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# Designing energy infrastructure for a climate-neutral Europe: Solutions for cost-effective system development

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Project overview and policy recommendations

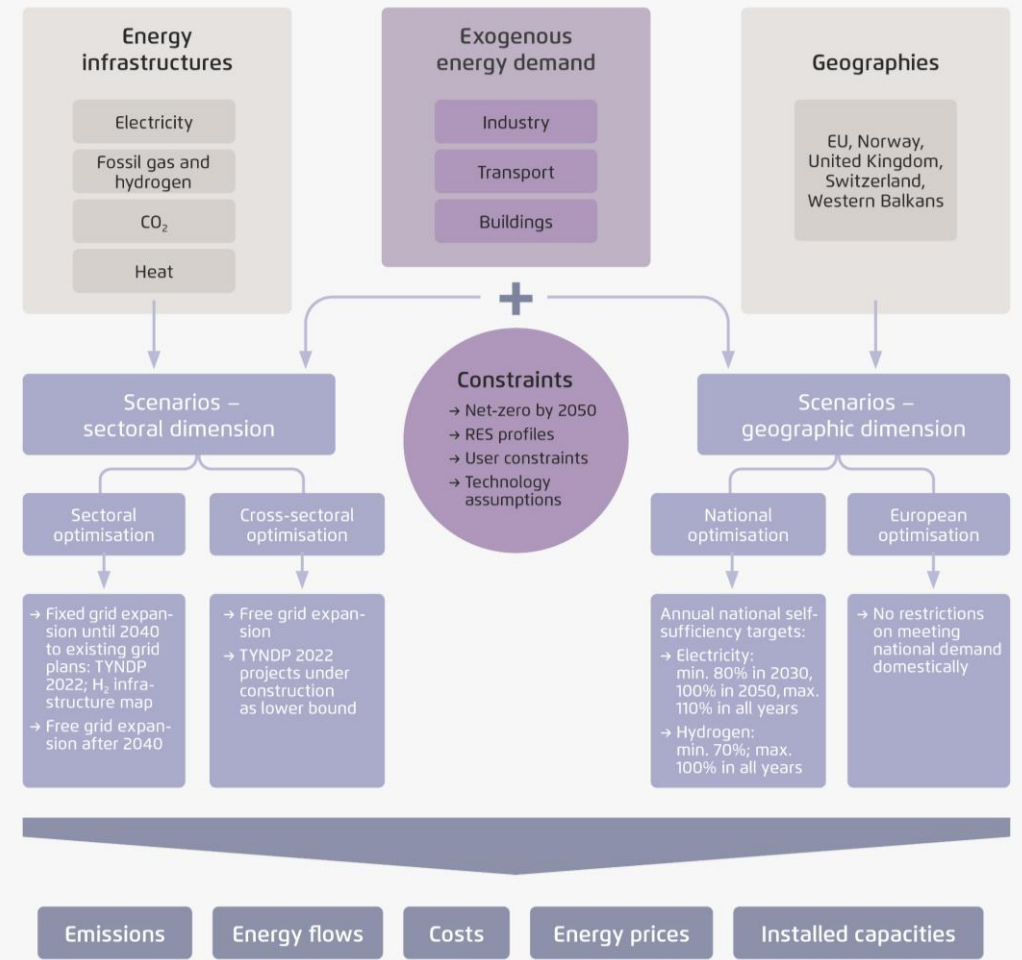
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Megan Anderson  
18 November 2025

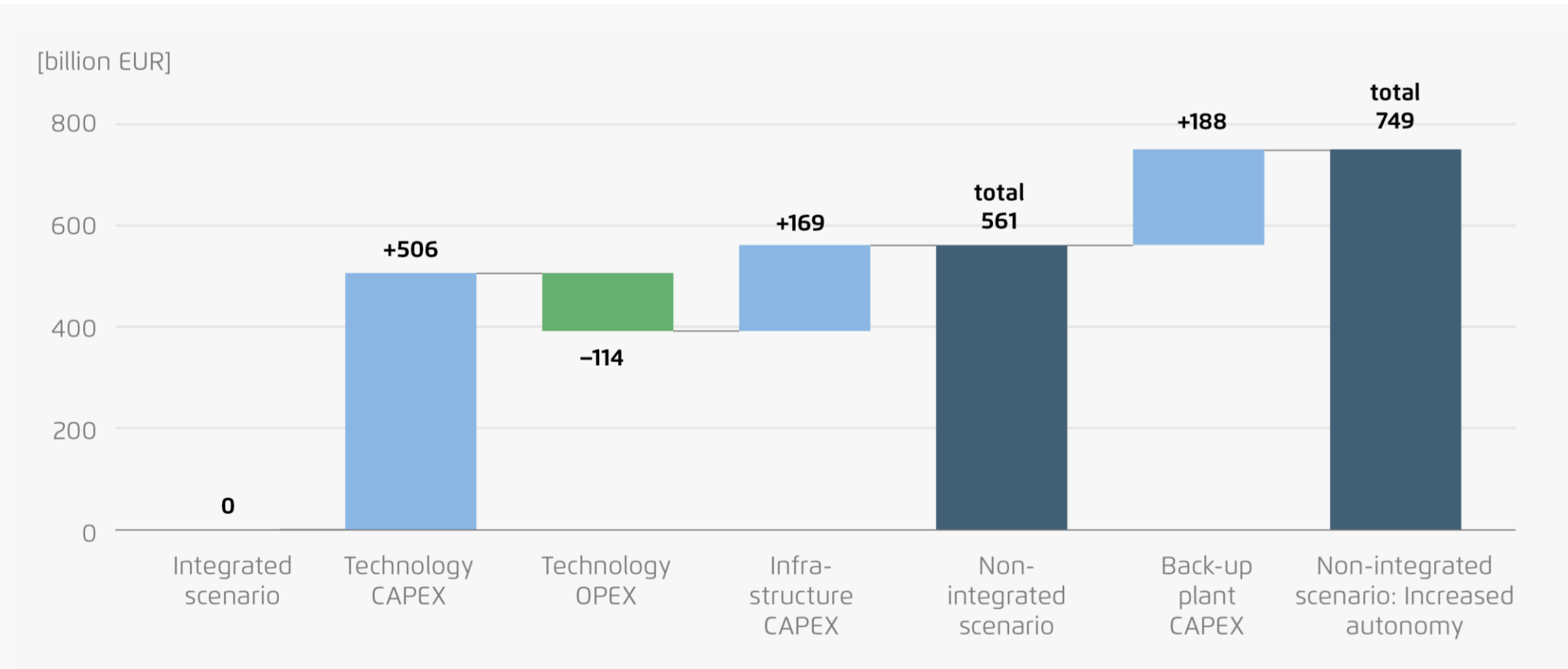


# Project as Process: Co-optimisation of energy and infrastructure systems

- Illustrate an integrated modelling framework:
  - Includes transmission-level electricity, fossil gas, hydrogen and CO<sub>2</sub> infrastructures; electricity distribution grids and district heating grids indirectly considered
  - Looks across Europe
  - Uses open-source PyPSA-Eur model customized to our analytical questions
  - Net-zero by 2050
- Extensive stakeholder engagement throughout the process to test assumptions and approach
- Model is published\*, to reproduce analysis and perform further analysis



# Overall findings in system cost differences between the low-integration and high-integration scenarios for Europe, 2030–2050



Agora Energiewende (2025) based on Fraunhofer IEG, Fraunhofer ISI and d-fine (2025)

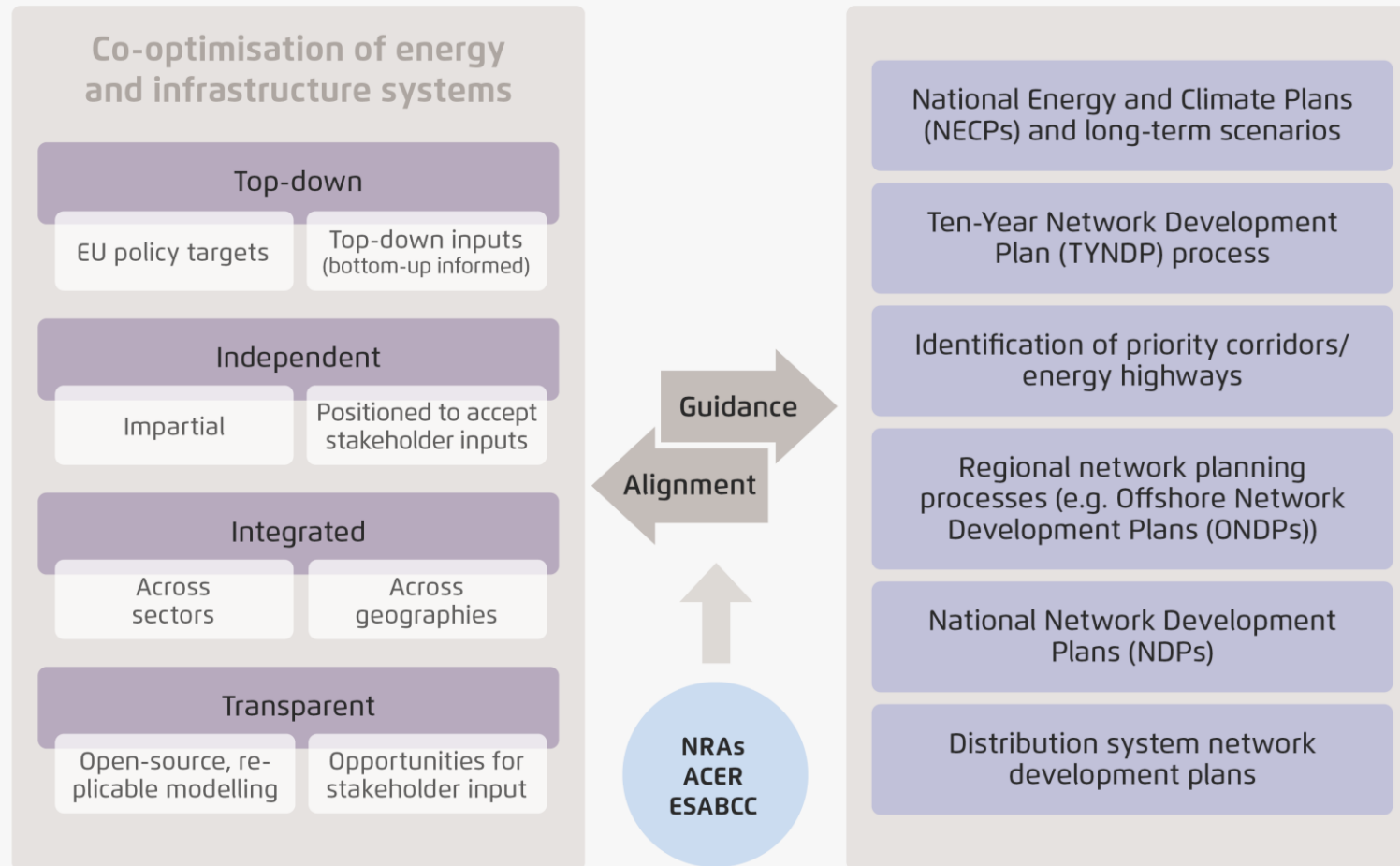
# Recommendations: Including system-wide co-optimisation modelling as an integral part of infrastructure planning

Top-down, integrated, independent and transparent energy system modelling

Planning to reflect the direction of the energy system: focus on electricity infrastructure + molecules in clusters

System-wide integrated modelling to identify priority corridors for infrastructure investment

# Top-down, integrated, independent and transparent energy system modelling



- Top-down modelling adds perspective about the system as a whole.
- Integrated modelling can provide solutions across the energy system.
- Having an independent entity conduct the top-down modelling can ensure non-biased outcomes.
- Using open-source modelling can augment transparency and provide opportunities for further analysis.

# Planning to reflect the direction of the energy system: focus on electricity infrastructure + molecules in clusters

## Planning aligned with system-wide co-optimisation

- \* Expanded role for National Regulatory Authorities to review projects to determine alignment with system-wide modelling
- \* Greater scrutiny of inconsistent projects – justification of deviations

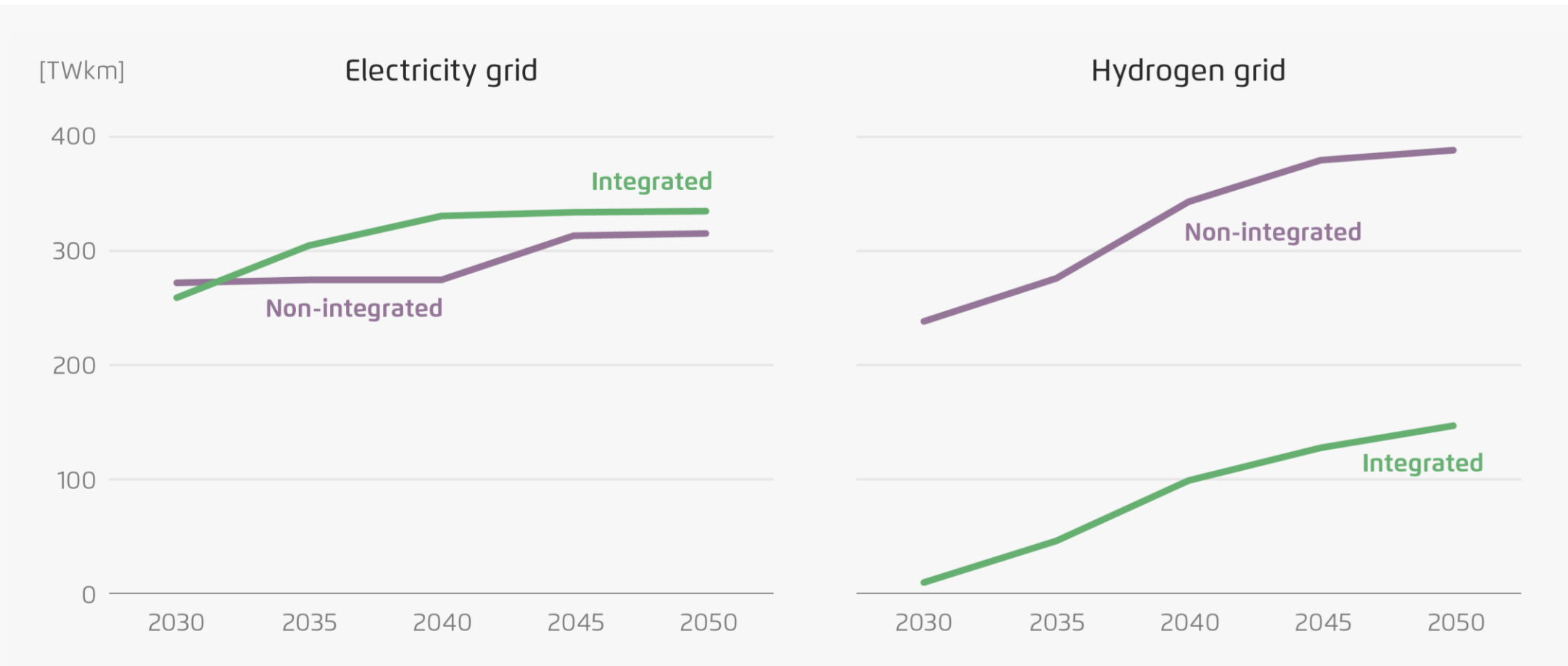
## Focus on electricity infrastructure

- \* Modelling demonstrates the importance of electricity grid buildout
- \* Incentivize projects aligned with co-optimization through facilitated permitting and approval

## Development of molecules in clusters

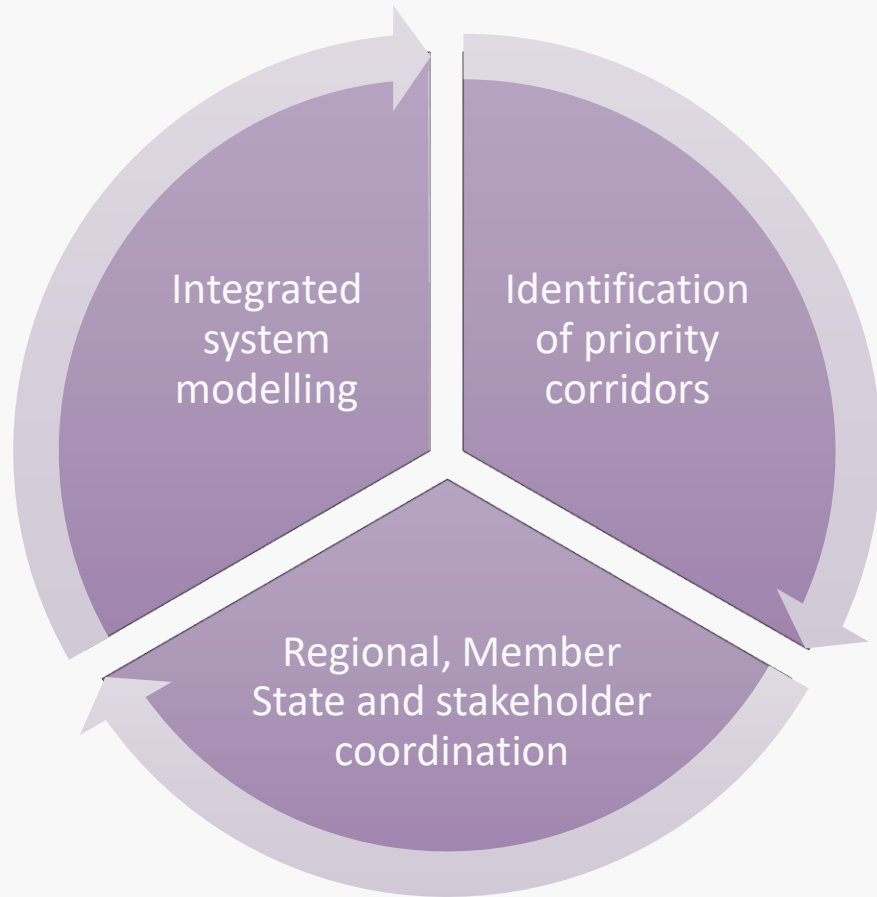
- \* Modelling shows hydrogen and CO<sub>2</sub> needs emerge in clusters
- \* Planning should reflect cluster-based emergence of use cases: targeted need for new infrastructure

# Pan-European transmission infrastructure for electricity and hydrogen in integrated and non-integrated scenarios



Agora Energiewende (2025) based on Fraunhofer IEG, Fraunhofer ISI and d-fine (2025)

# System modelling to identify priority corridors for infrastructure investment



- System-wide modelling can facilitate identification of priority corridors
- Through open-source and transparent system modelling, stakeholders have improved ability to participate in planning processes, including through independent use of the model to test and iterate solutions
- Modelling can provide insights to Member States and regional groups to inform discussions around project benefits and cost allocation

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# Thank you for your attention!

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Do you have any questions or comments?

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