DS3 Advisory Council Meeting 30

Tuesday 29 June 2021 @ 10:00am – 1:00pm (IST)

via MS Teams

Agenda Part 1

Chair: Eoin Kennedy

Topic	Time	Speaker
Introduction & Welcome	10:00	Liam Ryan, EirGrid (10 min)
Industry Presentation 1 • **Endgame – A zero-carbon electricity plan for Ireland**	10:10	Noel Cunniffe, Wind Energy Ireland (25 min)
System Data Summary	10:35	Emma Fagan, EirGrid (5 min)
Summary of 70% SNSP Trial Outcomes	10:40	Kenneth Conway, EirGrid (10 min)
75% SNSP Studies	10:50	Mostafa Bakhtvar, Ismail Ibrahim, EirGrid (20 min)
DS3 Programme Updates • **DS3 System Services Procurement** • **Qualification Trial Process (QTP)** • **Control Centre Tools (CCT)** • **Operational Implementation** • **Nodal Controllers** • **DS3 Milestone Plan** • **FlexTech**	11:10	Emma Fagan, Eoin Kennedy, EirGrid (30 min)
Industry Presentation 2 • **Statkraft – Topics for Discussion**	11:40	Peter Harte, Statkraft (25 min)

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Agenda Part 2

Topic	Time	Speaker
BREAK	12:05	ALL (10 min)
2030 Studies Outcome	12:15	Arijit Bagchi, EirGrid (10 min)
Shaping Our Electricity Future	12:25	Eoin Kennedy, EirGrid (10 min)
Control Centre of the Future	12:35	Simon Tweed, EirGrid (10 min)
AOB	12:45	All (5 min)
Discussion / Questions	12:50	All (5 min)
Closing remarks and comments	12:55	Eoin Kennedy, EirGrid (5 min)

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Previous Actions

Actions	Owner	Status
TSOs to present to market participants on the Ramping Margin Tool and how the ramping constraints are formulated.	TSOs	TSO has confirmation of a Ramping Margin Tool presentation at the next MOUG

Endgame

A zero-carbon electricity plan for Ireland

Noel Cunniffe, DS3 Advisory Council

windenergyireland.com

Introducing…
Endgame - A zero-carbon electricity plan for Ireland

We have brought the landmark '70 by 30' study into 2021 by accounting for market and policy developments

By 2030...

Less than

2 million tonnes CO_2

from 9 mtCO_2 today

Utilising

Zero carbon system services

Unlocking delivery of

85% RES-E

By 2030…

Less than

2 million tonnes CO_2

from 9 $mtCO_2$ today

Utilising

Zero carbon system services

Unlocking delivery of

85% RES-E

We show that this target can be achieved at a **lower cost to the end consumer** in Ireland, compared to delivery of the less ambitious '70 by 30' target

We further show that a zero-carbon power system is *possible* by 2030…

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A zero carbon power system is an

Achievable target in the early 2030s

A viable pathway requires investment in technologies new to Ireland

Long duration storage and green hydrogen

And the implementation of a

€100/tCO_2 carbon price floor

Baringa

Endgame - A zero-carbon electricity plan for Ireland

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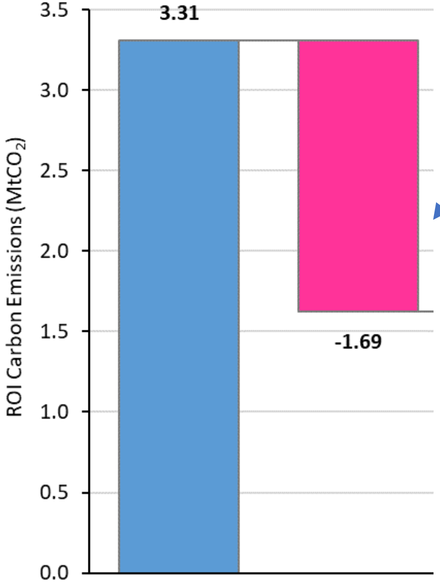
Power Sector CO_2 Emission Savings in ROI (2030)



	70 by 30 ($3.3 MtCO_2$)	Less than 2 $MtCO_2$
RES-E	70%	85%
PfG Capacity	50%	67%
Residual CO_2	3.31 Mt	1.62 Mt

Zero carbon system services, allowing 100% SNSP, 0 MW Min Generation.
End consumer savings of over €180m per annum.

Technology	100% Capacity
Onshore Wind	8.2 GW
Offshore Wind	5 GW
Solar PV	5 GW

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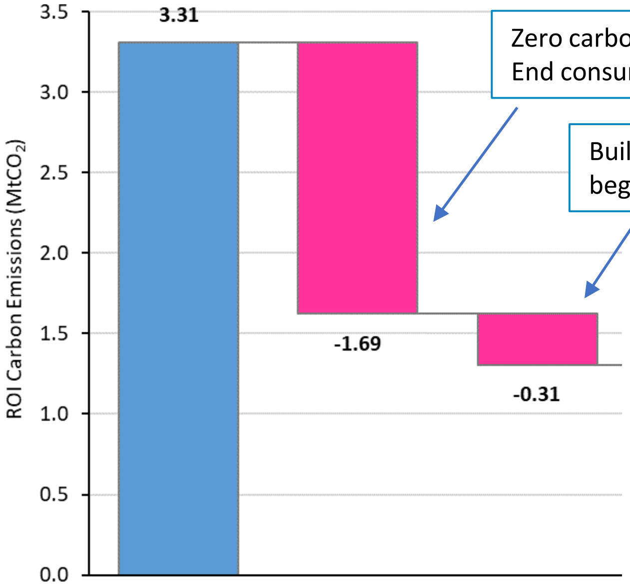
Endgame - A zero-carbon electricity plan for Ireland

Power Sector CO_2 Emission Savings in ROI (2030)



	70 by 30 ($3.3\ MtCO_2$)	Less than 2 $MtCO_2$	80% of PfG Capacities
RES-E	70%	85%	94%
PfG Capacity	50%	67%	80%
Residual CO_2	3.31 Mt	1.62 Mt	1.31 Mt

Zero carbon system services, allowing 100% SNSP, 0 MW Min Generation. End consumer savings of over €180m per annum.

Building more renewable capacity reduces CO_2 emissions further, but begins to create surplus generation that is curtailed and wasted.

Technology	100% Capacity
Onshore Wind	8.2 GW
Offshore Wind	5 GW
Solar PV	5 GW

Endgame - A zero-carbon electricity plan for Ireland

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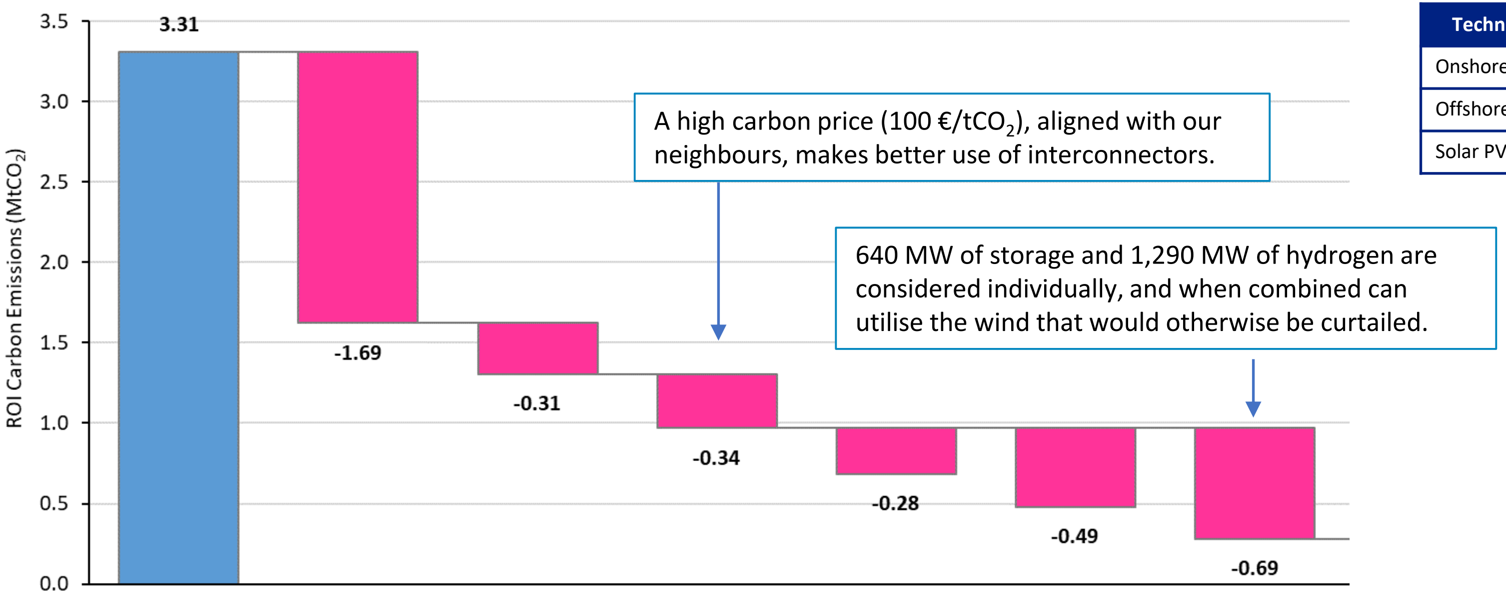
Power Sector CO_2 Emission Savings in ROI (2030)



	70 by 30 ($3.3\ MtCO_2$)	Less than 2 $MtCO_2$	80% of PfG Capacities	Same CO_2 price as non-ETS	Long-Duration Storage	Green Hydrogen	Storage & Hydrogen
RES-E	70%	85%	94%	94%	97%	89%	90%
PfG Capacity	50%	67%	80%	80%	80%	80%	80%
Residual CO_2	3.31 Mt	1.62 Mt	1.31 Mt	0.97 Mt	0.68 Mt	0.48 Mt	0.28 Mt

Technology	100% Capacity
Onshore Wind	8.2 GW
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Endgame - A zero-carbon electricity plan for Ireland

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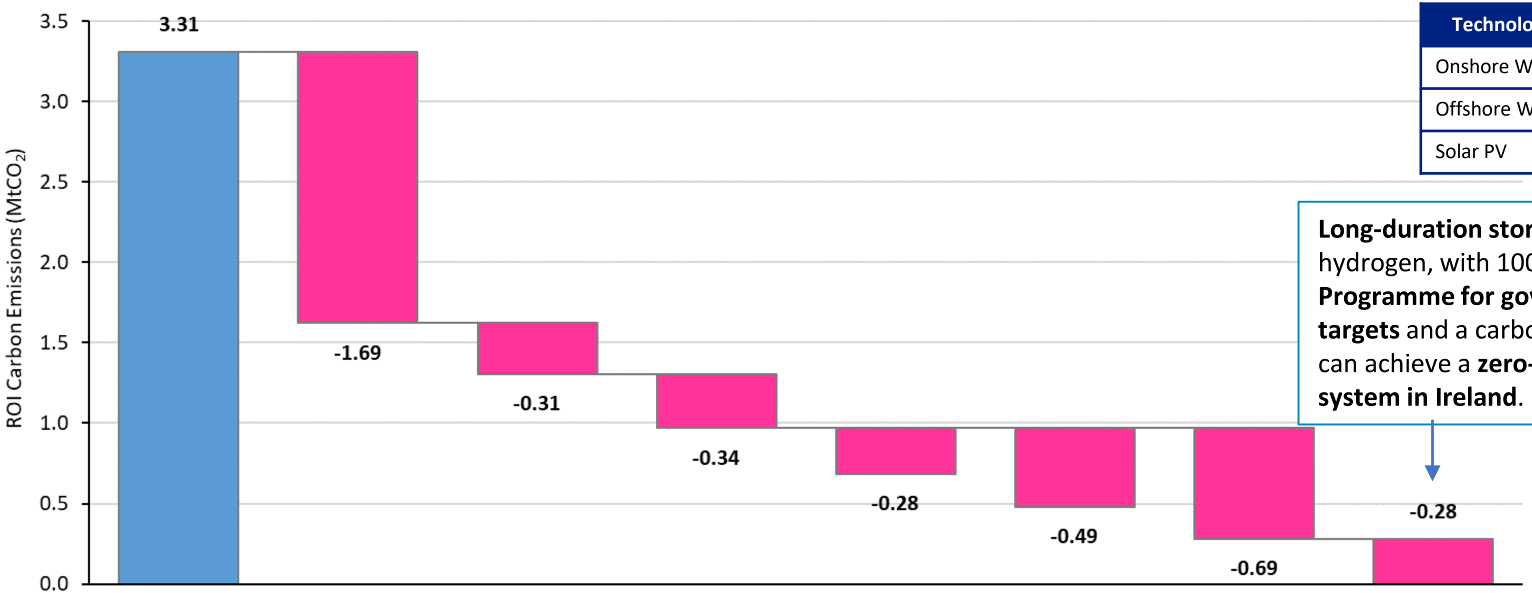
Power Sector CO_2 Emission Savings in ROI (2030)



Technology	100% Capacity
Onshore Wind	8.2 GW
Offshore Wind	5 GW
Solar PV	5 GW

Long-duration storage, green hydrogen, with 100% of the **Programme for government targets** and a carbon price floor can achieve a **zero-carbon power system in Ireland**.

	70 by 30 (3.3 $MtCO_2$)	Less than 2 $MtCO_2$	80% of PfG Capacities	Same CO_2 price as non-ETS	Long-Duration Storage	Green Hydrogen	Storage & Hydrogen	Zero Carbon (100% of PfG)
RES-E	70%	85%	94%	94%	97%	89%	90%	101%
PfG Capacity	50%	67%	80%	80%	80%	80%	80%	100%
Residual CO_2	3.31 Mt	1.62 Mt	1.31 Mt	0.97 Mt	0.68 Mt	0.48 Mt	0.28 Mt	0 Mt

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Phase 1:
Less than
2 $MtCO_2$

Phase 2:
Zero carbon
power sector

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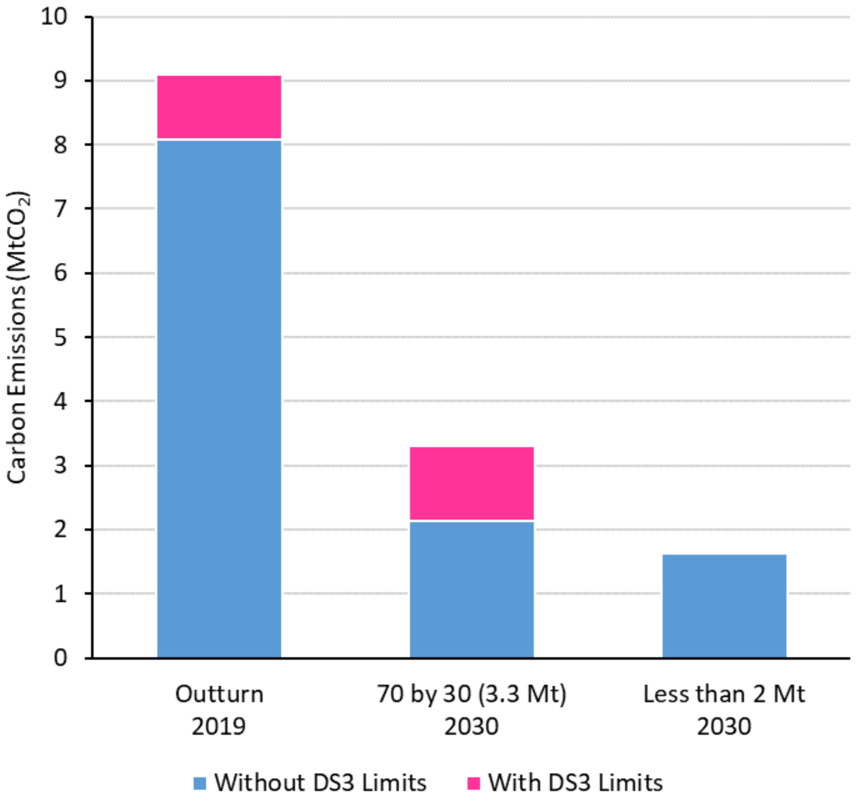
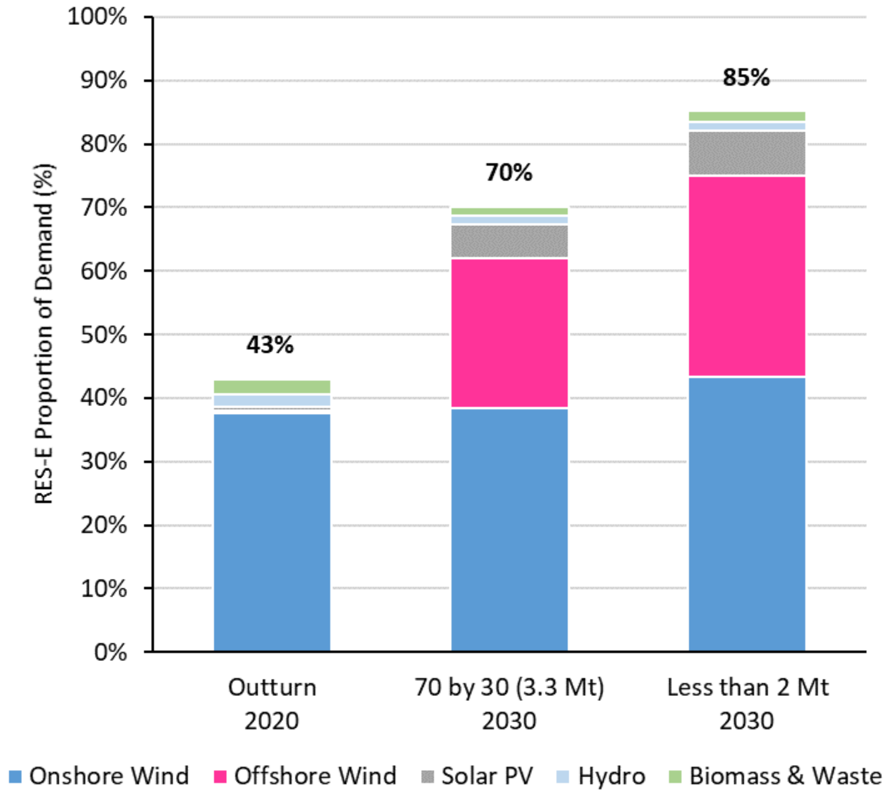
Zero-carbon system services are key to reducing emissions and integrating renewables





In the 'Less than 2 MtCO2' scenario, key operational limits are resolved by zero-carbon solutions

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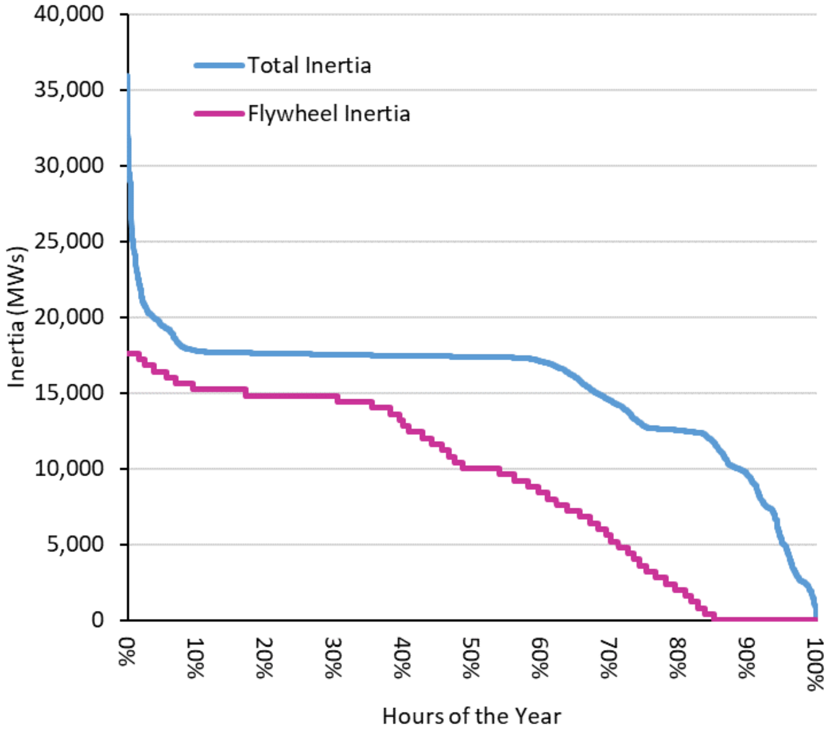
I-SEM Inertia provided by Flywheels and All Generators



SNSP of 100% is achieved

RoCoF limit of 1 Hz/s

Min Gen (system stability) constraints are relaxed in both ROI and NI

Local generation constraints (Dublin, South, Moneypoint, North West) met by grid reinforcements / voltage stability assets

17,500 MWs inertia met by dedicated synchronous condensers fitted with flywheels

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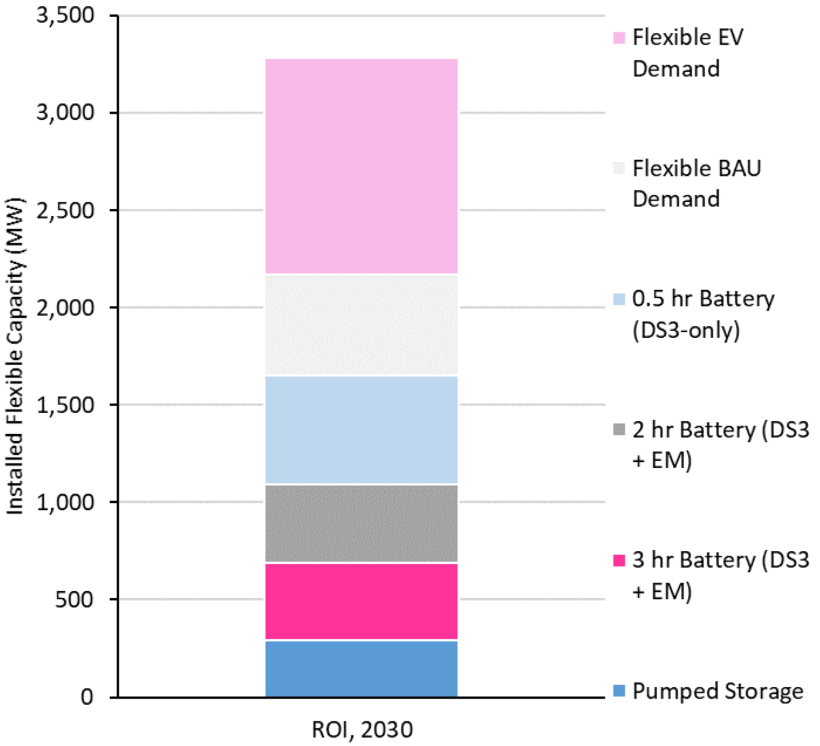
Energy storage and demand-side flexibility enable deployment of Programme for Government RES build

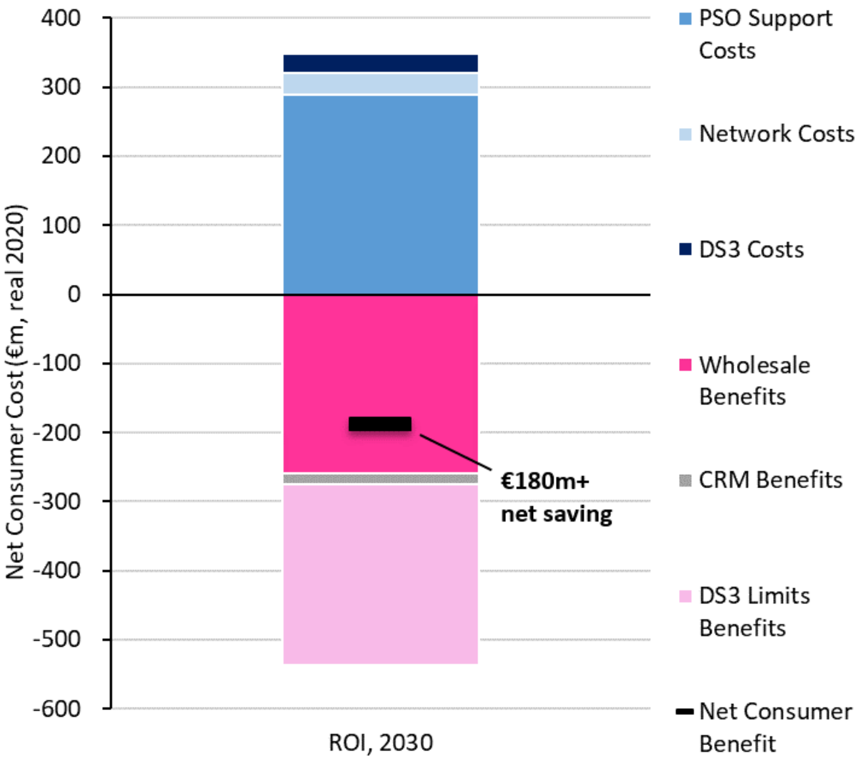


We have modelled over **3 GW of storage** and **demand-side flexibility** capacity in Ireland in our scenarios

Wholesale market response reduces oversupply

Provision of DS3 services reduces curtailment

Achieving 'Less than 2 MtCO2' saves end consumers over €180m in 2030 vs '70 by 30'



Relaxation of operational limits due to zero-carbon system services removes plant re-dispatch costs

This is a major contributor to end consumer savings

Phase 1:
Less than
2 $MtCO_2$

Phase 2:
Zero carbon
power sector

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Storage, Green Hydrogen & Carbon Pricing are key to achieving a zero-carbon power system

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Power Sector CO_2 Emission Savings in ROI (2030)

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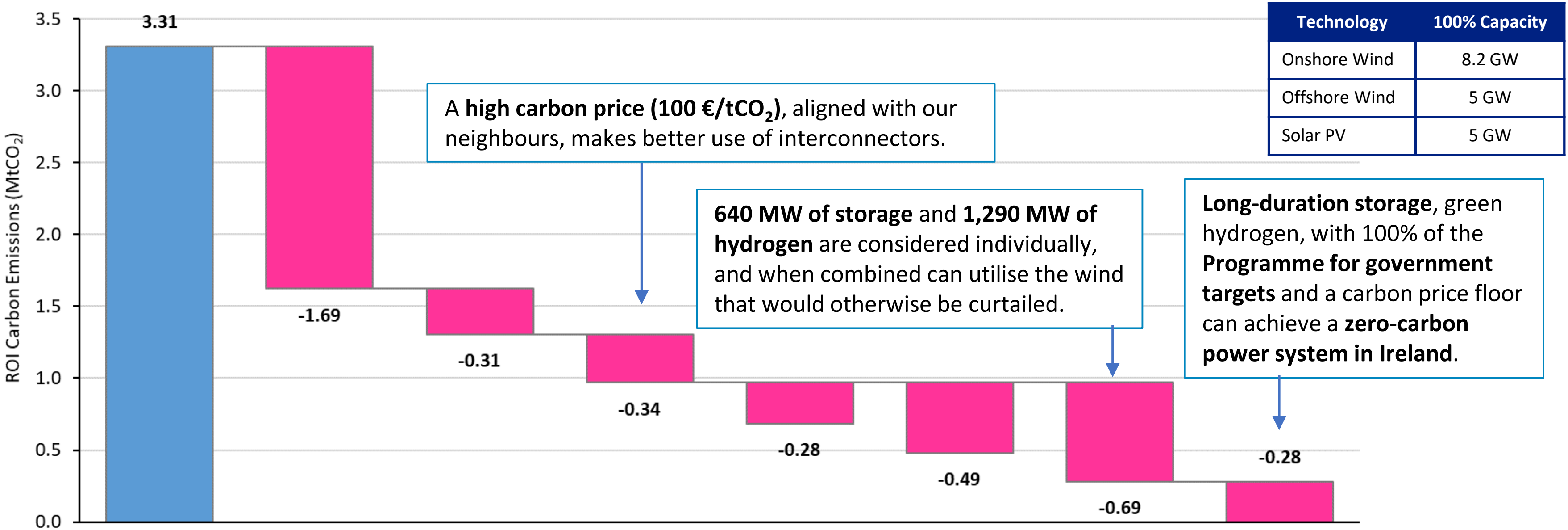

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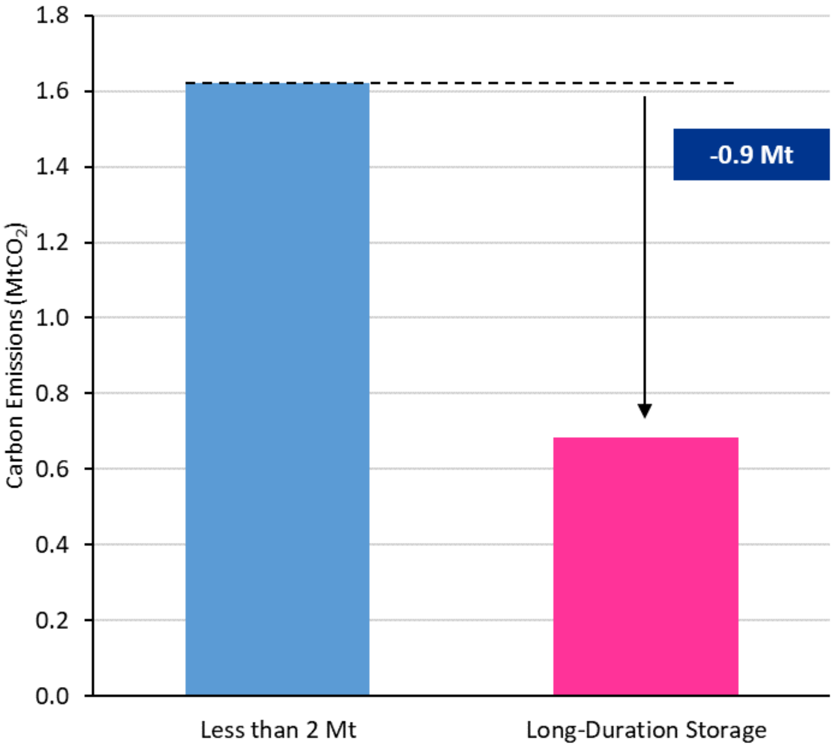
640 MW of 100-hour storage combined with a carbon price floor results in a saving of almost 1 $MtCO_2$



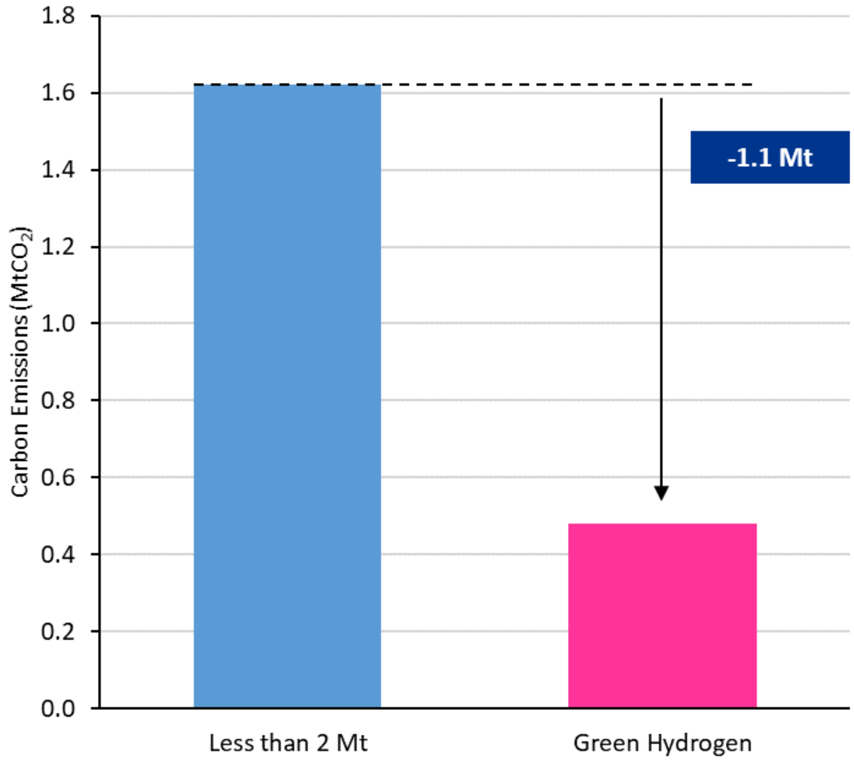
We consider 640 MW of 60% efficient long-duration storage – representative of technologies such as:

Pumped hydro	Liquid salt
Liquid air	Compressed air
Gravitational potential	Novel battery compositions

Storage flexibly absorbs excess renewable generation, then displaces gas-fired generation

Deployed in the right locations it can also alleviate network constraints

1.3 GW of hydrogen electrolysers combined with a carbon price floor results in a saving of almost 1.1 $MtCO_2$



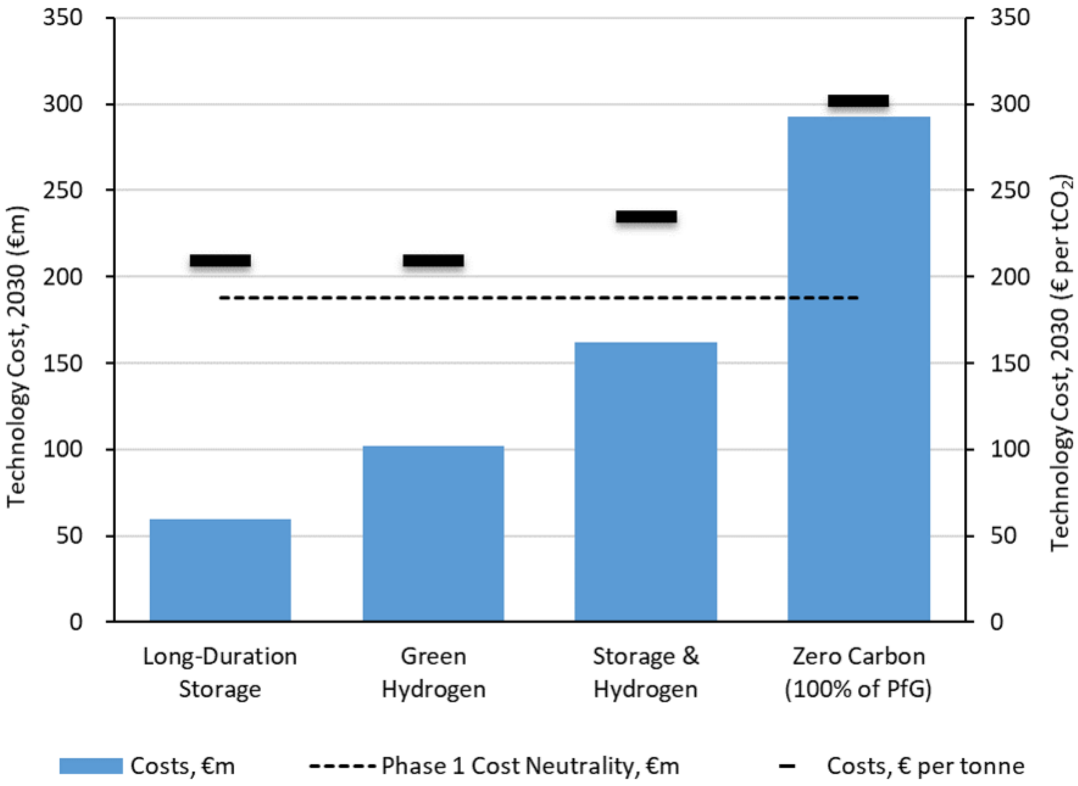
Electrolysers produce hydrogen when power prices are low

Hydrogen is utilised for generation in 900 MW of retrofitted gas-fired power stations in ROI

These are dispatched during peak power prices, displacing gas-fired generation

Deployed in the right locations it can also alleviate network constraints

Technology costs for zero carbon are comparable to the net benefit from implementing ‘Less than 2 $MtCO_2$’



Reducing power sector emissions in Ireland to less than 2 $MtCO_2$ is very achievable by 2030…

Less than

2 million tonnes CO_2

from 9 $mtCO_2$ today

Through delivery of

85% RES-E

Saving end consumers

Over €180m in 2030

versus a '70 by 30' target

Reducing power sector emissions in Ireland to less than 2 $MtCO_2$ is very achievable by 2030...

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Less than

2 million tonnes CO_2

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Through delivery of

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Saving end consumers

Over €180m in 2030

versus a '70 by 30' target

The electricity grid must be strengthened over the next ten years with new grid infrastructure, completion of critical projects, delivery of the Celtic and Greenlink Interconnectors and investment in the DS3 programme.

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… and a zero-carbon power system is an achievable target in the early 2030s

A zero carbon power system is an

Achievable target in the early 2030s

A viable pathway requires investment in technologies new to Ireland

Long duration storage and green hydrogen

And the implementation of a

€100/tCO_2 carbon price floor

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windenergyireland.com

System Data Summary

Emma Fagan

EIRGRID GROUP

All Island 2020 Summary

- All Island **RES-E of 42%** (percentage of demand) was achieved during 2020 with 36% from wind generation.
- At times, wind generation provided up to **89%** of All Island demand with the maximum output of **4,232 MW** in February 2020.
- Average monthly wind generation of **1,560 MW** across January to December 2020
- The Power System was operated between 25% and 50% SNSP for 39% of the time, and above 50% SNSP for **32%** of the time, an increase of 9% from 2019.
- In 2020, **1,741** GWh of additional wind energy was generated compared to the same reporting period in 2019.
- Total installed Wind Capacity All Island was **5,576** MW – an increase of 180 MW from 2019.
- Total System Demand 36,835 GWh – a reduction of 143 GWh from 2019.
- System Peak Demand Level 6,894 MW in December 2020.

NB: Data is based on average quarter-hourly SCADA data

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All Island 2021 Summary

- Average wind generation of **1,546 MW** across January to May 2021.

- At times, wind generation provided up to **95%** of All Island demand with the maximum output of **4,472 MW** (15 min average) and **4,489 MW** (1 min average) in February 2021.

- The Power System was operated between 25% and 50% SNSP for **46%** of the time, and above 50% SNSP for **29%** of the time.

NB: Data is based on average quarter-hourly SCADA data

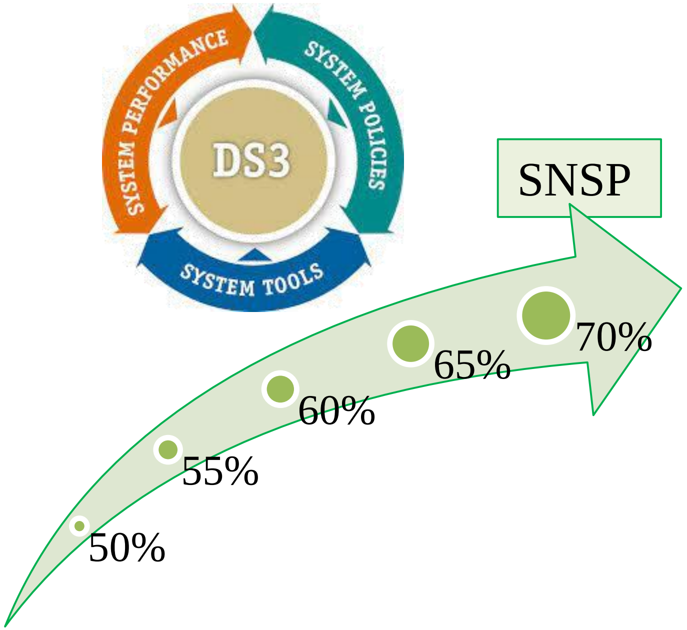
70% SNSP Trial Outcomes

Kenneth Conway

Background

- System Non-Synchronous Penetration

$$\frac{\text{Non Synchronous Generation} + \text{Net Interconnector Imports}}{\text{Demand} + \text{Net Interconnector Exports}} \times 100$$



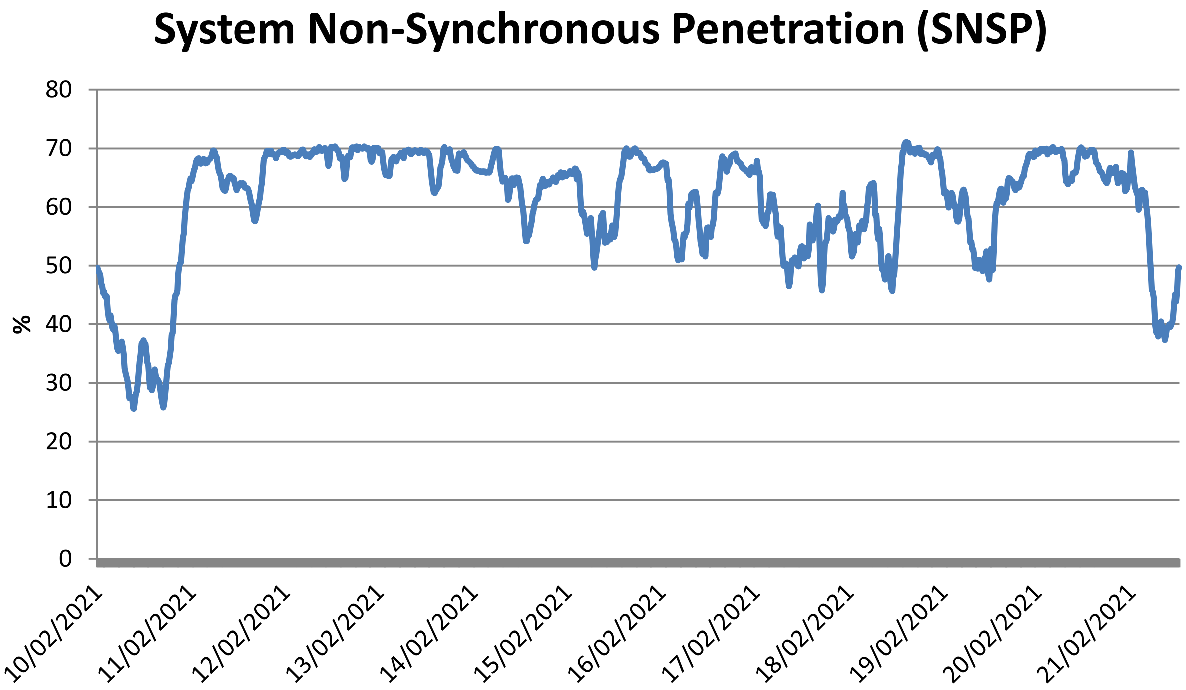
- Secure, reliable operation of power system guaranteed up to a certain SNSP level.

- A limit on SNSP → wind dispatch down

Key Statistics

- Trial period: 15 January 2021 – 30 March 2021
- Hours above 65% SNSP during trial: 312 hours
- Hours above 65% SNSP to end of May: 362 hours
- Maximum wind: 4,489 MW (new all-island wind record on 12 Feb)
- No recorded difference in system behaviour when SNSP was above 65%

High SNSP Operation



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Poolbeg Reactor Trip

- 14 February 2021 – Poolbeg R2002 tripped on overcurrent
- Low voltage of 348 kV recorded at Moneypoint
- Approximately 250 MW of wind tripped. Approximately 150 MW of data centre load tripped to UPS
- SNSP at the time was 64%
- The system remained stable for this significant event at high SNSP

Trial Analysis

- Detailed analysis of full trial period

- Online WSAT review – 10 cases with both VSAT and TSAT checked
- Offline VSAT review – 10 cases with 9 transfers each – 90 transfers
- Offline TSAT review – 10 cases with 4 scenarios each – 40 scenarios
- Offline CCT review – 10 cases with 2 scenarios each – 20 scenarios

- No steady state or dynamic issues associated with SNSP up to 70% were detected
- 70% SNSP became enduring operational policy on 30 March 2021
- 75% SNSP trial is in progress

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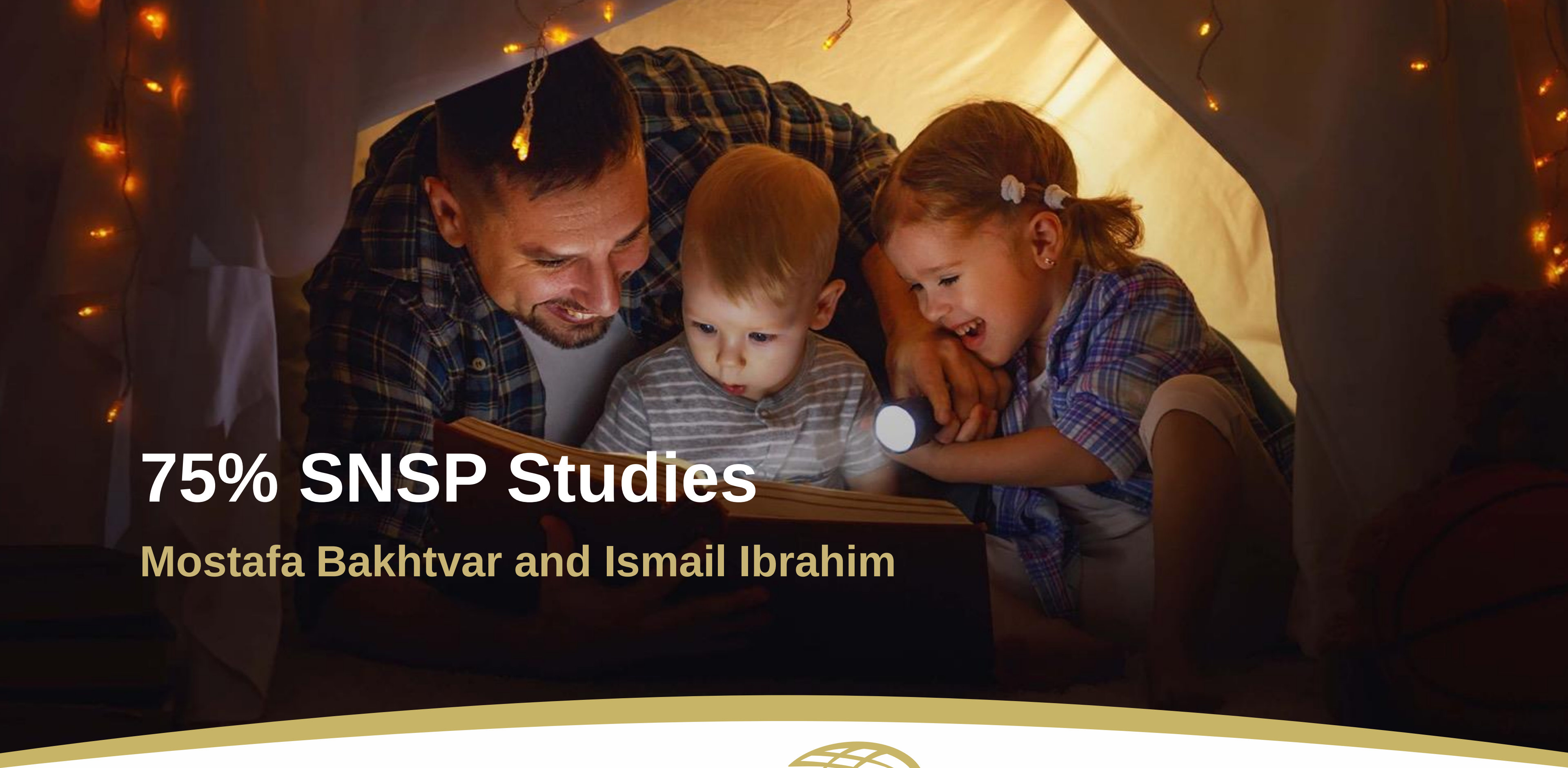

75% SNSP Studies

Mostafa Bakhtvar and Ismail Ibrahim

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Objectives & Timelines

Objectives:

- Identify potential voltage security issues arising from increasing the SNSP limit to 75%.
- Identify potential dynamic stability and frequency security issues.
- Propose mitigation measures for the observed issues.
- **Advise the operational policy review committee on increasing SNSP limit to 75%.**

Timelines:

- October 2020 – April 2021

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Assumptions

Assumption	As Is	VDIFD
75% SNSP	✔	✔
Min 8 Units	✔	✔
23 GWs inertia floor	✔	✔
ROCOF 1 Hz/s	✔	✔
Batteries react to frequency ⚠ (1/4/2021: 166 MW)	✗	✗
Data Centres react to frequency ⚠	✗	✗
WECC 1 Wind Farm models	✔	✗
WECC 2 Wind Farms models	✗	✔

- 2 Study streams:
  - As Is
  - VDIFD (voltage dip induced frequency drop)

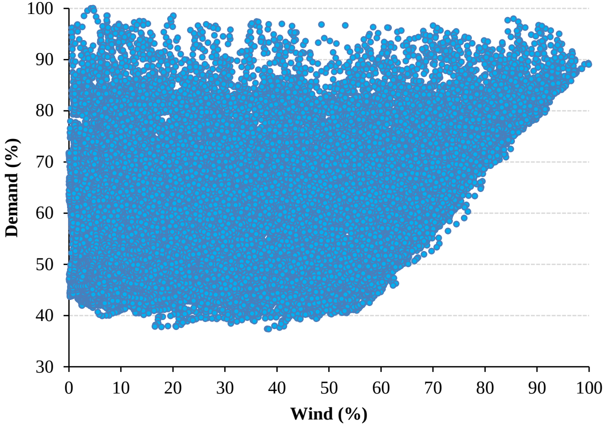
⚠ Prudent Assumptions

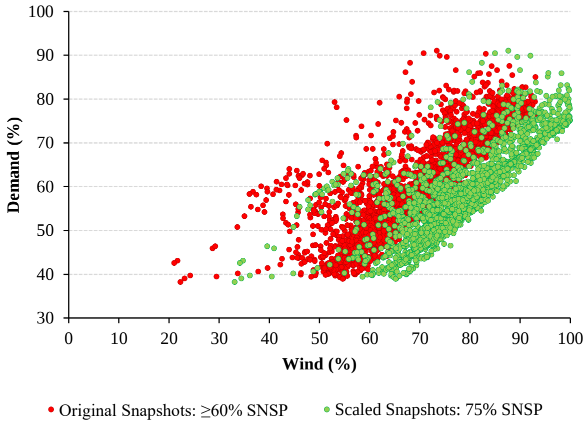
Methodology (October 2020)

Preparation of snapshots November 2020	Studies January 2021	Mitigation (Step-Back) March 2021
• Selection of snapshots from the last 12 months - WSAT cases with SNSP >=60% . • ~3000 of the initial snapshots have been selected and wind has been scaled up to give us 75% SNSP. • Machine learning based on data clustering to reduce the number of representative study snapshots from ~3000 to 300 and further to 89. • Based on selection refinements and with extreme snapshots the final batch of 137 study snapshots is compiled.	Voltage security studies through VSAT focusing on: Divergent contingencies Voltage issues RMS dynamic studies using TSAT and focusing on: Frequency/rocof insecurities Swing margin insecurities WSAT models and security criteria used as is. For VDIFD stream generic WECC 2 models used to simulate the effect of it.	A number of different mitigations and their combinations is considered: 1.Data centres (UPS disconnections). 2.Batteries expected to be connected by the 1st of April 2021. 3. Adjustment to tie-line flow. Option 3 only as the last resort if 1. and 2. or their combination is insufficient.

Snapshots Generation

- 2019-2020 snapshots filtered to yield ~3000 snapshots with ≥60% SNSP
- Complex algorithm to generate ~3000 power system snapshots (WSAT) with 75% SNSP
  - 23 GWs inertia floor (stored kinetic energy)
  - Min 8 gen sets
  - RoCoF 1 Hz/s
  - Generator Min/Max
  - Reactive power capability
  - etc.





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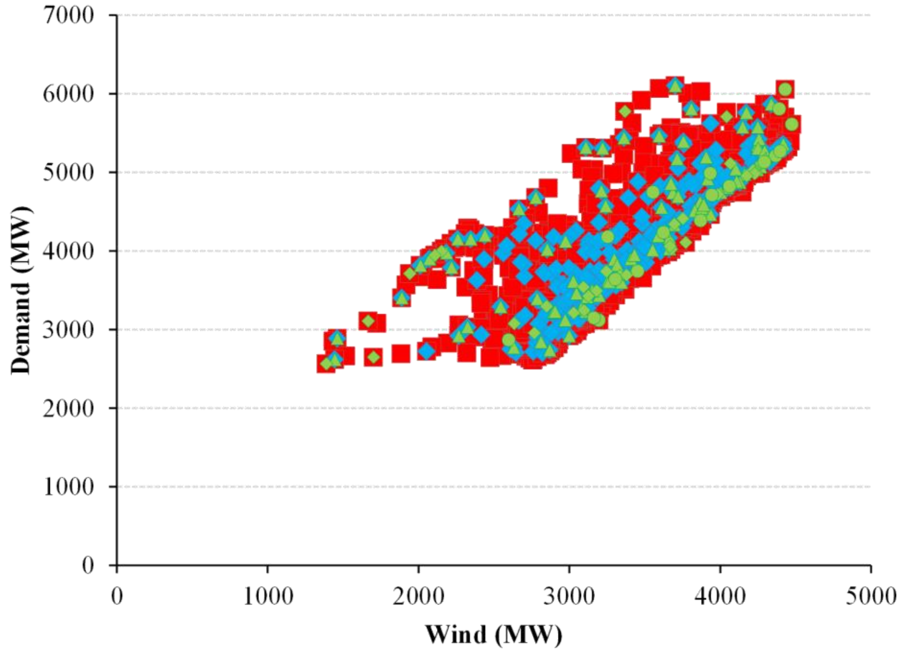
Final Selection of Snapshots



- 11 features/attributes for each snapshots
- Machine Learning + Engineering Experience
- Selection of 137 representatives from 3000 snapshots
- Cover all operation conditions with respect to all 11 attributes (this figure only shows 2)

■ Initial ~3000 snapshots with 75% SNSP

◆ 300 Clusters

▲ 89 Clusters

◆ 30 Snapshots added as refinement

● 18 Extreme snapshots added

137 Cases

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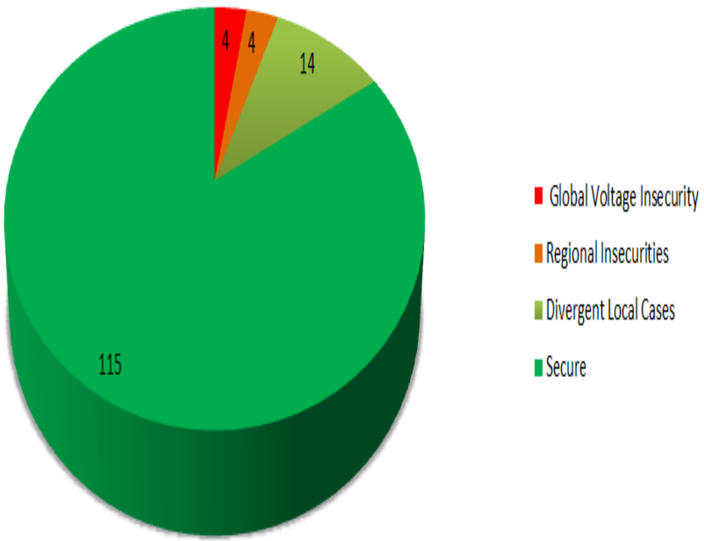
Voltage Security Study-Summary



- There are 4 out of 137 cases where the number of divergent contingencies is significant (more than 100). These are classified as global voltage insecurities.
- There are 4 cases where more than 20 divergent contingencies is recorded.
- A substantial number of cases 129 out of 137 have no divergent cases or the problem is of a local nature.
- Two regions in the All Island system with high wind power outputs are the main drivers of the observed voltage insecurities.
    - This driver is already known & being managed in real time operations.

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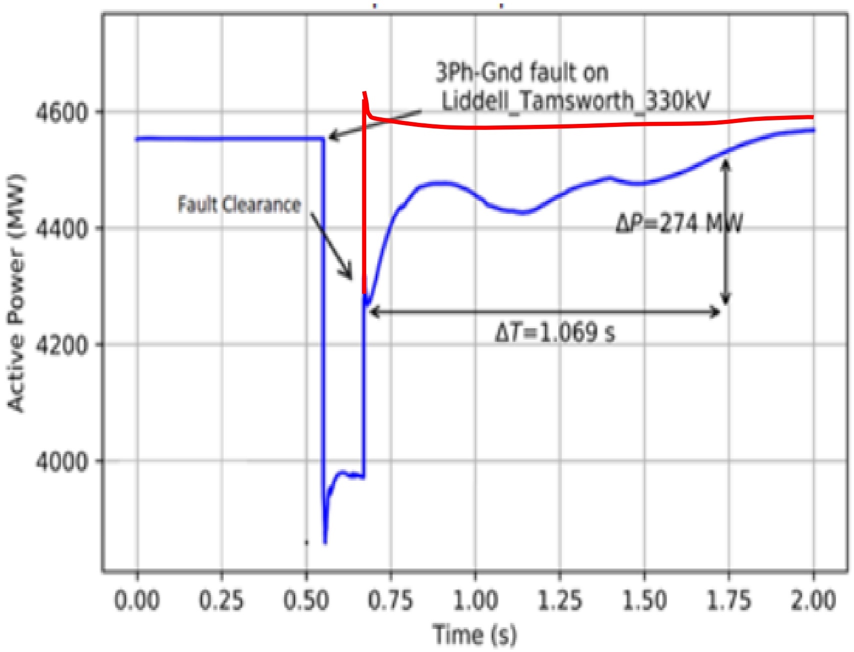
Voltage Dip Induced Frequency Deviation (VDIFD)



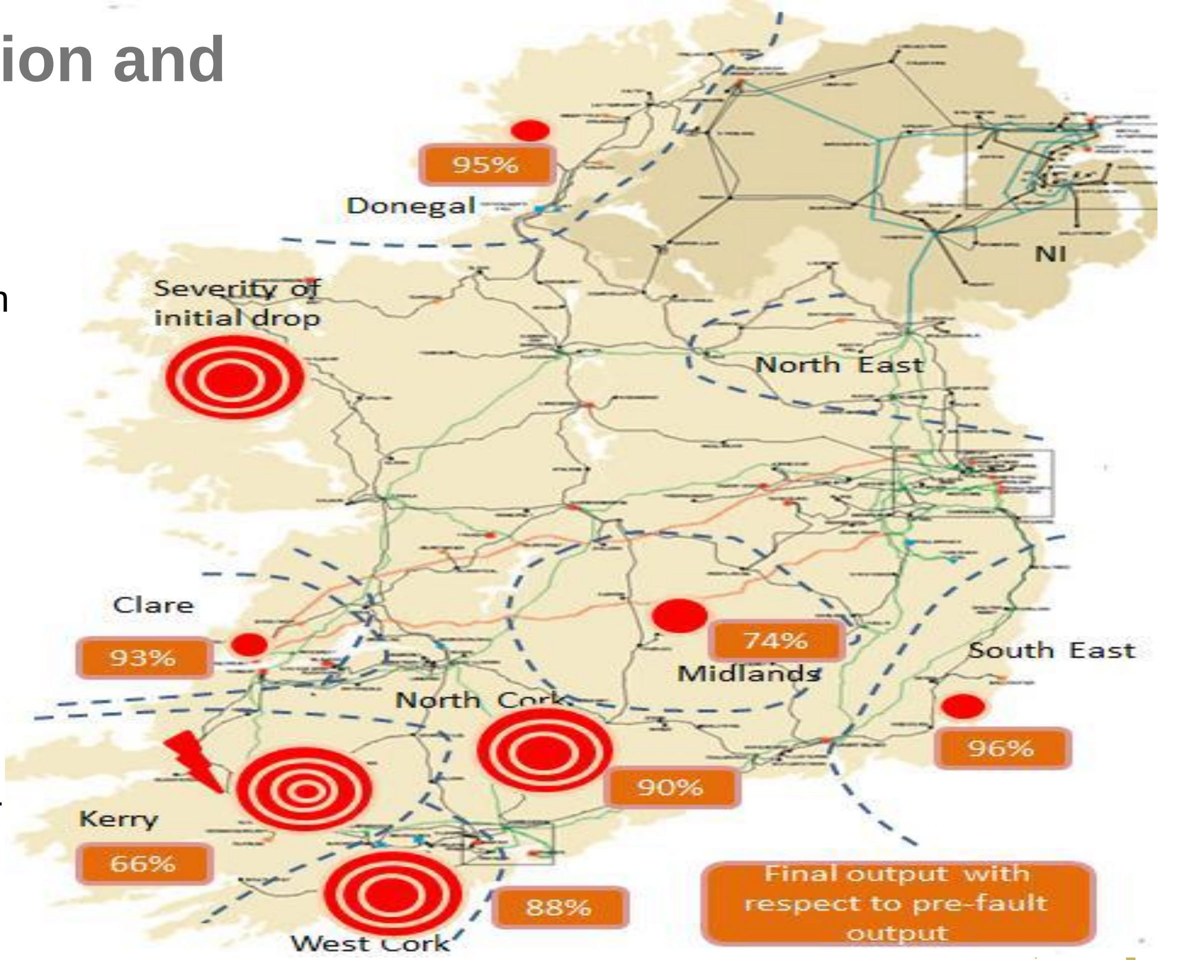
- Red trace is what would be a typical WF P response and the blue trace is reality**.
- Low voltage propagation drives the effect of VDIFD.
- There will be some MW loss due to VDIFD straight after the fault (=>ROCOF impact) – low voltage will propagate throughout the affected area, trigger VDIFD and wind power output might need some time to recover.
- Traditionally active power and frequency have been studied independently from voltage and reactive power. With VDIFD impact, such a "**decoupling**" might not be viable any longer.

** AEMO-Renewable integration study 2020

Low Voltage Propagation and VDIFD impact

A three phase fault in the Kerry region showing the impact of:

- The initial active power drop in every single region using the red concentric circles (the more concentric circles the bigger the impact is).
- The final active power recovery- where the percentage of the recovered active power, with respect its pre-fault values, is denoted by orange rectangles for different regions.



Note: This is an example of VDIFD impact due to WF model with conservative VDIFD response.

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Transient Stability Studies Setup

	Base Case (Both Streams)	Mitigation (Step-Back)
Batteries (Commissioned on April 2021)	**Not modelled**	**Modelled with conservative response**
UF Data Centres disconnections	**Disabled**	**Partly enabled (60%)**
Wind Farm models with VDIFD response	**Modelled with conservative response (VDIFD stream)**	**Modelled with conservative response (VDIFD stream)**

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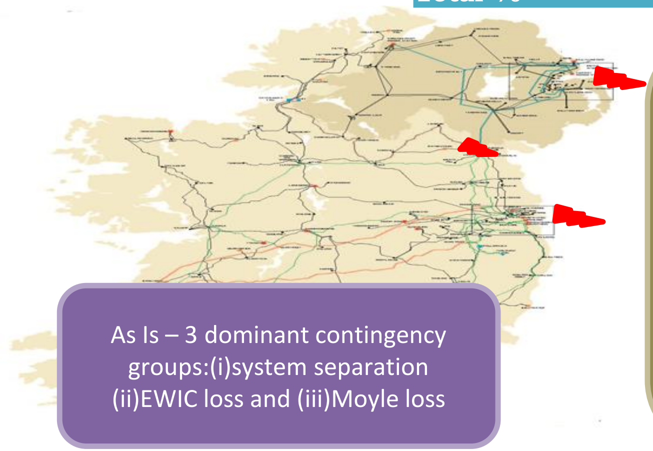
Transient Stability Studies Summary

Number of	Insecure VDIFD	Insecure As Is	Total Run
Contingencies (CTGs)	14	12	836 or 838**
Snapshots	45	35	137
Total CTGs	134	99	114644
Total %	**0.12%**	**0.09%**	**100.00%**

** Number of contingencies per snapshot

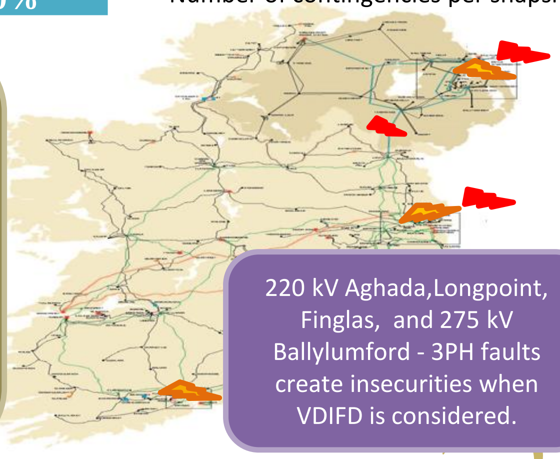


As Is – 3 dominant contingency groups:(i)system separation (ii)EWIC loss and (iii)Moyle loss

A small percentage of contingencies will cause frequency insecurities. **No angle instabilities.**

VDIFD aggravates situation. There are 3 dominant contingency groups causing the majority of insecurities

1. System separation >50%
2. Loss of EWIC
3. Loss of Moyle



220 kV Aghada,Longpoint, Finglas, and 275 kV Ballylumford - 3PH faults create insecurities when VDIFD is considered.

Every single insecurity is resolved using some mitigations or a combination of them!

Conclusions

- Study represents significant step-change in methodology
  - Novel modelling approach
  - Uses VDIFD & machine learning
  - Significant number of cases in limited time period
- There are frequency insecurities (similarly to the findings of 70% SNSP study) but there are mitigation options for all of them.
- The number of insecurities increased due to VDIFD impact.
- Study was completed in April 2021 and it was recommended to the Operational Policy Review Committee to move forward with the 75% SNSP trial
- Trial started at end April and is ongoing

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DS3 Programme Updates

Emma Fagan

EIRGRID GROUP

System Service Procurement

- Gate 4B
  - This process is almost complete. We have issued agreements and amendments to agreements for contract execution on 1 July 2021.
- Gate 5
  - This OJEU notice was published on 16 June 2021. The bidders information session took place on 22 June 2021.
  - Contract execution is scheduled for 1 October 2021.
- System Services Tariff Rates Consultation
  - Following two notes published to industry previously, a tariff rates consultation launched on 28 May.
    - Significant uptake of fast acting technologies that benefit from high fast acting scalars and high availability
    - Review necessary to mitigate against exceeding the Regulatory Authorities' budgetary guideline for DS3 SS spend (€235M) in the next tariff year.

Qualification Trial Process

- Both residential trials have successfully demonstrated a range of reserve services from domestic battery energy storage devices and electric vehicles.
    - The key learnings from each trial will provide recommendations to inform the roadmap for residential DSM.

- The solar trial in NI is the first solar farm on the island to demonstrate the provision of reserve services and solar will move to become a proven technology for future system service procurement gates.

- The final learning documents will be available the end of June and will be published as the final deliverable for WP4 of the EU-SysFlex project.

- Communications Trial - Not yet started but we are working to get the trials started as soon as we can

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Remaining Control Centre Tool Projects

- Ramping Margin Tool (RMT-E) - Enduring
  - Software development well advanced with three of four sprints now complete and tested
  - Go-Live planned for Q3 2021

- Voltage Trajectory Tool (VTT)
  - Detailed functional requirements complete and vendor build underway
  - System Go-Live planned for Q4 2021

- For both RMT and VTT
  - Hardware design complete, hardware has arrived and will be commissioned in July
  - Operational Readiness activities underway for the introduction of the new capability into the Control Rooms

Operational Implementation

- 75% SNSP and RoCoF trials are ongoing
  - Given weather and system conditions trials will extend beyond September

- NI Negative Reserve
  - We are working with the NI windfarms on changing frequency deadband settings to allow progress on the NI negative reserve trial

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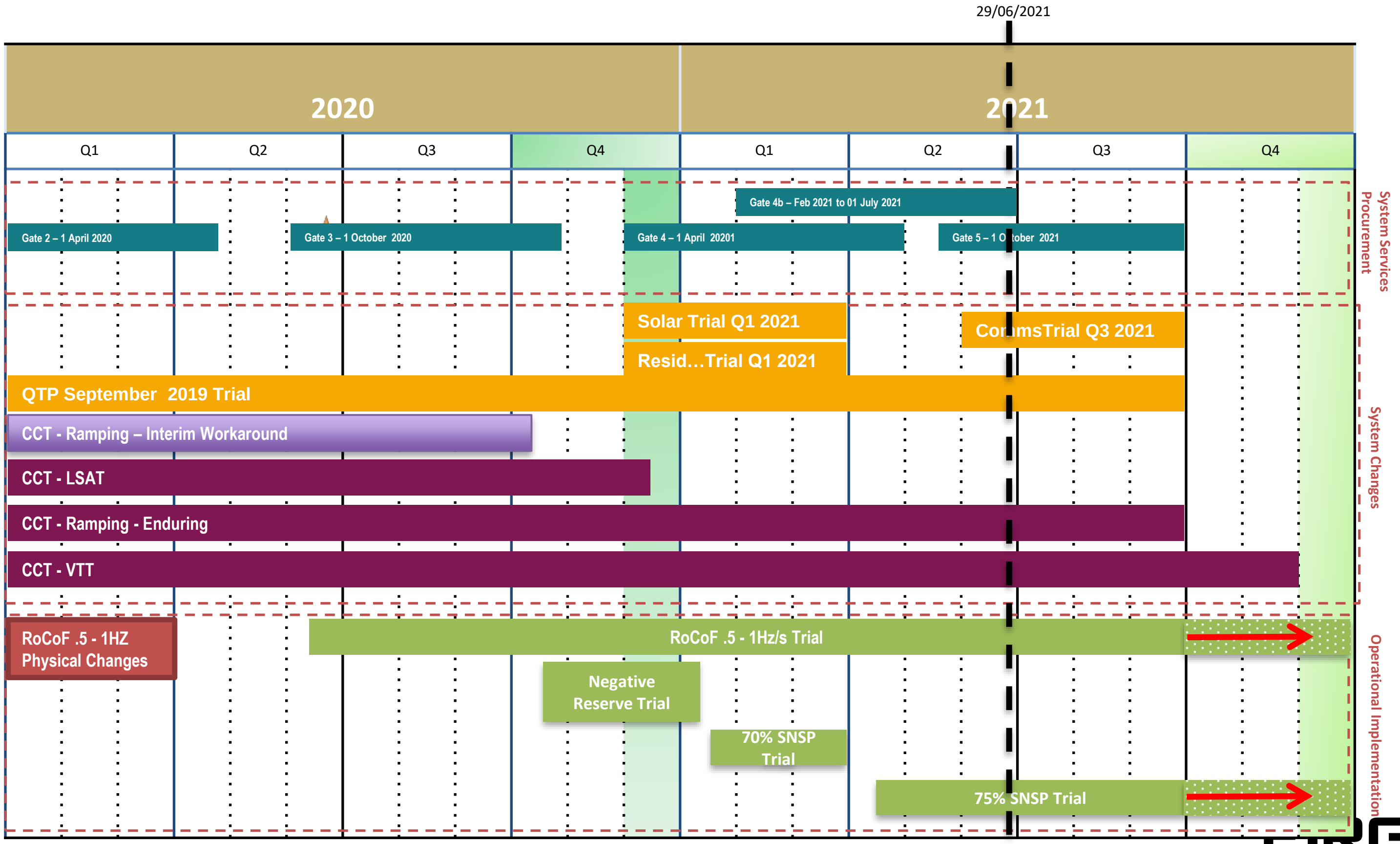
Nodal Controllers

- **Ireland -** Trial was suspended at end of 2020 but is due to restart shortly.

- **Northern Ireland** – Site Acceptance Testing commencing week of 2 August. Work has also begun on an initial CBA into further rollout of Nodal Controllers at NI cluster substations

DS3 Milestone Plan – June 2021



FlexTech

Eoin Kennedy

EIRGRID GROUP

FlexTech

- FlexTech initiatives incorporated as part of broader TSO-DSO plans agreed in both jurisdictions
- TSO-DSO governance arrangements established
- Plans will be refined over the coming months
- Planning to engage with industry on the EirGrid-ESBN joint plan for the period 2022-2026 (CRU incentive)

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DS3 Advisory Group

JUNE 2021

Topics

- Ramping
- Reactive power
- Tariff budget

Ramping margin requirements

We have based ramping requirements on published EirGrid examples

Wind Forecast Error

- As the capacity of wind generation increases on the system, the importance of accurate forecasts increases
- Similarly, the impact of incorrect forecasting can have a large impact on system operation
- An increased number of wind generators leads to an increased forecast error possibility for the same power output due to geographical spread

	2013	2015	2018
Installed Wind Generation Capacity	2.1 GW	2.5 GW	4 GW
Wind Generation Forecast	1.5 GW	1.5 GW	1.5 GW
97th Percentile Wind Forecast Error	500 MW	650 MW	850 MW

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Ramping Reserve Requirements Example

Characteristic	Starting Point (t=0)	1 Hour Horizon (RM1)	3 Hour Horizon (RM3)	8 Hour Horizon (RM8)
System Demand (MW)	3,500	3,750	4,250	5,600
Largest Single Infeed (MW)	450	450	475	500
97th Percentile Wind Forecast Error (MW)	-	100	450	720
Largest Offline Reserve Resource (MW)	-	150	225	400

$$\mathbf{RM1}\ \textbf{\textit{Ramping Reserve Requirement}} =$$
$$(3{,}750\ x\ 1\%) + \max(450\ \textbf{\textit{or}}\ 100) + 150 = 37.5 + 450 + 150 = 637.5\ MW$$

$$\mathbf{RM3}\ \textbf{\textit{Ramping Reserve Requirement}} =$$
$$(4{,}250\ x\ 1\%) + \max(475\ \textbf{\textit{or}}\ 450) + 225 = 42.5 + 475 + 225 = 742.5\ MW$$

$$\mathbf{RM8}\ \textbf{\textit{Ramping Reserve Requirement}} =$$
$$(5{,}600\ x\ 1\%) + \max(500\ \textbf{\textit{or}}\ 720) + 400 = 56 + 720 + 400 = 1{,}176\ MW$$

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- Source: EirGrid, May 2018 DS3 Advisory Council

Ramping margin requirements

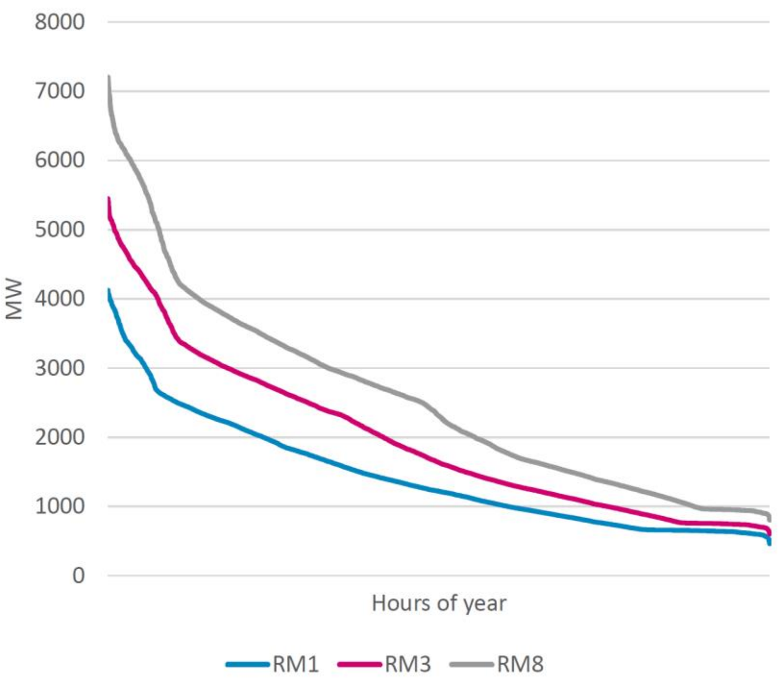
Baringa

Conservative assumptions adopted to test ramping requirements in 2025

- **Required RM =**
  Max (wind forecast error, largest gen infeed, largest line infeed) +
  1% demand + offline resource risk
- Wind forecast and infeed risk evaluated hourly
- Test model uses conservative assumptions for wind forecast error and (static) offline risk

	RM1	RM3	RM3
Offline resource risk	100 MW (OCGT/ engine)	200 MW (1/2 CCGT)	400 MW (large CCGT)
Offline CCGT capability	0%	50%	100%

Modelled ramping requirements, 2025



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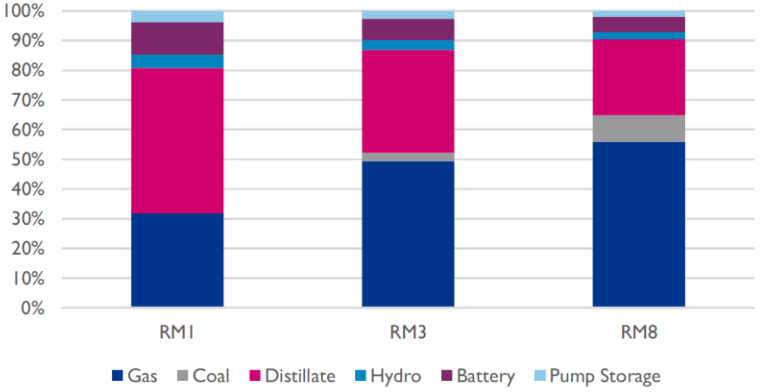
Ramping margin requirements

Our test model successfully met RM1/3/8 requirements in all hours for 2025

- Offline, fast response units such as distillate or gas peakers and batteries contribute strongly to RM1 provision
- Larger, slower starting non-spinning resources (e.g. CCGTs) contribute more to RM3 and RM8
- RM provision assumed to be non-exclusive with other DS3 services (e.g. replacement reserve)
  - PLEXOS model suggests POR, TOR1 and RR constraints binding rather than RM
- No provision assumed for interconnectors

Indicative ramping provision breakdown, 2025



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Ramping key message

- Customer savings (most of €301m Imperfections Charge) from zero-carbon reserves and inertia can't be fully realised until we remove the "last" reason to constrain on a fossil plant, i.e. ramping margin.

- Baringa's modelling indicates ramping doesn't appear to be binding, at least in 2025.

- Future plant mix (battery/storage/demand side flex) will in our view have better ramping capability than similar sized system made up of coal and peat today.

- Ideally EirGrid would clarify the ramping need by

  (a) setting out sufficient detail around their forecast accuracy and present/future operational rules

  (b) Publishing a study showing the ramping needs in a 70% RES-E and a zero carbon system

Features of Today's Reactive Power Regime

- EirGrid has contracted in DS3 Tariffs for 6.5GVAr at a cost of €20.8m/year in 2021, plus a portion of the €301m Imperfections Charge ('20/21) to constrain on fossil plant
- As part of the regulated asset base, new STATCOMs at Ballynahulla, Ballyvouskill, Thurles, etc. (€25m/site). A battery can do everything a STATCOM can. **Overlapping procurement responsibility brings real risk of stranded assets or insufficient or suboptimal investment.**

- Very difficult to model and build an investment case off the back of the SSRP service.

- Inertia procurement is likely to bring forward investment in sync-comps.
- These devices produce large volumes (200-300MVAr) of high quality reactive power
- Initial rounds (e.g. Vol Capped/Uncapped) of DS3 Procurement did not allow for locationally focussed procurement of reactive power.
- **Future procurements (e.g. inertia and Future Arrangements) are a key opportunity to send sync-comps, batteries, wind, solar, long duration storage etc. etc. a locational signal to ensure they are optimally located to replace all current fossil based reactive power.**

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Reactive Power – Ideal regime

	Today's regime	Ideal regime
Locational signal	Dublin or not-Dublin	Scalars applied to certain key nodes initially, later to all nodes.
Losses	Covered for fossil, not covered for renewables/batteries/sync-comp.	Covered for all plant equitably.
Paid for	Dispatch (>25%)	Availability
Procured by	System operator overlapping with industry.	Industry
Temporal signal	Targets high SNSP hours	Target hours when reactive is required, or pay for capability, not dispatch.

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Tariff Budget Consultation

- Paper appears to want to protect projects not only in construction (which is understandable) but also projects in planning.

- The purpose of the extension to 2024 was to bridge to the Future Arrangements, not to bring forward new investment. No project still in planning today and with an 18 month construction time had any reasonable expectation getting any tariff contract prior to the original April 2023 deadline.

- The tariff regime was meant to be stable and investable. Industry assumed that meant that EirGrid would forecast carefully as they approached the budget cap and stop procuring if they anticipated surplus services.

- Industry assumed that the “nuclear” options of terminating contracts or scaling back tariffs would only be used if the forecast around the budget needed some fine-tuning, or there was an unforeseen external event (e.g. pandemic).

- Industry could never have expected EirGrid would continue to procure services surplus to their requirements and which bring no benefit to consumers.

- Statkraft’s position is that there should be no procurement of surplus services such as reserves after Gate 5, other than for projects that can show an investment decision was made before the date of the consultation paper.

THANK YOU

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Break - 10 min

Agenda Part 2

Topic	Time	Speaker
BREAK	12:05	ALL (10 min)
2030 Studies Outcome	12:15	Arijit Bagchi, EirGrid (10 min)
Shaping Our Electricity Future	12:25	Eoin Kennedy, EirGrid (10 min)
Control Centre of the Future	12:35	Simon Tweed, EirGrid (10 min)
AOB	12:45	All (5 min)
Discussion / Questions	12:50	All (5 min)
Closing remarks and comments	12:55	Eoin Kennedy, EirGrid (5 min)

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A brief overview on upcoming report:

‘Potential Solutions for Mitigating Technical Challenges Arising from High RES-E Penetration on the Island of Ireland’

Arijit Bagchi

EIRGRID GROUP

What's the report about?

Potential challenges

- Frequency Stability
- Voltage Stability
- Transient Stability
- Congestion
- Power Quality
- System Restoration
- Generation adequacy

Challenges/mitigations are **NOT exhaustive**

Aim is to facilitate modelling of **capabilities** required to solve scarcities rather than focussing on technologies themselves

Primarily a **detailed technical study**; cost/benefit quantification largely out of scope

Potential mitigations

- Synchronous condensers
- Grid-forming
- BESS
- SVC
- STATCOM
- Wind farms
- PSS
- Switched shunts
- Network reinforcements

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Main findings

- Some scarcities can be mitigated by a range of different technologies/services; while some technologies can mitigate multiple challenges
- Key is to identify the **required service provision along with its optimal placement** that will be needed to ensure safety and reliability of system and deliver value to customers
- Report demonstrates (through simulations) that renewables and non-conventional technologies are well positioned to provide a range of **system services capability** needed to mitigate scarcities
- Future markets will need to be designed to promote choice for investors and incentivise investment in technologies with the right capability to support the power system's transition

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Shaping Our Electricity Future

Eoin Kennedy

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Shaping Our Electricity Future: Next Steps

Consider inputs from **ALL** stakeholders

Prepare a consultation report and response

Publish the final roadmap this autumn, prior to COP26

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Control Centre of the Future

Simon Tweed

The Control Centre of the Future

- The Control Centre of the Future project is a key initiative under the Operational Policies & Tools pillar.
- The aim of the project is to develop our control centre capability to safely and securely operate a resilient power system as complexity and uncertainty increases.
- For the first phase of this project we engaged the international expertise of EPRI and DNV GL.

Outputs

The key outputs are a vision of, and roadmap to, the control arrangements we require to 2030. These include a need for:

- Improved forecasting, constraint and curtailment management.
- Enhanced real-time and look-ahead analysis tools.
- Improved network modelling and model management.
- Development of probabilistic operations.
- Greater TSO-DSO interaction.

Relevant developments will be set out in our subsequent programme of work.

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AOB

Next meeting scheduled to take place September 2021

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