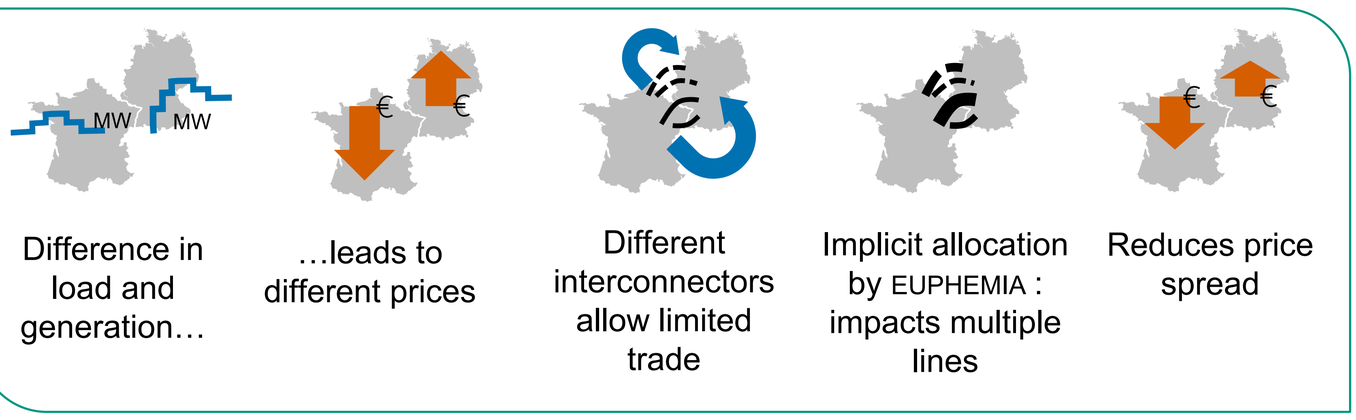
Forecasting Cross-Border Trade Capacities in Europe

Research Proposal

Flow-Based Market Coupling in the CORE Region

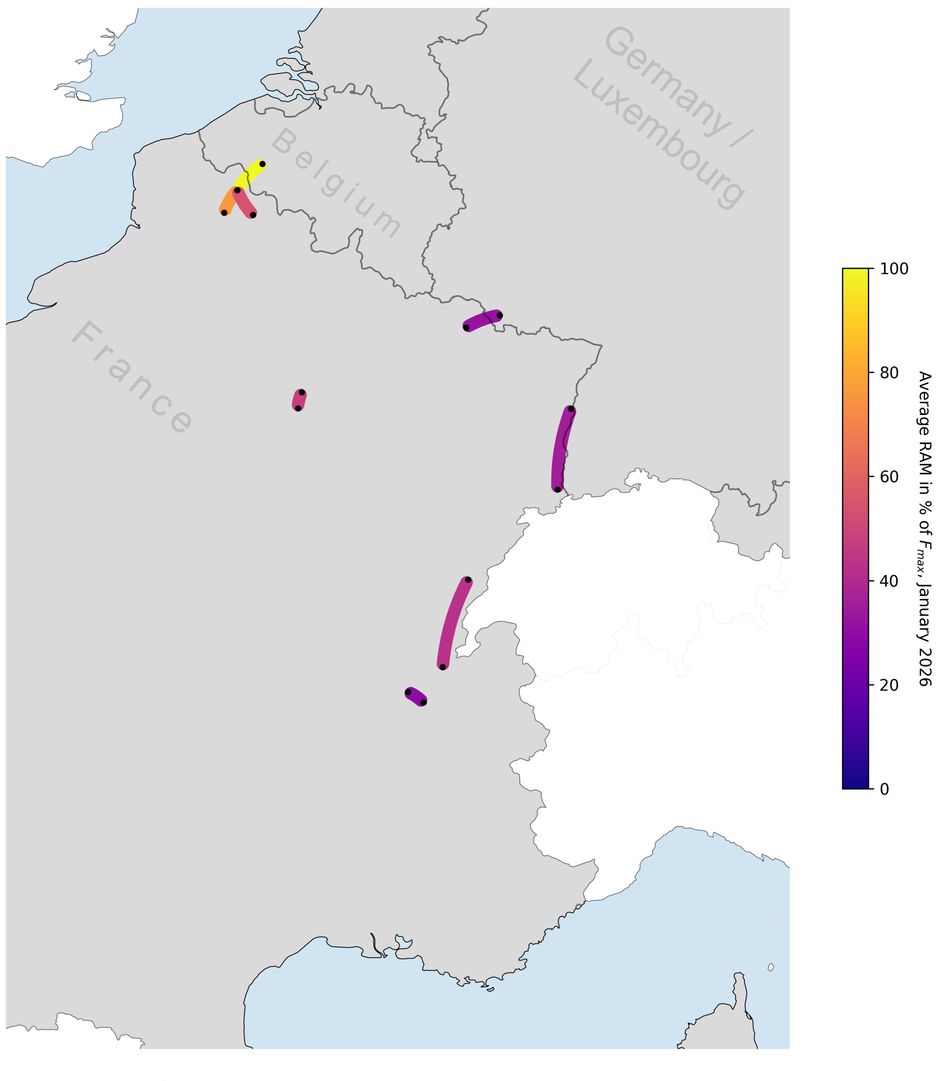
- Different renewable potentials and demands are coupled within CORE (Core Capacity Calculation Region):



Minimum Remaining Available Margins for Trading

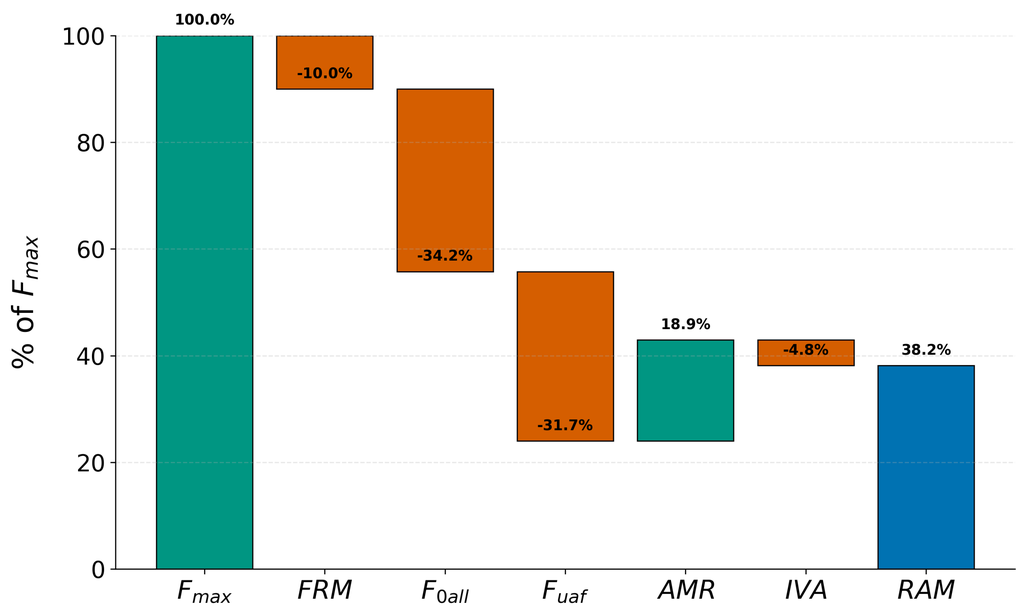
- Transmission system operators calculate the remaining capacities that can be used for trading, called Remaining Available Margin (RAM).
  A minimum proportion of capacity must remain available for trading, referred to as **minRAM** [1].

- RAM is dependent on multiple factors: the thermal limit ($\mathrm{F_{max}}$), error margins (FRM), existing flows ($\mathrm{F_{0all}}$), flows from outside CORE ($\mathrm{F_{uaf}}$).
  To allow for the implementation of minRAM, two additional adjustments are made ($\mathrm{AMR}, \mathrm{IVA}$) [2].



Average Remaining Available Margin (RAM) on critical power lines (Presolved CNECs) in the CORE region operated by the French TSO, RTE, during January 2026.

RAM is expressed in % of the respective thermal limit F_{max}.



$$\mathrm{RAM} = \mathrm{F_{max}} - \mathrm{FRM} - \mathrm{F_{0all}} - \mathrm{F_{uaf}} + \mathrm{AMR} - \mathrm{IVA}$$

Decomposition of average RAM of presolved constraints operated by RTE, January 2026.
Visualisation adapted from Frank Boerman [3].

Forecasting Remaining Available Margins

- Can structural inductive biases improve forecasting of Remaining Available Margins?

- How does forecasting accuracy translate into improved efficiency of cross-border electricity trading in the CORE region?

Proposed Methods

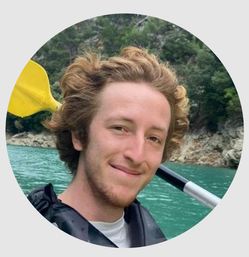
- Add inductive bias into neural networks to learn RAMs:

Embeddings

Graph Neural Networks

PINNs

Do you have an idea?



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LinkedIn

[1] *Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast)* vol. 158. 2019
[2] F. Nagy *et al.*, 'Day-Ahead Flow-Based Capacity Calculation and Market Coupling in Core CCR', in *European Electricity Market Coupling: A Practitioner's Guide*, A. Estermann, M. Schrade, and L. Anderson, Eds, Cham: Springer Nature Switzerland, 2025, pp. 219–258.
[3] F. Boerman, 'Flowbased Tutorial: CNECs and Active Constraints and how to analyse them', Blog Frank Boerman. Accessed: May 04, 2026. [Online].