Ireland and Northern Ireland's Operational Policy Roadmap 2025-2035

G-PST / ESIG Webinar

30 April 2025

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Introduction

- Together, EirGrid (the TSO for Ireland) and SONI (the TSO for Northern Ireland) operate the transmission systems, energy market and System Services arrangements on the Island of Ireland.
- EirGrid and SONI have recently updated and published their Operational Policy Roadmap to set out the targeted evolution of key operational policies (to achieve de-carbonisation goals) in the areas of:
  1. Dynamic Stability
  2. Reserves and Ramping, and
  3. Operational Security

Published Operational Policy Roadmap

Presentation Overview

1. Introduction to the All-Island Power System

2. Overview of the Operational Policy Roadmap 2025 to 2035 including key enablers

3. Policy change process and stakeholder engagement

All-Island Power System Overview

All-Island Power System Overview

System

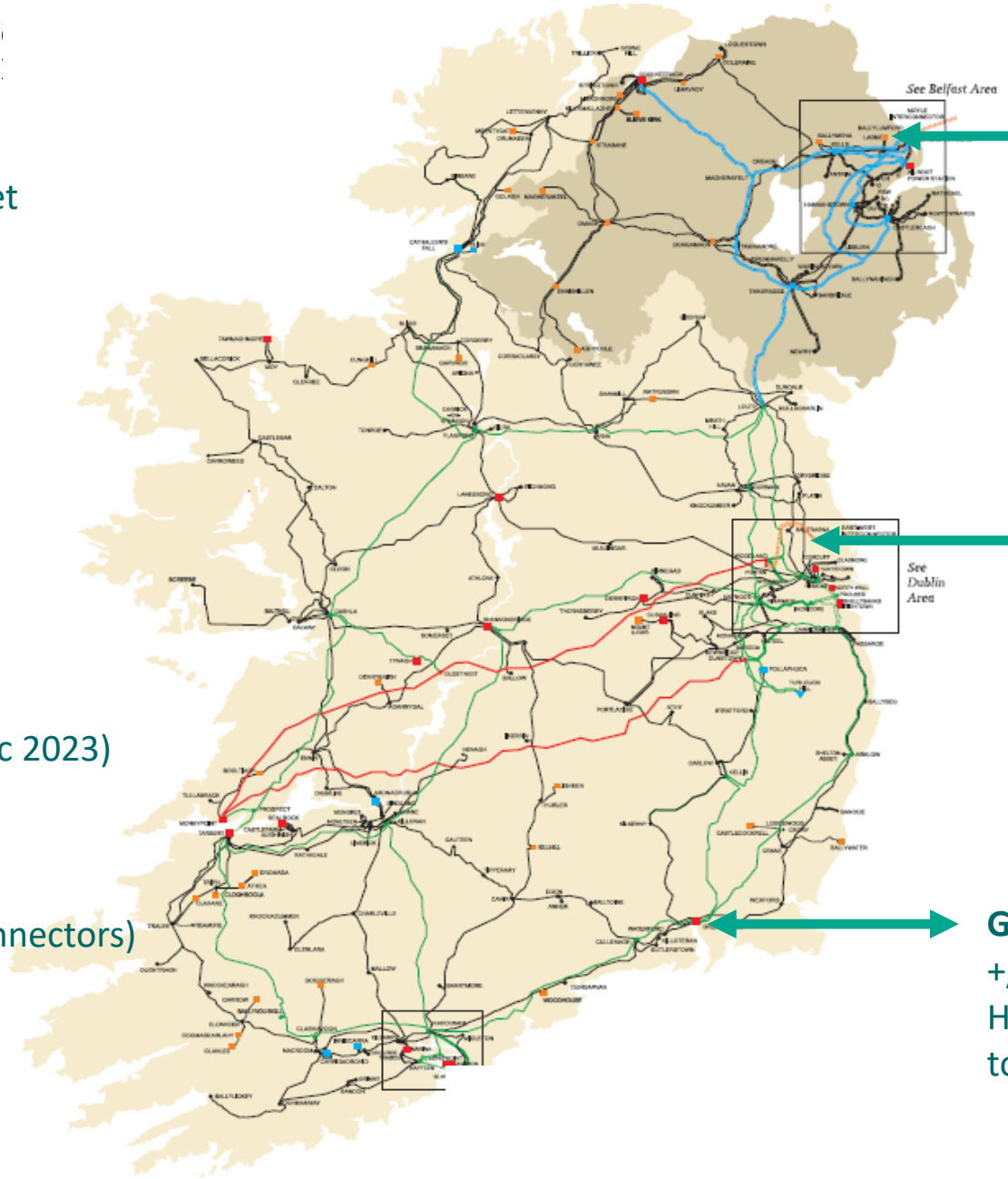
- Two Jurisdictions / Two TSOs
- Single Synchronous Area and Single Energy Market
- Transmission: 110/220/275/400 kV
- Jurisdictional Transmission Control
- All-Island Scheduling and Dispatch

Demand

- Peak Demand: 7.5 GW
- Minimum Demand: 2.7 GW
- Many global tech./pharma. companies

Generation

- Installed Wind: 6.3 GW, Peak Wind: 4.63 GW (Dec 2023)
- Solar growing rapidly (2% of energy in 2024)
- Small amount of hydro (2%)
- Gas/Oil/Coal mostly imported
- Largest Single Infeed/Outfeed: 500 MW (Interconnectors)



Moyle
+/- 500 MW
HVDC (LCC)
to Great Britain

EWIC
+/- 500 MW
HVDC (VSC)
to Great Britain

GreenLink
+/- 500 MW
HVDC (VSC)
to Great Britain

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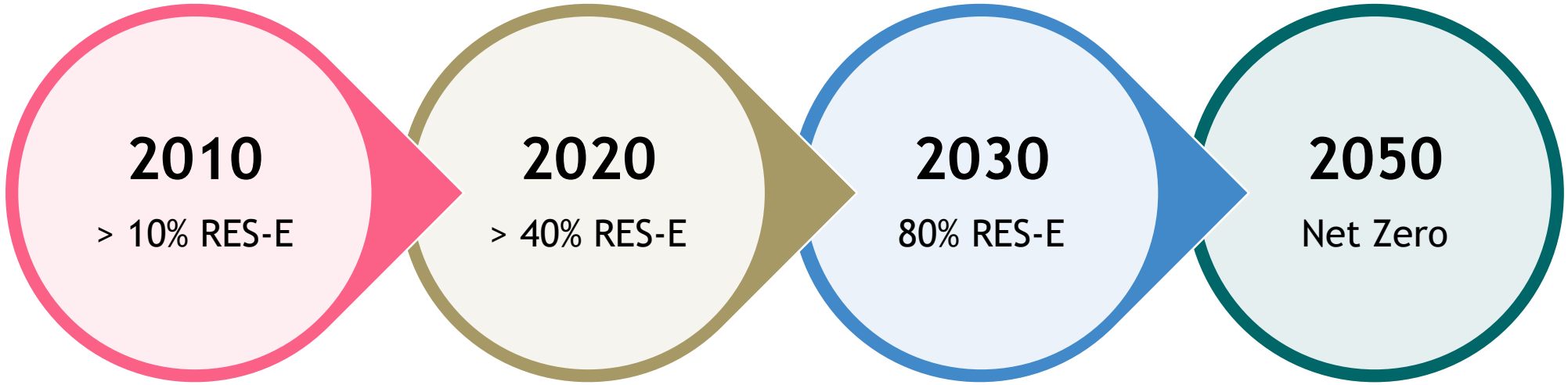
Renewables Targets



- Clear decarbonisation agenda backed up by legislation
- Small amount of hydro (~2 %) – almost all RES-E comes from onshore wind today
- Island power system – wind / solar poses challenges due to variability and non-synchronous nature
- Rapid demand growth driven by global technology / pharma companies in last 5 years

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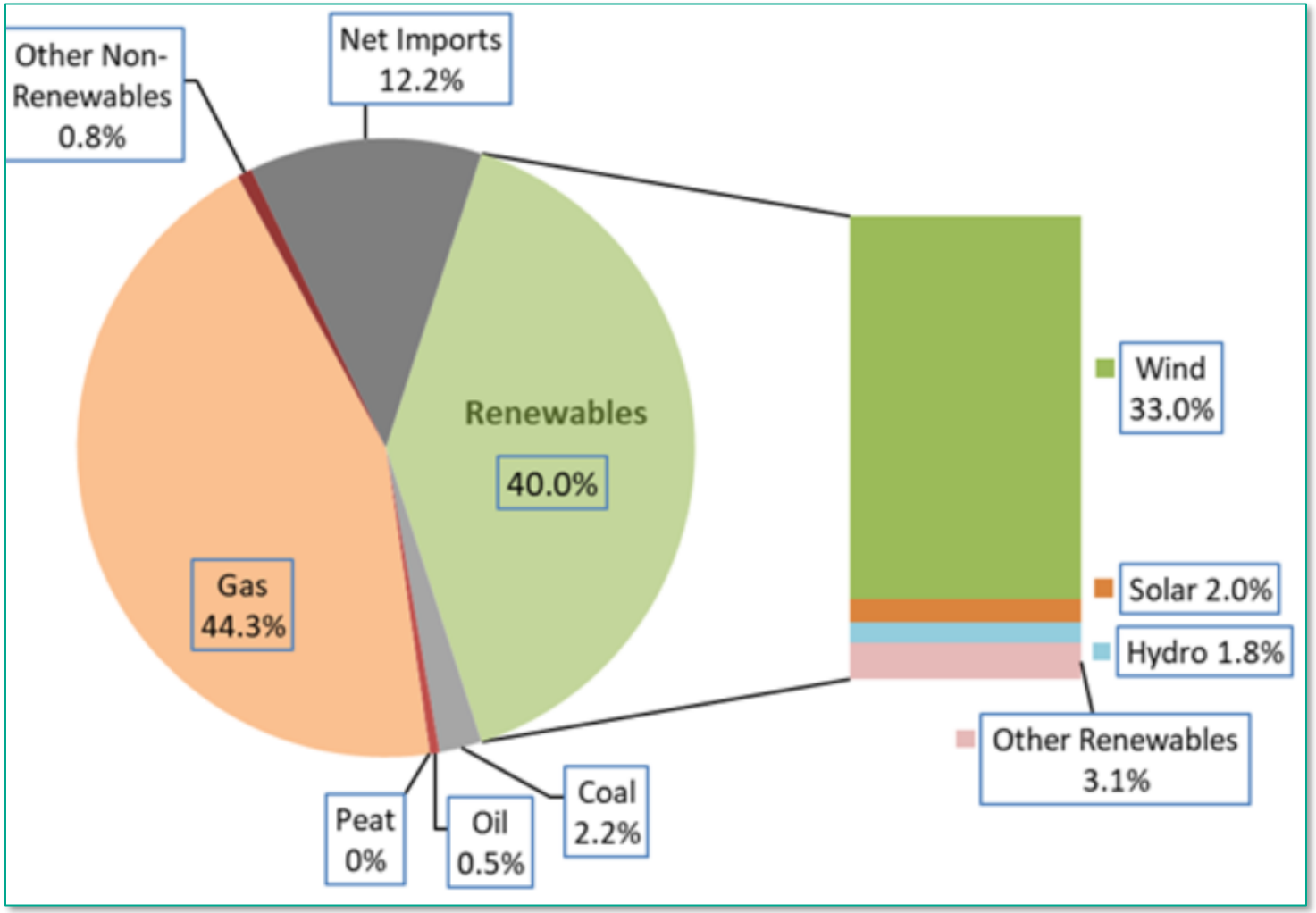
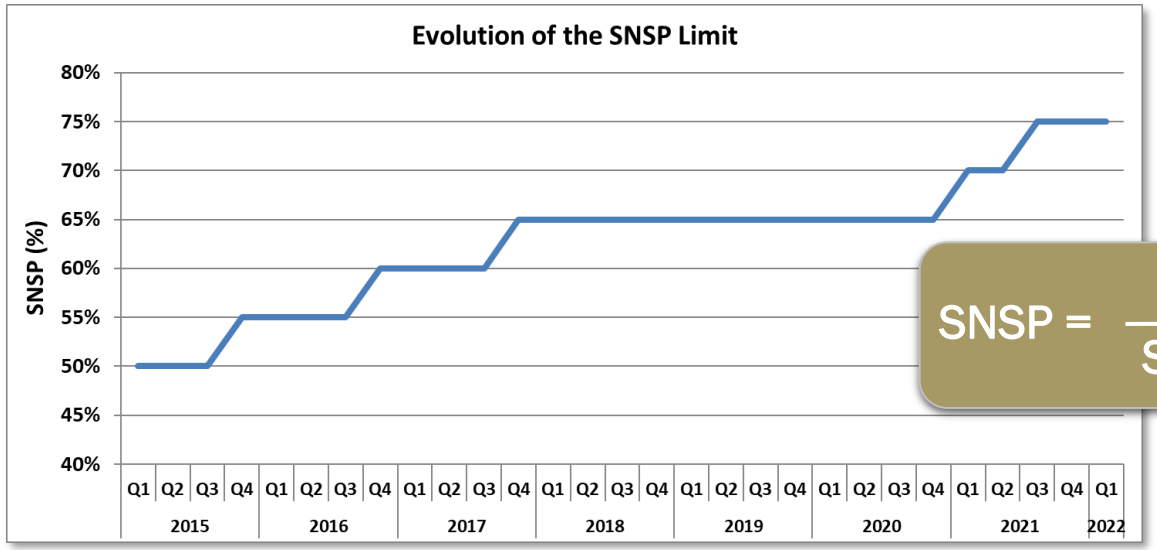
(RES-E: Renewable Energy Sources – Electricity)

All-Island Fuel Mix 2024 - 40% Renewables



Key System Wide Operational Metrics Today

Key Operational Limits	April 2025
Maximum Rate of Change of Frequency (RoCoF)	+/- 1.0 Hz/s
Minimum Synchronous Area Inertia	23,000 MVA.s
Minimum number of large synchronous units that must be synchronised	7
System Non-Synchronous Penetration limit (SNSP)	75 %



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

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Operational Policy Roadmap

Operational Policy Framework

Key Areas of Operational Policy

The operational policy roadmap is divided up in three (3) main sections:

- **Dynamic Stability**
- **Reserves and Ramping**
- **Operational Security**

These sections together cover the full spectrum of operational policy at EirGrid and SONI. It is important to note, however, that these three sections are merely useful 'buckets' to categorise different aspects of operational policy for understandability and reporting purposes.

Many of the underlying drivers, challenges and opportunities identified in individual sections may influence other aspects of system operation as well. These interdependencies are highlighted wherever relevant in the document.

Policy Area	Policy & Constraints	Definition	2024 Status
Dynamic Stability	Inertia	The minimum level of kinetic energy stored in rotating plant operating on the system. Inertia comes from synchronous generation, motor load and synchronous condensers.	23 GWs
	Rate of Change of Frequency (RoCoF)	How fast the frequency moves when subjected to an event that results in a mismatch between generation and demand.	1 Hz/s
	System Strength	Definition of the relative strength of the system in terms of short circuit strength, stability, retained voltage and others.	In development
	Minimum Number of Conventional Units (MUON)	Constraint on the system that specifies a minimum number of conventional units on-load required to be synchronised in Ireland and Northern Ireland.	7 (3 NI / 4 IE)
	System Non-Synchronous Penetration (SNSP)	A measure of the non-synchronous generation on the system at an instant in time. It is the ratio of the real-time MW contribution from non-synchronous generation and net HVDC imports to demand and net HVDC exports.	75 %[1]
Reserves and Ramping	Fast Frequency Response (FFR)	Response by resources and service providers in the 2 to 10 second range.	Dimensioning in development
	Primary Operating Reserve (POR)	Response by resources and service providers in the 5 to 15 second range.	75% LSI[2]
	Secondary Operating Reserve (SOR)	Response by resources and service providers in the 15 to 90 second range.	75% LSI[2]
	Tertiary Operating Reserve 1&2 (TOR)	Response by resources and service providers in the 90 second to 20-minute range in two tranches.	100% LSI[2]
	Replacement Reserve (RR)	Response by resource and service providers in the 20 minute to 4-hour range.	100% LSI[2]
	Ramping Margin (RM)	The level of dispatchable generation/demand available to mitigate very fast ramps and demand and RES forecast errors. There are 1-, 3-, and 8-hour ramping services.	Explicitly scheduled
	HVDC Ramping Rates	The rate of change of HVDC interconnector active power flow. This is an All-Island measure which includes the ramp rates for Moyle in NI and EWIC in IE.	5 MW/min per interconnector
Operational Security	Voltage Management	The ability to securely operate the system by controlling the voltage, within a specified range, pre and post contingency.	Defined in Operating Security Standards
	Thermal Security Management	The ability to securely operate the system by controlling the pre and post contingency thermal loading within the ratings of the transmission system plant.	Defined in Operational Security Standards
	Short Circuit Management	Assessment of equipment duty performed to ensure all plant is within its making, breaking and withstand ratings for the prospective short circuit current calculated.	Defined in Operational Security Standards

[1] 80% operational trials expected to be finalised in 2025.
[2] Referring to largest single infeed (LSI).

Dynamic Stability – Key Objectives 2025-2030

1. **Transition from a single, All-Island inertia floor to a model of regional inertia** for Ireland and Northern Ireland.
2. **Introduce a new *System Strength* policy including metrics for** EirGrid and SONI that must be monitored for real-time operations.
3. **Maintain the system-wide RoCoF limit** at 1 Hz/s subject to review of the RoCoF policy in the coming years, based on system needs and evolving capabilities.
4. **Relax and eventually remove SNSP** as a constraint but maintain it as a key operational reporting metric. Our aim is to achieve the ability to operate up to 95% SNSP by 2030 and close to 100% SNSP by 2035.
5. **Relax and eventually remove the minimum unit constraint for system stability,** while ensuring any local constraints are satisfied and linked to specific system dynamic stability scarcities. The aim is to achieve secure system operation with three or less conventional generation units by 2030 and the ability to operate with no conventional generation units online by 2035.

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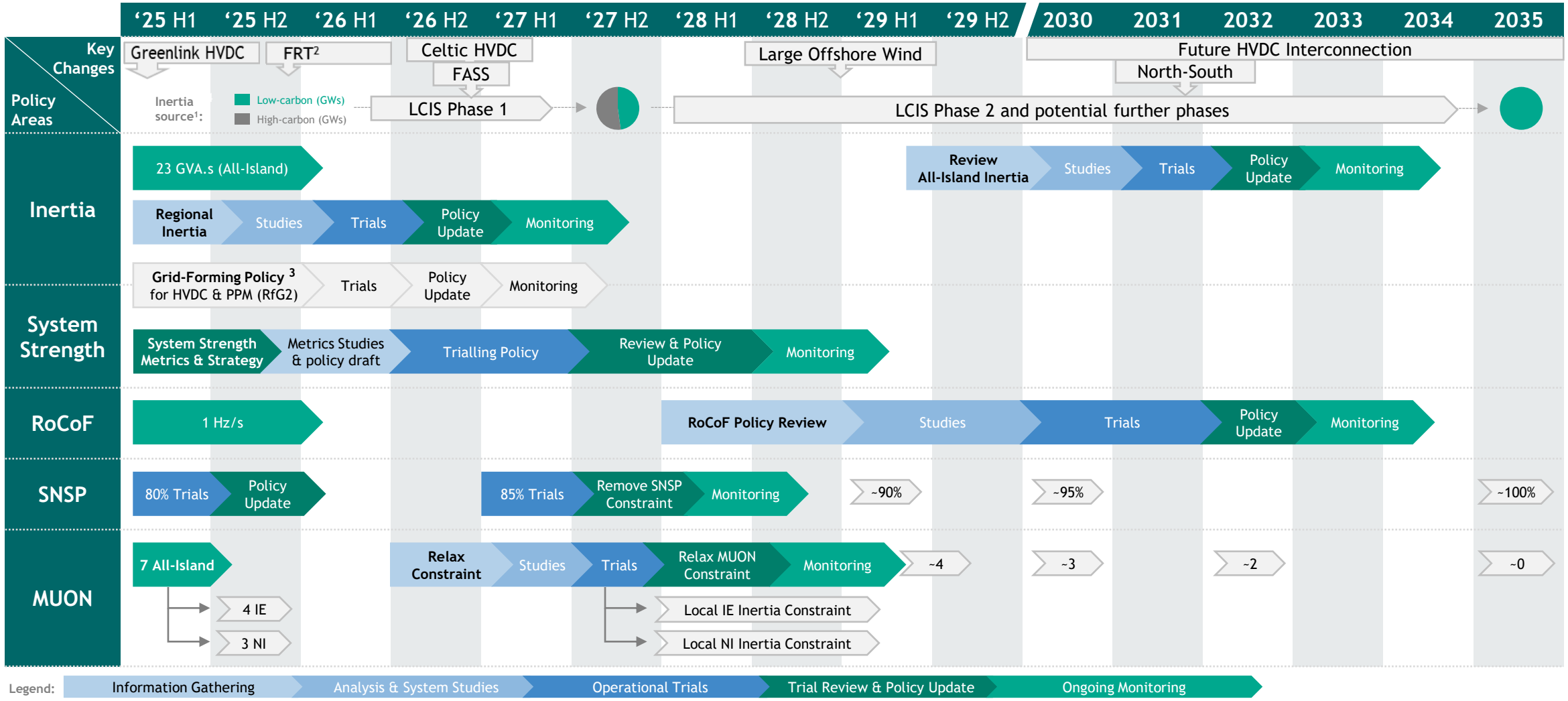
Dynamic Stability - Milestones & Timeline 2025-2035*



[1] Indicative values.
[2] Grid Code requirements for Fault-Ride Through capability of Demand Facilities in place.
[3] Indicative timeline for information purposes only, there is a dependency with the ENTSO-E RfG and HVDC 2.0 and associated Grid Code changes.
* The timelines and assumptions outlined in this roadmap take precedence over those found in SOEF V 1.1).

Some Key Enablers

1. **New System Services (Ancillary Services)**
   e.g. Low Carbon Sources of Inertia

2. **Enhanced Operational Tools and Capability**
   e.g. Power system modelling capability

3. **Improved Performance Standards for Grid Users**
   e.g. fault ride-through capability

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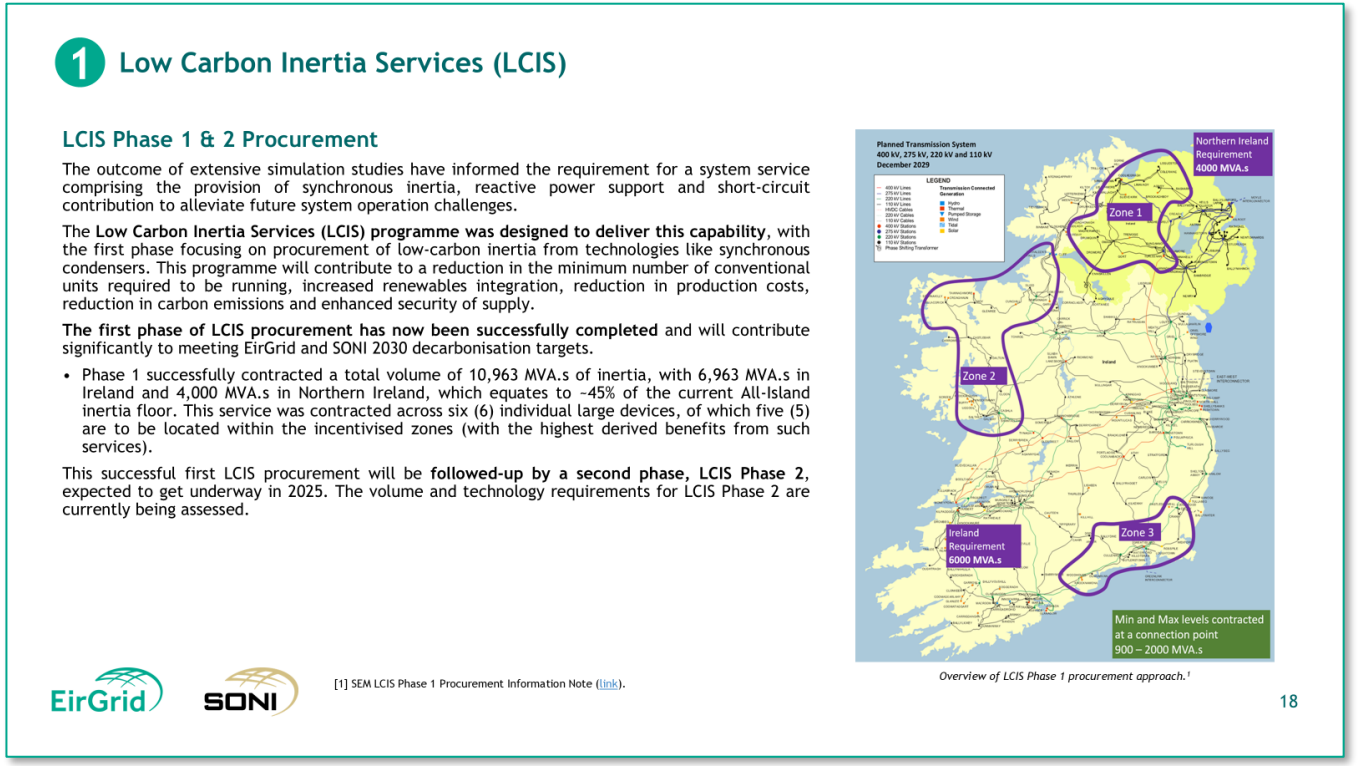
1. New System Services: Low Carbon Inertia Services (LCIS)

- Targeted procurement of Low Carbon Inertia Services to provide:
  - Inertia
  - Reactive Power
  - Short Circuit Contribution
- Approximately 11 GVA.s procured via long term contracts: 6 x Synchronous Condensers
- Will meet 45 % of system inertia requirement and enable reduction in the running of conventional thermal generation.
- A second procurement phase will commence in 2025.



1 Low Carbon Inertia Services (LCIS)

LCIS Phase 1 & 2 Procurement

The outcome of extensive simulation studies have informed the requirement for a system service comprising the provision of synchronous inertia, reactive power support and short-circuit contribution to alleviate future system operation challenges.

The **Low Carbon Inertia Services (LCIS) programme was designed to deliver this capability**, with the first phase focusing on procurement of low-carbon inertia from technologies like synchronous condensers. This programme will contribute to a reduction in the minimum number of conventional units required to be running, increased renewables integration, reduction in production costs, reduction in carbon emissions and enhanced security of supply.

The first phase of LCIS procurement has now been successfully completed and will contribute significantly to meeting EirGrid and SONI 2030 decarbonisation targets.

- Phase 1 successfully contracted a total volume of 10,963 MVA.s of inertia, with 6,963 MVA.s in Ireland and 4,000 MVA.s in Northern Ireland, which equates to ~45% of the current All-Island inertia floor. This service was contracted across six (6) individual large devices, of which five (5) are to be located within the incentivised zones (with the highest derived benefits from such services).

This successful first LCIS procurement will be **followed-up by a second phase, LCIS Phase 2**, expected to get underway in 2025. The volume and technology requirements for LCIS Phase 2 are currently being assessed.

Overview of LCIS Phase 1 procurement approach.[1]

[1] SEM LCIS Phase 1 Procurement Information Note (link).

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2. Enhanced Operational Tools and Capability

Operational capability must be continuously uplifted to align with the new challenges and requirements introduced by the increased complexity of system operations. For example, we will require enhanced capabilities in the areas of:

- Operational forecasting of demand and renewables
- High resolution observability and monitoring
- Control capabilities
- Power system modelling capability, e.g. Electromagnetic Transient (EMT) simulations for Inverter Based Resource (IBR) dominated networks must be further developed and increased automation will be necessary to carry out relevant analyses more frequently to inform system constraints.

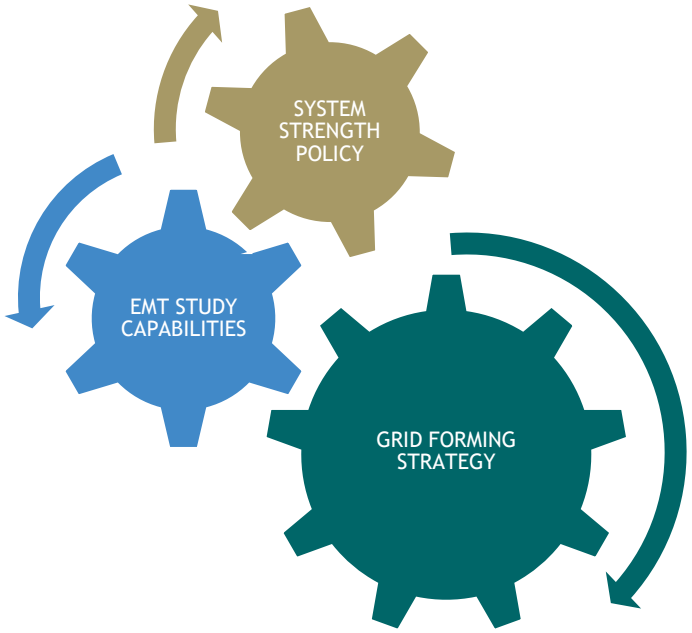

Illustration of interaction between GFM, system strength and need for EMT modelling capabilities.

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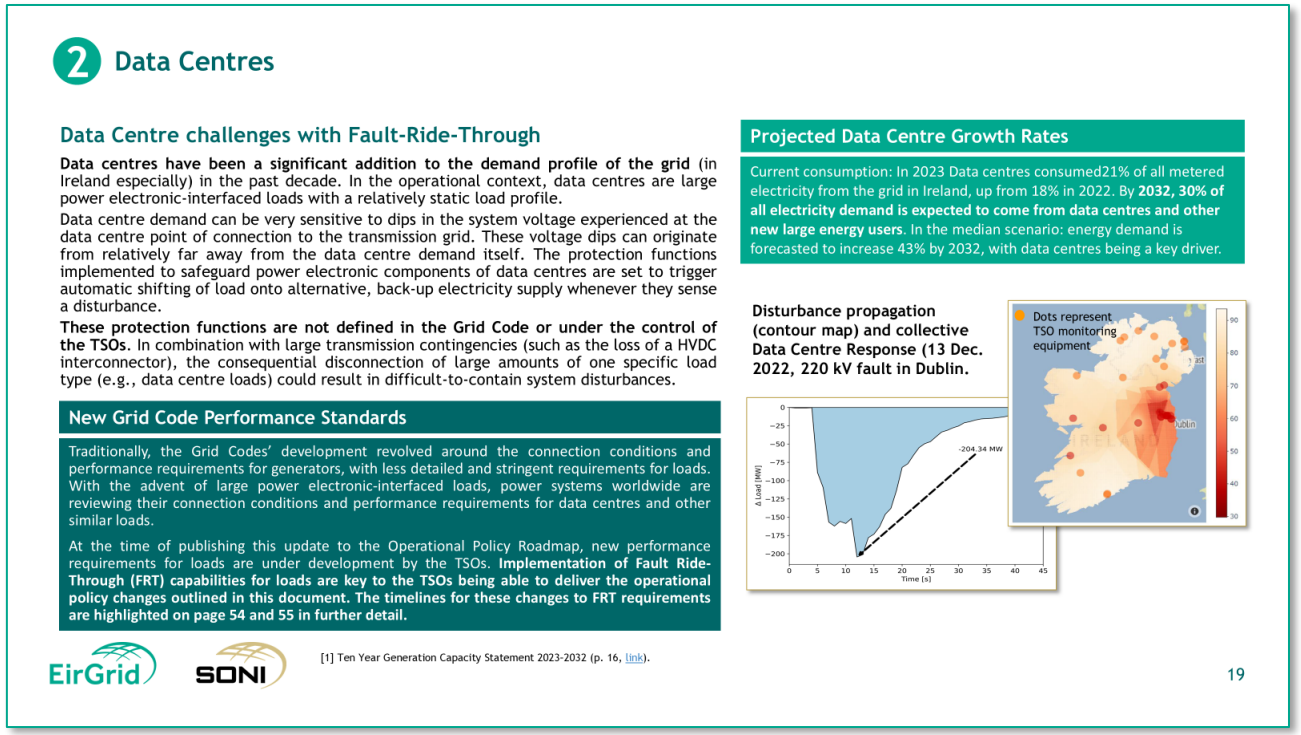
3. Performance Standards, e.g. Fault Ride-Through Capability

- Data centres make up a growing proportion of demand in Ireland (>20%).
- Remote faults can cause a significant proportion of this demand to reduce automatically, leading to a significant system imbalance.
- EirGrid and SONI are developing new Grid Code performance standards that would require these (and other) demand facilities to ‘ride-through’ faults.



2 Data Centres

Data Centre challenges with Fault-Ride-Through

Data centres have been a significant addition to the demand profile of the grid (in Ireland especially) in the past decade. In the operational context, data centres are large power electronic-interfaced loads with a relatively static load profile.

Data centre demand can be very sensitive to dips in the system voltage experienced at the data centre point of connection to the transmission grid. These voltage dips can originate from relatively far away from the data centre demand itself. The protection functions implemented to safeguard power electronic components of data centres are set to trigger automatic shifting of load onto alternative, back-up electricity supply whenever they sense a disturbance.

These protection functions are not defined in the Grid Code or under the control of the TSOs. In combination with large transmission contingencies (such as the loss of a HVDC interconnector), the consequential disconnection of large amounts of one specific load type (e.g., data centre loads) could result in difficult-to-contain system disturbances.

New Grid Code Performance Standards

Traditionally, the Grid Codes’ development revolved around the connection conditions and performance requirements for generators, with less detailed and stringent requirements for loads. With the advent of large power electronic-interfaced loads, power systems worldwide are reviewing their connection conditions and performance requirements for data centres and other similar loads.

At the time of publishing this update to the Operational Policy Roadmap, new performance requirements for loads are under development by the TSOs. **Implementation of Fault Ride-Through (FRT) capabilities for loads are key to the TSOs being able to deliver the operational policy changes outlined in this document. The timelines for these changes to FRT requirements are highlighted on page 54 and 55 in further detail.**

Projected Data Centre Growth Rates

Current consumption: In 2023 Data centres consumed21% of all metered electricity from the grid in Ireland, up from 18% in 2022. By **2032, 30% of all electricity demand is expected to come from data centres and other new large energy users**. In the median scenario: energy demand is forecasted to increase 43% by 2032, with data centres being a key driver.

Disturbance propagation (contour map) and collective Data Centre Response (13 Dec. 2022, 220 kV fault in Dublin.

[1] Ten Year Generation Capacity Statement 2023-2032 (p. 16, link).

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Operational Policy Change Process and Stakeholder Engagement

Operational Policy Change Process

EirGrid and SONI's joint **Operational Policy Review Committee (OPRC)** governs the process of operational policy changes. The OPRC comprises members with extensive experience and expert knowledge of system operations. The members consider the proposed changes, review all related materials/reports, and approve or reject the proposed changes following an operational trial period and assessment of same. Operational policy in EirGrid and SONI is monitored, reviewed, and updated according to a **five-stage continuous cycle process**, described below.

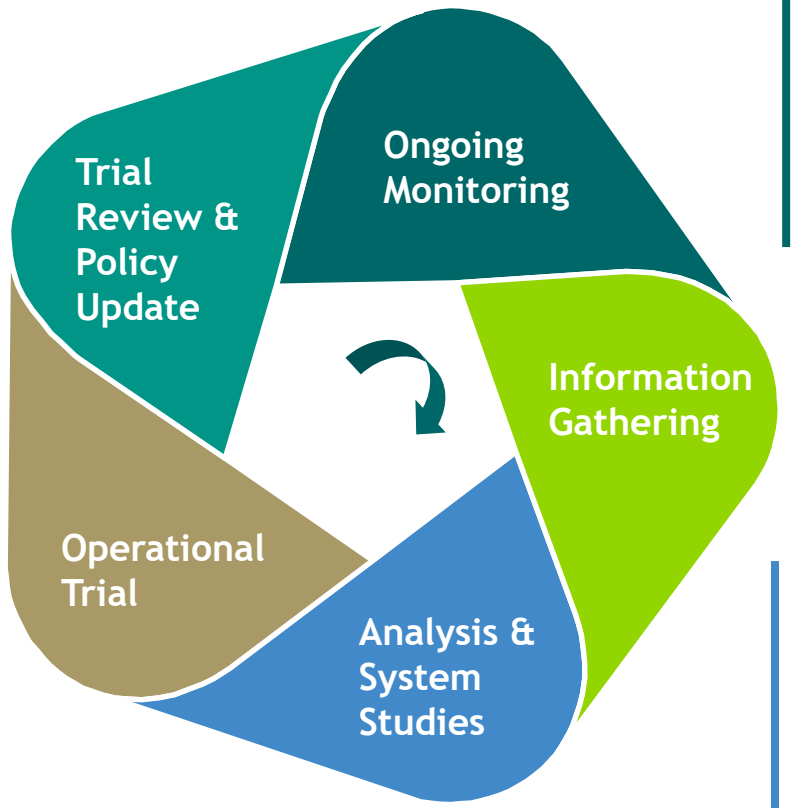
05 Trial Review & Policy Update

If the trial period of operation passes without adverse impacts, subject matter experts will study the results of the trial parameters and criteria. An in-depth examination of the trial period is carried out and reported on to the OPRC. The conditions and events during the trial are examined to determine if any trial related issues arose. The OPRC reviews the outcome and report and decides whether to either:

1. Cease the trial noting adverse impacts.
2. Continue the trial if there is insufficient evidence. Gather more relevant data points and information to support decisions.
3. Approve the proposed operational policy change as the enduring operational policy.

04 Operational Trial

If the OPRC grant approval, an operational policy trial is commenced with strict operational criteria and parameters to be monitored, including hours of operation. The trial may be suspended at any time by operations staff if adverse impacts arise during the trial.



01 Ongoing Monitoring

In the Ongoing Monitoring phase, EirGrid and SONI monitor the system parameters and analyse events and disturbances to assess system performance and generator compliance relative to operational policy parameters and metrics.

02 Information Gathering

During the Information Gathering stage the current status of the policy and parameters are assessed, and consultation is held with operations specialists on the drivers, requirements and need for changes.

03 Analysis & System Studies

At the Analysis & System Studies stage subject matter experts and operations policy specialists study the system under an extensive and detailed range of conditions. They study the impact of the proposed policy change and make recommendations on the conditions of the operational trial. The OPRC approve or reject the proposed trial, based on the studies and in-depth discussions.

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Industry / Stakeholder Engagement

Representation from:

- TSOs
- Wind Energy
- Conventional Generators
- Regulatory Authorities
- Academia
- Equipment Manufacturers
- Large Energy Users
- External TSO
- DSOs

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Shaping Our Electricity Future Roadmap: Version 1.1

March 2025

Operational Policy Roadmap

2025-2035

Link

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