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Fraunhofer Research Institution for Energy
Infrastructures and Geothermal Systems IEG



Fraunhofer Institute for Systems and
Innovation Research ISI

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Supporting Slide Deck

The European Energy System Model Scenario Design

Cross-sectoral optimisation:

Free grid expansion with TYNDP projects under construction as lower bound

VS.

Sectoral optimisation:

Fixed grid expansion until 2040 to existing grid plans (TYNDP, H₂ infrastructure map, German H₂ core network)

Sectoral policy dimension

CN:
Cross-sectoral,
National view

CE:
Cross-sectoral,
European view

SN:
Sectoral,
National view

SE:
Sectoral,
European view

National policy dimension

National self-sufficiency targets:

- Electricity (min: 80% in 2030, 100% in 2050, max: 110% in all year)
- H₂ (min: 70%, max 110% in all years)

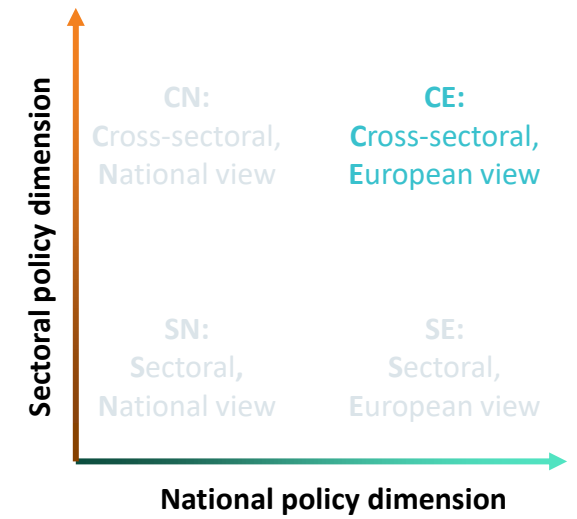
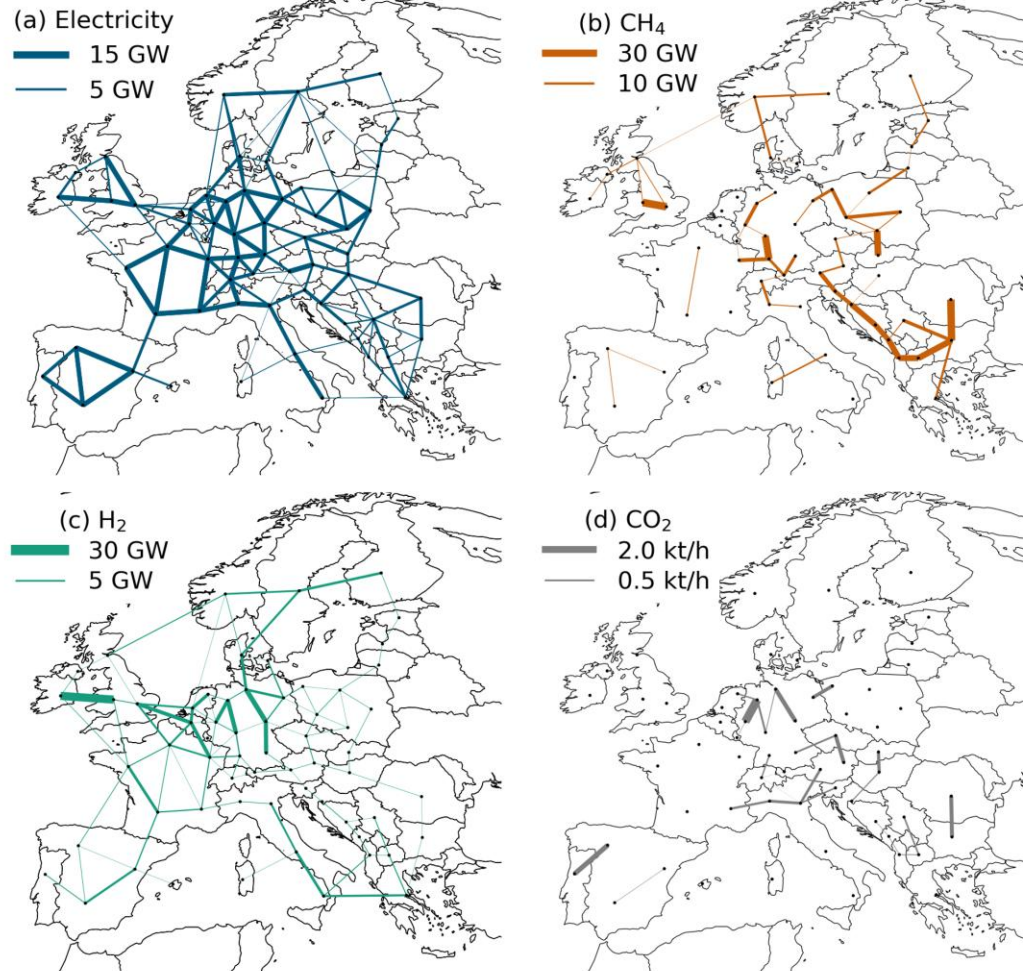
VS.

European optimisation

with no national restrictions

European Infrastructure in 2050

Optimal Transport Networks

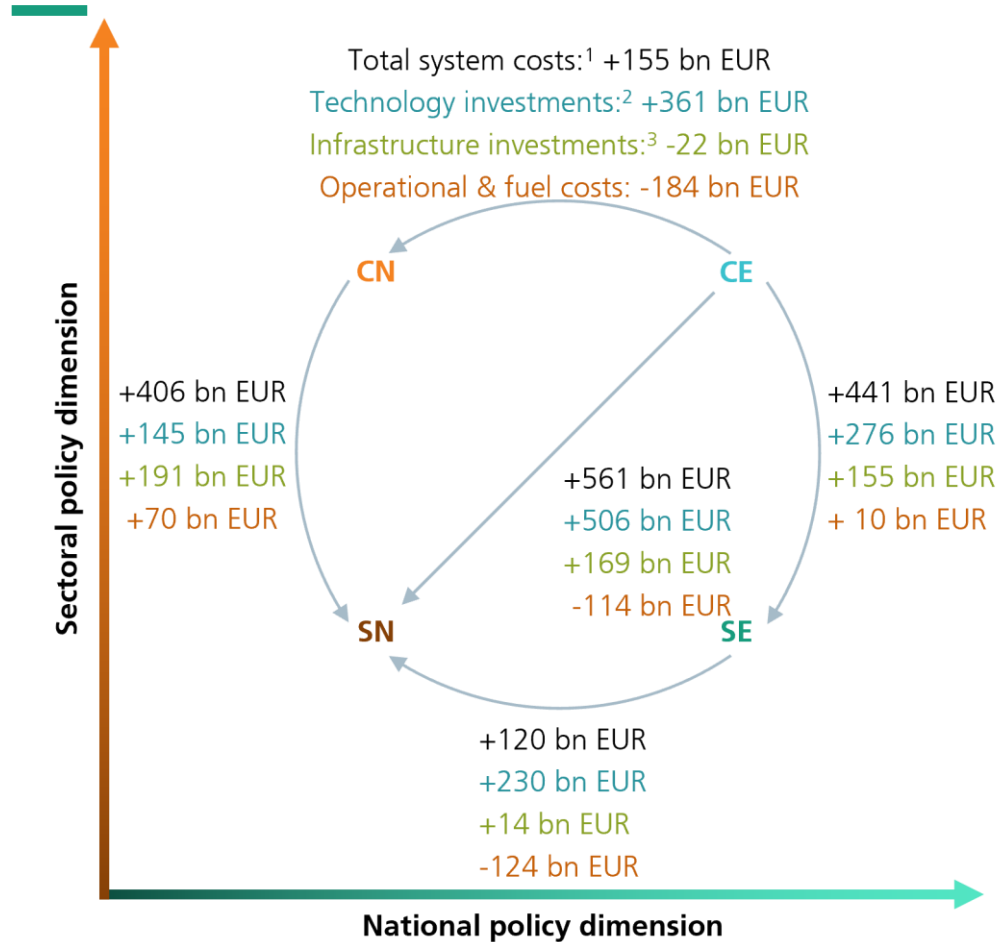


- **Massive expansion of electricity transmission grids across the EU.**
- **Significant hydrogen transport grid to supply industrial demand centres.**

- **Strong decrease of gas grid capacity utilisation.**
- **Local CO₂ transport systems emerge to connect point sources and storage / use.**

Benefits of Integration

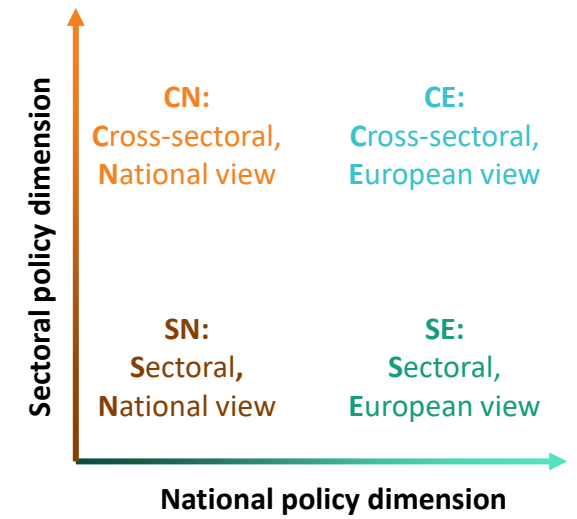
Cumulative System Costs



¹Capital, operational and fuel costs

²Power generation, heat generation, storage and transformation technologies (e.g. H₂ electrolysis)

³Electricity, hydrogen, methane and CO₂ network



Total system costs of about 560 bn € can be saved until 2050 due to European and sectoral integration.

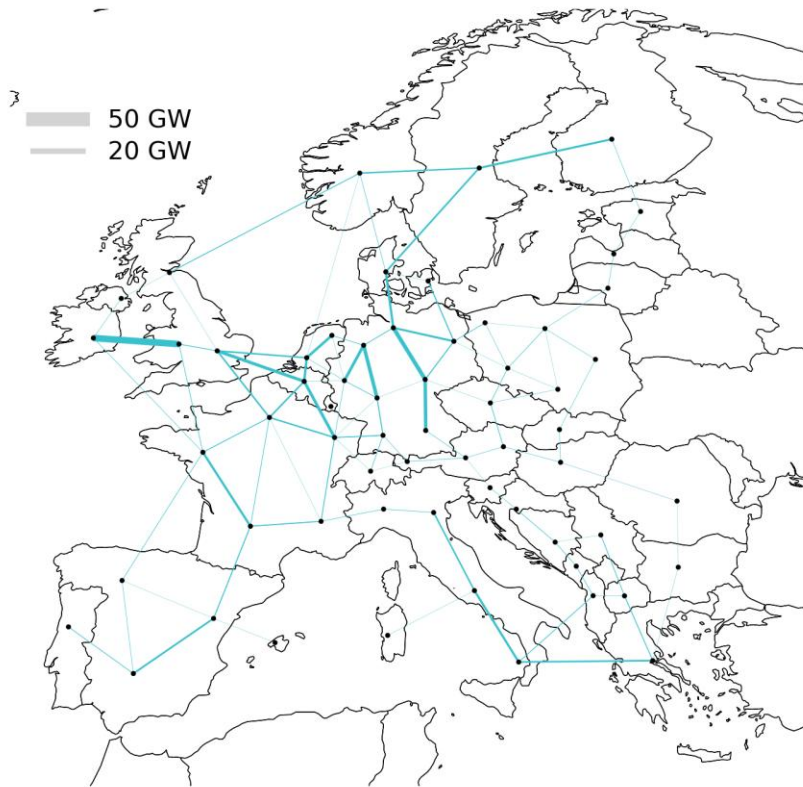
Avoided investments in generation assets followed by avoided infrastructure investments and avoided operational and fuel costs drive these cost savings.

European Hydrogen Network 2050

Influence of Hydrogen Grid Plans

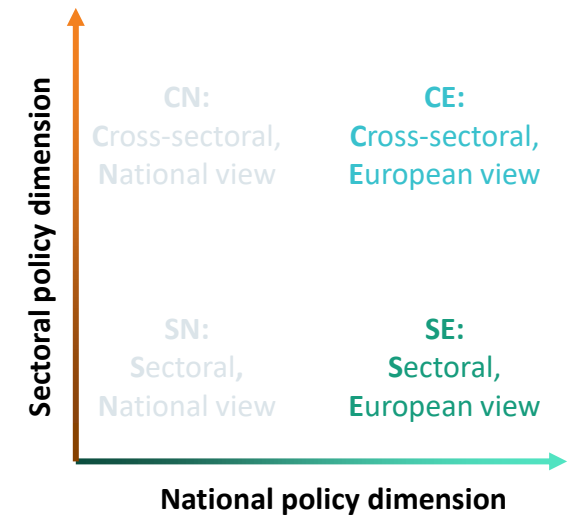
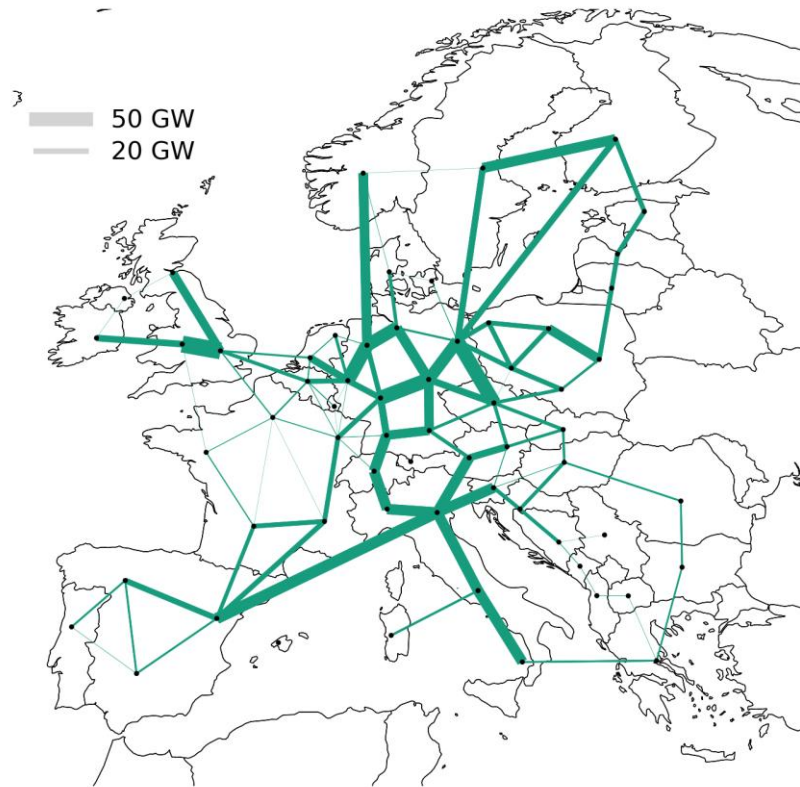
CE scenario:

Free optimisation



SE scenario:

Optimisation including grid plans



European hydrogen infrastructure is essential across scenarios.

Integrated planning helps assessing the infrastructure needed to meet hydrogen demands across Europe.