TECHNISCHE UNIVERSITÄT WIEN
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Energy Economics Group

Electricity System Transformation through NECPs

A Comparison of Austria and the Czech Republic

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Research Focus

- **Objective**: Compare NECP strategies in Austria & Czech Republic
- **Method**: Mixed-methods (policy analysis, simulations, SWOT)
- **Scope**: Electricity system transformation within EU 2030 climate targets

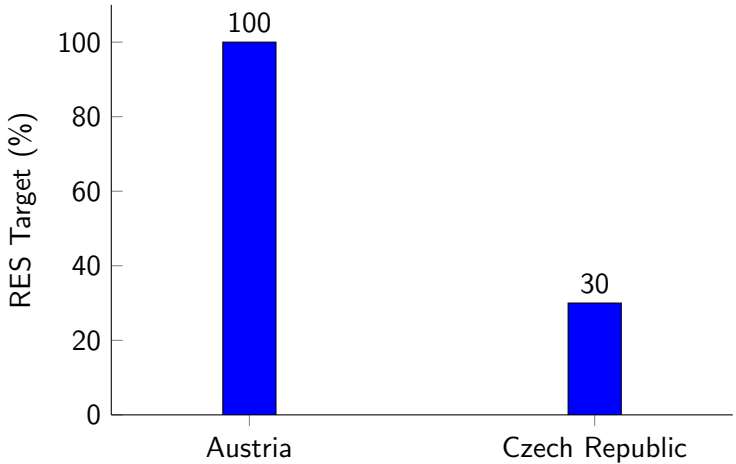
Source: European Commission (2024c)

NECP Overview

- National Energy and Climate Plans (NECPs) are the central planning tools guiding EU Member States toward achieving the 2030 climate and energy targets.
- They must align with evolving European frameworks such as *Fit for 55*, *REPowerEU*, and additional legislative updates.
- Austria and Czechia submitted revised NECPs in 2024.

RES Target Comparison by 2030

2030 renewable energy share targets in Austria and the Czech Republic



Source: Austria NECP (2024); Czech NECP (2024)

Comparative Case Studies

Table: NECP Targets for Austria and the Czech Republic

Category	**Austria**	**Czech Republic**
Renewable Energy Target (2030)	100%	30%
Emission Reduction Target (2030)	-55%	-30%
Share of Nuclear Power	0%	35%
Energy Efficiency Improvement	35%	25%
Investment in Grid Expansion	High	Moderate

Electricity Generation Sources: Austria vs. Czech Republic

Comparison of Electricity Generation Sources

Table: Electricity Generation Sources in Austria and the Czech Republic

Energy Source	Austria (%)	Czech Republic (%)
Hydropower	60	3
Nuclear	0	35
Coal	5	40
Wind	10	5
Solar	8	6
Biomass	7	8
Other	10	3

Scenario Definitions

To assess the electricity system impacts of different NECP strategies, three core scenarios were defined:

Scenario	Description
Baseline	Continuation of current trends without additional policy interventions. Reflects 2020–2022 policies only. Low RES expansion, minimal grid adaptation.
Policy Scenario	Reflects updated NECP targets submitted in 2024. Includes moderate RES growth, grid investments, sectoral measures (e.g. buildings, transport).
High-RES Scenario	Ambitious renewable pathway with accelerated deployment of wind, solar, and storage. Assumes enabling conditions such as faster permitting and EU funding alignment.

Source: Own modeling assumptions based on Austria and Czech NECPs (2024)

Key Performance Indicators (KPIs)

To evaluate the impact of the NECP strategies, the following indicators were used across all scenarios:

- **RES Share:** Share of renewables in electricity generation (in %)
- **System Cost:** Total system cost (EUR) including generation, grid, storage
- **CO_2 Emissions:** Annual emissions in electricity sector ($MtCO_2$)
- **Grid Investment Level:** Relative investment needs in transmission and distribution
- **Sectoral Distribution:** Emission reductions across sectors (electricity, transport, buildings, etc.)
- **Flexibility Potential:** Extent of demand response, storage, and smart grid integration
- **Security of Supply:** Need for imports or firm capacity to maintain adequacy

Source: Own modeling framework based on NECP targets and EU energy policy benchmarks

Electricity Mix Comparison (2024)

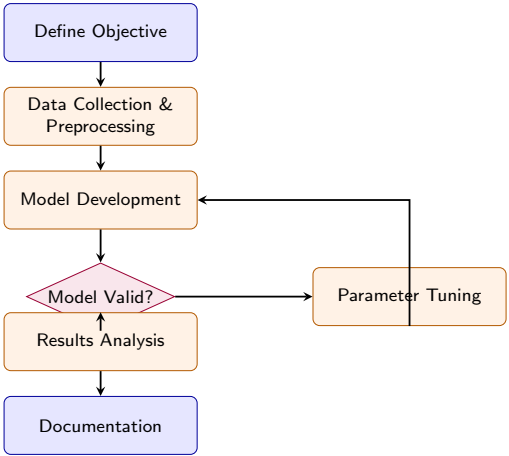
Electricity generation sources in Austria and the Czech Republic (in %):

Source	Austria (%)	Czech Republic (%)
Hydropower	60	3
Nuclear	0	35
Coal	5	40
Wind	10	5
Solar	8	6
Biomass	7	8
Other	10	3

Sources: E-Control Austria (2025); ERÚ (2025)

Methodology: Graphical Representation

Workflow for Evaluating National NECPs in the Electricity Sector



Note:
This model-based workflow was used to assess the impact of national NECPs on electricity systems.

Methods Used:

- PyPSA-Eur for techno-economic modeling
- Scenario comparison: Baseline, Policy, High-RES
- KPIs: system cost, CO emissions, grid needs, flexibility

SWOT Matrix: Austria

Strengths	**Weaknesses**
Strong hydropower base	Seasonal generation gaps (especially in winter)
Robust electricity grid infrastructure	Import dependency during peak demand
Ambitious 100% RES target by 2030	Limited domestic biomass potential
Opportunities	**Threats**
Solar PV expansion potential	Public opposition to grid expansion projects
Development of smart grids and digitalisation	Delays in storage deployment
Growth of energy communities	Winter supply security concerns

Source: Derived from Austria NECP (2024) and simulation results

SWOT Matrix: Czech Republic

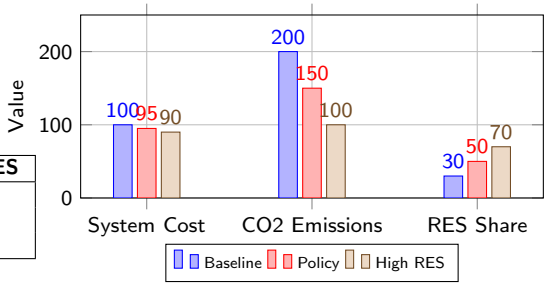
Strengths	**Weaknesses**
Stable baseload supply through nuclear energy Strong domestic energy technology and engineering sector	High dependency on coal in electricity mix Low renewable target (30% by 2030) Slow policy implementation
Opportunities	**Threats**
Deployment of small modular reactors (SMRs) EU funding and international technology partnerships	Delays in nuclear project development Resistance to coal phase-out from industry Political uncertainty on energy governance

Source: Based on Czech NECP (2024), Reuters (2024), AP News (2024)

Results of Default Input Settings

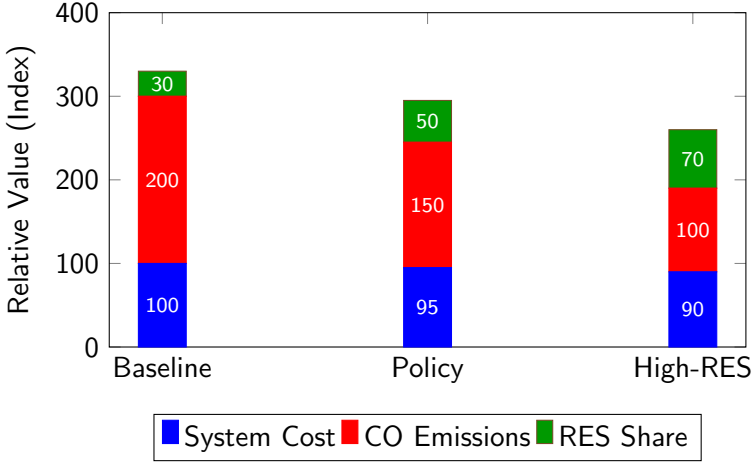
Metric	Baseline	Policy	High RES
System Cost (B €)	100	95	90
CO_2 Emissions (Mt)	200	150	100
Renewable Share (%)	30	50	70

Key results under default input assumptions.



Key Indicators and Scenarios

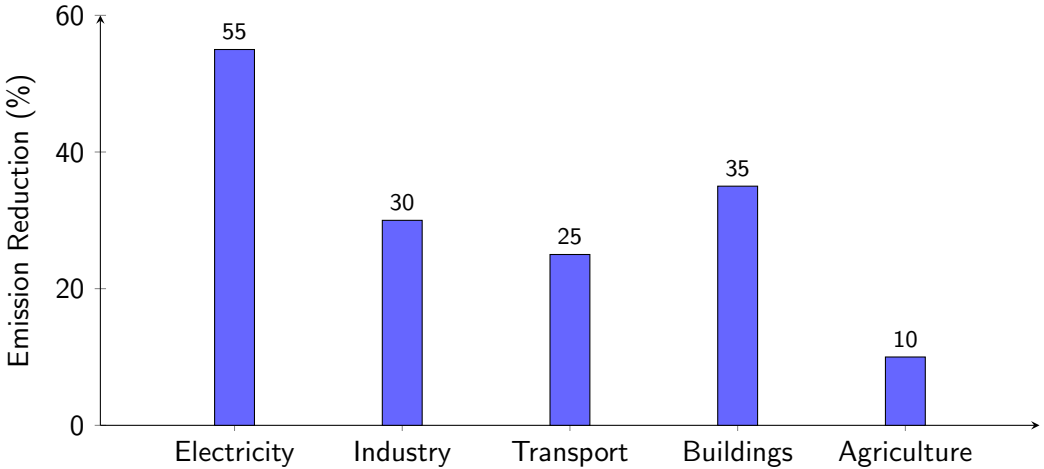
- System cost, CO_2 emissions, RES share under three scenarios
- Baseline, Policy, High-Renewable



Source: simulations

Sectoral Impact of Policy Interventions

CO_2 emission reductions by sector in the Policy Scenario (vs. Baseline, 2030)



Source: Simulation results (Policy Scenario, 2030) based on national NECP measures

Sensitivity Analysis

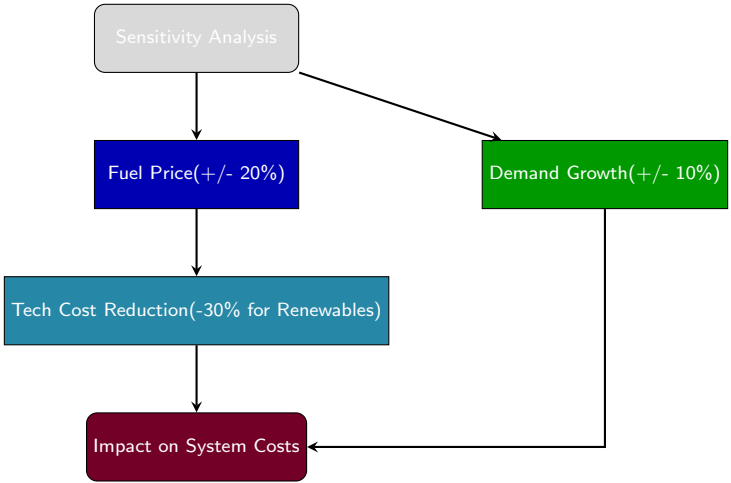


Figure: Impact of Sensitivity Analysis on System Costs

Comparison and Discussion of Results

Table: Summary of scenario outcomes

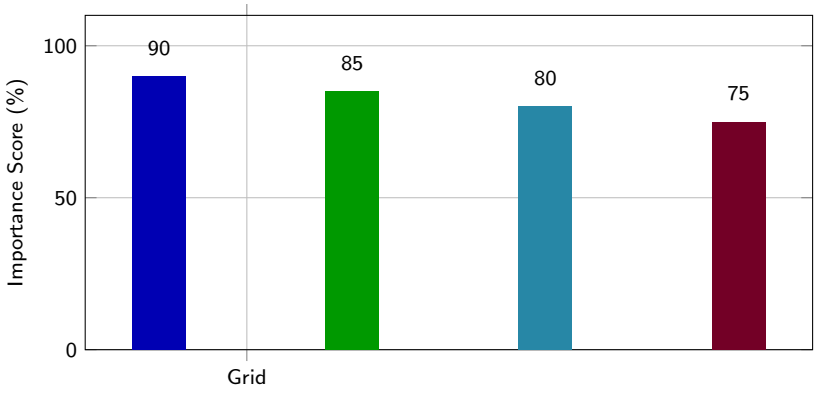
Finding	**Description**
Policy Scenario	Achieves meaningful emissions reductions with marginal increase in cost; supports balanced decarbonisation.
High-Renewable Scenario	Provides the lowest long-term costs and highest emission reduction; requires early capital investment.
Sensitivity Analysis	Highlights vulnerability of fossil-based systems to price volatility; supports strategic resilience via RES.

Analysis of Transition Strategies in Austria and Czech Republic

- **National Regulatory and Institutional Frameworks:**
  - Decisive in shaping transition trajectories.
  - Austria aligns with EU directives through cohesive policy instruments and well-integrated national planning.
- **Austria's Strategy:**
  - Reinforced by strong national planning frameworks and EU alignment.
  - Austria focuses on rapid renewable energy (RES) growth and carbon reduction.
- **Czech Republic's Strategy:**
  - Focuses on nuclear energy expansion.
  - Strong emphasis on international partnerships and investment tenders.
- **Divergence in Strategies:**
  - Reflects differences in energy resources, governance cultures, and public acceptance.

Source: (**BMK2025**; **AustriaNECP2024**; **NECP˙CZ˙2024**; **ReutersNuclear2024**)

Policy Recommendations



Source: Policy relevance based on NECP analysis

Conclusions & Discussion

- **Austria** follows an ambitious 100% renewable electricity strategy, leveraging its hydropower and solar PV potential. Seasonal imbalances remain a challenge.
- **Czech Republic** relies on a nuclear-led path with slower coal exit. The RES target (30%) is relatively low and may limit integration into future EU energy markets.
- Both countries must prioritize **grid investments** and **flexibility technologies** to meet their NECP targets and ensure supply security.
- **Policy relevance analysis** shows that grid development, cross-border cooperation, and digitalization are key success factors.
- Effective NECP implementation depends on **governance, regulatory certainty**, and **stakeholder coordination**—beyond target setting.

Source: Own analysis based on Austria and Czech NECPs (2024), simulation results

Selected References

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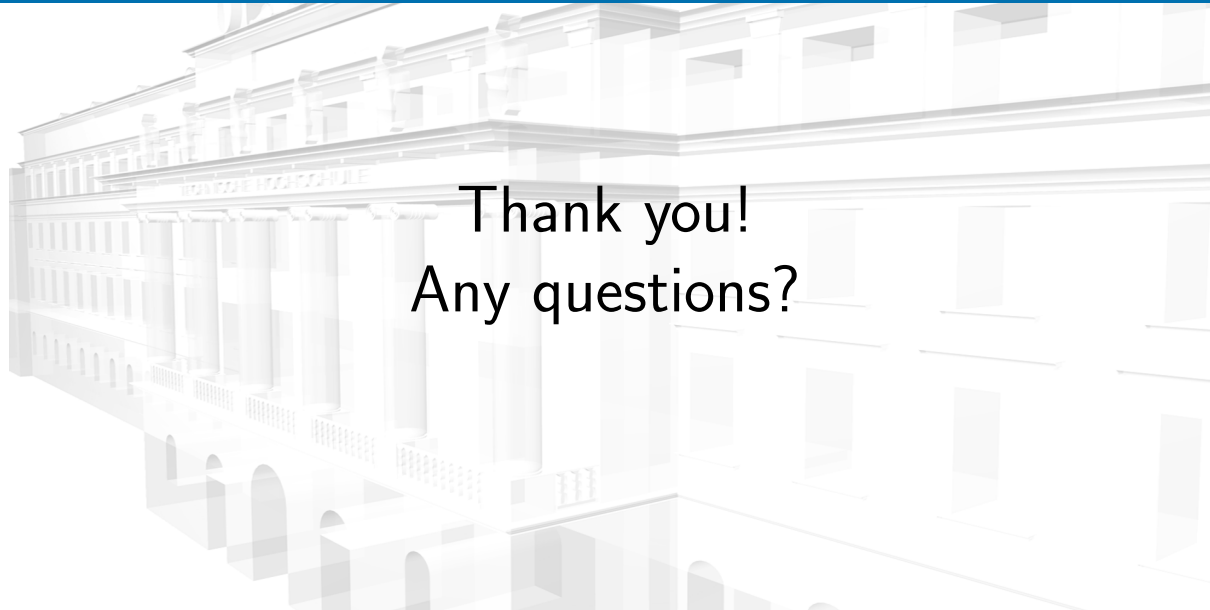
Full references available upon request or in the associated paper.



Thank you!
Any questions?