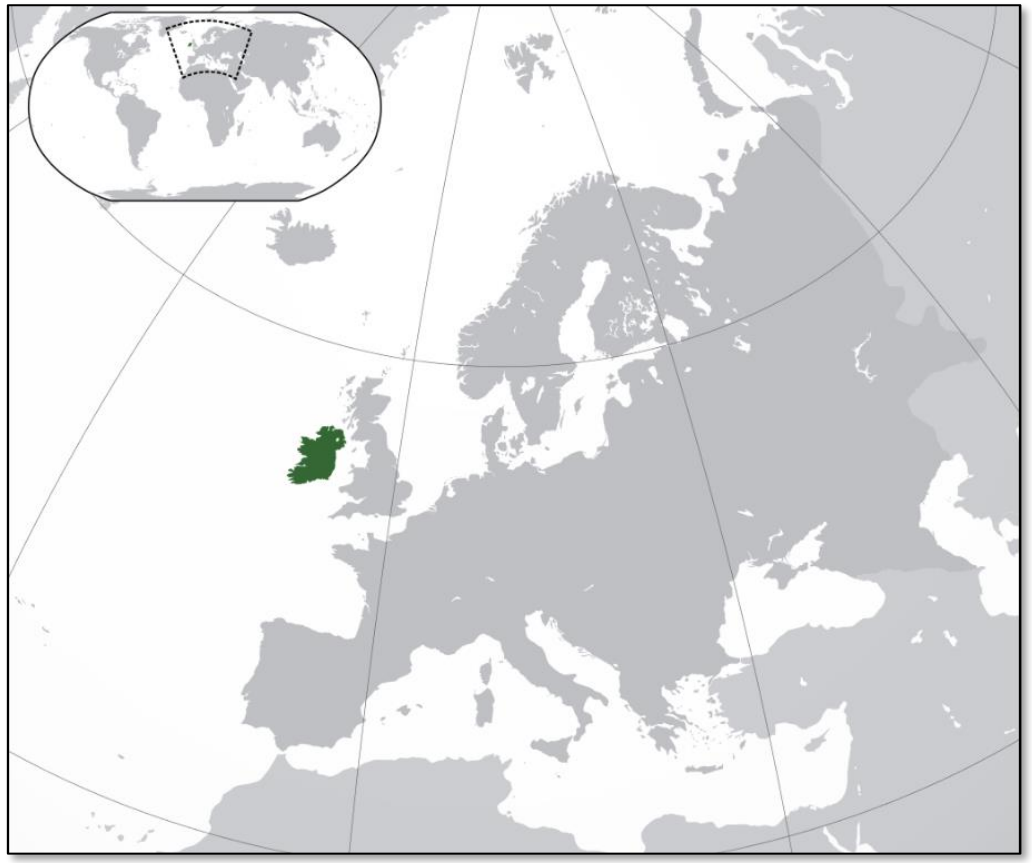
13 September 2023

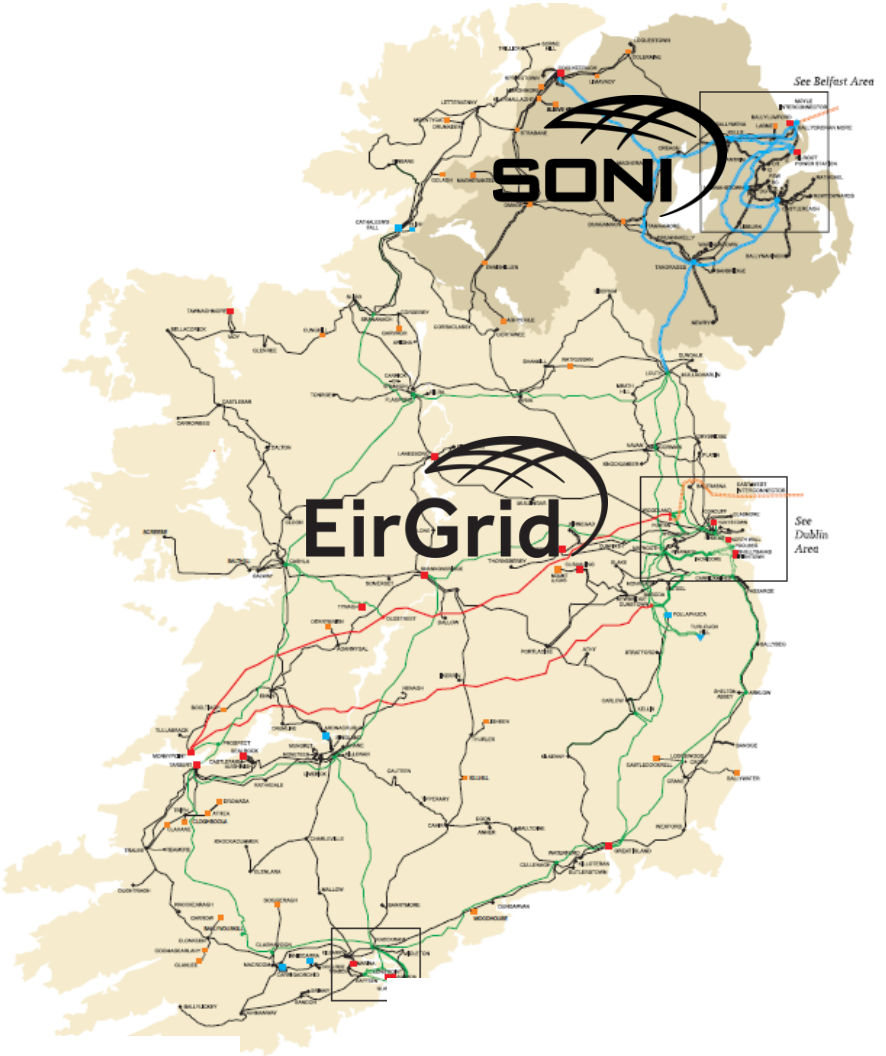
Transforming the Power System of Ireland and Northern Ireland for a Low Carbon Energy Future

Future of the Grid event

EirGrid SONI

The TSOs of Ireland and Northern Ireland





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All-Island Power System Overview

System

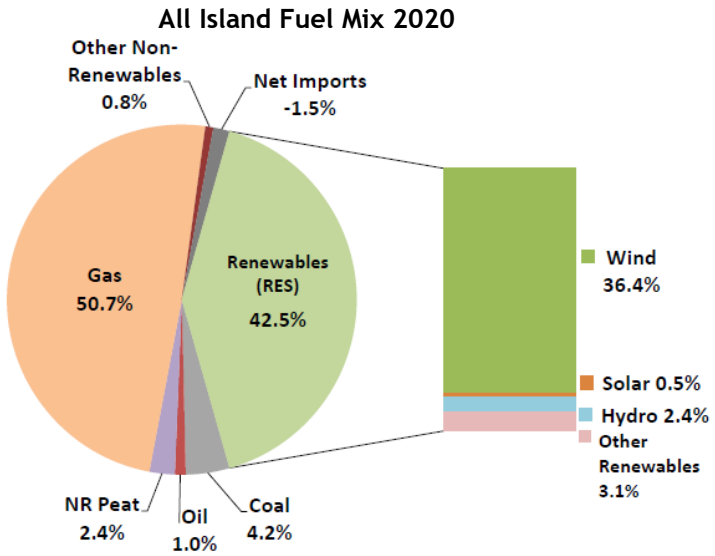
- Transmission: 110/220/275/400kV
- Single Synchronous Area & Market
- Two Jurisdictions / TSOs
- Jurisdictional Transmission Control
- All-Island Scheduling and Dispatch

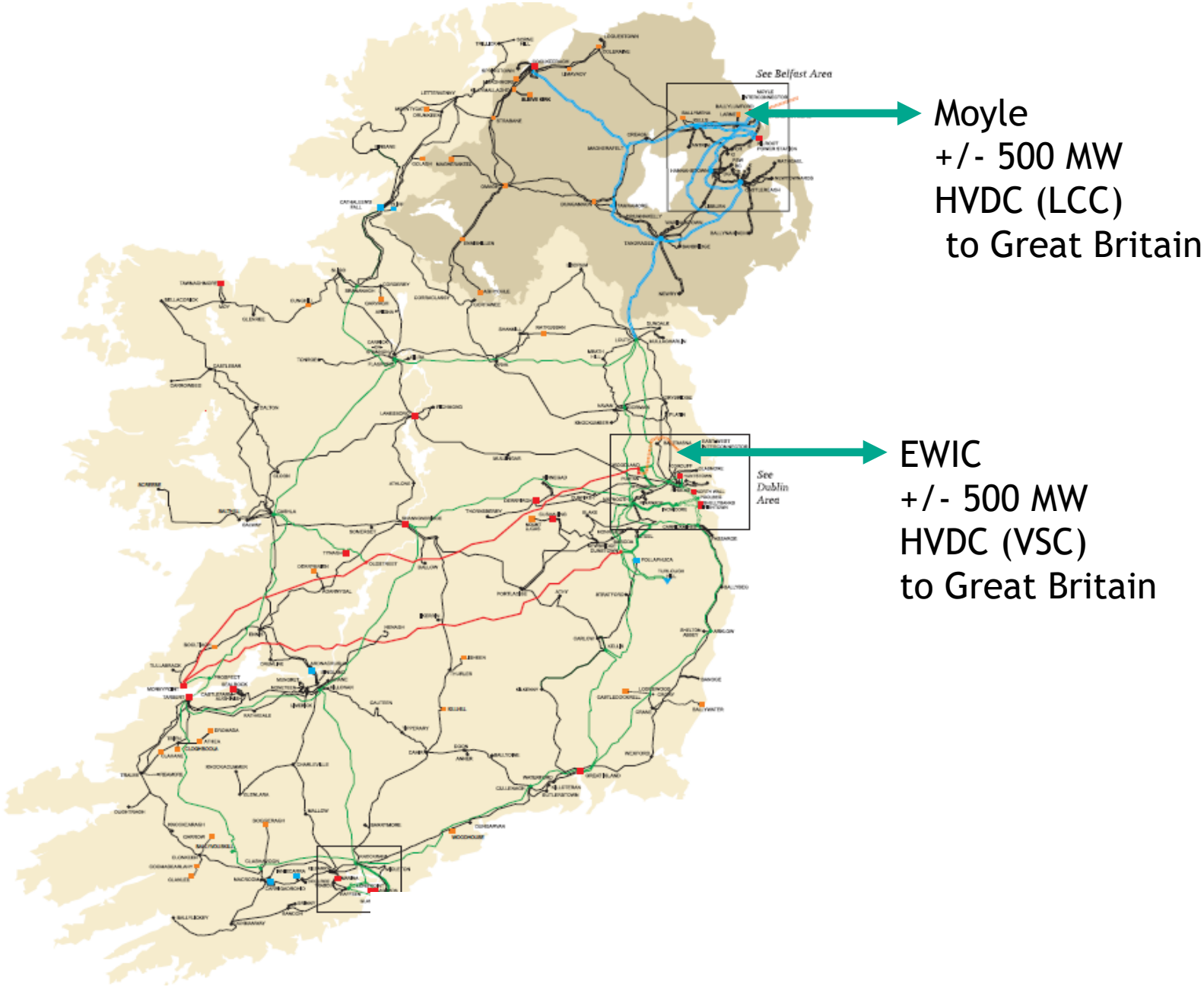
Demand

- Peak Demand: 7.0 GW
- Valley Demand: <2.5 GW

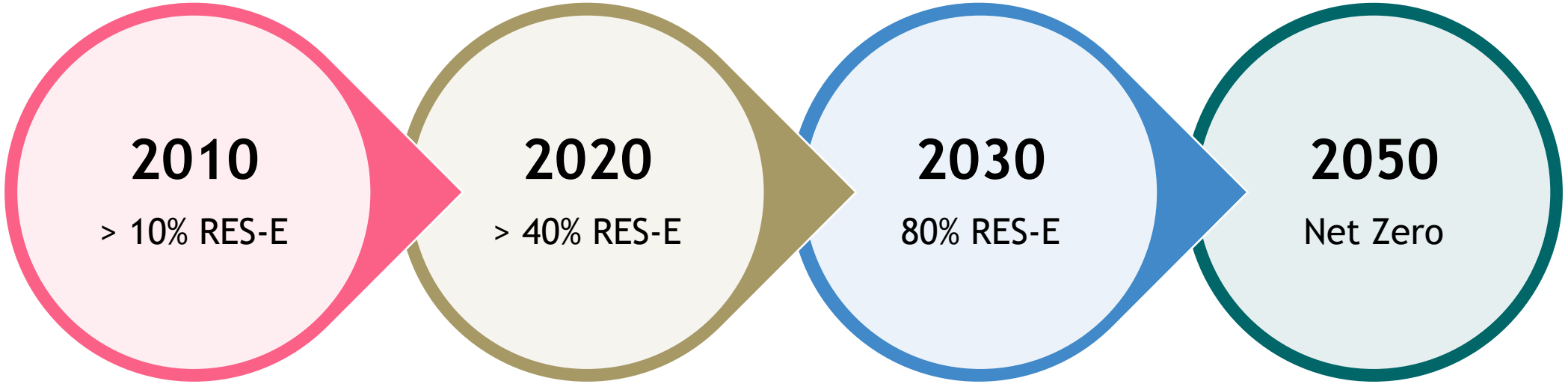
Generation

- Installed Wind: 5.9 GW
- Peak Wind: 4.6 GW (Feb 2022)





Renewables Revolution



- 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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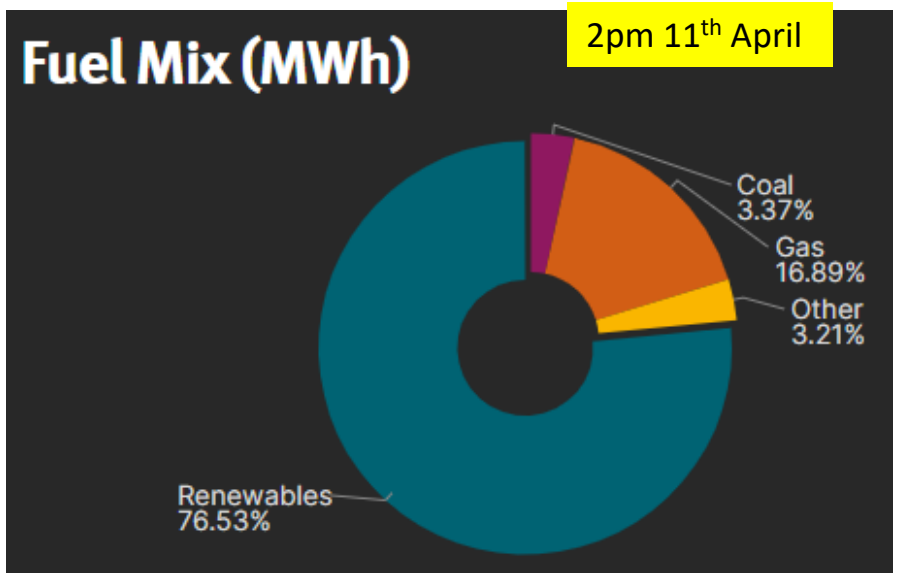
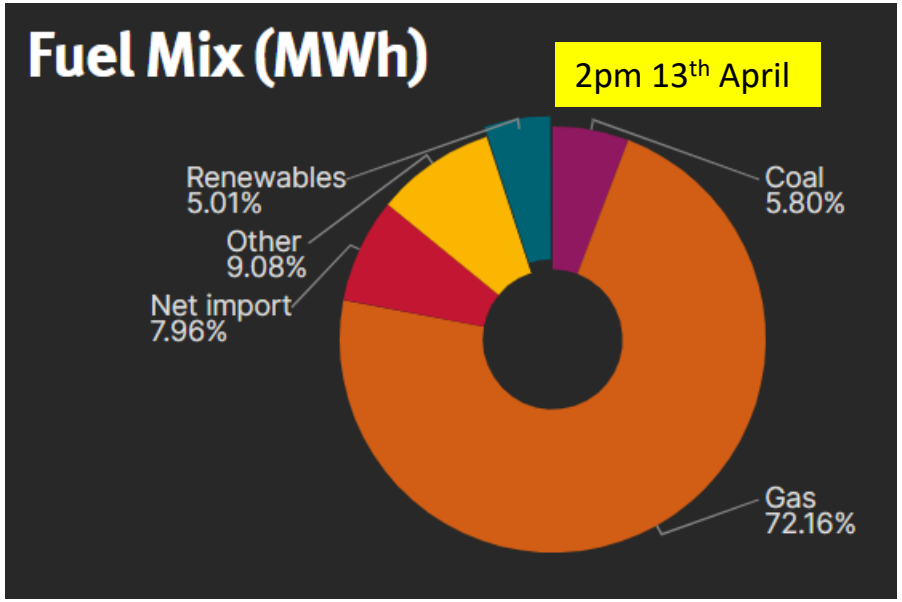
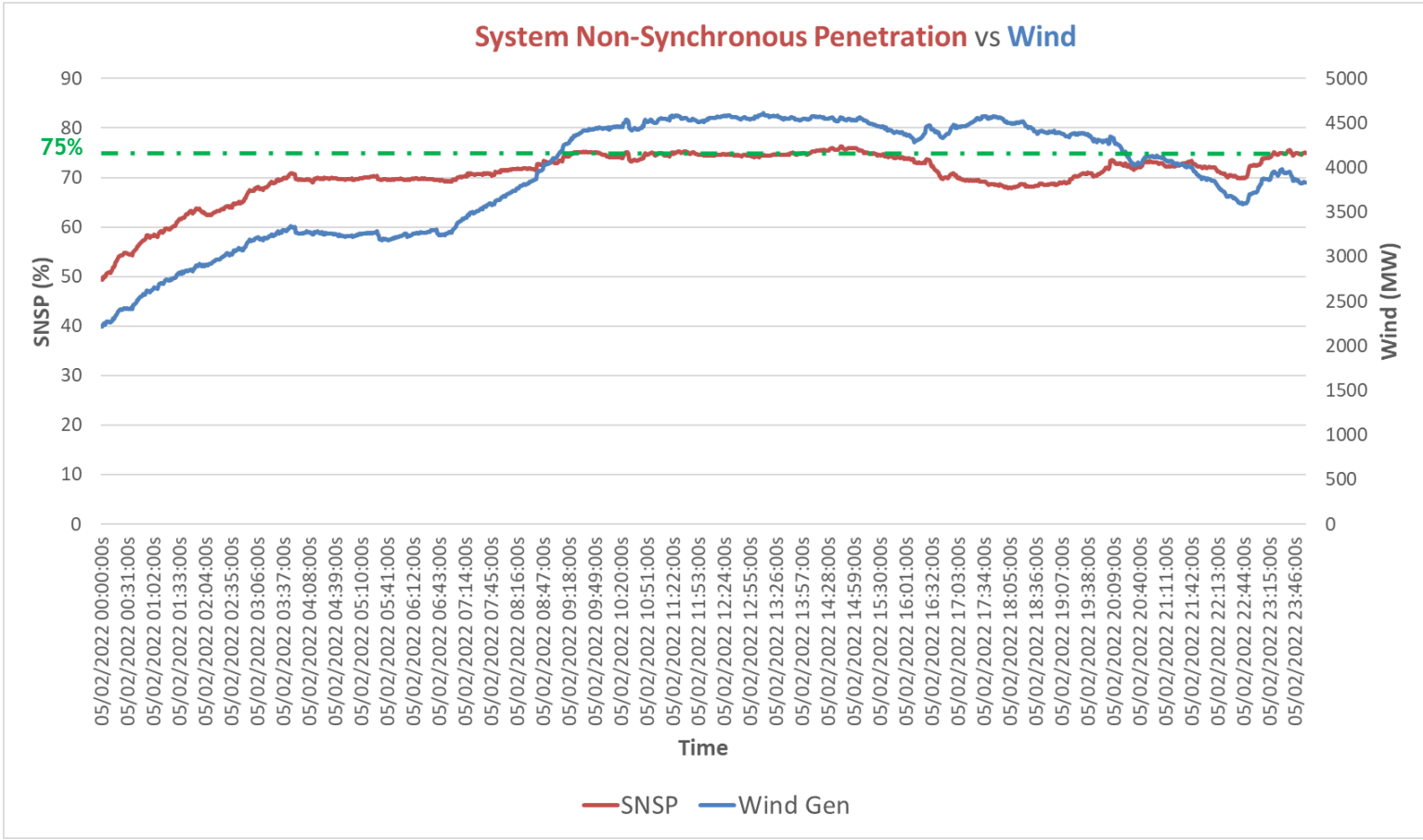
Key Challenge to date: Integration of Wind





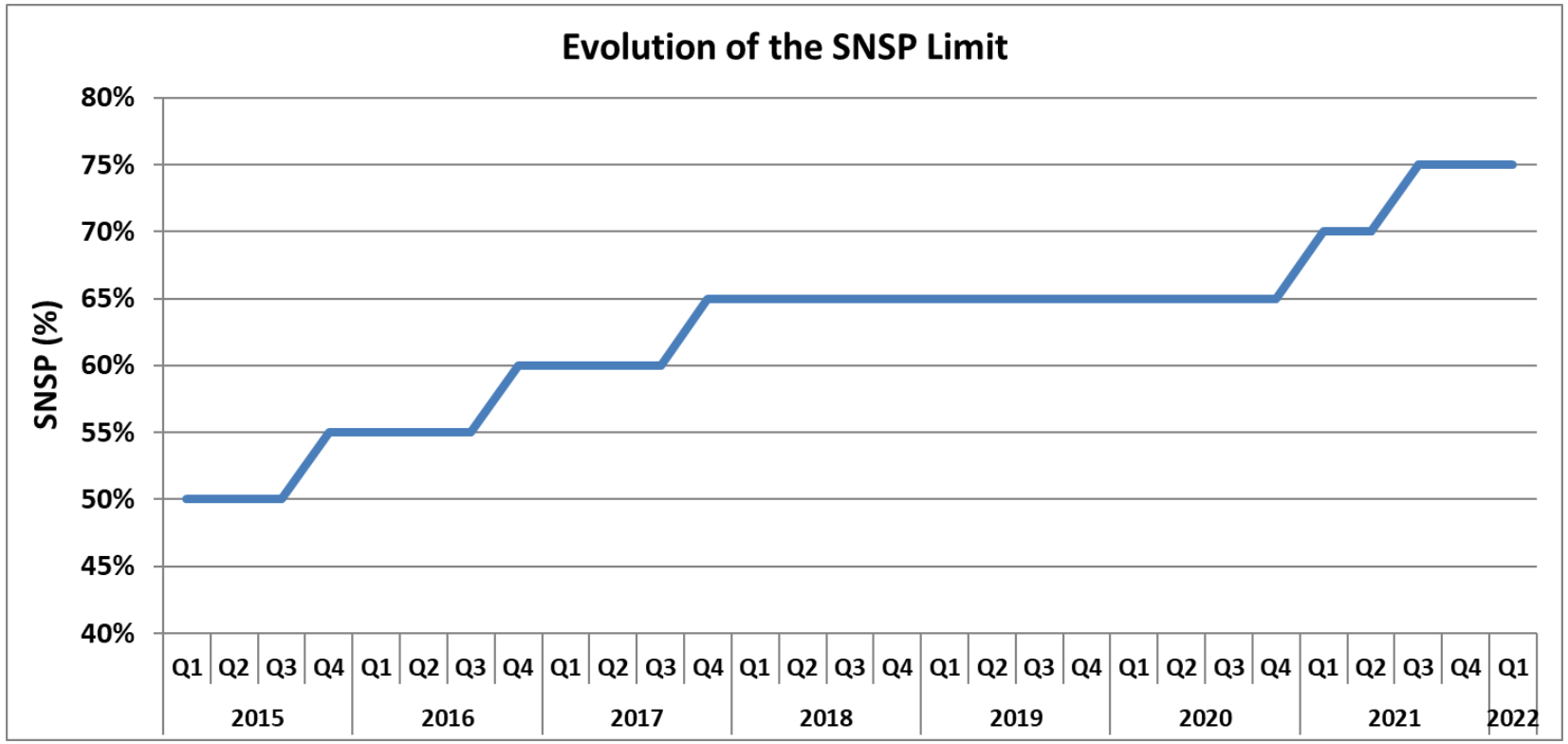
SNSP = System Non-Synchronous Penetration



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

System Non-Synchronous Penetration (SNSP)

- 75% SNSP confirmed as enduring operational policy in March 2022
- Targeting an increase in the SNSP limit to 95% by 2030



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

Enablers to 2020

Detailed Technical Analysis

2008 - All Island Grid Study
2010 - Facilitation of Renewables
2011 - Ensuring a Secure Sustainable System

Delivering a Secure Sustainable System (DS3)

- 2011 – Programme established
- Meeting the renewable policy objectives efficiently while maintaining system security
- Holistically considering technical, commercial and regulatory needs of the system
- Engaging with all industry stakeholders

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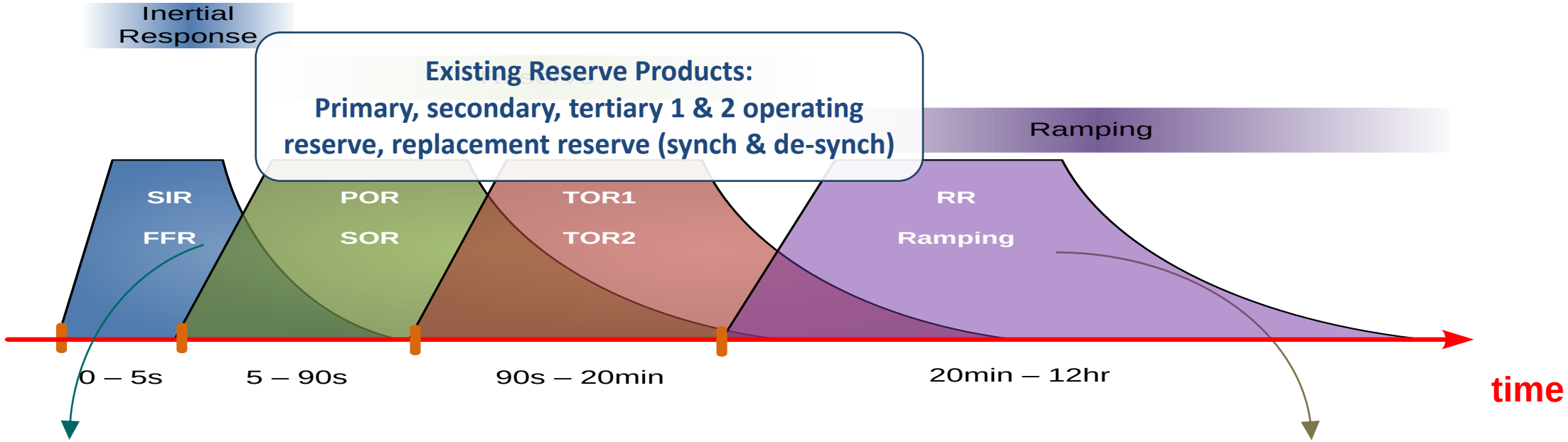
Introduction of new System Service products…

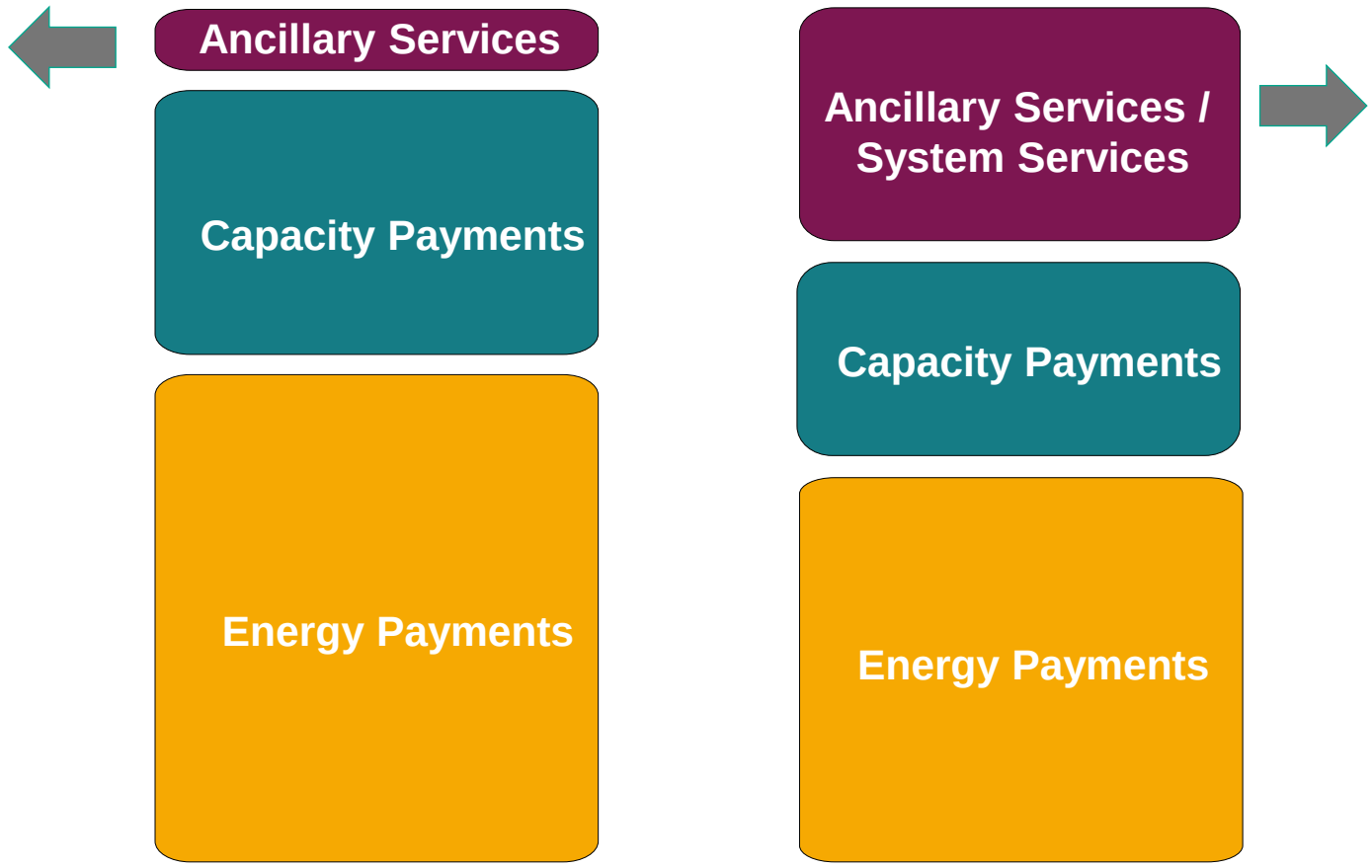


- Synchronous Inertial Response
- Fast Frequency Response

- Ramping Margin 1/3/8 hour

…but larger part of Investment Decision

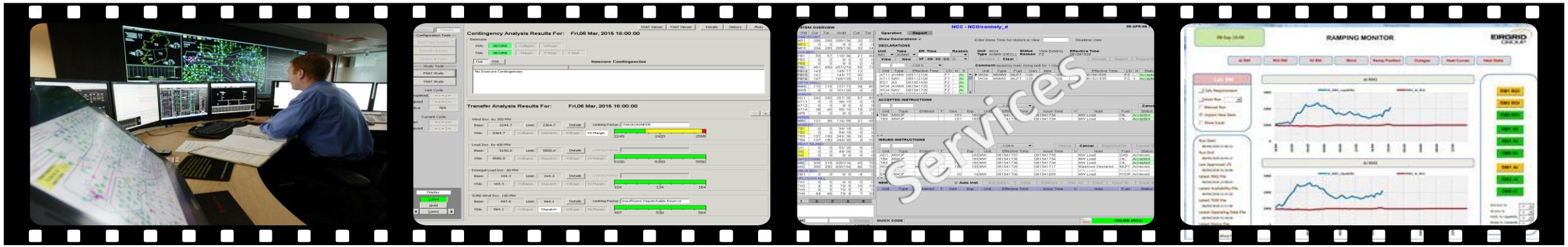
- 60 €m
- 7 Services



- 235 €m cap in 2021/22
- 14 Services

ILLUSTRATIVE

Control Centre Evolution



State-of-the-art control centre tools to facilitate the operational changes required e.g.

- Wind dispatch tool
- Wind security assessment tool
- Look-ahead security assessment tool
- Ramping tool
- Voltage trajectory tool

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System Operation Challenges Today - High RES-E

- **Producing Secure Generation Schedules**
  - Forecast Uncertainty
  - System Ramping requirements (load/wind/interconnection)
- **Ensuring System Stability – Now and Looking Ahead**
- **Voltage Management – Now and Looking Ahead**
- **Minimising Dispatch Down of Renewables**
  - Surplus renewables
  - Curtailment
  - Constraints
- **Other Challenges e.g. High Speed Shutdown**

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80% RES-E by 2030
EIRGRID
GROUP

Whole of Electricity System Challenge

Supply
(IE/NI)

- Offshore Wind (+ 5 / 0.5 GW)
- Onshore Wind (+ 4.5 / 1 GW)
- Solar (+ 5.5 / 0.3 GW)
- Microgen (+ 2.5 / 0.1 GW)
- Conventional (+2.2 / 1 GW)

Shaping Our Electricity Future

Demand (+50%)
(IE/NI)

- Large Energy Users (~1.6 GW)
- Electric Vehicles (~950 / 300 k)
- Heat Pumps (~600 / 120 k)
- Social & Economic Growth

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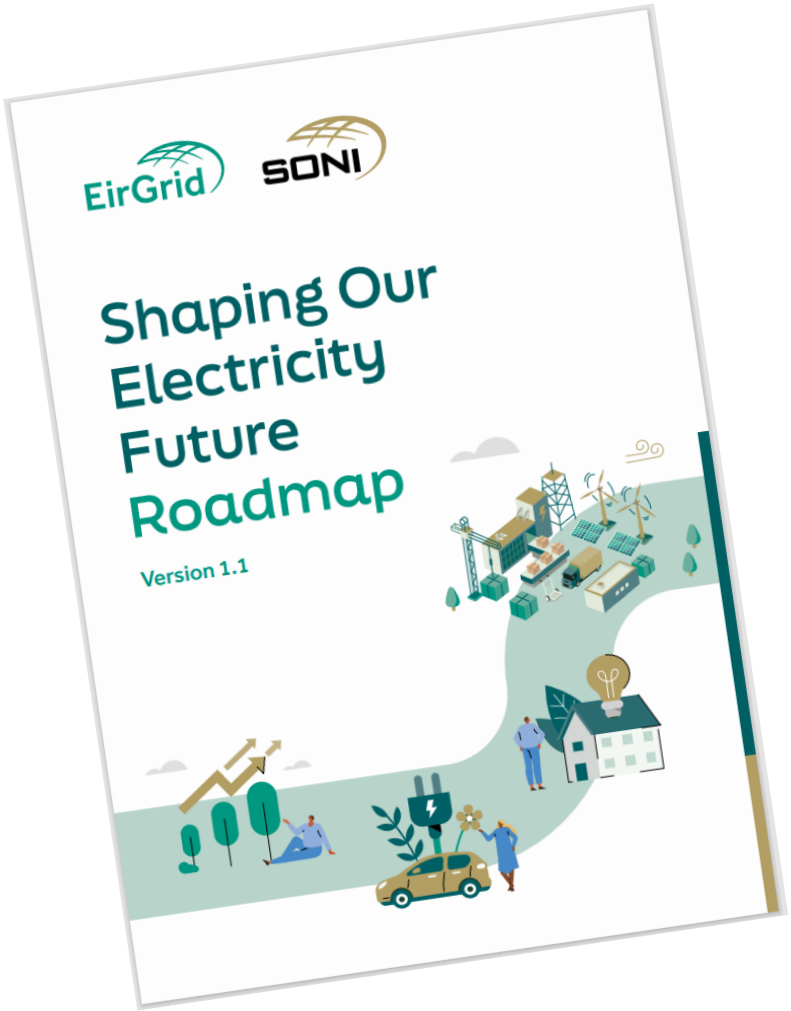
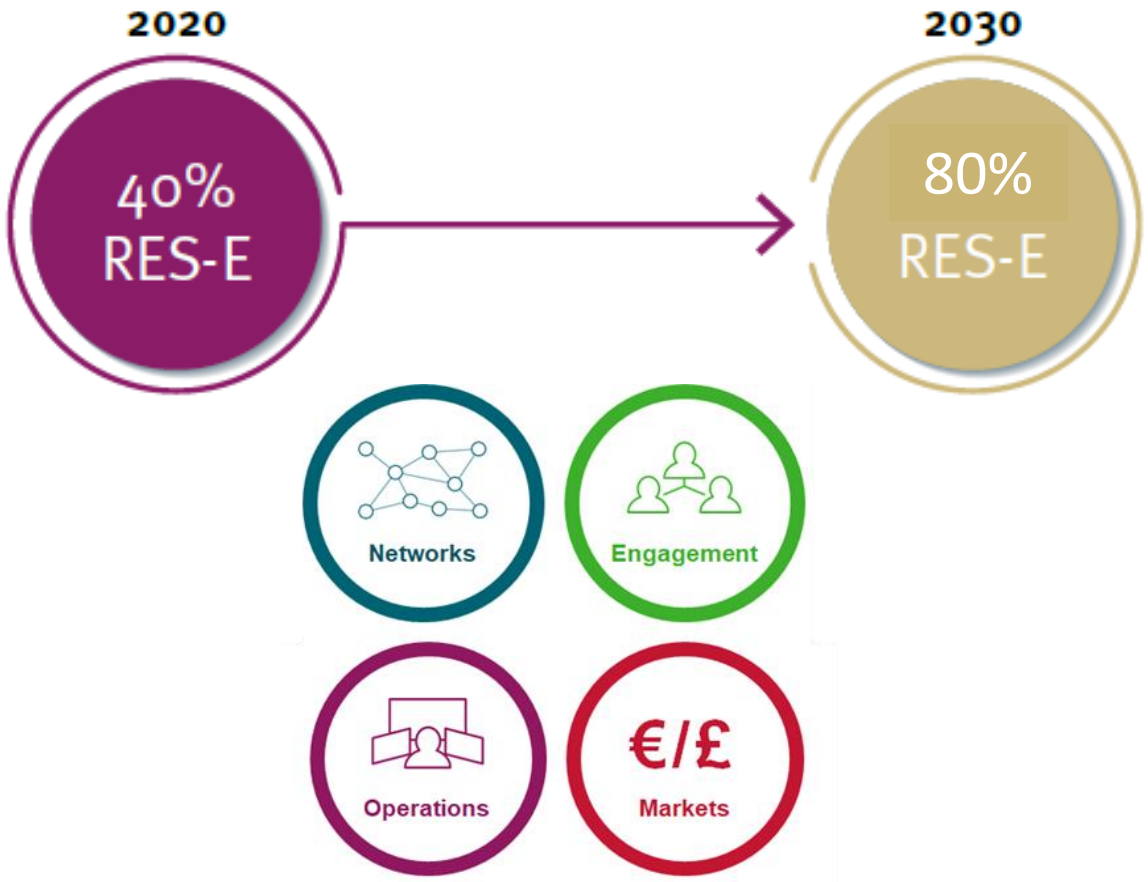
The next phase - Shaping Our Electricity Future

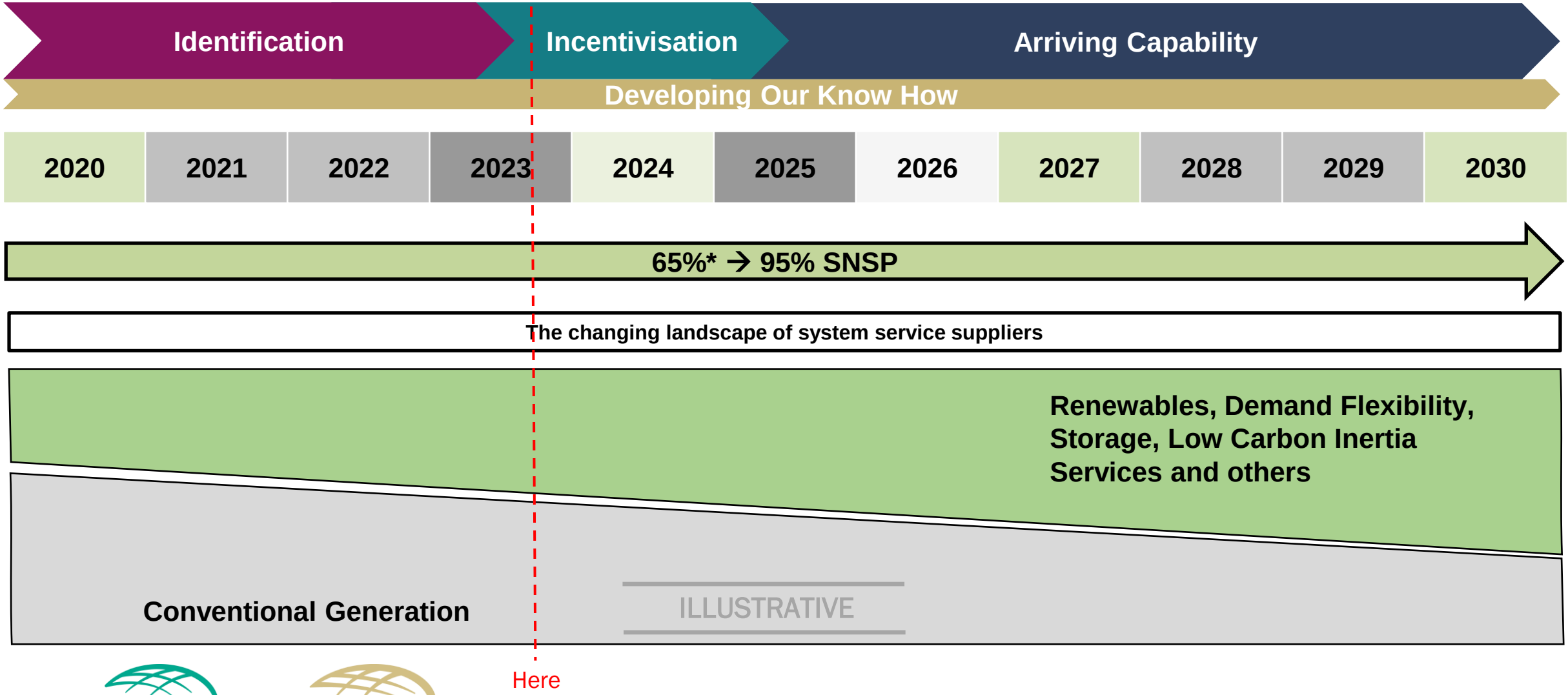




- **Shaping Our Electricity Future** is our plan to achieve government policy targets, version 1.1 published in July 2023.
- To achieve an 80% RES-E target we will need to raise **SNSP to 95%**

https://www.eirgridgroup.com/the-grid/shaping-our-electricity-f/

Operational Transition To 2030



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** SNSP has moved from 65% to 75% since 2020*

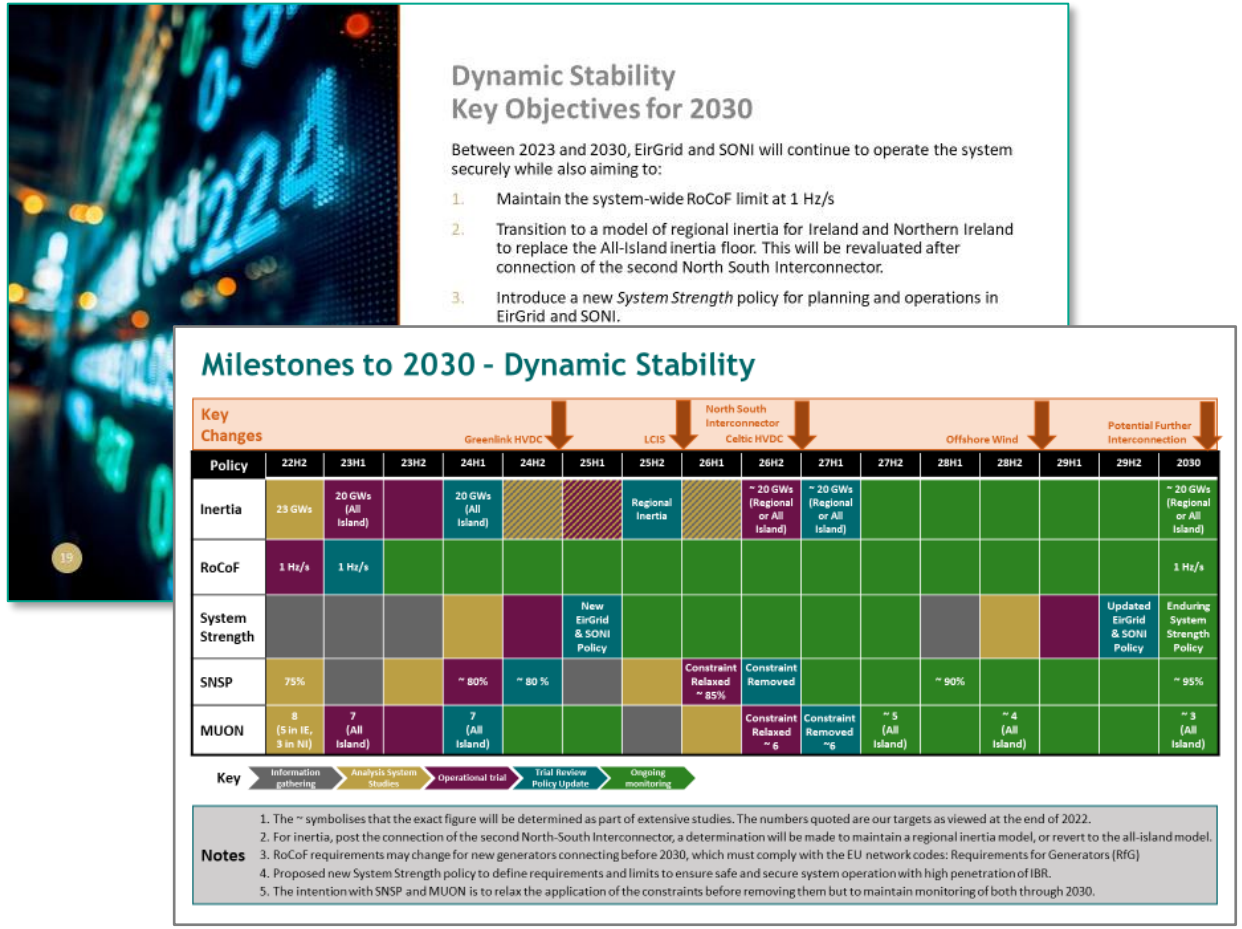
Operational Policy Roadmap 2023-2030

- Operational Policy Roadmap to 2030 published in December 2022, EirGrid website (here)

- For each main operational policy area:

  1. Dynamic Stability
  2. Reserves and Ramping, and
  3. Operational Security

We set out **key objectives** and a **milestone plan.**



Dynamic Stability
Key Objectives for 2030

Between 2023 and 2030, EirGrid and SONI will continue to operate the system securely while also aiming to:

1. Maintain the system-wide RoCoF limit at 1 Hz/s
2. Transition to a model of regional inertia for Ireland and Northern Ireland to replace the All-Island inertia floor. This will be revaluated after connection of the second North South Interconnector.
3. Introduce a new *System Strength* policy for planning and operations in EirGrid and SONI.

Milestones to 2030 - Dynamic Stability

Key Changes					Greenlink HVDC		LCIS	North South Interconnector Celtic HVDC				Offshore Wind				Potential Further Interconnection	
Policy	22H2	23H1	23H2	24H1	24H2	25H1	25H2	26H1	26H2	27H1	27H2	28H1	28H2	29H1	29H2	2030
Inertia	23 GWs	20 GWs (All Island)		20 GWs (All Island)			Regional Inertia		~ 20 GWs (Regional or All Island)	~ 20 GWs (Regional or All Island)						~ 20 GWs (Regional or All Island)
RoCoF	1 Hz/s	1 Hz/s														1 Hz/s
System Strength						New EirGrid & SONI Policy									Updated EirGrid & SONI Policy	Enduring System Strength Policy
SNSP	75%			~ 80%	~ 80 %			Constraint Relaxed ~ 85%	Constraint Removed			~ 90%				~ 95%
MUON	8 (5 in IE, 3 in NI)	7 (All Island)		7 (All Island)					Constraint Relaxed ~ 6	Constraint Removed ~6	~ 5 (All Island)		~ 4 (All Island)			~ 3 (All Island)

Key: Information gathering → Analysis System Studies → Operational trial → Trial Review Policy Update → Ongoing monitoring

Notes

1. The ~ symbolises that the exact figure will be determined as part of extensive studies. The numbers quoted are our targets as viewed at the end of 2022.
2. For inertia, post the connection of the second North-South Interconnector, a determination will be made to maintain a regional inertia model, or revert to the all-island model.
3. RoCoF requirements may change for new generators connecting before 2030, which must comply with the EU network codes: Requirements for Generators (RfG)
4. Proposed new System Strength policy to define requirements and limits to ensure safe and secure system operation with high penetration of IBR.
5. The intention with SNSP and MUON is to relax the application of the constraints before removing them but to maintain monitoring of both through 2030.

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System Operations - Evolving Operational Policy

Ultimate aim of the System Operations work programme is to evolve operational policy while maintaining security of supply → holistic approach required.

Operational Policy Workstream

Undertake operational studies and analysis and develop operational policies to facilitate the transition up to 80% RES-E by 2030.

Operational Tools Workstream

Identify and oversee the delivery of enhanced and new integrated control centre technologies and tools that are required to operate the system securely and efficiently with increasing levels of variable non-synchronous RES.

Operational Policy Change

Standards and Services Workstream

Ensure we have the right operational standards and appropriate system services frameworks to support investment in required capability. This will help ensure we achieve 80% RES-E and 95% SNSP by 2030.

Technology Enablement Workstream

Facilitate the development and integration of new technologies and innovations on the power system to enable them to operate efficiently and effectively.

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Conclusions & Takeaways

- The electricity industry is changing rapidly
- Preparing for and responding to this change is the big challenge for our sector
- EirGrid will embrace and respond to the challenge of transforming the Ireland and Northern Ireland power system for future generations

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