

Effects of Russian Gas Supply Cut-off on the German Gas Transmission System

Lucas De La Fuente Munita, Technische Universität Dresden, + 49 35146339766, lucas.delafuente@tu-dresden.de

Dominik Möst, Technische Universität Dresden, + 49 35146339770, dominik.moest@tu-dresden.de

Overview

Since the Russian invasion of Ukraine, the European Union and Germany in particular have been reevaluating its energy dependence on Russia. In the case of Germany more than half of its Natural Gas came from Russia in 2021, which added to heavy imports of oil and coal resulted in an import from about 30% of the total energy consumption from Russia (Bachmann, et al., 2022). Despite this, political pressure mounts for the German Federal Government to impose a gas embargo on Russian Energy exports. The additional threat of a partial or complete Russian energy export block to Germany makes the evaluation of worse case scenarios in the short term both relevant and necessary.

Previous analysis of the German gas grid's reliance under stress shows risk of congestion due to extreme weather events (Hauser, et al., 2019). Additionally, recent assessments by Bachman et al. (2022) of the state of the German gas economy after the Russian invasion of Ukraine foresee a new import structure which relies on elastic consumption to strengthen its reliability. These and other analyses (Gillissen, et al., 2019) point to the value of a reassessment of the stability of the German gas transmission grid as particularly relevant under the new European political context.

Methods

This study will evaluate the concrete implications of a partial and complete stop of gas supply to Germany. A fundamental gas infrastructure model depicting the pipeline structure will be used to analyze the gas grid under five different scenarios: baseline behaviour with increased prices due to the war with no shortage of supply, one where the “Eastern Corridor” (Poland) is cut-off, one where the “Southern Corridor” is cut-off (Czechia and Austria), one where Nord Stream 1 is cut-off, and the last one when all supplies from Russia are cut-off, including a variation in the length of the interruption.

The German gas grid will be modelled through GAMAMOD-DE, a gas grid model developed by the Chair of Energy Economics of the Technical University of Dresden. A model which Hauser (2021) already successfully applied to stochastically analyse energy security on the German gas grid.

Results

Results will focus on identifying nodes where demand cannot be met, pipeline system congestions, and exciting transmission dynamics such as changes of flow directions in pipelines or import/export. Nodes and pipelines will be compared across the mentioned scenarios to fully understand the consequences and challenges of a complete gas embargo.

Conclusions

Conclusions will relate to the effects identified during the modelling process and key indicators illustrating the impact of a potential gas embargo.

References

- Bachmann, R. et al., 2022. *What if? The Economic Effects for Germany of a Stop of Energy Imports from Russia*. s.l.:s.n.
- Gillissen, B., Heinrichs, H., Hake, J. F. & Allelein, H. J., 2019. *Energy security in context of transforming energy systems: A case study for natural gas transport in Germany*. s.l., Elsevier Ltd, pp. 3339-3345.
- Hauser, P., 2021. Does ‘more’ equal ‘better’? – Analyzing the impact of diversification strategies on infrastructure in the European gas market. *Energy Policy*, Band 153.
- Hauser, P., Heidari, S., Weber, C. & Möst, D., 2019. Does increasing natural gas demand in the power sector pose a threat of congestion to the German gas grid? A model-coupling approach. *Energies*, June.12(11).