

PSI Center for Nuclear Engineering and Sciences
Center for Energy and Environmental Sciences

Adaptive and Robust Policy Pathways to Net-Zero: EU Policy Spillovers and Swiss Climate Action

Insights from the POLIZERO project



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Objectives of the POLIZERO project

Assess Switzerland's transition to Net Zero

by accounting for EU energy system & policy interdependencies

Identify policies to deliver the Swiss Climate Strategy 2050

based on international examples and stakeholder input

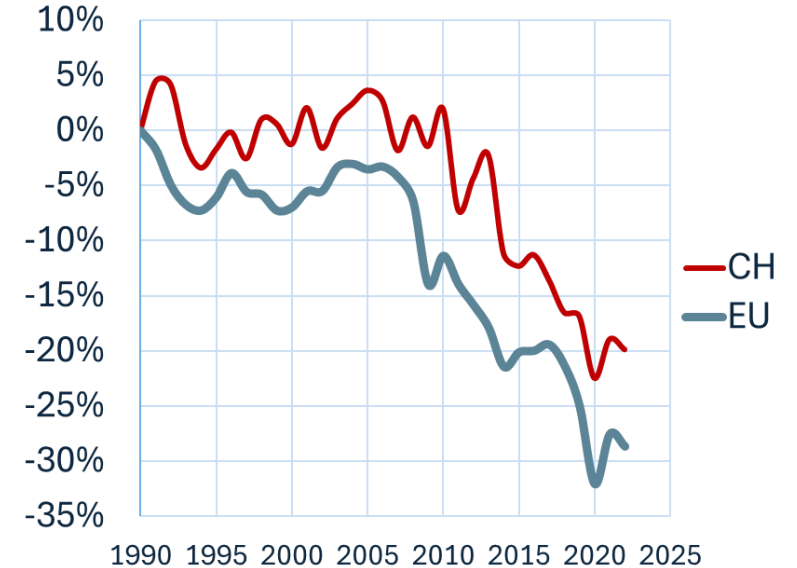
Derive adaptive policy pathways and implementation timing

by dealing with the uncertainty in the policy context



POLIZERO project ran from 2020 to 2024 and received funding from the Swiss Federal Office of Energy under the EWG Research Programme SI/502149-01. The authors bear the entire responsibility for the content of this presentation and for the conclusions drawn therefrom. www.polizero.ch

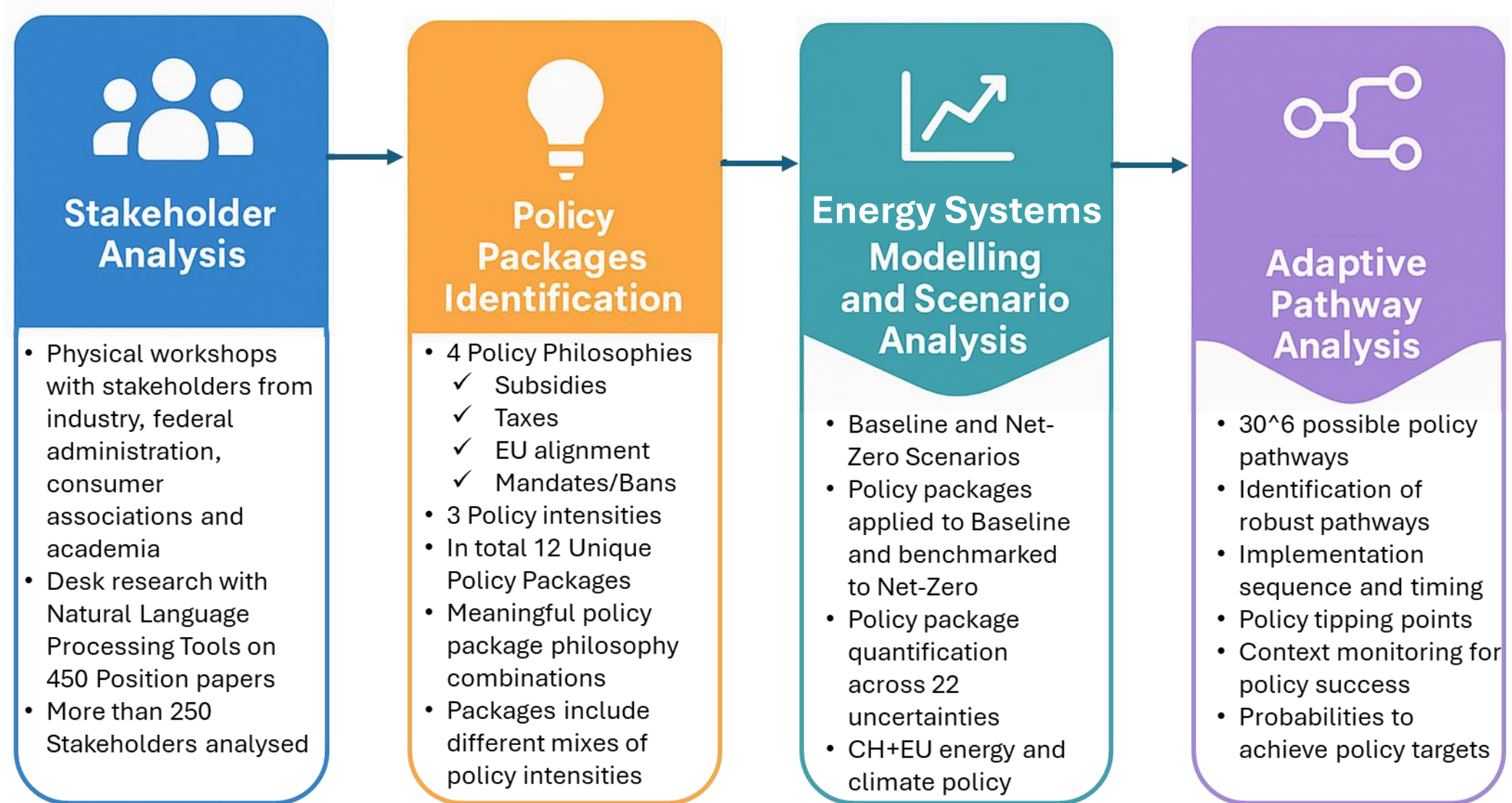
CO₂ emissions reductions from 1990



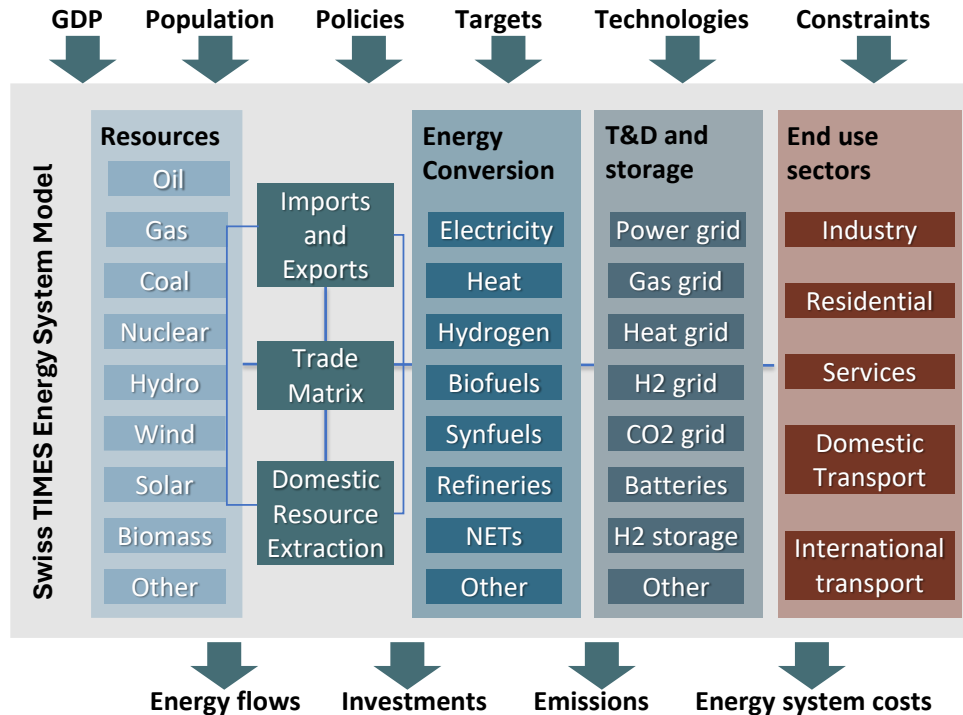
 **Up to 20% of Swiss emissions reductions in this decade may stem from EU-CH spillovers**

Why?

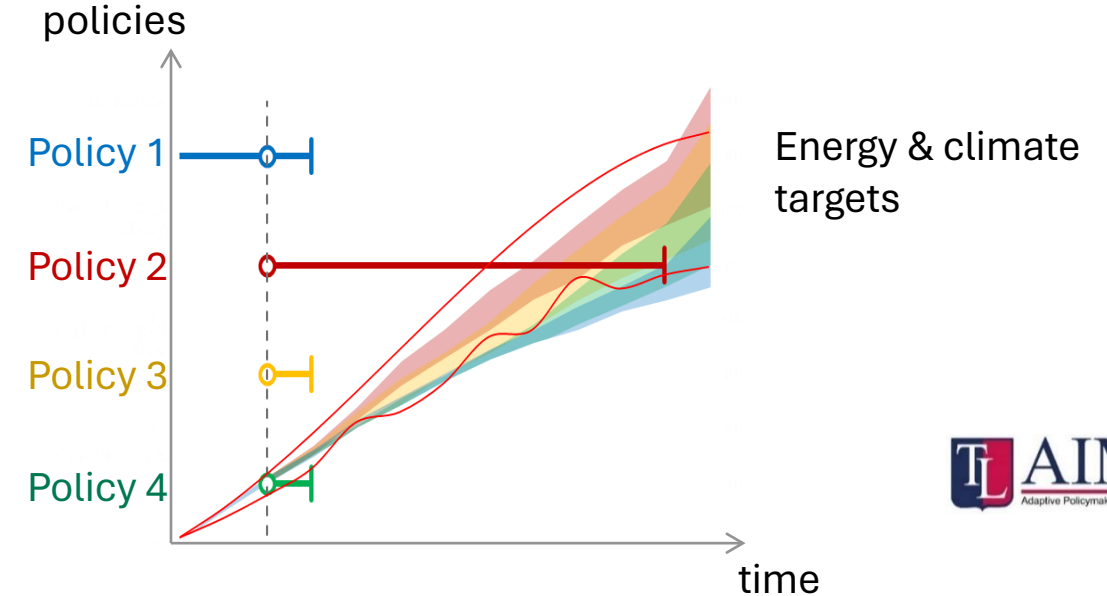
- Policy diffusion & harmonization
- EU-ETS linkage
- Infrastructure & Trade interdependence
- Technology and Innovation Spillovers



EU-CH energy system modelling (STEM)



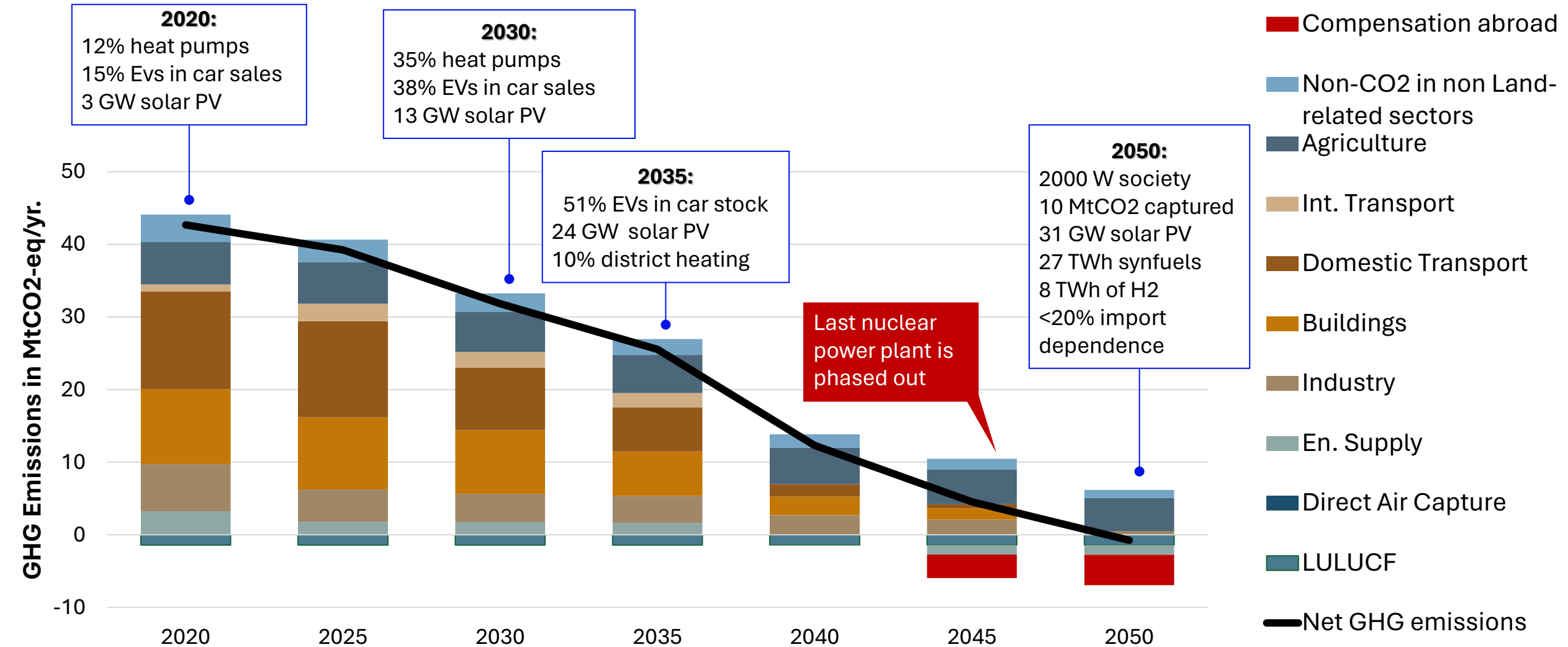
Adaptive Dynamic Pathway Analysis (AIM)



- **STEM – EU extension:** Multi-carrier, multi-sector
- 36 European countries + CH
- Time horizon 2020 – 2050+

- **AIM:** Decision support tool linked to JRC-EU-TIMES
- Detects when and why policies deviate from targets
- Monitors key policy performance indicators

Where do we aim at? Swiss energy system towards Net-Zero



How to get to Net-Zero? Stakeholders' views

Stronger CH-EU Integration

ETS expansion, energy agreements/participation in the EU market

Technology-neutral support schemes

avoid bans and technology exclusion, simplify regulations

Secure financing

soft loans for energy projects and building renovations

Technology vs behavioural switch

in short term technology switch, in long term behaviour changes

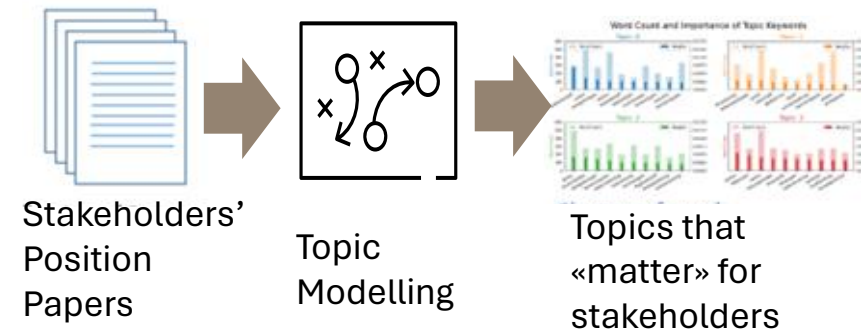
Concerns:

security of energy supply balanced with environment protection, distributional impacts, hard-to-abate emissions

Physical Workshops

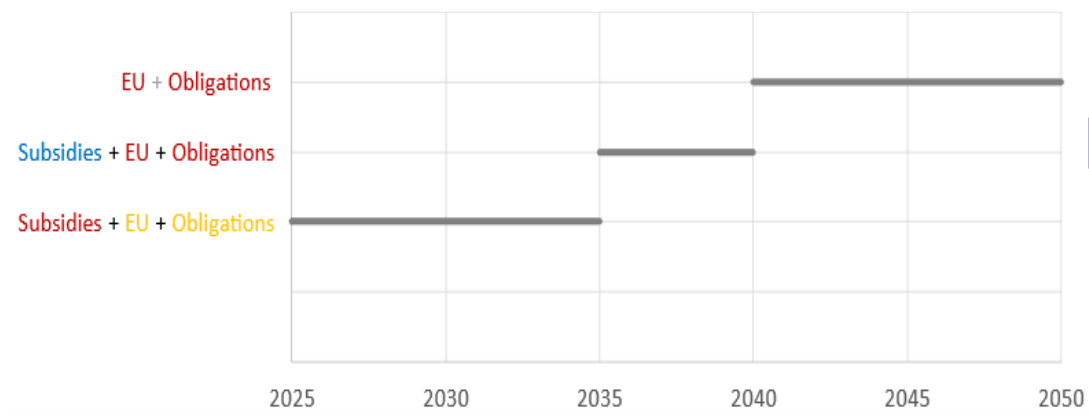


Natural Language Processing ML

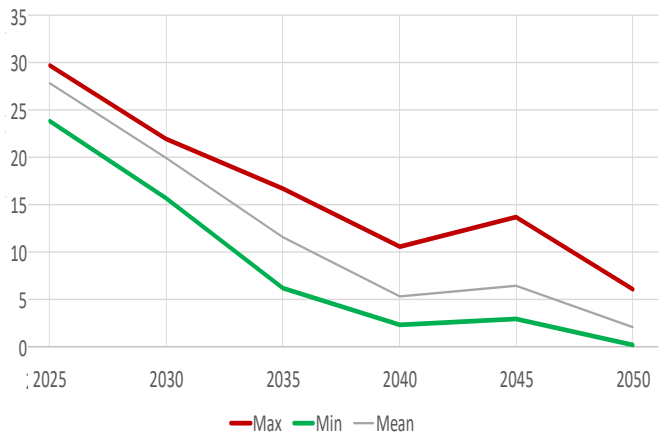


How far subsidies can lead us? Adaptive policy analysis

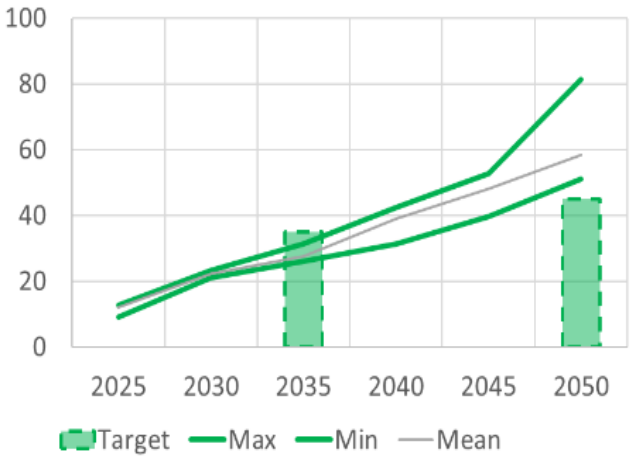
Policy Pathway 1



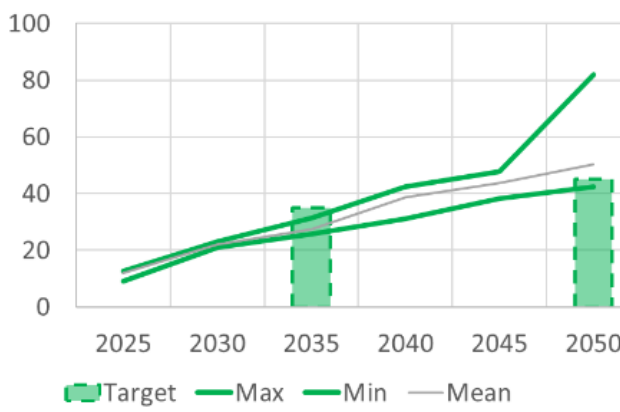
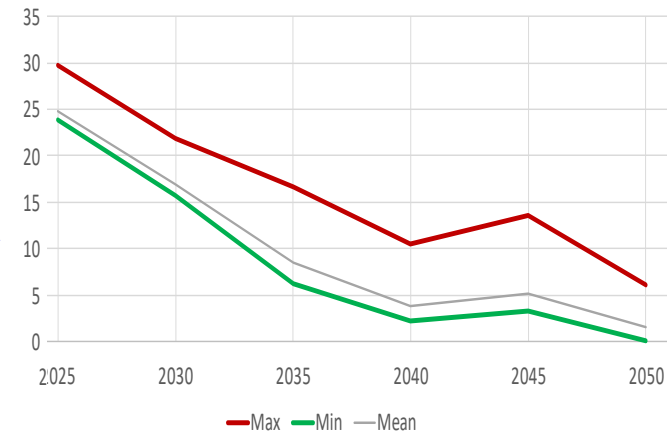
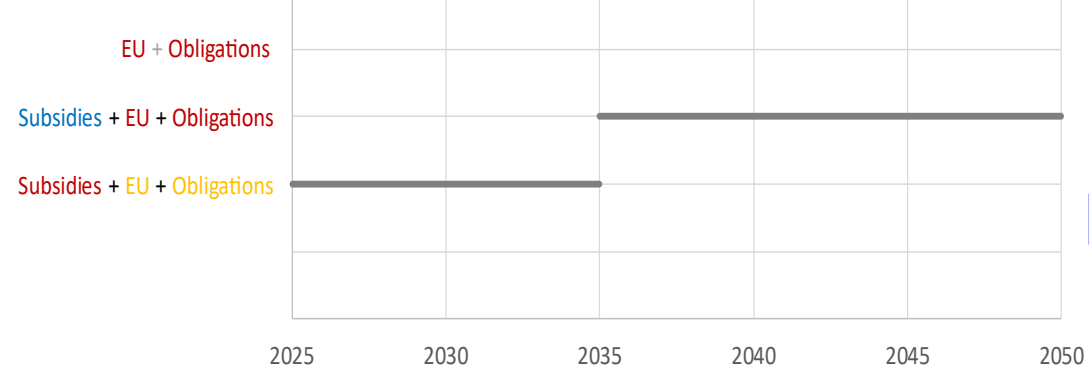
CO₂ Emissions



TWh of non-Hydro renewable electricity



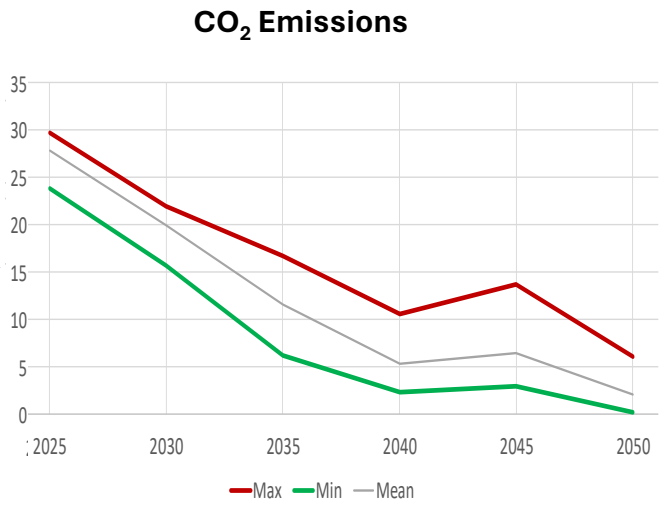
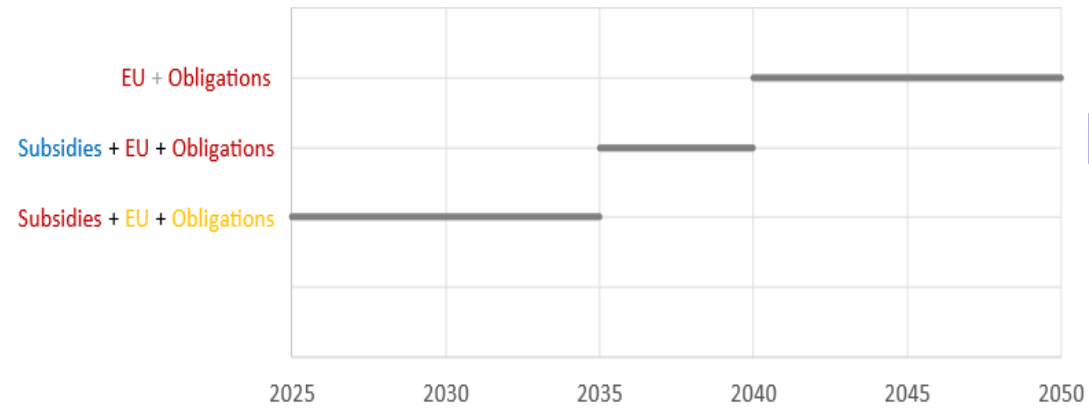
Policy Pathway 1a



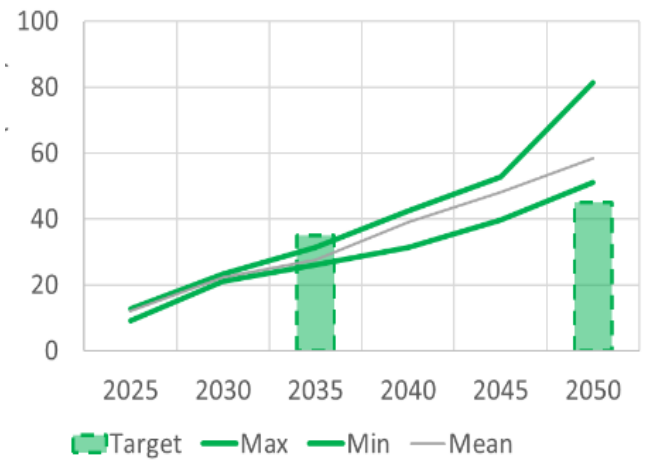
Blue: policies are implemented at low intensity
Yellow: policies are implemented at medium intensity
Red: policies are implemented at high intensity

CO2 price or quantity certainty? Adaptive policy analysis

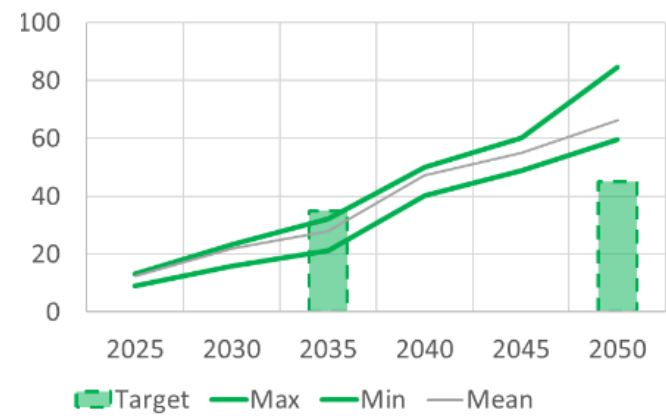
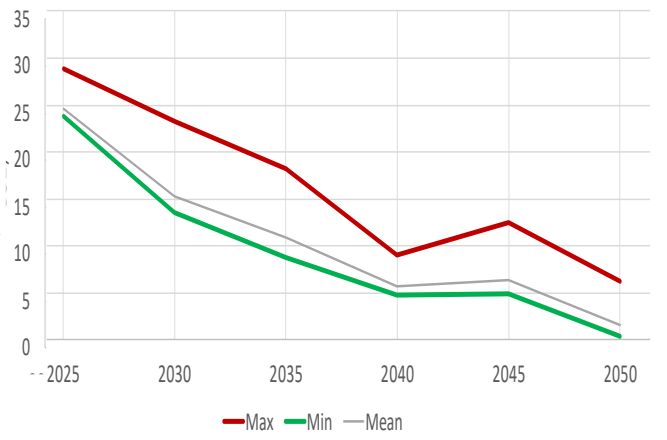
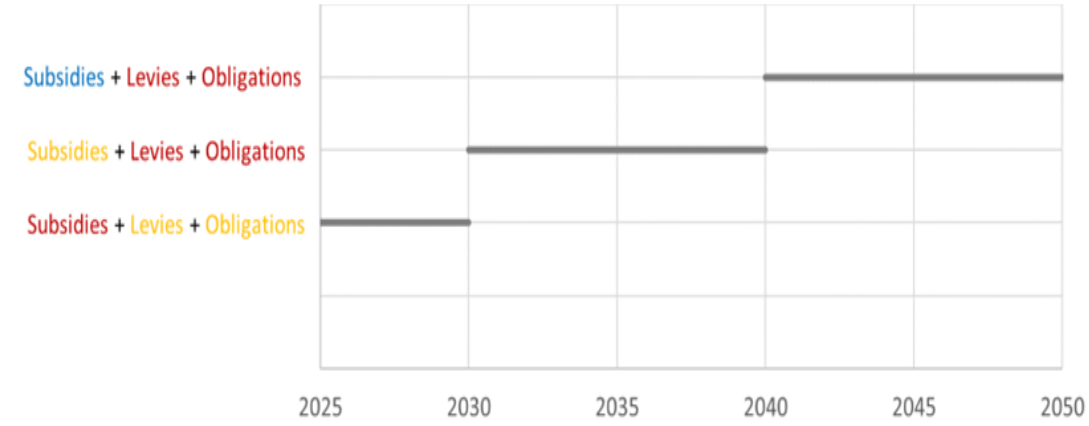
Policy Pathway 1



TWh of non-Hydro renewable electricity



Policy Pathway 2



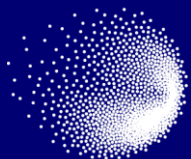
Blue: policies are implemented at low intensity
Yellow: policies are implemented at medium intensity
Red: policies are implemented at high intensity

Limitations of the study

- Limited workshops
- No economic feedbacks
- Perfect foresight
- Ex-ante policy assessment
- No financing/transaction costs
- No lead-in/phase-out policy timing

Moving towards net-zero Swiss system

- **2025-2035 is the make or break decade** for net-zero
 - Rapid replacement of heating + vehicles, keep solar PV momentum, expand district heating
- **2035-2050: scale up new infrastructures:**
 - CCUS + H2 + Synfuels + Winter renewables (wind,bio)
 - International agreements for new fuels and CO2 compensation
 - Deploy large heat pumps
- Subsidies help early — but **not enough alone**
- CO₂ levies better in buildings; transport needs **standards**
- Tax-only Swiss approaches will need to become much stronger
- **Alignment with EU ETS / ETS2 / standards** improves quantity certainty
- Timing + sequencing critical → **regulation earlier, not later**



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Thank you very much

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1. Panos E., Zhang, M., Flamos, A., Michas, S. (2025): POLIZERO –Swiss Policy towards Zero CO2 Emissions compatible with European Decarbonisation Pathways. Final Report to Swiss Federal Office of Energy
Report link: <https://www.aramis.admin.ch/Default?DocumentID=73434&Load=true>
Data set with results and assumptions: <https://doi.org/10.5281/zenodo.16759092>
2. Panos E., Ramachandran, K., Hirschberg, S., Kober, T. (2023): An assessment of energy system transformation pathways to achieve net-zero carbon dioxide emissions in Switzerland. Communications Earth & Environment
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Data set with results and assumptions:
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3. Luh, S., Ramachandran, K., McKenna, R., Schmidt, T.J., Kober, T. (2023): How, where, and when to charge electric vehicles – net zero energy system implications and policy recommendations. Environmental Research Communications
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