

Assessing Decarbonisation Options for Czechia: Biomass from Agricultural Land, Large-Scale Carbon Capture and Storage, and Green Hydrogen

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Extended Abstract

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Abstract Summary

This paper analyses decarbonisation pathways for Czechia using an extended TIMES energy system optimisation model, with particular emphasis on agricultural biomass, bioenergy with carbon capture and storage (BECCS), carbon storage and transport infrastructure, and low emission hydrogen. Czechia faces structural constraints due to its energy intensive industrial base, limited domestic renewable resources, and restricted domestic CO₂ storage capacity, which together limit the achievable depth of decarbonisation.

The TIMES CZ model is expanded to include biomass cultivation on up to 10% of agricultural land, a full carbon capture and storage value chain with domestic storage and offshore CO₂ export infrastructure, and BECCS deployment in combined heat and power production. Seven scenarios are evaluated through 2050, varying biomass availability, access to CO₂ export infrastructure, hydrogen imports, carbon prices, and CO₂ transport and storage costs. All scenarios are driven by EU ETS price signals rather than explicit emissions caps.

Results show that none of the scenarios achieves climate neutrality by 2050. In the Baseline scenario, high carbon prices drive investment in low carbon technologies, notably nuclear power, yet residual emissions remain at around 15 Mt CO₂eq. Adding agricultural biomass alone reduces emissions by only about 0.5 Mt, as limited domestic CO₂ storage capacity prevents BECCS from operating at scale. Enabling offshore CO₂ transport and storage removes this bottleneck, allowing large scale deployment of BECCS and other capture technologies and reducing emissions to approximately 14 Mt. Abundant low emission hydrogen further improves system flexibility and reduces emissions to roughly 12.2 Mt, while remaining complementary to biomass based BECCS rather than substituting for it.

Overall, these findings suggest that Czech decarbonisation strategy should pursue CO₂ export access as a priority, treat biomass as a CCS-dependent asset rather than a stand-

alone solution, and maintain robust long-run carbon pricing to keep CCS investment timelines on track.

Presenting Author Biography

Lukáš Rečka, Ph.D., is a dedicated environmental and energy economist and a long-time researcher at the Charles University Environment Centre in Prague. Since 2011, he has specialized in energy modeling, emission projections, and decarbonization strategies. An alumnus of Charles University's Faculty of Social Sciences, his work frequently bridges the gap between academic research and environmental policy. He is a key contributor to the SEEPIA project, focusing on socio-economic environmental predictions. Rečka is widely published in his field, contributing significant insights into sustainable energy demand and long-term climate goals.