Information Session – LCIS Consultation on Requirements and Procurement approach

19 July 2022

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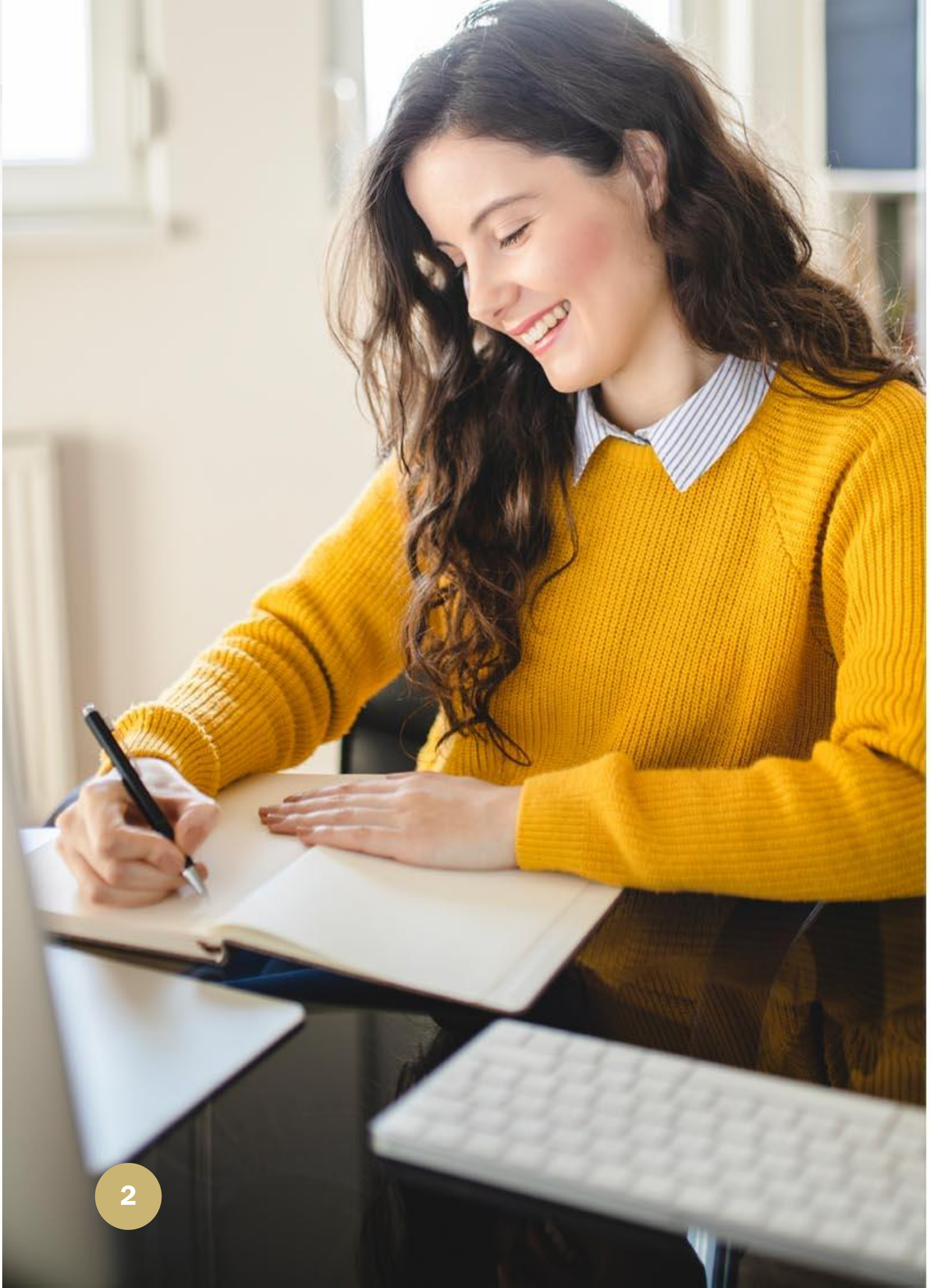
Delivering a cleaner energy future



Objective

To provide an overview of the ongoing Low Carbon Inertia Service consultation on Requirements (including studies performed) and to allow time for clarifications.

Agenda

14:30 Welcome and Introduction

14:35 Presentation of the LCIS studies and consultation

15:20 Q&A session

15:55 Concluding Comments

16:00 Close

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Consultation on requirements and procurement approach – Overview

Main Sections	Main Sub-sections (Non-exhaustive)
Procurement plan	• Overall procurement process plan
Technical aspects	• Studies • Requirements and locations incentivised • LCIS Provider requirements
Commercial aspects	• Contract (start dates / duration) • Performance bond • Availability requirements • Application of Scalars
Competition aspects	• Assessment process • Prerequisites • Bid format and cost of energy

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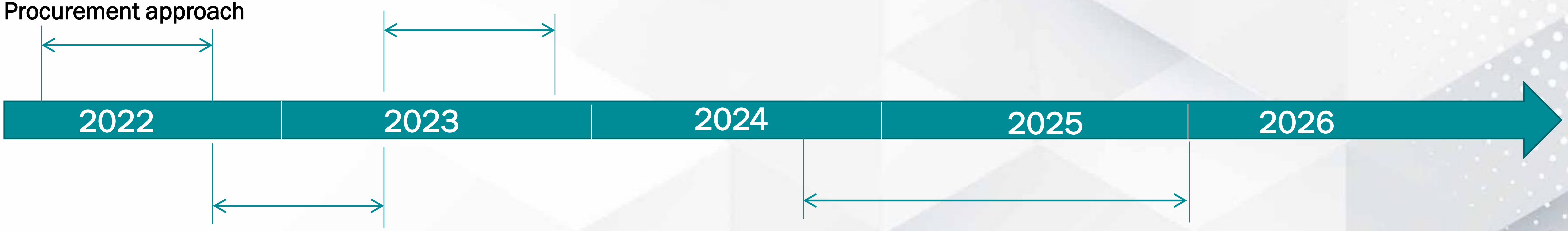
Overall timeline for LCIS Procurement

Overall timeline

23 June - October 22
Consultation, Recommendation and Decision on **Requirements and Procurement approach**

March – September 23
Complete Procurement Process and **award Contracts**



November 22 – March 23
Consultation, Recommendation and Decision on **Contractual Arrangements**

October 2024 – January 2026
Contract start dates – **Delivery of LCIS**

Technical aspects

- Studies
- Requirements and locations incentivised
- LCIS Providers requirements

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Technical Studies Focus

Stage 1: Preparation of steady state and dynamic cases

↓

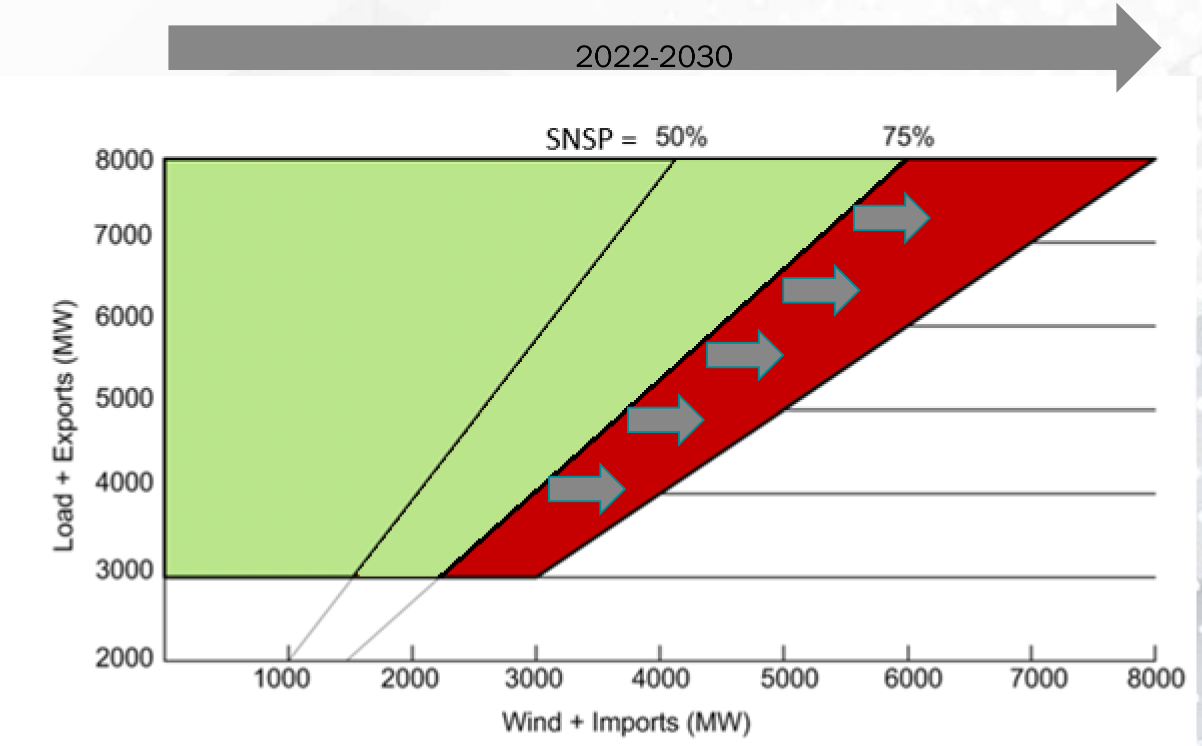
Stage 2: Identification of issues requiring additional inertia (primary concern), fault level contribution (system strength) and reactive power support

↓

Stage 3: Sizing and placement of LCIS to solve these issues

2026 Assumptions vs Today – Most Important Differences

1. Less conventional units – from eight to five
2. Significant BESS volumes
3. Two new interconnectors
4. Second N-S interconnector



$$SNSP = \frac{\text{Wind + Solar + Imports}}{\text{Demand + Exports}}$$

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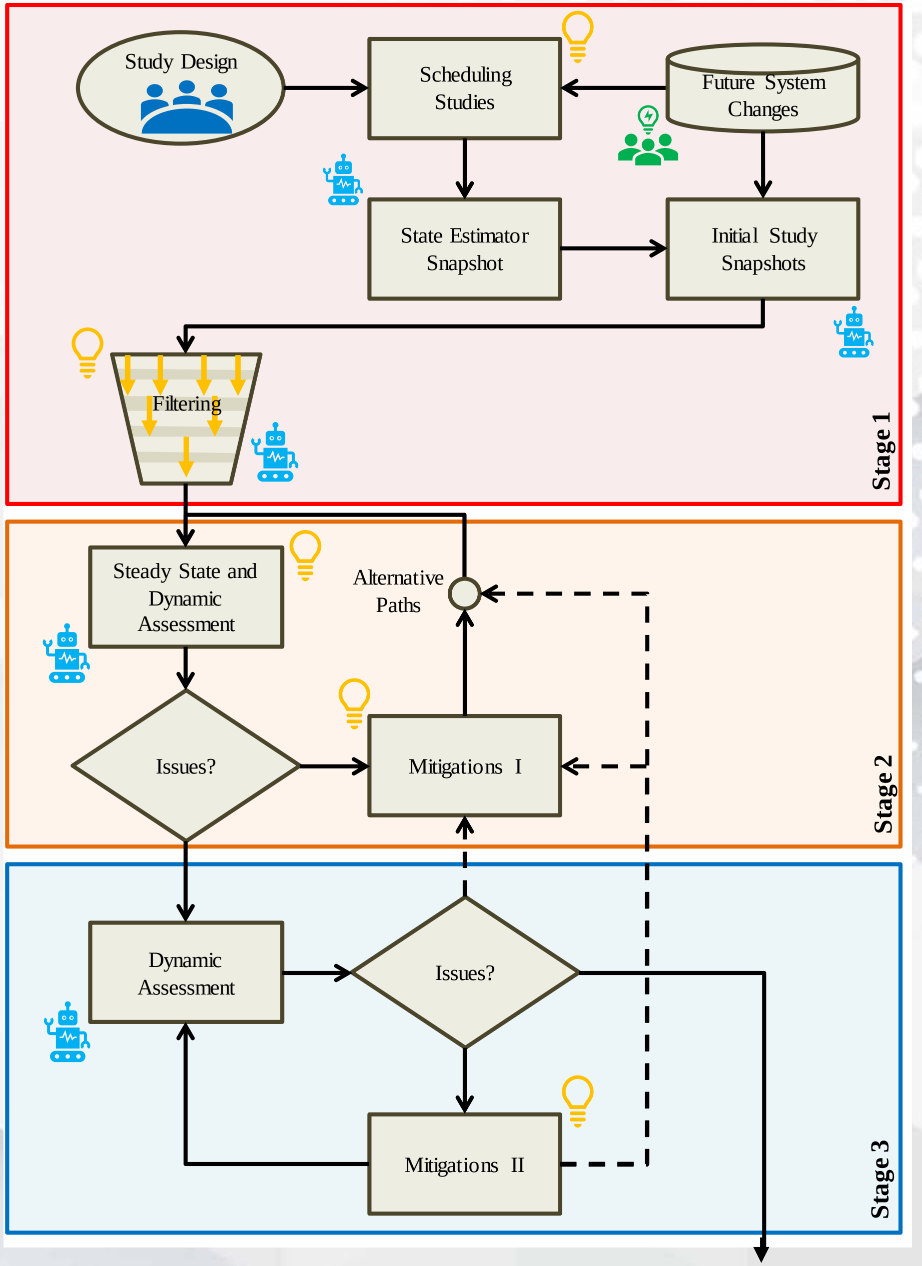
2026 Assumptions vs Today – Added Components and Case Assembling Process

1. 2026 Plexos Model used to obtain valid economically viable schedules
2. 28 BESS units
3. Two new interconnectors and second N-S(400 kV)
4. 87 PVs and Wind farms
5. Six conventional generators
6. Three STATCOMs
7. Model to mimic large loads
8. Various projects detailed in the Transmission Network Development Plan included



Background

- Dynamic Study: non-linear differential algebraic equations solved with step-by-step numerical integration techniques (for every 2-5 ms) for ~1100 disturbances/contingencies for every operating point of the study.

- Voltage Stability Analysis: Various power transfer scenarios in steady state and centred around bottlenecks accompanied with contingency analysis.

- Short Circuit Analysis: At every HV substation for intact, N-1 and N-1-1

Frequency - dynamic studies

- There is a risk for Inverter Based Resources (IBRs) operating in areas with low system strength to trip through their protection when exposed to frequency and voltage excursions.

- RoCoF might become rather a local phenomenon by 2026 - our studies demonstrate that there might be significant differences in terms of RoCoF across the system. We still calculate RoCoF as per our Grid Code (500ms rolling window).

- Looking into future entails considering uncertain factors. This requires imposing higher security/stability margins. We also considered sensitivity around disconnection of IBRs.

Stage 2

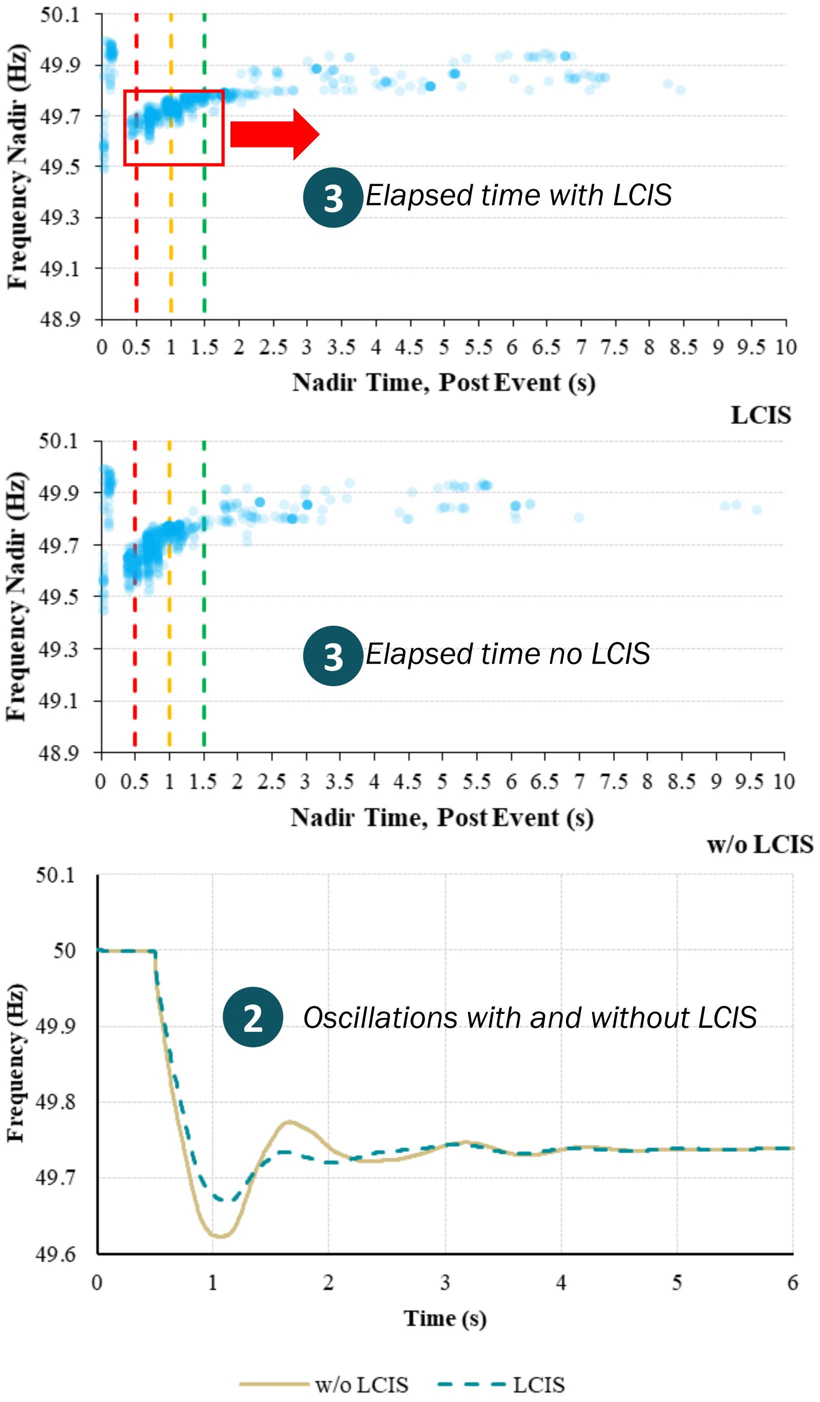
Frequency and RoCoF observations

1 There is no frequency security concerns (*f*<49 Hz or *f*>51 Hz) however there are RoCoF concerns (RoCoF>0.8 Hz/s or RoCoF<-0.8 Hz/s)-*next slide.*

2 Oscillations are likely through frequency recovery period.

3 Elapsed time between incident (fault and/or loss) and frequency nadir/zenith is expected to be significantly shorter.

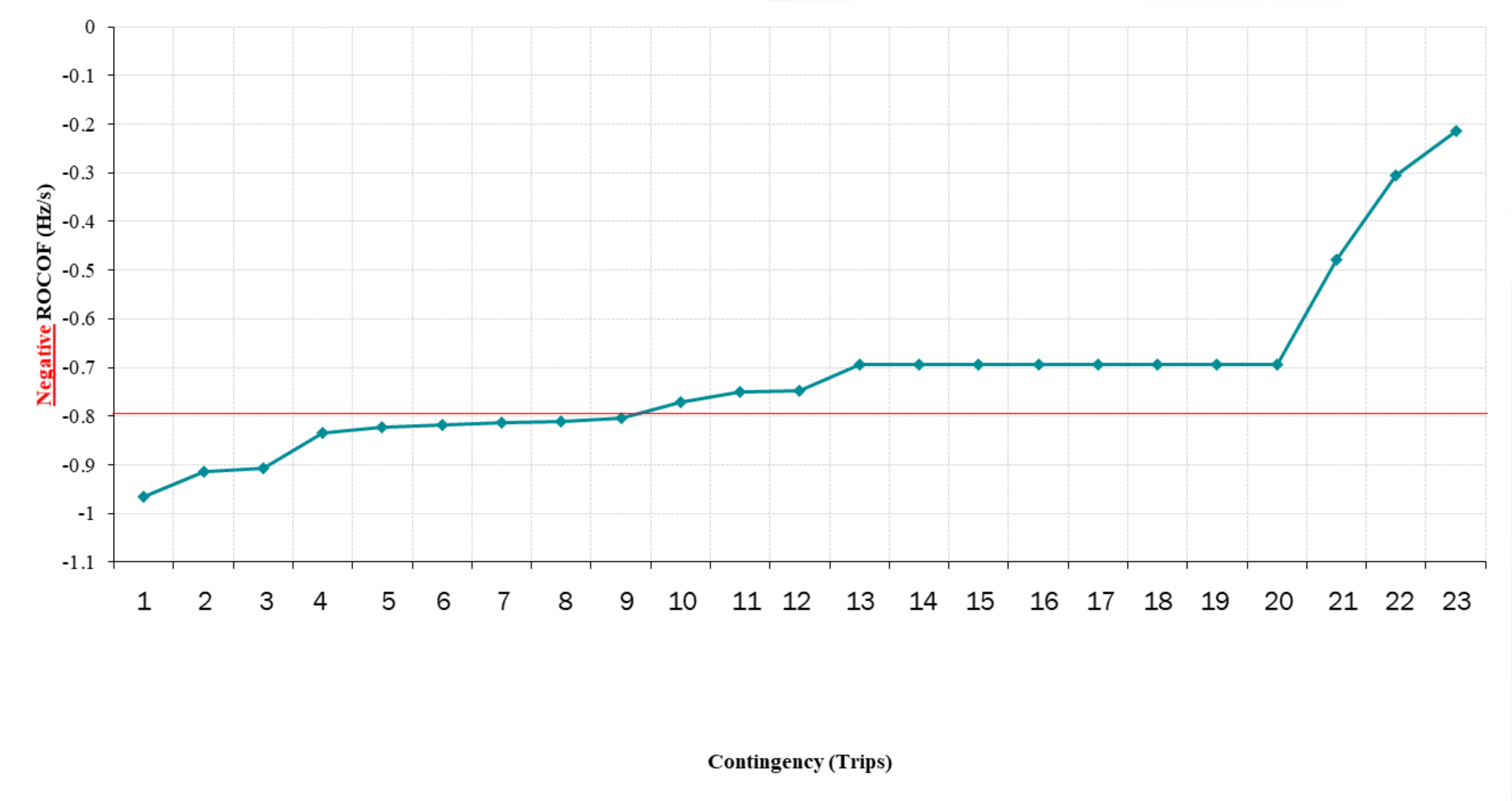
4 Low inertial response with a significant FFR and POR provided by IBRs (>90% by batteries and interconnectors).



RoCoF concerns

Continuation – RoCoF and Trips (Power Imbalance Related Contingencies)

1



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LCIS- Sizing and placement

1 **Selecting initial locations based on the system strength and RES capacity.**
Focus on low system strength areas and with a lot of RES.

2 **Iterative procedure to identify the best possible placement of synchronous devices:**

1. *Evaluate contribution of each initial location performing dynamic simulation adding a single LCIS device at the time.*
2. *Select the best placement for the current round i.*
3. *Perform dynamic simulation to check if there are still trip contingencies causing RoCoF beyond [-0.8 0.8] Hz/s and fault contingencies beyond [-1.0 1.0] Hz/s. If YES iterative procedure. move to the next step, otherwise stop the*
4. *Move to the next round i->i+1 only if the latest placement makes an acceptable improvement, otherwise stop the iterative procedure.*

3 **LCIS size and location sensitivity**

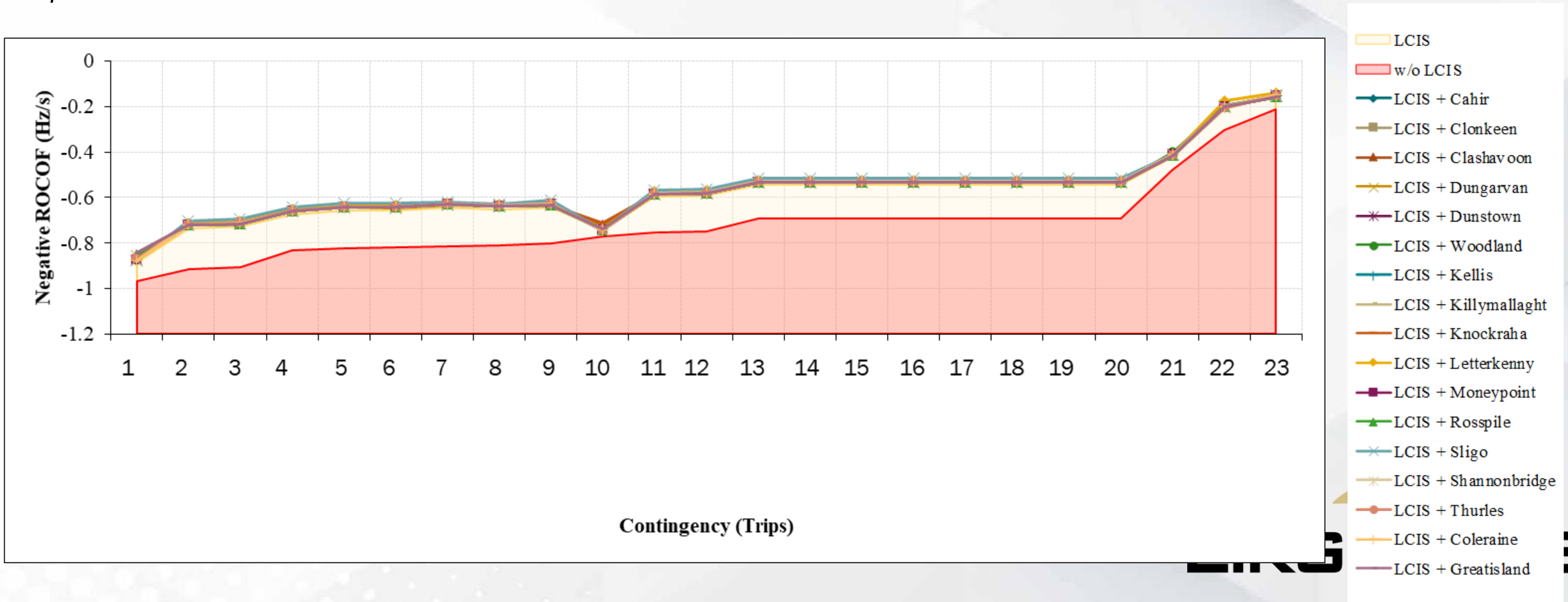
1. *Perform LCIS size sensitivity using the iterative procedure*
2. *Perform location sensitivity to around selected location*

LCIS – sizing and placement

2

Iterative procedure to identify the best possible placement of synchronous devices:

1. *Evaluate contribution of each initial location performing dynamic simulation adding a single LCIS device at the time.*
2. *Select the best placement for the current round i.*
3. *Perform dynamic simulation to check if there are still trip contingencies causing RoCoF beyond [-0.8 0.8] Hz/s and fault contingencies beyond [-1.0 1.0] Hz/s. If YES move to the next step, otherwise stop the iterative procedure.*
4. *Move to the next round i->i+1 (Step 1.) only if the latest placement makes an acceptable improvement, otherwise stop the iterative procedure.*



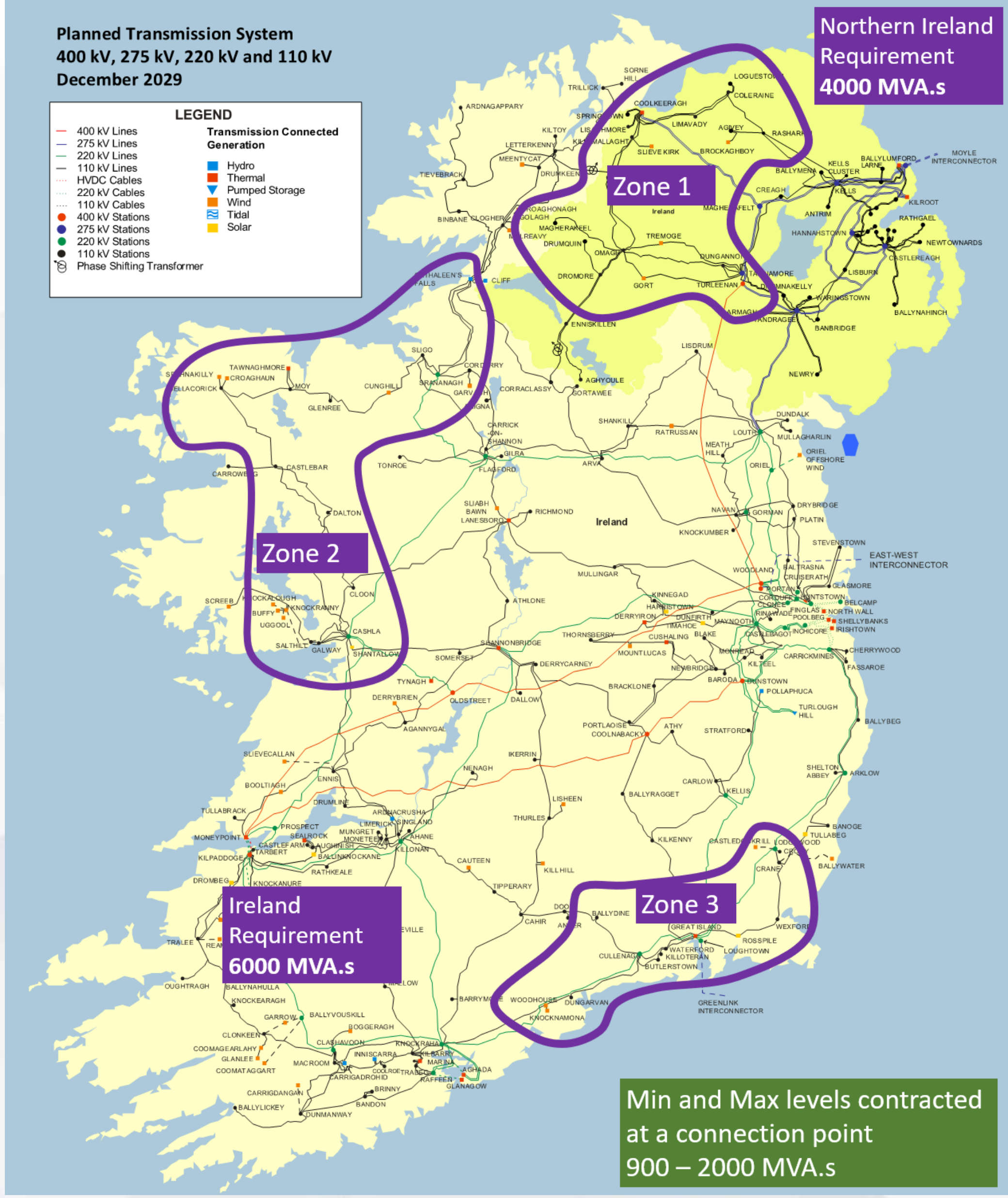
Stage 3

LCIS – sizing and placement

3 LCIS size and location sensitivity

Perform LCIS size sensitivity using the iterative procedure

Perform location sensitivity around the selected locations



Zone 1

Agivey 110 kV*
Brockaghboy 110 kV
Coleraine 110 kV
Coolkeeragh 110 kV
Coolkeeragh 275 kV
Dromore 110 kV
Drumquin 110 kV
Dungannon 110 kV
Gort 110 kV
Killymallaght 110 kV
Limavady 110 kV
Loguestown 110 kV
Magherakeel 110 kV
Omagh 110 kV
Rasharkin 110 kV
Strabane 110 kV
Tamnamore 110 kV
Tamnamore 275 kV
Tremoge 110 kV

Zone 2

Bellacorick 110 kV
Buffy 110 kV*
Cashla 110 kV
Cashla 220 kV
Castlebar 110 kV
Cathaleen's Fall 110 kV
Cloon 110 kV
Corderry 110 kV
Croaghaun 110 kV*
Cunghill 110 kV
Dalton 110 kV
Galway 110 kV
Garvagh 110 kV
Glenree 110 kV
Knockalough 110 kV
Knockranny 110 kV
Moy 110 kV
Salthill 110 kV
Shantallow 110 kV*
Sligo 110 kV
Srahnakilly 110 kV
Srananagh 110 kV
Srananagh 220 kV
Tawnaghmore 110 kV
Uggool 110 kV

Zone 3

Ballydine 110 kV
Butlerstown 110 kV
Cullenagh 110 kV
Cullenagh 220 kV
Dungarvan 110 kV
Great Island 110 kV
Great Island 220 kV
Killoteran 110 kV
Knocknamona 110 kV*
Lodgewood 110 kV
Lodgewood 220 kV
Loughtown 220 kV*
Rosspile 110 kV*
Waterford 110 kV
Wexford 110 kV
Woodhouse 110 kV

* New Transmission Stations expected to be built before 2026

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Technical aspects

- Studies
- Requirements and locations incentivised
- LCIS Providers requirements

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Procurement Volume – Phased Approach

- Studies focused on LCIS volume to be procured to meet our requirements 2026.
- We expect a further, separate, procurement process to meet our requirements 2030.

		Award Contract	Delivery
Phase 1	Up to 10,000 MVA.s	Q3 2023	1st January 2026
Phase 2	Volume and technology subject to outcome of Phase 1, analysis of system needs and technology capability (subject to decision by the regulatory authorities)	TBC	2028-2030

Note that following the outcome of Phase 1 procurement we will assess further if additional procurement phase will be needed to cover the period between 2026 and 2030

Procurement Volume

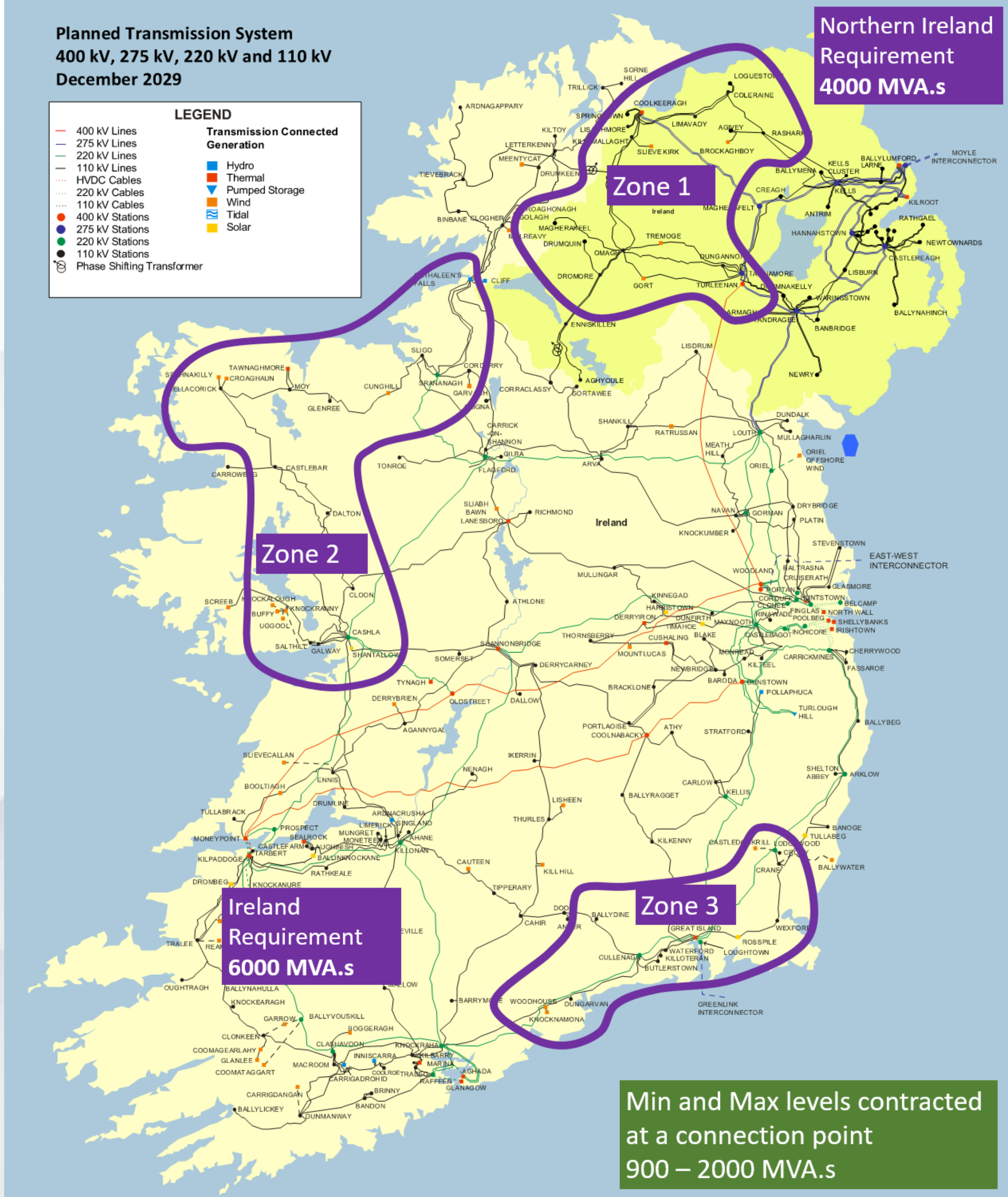
NI Requirement: 4000 MVA.s

- Outside of Zone 1 Locational Scalar: 1.0
- Inside Zone 1 Locational Scalar: 1.2

IE Requirement: 6000 MVA.s

- Outside of Zone 2/3 Locational Scalar: 1.0
- Inside Zone 2 and 3 Locational Scalar: 1.2

- Individual Unit Capability Contracted
- Min.: 900 MVA.s
- Max.: 2000 MVA.s



Technical aspects

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Overview of LCIS Providers Requirements

Topic	Proposals
LCIS definition	LCIS is one single service comprising the provision of Synchronous Inertia, Reactive Power support and Short-Circuit contribution.
Technical requirements	A range of requirements is defined for the inertia constant, short-circuit contribution and steady state reactive power capability.
Grid Code compliance	Grid Code requirements for LCIS providers will be largely based on synchronous generators requirements such as frequency and voltage operating ranges and fault ride-through requirements. A separate Grid Code Implementation Note is under development.
Inertia capability requirements	Minimum inertia capability contracted is 900 MVA.s and maximum contracted is 2000 MVA.s for an individual unit at the connection point. Additionally, no more than 2000 MVA.s at a single transmission station will be contracted.
Connection requirements	A LCIS provider can be connected directly or share an existing connection provided they can meet the technical requirements. A LCIS provider can be connected on a transmission station controlled by the TSO at 110kV or above.

Commercial aspects

Commercial aspects overview

Key elements	Proposal
Contract	• Award of contract: September 2023 expected • Start date: between the 1st of October 2024 and 1st of January 2026 • 6 years contract • End Date: no later than 31st December 2031
Performance Bond / Performance Milestone	• Bond 500€/MVA.s or equivalent in £
Payment	• Based on 97% availability (payment reduced in steps under this threshold, no payment under 60%, enforce through the performance scalar) • Cost of Energy consumed covered via the energy market • Period of maintenance allowed
Scalars	• Performance Scalar including three categories: 1) Availability 2) Dispatch 3) Operating (to incentivise the unit to reliably provide the service) • Product Scalar to incentivise Reactive Power capability and Short Circuit contribution • Locational Scalar to incentivise LCIS Providers to go in Zone 1, 2 and 3

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Product Scalars

Technical Requirement at the connection point	Range required	Indicative Product Scalars if Option 3 for bid format retained
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) at the connection point * per unit of rating in MVA	Lagging min 0.8 p.u.* Leading min -0.5 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 ≤-0.5 >-0.6 p.u. → Scalar 1.0

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Competition aspects

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Competition aspects overview

Key elements	Proposal
Assessment	• Pass/Fail requirements (e.g. legal standing, previous experience, financial, planning permission requirement) • Ultimate Cost (cheaper bid retained) for each jurisdiction
Connection requirements / Planning permission	• Full Planning Permission required • In NI, any person can apply for a connection offer at any time and get one within 3 months. • In IE, connection offer to be issued outside of the ECP Process subject to CRU direction
Bid format & Assessment	• Preferred option: bid a price in MVA.s per hour • Factor the cost of energy in the assessment

Consultation responses

Consultation responses

- Responses to the consultation, preferably structured in line with the specific questions raised in this paper, should be submitted via either EirGrid or SONI consultation portal **before 5 August 2022**.

- Please note your response will be publicly available for viewing on the portal. If you require your response to remain confidential, please clearly state this in your response.

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Q&A Session

Thank You