**Abstract**

This paper studies the development of the Austrian gas grid by 2040 under different decarbonization scenarios, ranging from electrifying most energy services to importing large amounts of renewable methane. The Austrian gas grid serves as a case study representative for those gas grids confronted with a drop in natural gas demand and an increase in domestic renewable gas generation in the future. A mixed-integer optimization model with a focus on the detailed representation of the existing grid (gas grid levels, pipeline capacity, route, and age) is used to determine the cost-optimal trade-off decision between expected low-utilized gas pipelines and an off-grid supply alternative (e.g., trucking and on-site gas storage) in a decarbonized Austrian and European energy system. Based on the required gas grid 2040 and its annual grid costs, estimates for tariffs of end customers are given. The paper's main conclusion is that the domestic distributed renewable gas generation uptake will be associated with the need for an area-wide gas grid, but one that will be significantly less utilized.

**Highlights** (3 to 5 bullet points; max. 85 characters including spaces)

* Study on the Austrian gas grid by 2040 under different decarbonization scenarios
* Granular modeling of transmission, high- and mid-pressure pipelines
* Trade-off between low-utilized gas pipelines and an off-grid supply alternative
* Annual gas grid costs used to estimate tariffs of end customers in 2040
* Tariffs of end customers in 2040 range between 1.5 and 7.0 EUR/MWh