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Rising Natural Gas Grid Fees as a Tipping Point: Implications for Local Energy System Transformation

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Extended Abstract

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Abstract Summary

As the energy transition reduces natural gas demand, the fixed costs of the existing natural gas grid infrastructure must be recovered from a shrinking customer base, causing grid fees to rise significantly. Recent projections suggest that average natural gas grid fees in Germany could increase by a factor of 10 to 15 by 2045. This study investigates how these rising fees affect technology choices and the timing of the natural gas phase-out in local energy systems.

Using the regional energy system optimization model DISTRICT, a small German city with a heat demand of 82 GWh/a, currently supplied predominantly by natural gas (~47%) and heating oil (~28%), is analysed. Natural gas grid fees are modelled endogenously as a function of a fixed revenue ceiling and the previous natural gas consumption. The scenario with endogenously modelled gird fee is compared with a scenario with constant grid fees, both without binding carbon constraints.

The results show that under the increasing grid fee scenario, fees rise by a factor of 18 between 2025 and 2045. This cost signal alone is sufficient to accelerate the heat supply transition significantly. Already by 2035, the resulting natural gas price is around 30% higher than in the constant fee scenario, making heat pumps economically more attractive earlier. By 2045, natural gas is fully displaced under rising grid fees, with heat pumps covering approximately 83% of heat supply. In contrast, under constant grid fees, natural gas still accounts for 4.5% of heat supply due to insufficient economic incentive for a complete phase-out.

This study demonstrates that rising natural gas grid fees have an impact on the transformation pathway of local energy systems. The increasing grid fee alone is sufficient to trigger a full phase-out of natural gas by 2045, even in the absence of binding carbon constraints.