

Low Carbon Inertia Service Protocol

Operational Requirements and
Performance Monitoring

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1. Introduction

This Low Carbon Inertia Service (LCIS) Protocol document is supplementary to the Low Carbon Inertia Services Agreement which applies to the service procured through the LCIS 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 LCIS contractual arrangements. An overview of the documents is given in Figure 1.

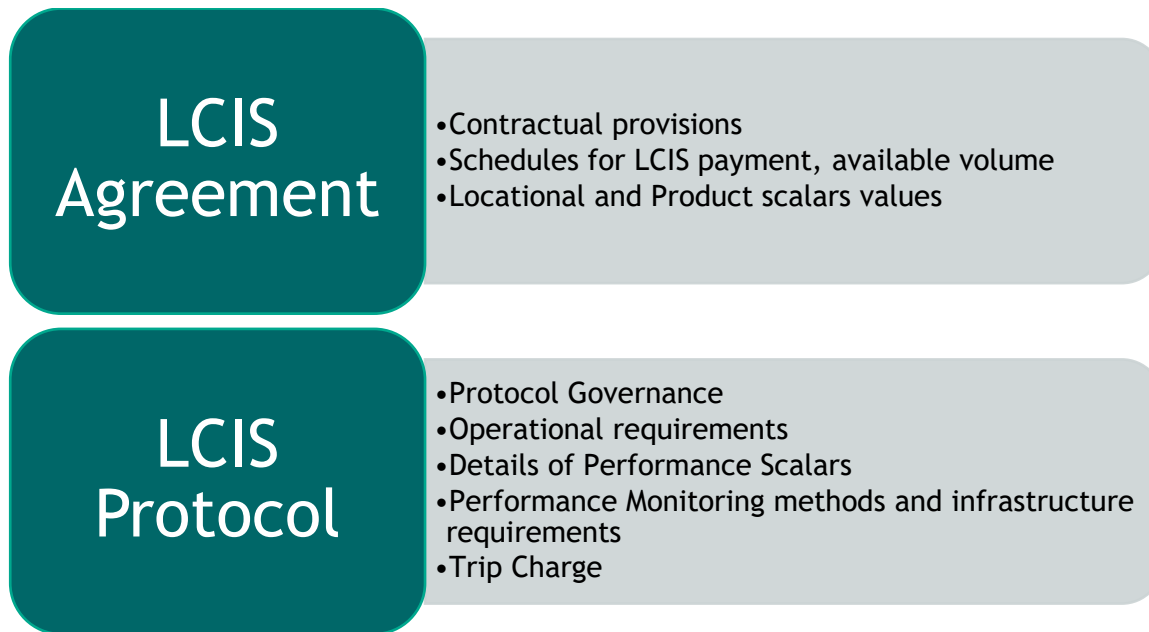


Figure 1: Overview of the LCIS contractual arrangements

Equation 1 sets out how payment is calculated for LCIS. This equation is also included in Schedule 2 of the LCIS Agreement. Each of the terms is defined in the Agreement.

$$\text{Trading Period Payment} = \text{Available Volume} \times \text{Payment Rate} \times \text{Scaling Factor} \times \text{Trading Period Duration}$$

Equation 1: Calculation of Trading Period Payments for LCIS arrangements

The Available Volume and Payment Rate are set out in the LCIS Agreement. Table 1 provides an overview of the Scalars that compose the Scaling Factor.

Category	Scalar	Specified in:
Locational Scalar	Locational Scalar	Schedule 2 of the Agreement based on the location of the Providing Unit.
Product Scalars	Inertia constant H Scalar	Schedule 2 of the Agreement based on the technical characteristics of the Providing Unit.
	Short-Circuit (or fault) Contribution Scalar	
	Reactive Power Product Scalar	Section 5 of the Protocol based on the technical characteristics and performance of the Providing Unit.
Performance Scalars	Synchronisation Dispatch Performance Scalar	Section 4 of the Protocol based on the performance of the Providing Unit
	Availability Performance Scalar	Section 6 of the Protocol based on the performance of the Providing Unit
	Consumption Performance Scalar	Section 7 of the Protocol based on the performance of the Providing Unit

Table 1: Overview of the Scalars

In addition, a separate Trip charge will apply as set out in Section 8 of the LCIS Agreement.

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

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 Service contracted. The Operational Requirements may be separate from and additional to the technical requirements assessed in the LCIS 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.

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 TSO.

- The Available Volume and the Reactive Power availability declared by a Providing Unit for each Trading Period must reflect its ability to provide LCIS.
- The Providing Unit must be able to declare the Available Volume and the Reactive Power availability via electronic means in real-time i.e. through EDIL or a real-time signal. In the case that the Providing Unit consists of several Individual Units connected to the same connection point, the Available Volume and the Reactive Power availability of each Individual Unit should be declared.
- The Providing Unit must ensure that the data quality of real-time signals, insofar as it is in the unit's control, is maintained to the required standards for the duration of the Agreement. The Providing Unit must engage with the TSOs without delay to resolve any issues that adversely affect the data quality of real-time signals.
- The Providing Unit must comply with the respective TSO's signal list (as may be amended during the lifetime of this Agreement).
- A Providing Unit shall provide reactive power dynamically once synchronised and not in discrete steps.
- The Providing Unit shall have an Automatic Voltage Regulation control (tested and approved).
- The Providing Unit shall declare that its AVR is on and fully functional, or off; through EDIL or other signalling means.

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) may be used for specific performance category.

4. Synchronisation Dispatch Performance Scalar

The timely synchronisation of the Providing Unit will be performance assessed using the 'Failure to Follow Notice to Synchronise Instruction' 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.

Based on these instructions, a Synchronisation Dispatch Performance Scalar (P_D) value between 1 and 0 will be calculated on a monthly basis (where values less than 1 will result in reduced payment) to incentivise the Providing Unit to synchronise on time. The value P_D will be calculated based on the data of the last 6 months as follows:

$$P_D = \left(\frac{\sum_{m=M-5}^{M-1} \left[\frac{\sum_{i=1}^N \left(1 - \frac{\text{Number of Failures of } u_i}{\text{Number of Instructions of } u_i} \right)}{N} \right] \times V_m}{\sum_{m=M-5}^{M-1} \left[\frac{\sum_{i=1}^N \left(1 - \frac{\text{Number of Failures of } u_i}{\text{Max}(\text{Number of Instructions of } u_i, 3)} \right)}{N} \right] \times V_m} \right) \times \frac{1}{3}$$

Where

u_i is the Individual Unit i from the Providing Unit;

N is the number of Individual Units within the Providing Unit (all connected to a single connection point);

m is the Month within which the Performance Incidents occurred; $m=M$ means the first full calendar month preceding the date for which the Synchronisation Dispatch Performance Scalar is

calculated (one month ago), $m=M-1$ means the second full calendar month preceding the date for which the Synchronisation Dispatch Performance Scalar is calculated (two months ago), etc.;

V_m is the Dynamic Time Scaling Factor;

Number of Failures refers to the number of Failures to Follow Notice to Synchronise issued by the TSO for month, m ;

Number of Instructions refers to the number of Synchronisation Dispatch Instructions issued by the TSO for month, m .

For any months, m , during which there are no operational data (i.e. before the Go-live Date) then the Number of Failures shall be zero.

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 Synchronisation Dispatch Performance Scalar (P_D) is being calculated. The purpose of this is to place more emphasis on the most recent performance. The Dynamic Time Scaling Factor (V_m) is calculated as illustrated in Table 1.

Table 2: Calculation of the Dynamic Time Scaling Factor (V_m)

Number of Months between the Dispatch Instructions Month and Scalar Assessment Month 'M'	Dynamic Time Scaling Factor ' V_m '
M	1
M-1	0.8
M-2	0.6
M-3	0.4
M-4	0.2
M-5+	0

Using this approach the maximum duration a Failure to Follow Notice to Synchronise instruction can impact the Synchronisation Dispatch Performance Scalar (P_D) is 5 months with the impact reducing each month.

5. Reactive Power Product Scalar

The Reactive Power Product Scalar, as defined in Schedule 2 of the Agreement shall be determined on a continuous basis according to the reactive power capability declared by the Providing Unit via EDIL for each Trading Period.

The Reactive Power Product Scalar can take a value between 1.1025 and 0.81 and will be calculated for each calendar month, as follows:

$$\text{Reactive Power Product Scalar} = \text{Lagging Scalar} * \text{Leading Scalar}$$

Where:

$$\text{Lagging Scalar} = \begin{cases} 1.05 & \text{Declared Unit}_{lagging} \geq 0.9 \\ 1.0 & 0.8 \leq \text{Declared Unit}_{lagging} < 0.9 \\ 0.125 * \text{Declared Unit}_{lagging} + 0.9 & \text{Declared Unit}_{lagging} < 0.8 \end{cases}$$

$$\text{Leading Scalar} = \begin{cases} 1.05 & \text{Declared Unit}_{leading} \leq -0.6 \\ 1.0 & -0.6 < \text{Declared Unit}_{leading} \leq -0.4 \\ -0.25 * \text{Declared Unit}_{leading} + 0.9 & \text{Declared Unit}_{leading} > -0.4 \end{cases}$$

Where:

$$\text{Declared Unit}_{lagging} = \text{Declared MVAR}_{lagging} / \text{Base MVA}$$

$$\text{Declared Unit}_{leading} = \text{Declared MVAR}_{leading} / \text{Base MVA}$$

Where:

The *Declared MVAR_{lagging}* and *Declared MVAR_{leading}* are the values declared by the Providing Unit via EDIL averaged over the month, M;

The *Base MVA* is the value set in the Schedule 9 of the LCIS Agreement;

In the case that the Providing Unit consists of several Individual Units connected to the same connection point, the *Declared MVAR_{lagging}* is the sum of the declared MVAR lagging of the Individual Units and the *Declared MVAR_{leading}* is the sum of the declared MVAR leading of the Individual Units.

~~When a Providing Unit declares their declared capability either lagging or leading to zero, the TSO may require the Providing Unit to maintain the declared capability to zero until they successfully pass a Compliance Test.~~

6. Availability Performance Scalar

The value of the Availability Performance Scalar was recommended by the TSOs and approved in SEM-23-002. The value of the Availability Performance Scalar will be determined based on the Availability Factor as per the table below:

Availability Factor	Availability Performance Scalar
<60%	0
≥60% <70%	0.25
≥70% <80%	0.50
≥80% <90%	0.70
≥90% <95%	0.85
≥95% <97%	0.95
≥97%	1.00

The Availability Factor will be calculated for each calendar month and will apply to all payments in that month. It will be based on the Available Volume versus the Contracted Volume considered over a period of 12 months, with each month given an equal weighting (month M to month M-11).

The Availability Factor for each month will be then calculated as follows:

$$Availability\ Factor = \sum_{m=M}^{M-11} \left(\frac{(Available\ Volume)_m}{(Contracted\ Volume)_m} * 1/12 \right) * 100\%$$

Where:

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

the Available Volume is the sum of the Available Volume for each Trading Period within that month, *m*. In the case that the Providing Unit consists of several Individual Units connected to the same connection point, the Availability Volume would be the summation of the Availability Volume of the Individual Units.

The Contracted Volume is the sum of the Contracted Maximum Available Volume for each Trading Period within that month, *m*.

In addition, allowances are made for Scheduled Outages as per Section 3.5.2 of the Agreement and the Available Volume shall be adjusted accordingly. In the case that the Providing Unit consists of several Individual Units connected to the same connection point, the duration of Scheduled Outages of the Individual Unit will be divided by the number of Individual Units within the Providing Unit.

For any months, m, during which there are no operational data (i.e. before the Go-live Date) then the Available Volume would be equal to the Contracted Volume.

7. Consumption Performance Scalar

The purpose of the Consumption Performance Scalar is to penalise if actual energy consumption of the LCIS Unit is above the contracted energy consumption for the reference operating conditions. The contracted energy consumption values will be as submitted at the LCIS tendering stage which will be used in the tender evaluation process.

The value of the Consumption Performance Scalar will be determined based on the Consumption Deviation Factor as per the table below:

Consumption Deviation Factor	Consumption Performance Scalar
≥200%	0
≥150% <200%	0.30
≥100% <150%	0.50
≥80% <100%	0.70
≥60% <80%	0.80
≥40% <60%	0.90
≥20% <40%	0.93
≥10% <20%	0.96
≥5% <10%	0.98
<5%	1

The Consumption Deviation Factor will be calculated after Performance Testing. The corresponding Consumption Performance Scalar will then apply to all Trading Period Payment.

The Consumption Deviation Factor is calculated as follows:

$$\text{Consumption Deviation Factor} = \text{Max} \left(0, \left(\left(\frac{\text{Consumption Volume Actual}}{\text{Consumption Volume Declared}} - 1 \right) * 100\% \right) \right)$$

Where:

Actual is the Consumption Volume, expressed in MWh, measured during Performance Testing;

Declared is the Consumption Volume, expressed in MWh, declared by the tenderer at the procurement stage and reflected in the LCIS Agreement;

The Consumption Volume is the sum of:

- (i) The energy consumed by the Providing Unit at 20% of rated reactive power consumption (lead);
- (ii) The energy consumed by the Providing Unit at 20% of rated reactive power production (lag);

8. Trip Charge

The Providing Unit should remain synchronised and able to provide its services under the Connection Conditions specified in the EirGrid and SONI Grid Codes. When the Providing Unit does not meet these obligations and trips, a 'Trip' will be recorded in EDIL and a Trip Charge will apply.

A Monthly Trip Charge will be calculated at the end of each calendar month, as follows:

$$\text{Monthly Trip Charge} = \sum_{i=1}^N \text{Trip Charge}_{im}$$

Where:

the Monthly Trip Charge is an amount expressed in € or £;

i refers to each individual trip in month M;

N refers to the total number of trips in month M

the Trip Charge is an amount expressed in € or £ for each individual trip, i;

m is the month, M

The Trip Charge is calculated for every trip as follows:

$$\text{Trip Charge} = \text{Trip Charge Rate} * \text{Available Volume}$$

Where:

the Trip Charge Rate is expressed in €/MVA.s or £/MVA.s

the Available Volume at the time of the trip is expressed in MVA.s

The Trip Charge Rate is set to €4515/MVA.s and to £39.8213.27/MVA.s (based on a GBP/EUR exchange rate of 1.13).

The Monthly Trip Charge will be netted off any other monthly Payments owed to the Service Provider under the Agreement.

9. Performance Monitoring Timelines and Business Process Overview

9.1.1. 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.

9.1.2. 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 scalars 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. Once the query is resolved the final outcome is then fed into the next monthly **Performance Scalar** calculation.

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: Key Milestones for Query Management Process

Acronym	Meaning
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

9.1.3. 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.

9.1.4. 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) Reactive Power Data Tab;
- c) Synchronisation Dispatch Data Tab;
- d) Availability Data;
- e) Trip Charge Data; and
- f) Glossary.

10. 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 performance to synchronise or provide reactive power which a Providing Unit provides in response to a Performance Incident;

“**Agreement**” means the document titled Low Carbon Inertia Service Agreement including all applicable Schedules, and Appendices as may be amended and/or supplemented by agreement of the Parties;

“**Assessment Period**” means the time period over which a Performance Scalar is calculated.

“**Availability Performance Scalar**” means a multiplicative factor ≤ 1 which is used to adjust the Service payment to reflect a Providing Unit’s historical Available Volumes for the provision of LCIS;

“**Availability Factor**” has the meaning given to it in Section 5;

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

“**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 Volume**” means, in relation to a Trading Period, the maximum Inertia Capability Contracted for that Trading Period;

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

“**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;

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

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

“**Dynamic Time Scaling Factor (Vm)**” refers to the component of the **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**;

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

“**Expected**” means, in relation to the Service, the level of response that a Providing Unit is expected to provide in response to a Performance Incident taking account of tolerances where appropriate;

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

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

“**Low Carbon Inertia Service**” or “**LCIS**” has the meaning given to it in the Agreement;

“**Metering Code**” has the meaning given to it in the Agreement;

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

“**Operational Requirements**” means the TSOs’ standards that a Service Provider must satisfy in providing the Service.

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

“**Performance Assessment**” means the evaluation of a Service Provider’s delivery of the Low Carbon Inertia Service;

“**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 the Service means an occurrence after which a Service Provider’s delivery is evaluated following a Dispatch Instruction;

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

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

“**Phasor Measurement Unit**” or “**PMU**” means a Monitoring Equipment device which can be used to measure the provision of the Service;

“**Power System**” has the meaning given to it in the Agreement;

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

“**Protocol**” means this document entitled “Low Carbon Inertia Service 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;

“**Regulatory Authority**” means the Commission for Energy Regulation for EirGrid or the Northern Ireland Authority for Utility Regulation for SONI

“**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 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;

“**Service**” 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 Low Carbon Inertia Service provision;

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

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

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

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

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

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

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