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Siloed vs. Integrated Network Cost Allocation in Multi-Energy Systems: Long-Run Investment Effects in a Two-Stage Equilibrium Model

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Extended Abstract

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Abstract Summary

European electricity and gas networks recover their costs through separate tariff systems: electricity users fund electricity grids and gas users fund gas networks. This siloed architecture reflects historically independent infrastructures but is increasingly challenged by sector coupling technologies such as combined-cycle gas turbines, hybrid heat pumps, electrolysers and power-to-gas units. These technologies create cross-network externalities: the gas network provides flexibility to the electricity system, while electrification supports gas decarbonisation. At the same time, declining gas demand concentrates gas network costs on fewer users, raising tariffs and potentially discouraging investments relying on gas infrastructure.

This paper studies how cost allocation between electricity and gas networks affects long-run investment incentives in a coupled system. We develop a two-stage equilibrium model extending the framework of Grimm et al. (2016) to a multi-energy setting. In the first stage, decentralised agents invest in generation and sector-coupling technologies and participate in commodity markets subject to network tariffs. In the second stage, a regulated operator expands electricity and gas networks and recovers costs through tariffs. The key comparative static is the cost-recovery rule: under a siloed regime, each network recovers costs from its own users; under an integrated regime, part of each network's costs is allocated across commodities to reflect cross-network externalities.

The model is calibrated to a stylised representation of the French electricity-gas system using PyPSA-Eur data and public tariff filings. Stage-1 calibration yields plausible price levels; full equilibrium simulations are ongoing.

The framework is designed to quantify how siloed cost recovery may distort investment in sector-coupling technologies and to assess the associated welfare impact. By isolating this

mechanism in a tractable equilibrium model, the paper provides a benchmark for evaluating alternative tariff designs in increasingly integrated multi-energy systems

Presenting Author Biography

Louis Soumoy is a researcher in energy economics affiliated with ENGIE, CentraleSupélec (Paris-Saclay University), and the Climate Economics Chair (Paris-Dauphine University). His work focuses on electricity market design, risk allocation, and long-term investment incentives in low-carbon power systems. He develops equilibrium models to study incomplete markets, long-term contracts, and regulatory mechanisms supporting generation, storage, and sector coupling. His research combines theoretical modelling with applied analysis to assess how policy and market design affect investment and welfare during the energy transition.