or equal to 90% of its **Average POR-o Requirement**, a **Fail** if it achieves less than or equal to 70% and a **Partial Pass** in between.

4.8 Secondary Operating Reserve (SOR) and SOR-o

4.8.1 Method of Performance Assessment for SOR and SOR-o

Performance Assessment of the **SOR** and **SOR-o** services will be based on an evaluation of the **Providing Unit's** performance for a **Performance Incident** during the entire time range of T+15 to T+90 seconds, i.e. the **SOR Period**.

4.8.2 Measurement Process for SOR and SOR-o Performance Assessment

The **Expected SOR** (or **Expected SOR-o**) and the **Achieved SOR** (or **Achieved SOR-o**) will be calculated for the **Providing Unit**. The difference between the **Expected SOR** (or **Expected SOR-o**) and **Achieved SOR** (or **Achieved SOR-o**) will determine the **Performance Incident Scaling Factor** ($\mathbf{Q_i}$) of the **Providing Unit** for the **Performance Incident.**

The **Expected SOR** (or **Expected SOR-o**) is determined for each sample point during the **SOR Period** and compared to the **Achieved SOR** (or **Achieved SOR-o**).

4.8.2.1 *Expected SOR and SOR-o Calculation*

The **Expected SOR** (or **Expected SOR-o**) is the **Expected** change from the **Pre-Event Output** made by the **Providing Unit** at each sample point during the **SOR Period** and is calculated as the minimum of:

1) The **SOR Trajectory Requirement** (or **SOR-o Trajectory Requirement**);
2) The **Time Zero Declared SOR** (or **SOR-o**).

The sample point **Expected SOR** (or **Expected SOR-o**) values are averaged over the **SOR Period** to give the "**Average SOR Requirement**" (or "**Average SOR-o Requirement**").

4.8.2.2 *Achieved SOR and SOR-o Calculation*

The **Achieved SOR** following a **Frequency Event** will be calculated for each sample point during the **SOR Period** as the **Providing Unit Output** minus the **Providing Unit Pre-Event Output**. Then the **Average Achieved SOR** is calculated as the average of these **Achieved SOR** values.

The **Achieved SOR-o** following a **Frequency Event** will be calculated for each sample point during the **SOR Period** as the **Providing Unit Pre-Event Output** minus the **Providing Unit Output**. Then the **Average Achieved SOR-o** is calculated as the average of these **Achieved SOR-o** values.

4.8.2.3 *Calculation of Q_i for the Provision of SOR*

For each Performance Incident, where the **Average SOR Requirement** is greater than or equal to 1 MW the **Performance Incident Scaling Factor** (**Q_i**) is calculated as follows;

*If the **Average SOR Requirement** minus the **Average Achieved SOR** Response is less than or equal to 1 MW and the **Average Achieved SOR** divided by the **Average SOR Requirement** is greater than or equal to 0.5, then;*

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

Otherwise;

$$\text{Let } \mathbf{S} = \frac{\text{Average Achieved SOR}}{\text{Average SOR Requirement}}$$

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

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

Otherwise, **Qi = (0.9 – S)*5**.

Equation 6: Calculation of Q_i for SOR

This results in a **Providing Unit** being awarded a **Pass** (**Qi** = 0) should it achieve greater or equal to 90% of its **Average SOR Requirement**, a **Fail** if it achieves less than or equal to 70% and a **Partial Pass** in between.

4.8.2.4 *Calculation of Q_i for Provision of SOR-o*

For each Performance Incident, where the **Average SOR-o Requirement** is greater than or equal to 1 MW the **Performance Incident Scaling Factor** (**Q_i**) is calculated as follows;

*If the **Average SOR-o Requirement** minus the **Average Achieved SOR-o** Response is less than or equal to 1 MW and the **Average Achieved SOR-o** divided by the **Average SOR-o Requirement** is greater than or equal to 0.5,*
Then

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

Otherwise;

$$\text{Let } \mathbf{S} = \frac{\text{Average Achieved SOR–o}}{\text{Average SOR–o Requirement}}$$

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

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

Otherwise, **Qi = (0.9 – S)*5**.

Equation 7: Calculation of Q_i for SOR-o

This results in a **Providing Unit** being awarded a **Pass** (**Qi** = 0) should it achieve greater or equal to 90% of its **Average SOR-o Requirement**, a **Fail** if it achieves less than or equal to 70% and a **Partial Pass** in between.

4.9 Tertiary Operating Reserve 1 (TOR1)

4.9.1 Method of Performance Assessment TOR1

Performance Assessment of the **TOR1** service will be based on an evaluation of the **Providing Unit's** performance during the entire time range of T+90 seconds to T+300 seconds, i.e. the **TOR1 Period**.

4.9.2 Measurement Process for 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**.

4.9.2.1 *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:

1) The **TOR1 Trajectory Requirement**;
2) The **Time Zero Declared TOR1**.

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

4.9.2.2 *Calculation of Achieved Provision of TOR1*

The **Achieved TOR1** will be calculated for each **Sample Point** during the **TOR1 Period** as the **Providing Unit Output** minus the **Providing Unit Pre-Event Output**. Then the **Average Achieved TOR1** is calculated as the average of these **Achieved TOR1** values.

4.9.2.3 *Calculation of Q_i for Provision of TOR1*

For each Performance Incident where the **Average TOR1 Requirement** is greater than or equal to 1 MW, the **Performance Incident Scaling Factor** (**Q_i**) is calculated as follows;

*If the **Average TOR1 Requirement** minus the **Average Achieved TOR1** is less than or equal to 1 MW and the **Average Achieved TOR1** divided by the **Average TOR1 Requirement** is greater than or equal to 0.5, then;*

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

Otherwise;

$$\text{Let } \mathbf{S} = \frac{\text{Average Achieved TOR1}}{\text{Average TOR1 Requirement}}$$

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

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

Otherwise, **Qi = (0.9 – S)*5**.

Equation 8: Calculation of Q_i for TOR1

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

4.10 Tertiary Operating Reserve 2 (TOR2)

4.10.1 Method of Performance Assessment Tertiary Operating Reserve 2 (TOR2)

Performance Assessment of the **TOR2** service will be based on an evaluation of the **Providing Unit's** performance during the entire time range of T+5 minutes to T+20 minutes,

i.e. the **TOR2 Period**. **TOR2** will be assessed using two separate assessment criteria depending on whether the service is required in response to a **Frequency Event**, or whether it is required in response to a **Dispatch Instruction**

4.10.1.1 *TOR2 Performance Incident Response Factor (Frequency Event)*

The **TOR2 Performance Incident Response Factor** for the **Providing Unit** will be calculated using methodology aligned with the **Performance Incident Response Factor** for **TOR1** where provision is required in response to a **Frequency Event** (see Sections 4.9.1 to 4.9.2.3 for details on the **TOR1 Performance Assessment** criteria).

4.10.1.2 *TOR2 Performance Incident Response Factor (Dispatch)*

At a future date (to be determined), 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 active power output of a Providing Unit within applicable tolerances.

~~Where issued in response to a **Dispatch Instruction, TOR2** will use the following approach to determine the **Performance Incident Scaling Factor (Q_i).** If a **Performance Incident Scaling Factor (Q_i)** is not available to inherit then a **Pass** will be awarded for the relevant **Performance Incident.**~~

4.10.2 Measurement Process for TOR2 Performance Assessment for non-synchronous Units

Performance Assessment of the **TOR2** service will be based on the methodology for assessing TOR2 under a frequency event as outlined in Section 4.10.1.1, with T=0 assumed to be the time at which the relevant **Dispatch Instruction** was issued to the Providing Unit.

4.10.2.1 *Measurement Process for TOR2 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.

4.10.3 Calculation of Qi for TOR2

4.10.3.1 *Criteria used to determine Q_i for TOR2 for DSUs*

For a **DSU** to achieve a '**Pass**' it is required to comply with some of, but not all of the criteria outlined in Section 4.10.2.1.

A '**Pass**' **Data Record** will be awarded should the **DSU** adhere to all three of Criteria (iii), (iv) and (v) in Section 4.10.2.1

A '**Fail**' **Data Record** will be awarded should the **DSU** fail to satisfy one or more of Criteria (iii), (iv) or (v) as outlined in Section 4.10.2.1.

For clarity, Criteria (i) and (ii) of Section 4.10.2.1 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 Q_i for TOR2 - 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.

If a **Performance Incident Scaling Factor (Q_i)** is not available to inherit then a **Pass** will be awarded for the relevant **Performance Incident.**

4.10.3.1 *Criteria used to determine Q_i for TOR2 Performance Assessment for non-synchronous Units*

For non-synchronous units (excluding DSUs), Q_i will be determined as for TOR1, outlined in Section 4.9.2.3.

4.11 Fast Frequency Response (FFR) and FFR-o

4.11.1 Method of Performance Assessment for FFR

Performance Assessment of the **FFR** service will be based on an evaluation of the **Providing Unit's** performance for a **Performance Incident**. The assessment of **FFR** performance is carried out ~~following~~ from **Time Zero** for the **Performance Incident**, and as such the starting point for measurement of **FFR Expected Response** is **Time Zero**~~.~~

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. The MW response from the **Providing Unit** should be sustained for the T=0 to T+10 seconds period. The energy (MWs) 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.

4.11.2 Measurement Process for FFR Performance Assessment

Two assessments will be carried out to calculate the performance of the Providing Unit. 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** for each sample point during the **FFR Period** and compares that to the **Achieved FFR** for each sample point.

The second assessment compares the **FFR Energy Provided** in the T=0 to T+10 seconds period with the **FFR Loss of Energy** in the T+10 seconds to T+20 seconds period.

The **FFR Energy Provided** is defined as the additional energy provided by a **Providing Unit** during the period of T=0 to T+10 seconds, when compared to the energy that would have been provided in this period based on the **Providing Unit Pre-Event Output**.

The **FFR Energy Provided** can be calculated by taking the sum of the equation below for each sample point *t* in the period of T=0 to T+10 seconds where the result of the equation below is greater than zero (all negative values are discarded).
Note that *dt* is the time between samples.

(Measured Response(t) – **Pre-Event Output**(t))*dt

The **FFR Loss of Energy** is defined as the energy not provided by a **Providing Unit** during the period of T=10 to T+20 seconds, when compared to the energy that would have been provided in this period based on the **Providing Unit Pre-Event Output**.

The **FFR Loss of Energy** can be calculated by taking the sum of the equation below for each sample point *t* in the period of T=10 to T+20 seconds where the result of the equation below is greater than zero (all negative values are discarded).
Note, *dt* is the time between samples.

(**Pre-Event Output**(t) – Measured Response(t))*dt

4.11.3 Calculation of Q_i for Provision of FFR

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 (if 1 MW is greater than 50% of the **Expected FFR Response** then a tolerance of 50% of the **Expected FFR Response** is applied). This tolerance is subtracted from the **Expected FFR Response** for the assessment of under frequency events.*

*Let S_2 be equal to an assessment of the energy recovered in the T+10 to T+20 seconds period. If the **FFR Energy Provided** is greater than the **FFR Loss of Energy** then a **Pass** (S_2=1) is awarded for S_2. Otherwise a **Fail** is awarded (S_2=0).*

The **Performance Incident Scaling Factor (Qi)** value is then determined as follows:

$$S = S_1 * S_2$$

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

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

Equation 10: Calculation of Q_i for FFR

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**.

4.11.4 Measurement Process for FFR-o Performance Assessment

Two assessments will be carried out to calculate the performance of the Providing Unit. 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-o** for each sample point during the **FFR Period** and compares that to the **Achieved FFR-o** for each sample point.

The second assessment compares the **FFR Energy Reduction** in the T=0 to T+10 seconds period with the **FFR Gain of Energy** in the T+10 seconds to T+20 seconds period.

The **FFR Energy Reduction** is defined as the energy reduction provided by a **Providing Unit** during the period of T=0 to T+10 seconds, when compared to the energy that would have been provided in this period based on the **Providing Unit Pre-Event Output**.

The **FFR Energy Reduction** can be calculated by taking the sum of the equation below for each sample point *t* in the period of T=0 to T+10 seconds where the result of the equation below is greater than zero (all negative values are discarded).
Note, *dt* is the time between samples.

FFR Energy Reduction = (**Pre-Event Output**(t) – Measured Response(t))*dt

The **FFR Gain of Energy** is defined as the additional energy provided by a **Providing Unit** during the period of T=10 to T+20 seconds, when compared to the energy that would have been provided in this period based on the **Providing Unit Pre-Event Output**.

The **FFR Gain of Energy** can be calculated by taking the sum of the equation below for each sample point *t* in the period of T=10 to T+20 seconds where the result of the equation below is greater than zero (all negative values are discarded).
Note, *dt* is the time between samples.

(Measured Response(t) – **Pre-Event Output**(t))*dt

4.11.5 Calculation of Q_i for the Provision of FFR-o

For each **Performance Incident**, where the maximum **Expected FFR-o 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-o Response** is equal to the **Expected FFR-o 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 (if 1 MW is greater than 50% of the **Expected FFR-o Response***

*then a tolerance of 50% of the **Expected FFR-o Response** is applied). This tolerance is subtracted from the **Expected FFR-o Response** for the assessment of over-frequency events.*

*Let S_2 be equal to an assessment of the energy recovered in the T+10 to T+20 seconds period. If the **FFR Energy Reduction** is greater than the **FFR Gain of Energy** then a **Pass** (S_2=1) is awarded for S_2. Otherwise a **Fail** is awarded (S_2=0).*

The **Performance Incident Scaling Factor (Qi)** value is then determined as follows:

$$S = S_1 * S_2$$

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

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

Equation 11: Calculation Q_i for FFR-o

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-o Response** to a **Performance Incident**.

4.12 Data Provision for Performance Assessment of FFR and FFR-o

For the **Performance Assessment** of **FFR** and **FFR-o** 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 4~~Figure 4~~outlines the high level process for data provision for assessment of **FFR**.

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**.

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 **Agreement**.

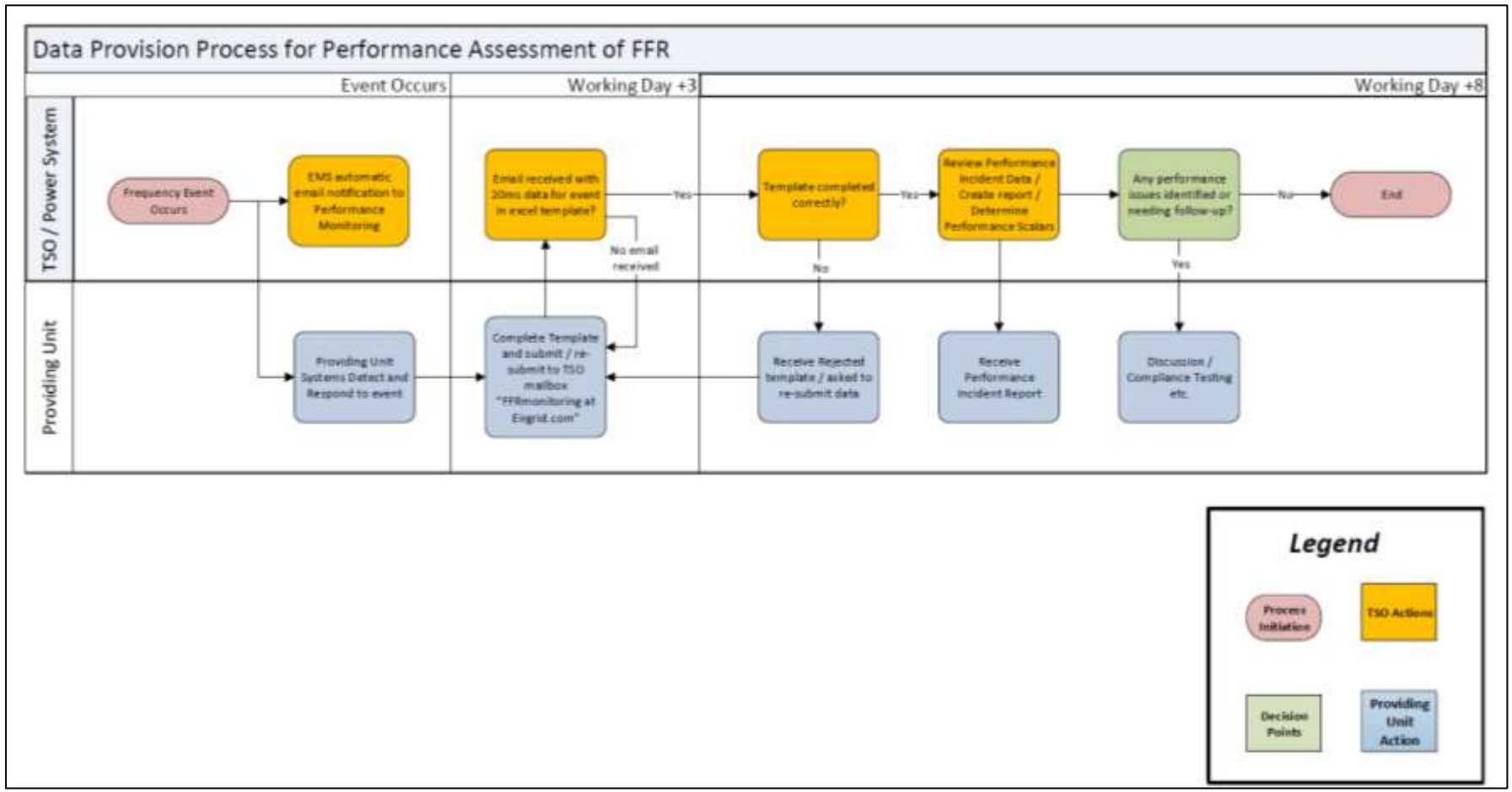

Figure 4: Data Provision for Performance Assessment of FFR

4.13 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 services 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**.

4.14 Performance Monitoring Timelines and Business Process Overview

4.14.1 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 will be processed in month M+1 and input into the M+2 settlement assessment, eventually being paid out in M+4.

4.14.2 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 **Performance Scalar** for the next settlement month along with accompanying data used to calculate the **Performance Scalar**, within 10 Working Days (D + 10) from D. Following the issuance of these **Performance Data Packs, Service Providers** have another 10 Working Days (D + 20) to raise queries / challenges in relation to the packs themselves.

Following D+20, the performance data issued will be used in the final calculation of the **Performance Scalar** calculation for the next settlement month unless a query was raised and remains open at D+20. In this instance the specific Data Records being queried are set to N/A for assessment (i.e., do not impact on the DS3 **Performance Scalar**) until such time as the query is resolved. Once the query is resolved the final outcome is then fed into the next

monthly DS3 **Performance Scalar** calculation, with the date of the **Performance Incident** updated to the date the query was resolved and **Performance Incident** becomes binding from.

Service Providers may query aspects of their **Performance Data Packs** occasionally. However, re-settlement will not take place for previous months where the result wasn't queried within the initial 10 working Days. The application of the outcome of the query will only be applied going forward into future assessment months. Key timeline millstones of the process are shown in Table 3~~Table 3~~.

Table 3: 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

4.14.3 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.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.

4.14.4 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.

4.15 Signal Availability Declarations

A **Providing Unit** may be required to make a number of declarations when contracted to provide **DS3 System Services** and **OFR Services**. The **Providing Unit** must be able to declare **Available Volumes** for contracted **DS3 System Services** and **OFR 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.

Table 4: EDIL Declarations for DS3 System Services. Note that the signals for the OFR Services FFR-o, POR-o, and SOR-o are not yet available in EDIL and are shown here as a placeholder. Once these are confirmed this Table will be updated.

Declaration	Fast Frequency Response	Primary Operating Reserve	Secondary Operating Reserve	Tertiary Operating Reserve 1	Tertiary Operating Reserve 2	FFR-o	POR-o	SOR-o
EDIL Acronym	FFR	POR	SOR	TOR1	TOR2	FFRO	PORO	SORO
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	FFR-o in MW	POR-o in MW	SOR-o in MW
Agreement term	Declared FFR	Declared POR	Declared SOR	Declared TOR1	Declared TOR2	Declared FFR-o	Declared POR-o	Declared SOR-o

5 Availability Performance Monitoring

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 Legal Agreements 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%

5.1 Total Availability Factor

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, with each month given an equal weighting

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 Availability Volume** for each trading period is calculated as follows:

Total Availability Volume = FFR Available Volume + POR Available Volume + SOR Available Volume + TOR1 Available Volume + TOR2 Available Volume + (FFR-o Available Volume x FFR-o Availability Modifier) + (POR-o Available Volume x POR-o Availability Modifier) + (SOR-o Available Volume x SOR-o Availability Modifier)

The **Total Contracted Volume** for each month *M* will be the sum of the **Total Contracted Volume** for each trading period within that month. The **Total Contracted Volume** for each trading period is calculated as follows:

Total Contracted Volume = Contracted FFR + Contracted POR + Contracted SOR + Contracted TOR1 + Contracted TOR2 + Contracted FFR-o + Contracted POR-o + Contracted SOR-o

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

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

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.

There are exceptions to this which are outlined in sections 5.2 and 5.3 below. In addition, allowances are made for Scheduled Outages as per the Agreement.

5.2 Post-response Availability

For the sake of calculating a Providing Unit's **Availability Performance Scalar** only, a unit will be assumed to be fully available for all services (i.e. its **Available Volume** is equal to its Contracted Volume) from the beginning of an event up until the end of the first trading period to end 8 hours after the event, assuming the unit responded as required. This 8 hour period can be extended to account for a TSO action preventing recharge. This will also apply to services provided in response to a **Dispatch Instruction.**

5.3 Availability & Network Limitations

Where **Network Congestion** on the **Transmission System** or **Distribution System** would prevent full delivery of all or any service, the **Providing Unit** would be treated as if it were fully available to provide the contracted **DS3 System Services** and **OFR Services** for the purpose of calculating the **Availability Performance Scalar** only. This assumes that no other reason is limiting the **Providing Unit**'s ability to provide these services.

Note that this is for the purpose of calculating the **Availability Performance Scalar** only, and does not apply to the calculation of a **Providing Unit's Available Volume** for the purposes of

determining hourly payments. For this, the risk of unavailability due to network limitations will rest with the service provider[4], and **Providing Units** who are fully or partially unavailable for service provision due to network limitations will only be deemed available for service up to the higher of their firm access quantity or the level of provision allowed by the network. This is reflected in the Agreement.

[4] As per SEM-18-049 and SEM-19-005

6 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 **Agreement.**

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

"Agreement" means the document titled DS3 System Services Fixed Contracts 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.

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

"Availability Modifier" means a multiplicative factor ≤1 that is applied to a Providing Unit's FFR-o, POR-o, and SOR-o Available Volumes when determining its Availability Performance Scalar;

"Availability Performance Scalar" means a multiplicative factor ≤1 which is used to adjust the payment for DS3 System Service provided under the Volume Capped Arrangements to reflect a Providing Unit's **historical Available Volumes** for the provision of DS3 System Services;

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

"Average Achieved POR" has the meaning given to it in Section 4.7.2.2;

"Average Achieved POR-o" has the meaning given to it in Section 4.7.2.2;

"Average Achieved SOR" has the meaning given to it in Section 4.8.2.2;

"Average Achieved SOR-o" has the meaning given to it in Section 4.8.2.2;

"Average Achieved TOR1" has the meaning given to it in Section 4.9.2.2;

"Average POR-o Requirement" has the meaning given to it in Section 4.7.2.1;

"Average POR Requirement" has the meaning given to it in Section 4.7.2.1;

"Average SOR-o Requirement" has the meaning given to it in Section 4.8.2.1;

"Average SOR Requirement" has the meaning given to it in Section 4.8.2.1;

"Average TOR1 Requirement" has the meaning given to it in Section 4.9.2.1;

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

"Compliance Test" means the process of assessing that Operational Requirements are satisfied;

"Connection Agreement" has the meaning given to it in the Grid Code;

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

"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 an Event

Performance Scalar;

"Data Source" means the source of the data used to collect Data Records used in the calculation of a Providing Unit's Performance Scalar;

"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;

"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**;

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

"EDIL" means Electronic Dispatch Instruction Logger;

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

"Event 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;

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

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

"Fail" means the outcome of a Performance Assessment where the response achieved following a Performance Incident is less than the Expected response taking account of tolerances where appropriate;

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

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

"**FFR Energy Provided**" has the meaning given to it in Section 4.11.2 of this document;

"**FFR Energy Reduction**" has the meaning given to it in Section 4.11.4 of this document;

"FFR Gain of Energy" has the meaning given to it in Section 4.11.4 of this document;

"**FFR Loss of Energy**" has the meaning given to it in Section 4.11.2 of this document;

"FFR-o" is the over-frequency equivalent of FFR and has the meaning given to it in the Agreement;

"FFR-o Trajectory" has the meaning given to it in the Agreement;

"FFR-o Trajectory Capability" 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 Time Zero for a given Frequency Event. The period between T+10 seconds and T+20 seconds is also assessed as per the 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;

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

"Frequency Event" has the meaning given to it in Section 4.6.1 of this document;

"Frequency Event Nadir/Zenith" 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" is the time at which the Frequency Event Nadir/Zenith occurs;

"Frequency Event Threshold" means a deviation in Transmission System Frequency of 0.3 Hz, which, if exceeded, denotes that a Frequency Event has occurred. The deviation is referenced from Nominal Frequency (50 Hz);

"Frequency Reserve Service" means FFR, FFR-o, POR, POR-o, SOR, SOR-o , and TOR1, and also TOR 2 where it is activated in response to the Frequency passing through a unit's Under-Frequency Reserve Trigger or OFR Trigger;

"Frequency Response Curve" means the set of parameters which define the frequency response characteristics of the providing unit, whose values are set in Schedule 9 of the Agreement;

"**Grid Code"** has the meaning given to it in the Agreement;

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

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

"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;

"**Network Congestion**" has the meaning given to it in the Agreement;

"Nominal Frequency" will for the purpose of this document be considered to be 50 Hz;

"OFR Services" means, for the purposes of this document, FFR-o, POR-o, and SOR-o

"OFR Trigger" has the meaning given to it in the Agreement;

"OFR Trigger Capability" 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.

"**Over-Frequency Response"** or "**OFR**" has the meaning given to it in the Agreement;

"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;

"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 a Monitoring Equipment device which can be used to measure a number of DS3 System Services;

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

"POR-o" is the over-frequency equivalent of POR and has the meaning given to it in the Agreement;

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

"POR-o Trajectory Requirement" means the level of POR-o the Providing Unit is obliged to

respond with for a given Frequency, as described by the Providing Unit's POR-o Reserve Characteristic.

"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 the Time Zero for a given Frequency Event;

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

"POR Trajectory Requirement" means the level of POR the Providing Unit is obliged to respond with for a given Frequency, as described by the Providing Unit's POR Reserve Characteristic.

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

"Pre-Event Output" means the mean Providing Unit Output between T-1.5 seconds and T-0.5 seconds from **Time Zero**.

"Product Scalar" has the meaning given to it in the Agreement;

"Protocol" means this document entitled "DS3 System Services Protocol – Volume Capped Arrangements" 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 Output" means the electrical power generated (or consumed) at a given moment, measured in MW;

"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;

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

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

"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;

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

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

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

"SOR-o" is the over-frequency equivalent of SOR and has the meaning given to it in the Agreement;

"SOR Trajectory Requirement" means the level of SOR the Providing Unit is obliged to respond with for a given Frequency, as described by the Providing Unit's SOR Reserve Characteristic.

"SOR-o Trajectory Requirement" means the level of SOR-o the Providing Unit is obliged to respond with for a given Frequency, as described by the Providing Unit 's SOR-o Reserve Characteristic.

"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 the Time Zero for a given Frequency Event;

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

"System Services" 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 Zero" has the meaning given to it in Section 4.6.1.1 of this document;

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

"Time Zero Declared" means the amount of reserve (either FFR, FFR-o, POR, POR-o, SOR, SOR-o or TOR1) declared to be available by a Providing Unit at the Time Zero 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 the Time Zero for a given Frequency Event;

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

"TOR1 Trajectory Requirement" means the level of TOR1 the Providing Unit is obliged to respond with for a given Frequency, as described by the Providing Unit's TOR1 Reserve Characteristic.

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

"TOR2 Period" means the time period after the instant of a Frequency Event that TOR2 is expected to be provided. The TOR2 period is taken to be between T+5 minutes to T+20 minutes after Time Zero for a given Frequency Event;

"Total Availability Factor" has the meaning given to it in Section 5.1;

"Total Available Volume" has the meaning given to it in the Section 5.1;

"Total Contracted Volume" has the meaning given to it in the Section 5.1;

"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;

"Under-Frequency Reserve Trigger" has the meaning given to it in the Agreement;

"Under-Frequency Reserve Trigger Capability" has the meaning given to it in the Agreement;

"Working Day" means a weekday which is not a public holiday or bank holiday in Ireland or Northern Ireland (as applicable);