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Increasing the Rate of Change of Frequency limit to +/- 1 Hz/s

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Background

- Over a decade ago ambitious targets of 40% of electricity to originate from renewable generation by 2020 were set out in Ireland and Northern Ireland
- Wind generation was expected to make up the majority of this
- In 2010 EirGrid and SONI published the “Facilitation of Renewables (FoR) study
    - Wind levels up to 75% (instantaneously) were possible on the island of Ireland– but with mitigations
    - RoCoF levels of +/- 0.5 Hz/s would be a limiting factor

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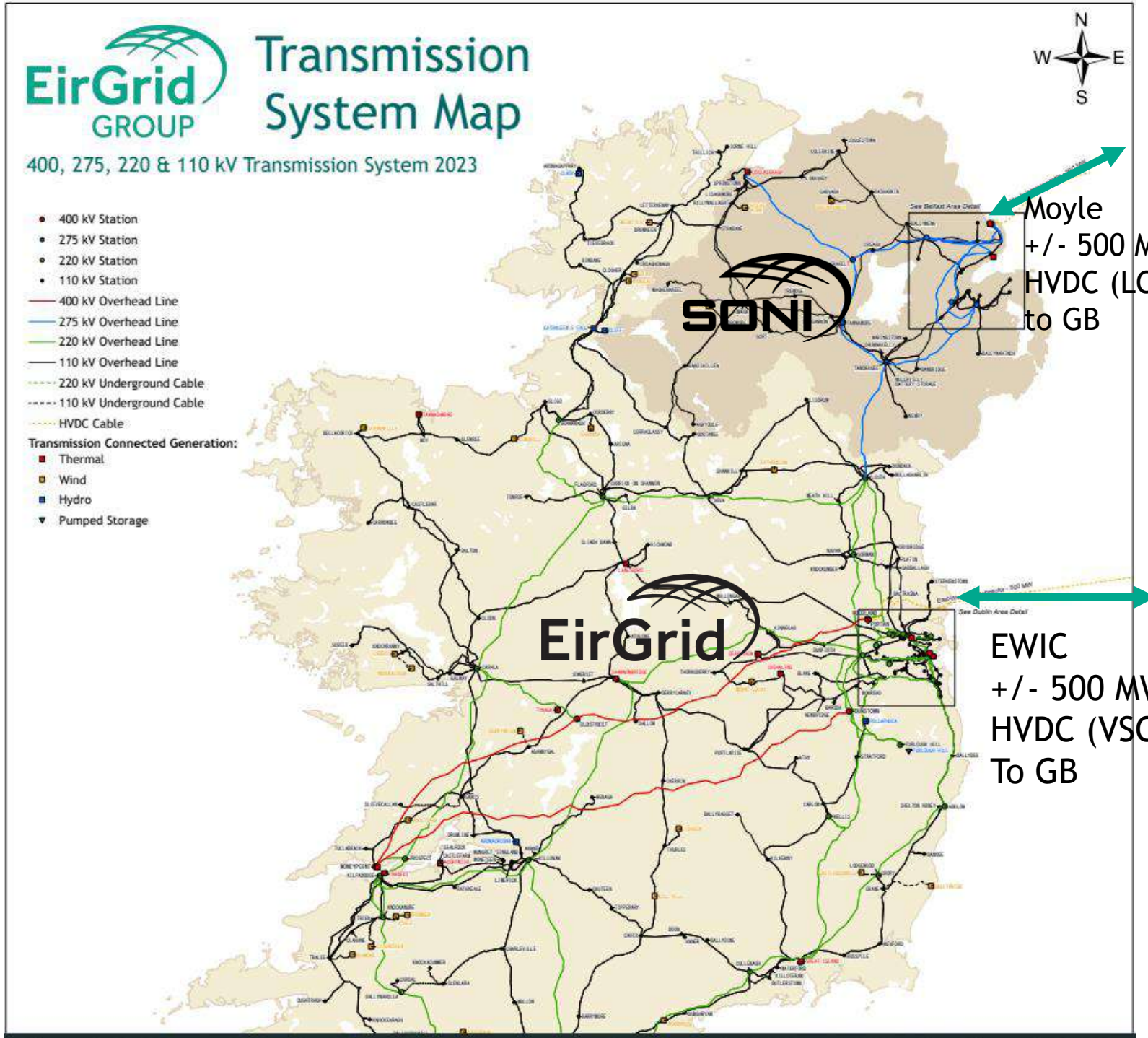
All-island System

- Ireland and Northern Ireland are one synchronous area – shared system frequency
- Double circuit 275 kV line connects the two



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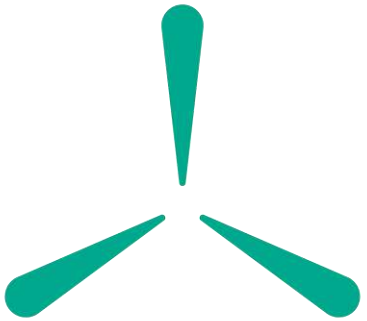
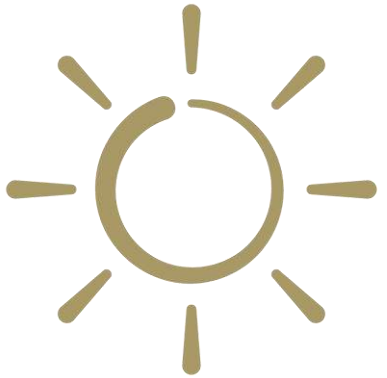
What is RoCoF?

$$RoCoF = \frac{f * \Delta P}{2(Ksys - Klost)}$$



- System Frequency is set to 50 Hz
- Disturbances in the system can cause the frequency to change
- loss of a generator can cause frequency to drop
- loss of demand can cause frequency to rise
- The rate of this change is known as **RoCoF**
- The prospective system RoCoF after a disturbance is calculated in real time
  - based on the online inertia and the size of the maximum infeed/outfeed.
  - The value is monitored in our control rooms to ensure adherence to the operational limit.
- Higher levels of renewables replacing conventional synchronous generation lead to reduced system inertia and increased potential RoCoF.
- Each device on the system has a RoCoF setting – if that setting is breached the device can trip in sympathy resulting in the disturbance propagating -System stability risk!



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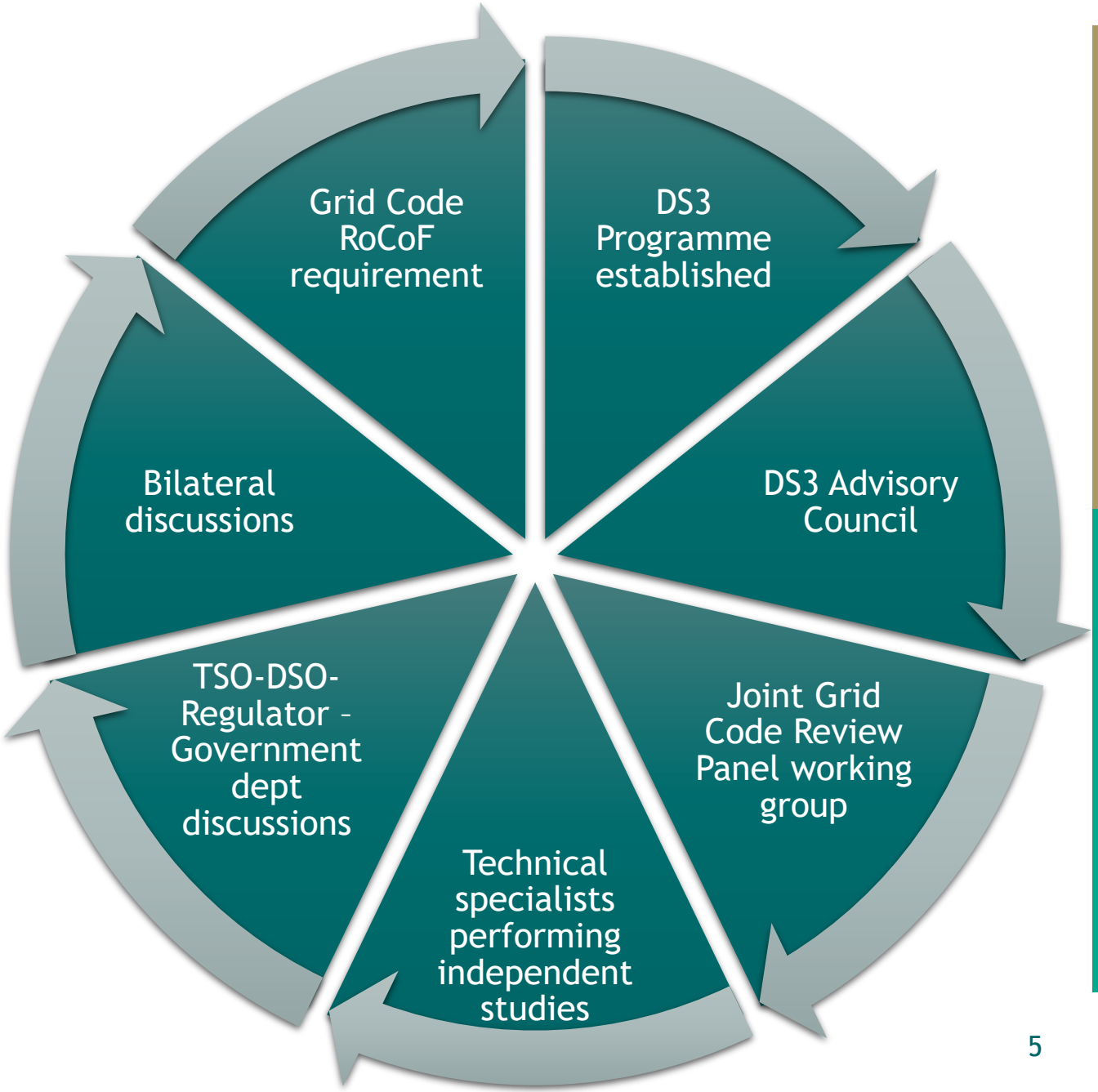
Multi-faceted programme of work

RoCoF



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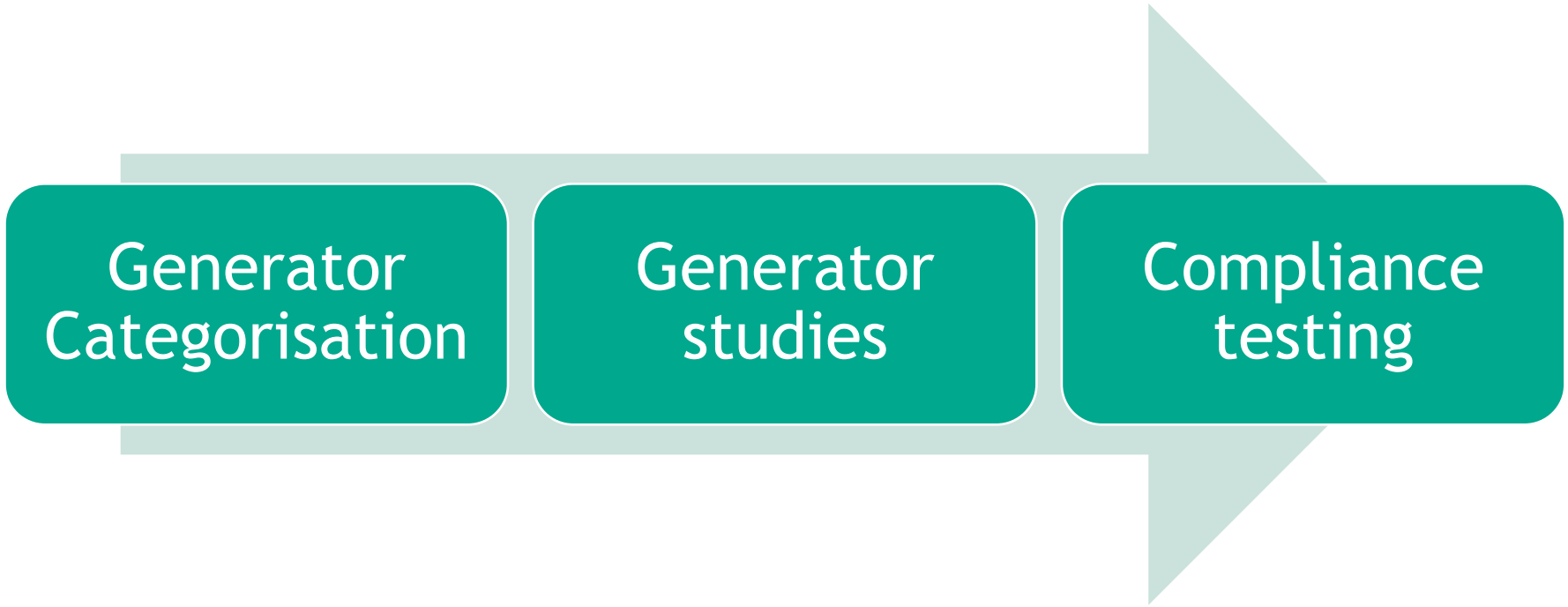
Generator Implementation Project



Distribution System Impacts

Ireland:

- Prior to this work, RoCoF, with a typical setting of 0.4 Hz/s was used for anti-islanding interface protection on practically all distribution connected generators in Ireland.
- The vast majority of these relays are on the customers side. All of these had to be changed to a 1 Hz/s setting. This represented an enormous logistical challenge, spanning some 800 sites.
- Ultimately after many years of determined effort and engagement, all bar 19 MW of the legacy generation was successfully changed.

Northern Ireland:

- Challenging programme given the large volume of embedded generation in NI and tight timelines
- Completion of the RoCoF Loss of Mains Strathclyde studies to verify that NIEN could de-sensitise the RoCoF settings, whilst still maintaining the risk of Islanding at an acceptable level, required significant engineering resource and the provision of a huge amount of system data
- The System Operator had limited control over the timing of the changes as the third party generation owner was responsible for funding and making the required changes. Delivering on the programme timelines required significant engagement with the generation owners to explain the need for change.

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RoCoF operational trial to new Operational Policy

- Pre-trial studies
- Advent of new Look-Ahead security Assessment Tool
- In-trial analysis
- SNSP increases from 65% to 70% to 75%
- End of trial analysis
- Trial completion & closure
- New operational policy +/- 1 Hz/s (May 2023)
- Ongoing monitoring and compliance

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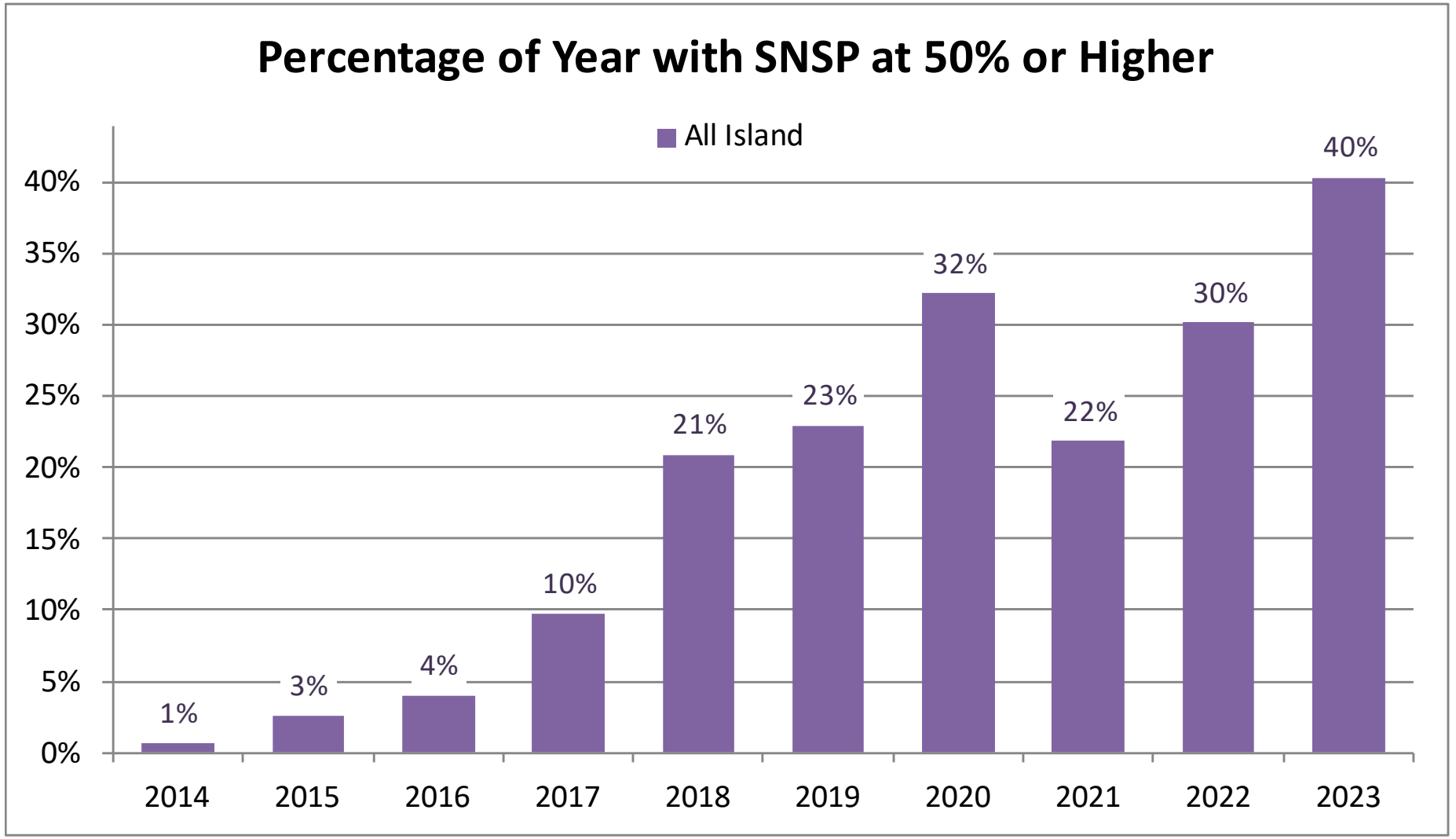
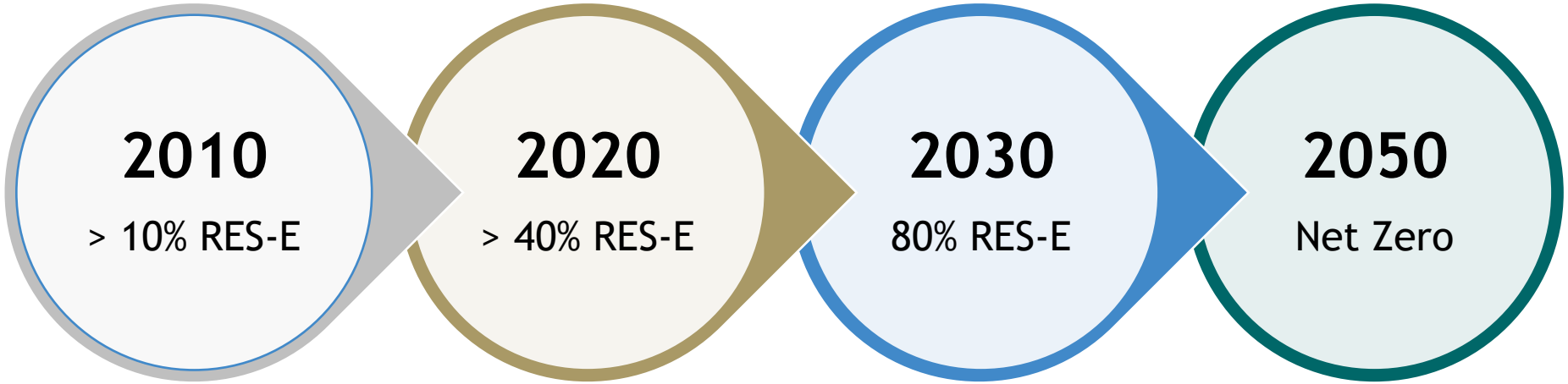

Percentage of Year with SNSP at 50% or Higher
All Island
40%
35%
30%
25%
20%
15%
10%
5%
0%
1%
3%
4%
10%
21%
23%
32%
22%
30%
40%
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

What's Changing?

(RES-E – Renewable Energy Sources – Electricity)



- Clear decarbonisation agenda backed up by legislation
- Small amount of hydro and solar – 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 in last 5 years

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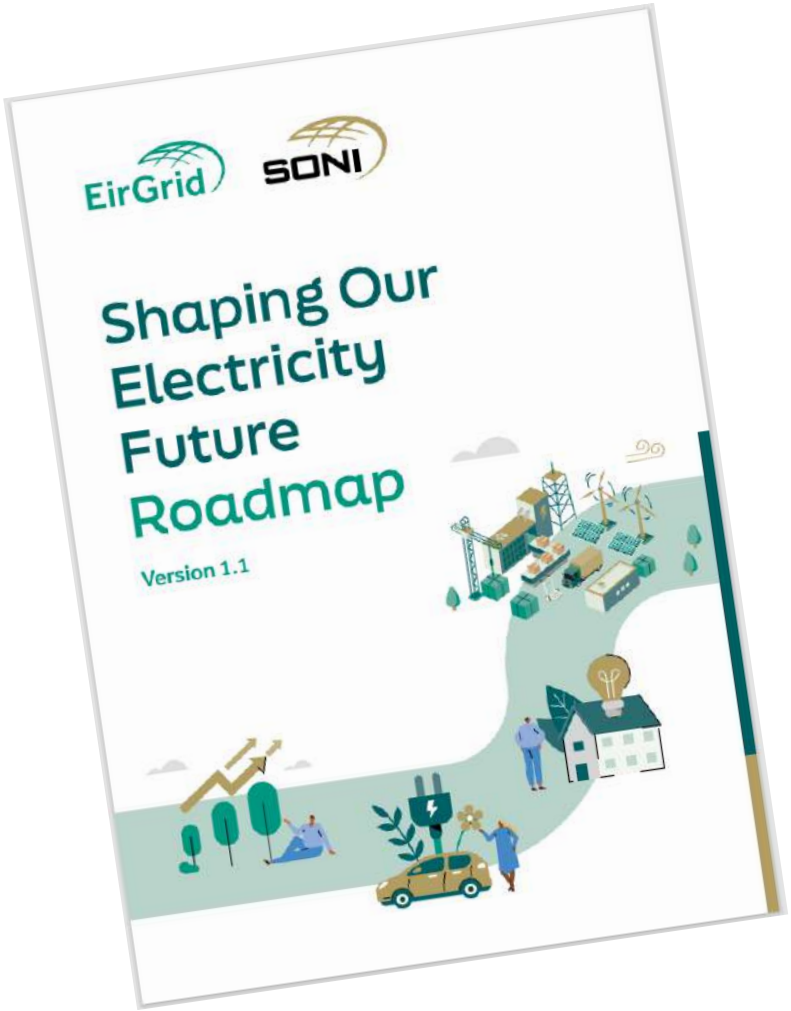
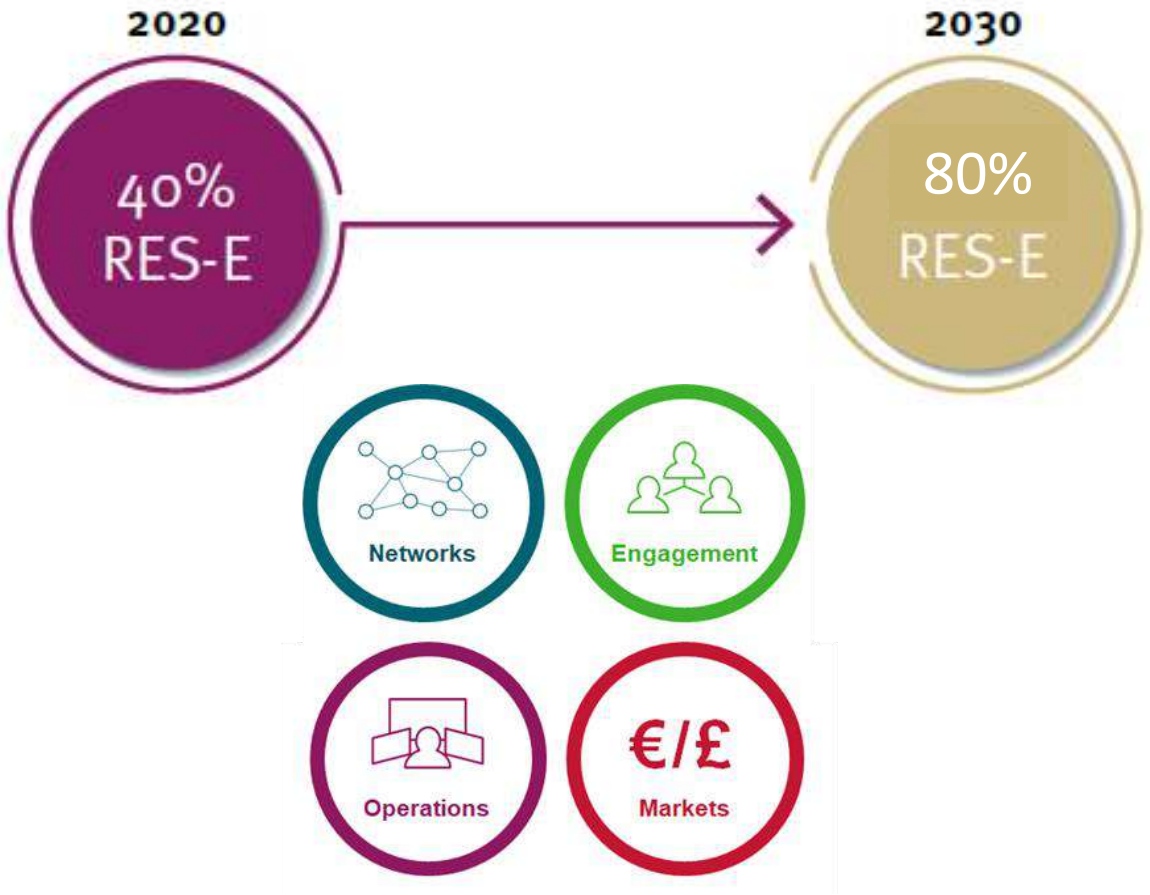
The next phase - Shaping Our Electricity Future





- **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%**

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

Operational Policy Roadmap 2023-2030

- Operational Policy Roadmap to 2030 published in December 2022, EirGrid website (here)
- Three main policy areas: Dynamic Stability, Reserves & Ramping and Operational Security

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

Thank you