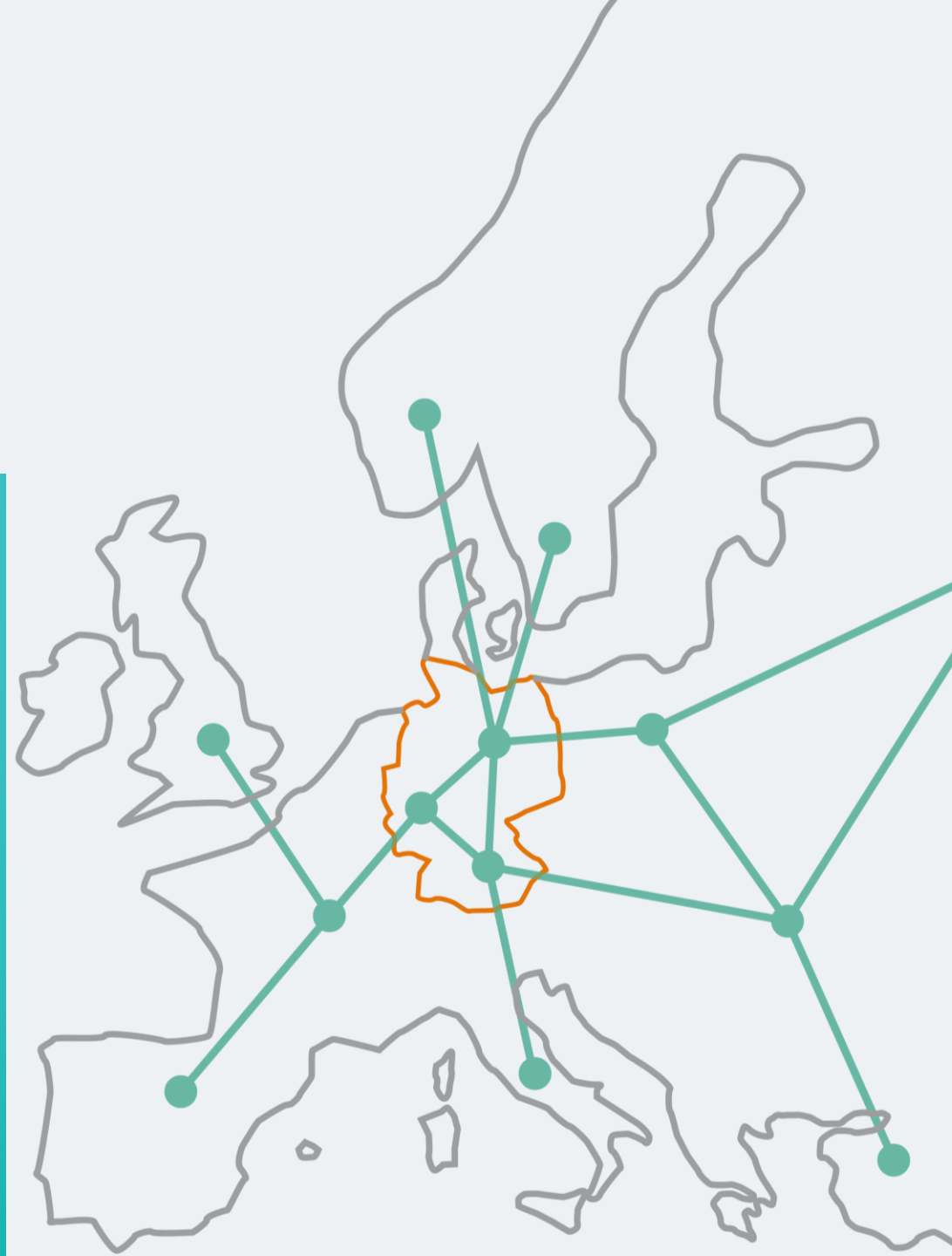




Patrick Jürgens  
ECEMP 2025  
Brussels, 17.10.2025

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# Modelling the European energy transition in the context of social and political developments

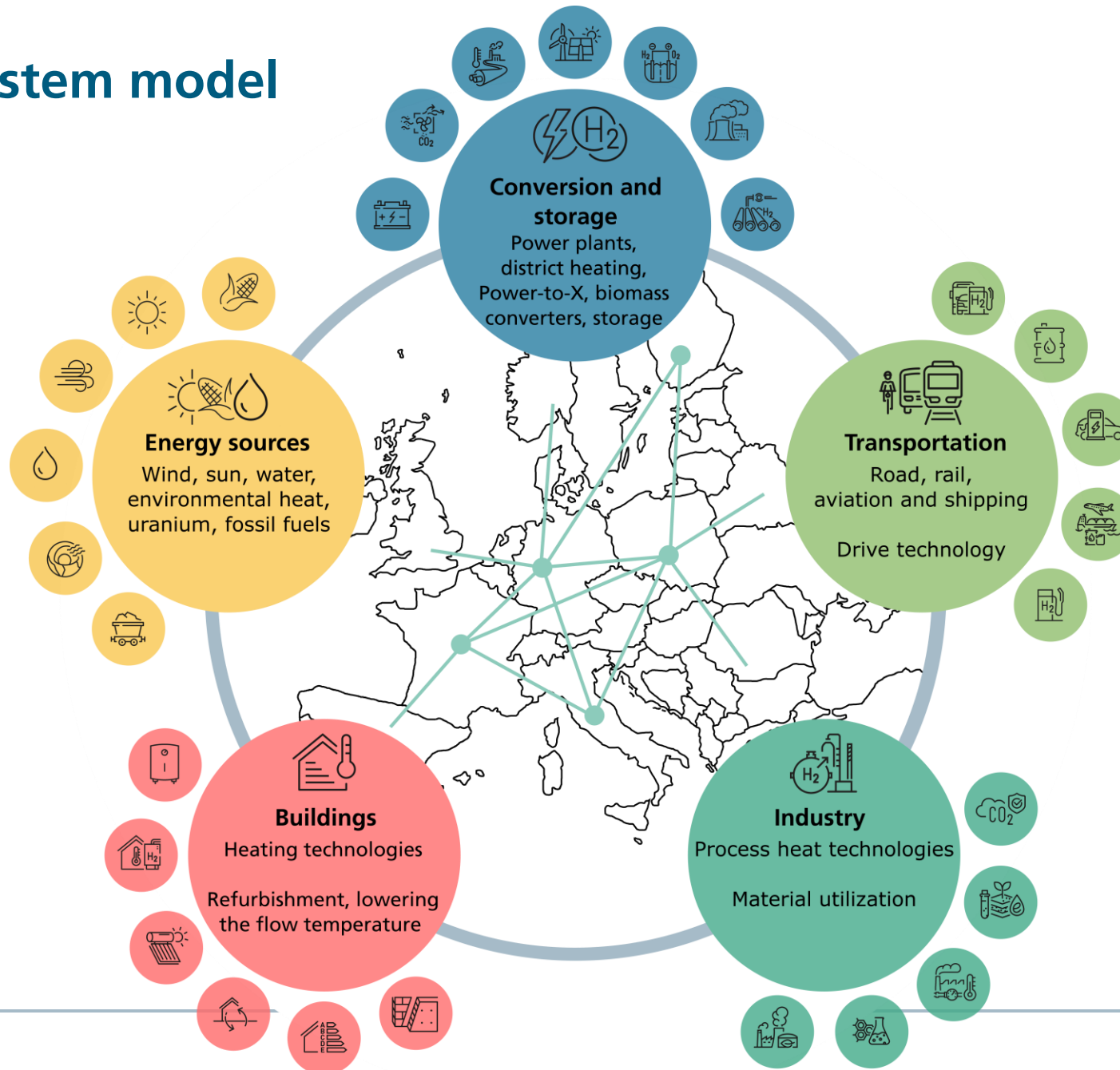




# How can the energy transition in Europe look like in the context of social and political developments?

# Energy system model

## REMod



- Hourly operating simulation
- Annual expansion optimization
- Spatial resolution
- Direct coupling of all sectors
- Integration of all CO2 emissions
- 5 different weather years

# Scenarios

## Description



### Green Deal

Cost-optimal  
international cooperation  
no geopolitical/societal disruptions



### National Interests

Limited international cooperation  
powerful national actors



### Energy Autonomy

Decrease geopolitical dependencies  
limit new dependencies  
strategical reindustrialisation



### Green Consciousness

Public awareness for climate mitigation  
and environment  
reduction of energy demand

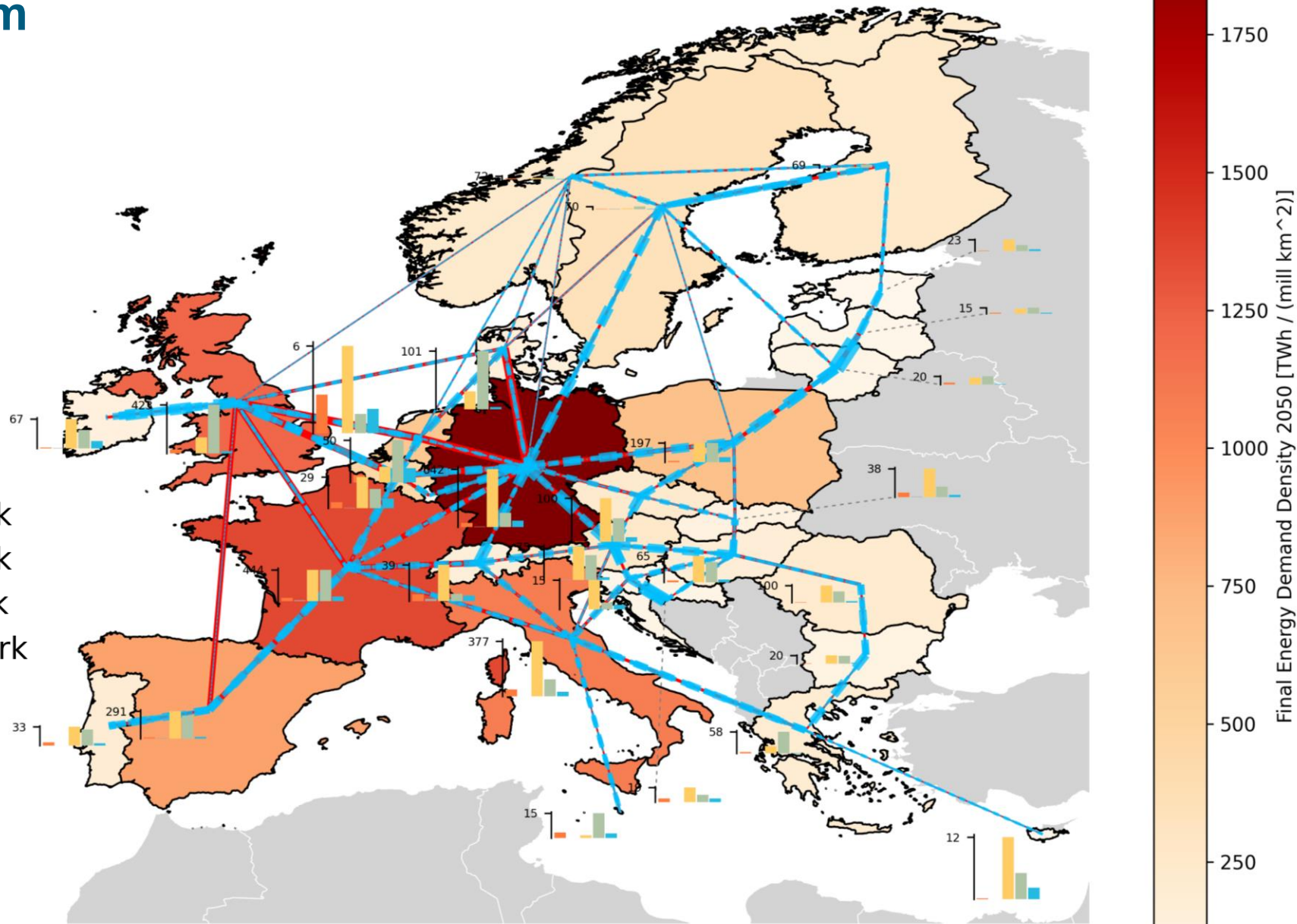
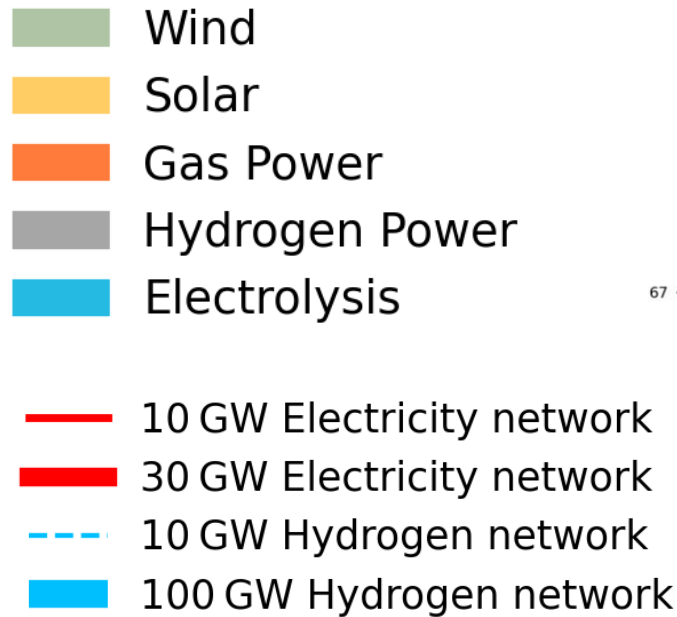
# Scenarios

## Parametrisation

	<b>Green Deal</b>	<b>National Interests</b>	<b>Energy Autonomy</b>	<b>Green Consciousness</b>
<b>Energy demand</b>	Projections		+25% industry	Overall decrease (≈15% reduction)
<b>Nuclear power</b>	Optimized	Forced in some states		No expansion
<b>End-use sectors</b>	Optimized	ICE-cars forced in some states		
<b>Grid expansion (H<sub>2</sub> and electricity)</b>	Optimized	Max 0.1 GW/yr per interconnector		
<b>Import potential H<sub>2</sub> and derivatives 2050</b>	2 000 TWh H <sub>2</sub> , 1 140 TWh liquids		10% of Green Deal	50% of Green Deal

# Overall energy system

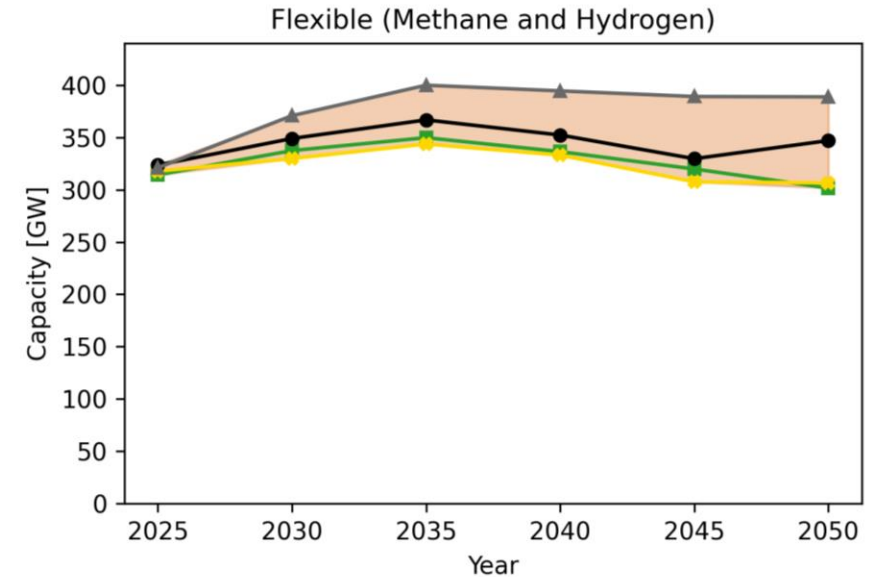
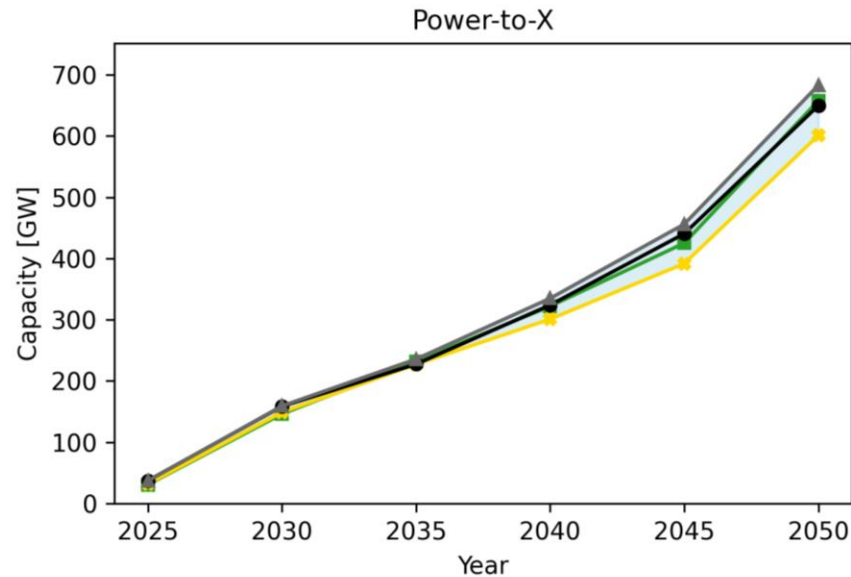
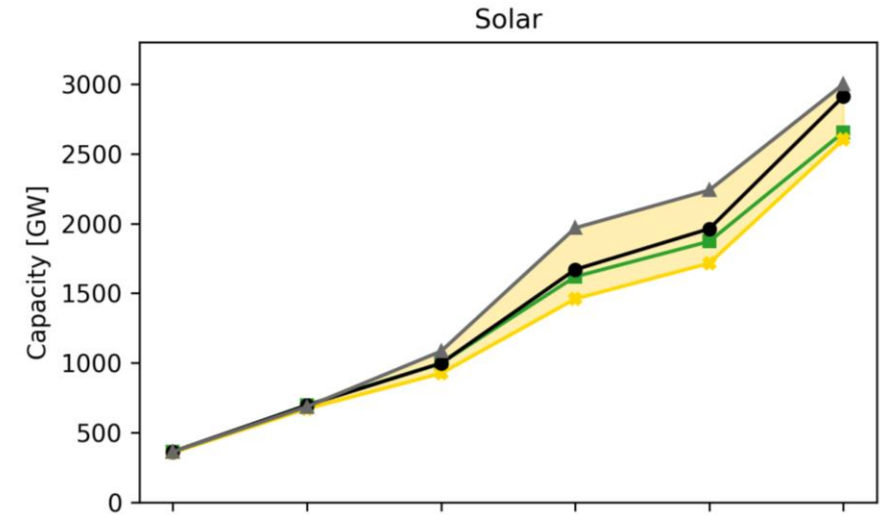
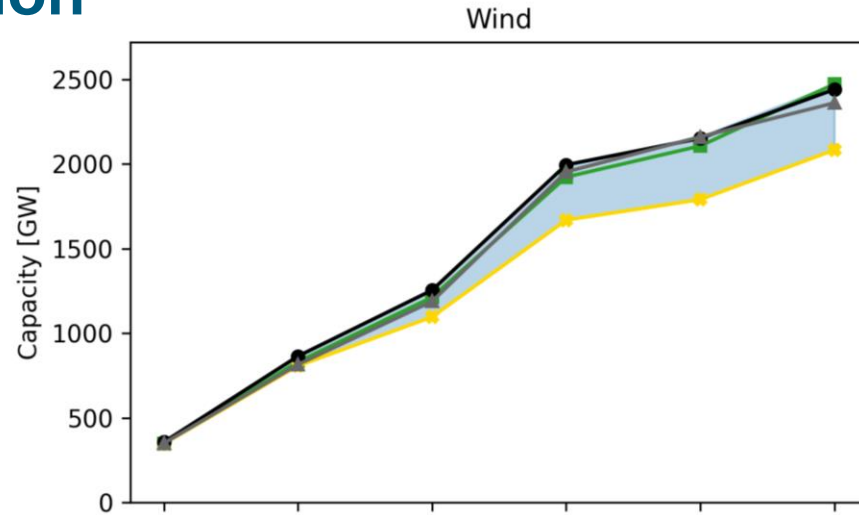
Scenario Green Deal





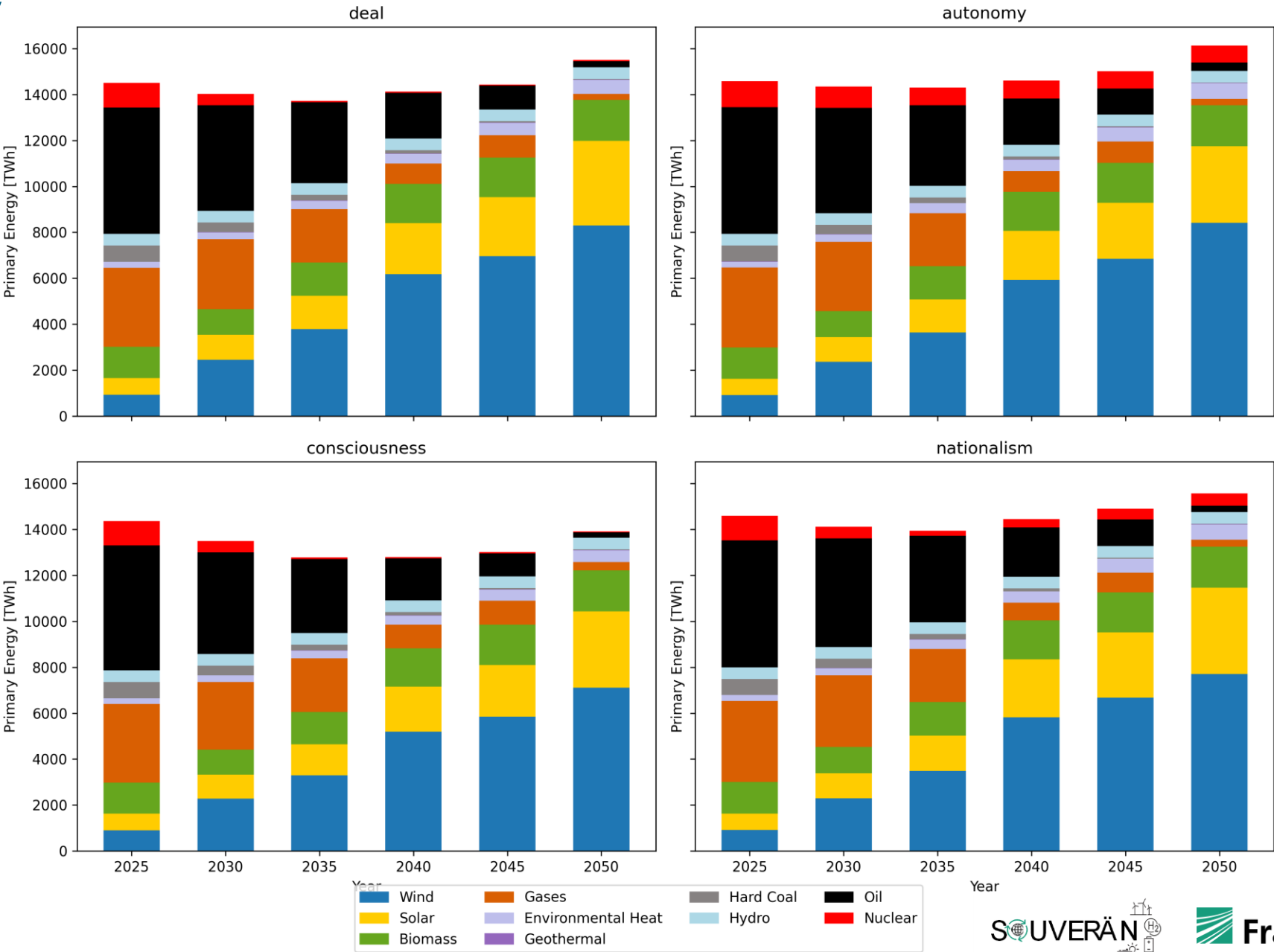
# Electricity Generation

## Key technologies



# Primary Energy

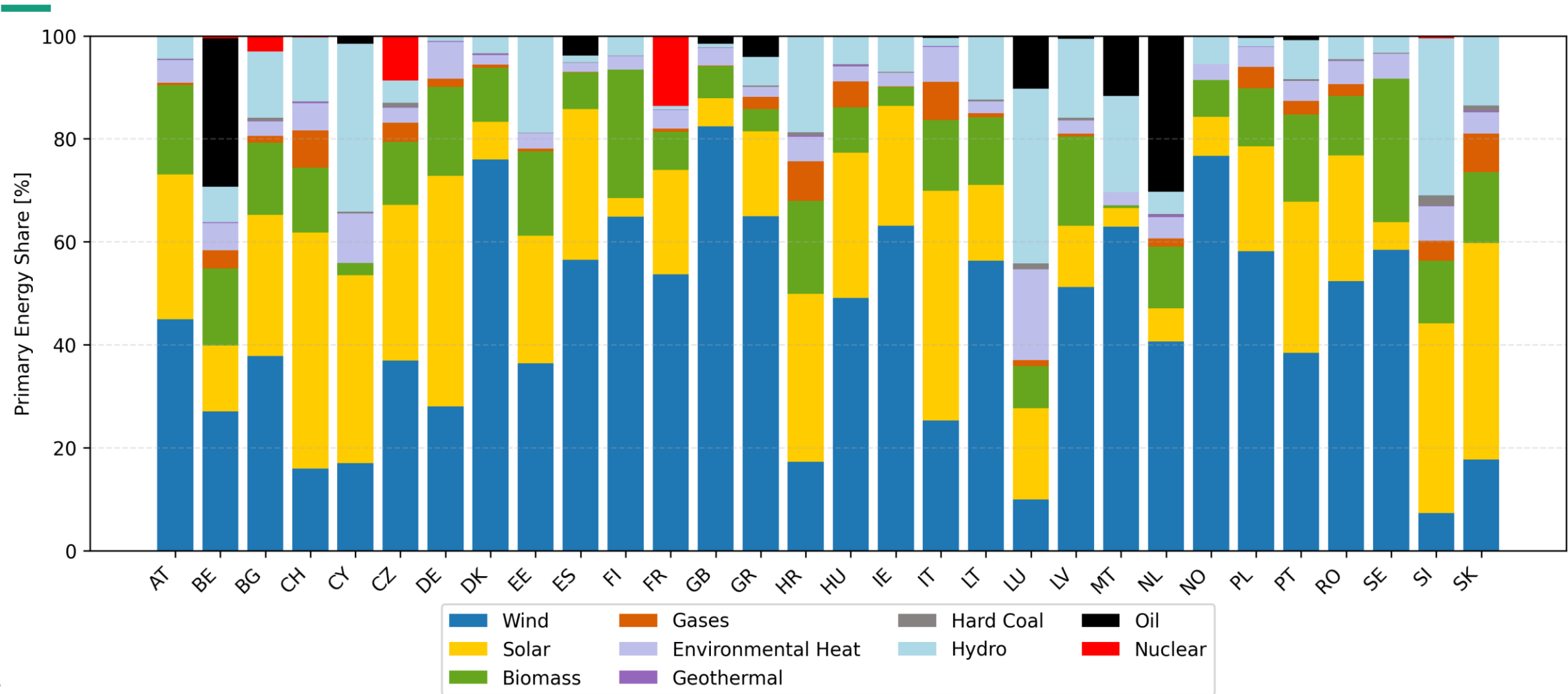
## Europe overall





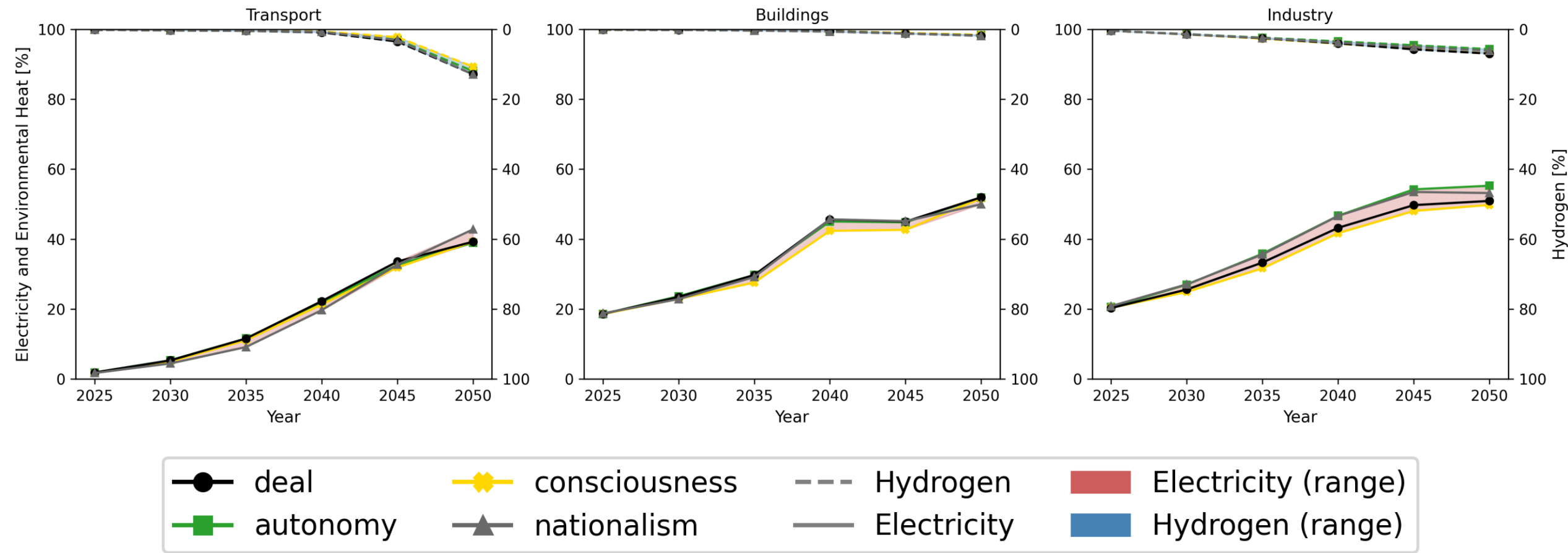
# Primary Energy – per States

## Green Deal Scenario



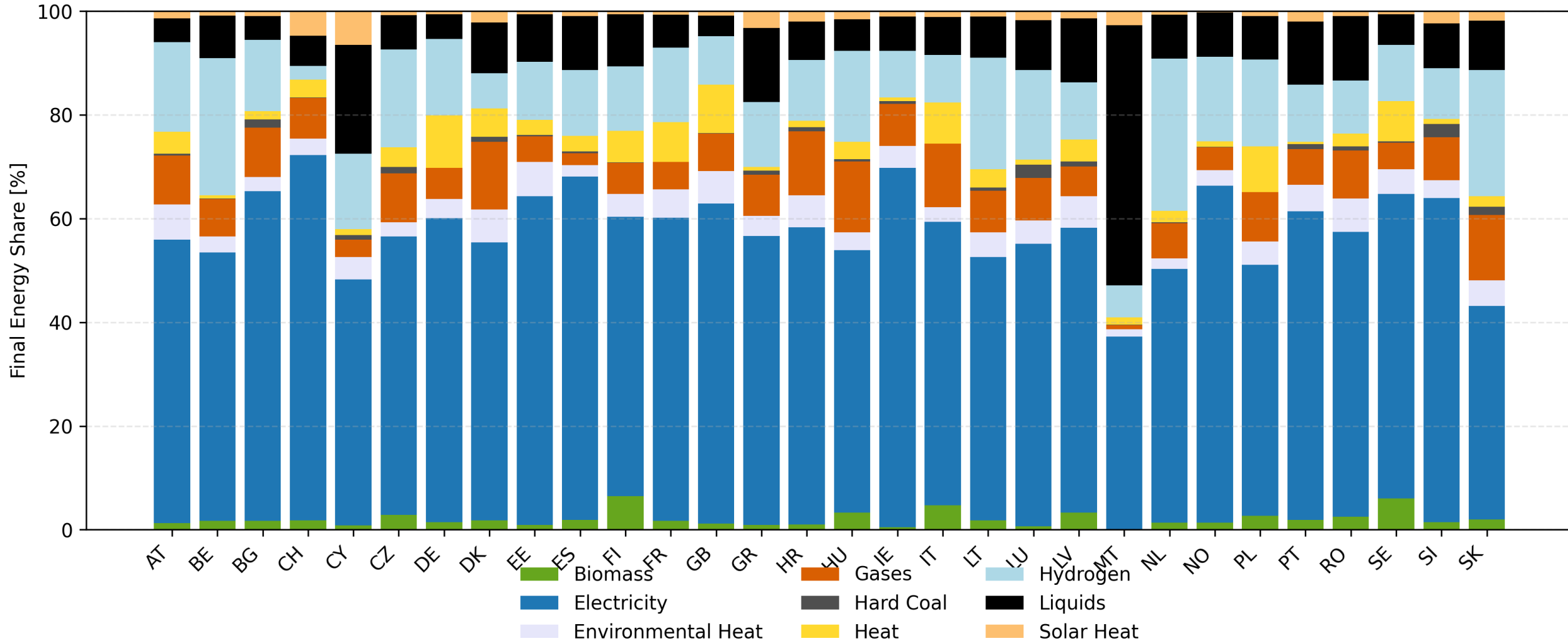
# End-use electrification and hydrogen

Per sector



# Final Energy – per state

Green Deal Scenario



## Key take aways

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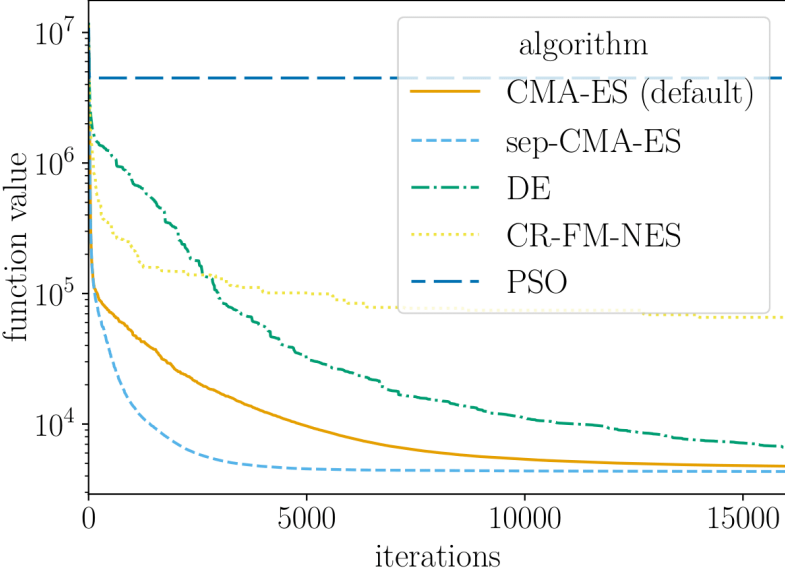
- **Sector-Coupled, long-term energy system applied to Europe**
- **Transformation pathways on member state level**
- **Electrification key strategy in all scenarios**
- **Further evaluation on scenario differences needed**

# Thank you for your attention!

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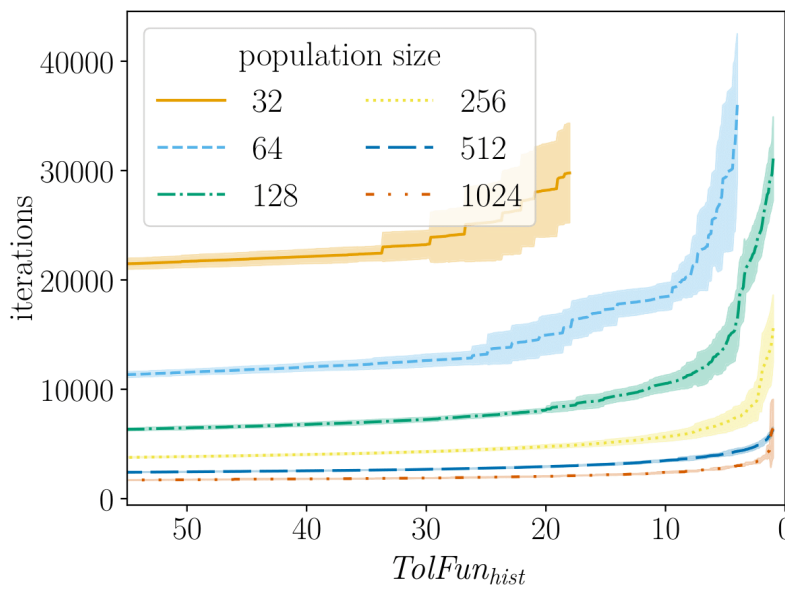
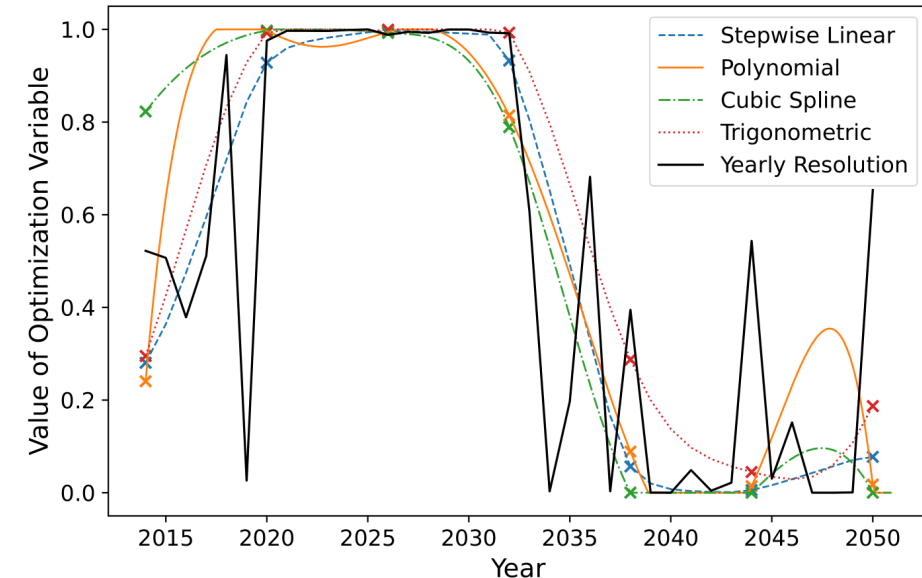
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# Improving the simulation-based optimization



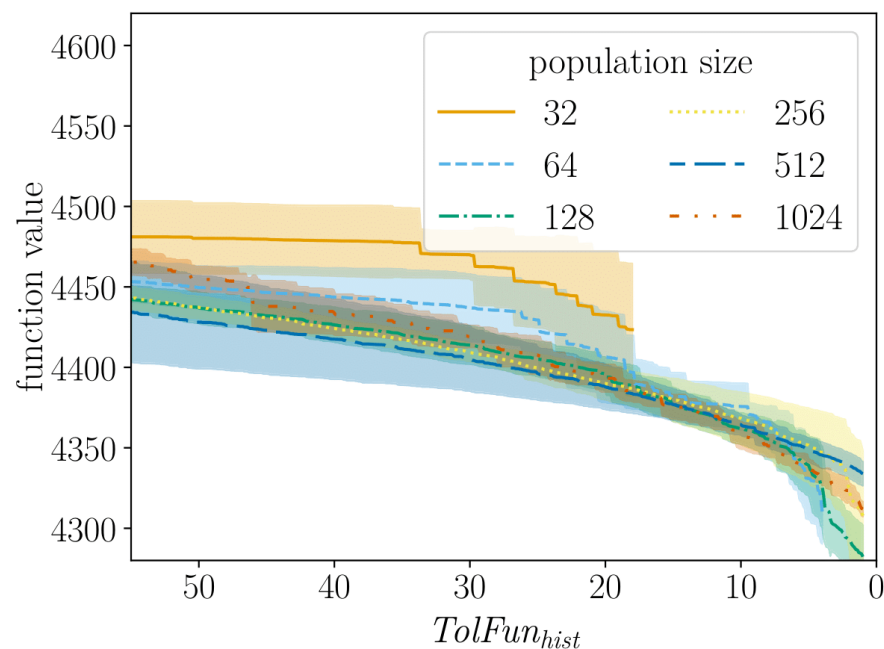
Algorithmen

Interpolation



Parallelisierung

Abbruchkriterium





# Energiesystemmodell REMod

## Modelllogik: Simulationsbasierte Optimierung

