

The Short and Long Term Impact of Europe's Natural Gas Market on Electricity Markets until 2050

Jan Abrell* and Hannes Weigt†

Executive summary

The transition of Europe's fossil fuel based electricity system towards a renewable based system is often considered to be linked with natural gas as important transition fuel. In particular, flexible combined cycle power plants are seen as low carbon backup option for the increasing share of generation from intermittent renewable resource such as wind and solar. On the other hand, uncertainties on the gas supply side and availability of import capacities, e.g., the Russia-Ukraine conflict, have put supply security back on the agenda while the shale-gas boom in the USA has initiated a new global market dynamic. The impact of those gas market developments on power plant investments and electricity market developments is becoming a major energy policy and regulatory concern.

Given the interplay of those aspects, it becomes evident that a combined assessment is needed to derive solid recommendations about the future development of European energy markets. The objective of this paper is to evaluate the feedback effect of different short and long run natural gas market developments on the European electricity market. We apply a model that simultaneously depicts the European natural gas and electricity markets with endogenous electricity generation investments and an aggregated spatial representation of both the gas and electricity network. The model is applied to analyze scenarios for European decarbonization at the horizon until 2050 to evaluate the underlying infrastructure implications of the transition paths. The analysis focuses on three interrelated topics in the electricity-gas nexus: the relation between Europe and Russia and its impact on supply security; the interaction of different policy and market approaches; and the vertical relation between natural gas and electricity.

Our analysis shows, that pathways with high emission reduction, deployment of renewables, and energy efficiency improvements yield an additional benefit in increasing natural gas supply security. The different policies help to reduce gas demand and thereby relax infrastructure bottlenecks. The simulation results also highlight the strong dependency of power plant investment decisions on the market framework. Especially the spatial nature of the European gas market and related market developments (i.e. increased LNG supply in West Europe; access to Russian gas in East Europe) can have a large impact on generation investment decisions. Finally, regarding the vertical interrelation between the different energy markets our simulations highlight the need for joint evaluation of natural gas and electricity market developments. Such combined approaches complement singular market analyses and thereby can provide more comprehensive insights.

* Swiss Federal Institute of Technology Zürich, Center for Energy Policy and Economics at ETH Zürich, Zürichbergstrasse 18, CH-8032 Zürich, Switzerland. E-mail: jabrell@ethz.ch.

† Corresponding author. Forschungsstelle Nachhaltige Energie- und Wasserversorgung, Wirtschaftswissenschaftliche Fakultät der Universität Basel, Peter Merian-Weg 6, CH-4002 Basel, Switzerland. E-mail: hannes.weigt@unibas.ch. Phone: + 41-(0)61 267 3259, Fax: + 41-(0)61 267 0496.