

UCC Net Zero Energy System Modelling for Ireland

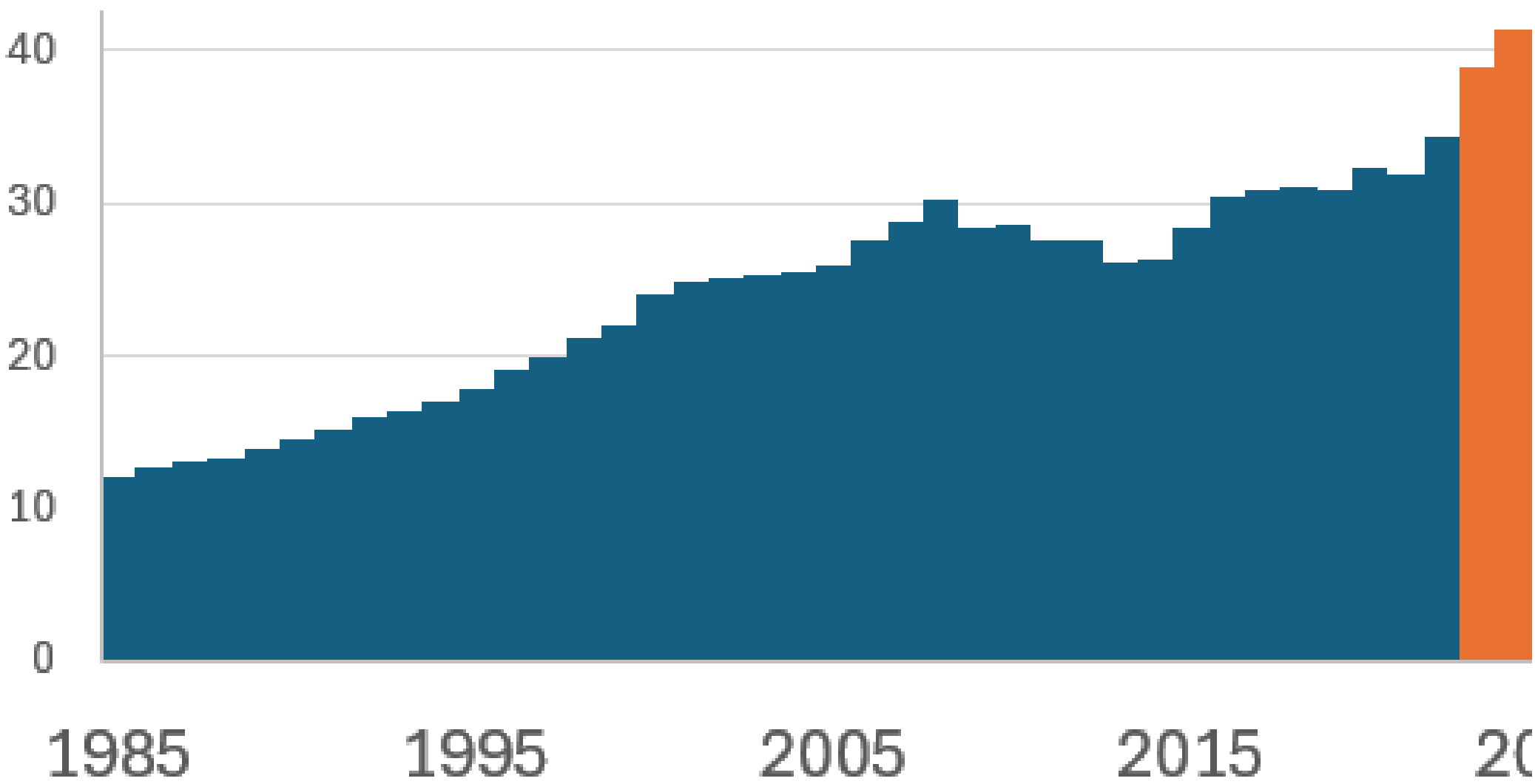
*A wind-rich grid and its interaction
with the rest of the energy system*

*Insights from University College Cork's
TIMES Ireland Model (TIM)*

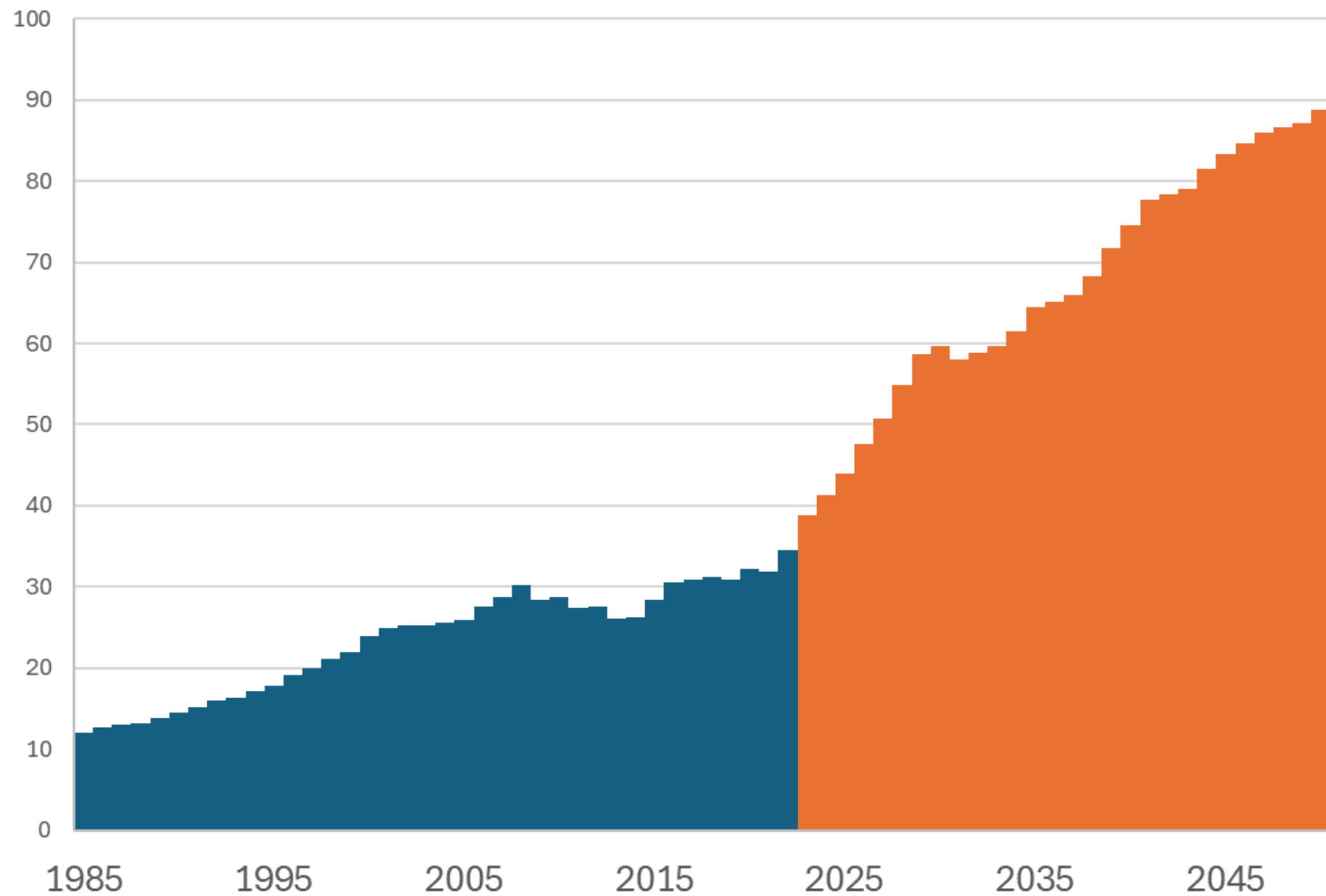
Andrew ZP Smith asmith@ucc.ie

Funded by

Data from the Energy Institute Statistical Review



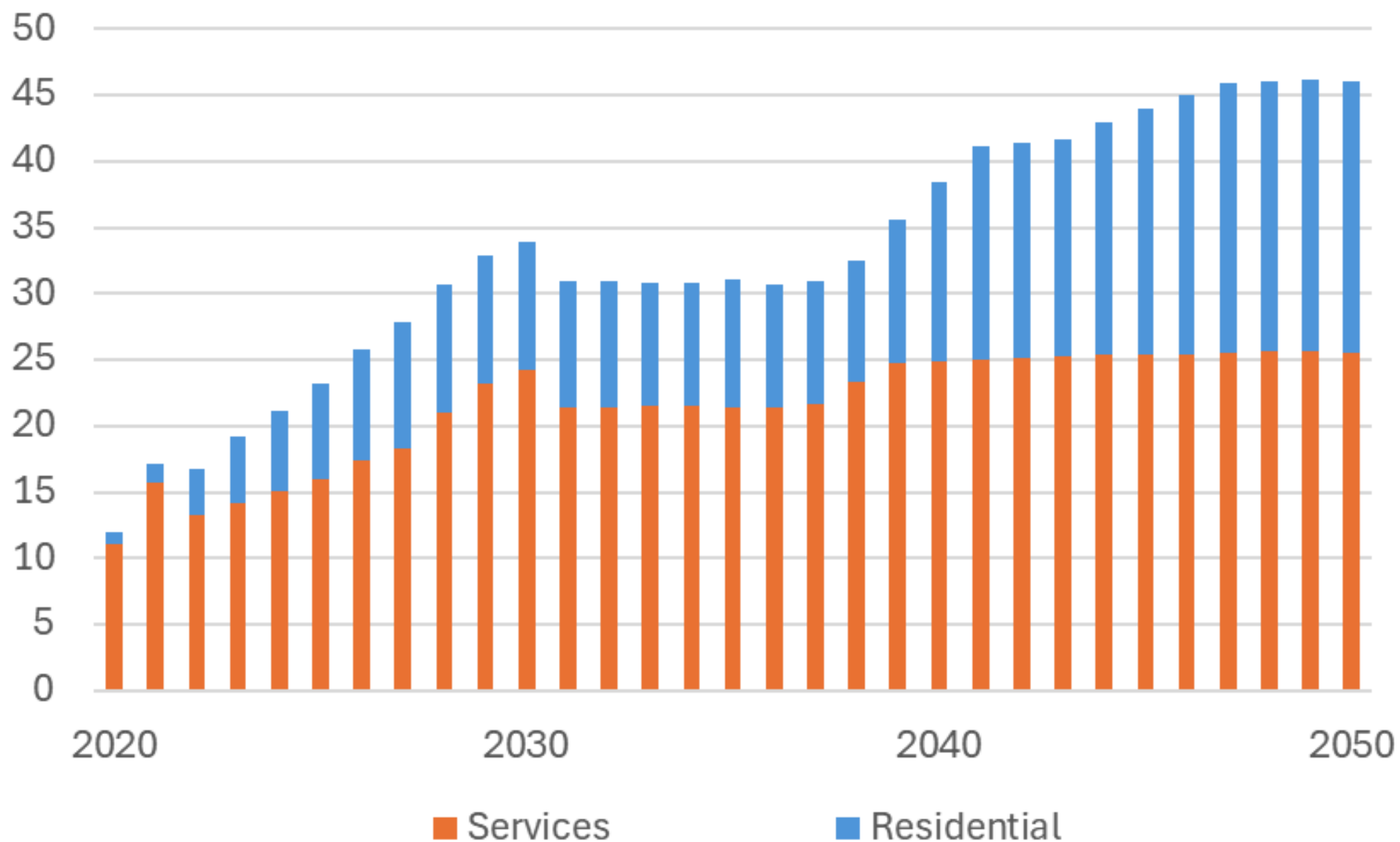
Ireland, TWh/y Electricity generation



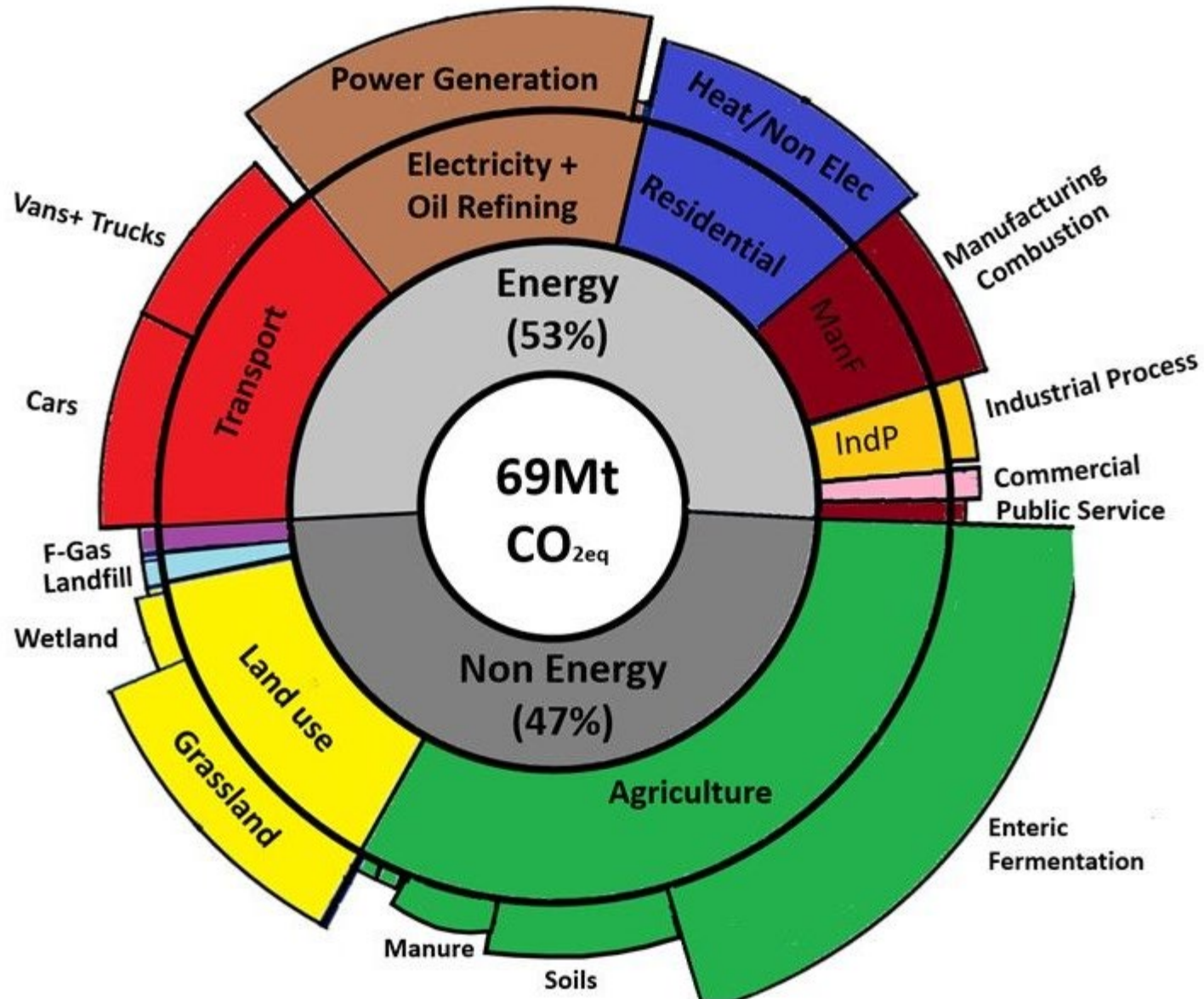
Ireland, TWh/y Electricity generation

Projections from the UCC Times Ireland Model

Electricity consumption (TWh/y): major growth sectors



Ireland's Greenhouse Gases 2021

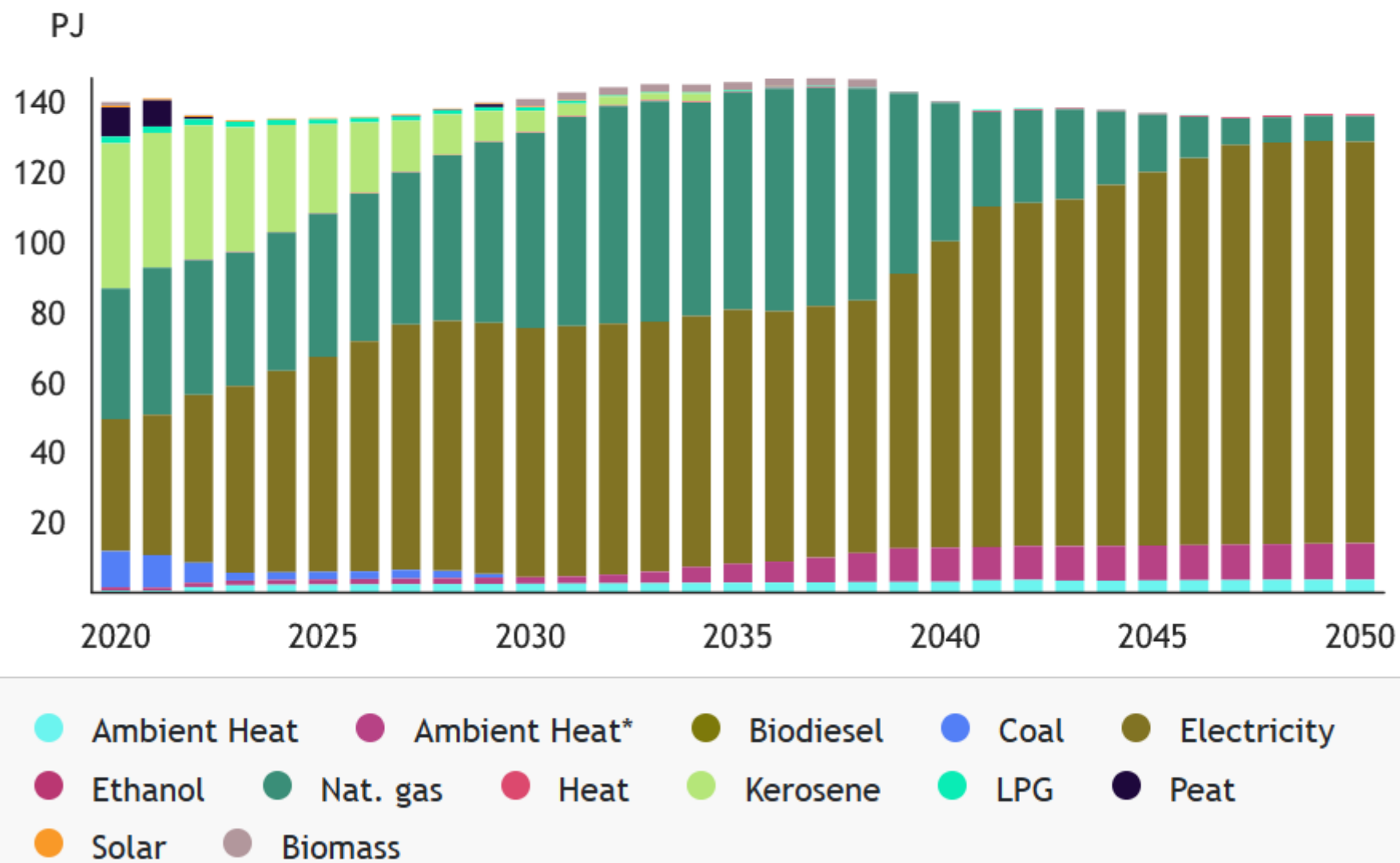


Ireland's Climate legislation targets a 51% reduction in All Greenhouse Gas pollution from 2021 to 2030

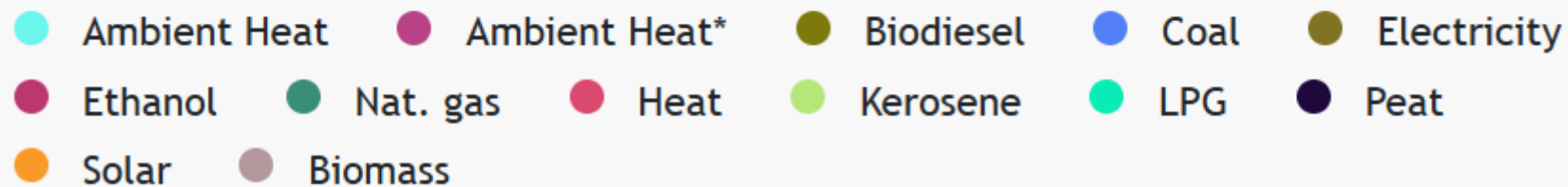
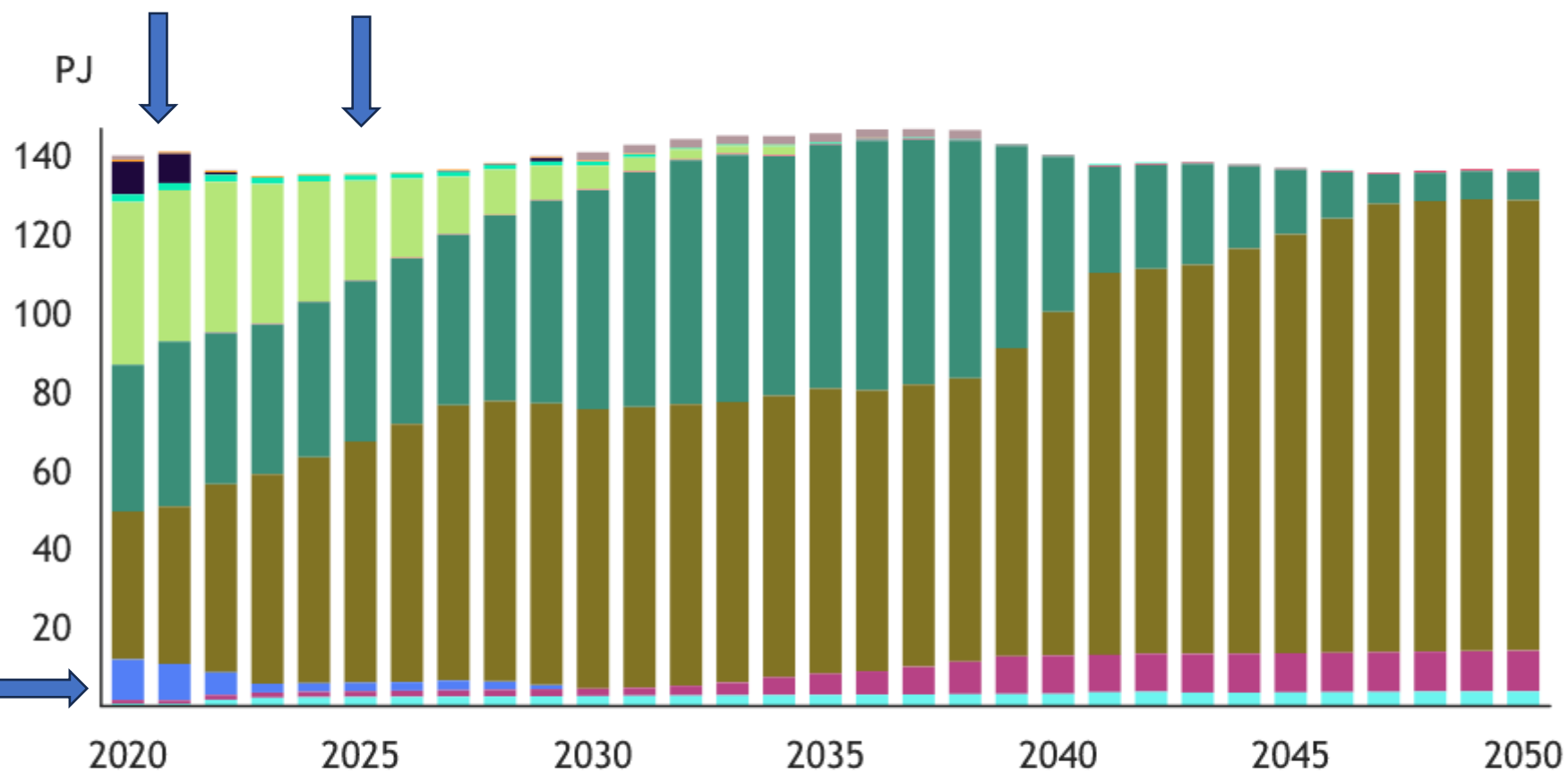
This is across Energy and Non-Energy

Across the Economy, Ireland has the second highest level of Greenhouse Gas pollution per person in the EU

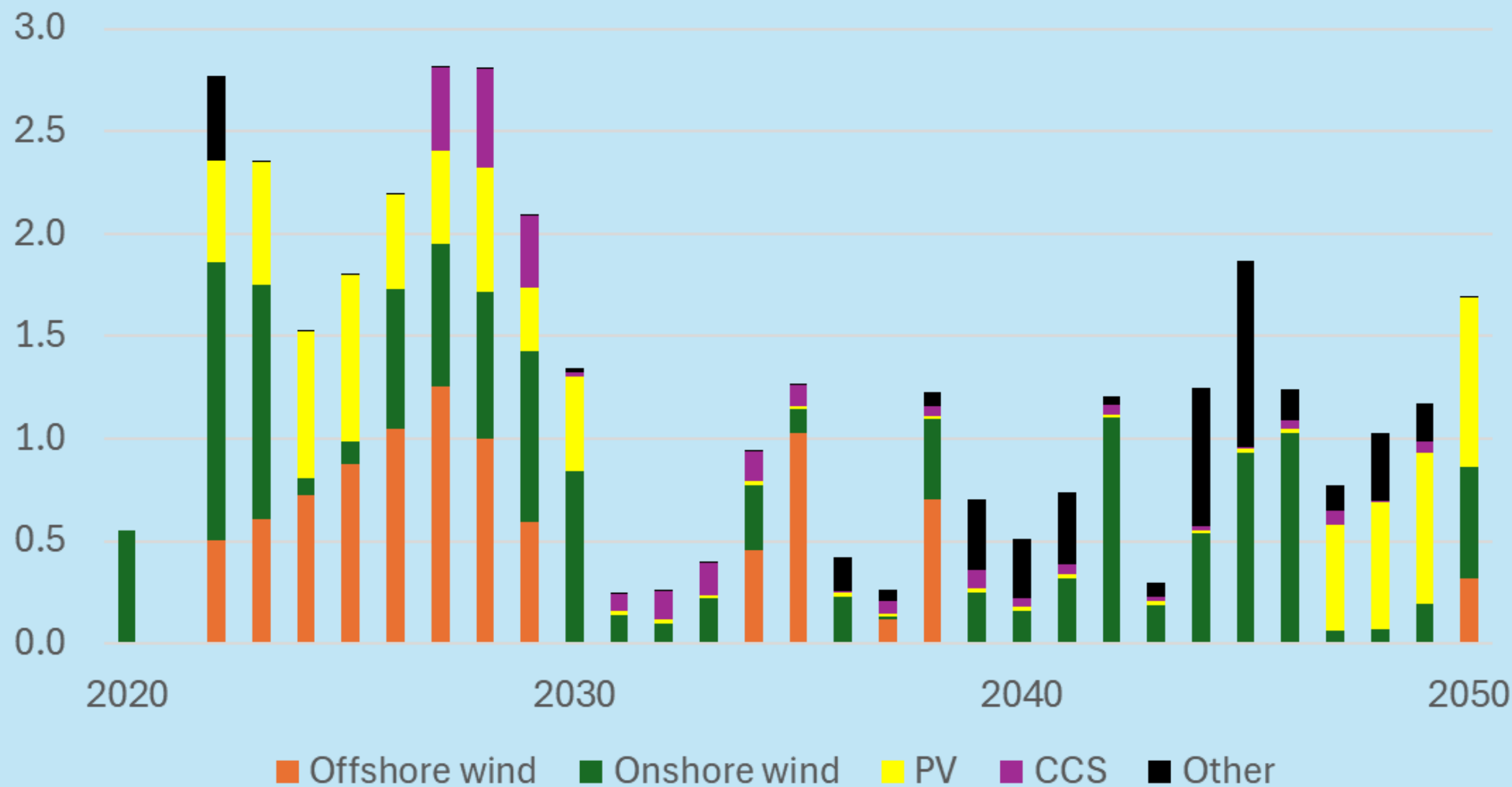
Residential Final Energy Consumption



Residential Final Energy Consumption



New generation capacity (GW)



Scenarios

No Mitigation

Baseline

Electrification

Sectoral CBs

Reduced Sectoral CBs

Whole System CB

Reduced System CB

Sectoral CBs (TO)

Reduced Sectoral CBs (TO)

Whole System CB (TO)

Reduced System CB (TO)

Sectoral CBs (HL)

Reduced Sectoral CBs (HL)

Overview

Supply

Power

Transport

Residential

Services

Industry

Agriculture

Emissions and cost

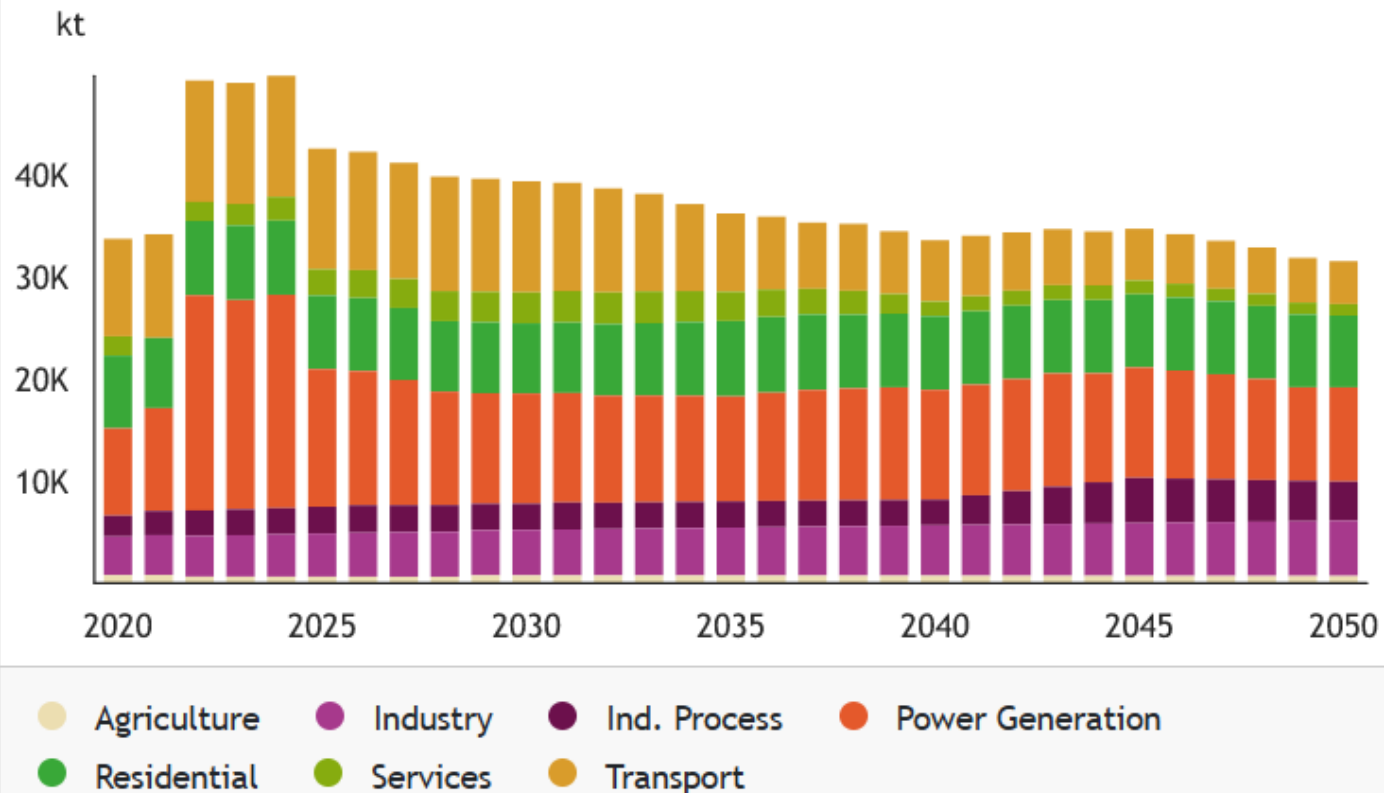
Final energy consumption

Primary energy

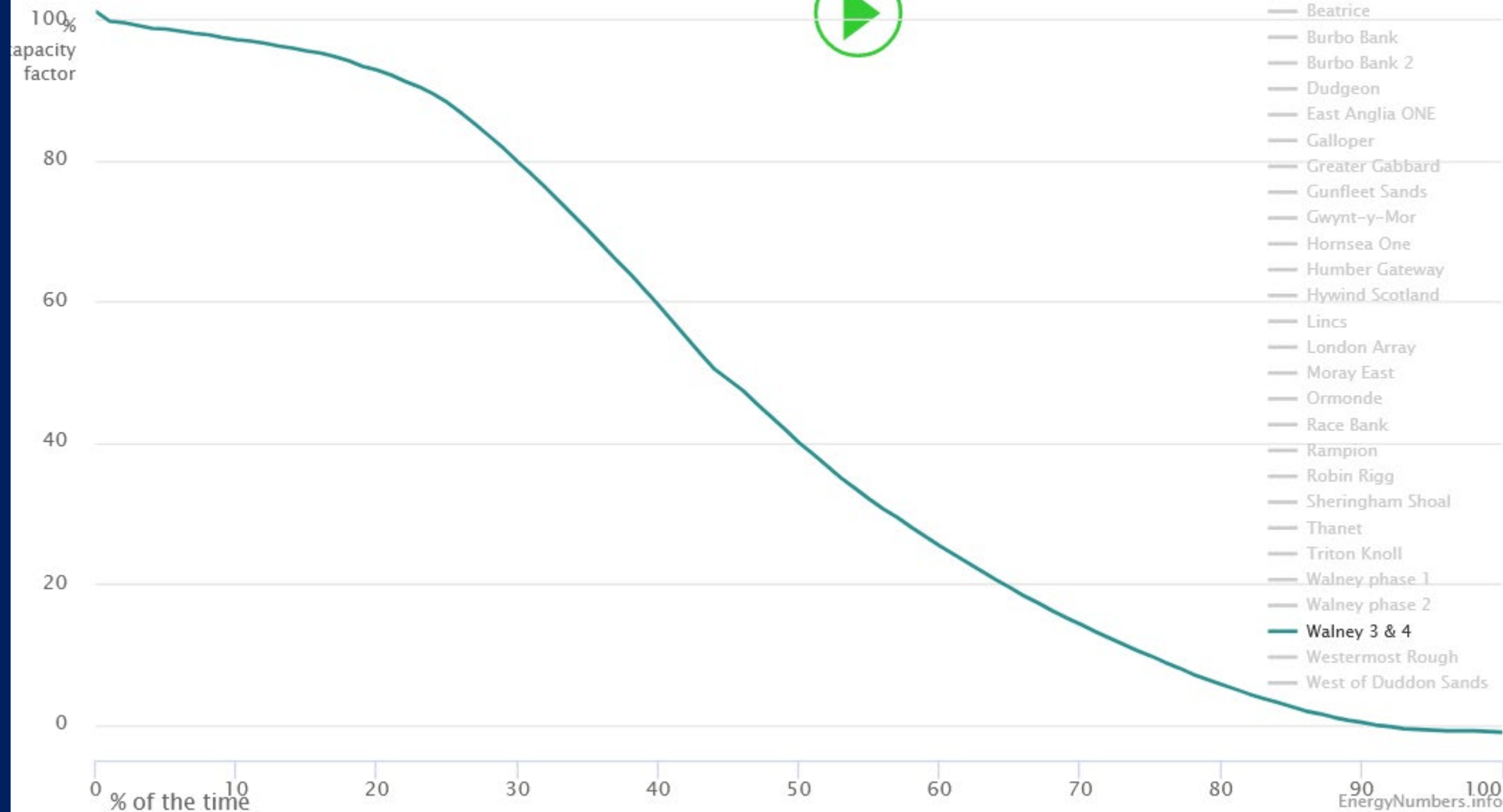
Other

Download data for any chart by clicking on the [↓](#) in its top-right corner.

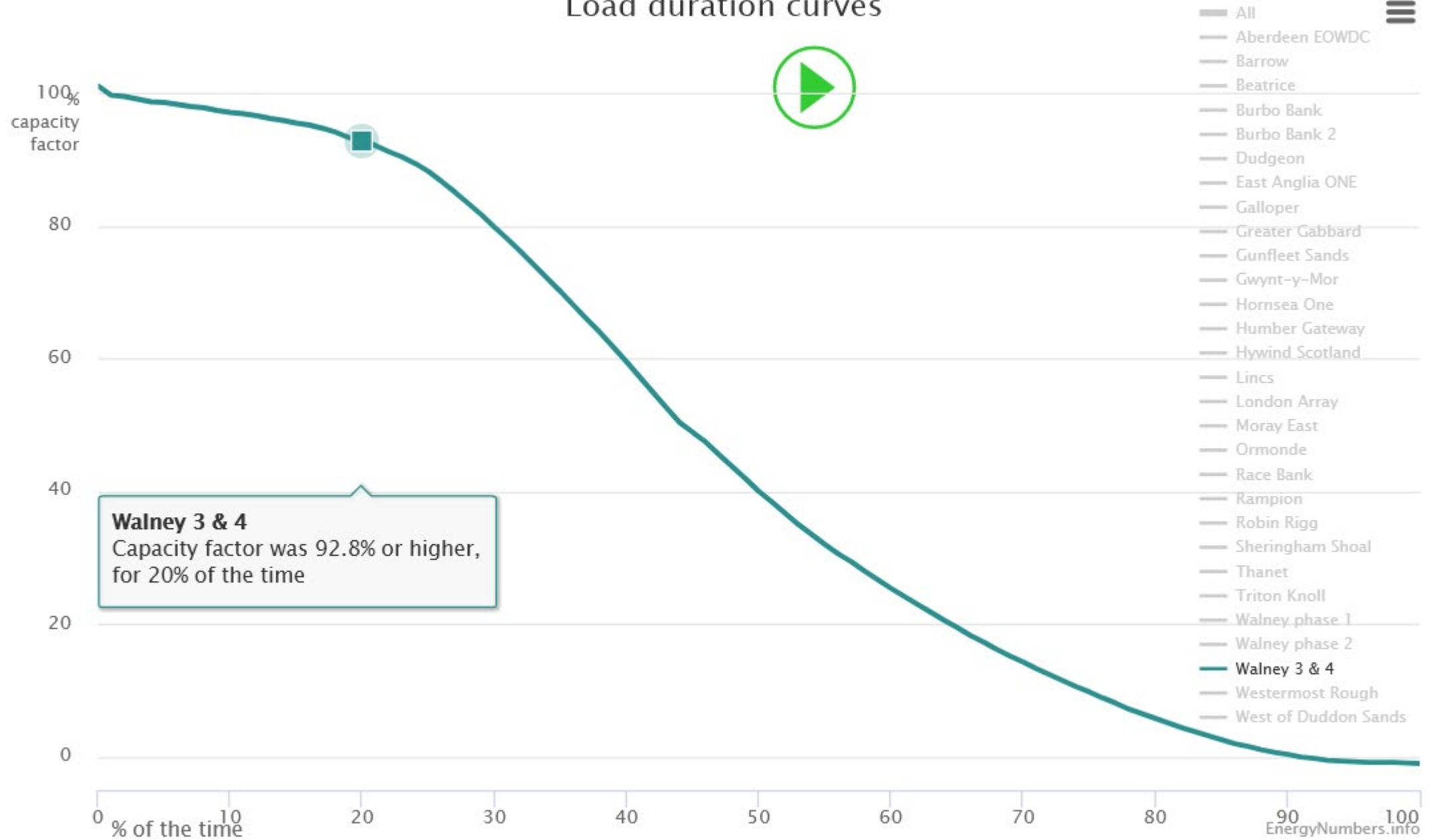
Domestic CO2 Emissions by Sector



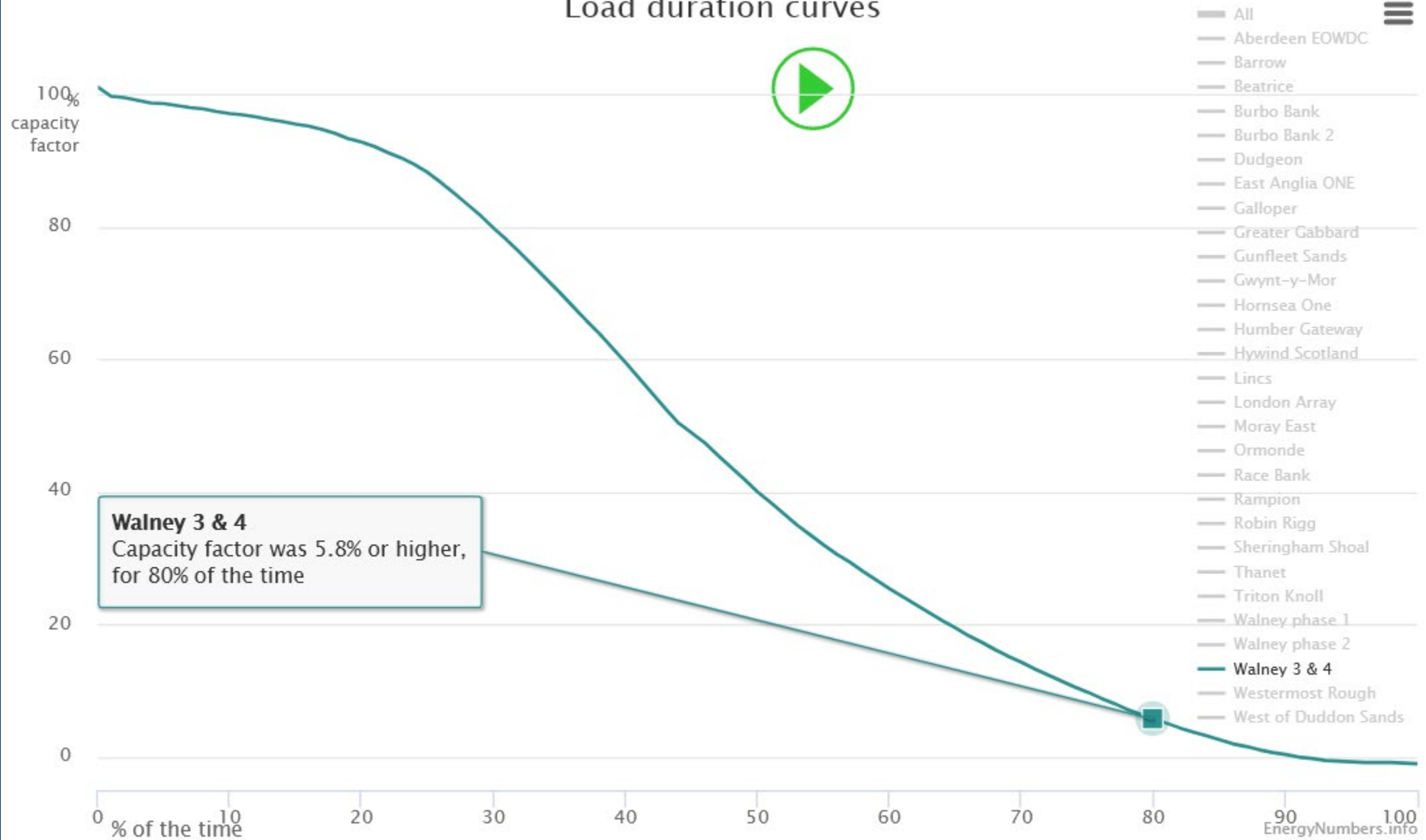
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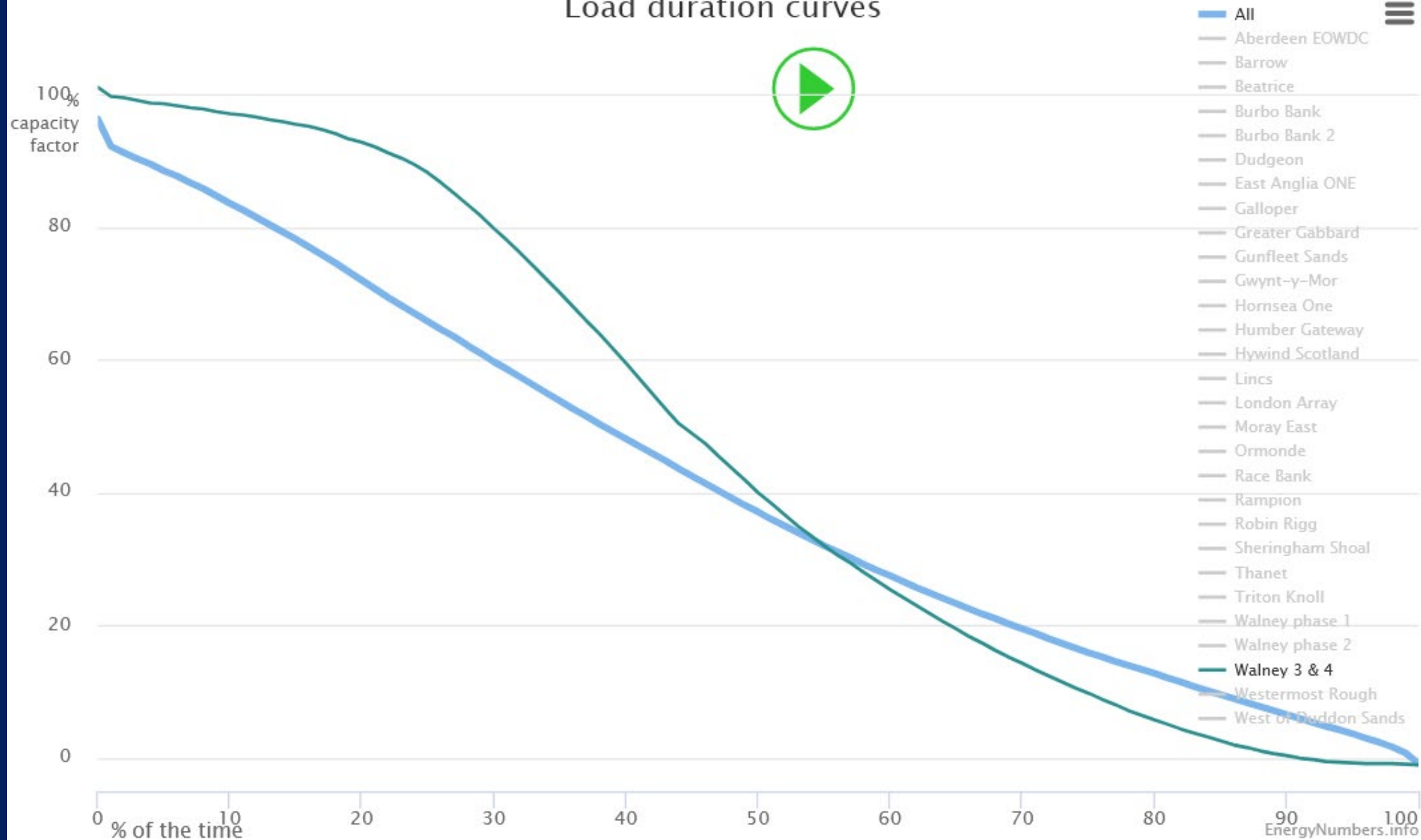
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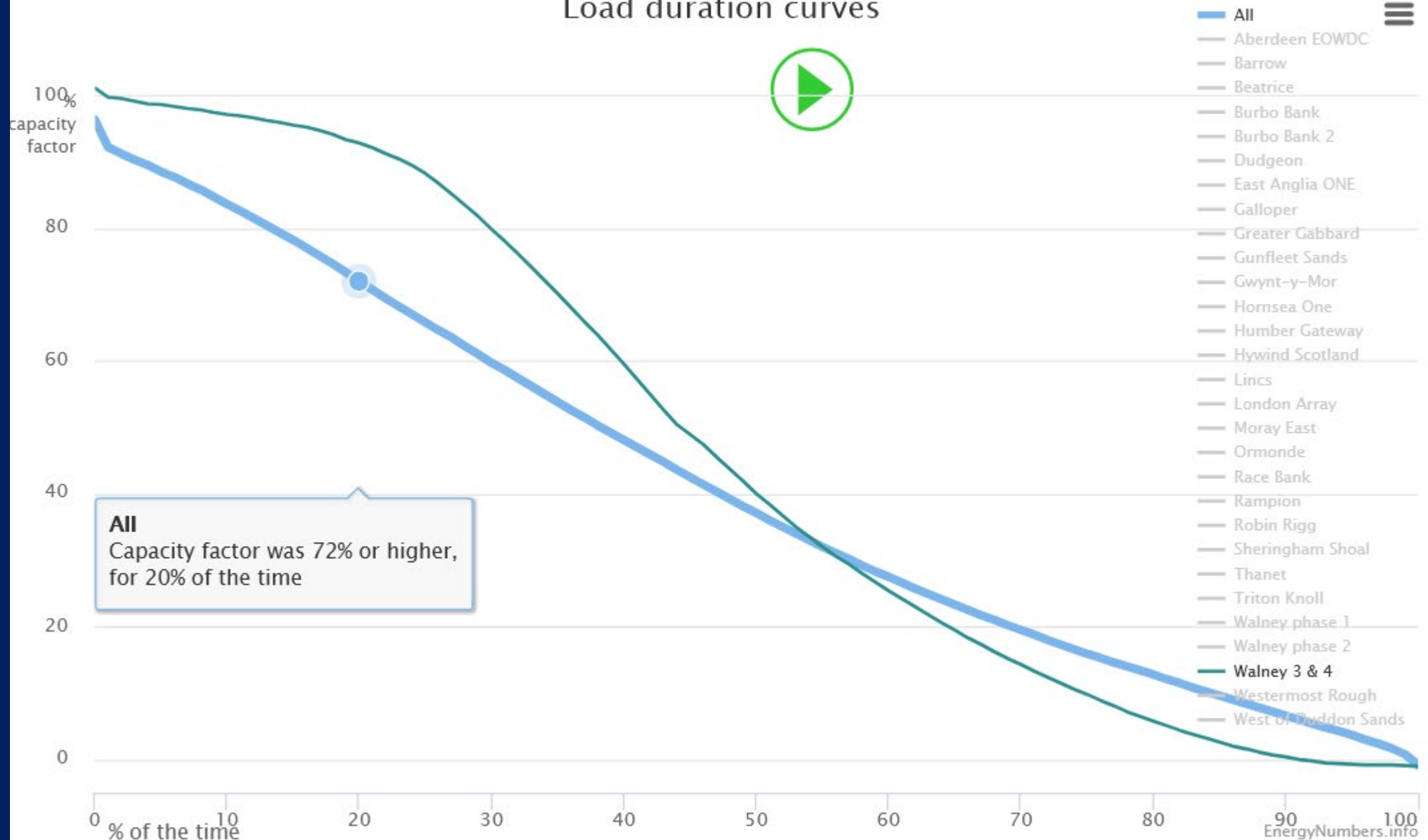
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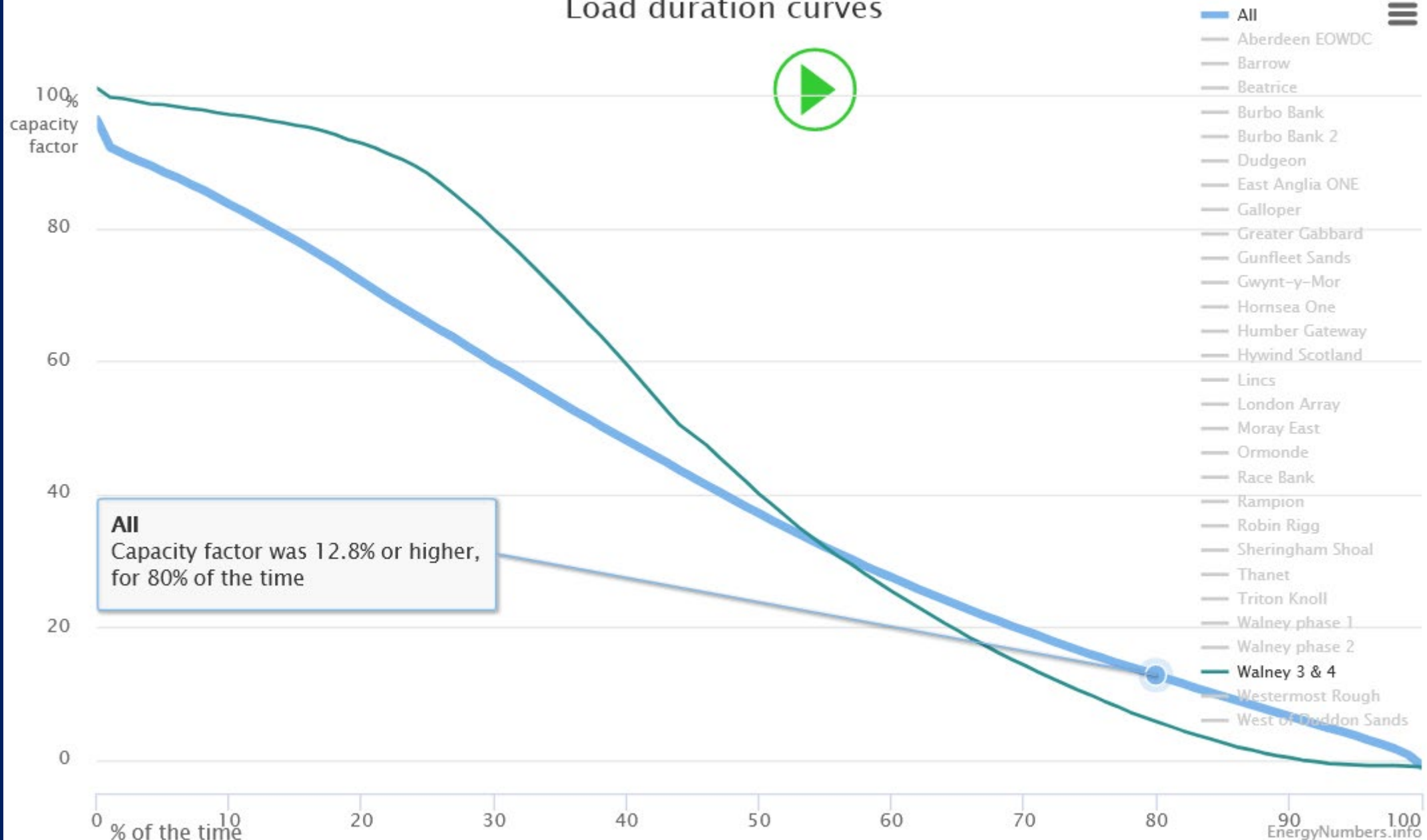
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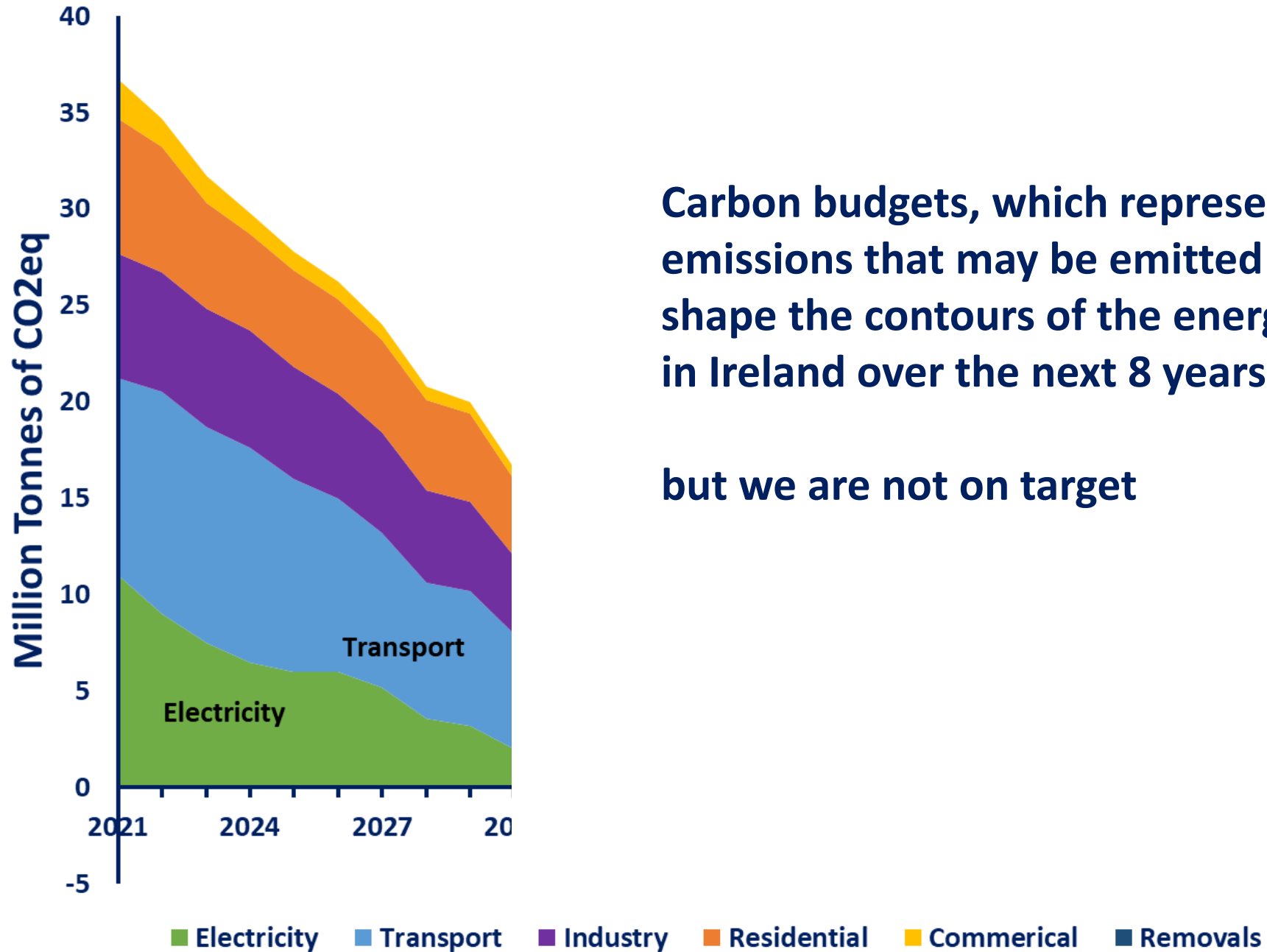
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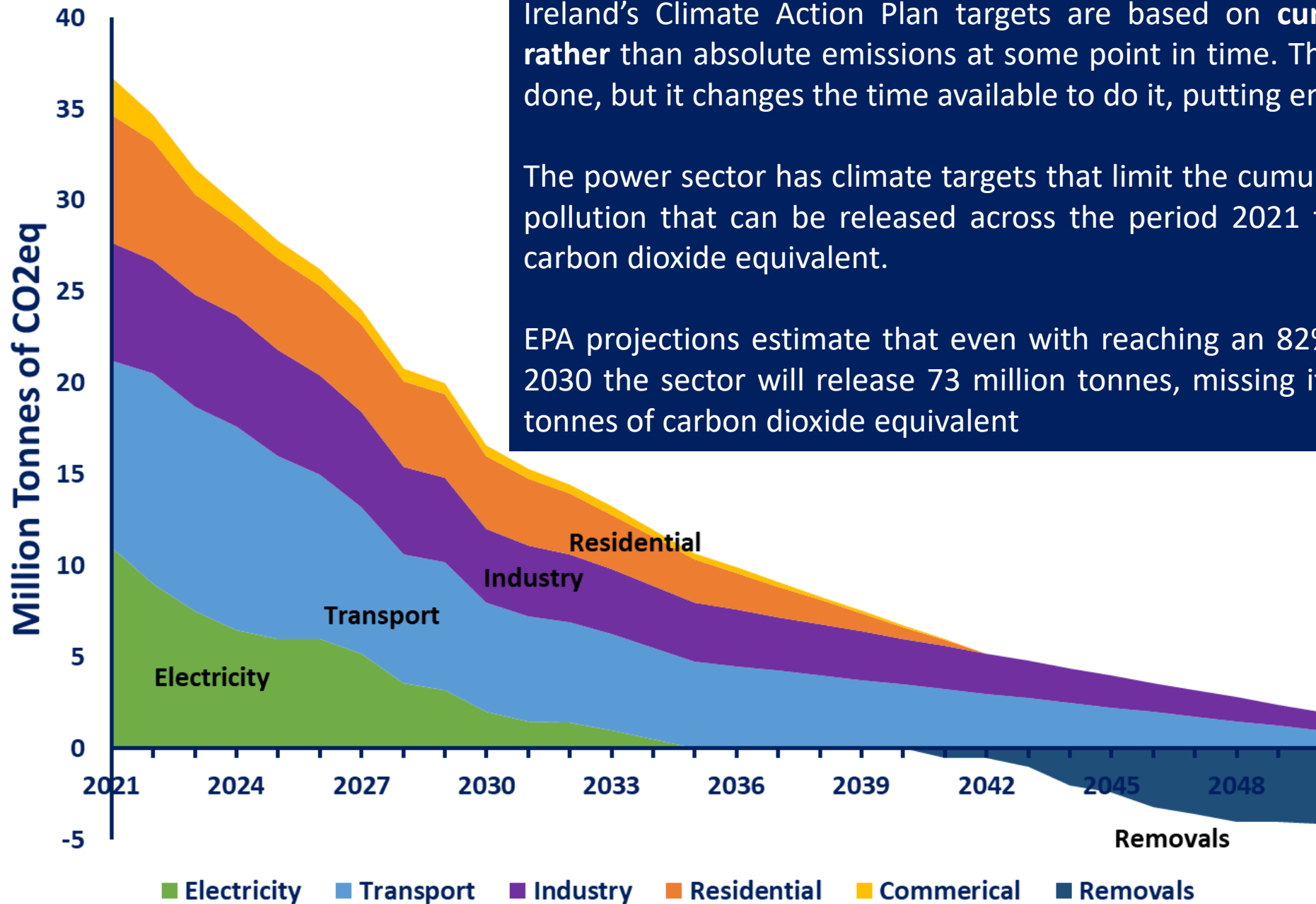
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'Net Zero' Energy System Emissions Reduction Profile



'Net Zero' Energy System Emissions Reduction Profile

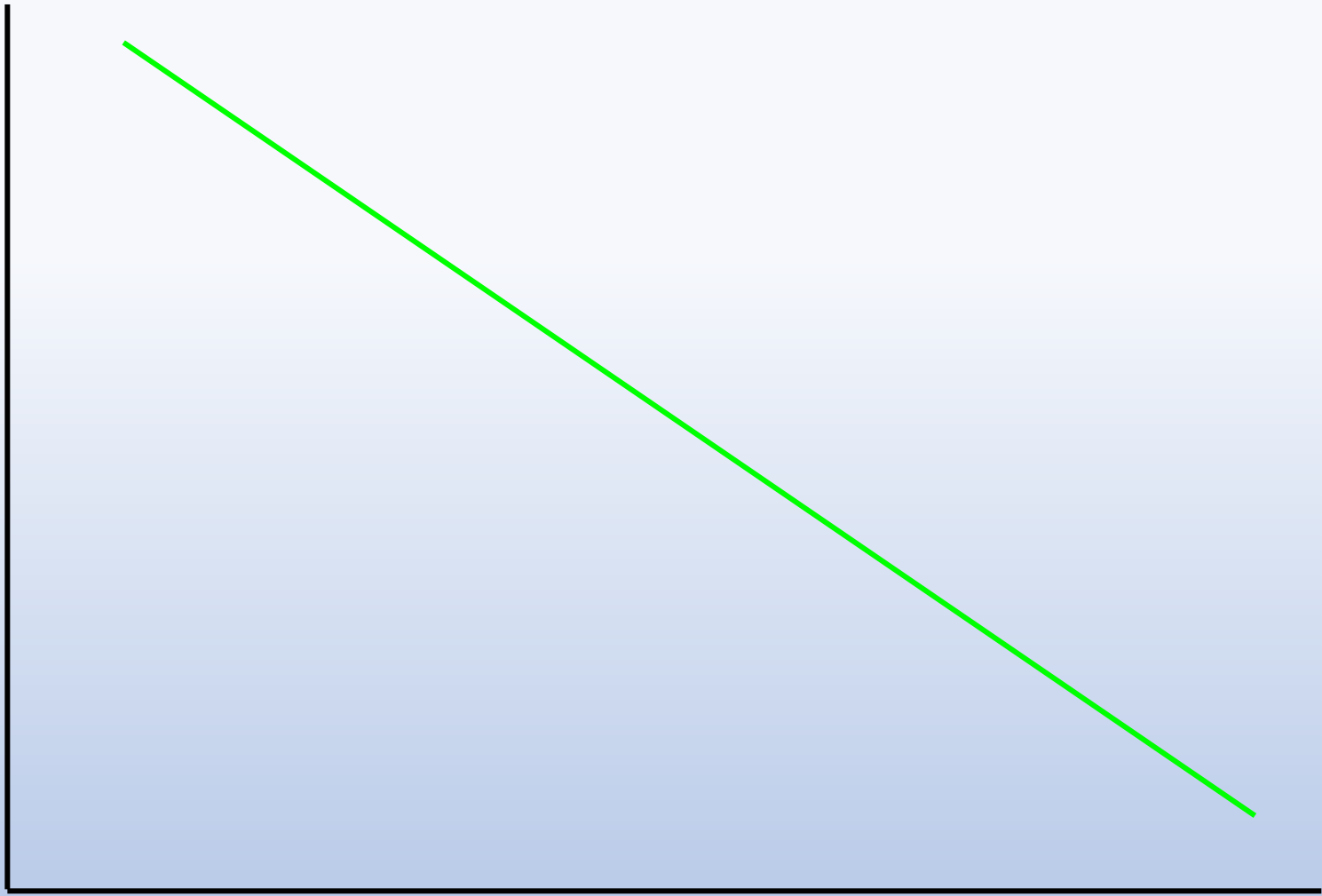


Ireland's Climate Action Plan targets are based on **cumulative emissions across time** **rather** than absolute emissions at some point in time. This doesn't change what must be done, but it changes the time available to do it, putting emphasis on **early action**

The power sector has climate targets that limit the cumulative amount of greenhouse gas pollution that can be released across the period 2021 to 2030 to 60 million tonnes of carbon dioxide equivalent.

EPA projections estimate that even with reaching an 82% renewable electricity target in 2030 the sector will release 73 million tonnes, missing its legislated target by 13 million tonnes of carbon dioxide equivalent

Emissions



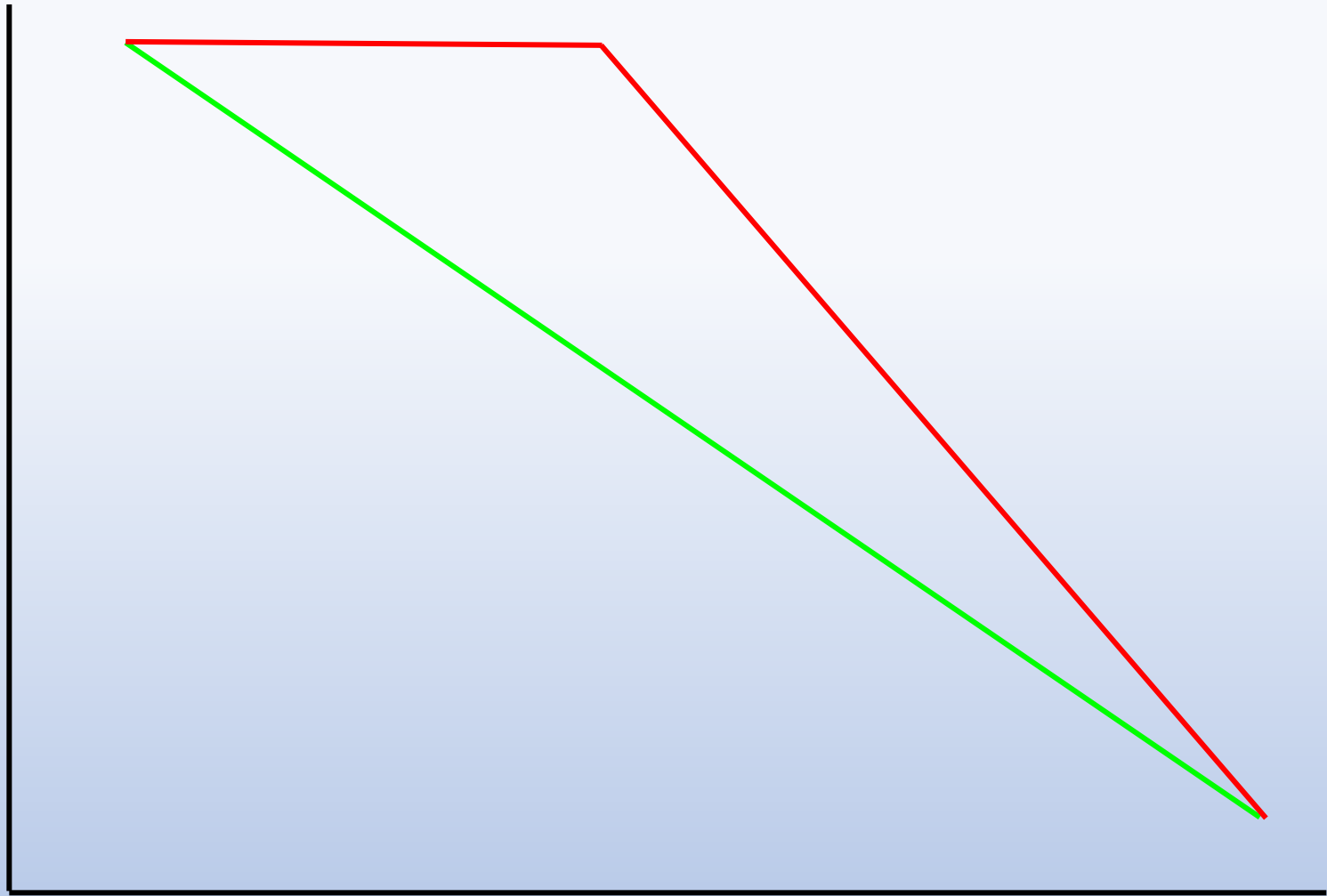
Time

Emissions



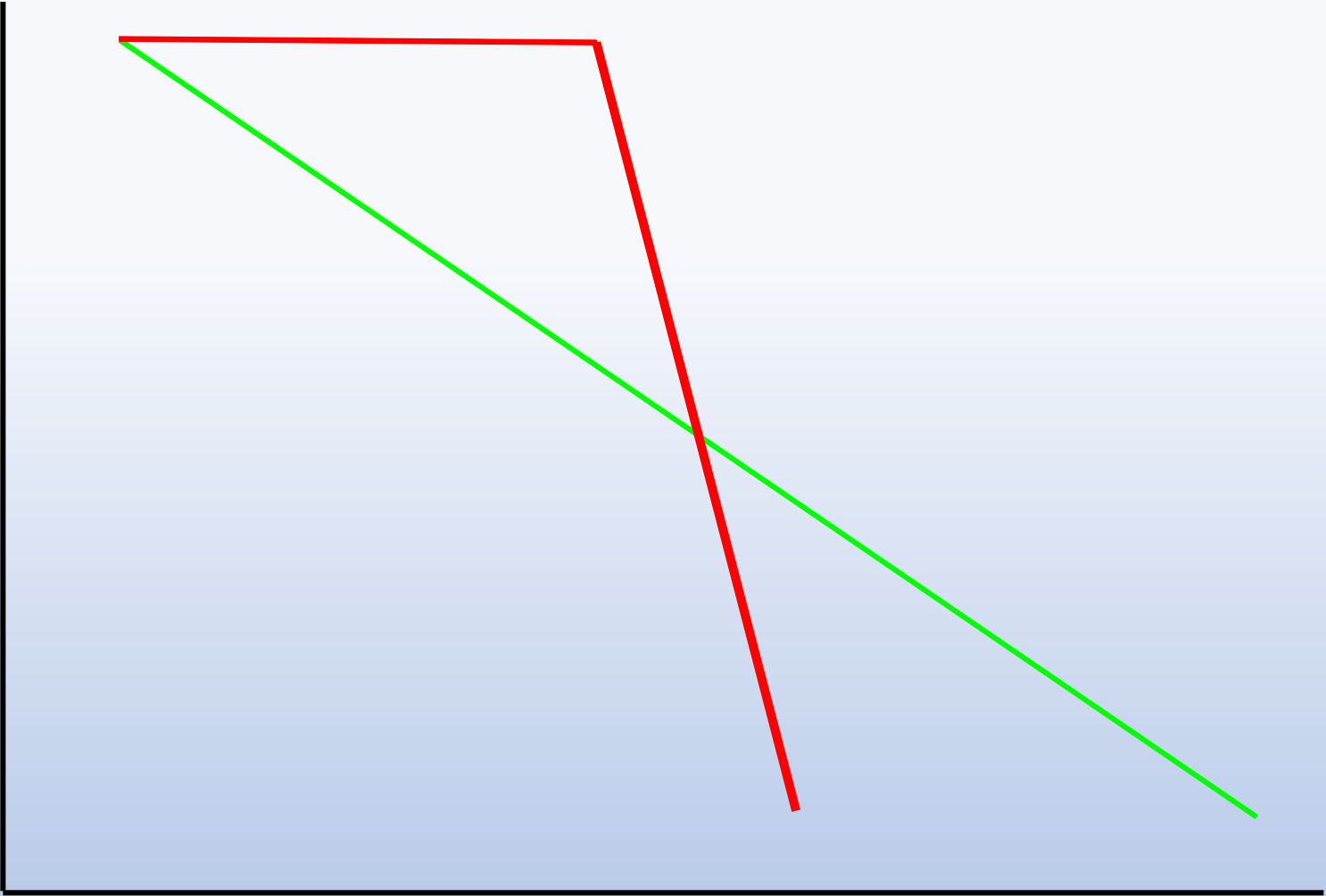
Time

Emissions



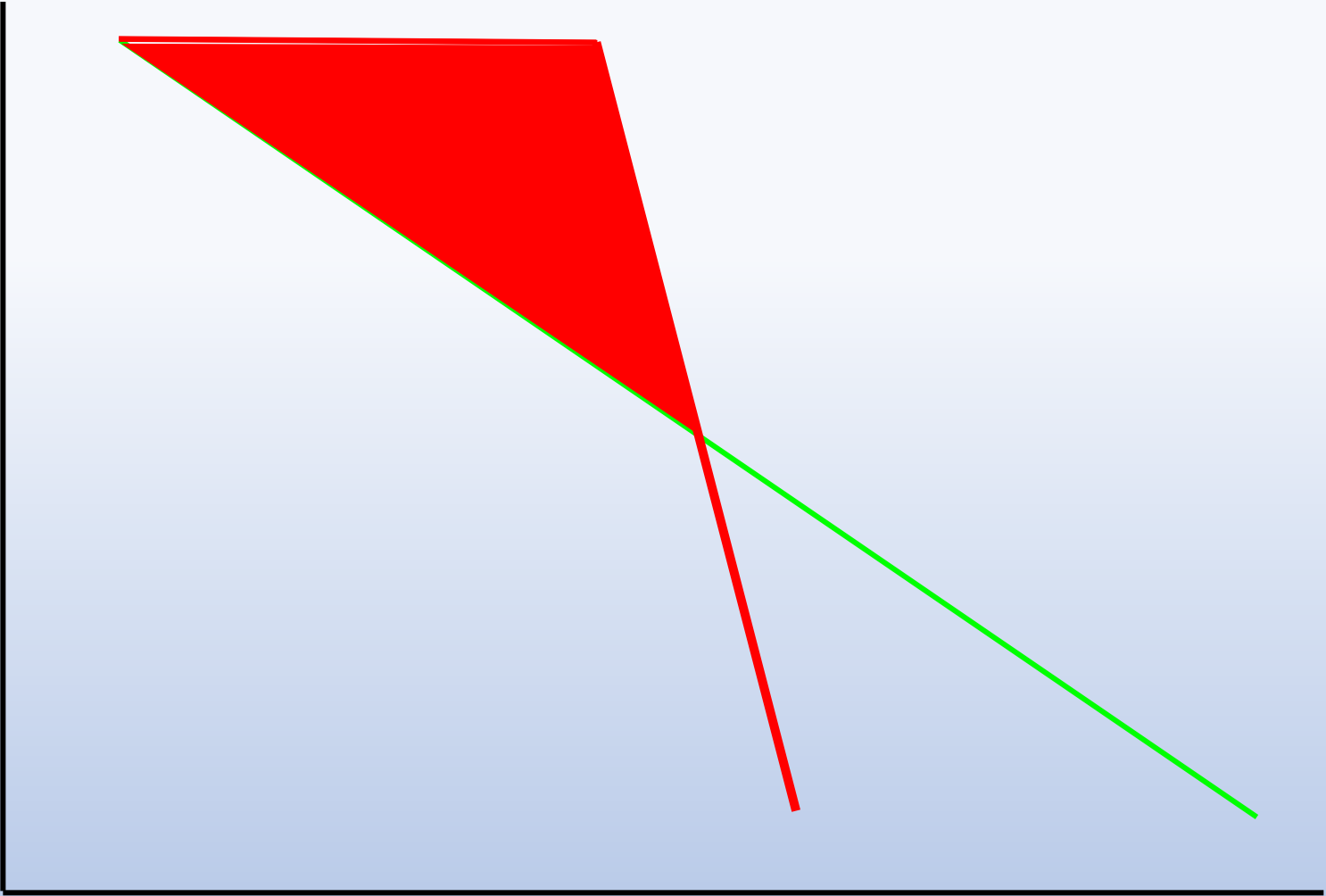
Time

Emissions



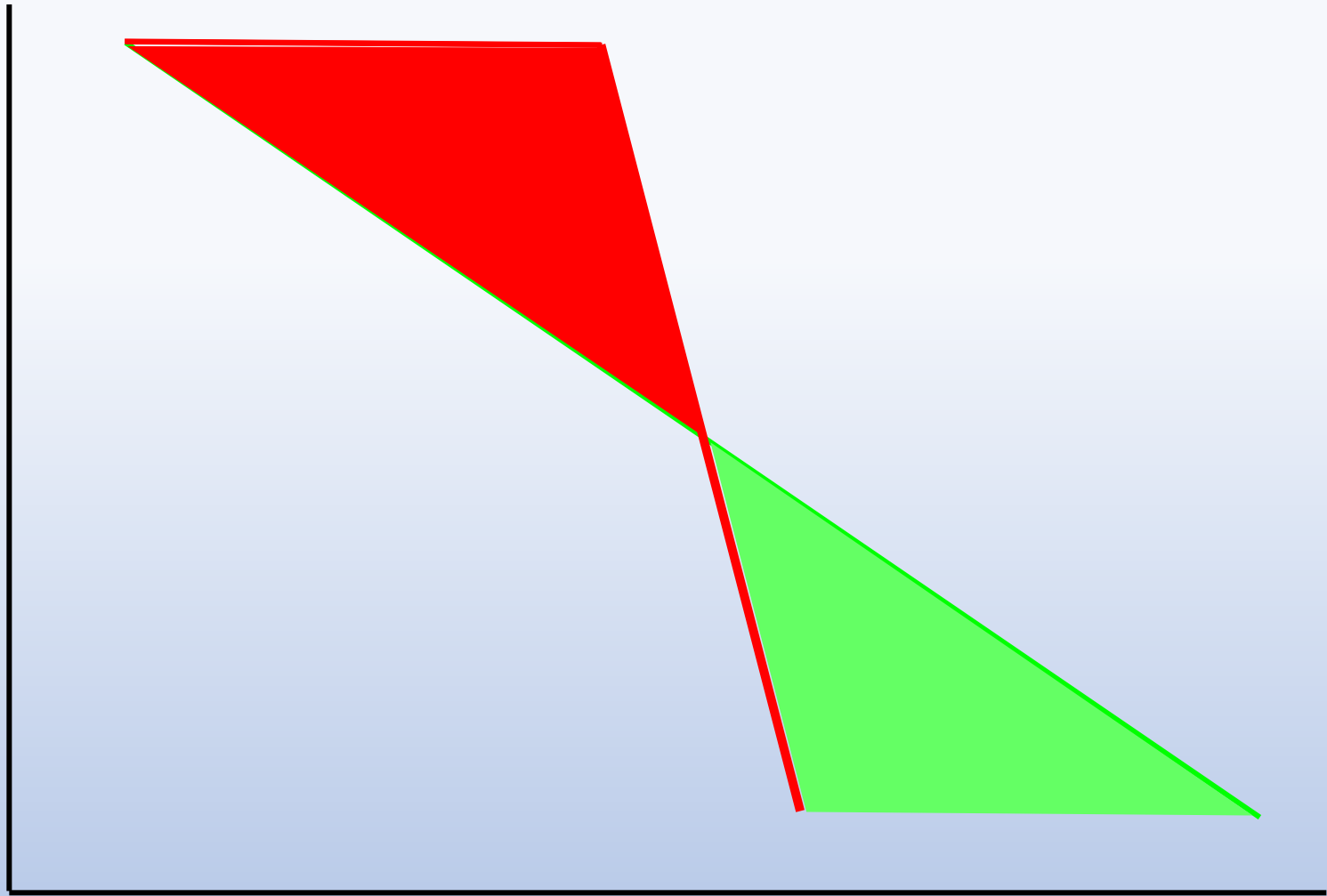
Time

Emissions



Time

Emissions



Time

What questions *can* TIM answer?

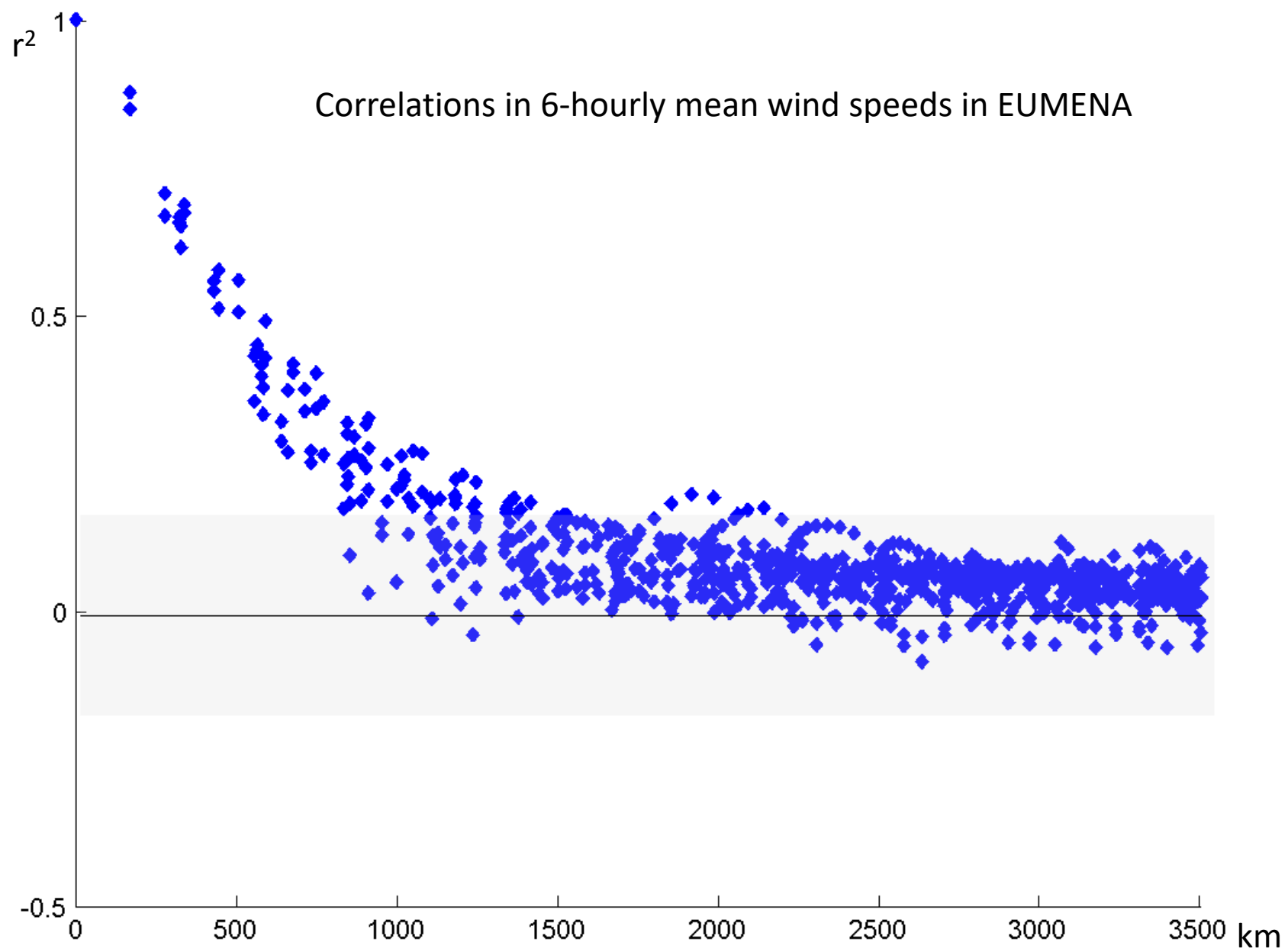
- ❖ What energy system changes would be needed to meet given decarbonisation targets (budget or given year)
- ❖ For an “all-time carbon budget”, what is the “optimal” pathway over time and across sectors?
- ❖ What is the “effort gap” between current measures and what is needed, sector-by-sector?
- ❖ What is the impact of excluding mitigation options (or adding new options)? How does that affect feasibility?

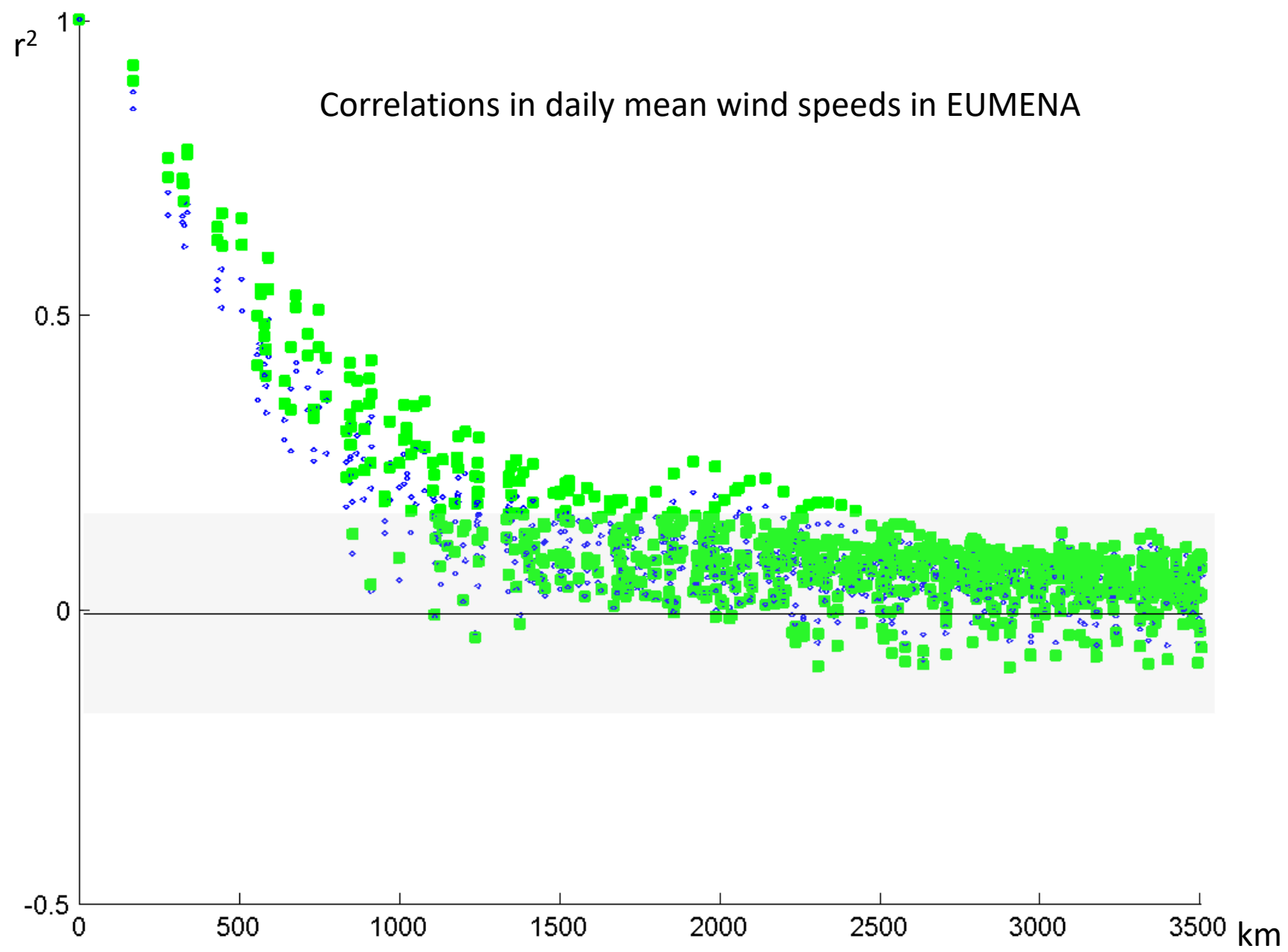
What questions can TIM *not* answer?

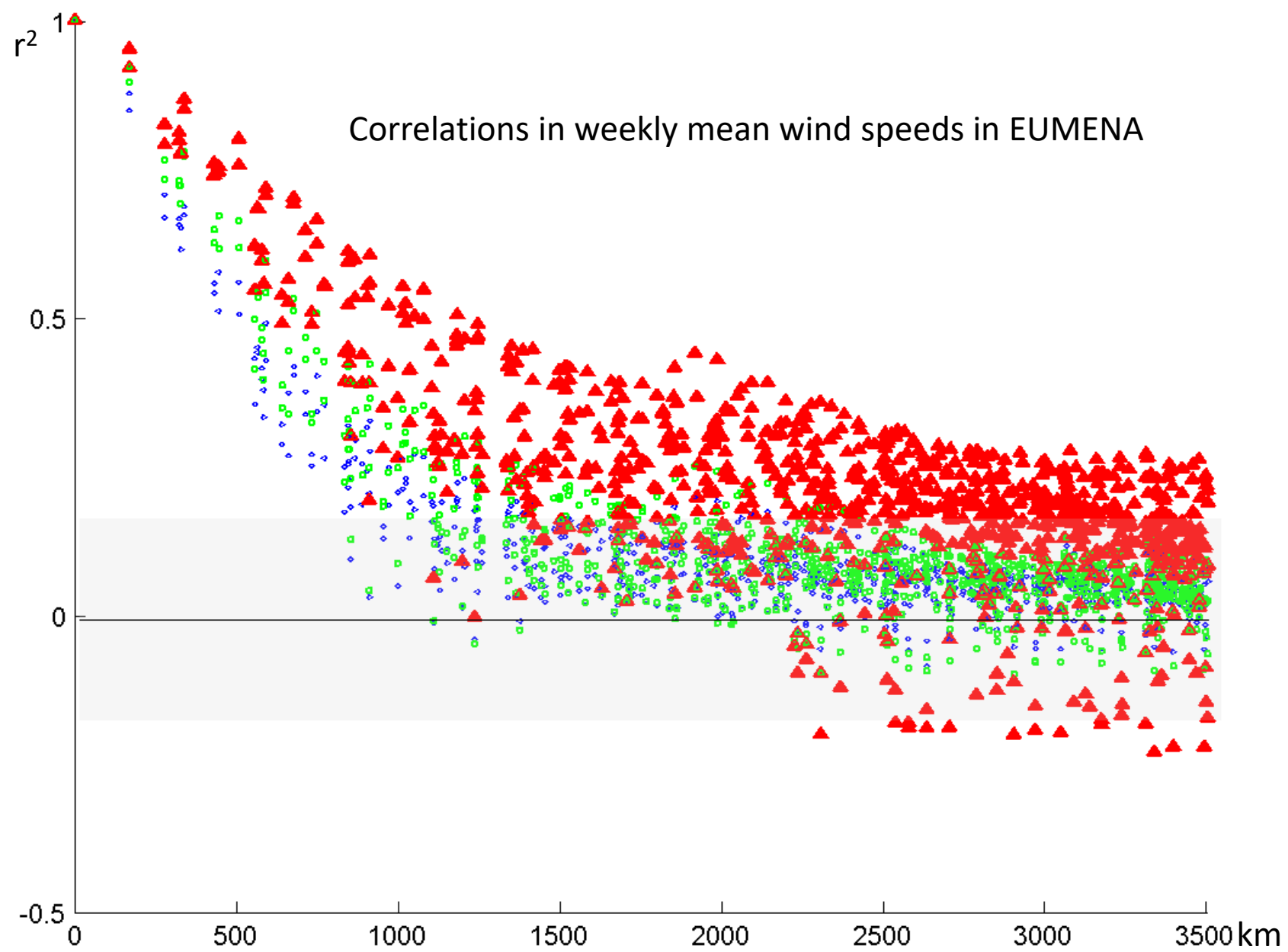
- ❖ What should the carbon budget for energy vs. agriculture emissions be?
- ❖ Who pays?
- ❖ What policies should be used to achieve the target?
- ❖ What are the interactions and trade-offs between energy, land-use and food systems for mitigation?
- ❖ What additional measures are required to ensure grid stability?
- ❖ Where do we need expansion of transmission & distribution grid capacity?

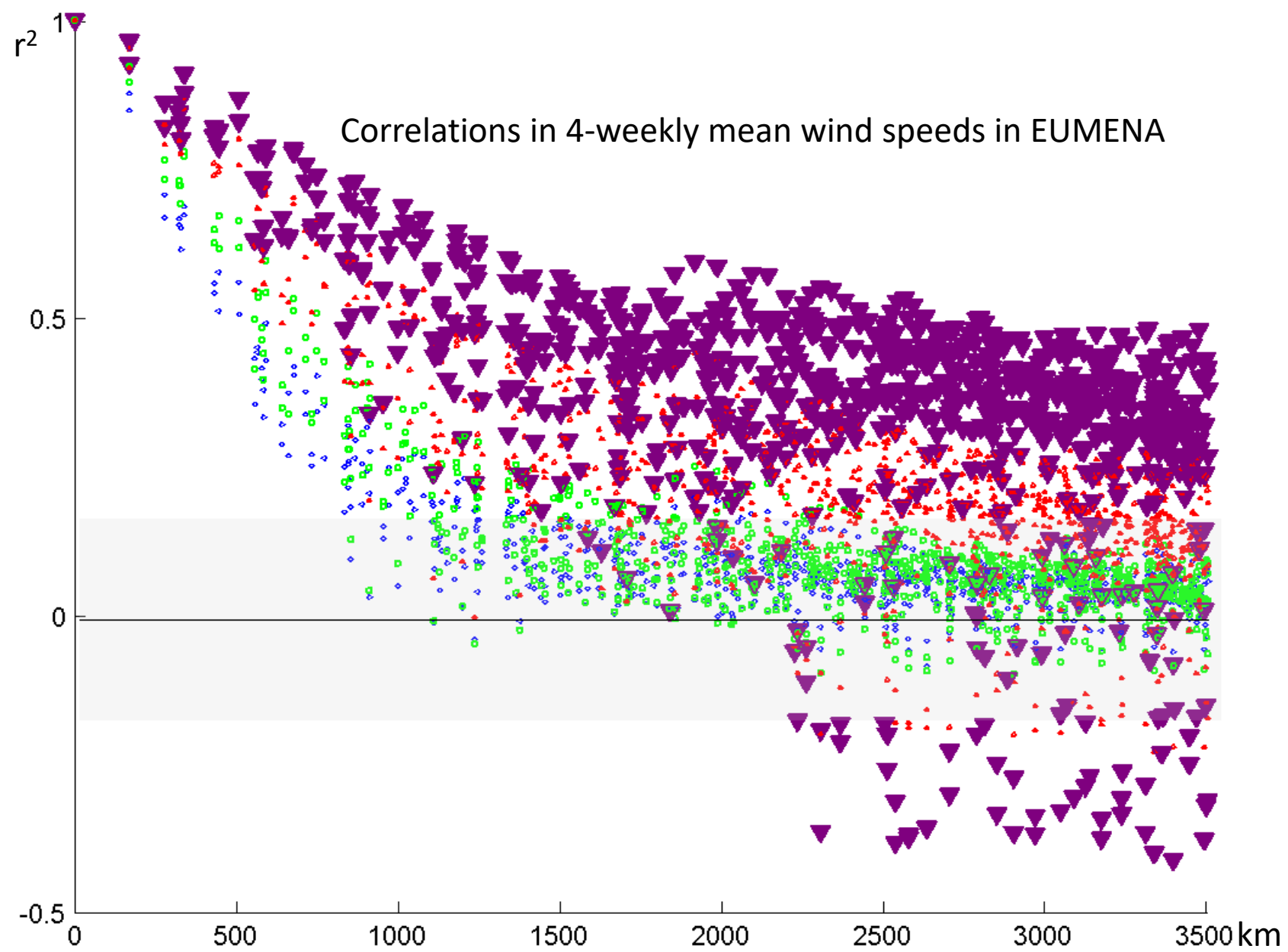
The grid beyond TIM

- ❖ We maintain two-way information flow (soft-linked) with our Plexos unit-commitment model, to ensure that we project a viable generation mix









- ❖ Quickly delivering a **much larger, secure, and clean** electricity system is core to meeting our carbon budgets
- ❖ Over the next decade, being able to operate the Irish grid during extended periods with **100% renewable generation is key to reducing emissions**. We can currently handle 75% SNSP – next step 80% (2024 H1), 95% by 2030
- ❖ Being able to operate the system at times with close to **0% wind & PV generation is essential for reliability**.
- ❖ Climate policy is based on averages, and **energy security is influenced by extremes**.
- ❖ Weather driven Renewables replace the almost all the **use of**, but not the **need for**, highly flexible on-demand generation.
- ❖ PV complements wind well. Together with geographic diversification and a larger share of offshore wind, the amount of long-duration energy storage is reduced. But being an island on the edge of the continent lessens the value of interconnectors, which nevertheless remain valuable