

Transformation of the European power system out to 2030: Detailed analysis of IRENA's REmap 2030 project using a European Electricity Model



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Research Question

How plausible are REmap results for the power sector considering baseline grid expansion plans and flexibility measure assumptions based on the latest ENTSO-E Ten Year Network Plan?

- What impact will variable renewable such as offshore wind, onshore wind and solar have on the European electricity system of the future?
- How will wholesale prices be impacted?

REmap

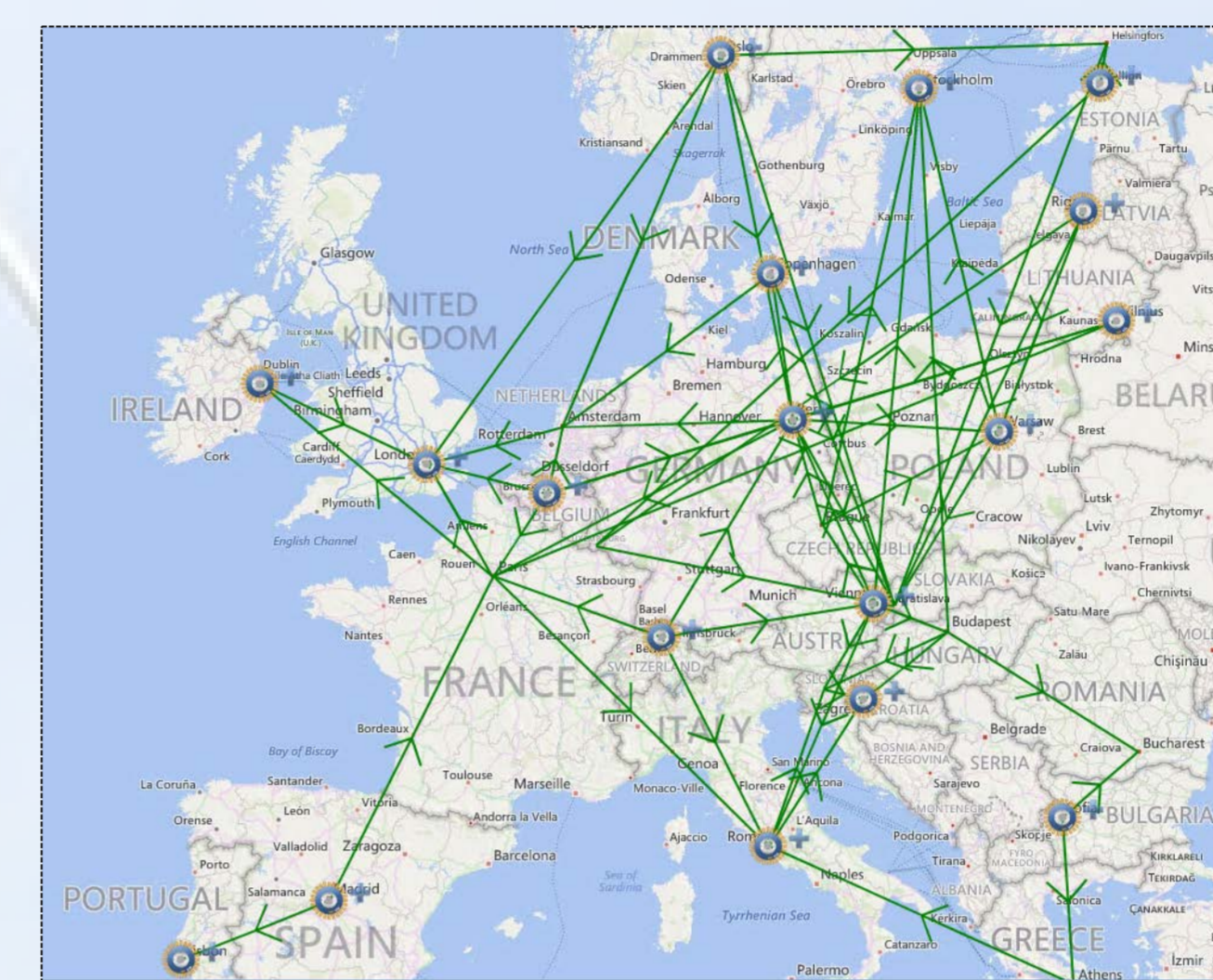


- Global pathways for doubling the share of renewable energy in the global energy mix
- 9 EU REmap countries
- REmap represents 70% of EU final electricity demand
- REmap looks at realistic potential of RE beyond the Reference Case through country consultation

Methodology

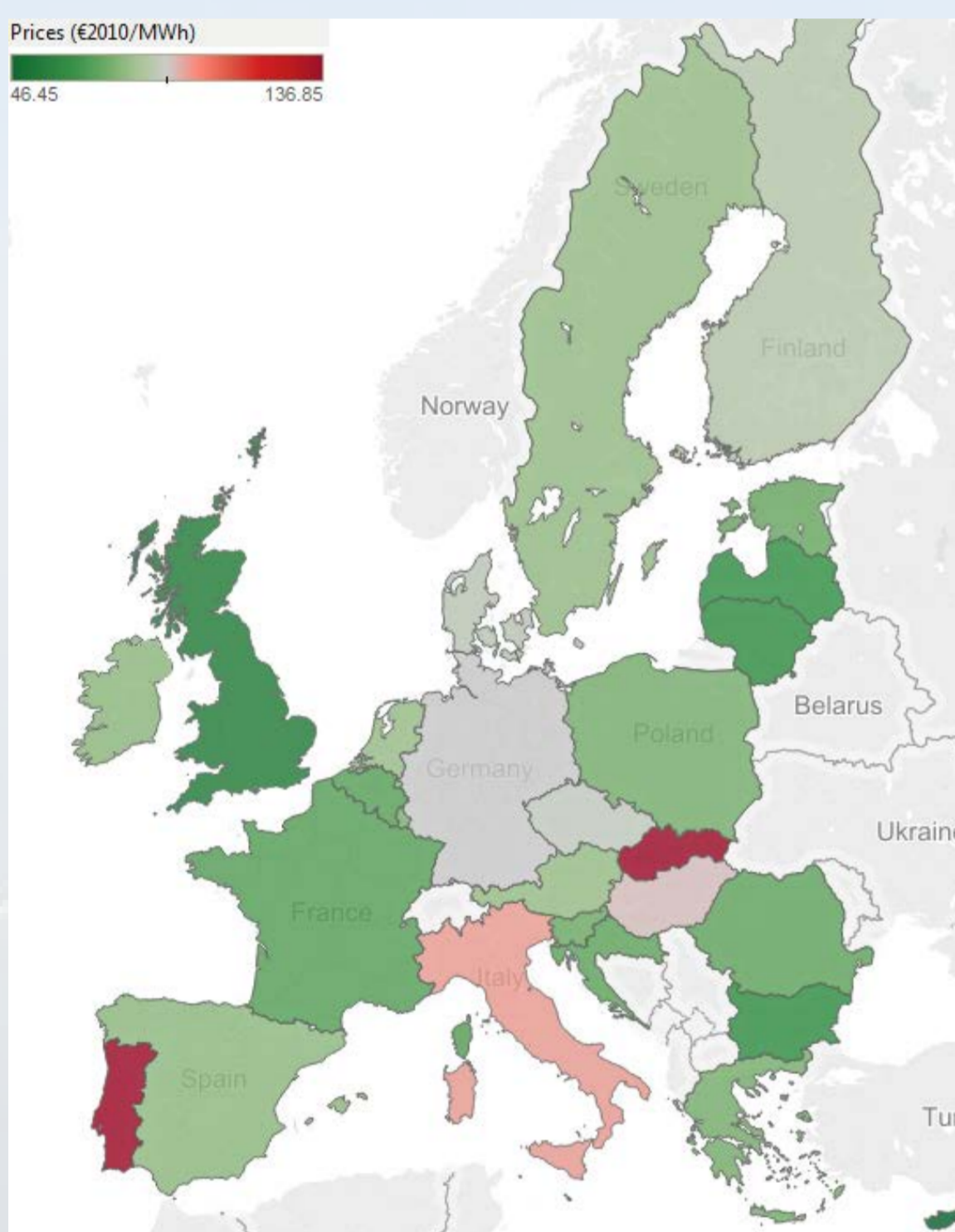
Use of a detailed EU-28 Power System Model provides:

- Detailed analysis of REmap results using soft-linking techniques
- Localised Variable Renewable Generation Profiles
- High temporal resolution
- High technical detail



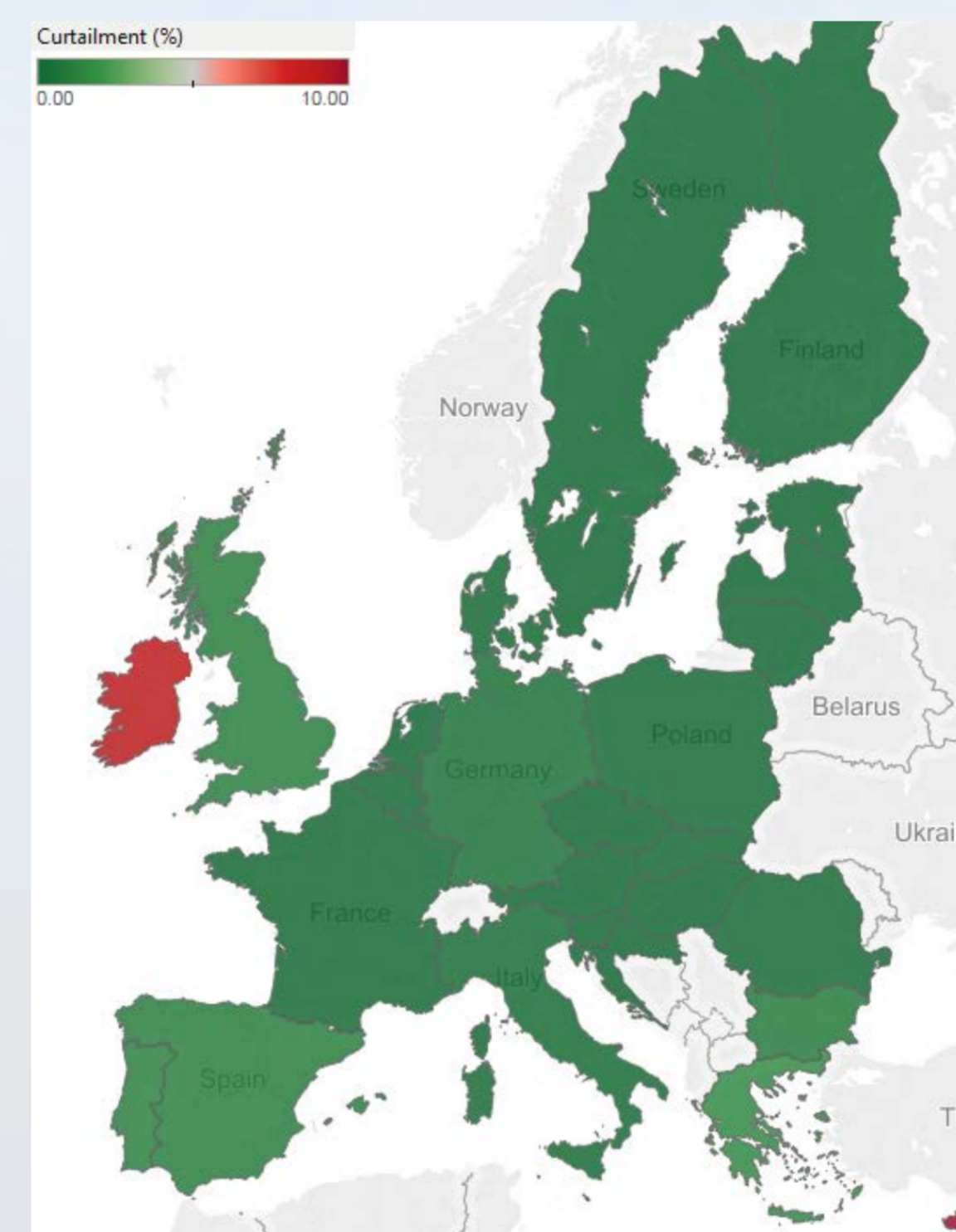
Final EU-28 Model consists of:
 3,000 generators, 22 PHES Units, 62 IC Lines

Wholesale Electricity Pricing



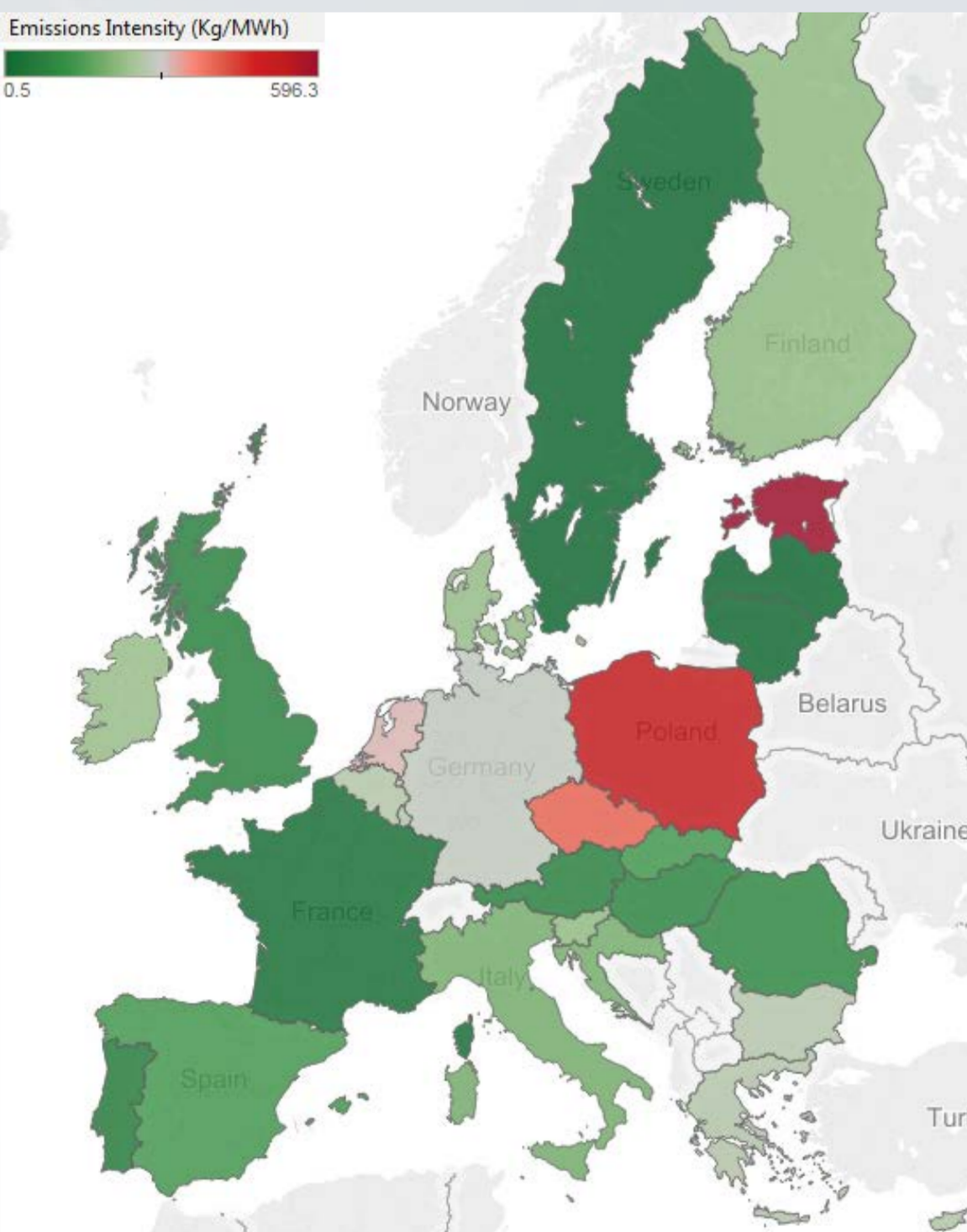
- Increased VRES causes systematic decrease in system pricing
- Renewables causing a shift in the merit order curve
- Affects revenues of conventional power plants

Variable Renewable Curtailment



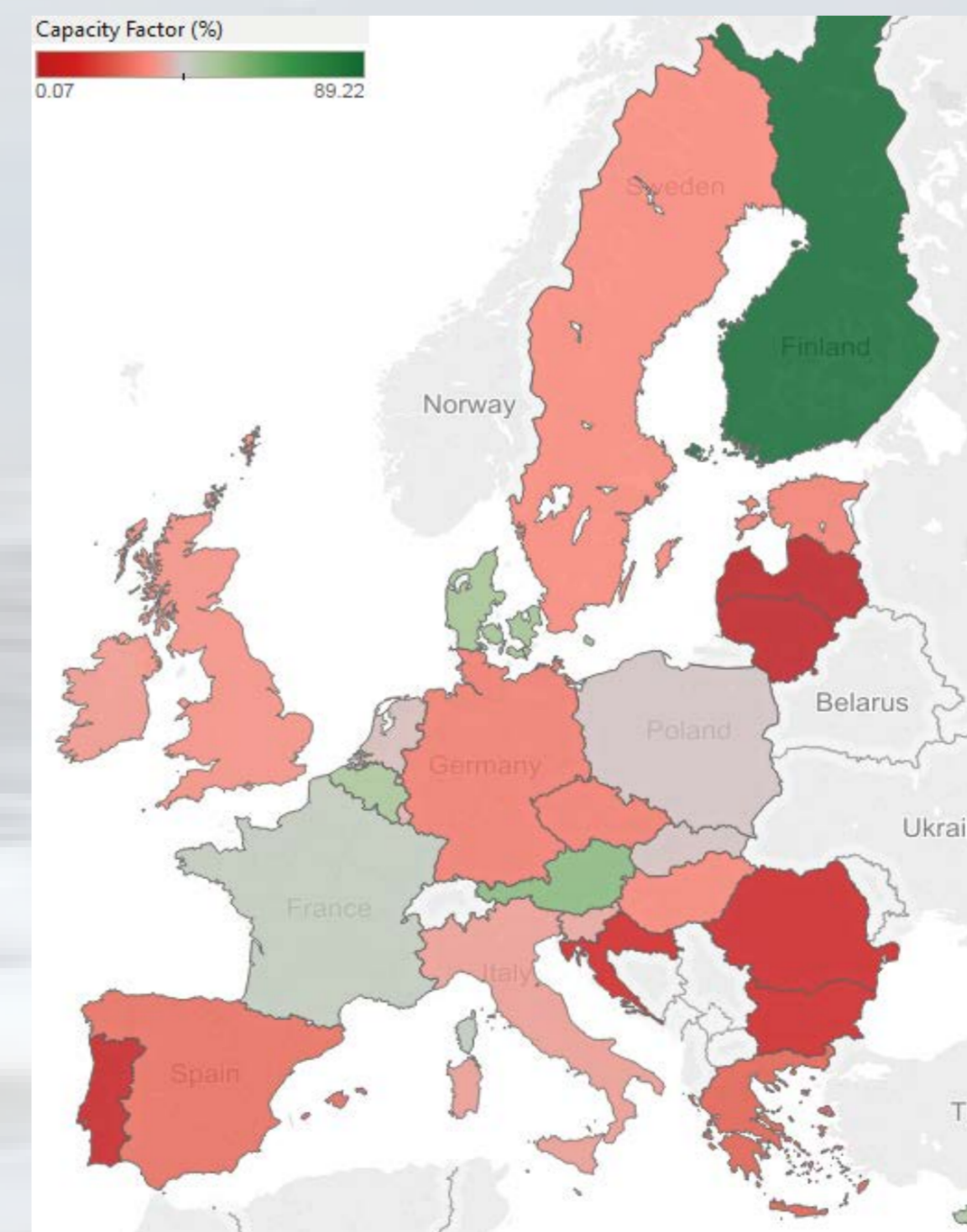
- Raises concerns regarding the ability of the power system to absorb the variable renewables
- Well interconnected states within the model run experiencing curtailment identify increased need for system flexibility

Emissions Intensity



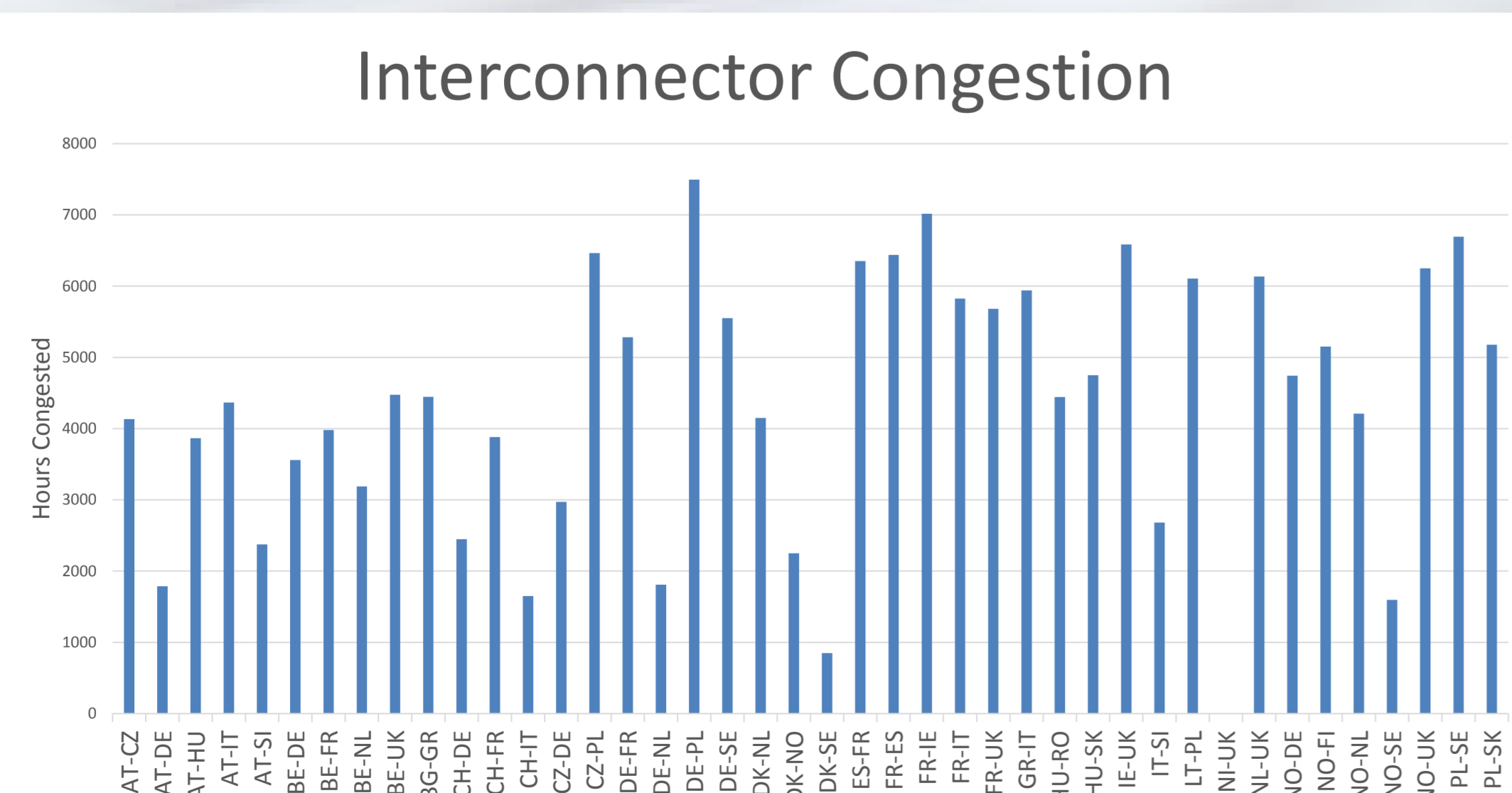
- Reduction in dispatchable capacity across REmap countries causes increased emissions in non-REmap countries

CCGT Capacity Factors



- A market with reduced capacity factors
- Significant increase in price received by generators per MWh
- Overall profitability reduced

Interconnector Congestion



- Limits the efficient movement of electricity particularly in FR, DE and UK
- Raises concerns over the flexibility of power systems with significantly increased VRES penetration

Conclusions

- REmap results enhanced with broader regional modelling of interconnected regions
- REmap EU power sector possible subject to careful substitution of dispatchable generation with VRES
- High VRES generation leads to increased importance of interconnection

Seán is a PhD researcher of the Energy Policy and Modelling Group at University College Cork.

