Managing Curtailment in 2030

Paul Blount & Rory Mullan

October 2019

Presentation Overview

1. Project Team and Scope
2. What is Curtailment
3. Historical Curtailment
4. Policy Context
5. Demand Forecasting
6. Adding Wind to reach High RES-E %
7. Adding Solar to reach High RES-E%
8. Introduction to Curtailment Mitigation Measures up to 2030
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Project Team

Paul Blount

Company/Institution: Coillte
Job Title: Portfolio Director
Project Role: Model Development & Analysis
Background: Civil Engineer with 10 year's experience in renewables.

Rory Mullan

Company/Institution: Mullan Grid
Job Title: Senior Consultant
Project Role: Project Lead
Background: Consultant on grid connections to the renewable industry for the past 12 years and worked for Irish Utilities

Peter Lynn

Company/Institution: Mullan Grid
Job Title: Senior Engineer
Project Role: Project Support
Background: Chartered Engineer with 18 years experience in the Irish engineering consultancy sector and has spent the past 10 years specialising in grid connections for renewable generation in Ireland and Northern Ireland.

Dr James Carton

Company/Institution: DCU
Job Title: Assistant Professor
Project Role: Project Support
Background: Co-leader of The Climate Change Task Force, and member of Future Energy Leaders programme of the World Energy Council.

Conor Forde

Company/Institution: Mullan Grid
Job Title: Project Engineer
Project Role: Project Support
Background: Recent DCU graduate in Mechanical Engineering, currently undertaking a research masters on hydrogen storage in DCU.

Project Objectives

Examine the electricity system in Ireland and seek to determine the relative and combined impact and importance of a series of curtailment mitigation measures to facilitate high levels of RES-E

Project Aims and Objectives:

- Develop, calibrate and test a model for estimating curtailment in Ireland.
- Investigate potential measures to mitigate curtailment in 2030.
- Develop scenario of a high RES-E in 2030 with relatively low curtailment.
- Animation of 2030 curtailment results.
- Dissemination and Project report for policy makers and stakeholders.

Note - Analysis has not considered grid limitations at transmission and distribution level

- Assuming curtailment allocated on a pro-rata basis across wind and solar

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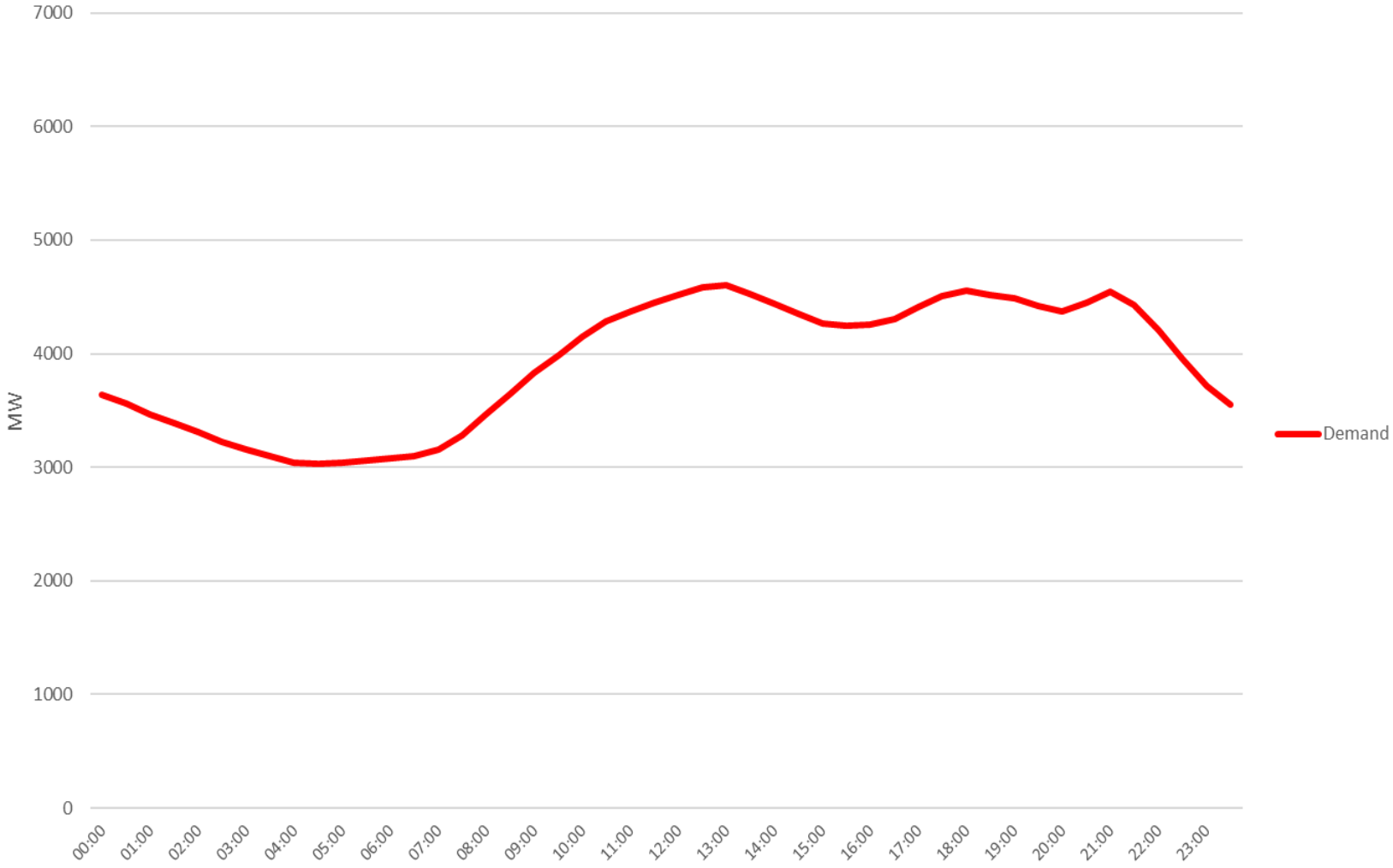

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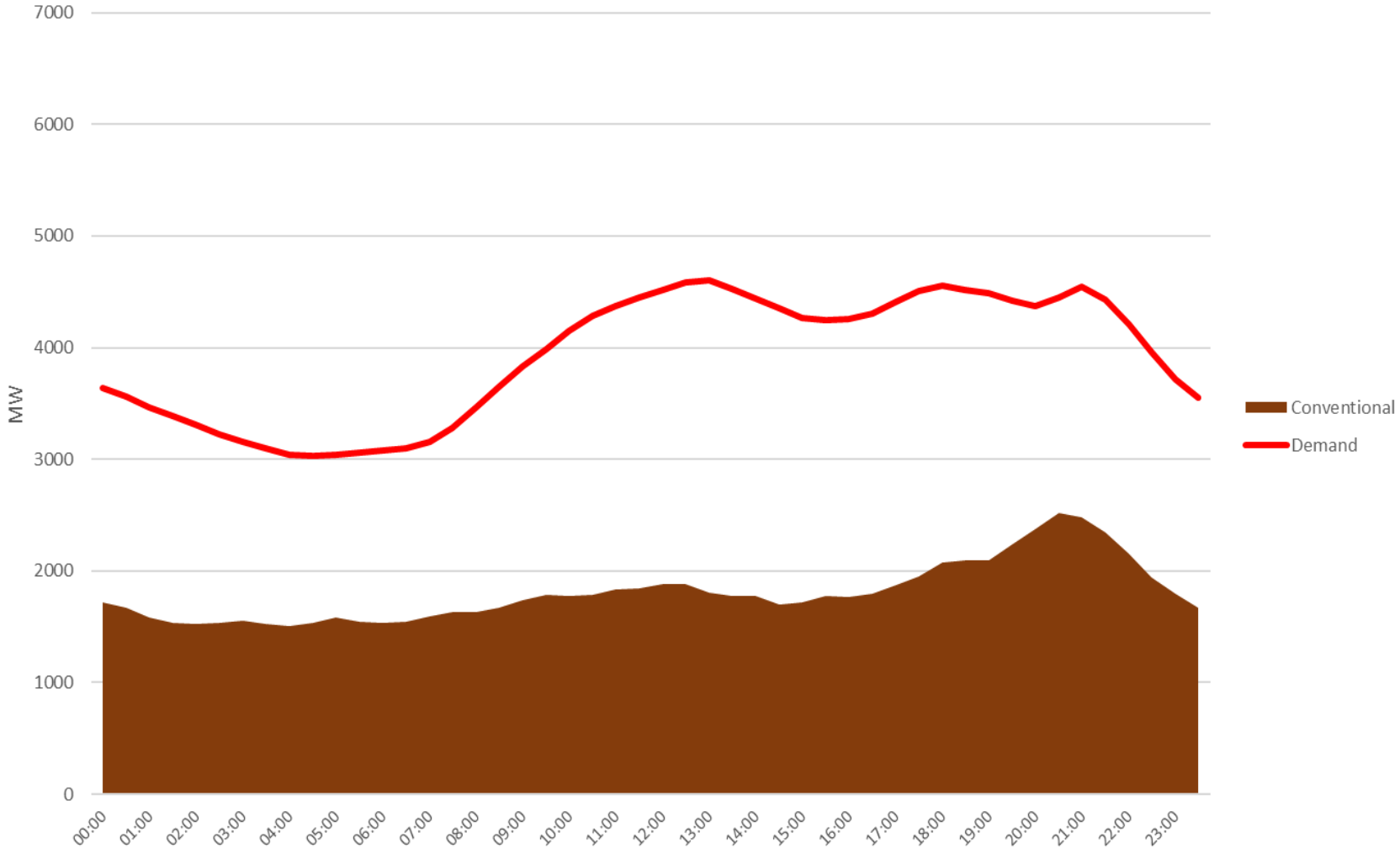

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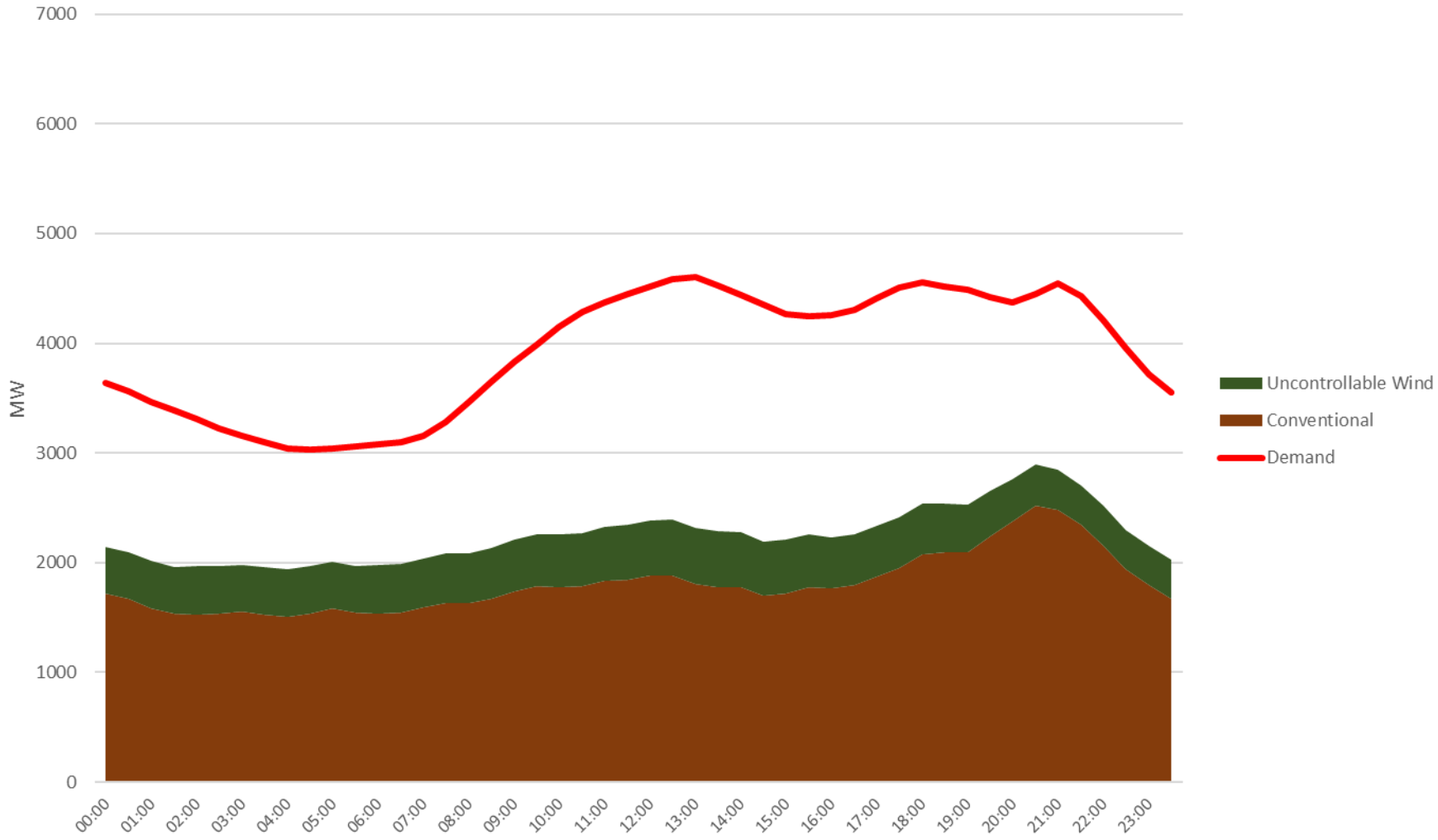

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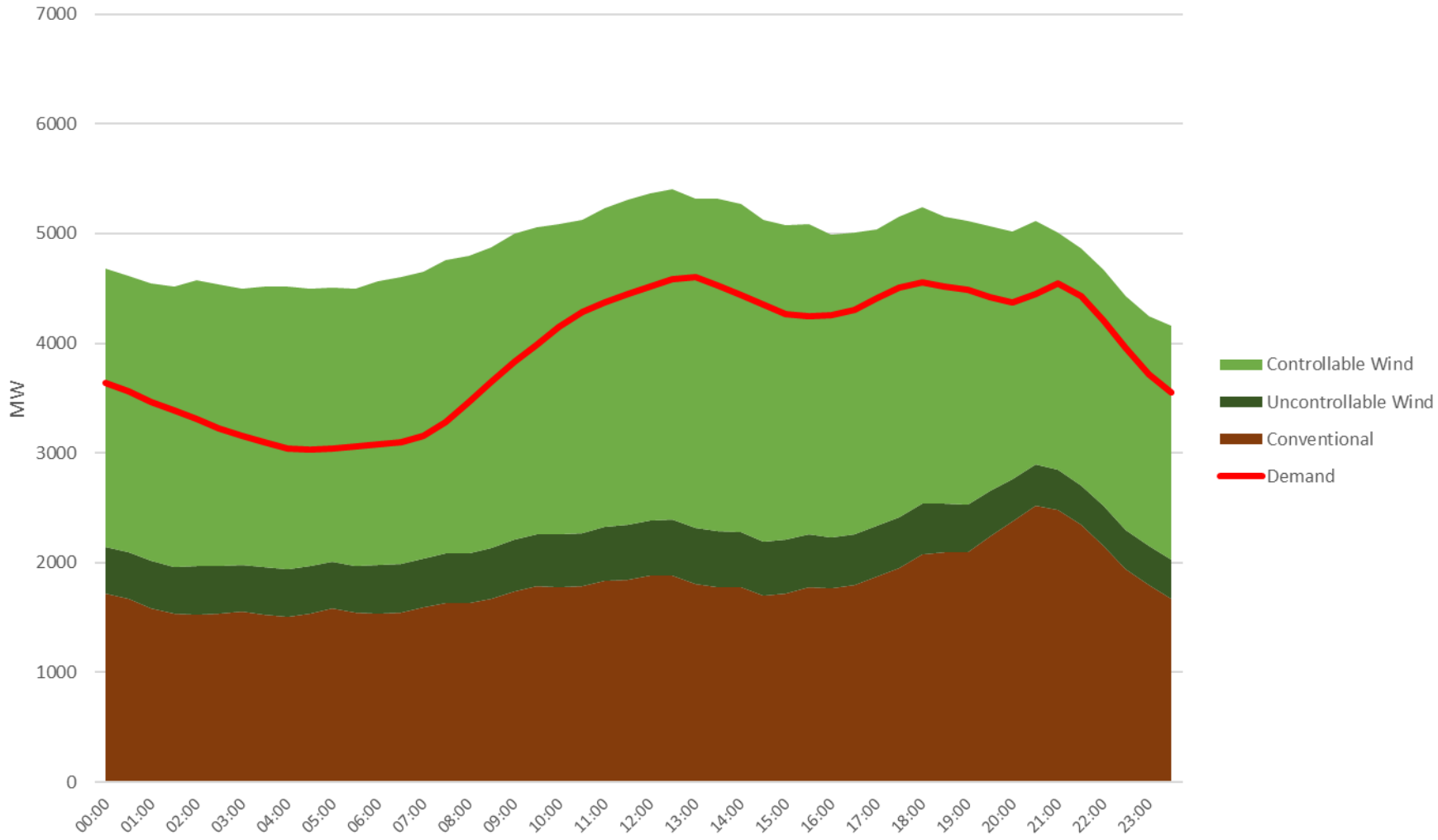

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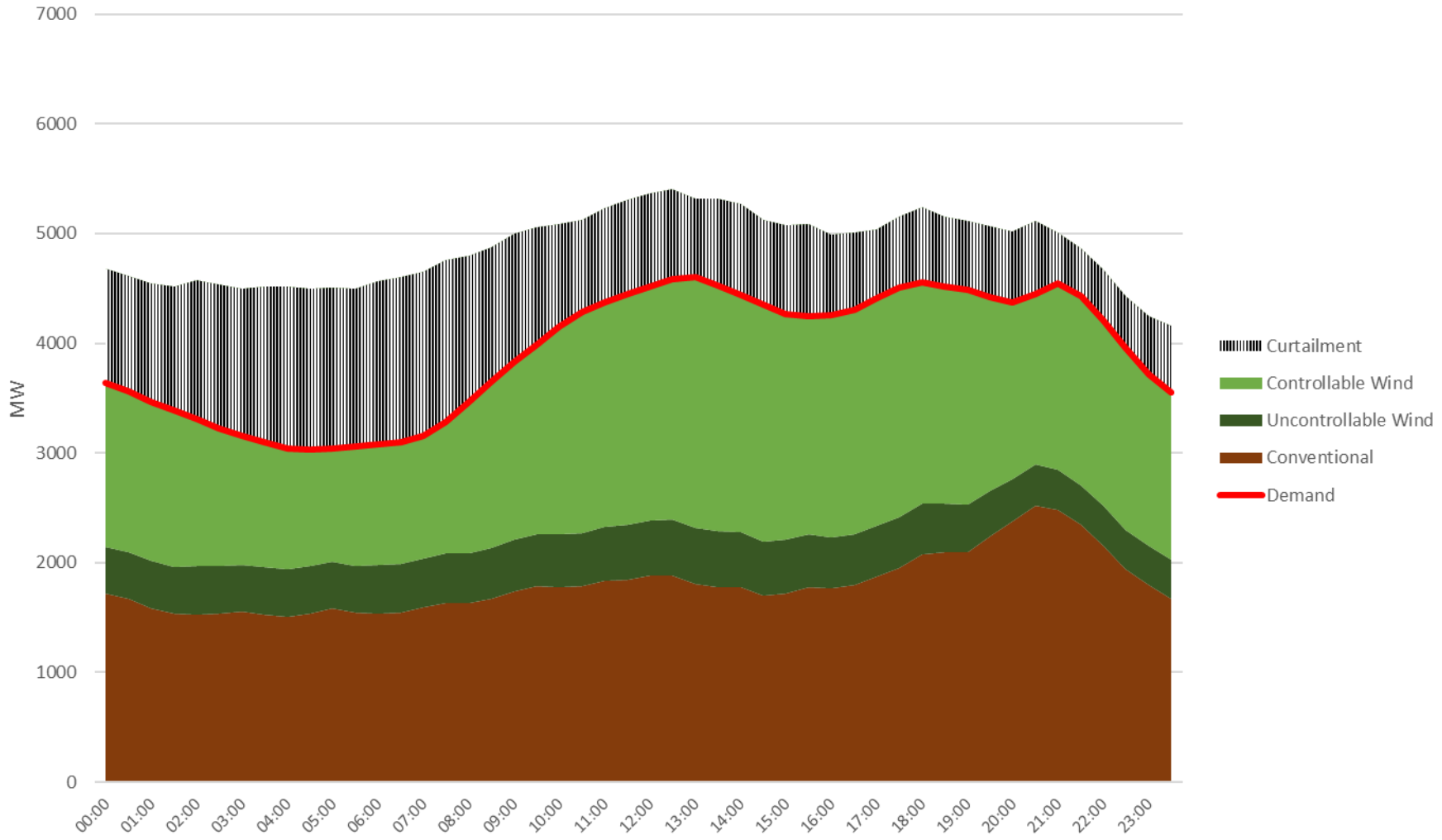

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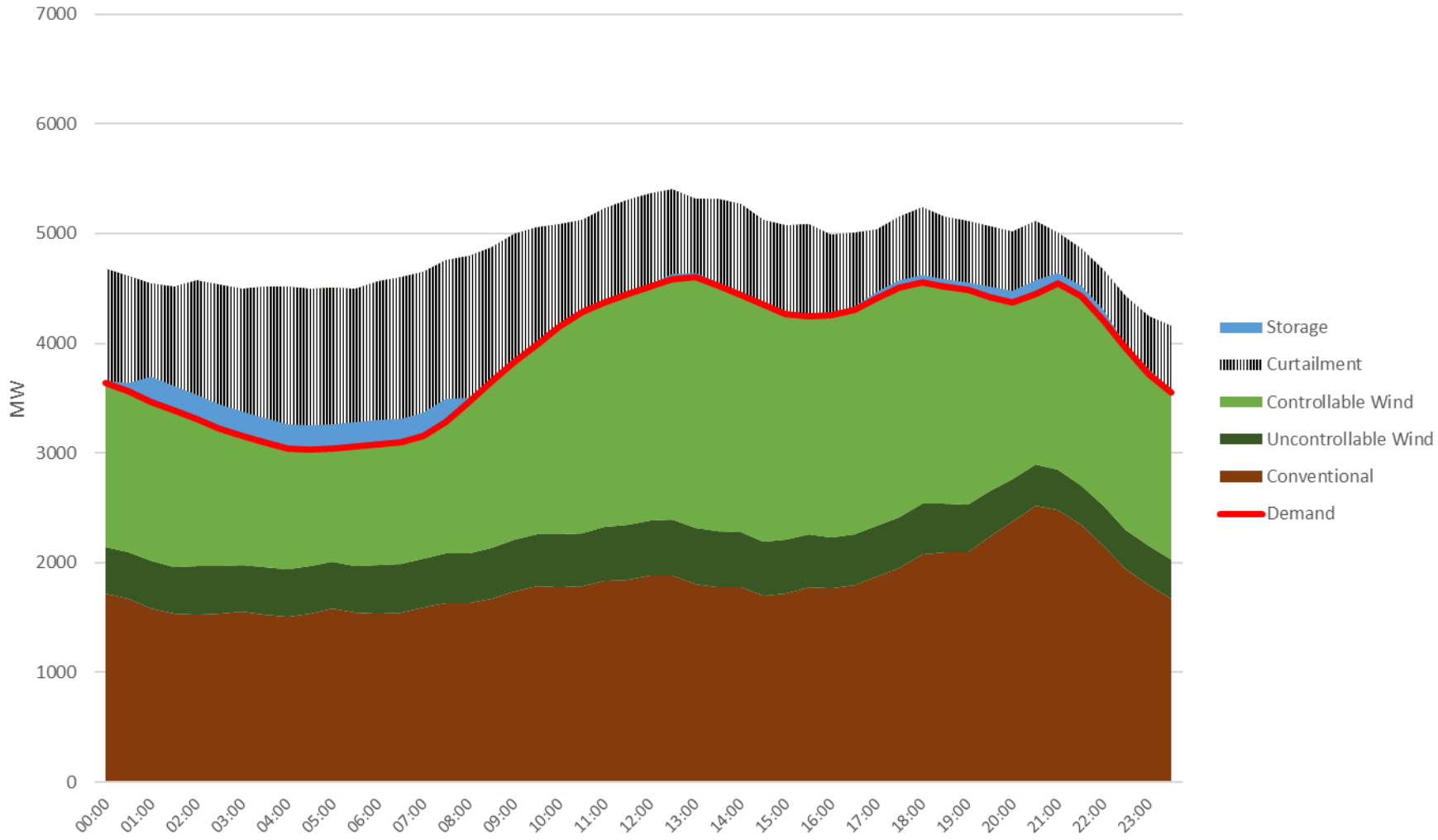

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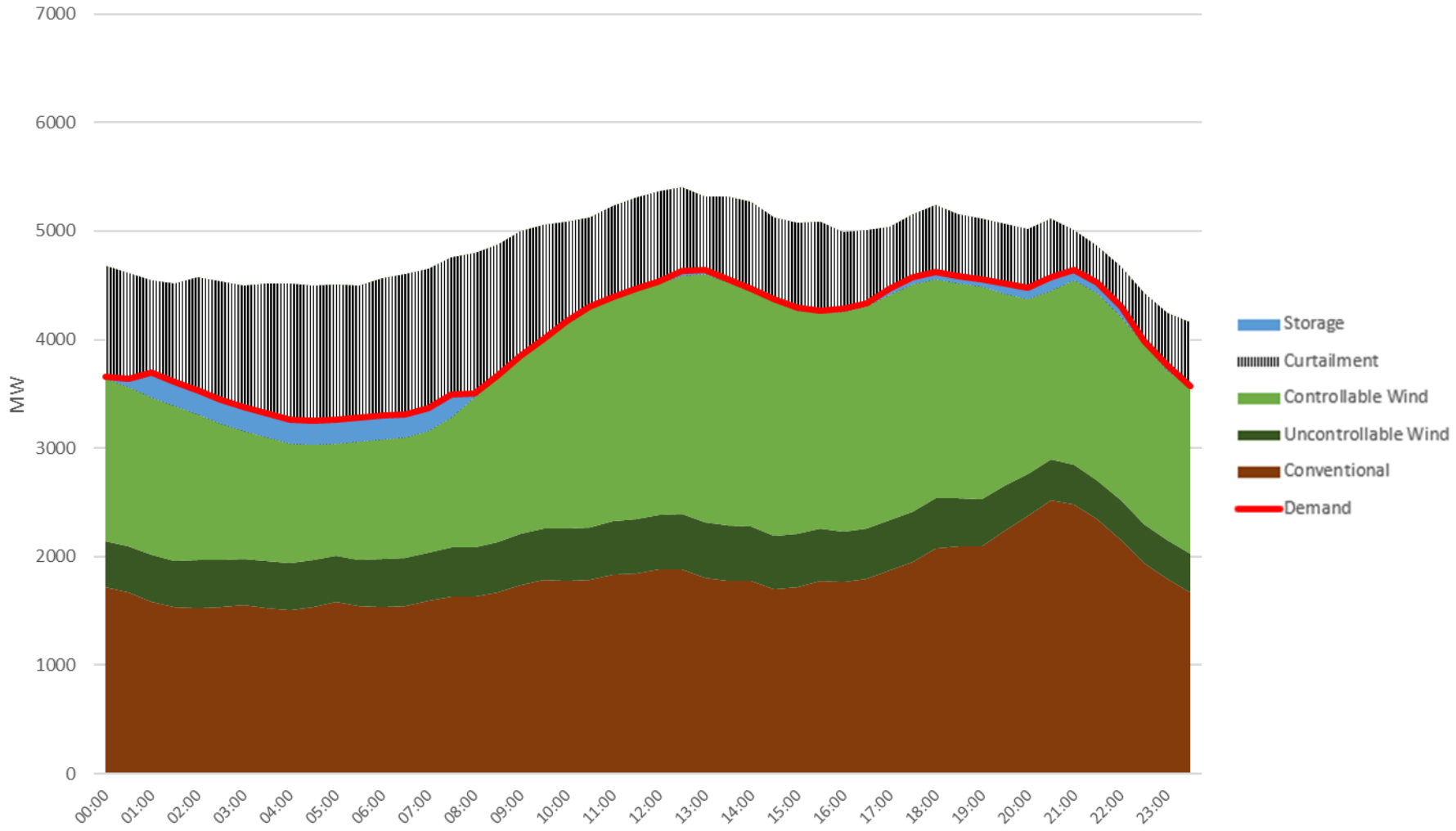

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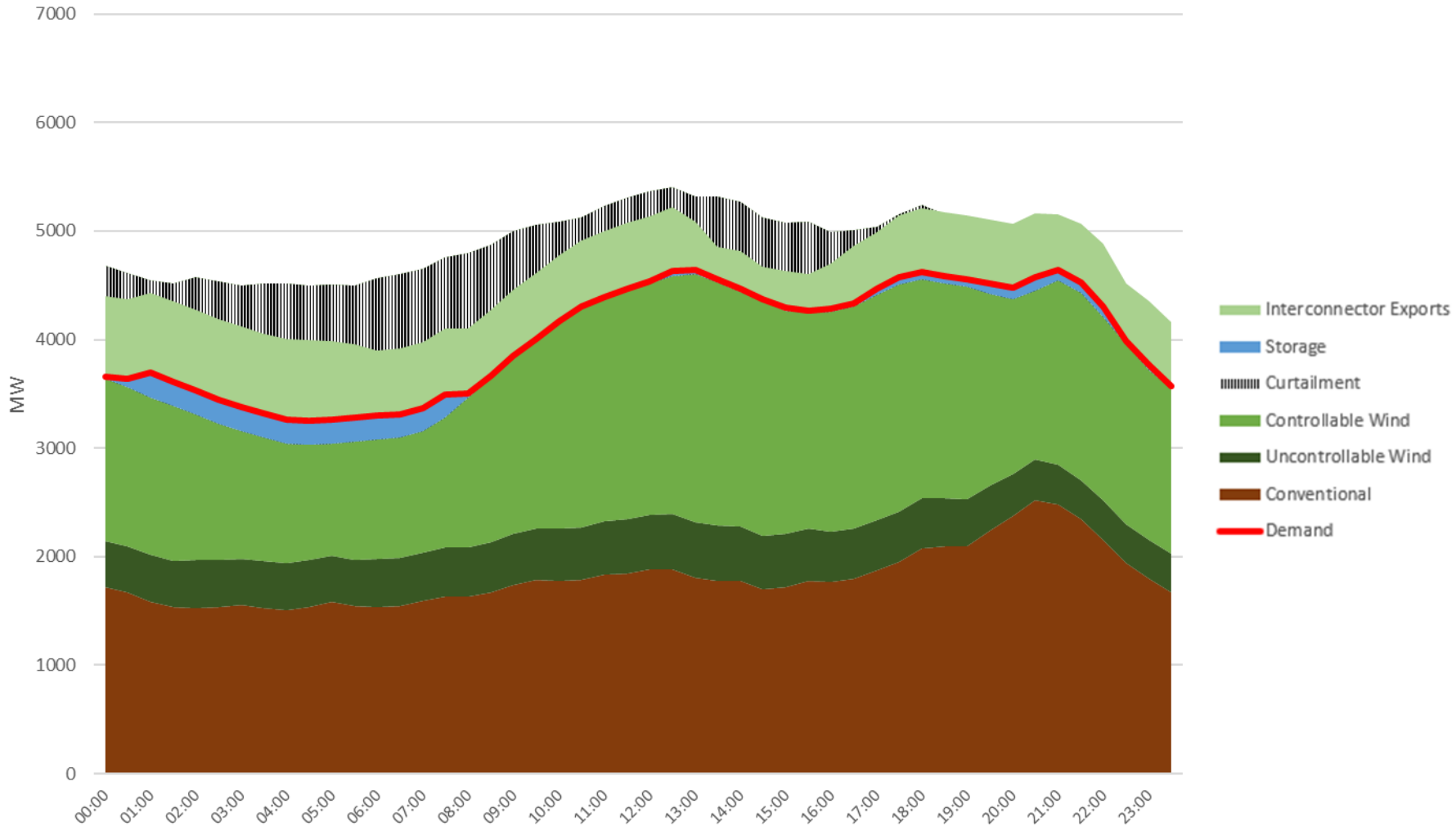
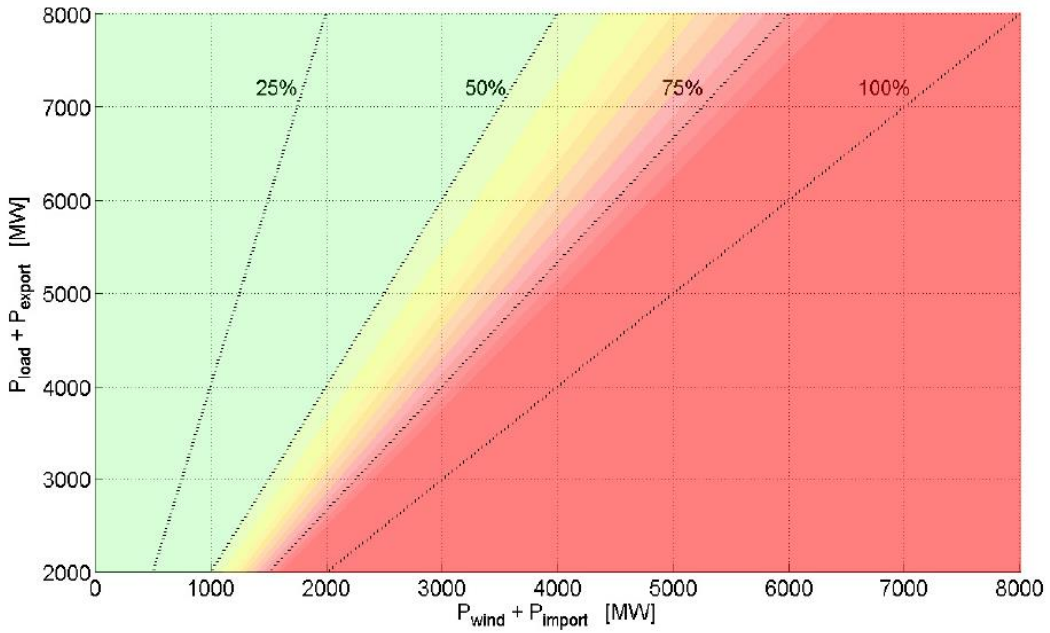


What is SNSP ?

- EirGrid's plan to manage curtailment - Delivering a Secure, Sustainable Electricity System (DS3)
- System Non-Synchronous Penetration (SNSP) limit:

$$\text{SNSP} = \frac{\text{Non-Synchronous Generation + Import}}{\text{Demand + Export}}$$

- Aim of DS3 for 2020 is to increase SNSP from 50% to 75%



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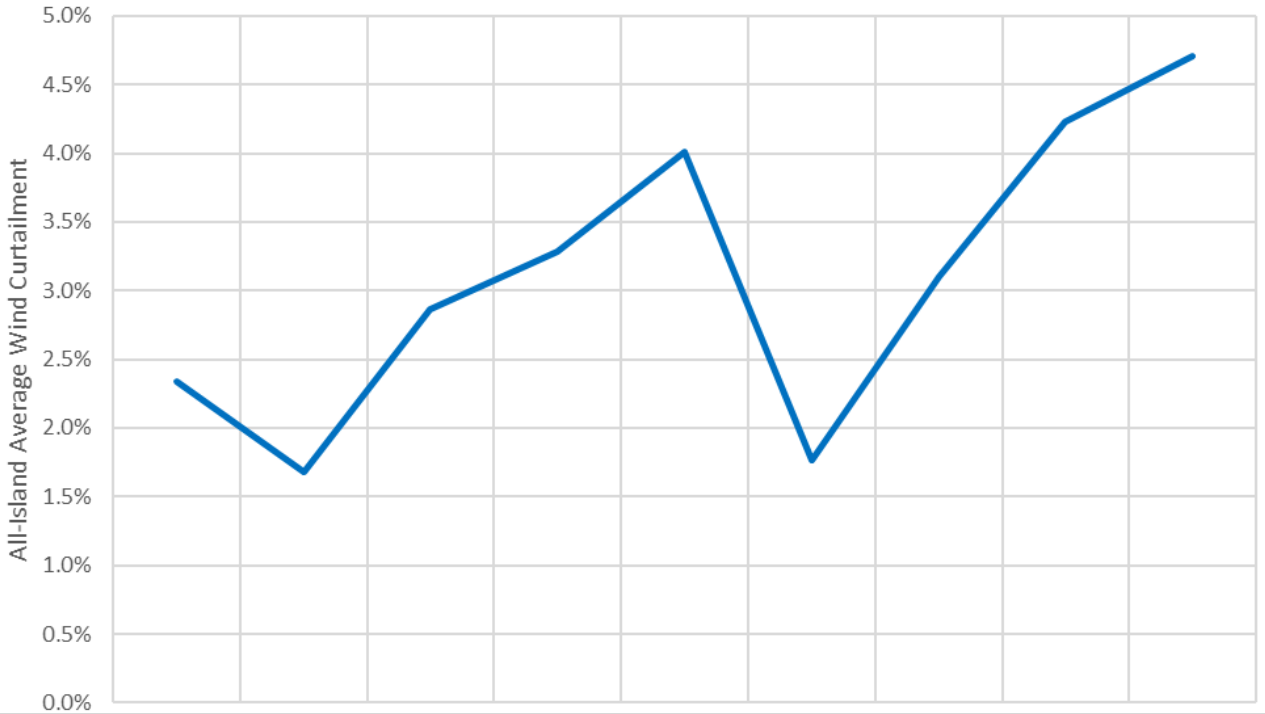
Historical Wind Curtailment



Year	2011	2012	2013	2014	2015	2016	2017	2018	Q1-Q2 2019
Installed Wind (MW)	2097	2303	2563	2996	3198	3722	4467	4886	5018

All-Island Average Wind Curtailment

Source: Curtailment data from EirGrid & SONI's Annual Renewable Energy Constraint and Curtailment Reports, and Wind Farm Dispatch Down Reports.

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Policy Context

Renewable Energy Directive 2009/28/EC

- Directive with 2020 RES-E targets and mandating priority dispatch of renewables.

Clean Energy Package for All Europeans

- EU target of at least 32% in renewable energy by 2030.
- Progress report on National Energy Climate Plans (NECPs) to be provided on a biennial basis.

Climate Action Plan 2019

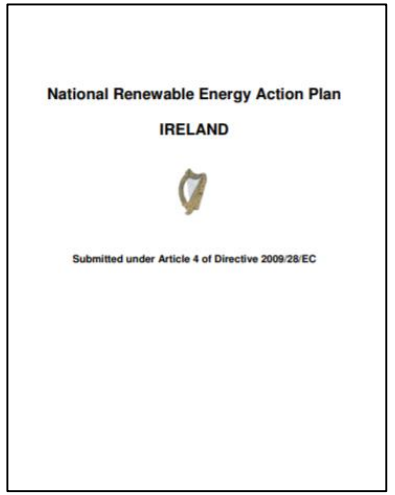
- New 70% RES-E 2030 target for 2030.

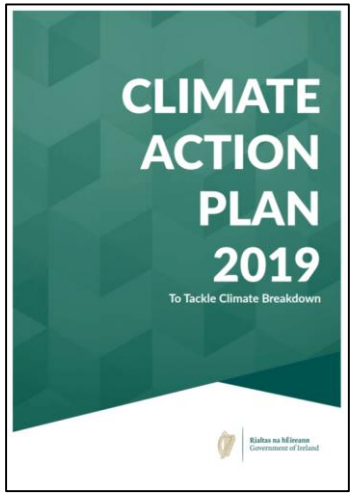
DS3 Programme

- EirGrid's programme to minimise curtailment up until 2020.

EU-SysFlex

- EirGrid led project to investigate challenges of high RES-E systems. This is the groundwork for DS30.





EU-SysFlex

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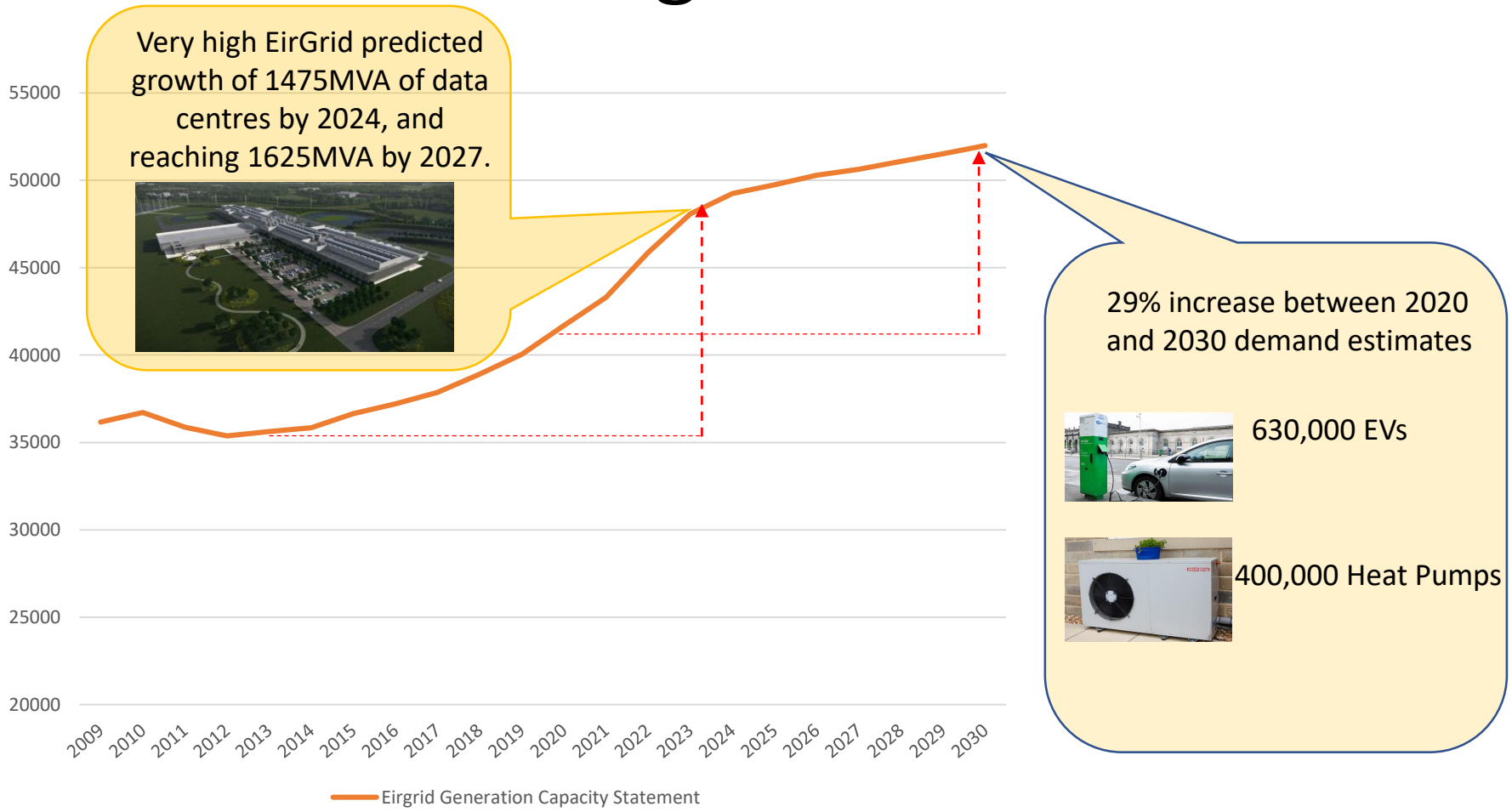
Demand growth



Source: Demand between 2018 and 2029 sourced from EirGrid's median demand forecasts from the 2018 Generation Capacity Statement

* Electric vehicle and heat pump assumptions from IWEA 70 by 30 Study

All Island 2030 Demand

Demand Component	ROI (MWh)	NI (MWh)	All Island (MWh)
Background Demand	29,532,561	9,696,431	39,228,992
Data Centres	11,151,480	-	11,151,480
Electric Vehicles	1,186,804	566,699	1,753,503
Heat Pumps	1,199,975	504,514	1,704,489
Total Demand	43,070,820	10,767,644	53,838,464

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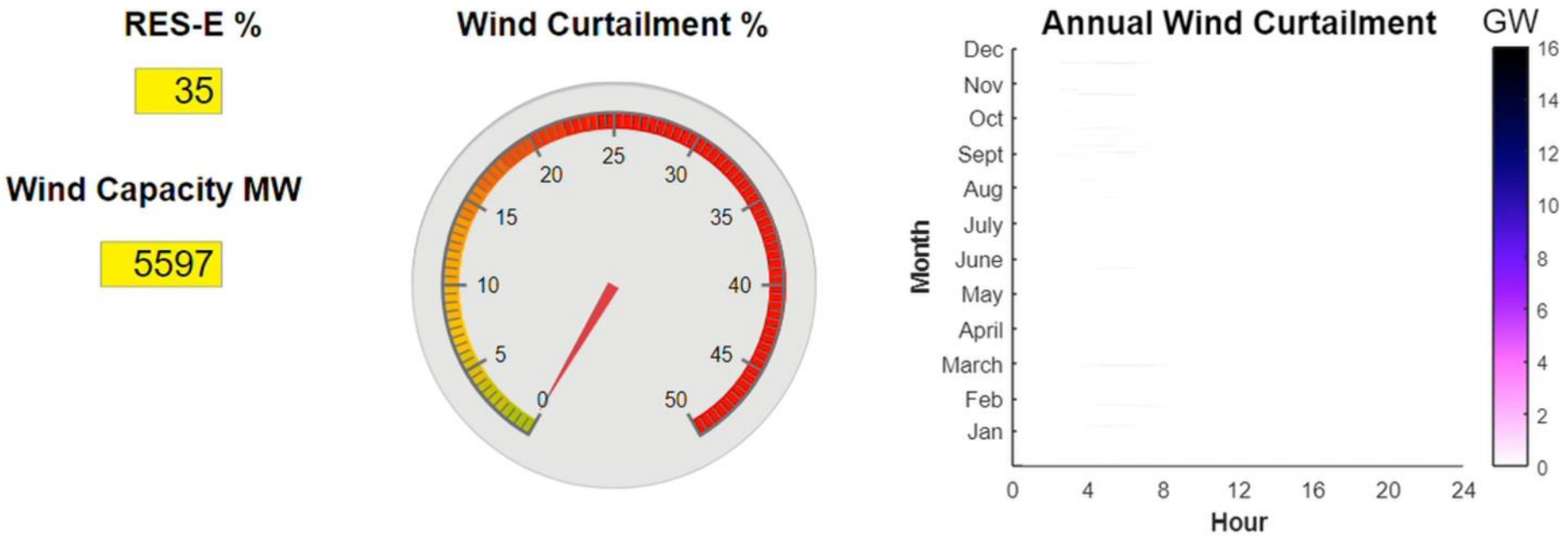

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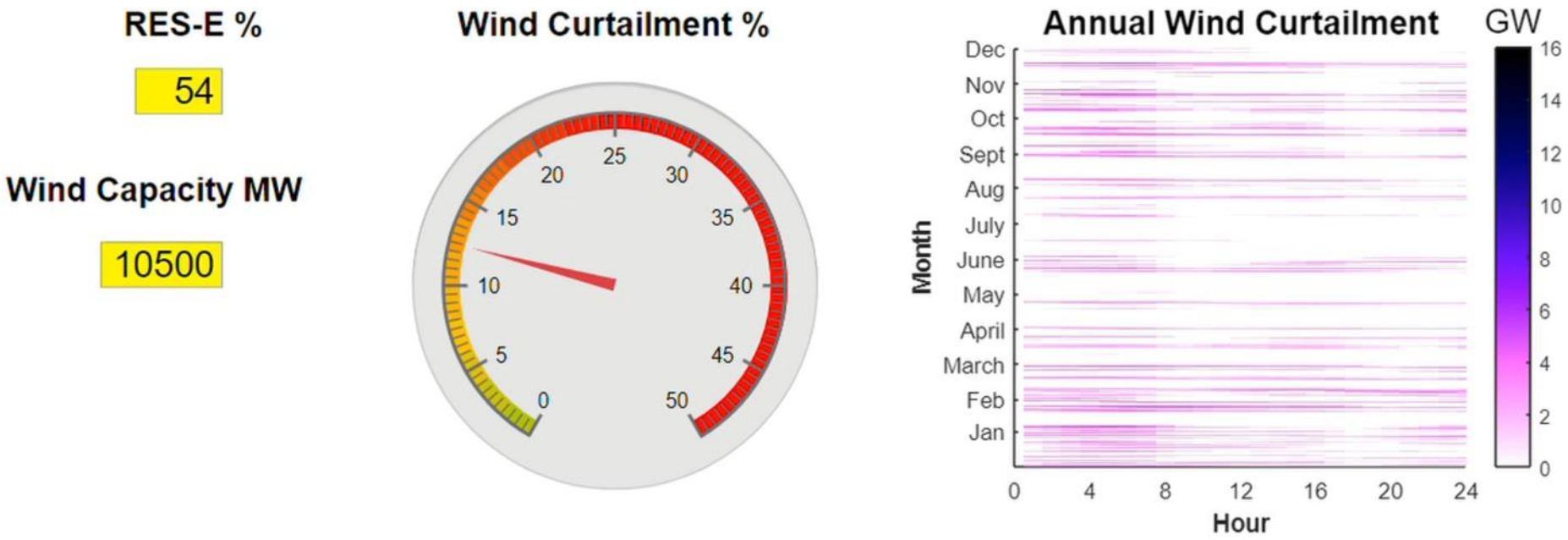


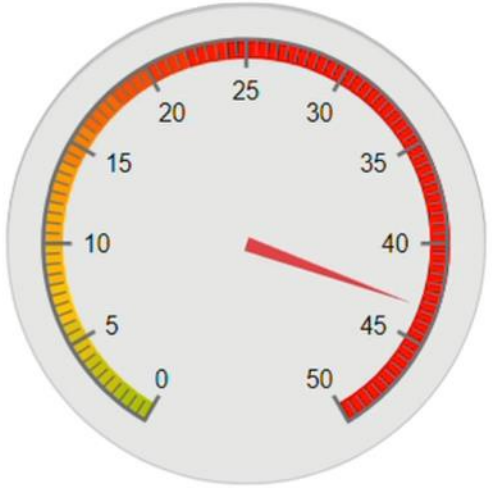
Adding Wind to reach high RES-E

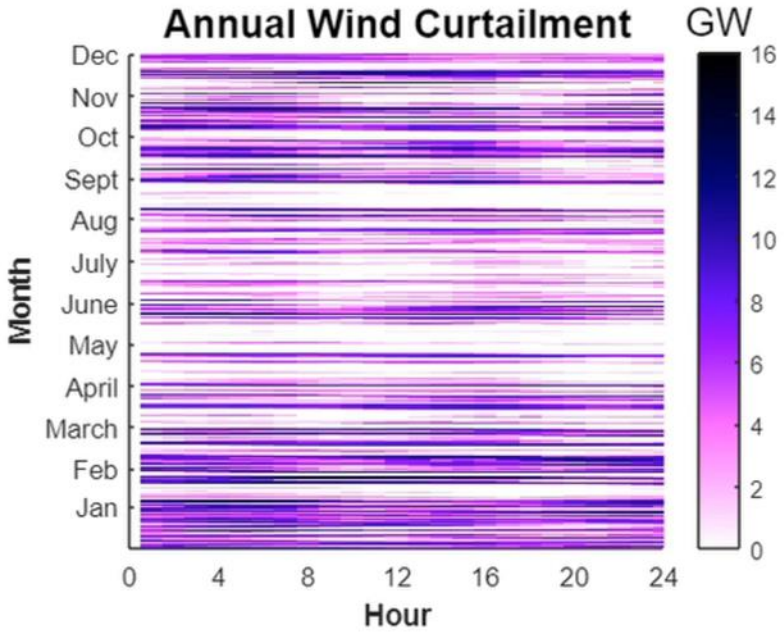
RES-E %

70

Wind Capacity MW

21200





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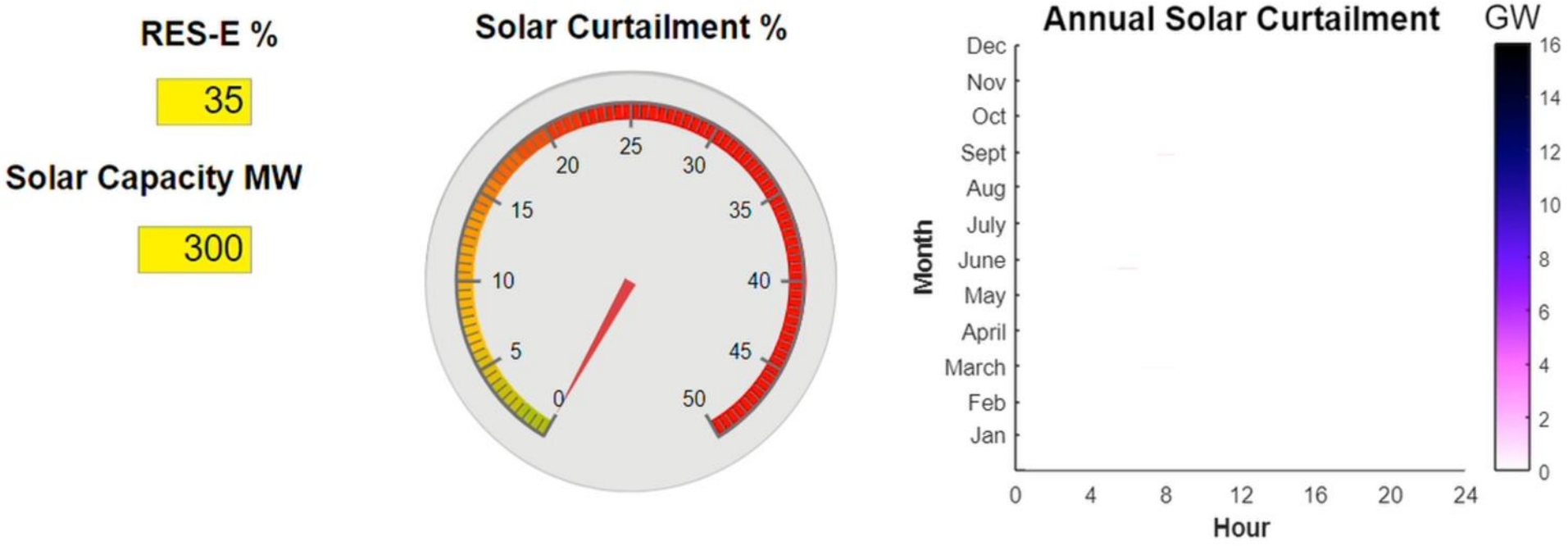


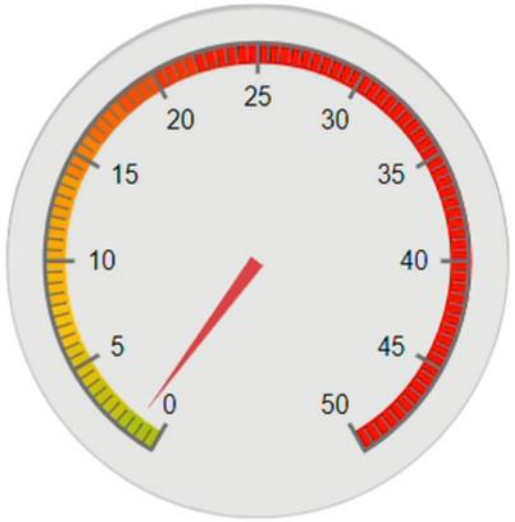
Adding Solar to reach high RES-E

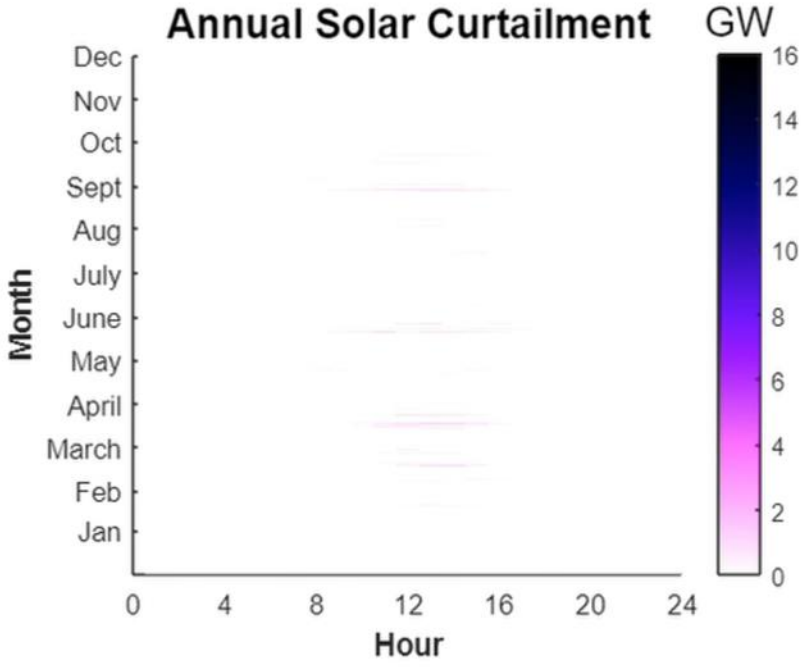
RES-E %

42

Solar Capacity MW

4800





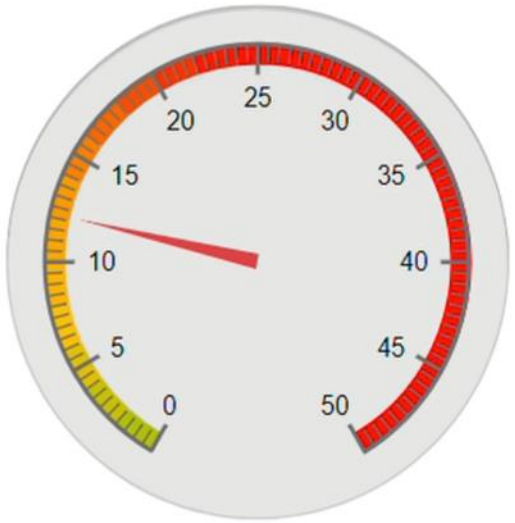
Adding Solar to reach high RES-E

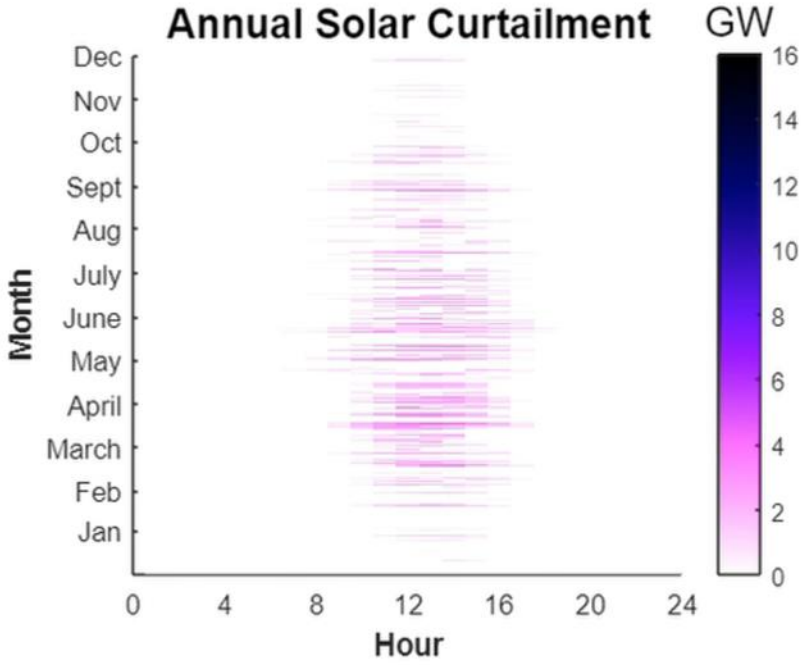
RES-E %

47

Solar Capacity MW

9800





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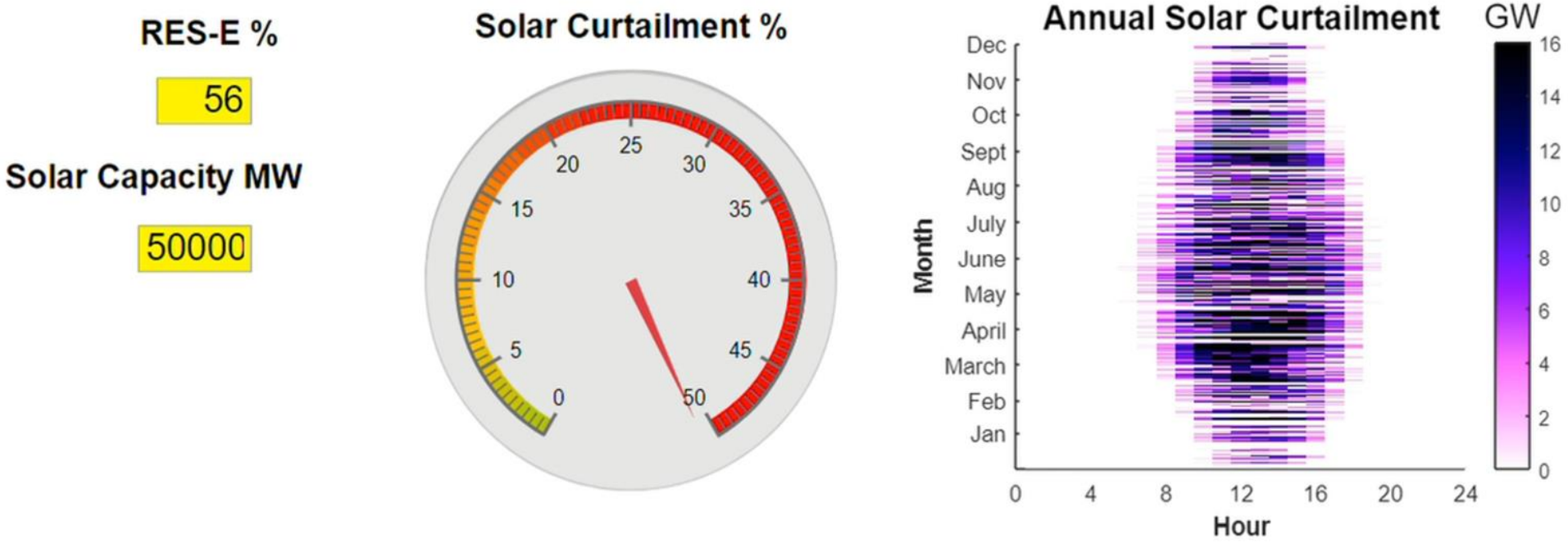

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Investigation of Curtailment Mitigation Measures

Measure	Description	
Relieve operational constraints	-Min Gen	1400 MW – 0 MW
	-SNSP	75% - 100%
Additional interconnection capacity	-Celtic IC -Greenlink IC -Additional capacity	Up to 3000 MW
Additional Energy storage capacity	-3hr Batteries -6hr, 15hr, 30 hr PHES	Up to 3000 MW
Increased wind capacity factor	-Blended Onshore & Offshore Fleet Cap Factor	30% - 50%
Diversification of technologies	-Increase Solar Capacity	300 MW Up to 14,000 MW
Demand side Management	-% EV Demand Flexible -% Background Demand Flexible -% Heat Pump Demand Flexible	0% - 100%

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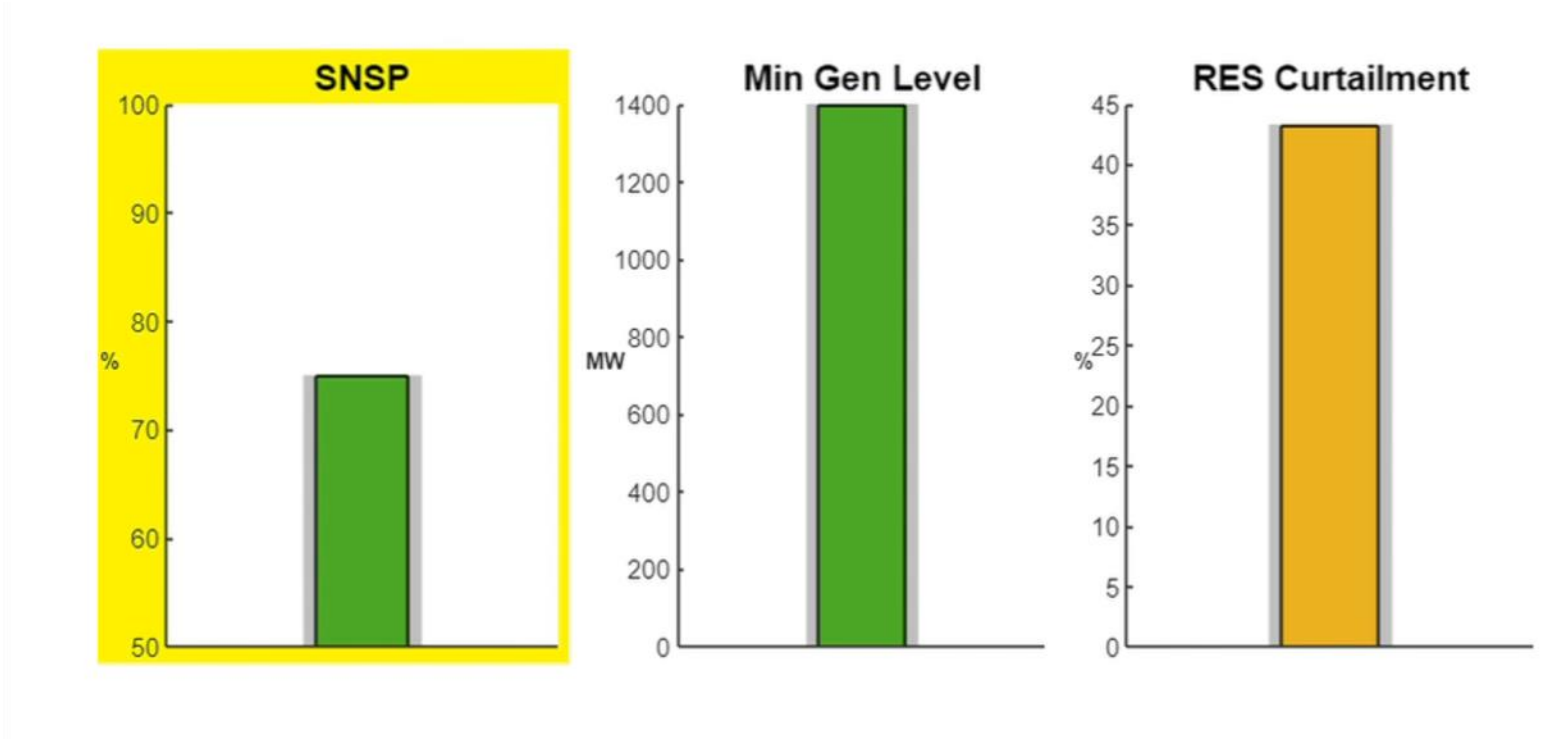

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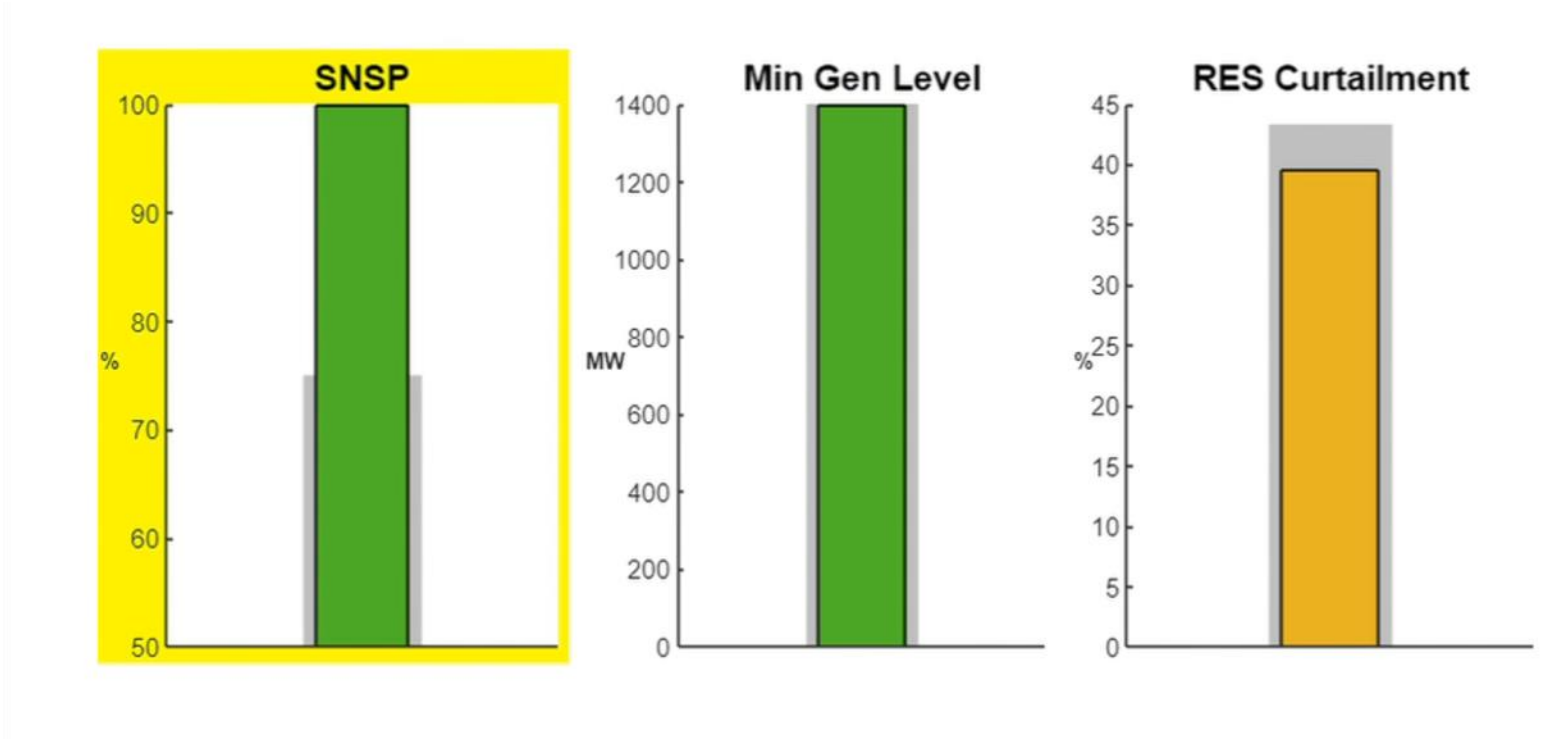

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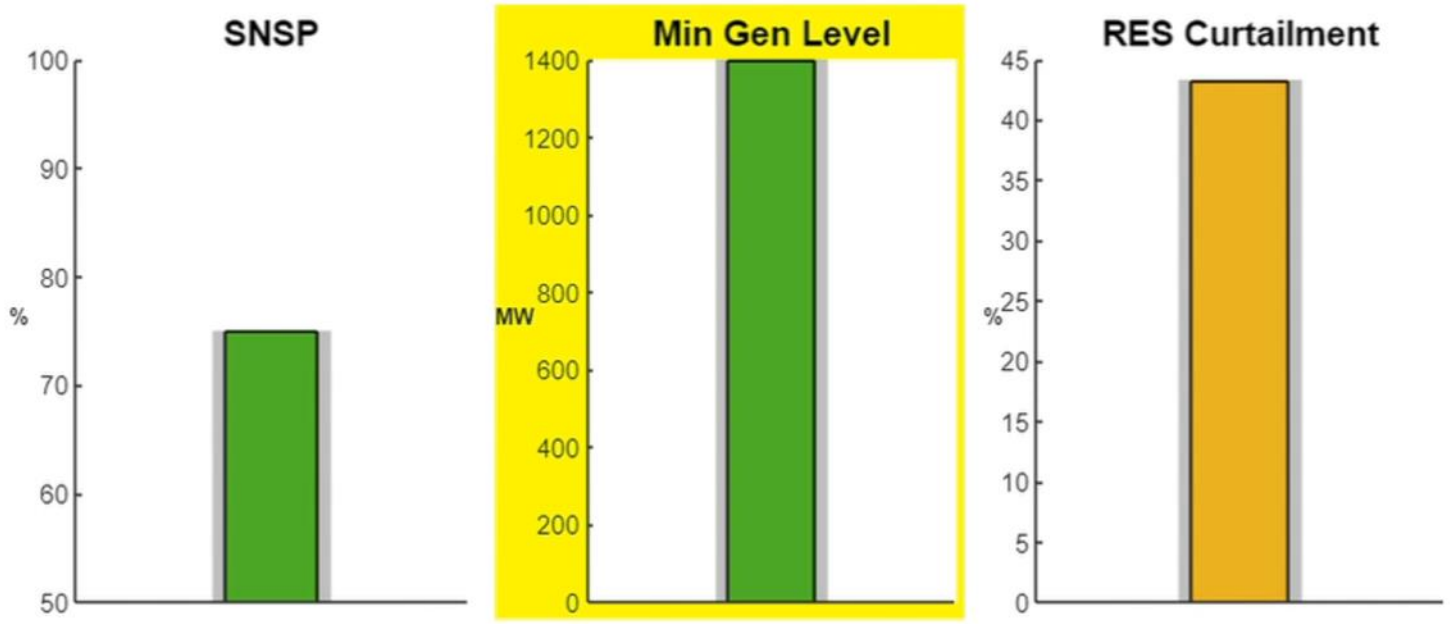

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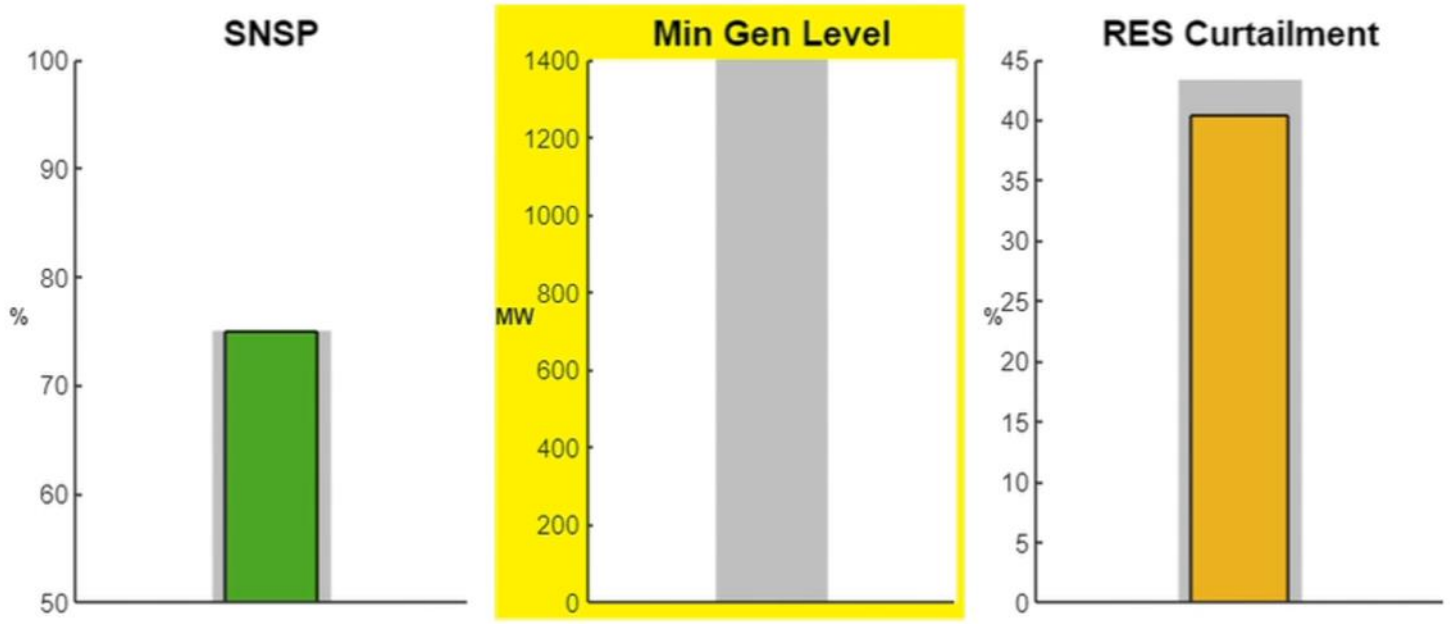

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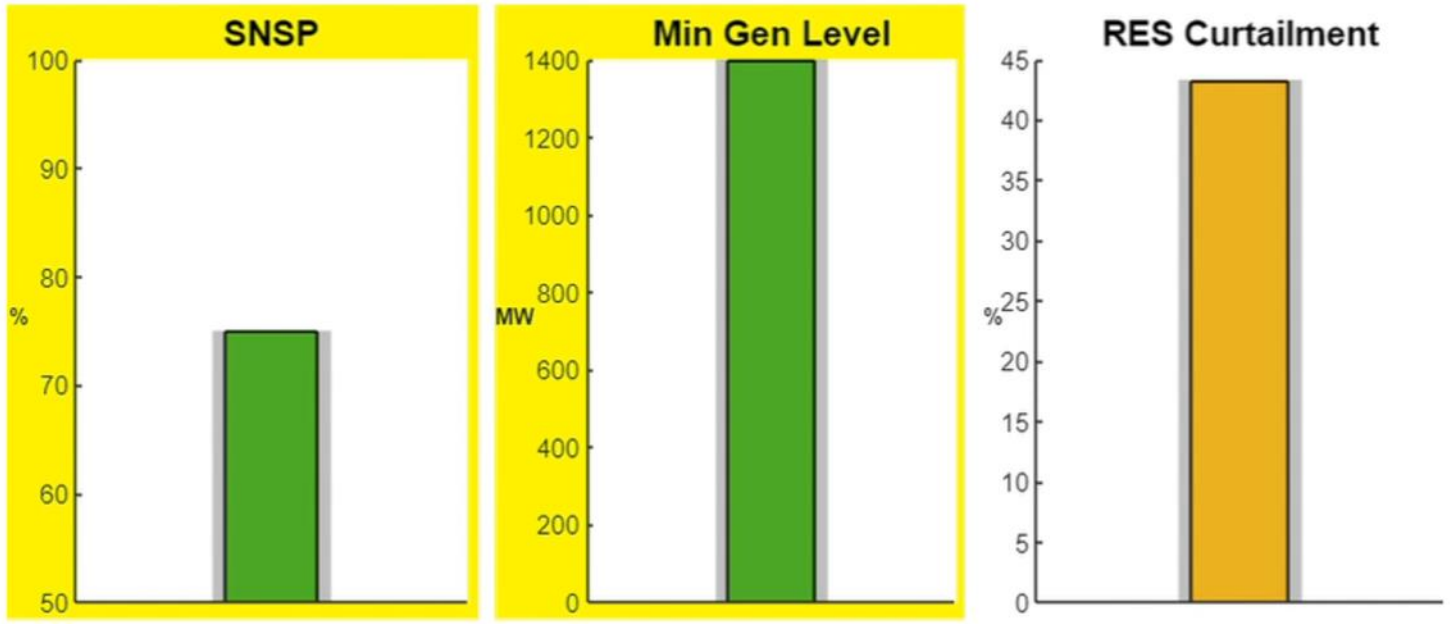

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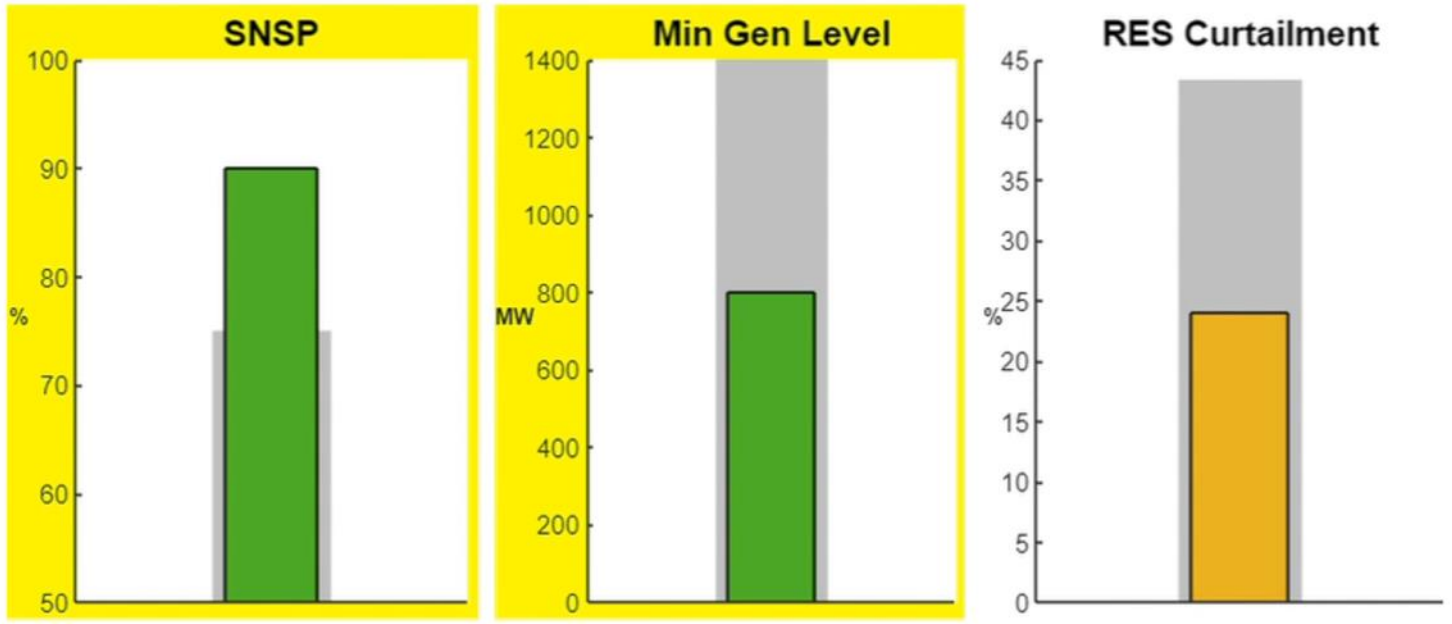

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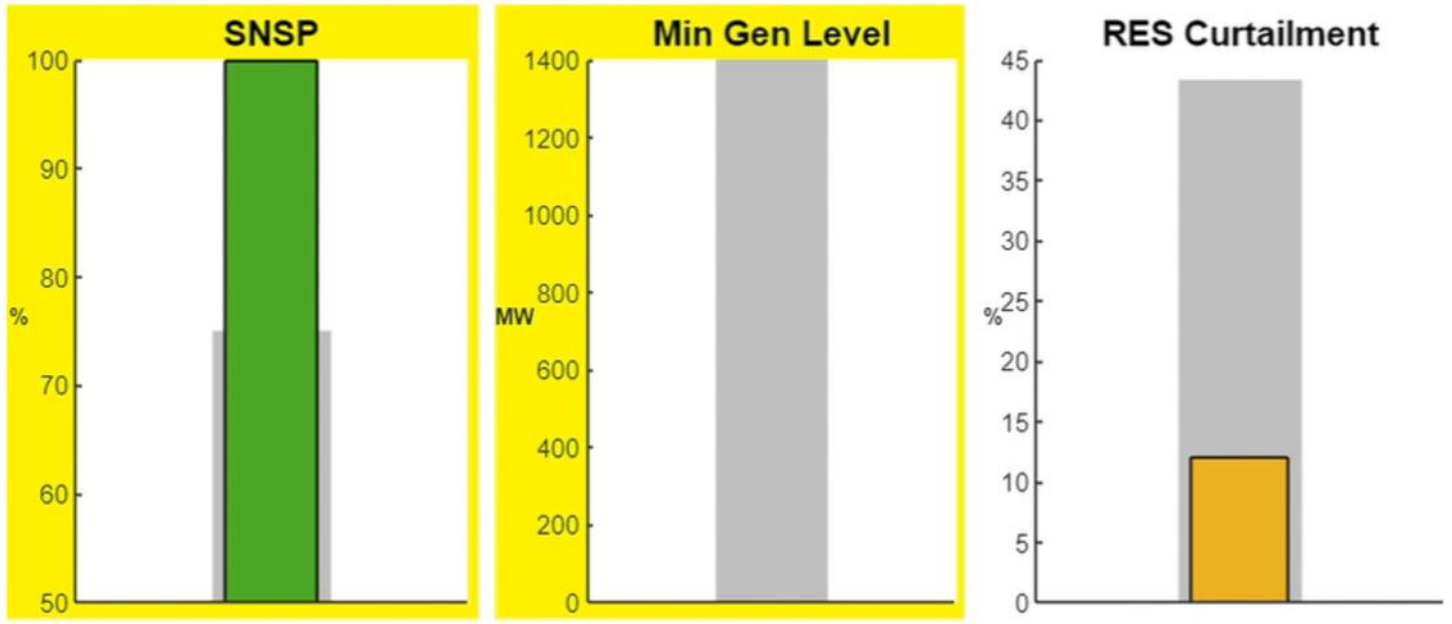

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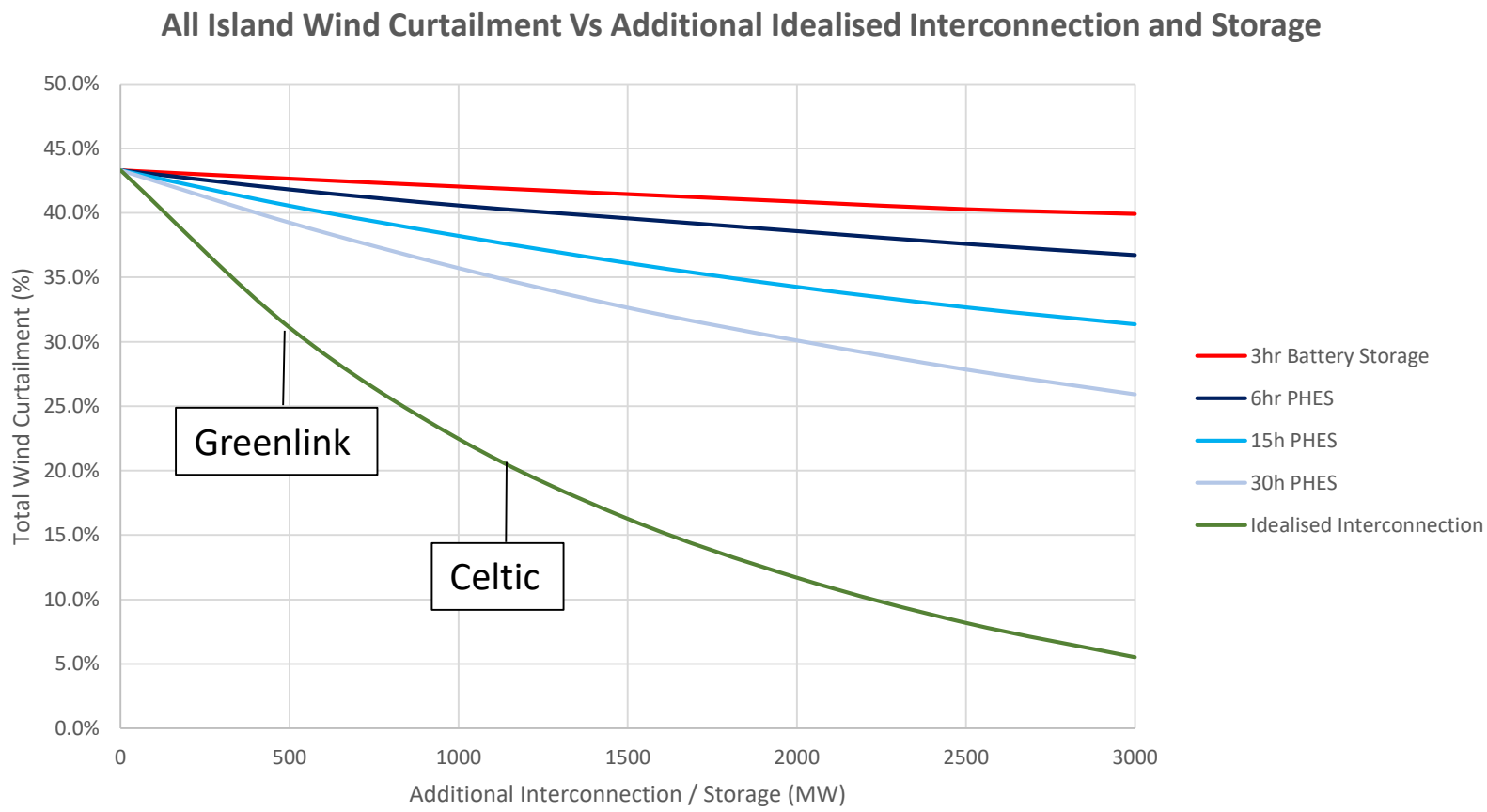

Benefits of Battery Storage

- **Provision of DS3 System Services**
- **Ramping**
- **Security of Supply**
- **Deferring Network Investment**
- **Maximising Auto-Production**
- **Energy Arbitrage**

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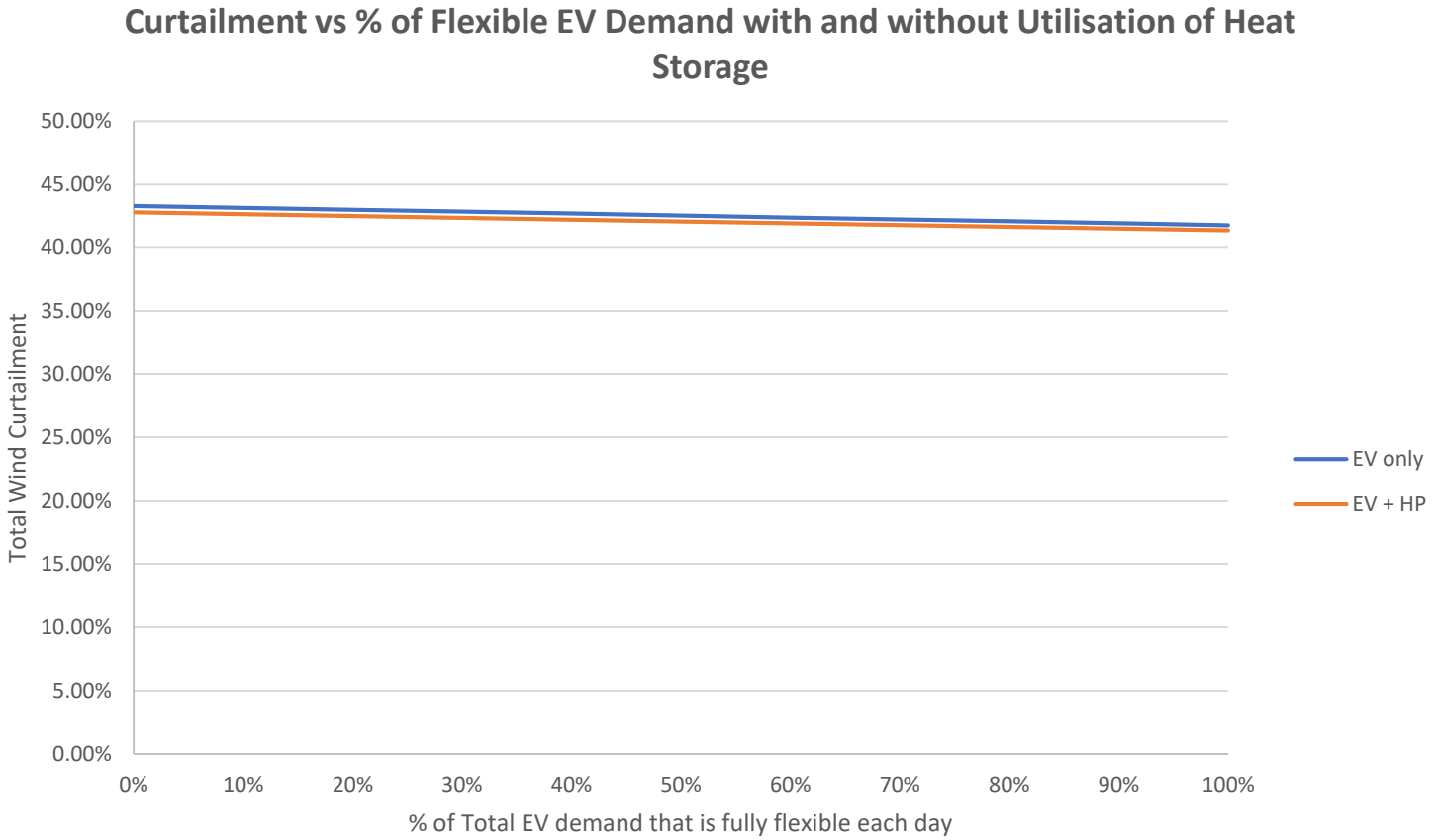

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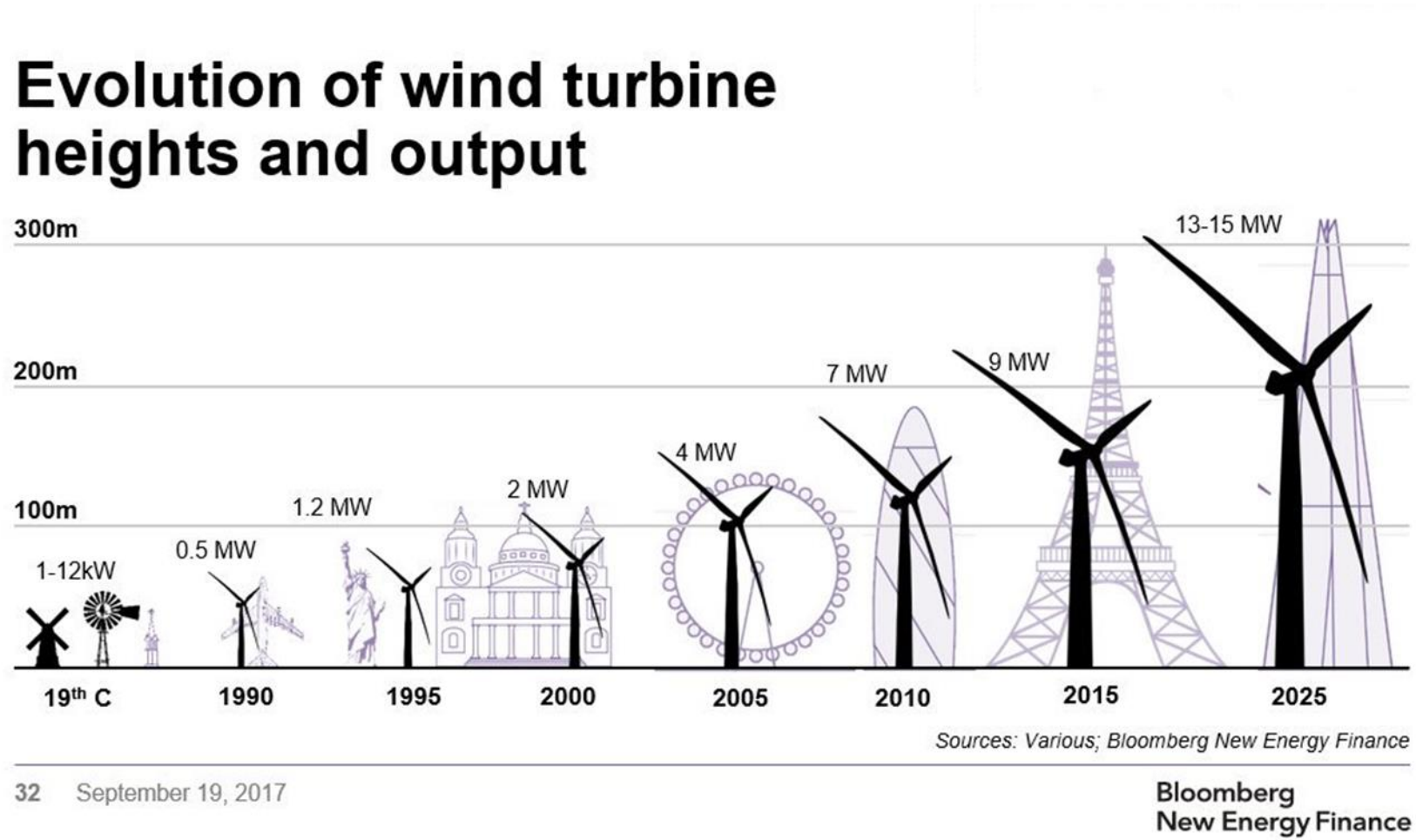
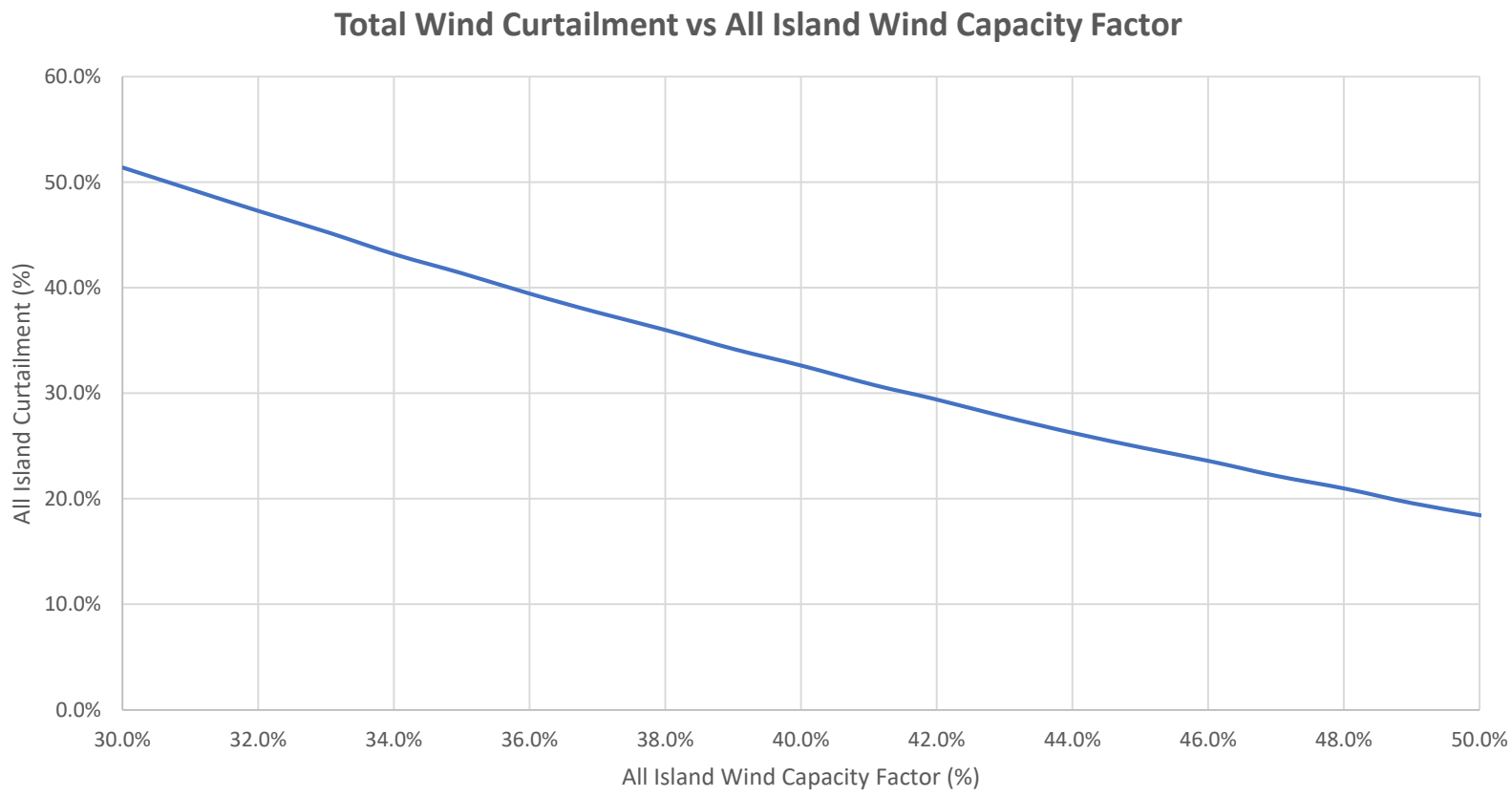


The Impact of Improved Wind capacity factor on 70% RES-E System



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Proposed Measures: 2030 High RES-E System

Measure	Description	2030
Relieve operational constraints	-Min Gen	700 MW
	-SNSP	90%
Interconnection*	-Celtic IC -Greenlink IC -EWIC -MOYLE -Additional Capacity	700 MW 500 MW 500 MW 80 MW 240 MW 2020 MW
Energy storage	-Turlough Hill	219 MW
Increased wind capacity factor	-Blended Onshore & Offshore Fleet Capacity Factor	38%
Diversification of technologies	-Solar Capacity	7000 MW
Demand side Management	-% EV Demand Flexible -% Background Demand Flexible -% Heat Pump Demand Flexible	60% 15% 100%

* Interconnector Availability Assumed to be 90%

Low Curtailment Proposals for High RES-E in 2030

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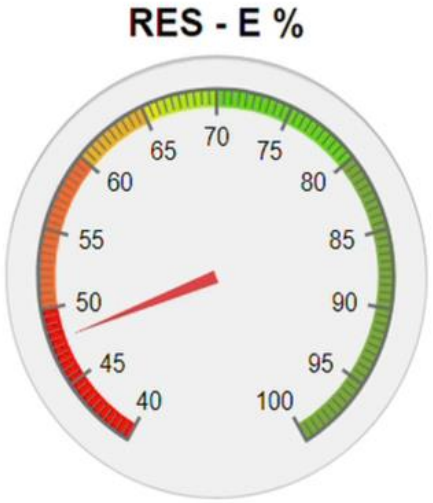

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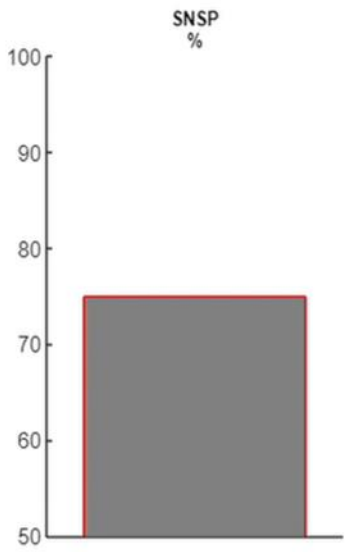

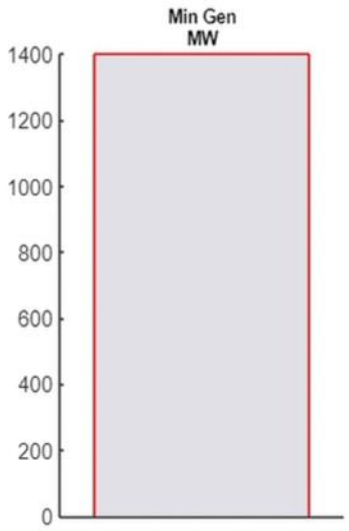

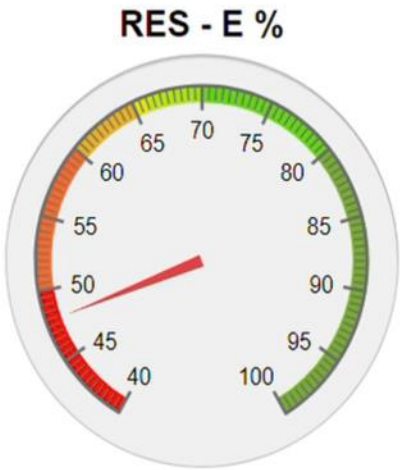

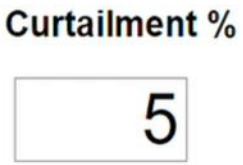

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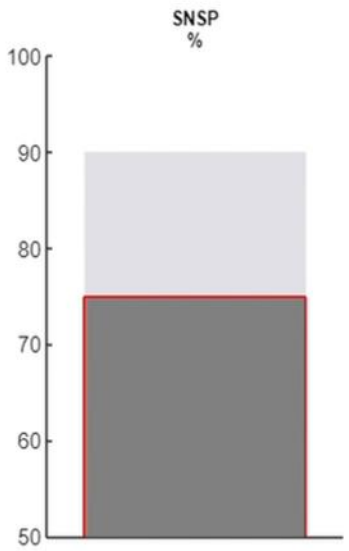

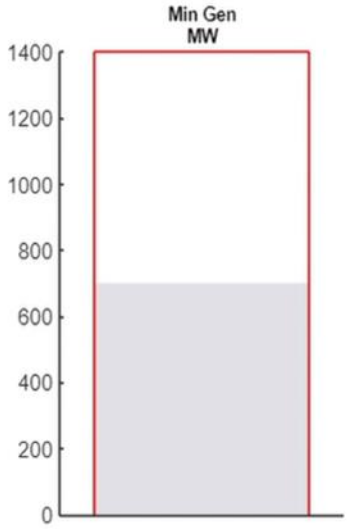

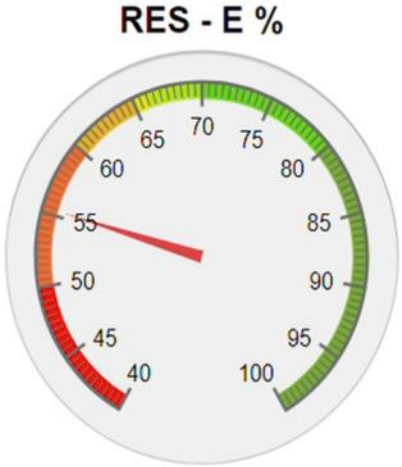

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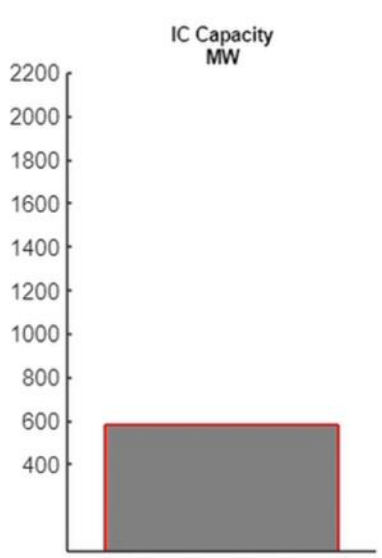

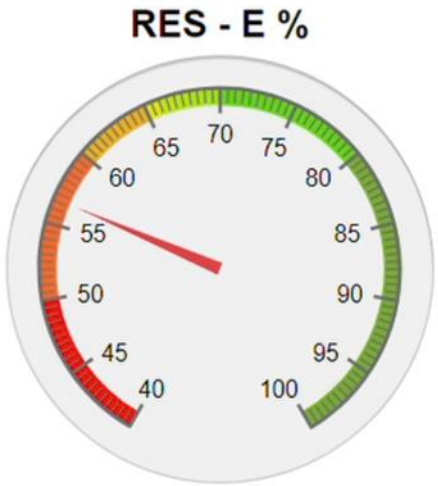

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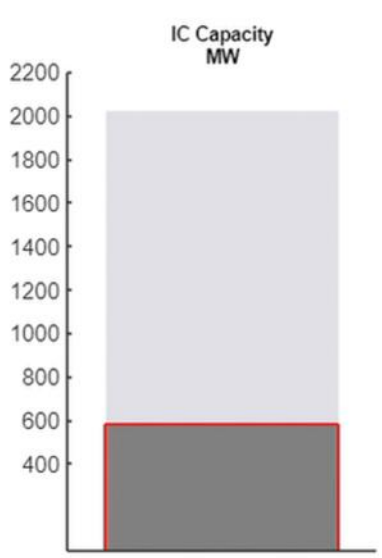

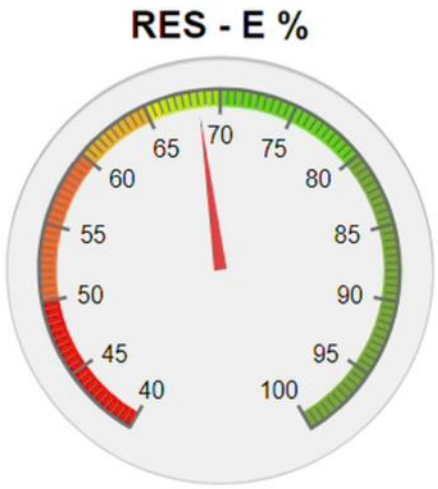

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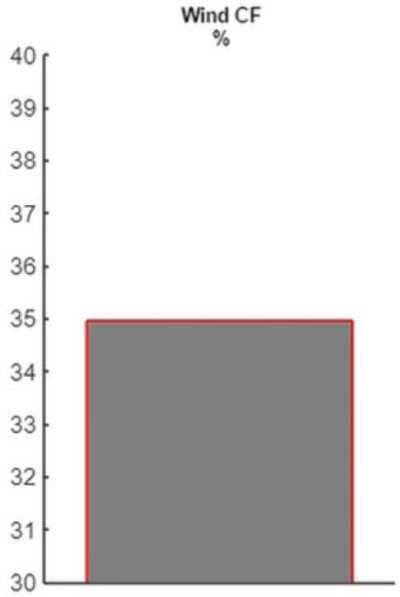

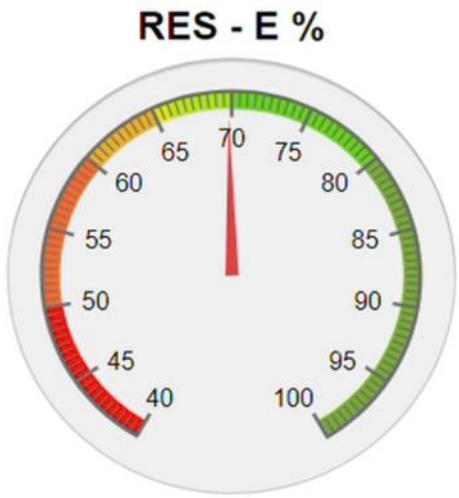

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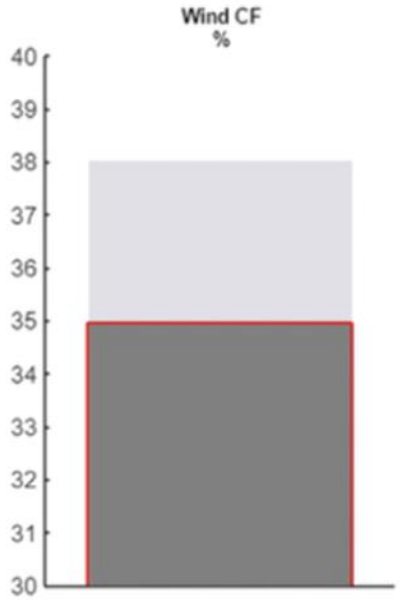

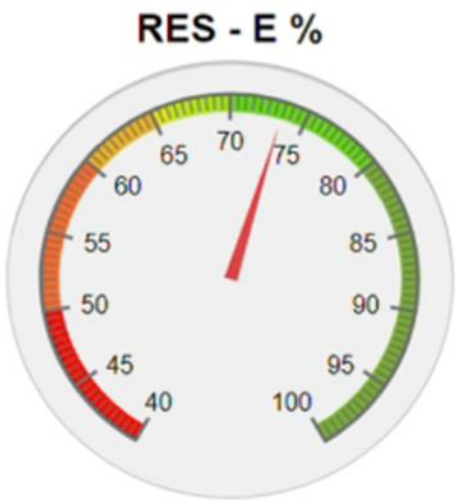

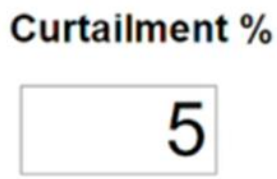

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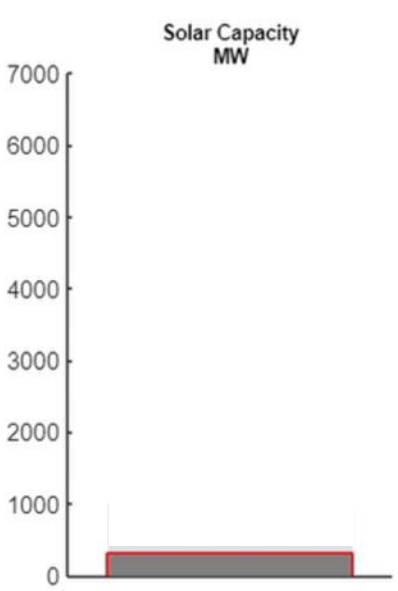

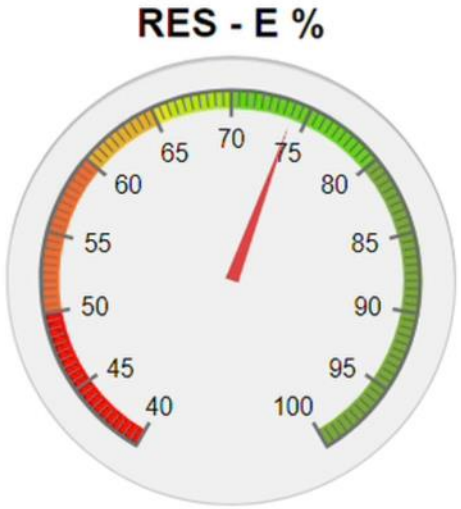

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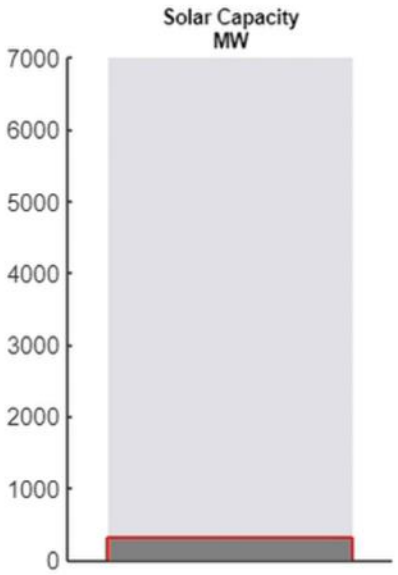

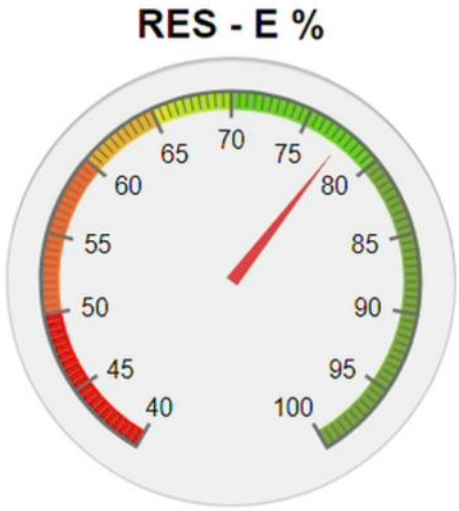

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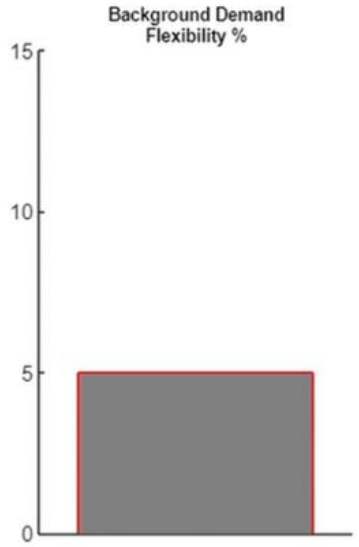

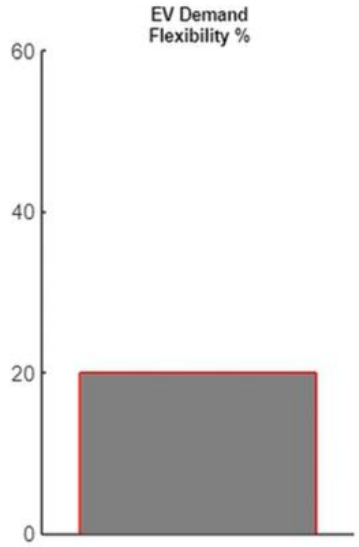

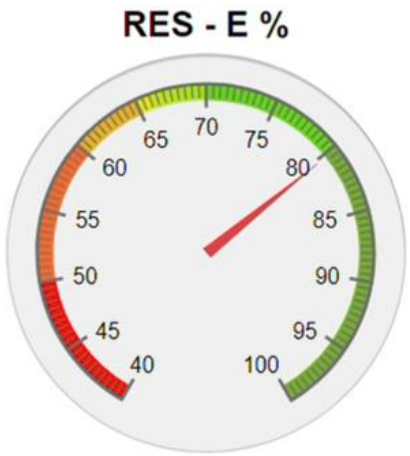

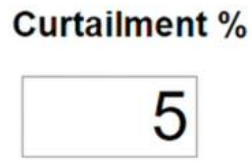

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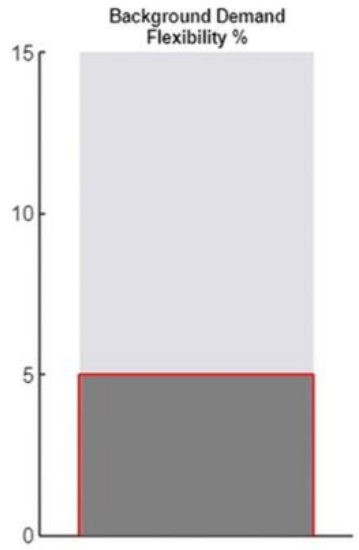

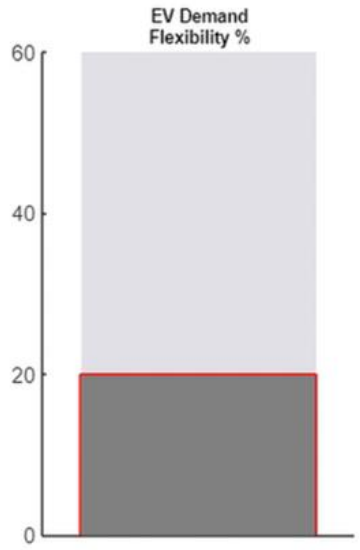

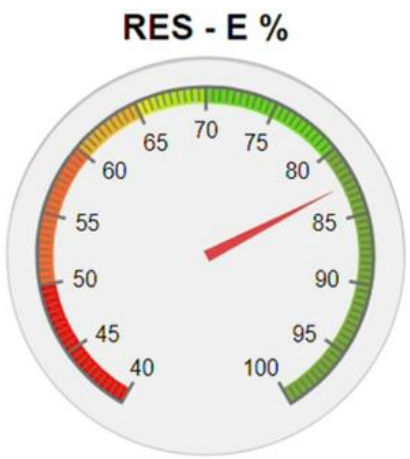

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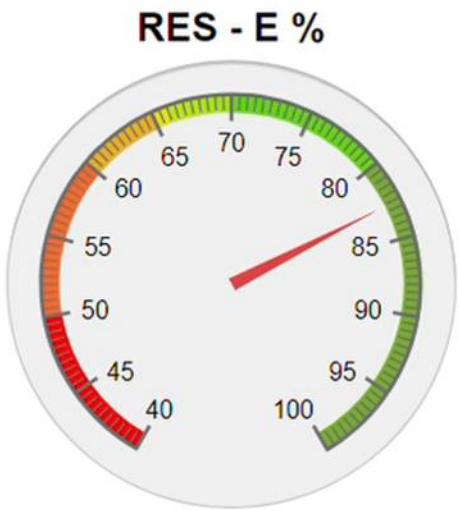

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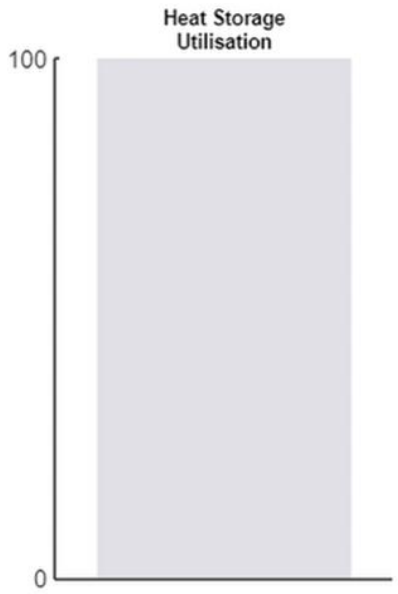

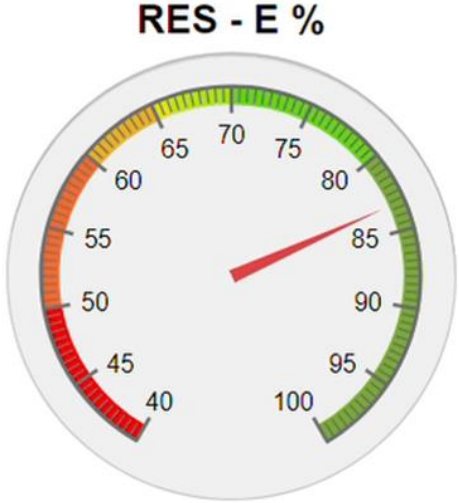

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Recommendations

- EirGrid implement DS30 to relieve operational constraints.
- Review impact of clean energy package rules
- Build new interconnectors.
- Examine market design for high RES-E.
- Consider policies to incentivise higher wind capacity factors (onshore & offshore).
- Incorporate solar to optimise high RES-E.
- Review benefit of storage and DSM for capacity and system services.
- Moving from “can we” to “how do we” get to 70% - Lots more studies required!