Recommendation on procurement of Low Carbon Inertia Services (LCIS)

Requirements and Procurement Approach

14 November 2022

EIRGRID SONI

Glossary of Terms

Term	Definition
Connection Offer	means the offer letter issued to a Service Provider for a Connection Agreement
Connection Point	means the point where the LCIS Provider is connected to the Transmission System (110 kV or above)
ECP	means Enduring Connection Policy in Ireland (Enduring Connection Policy (eirgridgroup.com))
LCIS	means the Low Carbon Inertia Service, including provision of Synchronous Inertia, Reactive Power support and Short-Circuit contribution, to be procured and delivered as part of this proposed procurement exercise
LCIS Providers	means the units delivering the LCIS
MEC	means the value (in MW, MVA, kW and/or kVA) provided in accordance with the User's Connection Agreement.
MVA.s	means mega Volt-Ampere second (unit for inertia)
RES	means Renewable Energy Sources
Scalar	means a multiplier which adjusts the payment for a System Service to reflect the characteristics of the service delivery
SNSP	means System Non-Synchronous Penetration. It is a real-time measure of the percentage of generation that comes from non-synchronous sources, such as wind and HVDC interconnector imports, relative to the system demand

Table 1: Terms and Definitions

Executive Summary

In the SEM-21-021 Decision on the System Services Future Arrangements[1], the SEM Committee (SEMC) requested that the TSOs carry out an evaluation and bring forward proposals for a fixed term procurement in relation to Low Carbon Inertia Services (LCIS).

The motivation for this request is to support the integration of technologies which can facilitate a reduction in the quantity of carbon-intensive conventional generation required to run at any given time on the Ireland and Northern Ireland power systems. This reduction will facilitate the further integration of renewable generation and contribute towards achieving the 2030 Renewable Energy Source (RES) targets set in both Ireland and Northern Ireland.

As part of our Shaping Our Electricity Future Roadmap, the development and execution of a plan to procure LCIS has been identified as a key action.

From 23 June 2022 to 12 August 2022, EirGrid and SONI consulted stakeholders[2] on the requirements and a range of design elements underpinning the LCIS procurement process that is expected to commence in 2023. The TSOs received 23 responses and had further engagement with stakeholders through bilateral meetings where requested.

This recommendation paper presents the outcomes of the consultation and provides clarity for interested parties on our recommended requirements and procurement approach for LCIS.

These recommendations are based on our consideration of the appropriate balance of system requirements, delivery timeframes, performance incentives and contractual arrangements to drive investment in LCIS for the overall benefit of the power system and consumers in Ireland and Northern Ireland.

An overview of these recommendations is provided in Section 3 of this paper.

Note that proceeding with the resulting procurement process is subject to approval of funding arrangements by the Regulatory Authorities.

[1] SEM-21-021 System Services Future Arrangements - Decision Paper 1 | SEM Committee

[2] https://consult.eirgrid.ie/consultation/consultation-low-carbon-inertia-service-lcis-competitive-procurement https://consult.soni.ltd.uk/consultation/consultation-low-carbon-inertia-service-lcis-competitive-procurement-0

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1. Introduction and Background

1.1 EirGrid and SONI

EirGrid and SONI are the Transmission System Operators (TSOs) in Ireland and Northern Ireland. It is our job to manage the electricity supply and the flow of power from generators to consumers. Electricity is generated from gas, coal and renewable sources (such as wind, solar and hydro power) at sites across the island. Our high voltage transmission network then transports electricity to high demand centres, such as cities, towns and industrial sites.

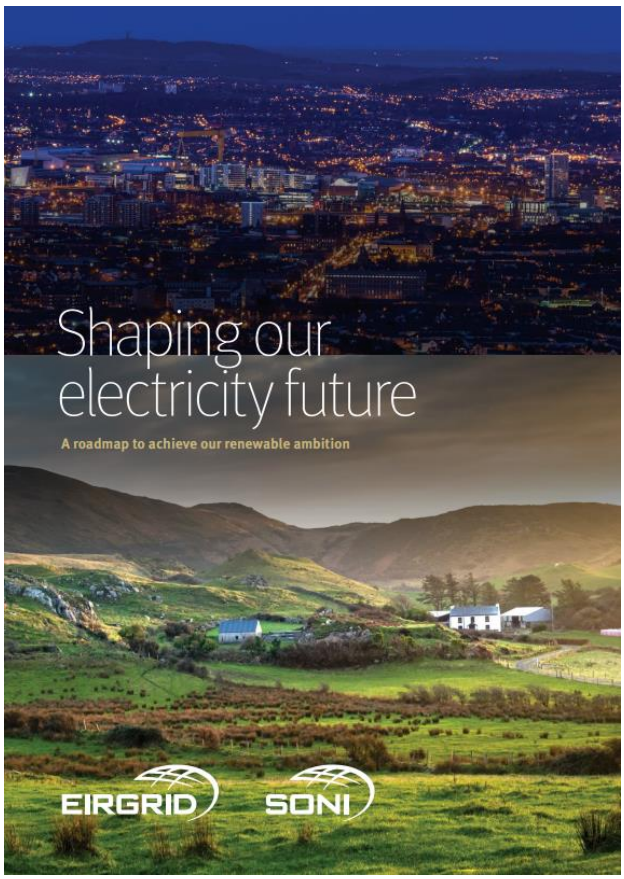
We have a responsibility to facilitate connections to the power system including increased levels of renewable sources to generate on the power system while continuing to ensure that the system operates securely and efficiently.

1.2 Shaping Our Electricity Future

In November 2021 we published the inaugural Shaping Our Electricity Future Roadmap[3] following consultation with stakeholders across society, government, industry, market participants and electricity consumers.

This Shaping Our Electricity Future Roadmap provides an outline of the key developments from a networks, engagement, operations and market perspective needed to support a secure transition to at least 70% renewables on the electricity grid (RES-E) by 2030 – an important step on the journey to 80% RES-E and to net zero by 2050. Inherent in this is a secure transition to 2030 whereby we continue to operate, develop and maintain a safe, secure, reliable, economical and efficient electricity transmission system.

A key action identified in this roadmap was the development of a process to procure Low Carbon Inertia Services (LCIS) that would support these RES-E objectives.



[3] https://www.eirgridgroup.com/site-files/library/EirGrid/Shaping_Our_Electricity_Future_Roadmap.pdf
https://www.soni.ltd.uk/media/documents/Shaping_Our_Electricity_Future_Roadmap.pdf

1.3 SEM Committee Request

In the SEM-21-021 Decision[4] on the System Services Future Arrangements, the SEM Committee requested that the TSOs carry out an evaluation and bring forward proposals for a fixed term procurement in relation to LCIS.

The motivation for this request is to support the integration of technologies which can facilitate a reduction in the quantity of carbon intensive conventional generation required to run at any given time on the all-island power system.

As outlined in its decision paper, the SEM Committee decided to set a process for LCIS procurement similar to the one used previously in 2018, in which 110 MW of high availability reserve services was procured for a six year period (SEM-18-049[5]). As part of this LCIS procurement process, the SEM-21-021 decision stated that "*The TSOs' will publish the detailed proposal for public consultation which should cover the following:*

- *the proposed start and end dates of the contract;*
- *the details relating to the Performance Bond;*
- *detailed technical definitions of the services;*
- *the minimum and maximum volume to be procured in the auction;*
- *the treatment and application of scalars; and*
- *any other proposals that the TSOs consider appropriate.*

Following this public consultation, the TSOs shall submit a Recommendation Paper to the SEM Committee. The SEM Committee, following a review of the consultation responses and TSOs Recommendations Paper, will then publish a Decision paper setting out the arrangements for that Fixed Contract procurement."

1.4 Procurement plan

In line with the SEM Committee Request, EirGrid and SONI developed a project plan which will ultimately provide fixed term contracts for LCIS (including inertia, reactive power and short circuit contribution capability). The targeted date for completion of the procurement process and contract award is December 2023.

The overall procurement plan is provided in Table 2.

[4] https://www.semcommittee.com/sites/semc/files/media-files/SEM-21-021%20System%20Services%20Future%20Arrangements%20-%20Decision%20Paper%201.pdf
[5] https://www.semcommittee.com/sites/semc/files/media-files/SEM-18-049%20DS3%20System%20Services%20Fixed%20Contracts%20Procurement%20Arrangements.pdf

Description	Start Date	Finish Date
Detailed plan for the implementation of the project to be presented to the Industry **(Complete – webinar held on 15 Dec. 2021)**	Q4 2021	Q4 2021
Studies to identify the technical and locational requirements considering inertia, reactive power and short circuit level **(Complete)**	Q3 2021	May-22
Consultation, recommendation and SEMC decision on the procurement and requirements **(Complete)**	Jun-22	Jan-23
Consultation, recommendation and SEMC decision on the contractual arrangements	Feb-23	Jun-23
Undertake procurement process and award contracts	Jul-23	Dec-23

Table 2: Overall procurement process plan

1.5 Recommendation Paper on the procurement and requirements

This recommendation paper represents the results of the consultation[6] that has ended on 12 August 2022 and provides clarity for interested parties on the requirements and procurement approach which the TSOs recommend for the LCIS competitive procurement exercise.

This recommendation paper should be read in conjunction with the accompanying SEM Committee Decision Paper, which may or may not align with the TSOs' recommendations. As shown in the procurement plan in the section above, a separate consultation on the contractual arrangements will be conducted, targeted to start in December 2022. This will provide stakeholders with the opportunity to provide feedback on the proposed contract for successful parties under this competition.

1.6 Structure of the Recommendation Paper

The remainder of this recommendation paper is structured as follows:

Section 2 provides information on the number and type of responses received to the consultation.

Section 3 summarises all the TSOs' recommendations.

Section 4 sets out the consultation proposal for each topic contained within the 'Technical aspects' section of the consultation, followed by stakeholder comments for each topic, the TSOs' response to these comments and finally, the TSOs' recommendations.

[6] https://consult.eirgrid.ie/consultation/consultation-low-carbon-inertia-service-lcis-competitive-procurement
https://consult.soni.ltd.uk/consultation/consultation-low-carbon-inertia-service-lcis-competitive-procurement-0

Section 5 provides the same function as Section 4 but for the 'Commercial aspects' section of the consultation.

Section 6 provides the same function as Section 4 but for the 'Competition aspects' section of the consultation.

Section 7 provides stakeholder comments on the funding arrangements.

Section 8 provides an overview of next steps and details the consultation questions.

Appendix A: List of Transmission Stations within the LCIS Incentivised Zones.

2. Responses to the Consultation

The consultation on the LCIS competitive procurement – Requirements and Procurement approach, closed on 12 August 2022. In support of this consultation, EirGrid and SONI held an industry webinar on 19 July 2022. In total, 23 responses were received. The 19 non-confidential respondents are listed below:

- Neoen
- Irish Energy Storage Association (IESA)
- SSE
- Greenlink
- RWE
- Siemens
- GDA Energy
- Orsted
- ABO Wind NI Ltd and ABO Wind Ireland Ltd
- Hanwha Energy Corporation Ireland
- ESB Generation and Trading
- Bord na Móna
- Wind Energy Ireland (WEI), Energy Storage Ireland (ESI) and RenewableNI (RNI)
- Energia
- Bord Gáis Energy
- Lumcloon Energy Ltd
- Mutual Energy
- EDF Renewables
- Irish Solar Energy Association

Note that all non-confidential responses have been published on the EirGrid[7] and SONI[8] consultation portals.

[7] https://consult.eirgrid.ie/node/2529/submissions
[8] https://consult.soni.ltd.uk/node/366/submissions

3. Overview of TSOs' Recommendations

The following table provides an overview of the recommendations which are contained within this recommendation paper.

Section	Requirement	TSOs' Recommendations
4.1.4	Phased approach	Phased approach with the procurement of a targeted volume of 10,000 MVA.s in Phase 1 to meet our requirements for 2026. Phase 2 (and further phases if required) will be subject to a later, separate consultation and procurement process (subject to RA decisions) to meet our requirements for 2030.
4.2.4	Volume and location	A targeted volume of 4000 MVA.s in Northern Ireland and 6000 MVA.s in Ireland shall be procured in Phase 1. Three zones have been defined in which the placement of LCIS shall be incentivised. Potential LCIS providers located outside of the three incentivised zones can still participate in the procurement process.
4.3.4	LCIS definition	LCIS comprises the provision of Synchronous Inertia, Reactive Power support and Short-Circuit contribution.
4.3.4	Technical requirements	A range of requirements is defined for the inertia constant, short-circuit contribution and steady state reactive power capability.
4.3.4	Grid Code compliance	Grid Code requirements for LCIS providers will be largely based on synchronous generator requirements such as frequency and voltage operating ranges and fault ride-through requirements. A separate Synchronous Condenser Grid Code Implementation Note has been developed and published by the TSOs.
4.3.4	Inertia capability requirements	Minimum inertia capability contracted is 900 MVA.s and maximum contracted is 2000 MVA.s at an individual connection point. Additionally, no more than 2000 MVA.s at a single transmission station will be contracted.
4.3.4	Connection requirements	The LCIS provider shall connect directly to the transmission system or share a connection provided they can meet the technical requirements at the connection point and respect the contractual, regulatory and legal frameworks in place at the time of the procurement. A

Section	Requirement	TSOs' Recommendations
		LCIS provider can only be connected at a transmission station controlled by the TSO[9] at 110kV or above.
5.1.4	Contract start date and duration	The earliest contract go-live date shall be the 01 October 2024 and the latest targeted go-live date shall be 33 months after the award of contract. All contracts will end 6 years after the latest targeted go-live date.
5.2.4	Performance Bond and Milestones	A performance bond of 500 €/MVA.s or equivalent in £ will be required. Indicative performance milestones are provided and will be further detailed in the consultation on the contractual arrangements.
5.3.4	Availability	Payment based on 97% annual availability requirement, exclusive of 15 days of planned outages allowed annually following notification to the TSOs.
5.4.4	Application of scalars	A performance scalar will apply to incentivise the availability of LCIS and a product scalar will apply for LCIS providers with better reactive power and short circuit contribution capability. A locational scalar will also apply to incentivise the delivery of LCIS in the three zones defined in Section 4.2.3.
5.5.4	Transmission Network availability	The same Grid Code Outturn Availability arrangements applicable to conventional generation will apply to LCIS providers. If the Connection Offer identifies particular scenarios where the synchronisation of the LCIS unit is restricted, the LCIS provider shall be considered unavailable when the restriction is active.
5.6	Network Charges and Licensing	The Transmission Use of System Charges[10] applicable to a LCIS provider will be progressed independently of this procurement.
6.1.4	Overall procurement process	Tenderers will need to go through a pre-qualification stage. Tenderers that make it through the pre-qualification stage will then receive a Request for Proposal and successful tenderers will be selected based on the cost per MVA.s / h.

[9] Where TSOs have operational control of the LCIS unit, meaning the possibility to instruct the unit to come on and off and to produce/consume reactive power.

[10] https://www.eirgridgroup.com/site-files/library/EirGrid/Statement-of-Charges-2021_22-_final_draft-v.1.0.pdf https://www.soni.ltd.uk/media/documents/FINAL-TUoS-Statement-of-Charges-2021-22.pdf

Section	Requirement	TSOs' Recommendations
6.2.4	Grid connection / Planning permission requirements	Full planning permission is required for tender submission (after pre-qualification) in both jurisdictions. In Ireland, successful LCIS tenderers who do not have a connection offer will need to be prioritised outside of the ECP process by direction from the CRU. In Northern Ireland, the standard connection offer process arrangements will apply.
6.3.4	Bid format	Bidding a price for LCIS in €/MVA.s per hour or £/MVA.s per hour.
6.4.4	Cost of Energy	Cost of imported energy will be factored in to the evaluation. It will be converted to a cost per MVA.s per hour and added to the bid received.
6.5.4	Price Determination	Pay-as-bid pricing will be used.
7	Funding Arrangements	LCIS is a critical service to deliver on the Governments' ambitions to 2030 so an additional annual allowance above the current allowance of €235m is required, to secure the service.

Table 3: Overview of Proposals

4. Technical aspects

4.1 Phased Approach

4.1.1 Consultation Paper Proposal

In our consultation paper, we outlined the proposal below regarding a phased approach to the procurement of LCIS.

TSOs' Proposal:

LCIS will be procured in a phased approach. Up to 10,000 MVA.s will be procured in Phase 1 to meet our requirements for 2026. Phase 2 (and further phases if required) will be subject to a later, separate consultation and procurement process (subject to decisions by the regulatory authorities) to meet our requirements for 2030.

Respondents were asked the following question:

Question 1: Do you have any comments on the proposed phased procurement approach?

4.1.2 Summary of consultation responses

17 of the 23 respondents set out their views to the question on the phased procurement approach, with 5 respondents acknowledging that a phased approach is sensible.

However, a number of respondents requested further clarity on Phase 2, mainly regarding the volume requirement and the type of technology that will be considered. Among them, some respondents also recommend starting Phase 2 shortly after Phase 1 or as soon as possible in order to deliver on our climate goals by 2030 and in light of supply chain issues that were flagged.

In relation to our climate goals, some respondents proposed to go further in our ambition and to relax the minimum number of Large Conventional Units to zero to define our 2030 LCIS requirements.

In term of revenue stream, 2 respondents asked if it would be possible to get a second contract in Phase 2, while another respondent asked how LCIS providers are expected to continue to finance their projects once the 6-year contract term ended. Also, one respondent sought clarification about the 2,000 MVA.s cap and whether this cap would be applied in a cumulative manner across the tender phases were two contracts to be awarded successively to the same installation.

4.1.3 TSOs' Response

We note that a number of respondents explicitly agreed that a phased approach is appropriate and that no respondents objected to this approach.

We recognise that details regarding Phase 2 are not provided at this stage. There are several reasons for this:

- further technical studies need to be carried out to define our requirements beyond 2026;
- the outcome of the first phase needs to be known to start these studies (e.g. the volume, location and characteristics of the LCIS units awarded contracts);

- the capability of non-synchronous technology to provide the LCIS service needs to be further assessed;
- any additional procurement phase will require the approval of the regulatory authorities.

Finally, by the time these contracts end, new commercial arrangements for system services (please refer to the SEM Committee Decision SEM-22-012[11] on the High-Level Design of the Future Arrangements) will be in place and will aim to provide long-term investment signals. Note that the Detailed Design of these arrangements is under development and that stakeholders will be consulted.

4.1.4 TSOs' Recommendation

Given the above, we recommend the following regarding the phased approach:

TSOs' Recommendation:

LCIS will be procured in a phased approach. A targeted volume of 10,000 MVA.s will be procured in Phase 1 to meet our requirements for 2026. Phase 2 (and further phases if required) will be subject to a later, separate consultation and procurement process (subject to decisions by the regulatory authorities) to meet our requirements for subsequent years.

4.2 Volume and incentivised locations for Phase 1

4.2.1 Consultation Paper Proposal

In our consultation paper, we made the proposal below regarding the volume to be procured and the incentivised zones.

TSOs' Proposal:

A volume of inertia of 4000 MVA.s in Northern Ireland and 6000 MVA.s in Ireland shall be procured in Phase 1. Three zones have been defined in which the placement of LCIS shall be incentivised.

Respondents were asked the following question:

Question 2: Do you have any comments on the volume to be procured and the definition of incentivised zones?

4.2.2 Summary of consultation responses

16 of the 23 respondents set out their views on this question.

Volume Requirement:

Regarding the volume to procure in Phase 1, two respondents indicated that the requirements should be at least 10,000 MVA.s for Phase 1 while another respondent supported the procurement

[11] https://www.semcommittee.com/sites/semc/files/media-files/System%20Services%20Future%20Arrangements%20High%20Level%20Design%20Decision%20Paper.pdf

in two lots to ensure there is no risk of deficit in either Ireland or Northern Ireland.

Among these respondents, one suggests having the option to procure more while two other respondents asked if a mechanism to procure more or less, depending on, for example, volumes tendered below a "target" price is foreseen.

Two respondents expressed concerns about the volume requirement and the risk of under procurement due to the use of only one set of assumptions.

Finally, one respondent outlined that it is not clear if the 10,000 MVA.s requirement is net of existing LCIS devices or not.

Incentivised zones:

4 respondents believe that the incentivised zones make sense while a number of respondents asked for clarifications:

- What volumes are required per zone?
- Do reactive power and short circuit contribution need to be located anywhere?
- How will locational procurement be managed and signaled to the market?
- Are incentivised zones based on regional oscillations at various inertia centres?
- Will there be caps per zone to avoid over procurement in specific areas?
- Consequences of no LCIS in the incentivised zones?
- Were there assumptions that areas with current "must run" will continue and therefore not require LCIS in those areas?

4.2.3 TSOs' Response

Volume Requirement:

Given the size of individual LCIS devices we are proposing to procure (a minimum size of 900 MVA.s, a maximum size of 2000 MVA.s) it is possible that we may not be able to exactly achieve the targeted jurisdictional volumes of 4000 MVA.s in Northern Ireland and 6000 MVA.s in Ireland in the procurement process.

The specific rules that will be applied in determining the total jurisdictional volume procured will be set out at the procurement stage.

Note also that we have not assumed any existing or planned LCIS devices as already contributing to the overall 10,000 MVA.s requirement.

Incentivised zones:

Our intention is to offer more opportunities to the market to enhance competition. For this reason, no minimum or maximum volumes have been defined for the incentivised zones, but only a procurement in 2 lots to avoid any deficit either in Ireland or Northern Ireland.

Our studies showed that the placement of LCIS devices in the incentivised zones brings greater benefits. However, this is not to say that being outside these zones is not beneficial to the system. Another outcome of our studies is that enhanced short circuit contribution capability is also more beneficial to the system.

To reflect these benefits, we recommend in section 5.4.4 of this recommendation paper to apply:

- a locational scalar when a LCIS device is in one of the incentivised zones and;
- a product scalar for enhanced capability.

Regarding the assumptions taken, we have performed sensitivity analyses that, we believe, give us confidence that the proposed volume to procure will meet our requirements.

Our 2026 LCIS requirement for Northern Ireland and Ireland as well as the incentivised zones recommended are shown in Figure 1.

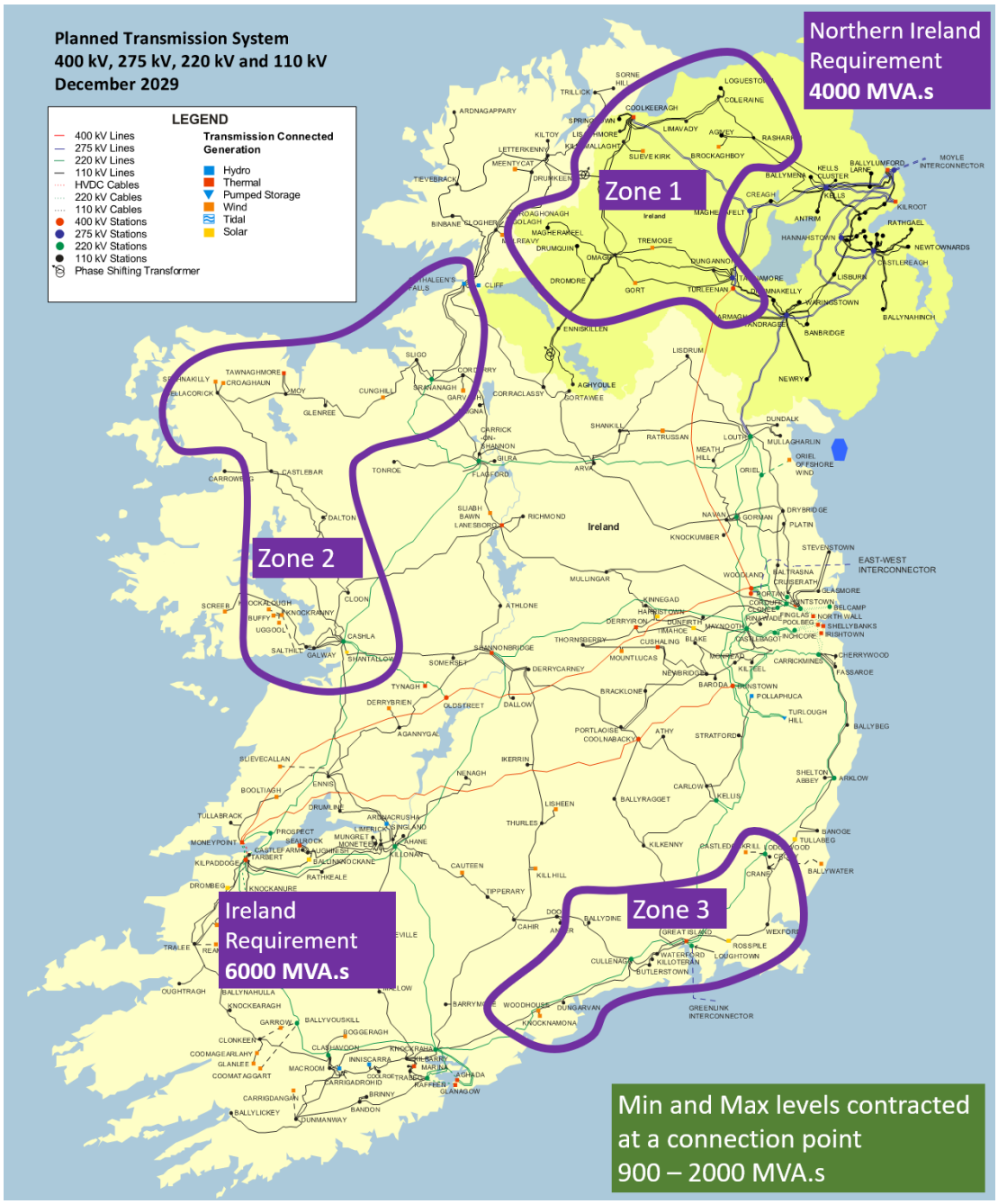


Figure 1: Zones incentivised and requirements (in MVA.s) for placement of LCIS

4.2.4 TSOs' Recommendation

Given the above, we recommend the following regarding the volume to be procured and the incentivised zones.

TSOs' Recommendation:

A targeted volume of inertia of 4000 MVA.s in Northern Ireland and 6000 MVA.s in Ireland shall be procured in Phase 1. Three zones have been defined in which the placement of LCIS shall be incentivised. Potential LCIS providers located outside of the three incentivised zones can still participate in the procurement process.

Appendix A lists the transmission stations in each of the zones and Section 5.4.3 provides further information on the application of the proposed locational scalar.

4.3 Product definition and service provider requirements

4.3.1 Consultation Paper Proposal

In our consultation paper, we made the following proposals regarding the product definition and service provider requirements.

LCIS definition:

TSOs' Proposal:

LCIS Providers will need to provide synchronous inertia, reactive power support and short-circuit contribution to meet the specified requirements.

Technical requirements:

TSOs' Proposal:

LCIS providers will need to meet the minimum technical requirements with respect to the inertia constant, short circuit contribution and reactive power, as set out in Table 4 (of the consultation paper).

Grid Code requirements:

TSOs' Proposal:

LCIS providers will need to be Grid Code compliant. In advance of completion of the Grid Code modifications, a Grid Code Implementation Note is being progressed to provide stakeholders with guidance on synchronous LCIS requirements.

Inertia Capability requirements:

TSOs' Proposal:

The LCIS inertia capability contracted should be no lower than 900 MVA.s and no higher than 2000 MVA.s at the Connection Point. Additionally, no more than 2000 MVA.s will be contracted at a single Transmission Station.

Connection requirements:

TSOs' Proposal:

The LCIS provider shall connect directly to the transmission system or share a connection provided they can meet the technical requirements set out in Section 4.3 (please refer to consultation document).

Respondents were asked the following question:

Question 3: Do you have any comments on the LCIS Provider requirements?

4.3.2 Summary of consultation responses

18 of the 23 respondents replied to this question which covers a wide range of topics (definition of the service, technical requirements, size requirements, connection method, etc.).

LCIS definition:

12 respondents set out their views on the LCIS Definition.

A number of respondents are concerned that the definition does not allow non-synchronous technology while some respondents indicate that grid forming technology should be progressed as soon as possible in parallel to Phase 1.

One respondent recognised that allowing inverter-based technology requires following a rigorous assessment process (e.g. through the Qualification Trial Process) which might take time and therefore supports the LCIS definition proposed for Phase 1.

Technical requirements:

9 respondents set out their views on the technical requirements.

Among these respondents, 4 support the proposed requirements while some respondents believe that the requirements should be defined in absolute values and not in per unit of rating in MVA. One of the respondents believes that, depending on the transformer rating at the connection point, the LCIS developer could find themselves limited to a small range of OEM providers and suggests a reactive power range slightly different (Lagging ≥0.8 p.u and leading ≤-0.4 p.u) to alleviate this supply chain competition concern.

A number of other clarifications questions have been asked:

- How is system strength assessed (ik' or ik'', bolted three-phase faults on Connection Point)?

- What Automatic Voltage Regulator (AVR) mode is considered? Is On Load Tap changer allowed?
- How does EirGrid intend to calculate the H constant?

Connection methods:

One respondent agrees with our proposal to connect LCIS devices on the transmission system to ensure maximum effectiveness of the unit while 2 other respondents consider that the pool of market participants should be broadened by allowing connection to the distribution system.

Another respondent asked what would be the preferred connection voltage level?

Regarding the potential for a shared connection, most of the respondents that set out their views welcomed this proposal but required more clarifications on how this would operate.

LCIS devices inertia capability requirements:

4 respondents set out their views on the inertia capability requirements.

Among the respondents, 3 consider that the maximum size contracted is not cost effective given that larger plants are not much more expensive and asked whether there are technical reasons for it.

Regarding the minimum limit of 900 MVA.s, 2 respondents believe that this minimum limit is unclear, and one asked if the market could decide the minimum size.

In relation to the maximum limit of 2,000 MVA.s contracted, one respondent asked why it would not be possible to have a DS3 contract for the capabilities above 2,000 MVA.s considering that with the current arrangement, an installation would be paid for the full capability.

Finally, regarding the maximum contracted capability of 2,000 MVA.s at a single substation, one respondent asked if this includes or excludes the capability provided or to be provided by the assets under the DS3 System Services arrangements, System Services Future Arrangements or compensated assets?

Grid Code:

Regarding the Grid Code requirements for LCIS devices, one respondent believes that they need to be published urgently while another one estimates that they need to be published at least 18 months before the latest Targeted Go-Live date.

Operations:

Finally, 3 respondents consider that the way LCIS devices will be operated is important for the design (e.g. number of starts, number of hours in different reactive power ranges, etc.)

4.3.3 TSOs' response

LCIS definition:

Regarding the LCIS definition we understand that many stakeholders would like to see this procurement also open to non-synchronous technologies. We note that non-synchronous (inverter based) technology is beginning to demonstrate the provision of, for example, inertia type services in some other jurisdictions. However, we believe that the application of this technology at scale is still in the early stages of development and would present a higher risk to the timely delivery of the

services we require for this procurement phase when compared to more proven synchronous unit technology.

Given the above and the fact that we are targeting a reduction in the minimum number of Large Conventional Units to a very low number (4 or less by 2030), we consider it important to still have synchronous technology providing LCIS to avoid any stability issues. However, as indicated in section 4.1.4 on the phased approach, it is our intention to consider including inverter-based technologies for future procurement phases.

Technical requirements:

We note that a number of respondents support the proposed requirements.

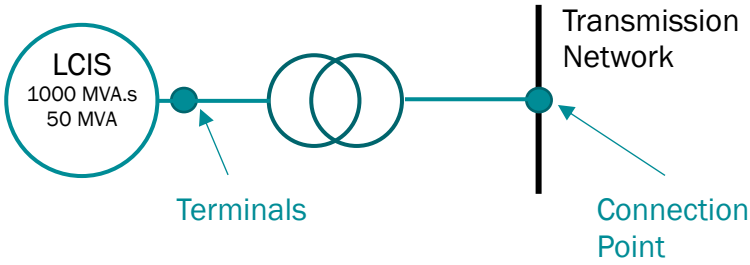
However, some respondents propose to define the short-circuit and reactive power requirements in absolute values rather than in per unit of rating in MVA. Considering that we allow different unit sizes and different locations, we believe that a requirement set out as a function of the LCIS device MVA base is more relevant and allows incentivisation of better capability through the product scalars (see TSOs' response on the product scalars in section 5.4.3).

Regarding the required range of reactive power capability, we consider that relaxing the range to have access to a wider range of OEM providers is reasonable. We recommend then to apply the following minimum requirements at the connection point:

Technical requirement at the connection point	Range	Comment
Inertia constant H (MVA.s/MVA)	≤20s*	This range reflects our system needs as well as our understanding of the technology capability of LCIS devices.
Short Circuit (or fault) Contribution (MVA)	≥3 p.u.*	Typical fault contribution for conventional generators is between 4 p.u. and 5 p.u at the terminals. However, the requirement for LCIS devices is at the point of connection and reflects our understanding of the technology capability of LCIS devices.
Reactive Power (MVAr) * per unit of LCIS device rated MVA	Lagging ≥0.8 p.u.* Leading ≤-0.4 p.u.* Automatic Voltage Regulator (AVR) required	This range reflects our system needs as well as our understanding of the technology capability of LCIS devices. The requirements specified here are with reference to the Connection Point. Requirements will ultimately be specified in the Grid Codes at the LCIS unit terminals and Connection Point.

Table 4: Technical minimum requirements at the connection point

In order to clarify how these requirements would apply to a LCIS device, an example is provided in Figure 2.



Technical requirements for a LCIS device 50 MVA / 1000 MVA.s	
Inertia constant H	20 s
Min reactive power lagging	40 MVAr at the connection point
Min reactive power leading	20 MVAr at the connection point
Min short circuit contribution	150 MVA at the connection point

Figure 2: Technical requirements example

With regards to the technical requirements, we can clarify the following points:

- The fault-level is assessed according to IEC 60909-0 standard. The initial symmetrical short-circuit current, $I_k^{"}$, is used for this purpose. The initial symmetrical short-circuit current/power of the LCIS should be calculated for a 3-phase bolted fault at the point of connection on the LCIS device's rated MVA. Flat voltage (i.e. 1 pu) and minimum voltage factor, C = 1.0, should be used. Further details on the initial symmetrical short-circuit current can be found in IEC 60909-0 documentation[12].

- As indicated in section 3.2.4 of the LCIS consultation paper the "*inertia constant parameter … would be calculated based on the rating of the LCIS device and the contracted value (capped at 2000 MVA.s)*".

- The requirements relating to voltage control will ultimately be defined in the Grid Code. To inform the development of these requirements, the TSOs have published a Synchronous Condenser Grid Code implementation note to seek industry feedback[13].

LCIS devices inertia capability requirements:

As indicated in our consultation paper we propose the minimum and maximum inertia contracted limits to balance technical requirements that meet system needs, economies of scale and the vendor capability of LCIS devices.

When it comes to the maximum contracted capability of 2,000 MVA.s at a single substation, our intention is to spread the LCIS service that will be contracted in this procurement phase only. This

[12] Short-circuit currents in three-phase a.c. systems - Part 0: Calculation of currents, IEC 60909-0 Ed.2, 2016.
[13] https://www.eirgridgroup.com/site-files/library/EirGrid/Synchronous-Condenser-Implementation-Note.pdf

means that the limit will not take into consideration the inertia already provided through the current DS3 System Services.

Regarding the possibility to hold a fixed contract for the maximum contracted capability of 2,000 MVA.s and another DS3 System Services contract for the inertia capability above 2,000 MVA.s, we need to consider further the legal and practical implications in the contractual arrangements which will be consulted on separately.

Connection method:

Although allowing a connection to the distribution network would broaden the pool of participants, LCIS devices are more effective when connected to a voltage level at 110 kV and above. For this reason, we recommend allowing only LCIS devices that are connected to the transmission system.

Regarding the potential for a shared connection, we propose to allow such connections provided the contracting party can meet the technical service provision requirements at the connection point and respect the contractual, regulatory and legal frameworks in place at the time of the procurement.

Transformer rating limits:

Regarding the preferred voltage level and feedback in the consultation, we have identified potential limitations requiring setting transformer rating limits for different voltage levels in order to reduce the potential for connection issues arising at a later stage. In weak parts of the network, the inrush current created when energising a large transformer can be too high and create a voltage step that would be above acceptable limits. For this reason, we propose the following LCIS transformer rating limits per voltage level:

LCIS Transformer rating limits	Voltage level
100 MVA	110 kV
250 MVA	220 kV
260 MVA	275 kV
400 MVA	400 kV

Table 5: LCIS Transformer rating limit per voltage level

Note that one respondent also highlighted the potential for network limitations to restrict reactive power exports (see section 5.4.2).

It is our view that this recommendation is key to reducing the risk of awarding a contract to an oversized LCIS device.

4.3.4 TSOs' recommendation

Given the above, we recommend the following regarding the service definition and service provider requirements:

LCIS definition:

TSOs' Recommendation:

LCIS providers will need to provide synchronous inertia, reactive power support and short-circuit contribution to meet the specified requirements.

Technical requirements:

TSOs' Recommendation:

LCIS providers will need to meet the minimum technical requirements with respect to the inertia constant, short circuit contribution and reactive power, as set out in Table 4.

Grid Code requirements:

TSOs' Recommendation:

LCIS providers will need to be Grid Code compliant. In advance of completion of the Grid Code modifications, a Synchronous Condenser Grid Code Implementation Note has been published to provide stakeholders with guidance on synchronous LCIS requirements.

Inertia Capability requirements:

TSOs' Recommendation:

The LCIS inertia capability contracted should be no lower than 900 MVA.s and no higher than 2000 MVA.s at the Connection Point. Additionally, no more than 2000 MVA.s will be contracted at a single Transmission Station.

LCIS Transformer rating limits:

TSOs' Recommendation:

The transformer rating limits for the different voltage levels are set as follow:

- 100 MVA max at 110 kV;
- 250 MVA max at 220 kV;
- 260 MVA max at 275 kV;
- 400 MVA max at 400 kV.

We also expect that the LCIS device rating will match the transformer size to reduce the risk of transient stability issues and to meet the reactive power requirements at the connection point.

Connection requirements:

TSOs' Recommendation:

The LCIS provider shall connect directly to the transmission system or share a connection provided they can meet the technical service provision requirements at the connection point and respect the contractual, regulatory and legal frameworks in place at the time of the procurement.

A LCIS provider can only be connected on a transmission station controlled by the TSO[14] at 110kV or above.

[14] Where TSOs have operational control of the LCIS unit, meaning the possibility to instruct the unit to come on and off and to produce/consume reactive power.

5. Commercial aspects

5.1 Contract start date and duration

5.1.1 Consultation paper proposal

In our consultation paper we outlined the following proposal regarding the contract start date and duration.

TSOs' Proposal:

Contract go-live date shall be between the 1st of October 2024 and the 1st of January 2026. Contracts will have a maximum term of 6 years and end no later than 31st December 2031.

Respondents were asked the following question:

Question 4: Do you have any comments on the start dates and duration of the contracts?

5.1.2 Summary of consultation responses

Contract duration:

Most of the respondents believe that a contract duration of 6 years is too short given the investment required and the lack of certainty on the Future Arrangements for System Services.

Many respondents requested a 10-year contract as proposed in Great Britain for the procurement of a similar service, which would reduce the cost for the consumer. Some respondents suggested an even longer duration, for example, to link the contract duration to the lifetime of the asset to spread the level of costs on end consumers.

Three respondents believe that 6 years is not unreasonable, but that a longer contract may result in better value for the consumer.

Timeline – Planning permission as prerequisite:

Most respondents commented on the planning permission prerequisite and timeline; their responses have been summarised in section 6.2.2 which covers planning and grid connection requirements.

Timeline –Go-Live Dates:

Regarding the latest targeted go-live date, many respondents consider the date as ambitious and very challenging considering current supply chain issues. Some respondents propose to postpone the latest targeted go-live date to mid-2026 to leave at least 30 months from the award of the contract or even to January 2027.

One respondent agreed with the proposed dates in the consultation.

Some respondents suggested incentivising early delivery by extending the contract duration.

5.1.3 TSOs' response

Contract duration:

The proposed LCIS fixed term contract period will overlap with the implementation and operation of the Future Arrangements for System Services. We believe that this overlap period should be

minimised to reduce potential conflict with the Future Arrangements and their development / implementation.

We therefore recommend setting the end date of all contracts 6 years after the latest targeted go-live date but we also recommend incentivising early connection from the 1st of October 2024. This means that the contract duration could be close to 8 years for projects delivered early.

Timeline – Planning permission as a prerequisite:

Please refer to Section 6.2 for the recommendation regarding planning permission.

Timeline –Go-Live Dates:

Regarding the latest targeted go-live date, we acknowledge the feedback on supply chain issues and consider that being too ambitious in our timelines would not be beneficial as it could significantly reduce the contract period.

Some respondents suggested a minimum of 30 months and others a date 40 months after the award of contracts. We recommend setting the latest targeted go-live date 33 months after the award of contracts. We also recommend incentivising early connection by setting the end date of all contracts to be 6 years after the latest targeted go-live date.

For example, if the contracts are awarded the 30th of November 2023, the latest go-live date will be the 1st of September 2026 and the end date of the contract will be on 31st of August 2032.

5.1.4 TSOs' Recommendation

Given the above, we recommend the following regarding the contract start date and duration:

TSOs' Recommendation:

The earliest contract go-live date shall be the 1st of October 2024 and the latest targeted go-live date shall be 33 months after the award of contracts. All contracts will end 6 years after the latest targeted go-live date.

5.2 Performance Bond and Milestones

5.2.1 Consultation paper proposal

In our consultation paper we outlined the proposal below regarding performance bond and milestones:

TSOs' Proposal:
Successful Tenderers will be required to submit a performance bond on the date of execution of the contract, chargeable in the event of non-delivery. The performance bond will be €500 per MVA.s or equivalent in £ of the LCIS provider's unit.

Respondents were asked the following question:

Question 5: Do you have any comments on the Performance Bond and Milestones?

5.2.2 Summary of consultation responses

Bond:

A number of respondents consider a bond of €500 per MVA.s to be reasonable. Two respondents consider it to be too high and believe that there is a risk of excluding small and medium companies. However, one respondent considers the bond low compared to the bonding arrangements for RESS-2.

Some respondents also asked for clarification regarding the treatment of projects already operational and what other bonds would apply.

Milestones:

Regarding the milestones, some respondents agree with aligning the performance milestones broadly with the capacity market milestones.

Some respondents also asked for more details regarding the conditions where EirGrid might consider it is not appropriate to impose penalties, for example;

1. Delays with non-contestable works, testing and reports
2. Delays outside of a provider's control e.g, COVID-19

5.2.3 TSOs' response

Following the feedback received regarding the performance bond, we believe that a €500 per MVA.s of inertia or equivalent in £ is reasonable.

For LCIS providers that would build LCIS devices >2000 MVA.s, we consider that applying the bond to the maximum contracted level is appropriate.

Regarding the details of the performance bond arrangements and performance milestones, further details will be provided in the contractual arrangements under development which will be consulted on separately.

Note that this performance bond is a security for the delivery of the LCIS service while other arrangements in place are still applicable (e.g. connection bond which provides a security in respect of the connection charges).

5.2.4 TSOs' Recommendation

Given the above, we recommend the following regarding the performance bond and milestones:

TSOs' Recommendation:

Successful Tenderers will be required to submit a performance bond on the date of execution of the contract, chargeable in the event of non-delivery. The performance bond will be €500 per MVA.s, or equivalent in £, of the LCIS provider's unit rating.

5.3 Payment based on Availability Requirements

5.3.1 Consultation paper proposal

In our consultation paper, we outlined the following proposal regarding the payment based on availability:

TSOs' Proposal:

The LCIS annual availability requirement will be 97%. This obligation will exclude planned periods of maintenance (with further information to be included within the contracts consultation to be held later in 2022).

In addition to this proposal, we have suggested to allow 15 days of planned outages and to cover the cost of energy imported via the energy market.

Respondents were asked the following question:

Question 6: Do you have any comments on the proposed payment mechanism based on availability?

5.3.2 Summary of consultation responses

Payment based on high availability:

The approach is reasonable for a number of respondents who consider that 97% availability is high, but achievable.

However, some respondents believe that the mechanism is very punitive with only downward penalties and propose a lower availability target (90%) with incentives/scalars to achieve 97% (see section 5.4.2 for the availability scalar scale which they propose).

Planned Maintenance - 15 days allowed annually:

Regarding the 15 days allowed annually for maintenance, 3 respondents believe that these days should be averaged over 6 years while another respondent proposes to have the ability to roll over 2 days per year up to a maximum of 10 days.

Cost of Energy:

Respondents agree that cost of energy imported shall be covered and asked how this will operate (market mod 13_19)?

One respondent considers that the start-up cost should also be covered.

5.3.3 TSOs' response

Payment based on high availability:

We note that a number of respondents consider the payment approach based on high availability reasonable while some others consider the mechanism punitive.

It is our view that high availability of the LCIS service is key to delivering the benefits of the service. Low availability of LCIS would result in the need to constrain on conventional generation at times to provide the services and/or the need to procure additional LCIS units.

Planned Maintenance - 15 days allowed annually:

We acknowledge that LCIS providers could have minor and major maintenance periods and that averaging these days over the contract duration would allow more flexibility for the project developers.

However, we currently do not have a resettlement or reconciliation process at the end of the contract which means that the possibility to carry over days from one year to another would be subject to settlement system implementation. The retained provisions will be confirmed in the contractual arrangements.

Cost of Energy:

A market modification to the Trading and Settlement Code is being developed where the metering of an LCIS unit will be set to zero when a dispatch instruction is sent by the TSO. Note also that we are considering development of a Guidance Note to provide more information.

5.3.4 TSOs' Recommendation

Given the above, we recommend the following to incentivise high availability:

TSOs' Recommendation:

The LCIS annual availability targeted will be 97%. Under this target, the payment will be reduced through the application of an Availability Performance Scalar (see Section 5.4). This obligation will exclude planned periods of maintenance for which 15 days will be allowed following notification to the TSOs.

5.4 Application of Scalars

5.4.1 Consultation paper proposal

In our consultation paper, we made the following proposals in relation to the application of scalars:

Performance Scalar:

TSOs' Proposal:

Three performance categories shall be considered i) Availability Performance ii) Dispatch Performance iii) Operating Performance. For the availability performance, the revenue is reduced in steps for reductions in availability.

Product Scalar:

TSOs' Proposal:

Product Scalars would not be retained, unless Option 3 for the bid format is retained. This is because bidding a MVA.s per hour price might otherwise lead to reduced reactive power and short circuit capability if tenderers seek to be more competitive for inertia provision.

Product Scalars would be applied to a service provider's remuneration but not applied in bid assessment.

Wattless Scalar:

TSOs' Proposal:

The Wattless Scalar should be excluded as all LCIS Providers will provide a zero MW output service.

Locational Scalar:

TSOs' Proposal:

A locational scalar shall apply to LCIS Providers to incentivise them to connect in the zones that bring most benefits.

Temporal Scalar:

TSOs' Proposal:

The temporal scalar should be excluded.

Respondents were asked the following question:

Question 7: Do you have any comments on the proposed application of the scalars?

5.4.2 Summary of consultation responses

Scalars general approach:

A number of respondents stated that the general approach for scalars was sensible.

One respondent believes that the scalars are too low since it is proposed that the risk in case of transmission network limitations is on the LCIS provider.

Finally, one respondent asked how these scalars would work in conjunction with the bid submitted.

Product scalars:

Regarding the product scalar, a respondent suggests decreasing the Short Circuit Contribution scalar while another one suggests increasing it.

One respondent believes that LCIS providers will be encouraged to derate the machine in order to meet the per unit values.

Some respondents consider it counterintuitive to incentivise a lower inertia constant H value as bigger values would mean more inertia for the system while one respondent is concerned that incentivising a bigger machine rating could lead to a level of services that the network cannot take. This respondent proposes to set the maximum MVAr rating for various voltage levels up to which LCIS providers would be paid.

Performance Scalar - Availability:

Some respondents requested clarification as to how the Availability Performance scalar will be calculated in case of transmission network limitations. For example, is availability affected if a LCIS provider can export reactive power >0.9 p.u. but is restricted due to network limitations?

Regarding the calculation of the Availability Performance based on 12-month rolling average basis, a respondent also asked how it will be calculated for the first year?

Finally, one respondent considers that the Availability Performance availability should not be reduced if the TSO decides to dispatch another unit when sharing the same connection.

Note also that, when answering question 6 on the proposed payment mechanism, some respondents outlined that the Availability Performance scalar should be less punitive and proposed the following availability mechanism scalars:

Availability	Performance to Synchronise	Performance for Reactive Power
≥10% <20%	0%	10%
≥20% <30%	0%	20%
≥30% <40%	0%	30%
≥40% <50%	0%	40%
≥50% <60%	0%	50%
≥60% <70%	25%	60%
≥70% <80%	50%	75%
≥80% <85%	75%	85%
≥85% <90%	100%	95%
≥90% <95%	105%	100%
≥95%	110%	110%

Performance Scalar - Dispatch and Operating:

Regarding the Dispatch and Operating Performance, some respondents stated that they require further consultation as no details have been provided in the consultation.

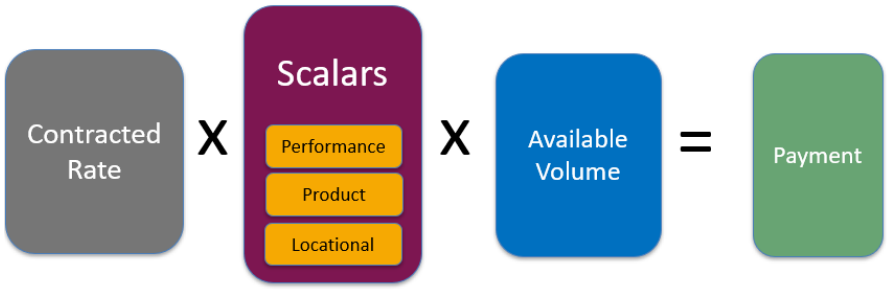
Locational Scalar:

Regarding the locational scalar, some respondents believe that the scalar value is too low and could lead to under procurement in the incentivised zones while one respondent suggests potentially extending the zones with the inclusion of intermediate values (e.g. 1.1, 1.05).

5.4.3 TSOs' response

Scalars general approach:

The proposed approach to application of scalars in each settlement period is illustrated in the following diagram:



Where:

- the Contracted Rate is equal to the bid price (€/MVA.s or £/MVA.s);
- the Performance Scalar[15] reflects the rolling availability performance of the LCIS Provider and is calculated each calendar month on a rolling 12 month basis;
- the Product Scalar is fixed depending on the technical characteristics of the LCIS unit;
- the Locational Scalar is fixed depending on the location of the LCIS unit;
- the Available Volume of inertia is determined based on the availability of the LCIS unit for each settlement period.

Note that further details will be provided in the consultation on the contractual arrangements.

Product scalars:

The intention of the product scalars is to incentivise balanced capability across inertia, reactive power and short circuit contribution. In that regard, we recognise that incentivising a lower inertia constant might be counterintuitive. The reason is that we are defining in this procurement our requirement in inertia only while short circuit contribution is also important for frequency stability. So, procuring 10,000 MVA.s with a high inertia constant would give us small LCIS device ratings while procuring the same amount of inertia with a lower inertia constant would give us bigger LCIS device ratings that will come with greater short-circuit contribution and reactive power ranges as these requirements are defined in per unit of MVA rating.

Regarding the concerns of one respondent who indicated that incentivising a bigger machine rating could lead to a level of services that the network cannot take, we believe that the introduction of transformer rating limits per voltage level will reduce this risk (see section 4.3.3 and 4.3.4).

We therefore recommend the following product scalars:

[15] Note that other performance categories are considered as summarised in Table 8 and may be implemented by a scalar or event charges.

Technical Requirement at the connection point	Range required	Product scalars
Inertia constant H (MVA.s/MVA)	less than 20s	<5s → Scalar 1.25 ≥5s <10s → Scalar 1.2 ≥10s <14s → Scalar 1.15 ≥14s <17s → Scalar 1.05 ≥17s <20s → Scalar 1.0
Short Circuit (or fault) Contribution (MVA)	>=3 p.u.*	≥5 p.u. → Scalar 1.15 ≥4 <5 p.u. → Scalar 1.1 ≥3 <4 p.u. → Scalar 1.0
Reactive Power (MVAr) * per unit of rating in MVA	Lagging min 0.8 p.u.* Leading min -0.4 p.u.*	≥0.9 p.u. → Scalar 1.05 ≥0.8 <0.9 p.u. → Scalar 1.0 ≤-0.6 p.u. → Scalar 1.05 ≤-0.4 >-0.6 p.u. → Scalar 1.0

Table 6: Product scalars

Note that an overall product scalar will be calculated by multiplying the three sub product scalars recommended in Table 6.

Performance scalar – Availability:

In the case where the full reactive power range cannot be provided due to network limitations, our initial intention was to reduce the availability of the LCIS provider through the Availability Performance scalar for Reactive Power. However, given that we have introduced a transformer rating limit for different voltage levels (see section 4.3.3 and 4.3.4), which will drive the size of the LCIS, we believe that the risk of network limitations will be lower. Therefore, we propose removing the Availability Performance scalar for Reactive Power and to keep only the Availability Performance to Synchronise as follows:

Availability	Availability Performance Scalar
<10%	0
≥10% <20%	0
≥20% <30%	0
≥30% <40%	0
≥40% <50%	0
≥50% <60%	0
≥60% <70%	*0.25*
≥70% <80%	*0.5*
≥80% <90%	*0.7*
≥90% <95%	*0.85*
≥95% <97%	*0.95*
≥97%	*1*

Table 7: Performance Availability scalar

Note that further details will be provided in the consultation on the contractual arrangements regarding the calculation of the Availability Performance Scalar based on a 12-month rolling average basis.

Regarding the case of a shared connection where only one unit could be on at the same time, we believe that the LCIS unit availability should be reduced from a payment perspective if it cannot run when the other unit is on.

Performance scalar – Dispatch and Operational:

We note that some respondents requested further detail on the arrangements for incentivising Dispatch and Operating Performance which may be implemented by scalars or event charges. As indicated in the consultation paper, we propose to provide further details in the contractual arrangements which will be consulted on separately.

Table 8 summarises the performance categories that we are considering.

Performance Category	Performance Metric	Description
Availability	Availability (to synchronise)	To incentivise a high level of declared availability to synchronise the unit and provide services.
Dispatch Performance	Following Reactive Power dispatch instruction	To incentivise the unit responding to reactive power dispatch instructions from the TSO within the required timeframe.
	Synchronising within specified time	To ensure the unit synchronises within a specified number of minutes of the instructed time.
Operating Performance	Remaining Synchronised	To incentivise the unit to reliably deliver its services in steady state and during system frequency/voltage events – i.e. that it does not trip.

Table 8: Performance categories

Locational scalar:

Regarding the locational scalar, we agree that the zones could be potentially extended with more granularity for the scalar (e.g. 1.2, 1.1, 1.05). However, doing such an exercise would require us to do many more simulations for each node of the system to identify the efficiency of a LCIS device. We have therefore limited the application of scalars to these three zones.

Zones	Locational Scalar
Zone 1	1.2
Zone 2	1.2
Zone 3	1.2
Outside Zones 1, 2, 3	1.0

Table 9: Locational scalar for incentivised zones

Appendix A lists the transmission stations in each of the zones.

5.4.4 TSOs' Recommendation

Given the above, we recommend the following regarding the application of scalars:

Performance Scalar:

TSOs' Recommendation:

Three performance categories shall be considered i) Availability Performance ii) Dispatch Performance iii) Operating Performance. For the availability performance, only the availability to synchronise scalar is retained and the scalar is reduced in steps for reductions in availability.

Product Scalar[16]:

TSOs' Recommendation:

Product Scalars shall be retained to incentivise reactive power and short circuit capability. Product Scalars would be applied to a service provider's remuneration but not applied in bid assessment.

Locational Scalar:

TSOs' Recommendation:

A Locational Scalar shall apply to LCIS Providers to incentivise connection in the zones that bring most benefits.

Wattless and temporal scalar:

TSOs' Recommendation:

The Wattless Scalar and Temporal scalar shall be excluded.

5.5 Transmission Network Availability

5.5.1 Consultation paper proposal

In our consultation paper, we outlined the following proposal regarding the payment based on availability:

TSOs' Proposal:

LCIS Providers who are fully or partially unavailable for service provision due to transmission system limitations will be deemed available for service up to the level of provision allowed by the transmission system.

Respondents were asked the following question:

Question 8: Do you have any comments on the proposed approach to Transmission Network Availability?

5.5.2 Summary of consultation responses

Most of the respondents to this question believe that the risk should not be on the provider, but on the TSOs who respondents consider are best placed to manage this risk. One respondent suggests that this risk should at least be shared with the TSOs.

In addition, if the risk should be placed on the LCIS providers, timely information on the likelihood of transmission system limitations for their connections would need to be provided.

[16] Bidders with higher expected product or locational scalars would be expected to be able to submit a lower €/£ per MVA.s per hour bid all else being equal.

One respondent highlighted that there are a variety of transmission system limitations that could apply (i.e. forced outage, transmission system not able to take the full reactive power capability due to thermal rating limit or due to the breach of the voltage standards), and it is therefore necessary to clarify what the definition covers.

5.5.3 TSOs' response

We acknowledge that the proposal made in the consultation paper where the risk would be on the LCIS provider introduces a revenue uncertainty and we have therefore given further consideration to this approach. We would also like to bring more clarity in this recommendations paper on the type of restrictions that could apply.

We consider two types of restrictions for the delivery of the LCIS service:

- Transmission Network Outages: planned and forced outages;
- Transmission Network Limitations: thermal limits, voltage violations, short-circuit limits

Transmission Network Outages:

In the case of Transmission Network Outages, we believe that the current EirGrid and SONI Grid Code arrangements (Scheduling and Dispatch Code) in place to calculate the outturn availability for generator units should apply to LCIS units.

When annual transmission maintenance outages are scheduled by the TSOs, the availability of a unit shall be set at 0 for a maximum of 5 days in total in a calendar year according to these arrangements. However, the TSOs will try to align transmission outages with the customer's outage. As outlined in Section 5.3.3, we propose to allow 15 days of LCIS unit maintenance without impacting the Availability Performance Scalar.

These arrangements do not foresee a reduction in outturn availability in the case of a forced transmission outage.

Transmission Network Limitations:

In our consultation we proposed that in case of network limitations that would not allow the full range of reactive power to be available, this would have been factored through the Availability Performance Scalar for Reactive Power initially proposed. However, as we have now recommended introducing a transformer rating limit per voltage level, we believe that this risk will be reduced (see Section 5.4.3) and we are proposing not to include an Availability Performance Scalar for Reactive Power. This proposal removes some uncertainty for the project developers.

Regarding the ability of the LCIS devices to synchronise, and inherently provide inertia and short circuit current, we believe that there are only some cases where a LCIS device could connect but would be restricted to synchronise when certain conditions are met (e.g. fault level issues). In that case, these conditions shall be introduced in the Connection Offer and affect the availability of the LCIS provider.

Table 10 below provides a summary of potential LCIS capability restriction scenarios and the recommended Commercial/Contractual outcome.

Scenario	LCIS Commercial / Contractual Availability	Comment
Transmission connection outage - planned	Unavailable for up to 5 days	Align with the Grid Code Outturn Availability arrangements applicable to conventional generation. TSO can schedule an outage of up to 5 days during which the LCIS will be deemed unavailable.
Transmission connection outage - forced	Fully Available	Aligned with approach taken for conventional generation. LCIS can continue to declare fully available.
Outage on the meshed Transmission network - planned or forced	Fully Available	LCIS can still connect and provide inertia. May be a restriction on reactive power production/consumption but this is under the TSO's control. LCIS can continue to declare fully available.
LCIS connection restriction e.g. fault level restriction	Unavailable when restriction is active	Our expectation is that LCIS units can synchronise at any time requested by the TSO and that there should normally be no inherent design limitation on synchronisation (other than for an outage on the connection assets). If there is a particular scenario in which the LCIS unit cannot synchronise because: a) It is a feature of the connection design, e.g. LCIS unit shares a connection point with another unit and cannot run at the same time as this unit; or b) of an inherent connection restriction, e.g. that its connection would cause fault levels in the station to be exceeded when other units in the vicinity are on; then the LCIS should be deemed unavailable from a commercial/contractual perspective at the times when the restriction is active. **Any such inherent design restriction could be stated in the LCIS connection offer and/or the LCIS Contract.**

Table 10: LCIS capability restrictions and Commercial/Contractual outcomes on availability

5.5.4 TSOs' Recommendation

Given the above, we recommend the following regarding the network limitations.

TSOs' Recommendation:

The same Grid Code Outturn Availability arrangements applicable to conventional generation will apply to LCIS providers.

If the Connection Offer identifies particular scenarios where the synchronisation of the LCIS unit is restricted, the LCIS provider shall be considered contractually unavailable when the restriction is active.

5.6 Network Charges and Licensing

5.6.1 Consultation paper proposal

In our consultation we have proposed that LCIS providers will be subject to the relevant network charges for their connection. The process for this application and charging exists outside of the requirements for this procurement competition and will be progressed separately.

No question was asked regarding this, however, one respondent commented on this.

5.6.2 Summary of consultation responses

A respondent asked for clarity on Use of System charging stating that LCIS units have no possibility of recovering varying system charges – unlike generation plant who can include such charges in their energy market bid prices.

5.6.3 TSOs' response

We recognise that not having this information at the time of entering the procurement process could lead project developers to bid at a higher price. These arrangements are under the governance of the regulatory authorities.

6. Competition aspects

6.1 Procurement Process Overview

6.1.1 Consultation paper proposal

In our consultation we outlined the following proposal regarding the process for assessing tenders:

TSOs' Proposal:
Tenderers will need to go through a pre-qualification stage. Tenderers that make it through the pre-qualification stage will then receive a Request for Proposal and successful tenderers will be selected based on the cost per MVA.s / h.

Respondents were asked the following question:

Question 9: Do you have any comments on the proposed mechanism for assessing tenders?

6.1.2 Summary of consultation responses

Most of the respondents agree with the high-level process by which tenders will be assessed while 2 respondents consider that the TSOs should consult further with more details.

6.1.3 TSOs' response

We note that the high-level process is welcome by the respondents. The procurement documentation that we will publish will outline the procurement process to be followed in each jurisdiction.

6.1.4 TSOs' Recommendation

Given the above, we recommend the following procurement process:

TSOs' Recommendation:

Tenderers will go through a pre-qualification stage. Tenderers that make it through the pre-qualification stage will receive a Request for Proposal with selection then based on defined evaluation criteria.

6.2 Grid connection offer and planning permission requirements

6.2.1 Consultation paper proposal

In our consultation, we have proposed the following regarding grid connection offer and planning permission requirements:

TSOs' Proposal:

Full planning permission will be required to pass the pre-qualification stage.

In Ireland, in order to expedite the issue of Connection Offers to LCIS projects that are successful in the procurement process, EirGrid proposes that a Connection Offer would be issued outside of the ECP process for successful projects. A CRU direction would be required to do this.

TSOs' Proposal:

In Ireland, successful LCIS tenderers who do not have a connection offer will be able to apply for a Connection Offer outside of the ECP process (subject to CRU direction).

Respondents were asked the following question:

Question 10: Do you have any comments on the proposed prerequisites with respect to grid connection and planning permission requirements?

6.2.2 Summary of consultation responses

Planning permission as prerequisite:

Some respondents explicitly agree with the necessity to have full planning permission as a criterion for this procurement. However, most respondents expressed concern about the timeline and believe that it would not be possible to get planning permission at the prequalification stage, expected in March 2023, if the project is not already in the planning process.

To mitigate these concerns, respondents suggested alternative options:

- Proof of planning application only;
- Proof of planning application at the prequalification stage (March 23) and Planning permission granted at the Request for Proposal stage (June/July 23);
- Post auction longstop to get planning permission by March 24.

In addition, one respondent asked to specify what we mean by 'Planning Permission granted'.

Connection Offer:

Most of the respondents welcome the proposal that a connection offer should be issued outside of the Enduring Connection Policy (ECP) process in Ireland for the successful projects.

Some of the respondents believe that having a Connection Offer should also be a prerequisite as this removes significant risk for the consumer and developer. One of the concerns of a respondent is that speculative bids not accounting properly for the grid connection costs and timeline might be submitted to be successful in the procurement process.

6.2.3 TSOs' response

Planning permission as a prerequisite:

We recognise that the timeline to have full planning permission granted at the pre-qualification stage is ambitious and have assessed some of the alternatives proposed.

The option which consists of asking only for proof of planning application has merit as it would allow for an increase in the competition of this procurement while showing a certain level of engagement

from the project developer. However, there is a risk that a project will ultimately fail to get planning permission and will therefore not deliver the services we require.

The longstop date post auction option presents the same risks.

Requiring full planning permission granted at the Request for Proposal stage might reduce the level of participation in the procurement, however, we believe that this is a better option as it removes one of the major delivery risks.

We therefore recommend amending our original proposal from having full planning permission granted at the Pre-Qualification stage to having full planning permission granted at the Request for Proposal stage. This will provide developers with additional time to achieve planning permission while removing the planning permission risk from this procurement.

Grid Connection Offer in Ireland:

Following the responses received, we would like to reiterate our recommendation to prioritise successful tenderers outside of the ECP process by direction from CRU.

6.2.4 TSOs' Recommendation

TSOs' Recommendation:

Full planning permission will be required at the Request for Proposal procurement stage in both jurisdictions.

In Ireland, successful LCIS tenderers who do not have a connection offer will need to be prioritised outside of the ECP process by direction from the CRU.

In Northern Ireland, the standard connection offer process will apply (i.e. a non-gated process).

6.3 Bid format

6.3.1 Consultation paper proposal

In our consultation we have proposed the following regarding the bid format for this procurement process:

Option 1: Bidding both a MVA.s per hour and a MVAr per hour price
Option 2: Bidding a discount factor against the existing tariff rates for SIR and SSRP
Option 3: Bidding a MVA.s per hour price only + product scalar to incentivise reactive power and short circuit capability

TSOs' Proposal: Option 3 will be used as it allows a transparent way of ranking the bids while incentivising the provision of reactive power and short circuit capability.

Respondents were asked the following question:
Question 11: Do you have any comments on the bid format option proposed?

6.3.2 Summary of consultation responses

The majority of respondents agreed that option 3 is the preferred approach. One respondent stated that they were not in a position to comment on these options due to limited details.

6.3.3 TSOs' response

Following the responses received to this question, we recommend option 3 - bidding a price for LCIS in €/MVA.s per hour or £/MVA.s per hour.

6.3.4 TSOs' Recommendation

Given the above, we recommend:

TSOs' Recommendation:

Bidding a price for LCIS in €/MVA.s per hour or £/MVA.s per hour.

6.4 Cost of Energy factored in the assessment

6.4.1 Consultation paper proposal

In our consultation we have proposed the following regarding the cost of energy:

TSOs' Proposal:

The cost of energy consumed by the LCIS provider should be factored into the evaluation. The cost of energy per hour would be converted to a cost per MVA.s per hour and be added to the bidders MVA.s per hour offer for the evaluation.

Respondents were asked the following question:

Question 12: Do you have any comments on the approach to factor in the cost of imported energy?

6.4.2 Summary of consultation responses

A number of respondents agree with the approach which consists of factoring the cost of imported energy into the evaluation.

However, 3 respondents are concerned that project developers might provide inaccurate information at the bidding stage. One of the respondents suggests having a testing regime which would verify the losses and associated penalties applied for any material increase from the stated losses figures provided at bid stage.

Another respondent suggests allocating an energy budget based on standard equipment which would allow an operator to take a view on how much of the difference from the budget they would feed back into the bid price.

6.4.3 TSOs' response

We note a general agreement to factor the cost of imported energy as part of this procurement process and acknowledge the risk that actual energy consumption could be different.

In order to reduce the risk of energy consumption being underestimated at procurement stage, we propose the development of an arrangement that would assess actual energy consumption levels and allow for energy or service payments to be capped or reduced if they exceeded a contractual threshold. These arrangements will be set out in our future consultation on the contractual arrangements.

We also note the approach which consists of allocating an energy budget, however, the practical implementation and definition of these energy budgets would be challenging and not compatible with the market modification currently in development. Note that a Guidance Note will provide further details on this market mod to cover the cost of energy consumed.

Additionally, we would like to provide greater clarity on the information we require to factor in the cost of energy as we believe that our initial proposal was incomplete and would have led to developers potentially overestimating the energy cost. For the purposes of the tender evaluation we are assuming that LCIS units will be operated 80% of the time in the range 0-25% of rated reactive power both leading and lagging. Within this range, we assume that the unit will not be used 80% of the time in the upper band of the range and therefore propose to base the valuation on the energy consumed at 20% of the rated reactive power consumption and production. We will also assume that LCIS units will be operated for equal time periods in production and consumption for the purpose of this evaluation.

The elements to be considered for the purpose of the evaluation are summarised in Table 11.

Elements to factor into cost of imported energy	Recommendation
Imbalance energy price (€/MWh or £/MWh)	The TSOs will use an Imbalance Price to be confirmed at the procurement stage.
Energy consumed (MWh)	To be provided by the tenderer for the LCIS device at: • 20% of rated reactive power consumption (lead) • 20% of rated reactive power production (lag)
Operating reactive power for the purpose of the evaluation	The TSOs will assume operation of: • 50% of the time in consumption (lead) • 50% of the time in production (lag)

Table 11: Elements required for factoring cost of energy imported

Example:

A LCIS Unit of 1000 MVA.s consumes:

- 3 MWh at 20% of the rated reactive power consumption (lead)
- 3 MWh at 20% of the rated reactive power production (lag)

The assumed Imbalance price to be provided by the TSOs, for this example it is 150 €/MWh.

The cost per MVA.s per hour will be calculated as follow:

((3 MWh*0.5+3 MWh*0.5)*150€/MWh)/1000 MVA.s= 0.45 €/MVA.s per hour

6.4.4 TSOs' Recommendation

Given the above, we recommend the following cost of energy assessment:

TSOs' Recommendation:

The cost of energy consumed by the LCIS provider should be factored into the evaluation. The cost of energy consumed per hour would be converted to a cost per MVA.s per hour and be added to the bidders MVA.s per hour offer for the evaluation.
We will develop a mechanism to manage energy consumption or LCIS service payments that reduces the risk of under estimation of energy consumption at the tender stage.

6.5 Price determination

6.5.1 Consultation paper proposal

In our consultation paper, we outlined the following proposal regarding the price determination mechanism:

TSOs' Proposal:

Pay-as-bid pricing will be used for remuneration of the LCIS service.

Respondents were asked the following question:

Question 13: Do you have any comments on the proposed 'pay-as-bid' mechanism for remuneration of the LCIS service?

6.5.2 Summary of consultation responses

Half of the respondents agree with the pay-as-bid approach proposed while the other half believe that pay-as-clear should be considered.

Among the respondents in favour of the pay-as-clear approach, some outline the alignment with the European Framework Guidelines or Electricity Balancing Guidelines, while others believe that it would incentivise more participants and encourage price competition. A respondent also highlighted that such an approach would create a greater incentive to provide short circuit contribution and reactive power.

6.5.3 TSOs' response

As set out in the consultation paper, we consider that the pay-as-clear approach would be more appropriate in a mature market where there is likely to be a high degree of competition.
In the context of this LCIS procurement exercise, this is a new service for which we are procuring a limited capacity in each jurisdiction. We believe that a pay-as-bid approach is more appropriate under these circumstances.

6.5.4 TSOs' Recommendation

Given the above, we recommend the following price determination approach:

TSOs' Recommendation:

Pay-as-bid pricing shall be used for remuneration of the LCIS service.

7. Funding Arrangements

7.1.1 Consultation paper position

The existing System Services arrangements and budgetary allowance is associated with delivering the 2020 objectives, such as operating up to 75% SNSP, and reaching 40% RES-E. These targets have now been achieved. Therefore, new and enhanced System Services and associated funding are required urgently to deliver on the Governments' ambitious targets for renewable integration and decarbonisation.

LCIS is one of these new services and requires additional annual budgetary allowance outside of the €235 million allowance as provided for under the existing arrangements.

Proceeding with this LCIS procurement process in 2023 will be subject to agreement on funding arrangements with the Regulatory Authorities.

7.1.2 Respondents' comments

Many respondents asked for clarity on the issue of funding. Respondents stated that the absence of clarity on funding arrangements introduces a material risk to the development of their projects.

7.1.3 TSOs' Recommendation

Given the above, we recommend the following on the funding arrangements:

TSOs' Recommendation:

LCIS is a critical service to deliver on the Governments' ambitions to 2030 so an additional annual allowance above the current allowance of €235m is required, to secure the service.

8. Next steps

This paper provides stakeholders with information on our recommendations in relation to the LCIS procurement exercise. It has been submitted to the SEM Committee to inform their decision on the various elements of the design.

The SEM Committee's decision paper will set out the final decisions on the LCIS Requirements and Procurement approach to be implemented by the TSOs. The SEM Committee decision on certain elements of the arrangements may differ in parts to our recommendation.

The TSOs will assess the final SEM Committee decision and develop a plan to implement the various aspects of the arrangements as soon as possible. Subsequent to this decision, a consultation on the contractual arrangements will be conducted, providing stakeholders with the opportunity to comment on the proposed contract for LCIS.

A.1 List of Transmission Stations within the LCIS Incentivised Zones

Zone 1	Zone 2	Zone 3
Coleraine 110 kV	Bellacorrick 110 kV	Ballydine 110 kV
Coolkeeragh 110 kV	Buffy 110 kV*	Butlerstown 110 kV
Coolkeeragh 275 kV	Cashla 110 kV	Cullenagh 110 kV
Dromore 110 kV	Cashla 220 kV	Cullenagh 220 kV
Drumquin 110 kV	Castlebar 110 kV	Dungarvan 110 kV
Dungannon 110 kV	Cathaleens Fall 110 kV	Great Island 110 kV
Garvagh 110 kV	Cloon 110 kV	Great Island 220 kV
Gort 110 kV	Corderry 110 kV	Killoteran 110 kV
Killymallaght 110 kV	Croaghaun 110 kV*	Knocknamona 110 kV*
Limavady 110 kV	Cunghill 110 kV	Lodgewood 110 kV
Loguestown 110 kV	Dalton 110 kV	Lodgewood 220 kV
Magherakeel 110 kV	Galway 110 kV	Loughtown 220 kV*
Omagh 110 kV	Garvagh 110 kV	Rosspile 110 kV*
Rasharkin 110 kV	Glenree 110 kV	Waterford 110 kV
Strabane 110 kV	Knockalough 110 kV	Wexford 110 kV
Tamnamore 110 kV	Knockranny 110 kV	Woodhouse 110 kV
Tamnamore 275 kV	Moy 110 kV	
Tremoge 110 kV	Salthill 110 kV	
Coleraine 110 kV	Shantallow 110 kV*	
Coolkeeragh 110 kV	Sligo 110 kV	
Coolkeeragh 275 kV	Srahnakilly 110 kV	
	Srananagh 110 kV	
	Srananagh 220 kV	
	Tawnaghmore 110 kV	
	Uggool 110 kV	

* New Transmission Stations expected to be built before 2026