

# Weather-driven Energy System

Presentation to IEA

12 September 2022

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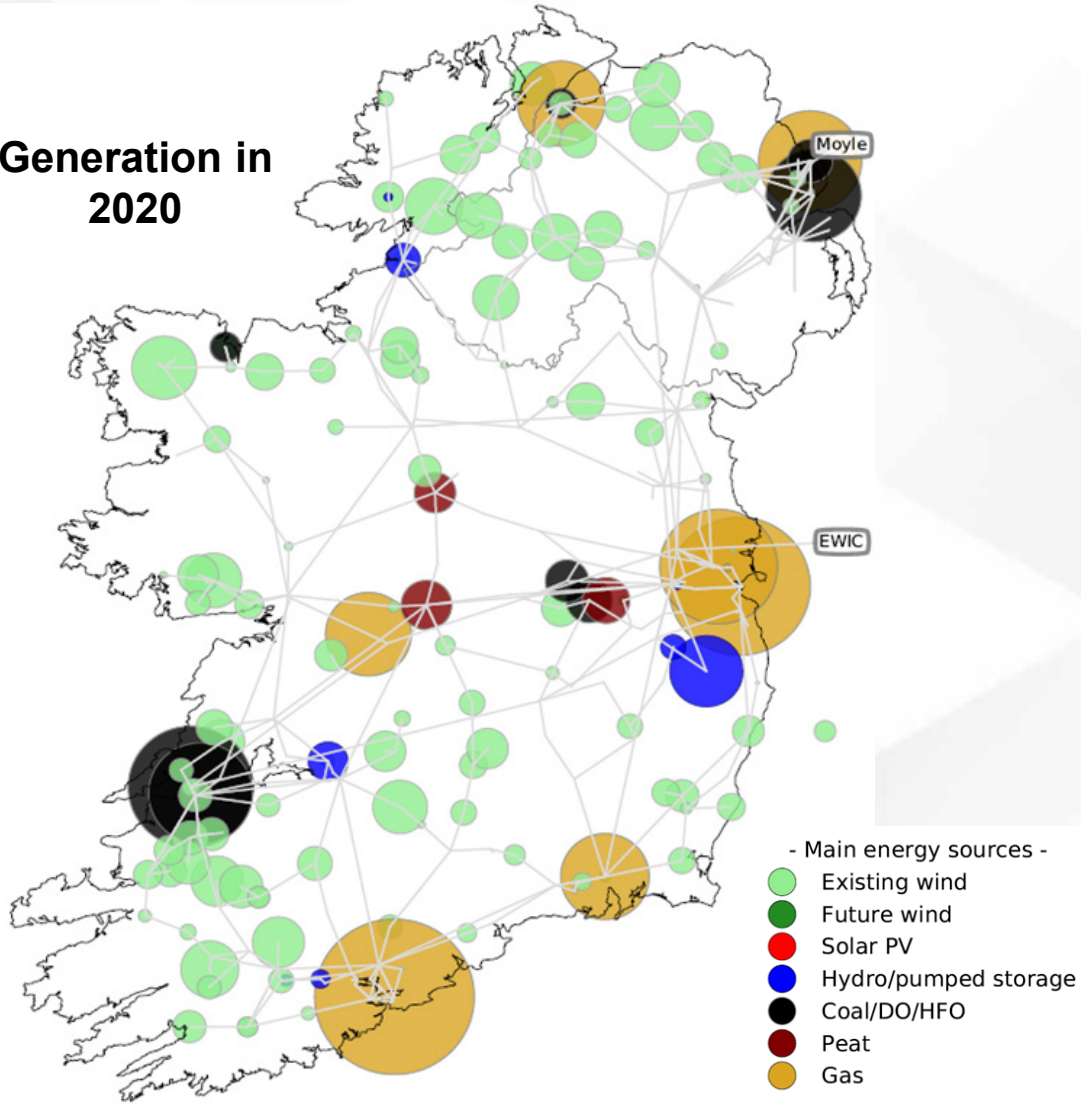


# INTRODUCTION TO EIRGRID

- We are owned by the Irish Government, and we are a regulated utility. This means we operate solely for the benefit of the electricity user.
- We do not generate electricity – we bring it from generators across the grid. We also operate some interconnectors with neighbouring electricity grids.
- We run the wholesale electricity market. This ensures electricity is always available at the most economic price possible.
- We do not own the electricity grid, and have no vested interest in adding to it.
- We only upgrade or add to the grid in response to government policy, or where it is an essential response to secure Ireland’s electricity supply.

# ISLAND OF IRELAND POWER SYSTEM

Generation in  
2020



## Facts & Features

Prevailing wind onto Western Atlantic Coast

Main load centres on the East Coast

Two 500 MW HVDC links to GB

High level of operational constraints (e.g. 75% SNSP)

Fuel mix dominated by gas and wind

## Statistics

10 GW Dispatchable/Controllable Gen (incl wind & solar)

7 GW Winter Peak Demand

2.5 GW Summer Valley Demand

Record Wind 4.5 GW on 5<sup>th</sup> Feb

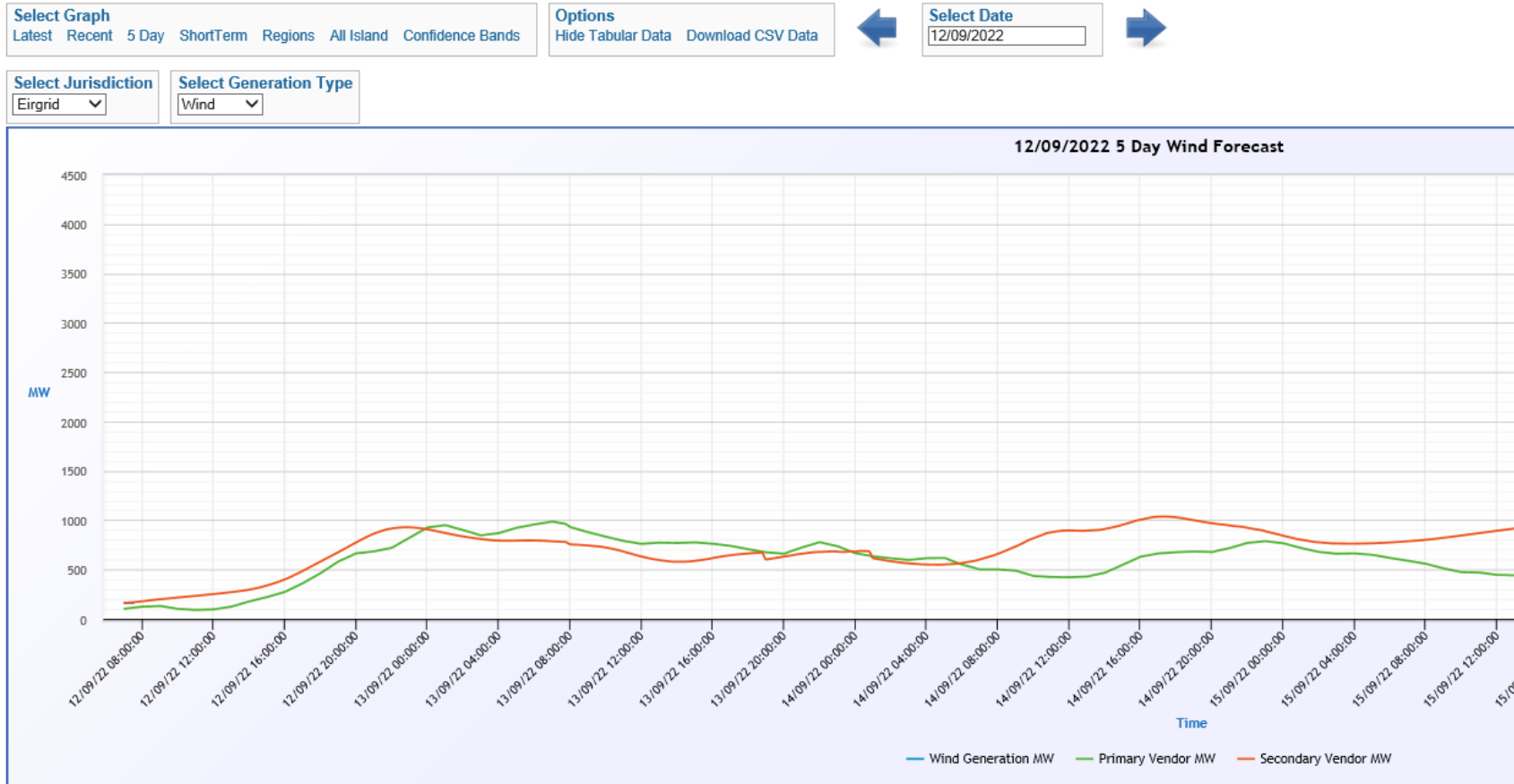
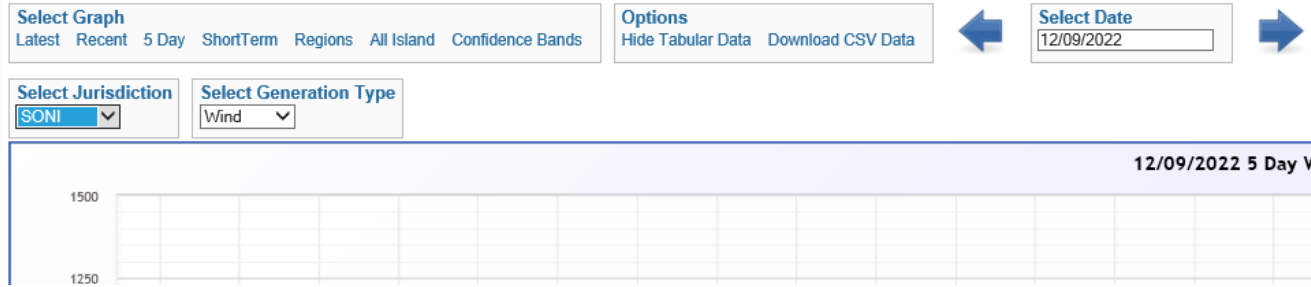
Record Wind 96% of all-island demand on 6<sup>th</sup> Feb



## LET'S TALK ABOUT THE WEATHER

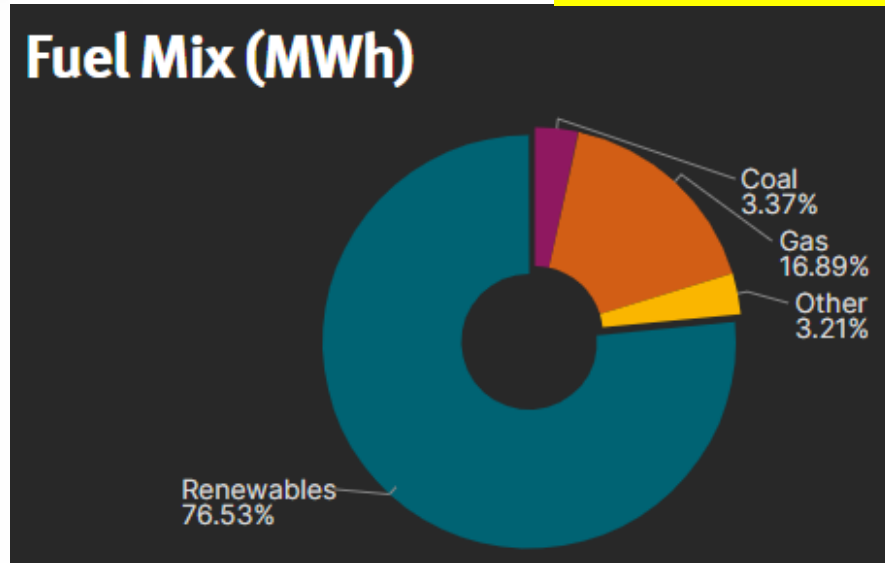
- Why is it important to forecast?
- What forecasts do we use?
- How do we use the forecasts?
- What does the future hold?

# TODAY

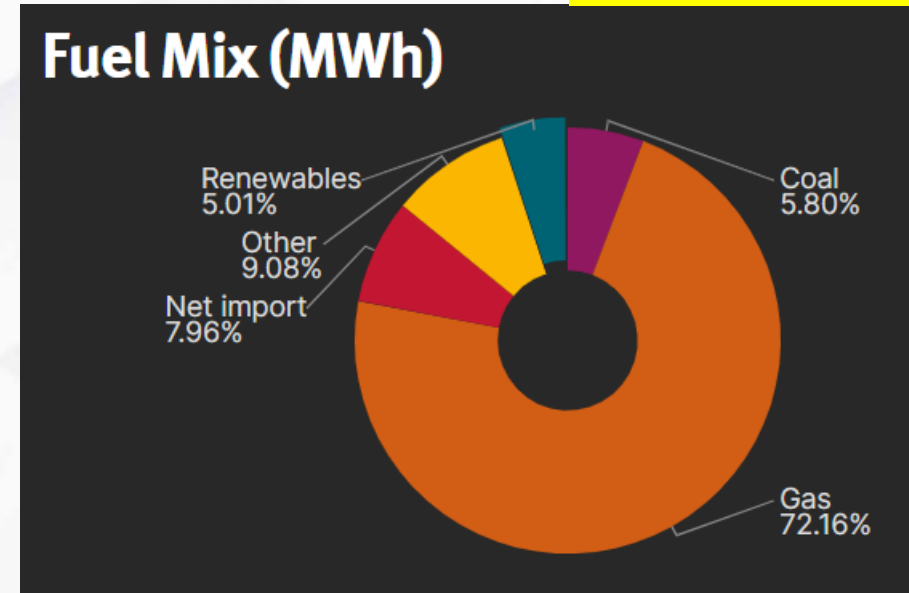


# ENERGY TRANSITION

2pm 11<sup>th</sup> April



2pm 13<sup>th</sup> April



Need to manage each type of day.

Need to manage the transition between the days.

# EIRGRID'S CHANGE MANAGEMENT

## DS3 & SOEF Programmes

### System Policy

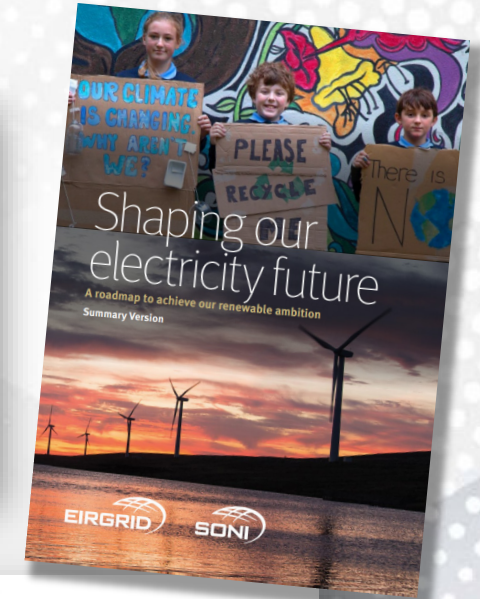
- Robust Operational Change Governance
- Systematic System Trials to push operational limits

### System Performance

- Power System
- Generator and new technology

### System Tools

- EMS including Wind Dispatch Tool
- Wind Forecasting Tool
- **New:** Ramping Margin Tool
- **New:** Look Ahead Stability Assessment Tool
- **New:** Voltage Trajectory Tool



Contingency Analysis Results For 07/24/20 17:00:00 - 241525

Basecase

RT	00:39hr	01:00hr	02:00hr
0.00 MW Moyle Runback	0.00 MW Moyle Runback	0.00 MW Moyle Runback	0.00 MW Moyle Runback
VSA: SECURE	VSA: INSECURE	VSA: INSECURE	VSA: INSECURE
TSA: SECURE	TSA: INSECURE	TSA: SECURE	TSA: INSECURE

Insecure Contingencies

Ct...	Ctg. N...	Security	Collapse	Voltage...	RA Scheme
1	FIN2SHL1	Insecure	No	0.0167	

Transfer Analysis Results For 07/24/20 17:00:00 - 241525

EWIC\_export

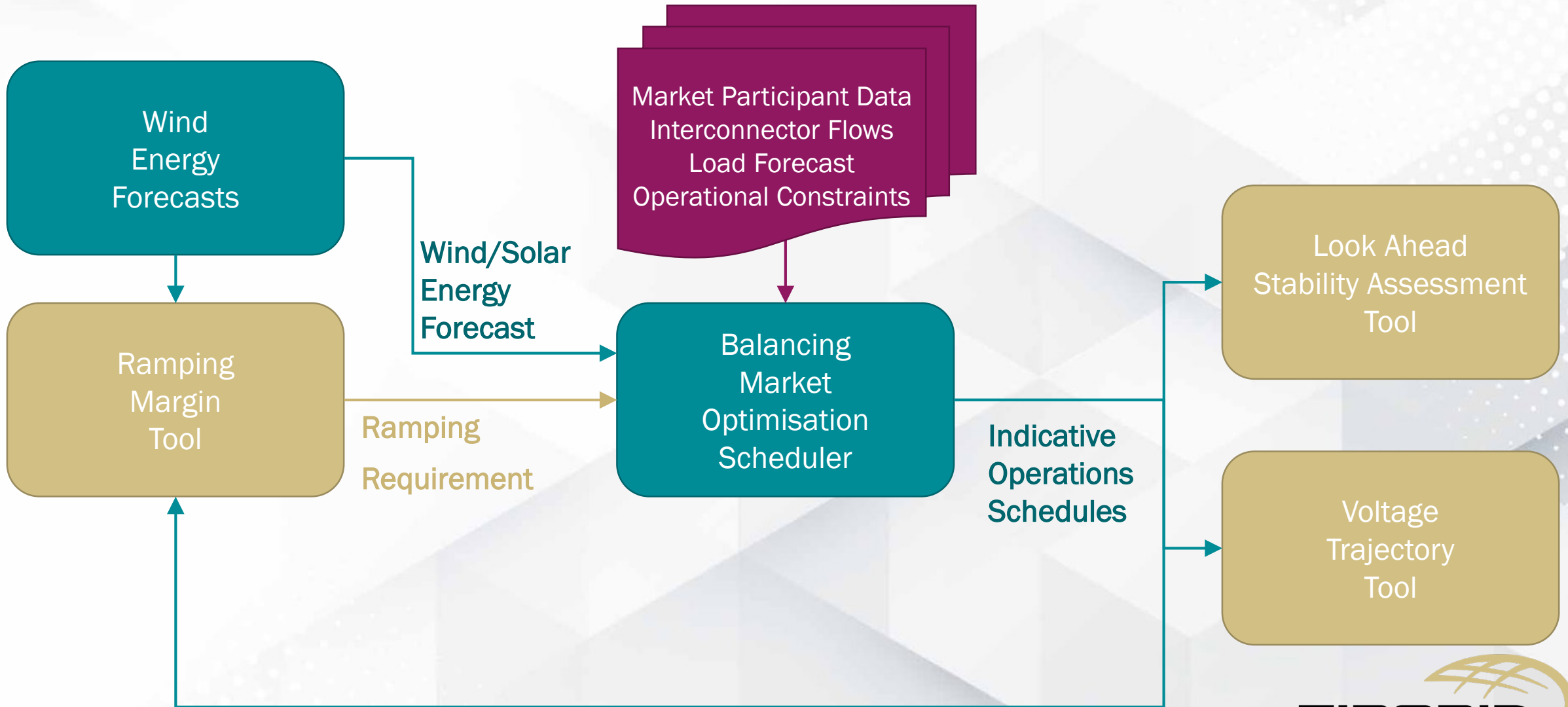
Base:	Limit:	Limiting Reason:
500.0	500.0	FIN2SHL1NFDR

VSA: 500.0

Collapse Dispatch Overload Voltage

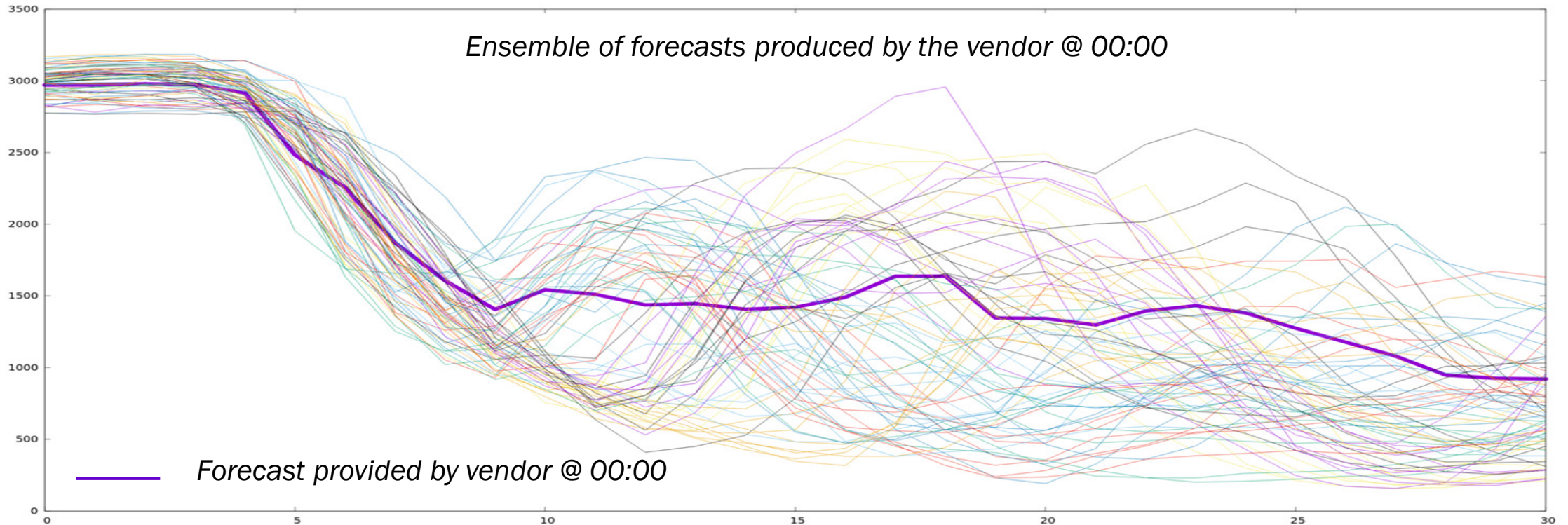
500 1025 1550

# CURRENT STATE OF EIRGRID'S SCHEDULING TOOLS



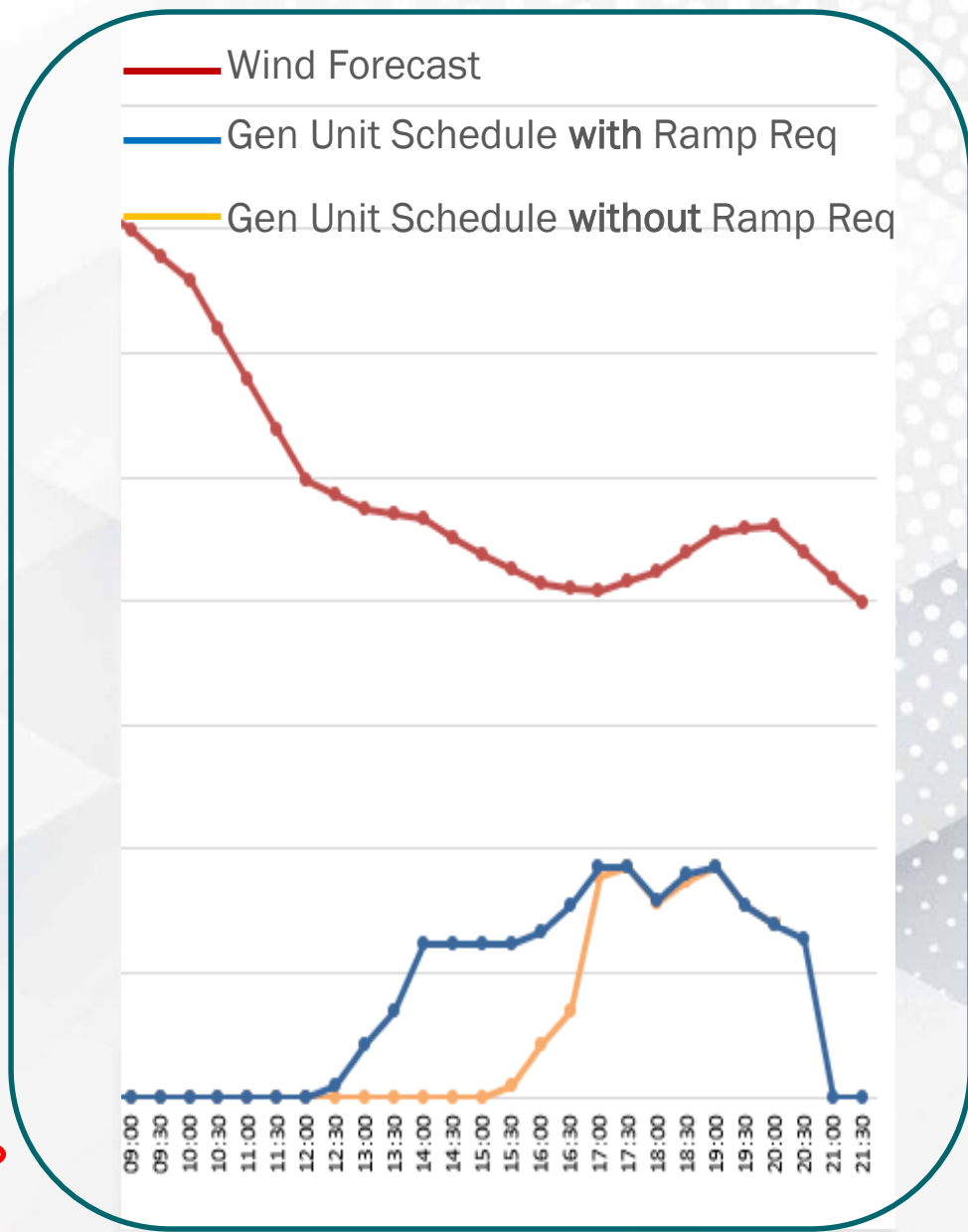
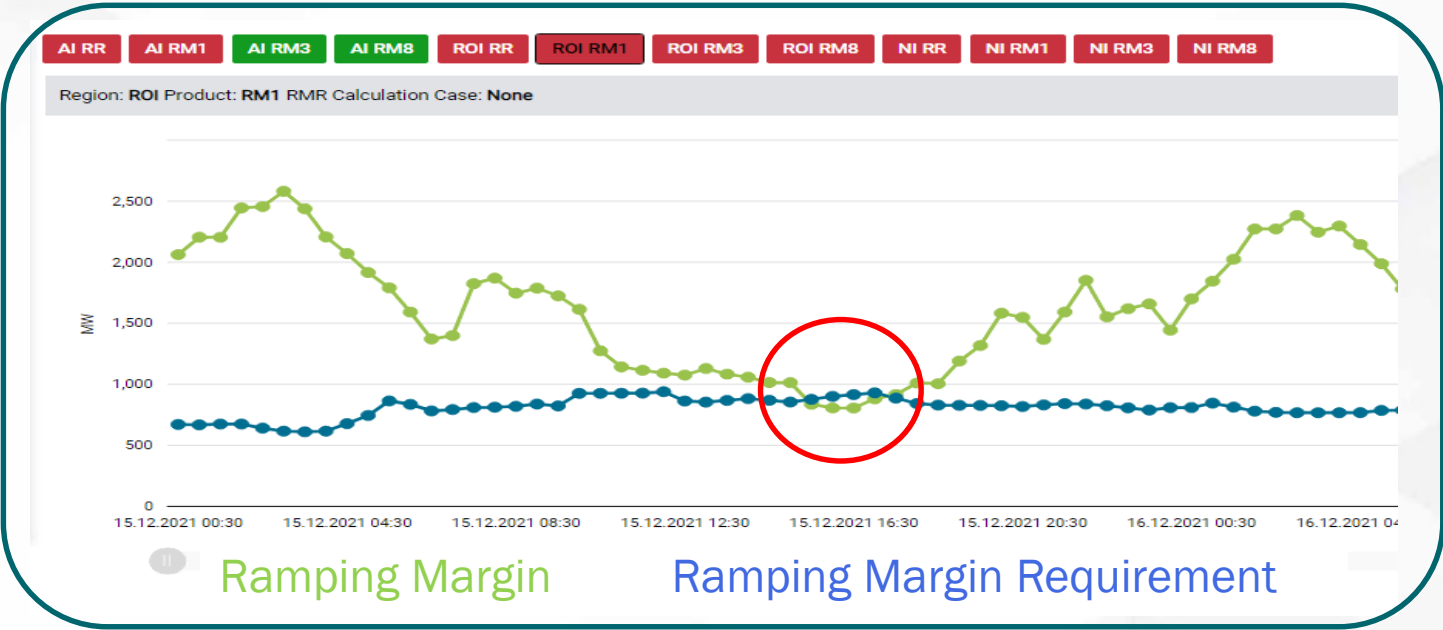


# WIND & SOLAR ENERGY FORECASTS



- Each vendor generates an ensemble of forecasts based on different weather models.
- The average forecast is provided as the Variable Generation Forecast.
- The ramp forecast is generated by calculating the ramp for each forecast within the ensemble, for 1, 3 & 8 hours.
- The 80<sup>th</sup> percentile is the value provided in the ramp forecast.
- The Variable Generation Forecast and the Variable Generation Ramp Forecast are used to calculate the Variable Generation Uncertainty.
- The Variable Generation Uncertainty is combined with Load Forecast Uncertainty and Interconnector Uncertainty to produce the **Ramping Requirement**.
- The Ramping Requirement is an input to the Integrated Scheduling Process.

# RAMPING MARGIN TOOL IN ACTION

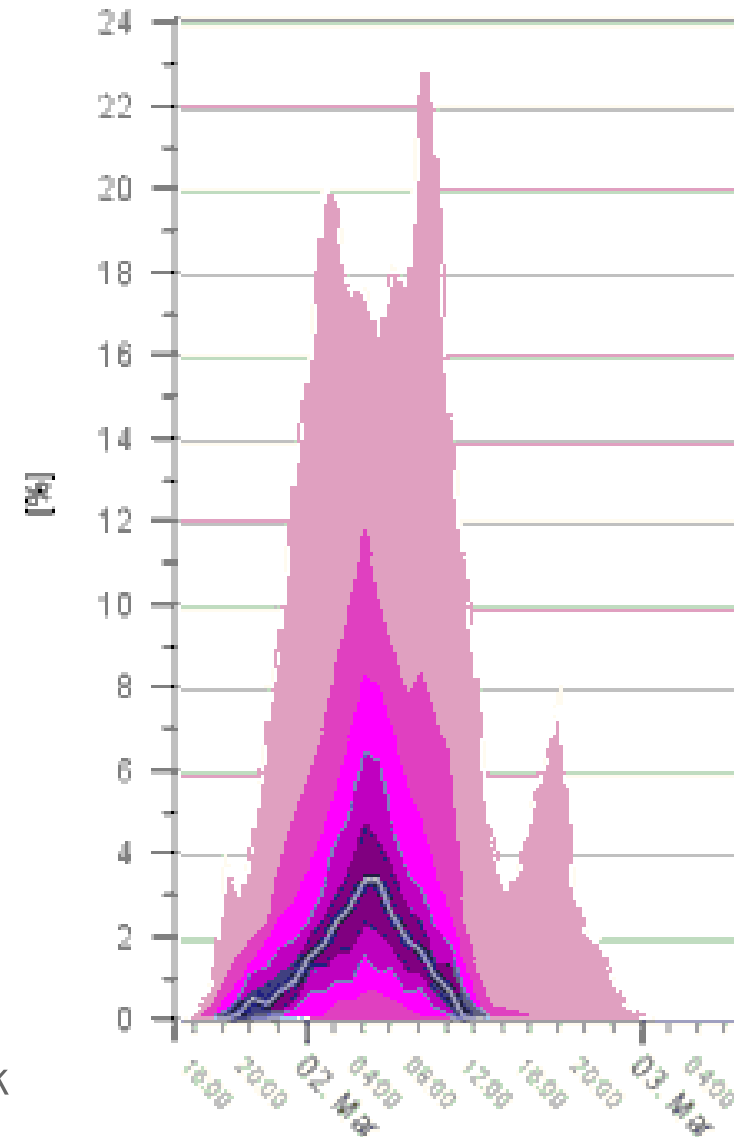


TCG Name	Scheduling Interval	Ramping Margin 1 Req. (MW)	Actual (MW)	INT LD (MW)	Shadow Price (€/MW)
	15/12/2021 13:30:00 GMT	876.02	1706.43	164	0
	15/12/2021 14:00:00 GMT	880.36	1702.85	164	0
	15/12/2021 14:30:00 GMT	976.95	1677.9	164	0
	15/12/2021 15:00:00 GMT	1108.02	1625.31	164	0
	15/12/2021 15:30:00 GMT	1248.82	1456.34	164	0
ROI	15/12/2021 16:00:00 GMT	1348.97	1348.97	164	20.4
	15/12/2021 16:30:00 GMT	1156.18	1156.18	164	8.2
	15/12/2021 17:00:00 GMT	859.13	946.04	164	0
	15/12/2021 17:30:00 GMT	624.39	864.33	164	0
	15/12/2021 18:00:00 GMT	562.61	1002.26	164	0
	15/12/2021 18:30:00 GMT	586.84	975.14	164	0
	15/12/2021 19:00:00 GMT	580.23	933.84	164	0

# RAMPING IN HIGH WIND

Exercise Judgement:

- Schedule “defensively”.
- Consider “using lower forecast” in long term schedule.
- Consider scaling down the forecast in long term schedule.
- Consider commitment of marginal ‘slow start’ units.
- Share less reserve capacity between North and South.
- Consider increasing regional stability/Target lower flows between regions.
- Preemptively constrain wind to reduce impact of gusts and improve frequency control and reduce risk of inadvertent protection trippings.

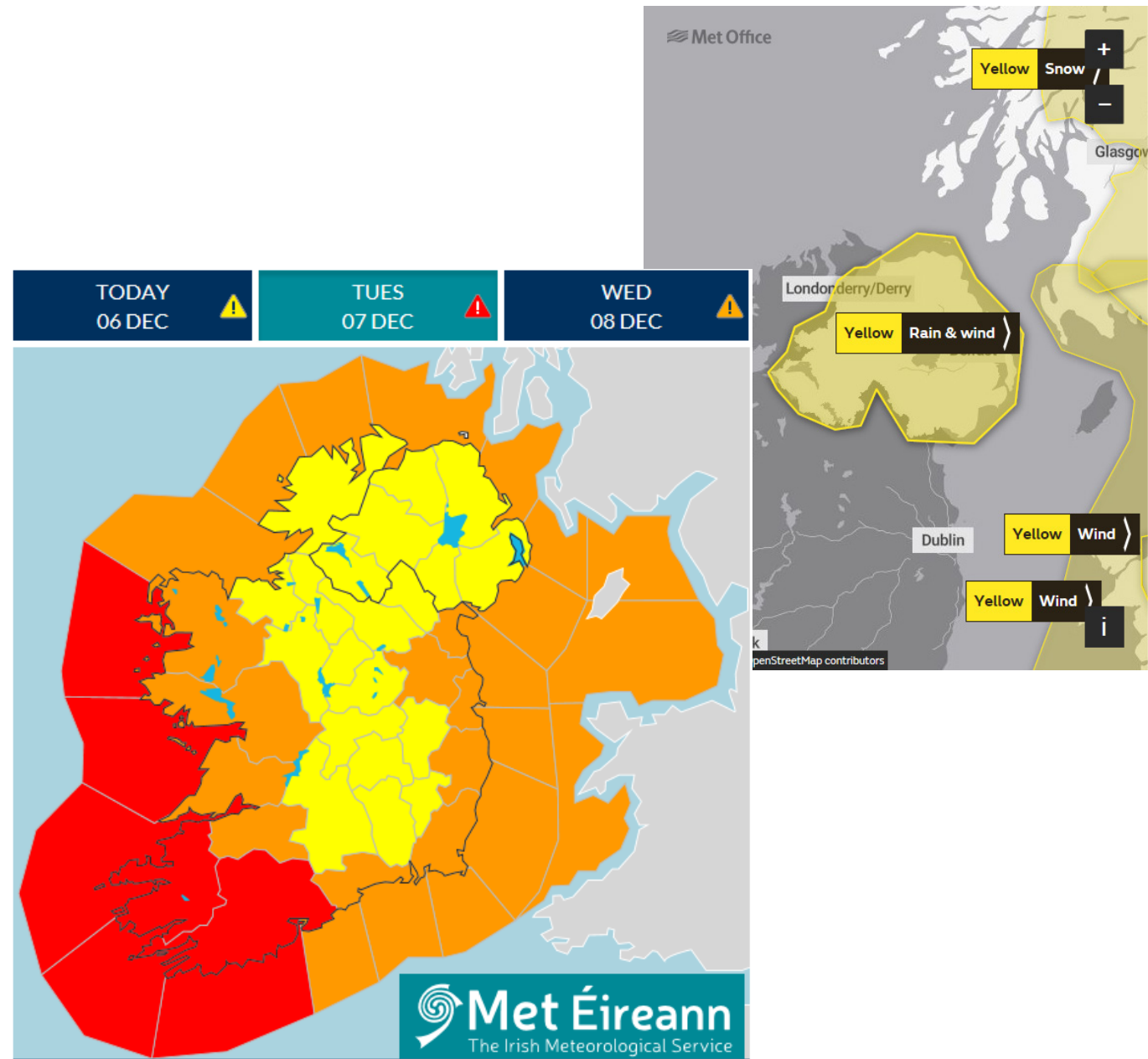


High Speed Shut Down

# RAMPING IN STORM CONDITIONS

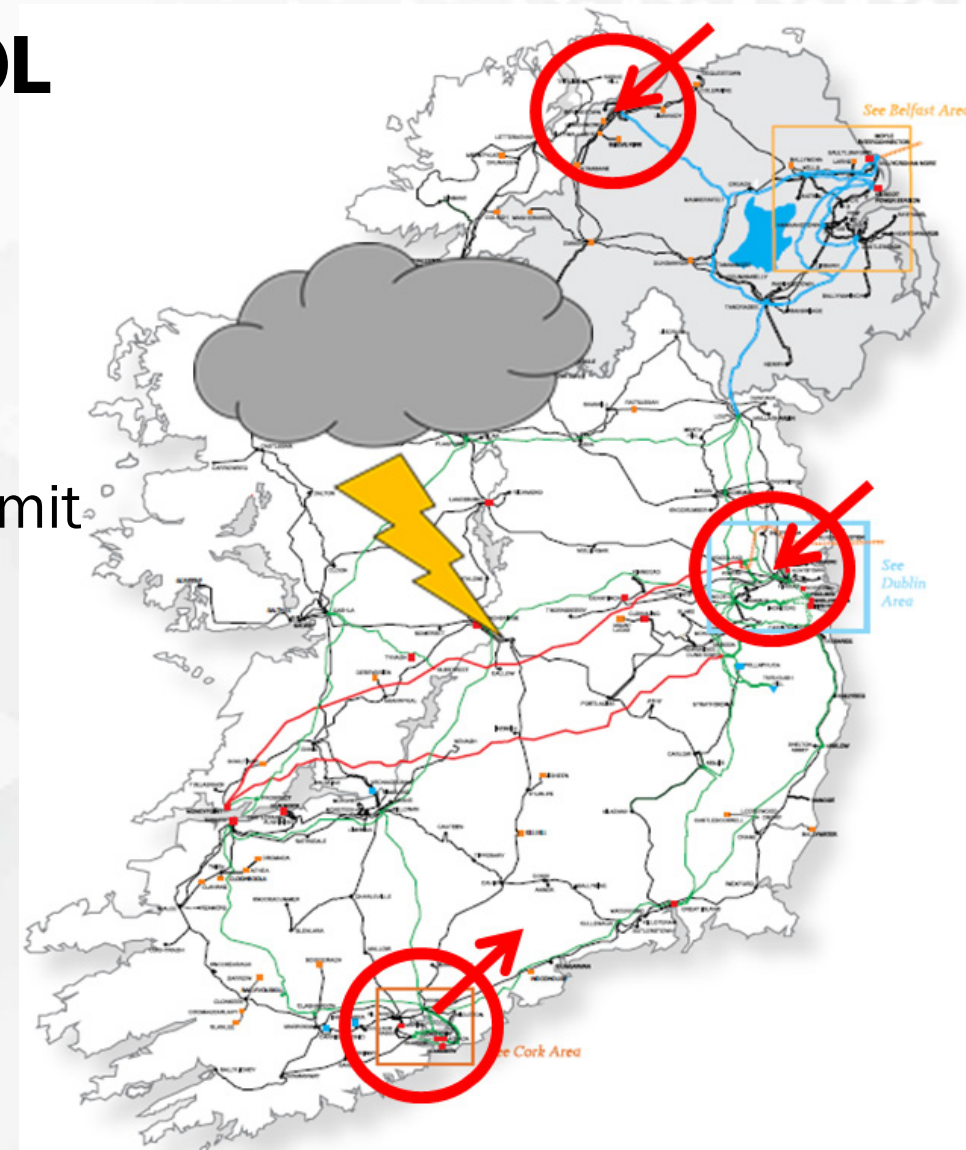
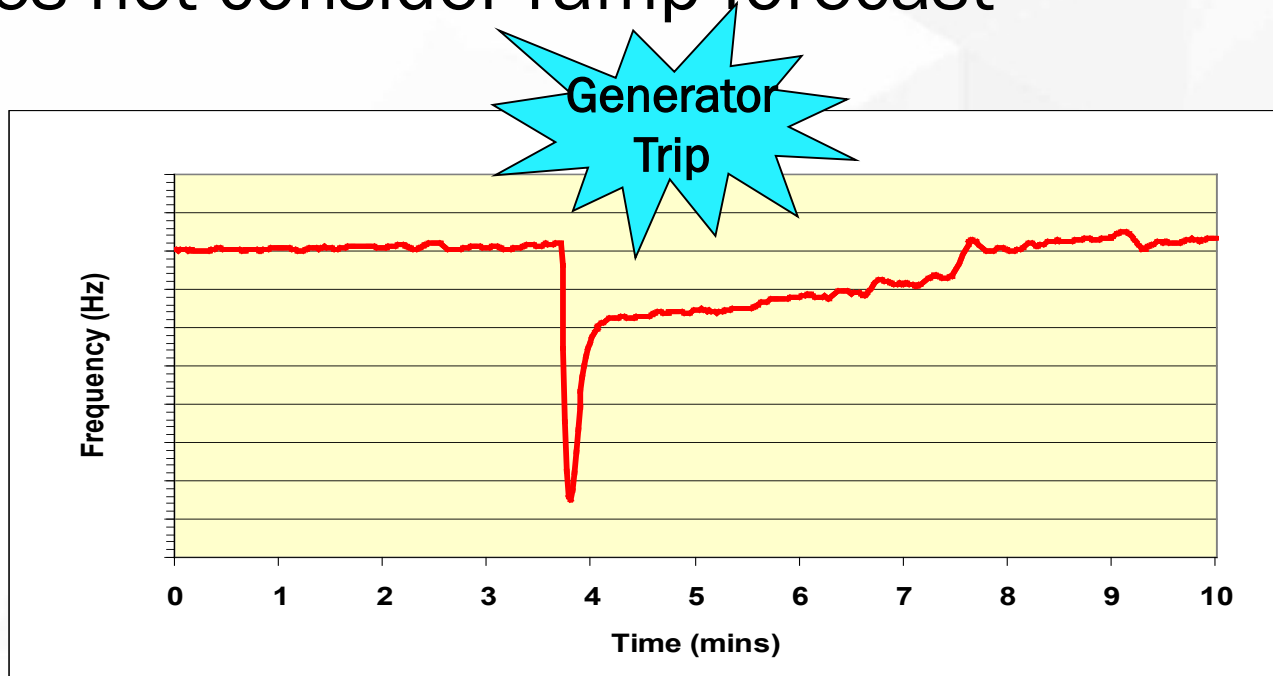
Convene Storm Response Team

- Return circuits from maintenance outages.
- Put power system trials on hold.
- Audit protection settings.
- Identify risk areas.
- Anticipate tripping and impacts thereof (loss of load, loss of wind)
- Communicate internally and externally.
- Staff up the Control Centres.
- Again: Schedule defensively.

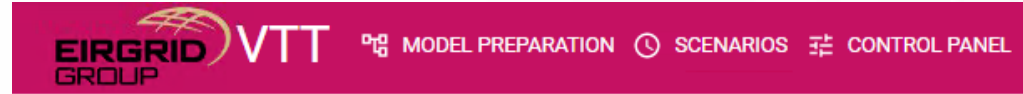


# LOOK-AHEAD STABILITY ASSESSMENT TOOL

- Simulates tripping of 800+ scenarios
- Checks power system stability
  - Operates within secure frequency ranges
  - Stay within Rate of Change of Frequency (RoCoF) limit
- “What if” transfer analysis
- Does not consider ramp forecast

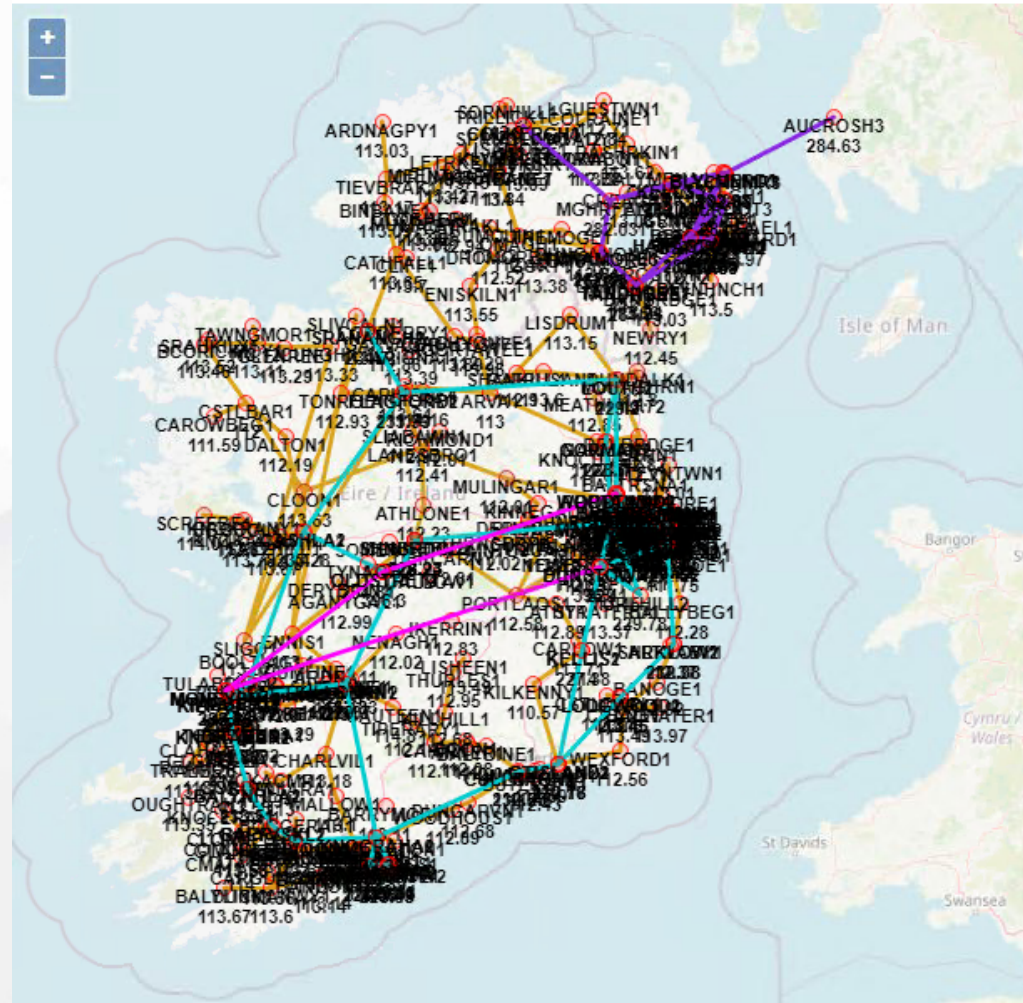


# VOLTAGE TRAJECTORY TOOL

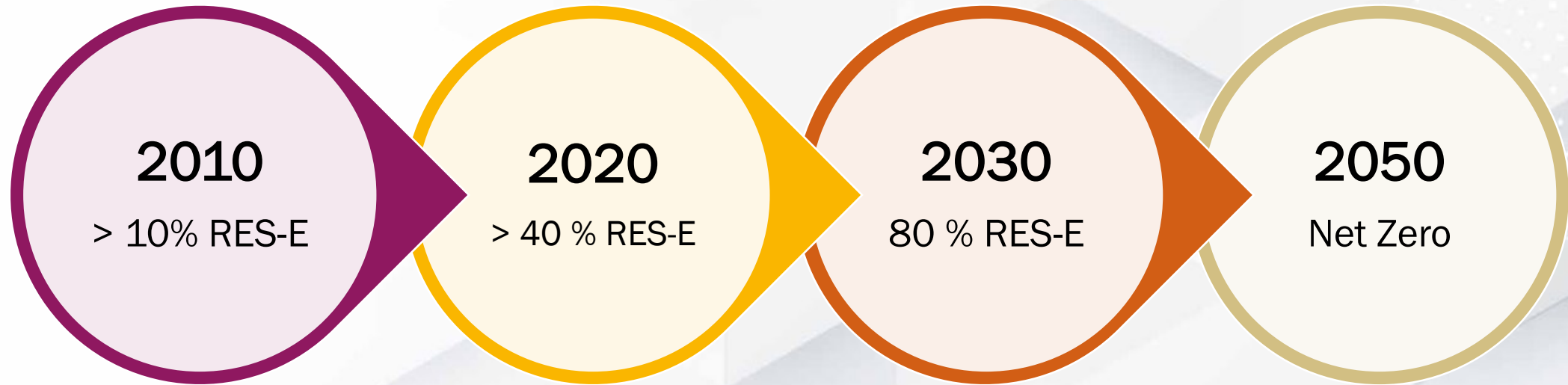


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- Operate within secure voltage ranges
- Suggests corrective voltage actions
- Does not consider ramp forecast

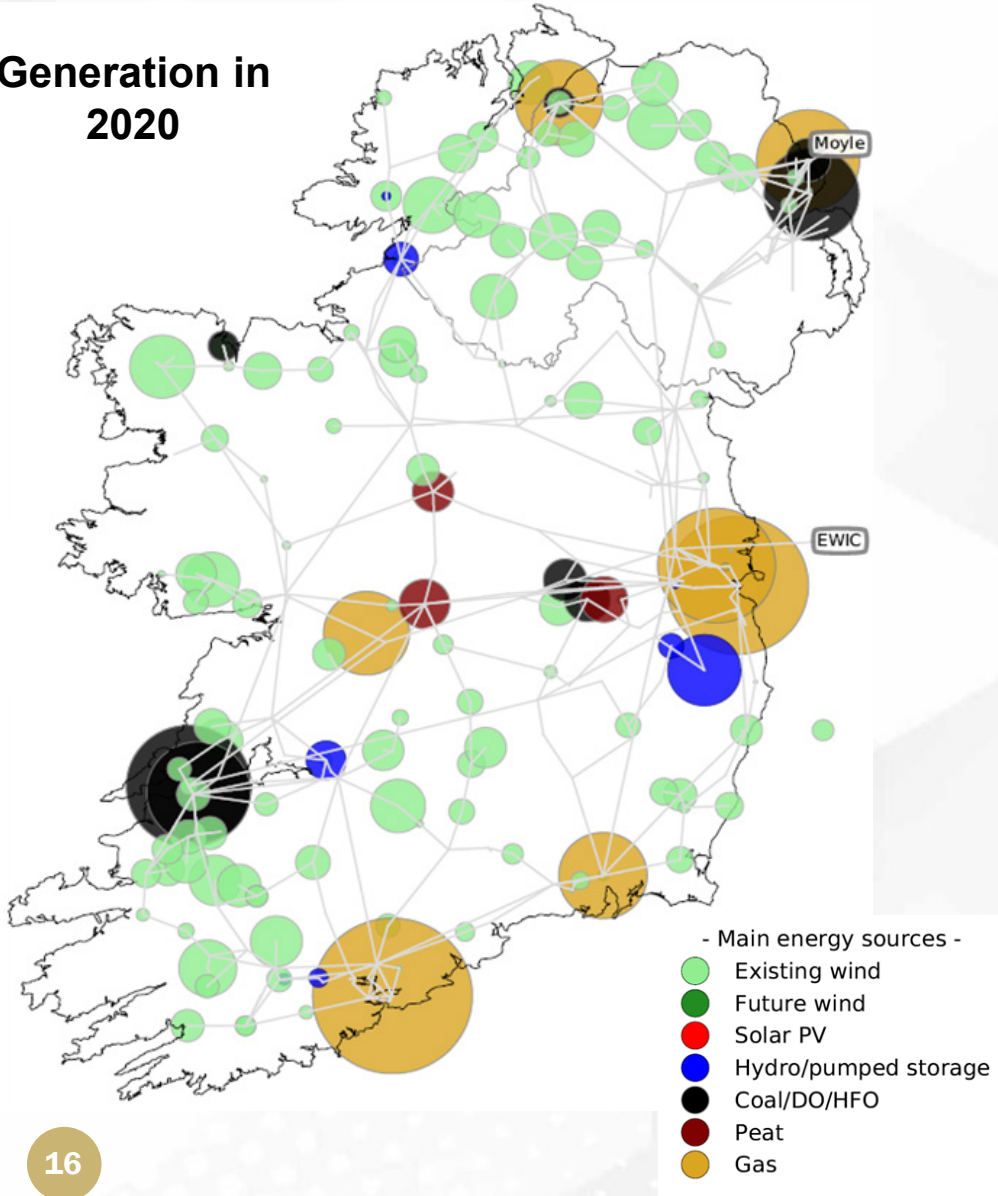


# THE FUTURE: SHAPING OUR ELECTRICITY FUTURE

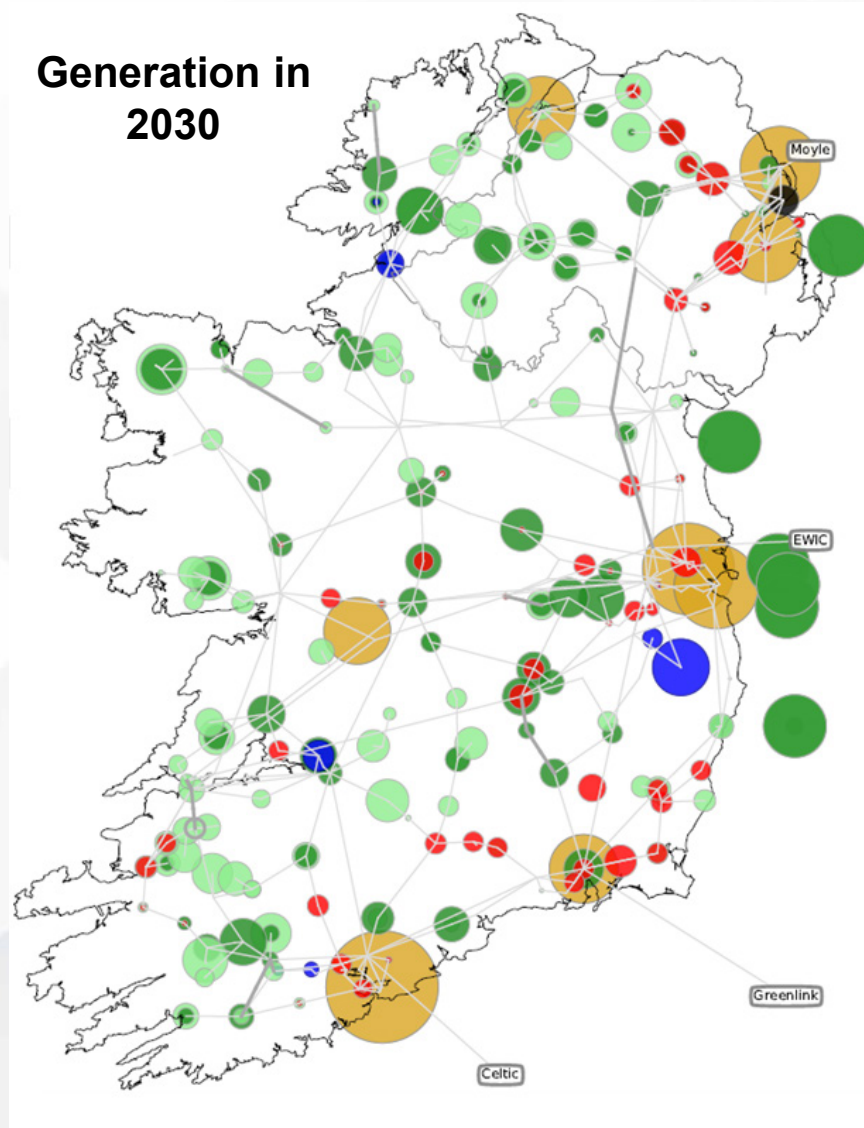


# THE FUTURE: SHAPING OUR ELECTRICITY FUTURE

Generation in 2020



Generation in 2030

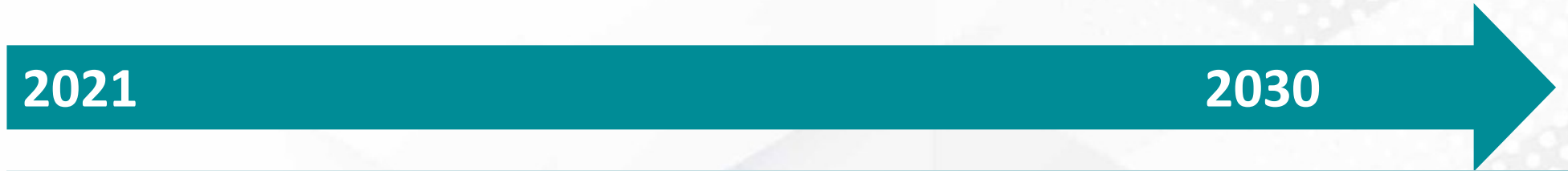


## Changes

- No Peat
- Little Coal
- More Solar
- More Onshore Wind
- More Offshore Wind
- 3<sup>rd</sup> GB Connection
- French Connection



# THE FUTURE: SHAPING OUR ELECTRICITY FUTURE



	2021	2030
<b>Policy</b>	40% RES-E	80% RES-E
<b>Demand</b>	Data Centres	Heat Pumps
<b>Generation</b>	Onshore/Offshore Wind	Solar <b>Energy-Limited</b> Distributed/Micro Resources
<b>New I/Cs</b>	GreenLink (500 MW)	Increased Ramp Rates Celtic (700 MW)
<b>Market</b>	Dispatchable Wind	European re-integration
<b>Infrastructure</b>	Statcoms / Sync Cons. Series Comp. Power Flow Controllers	Dynamic Line Rating

## In Summary:

Operating our weather-driven power system is very complex. This complexity will increase so our ability to manage uncertainty will have to grow and grow.

Thank You

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[www.smartgriddashboard.com](http://www.smartgriddashboard.com)