

Europe's independence from Russian natural gas – Effects of a complete import stop on energy system development

Themenbereich 1 – Energie-/Klimapolitik, Versorgungssicherheit
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Motivation und zentrale Fragestellung

Russia's current war in Ukraine shows Europe's dependence on Russian natural gas more than ever. Before the COVID-19 pandemic, it covered about 23.7% of Europe's energy supply [1]. Even after 6 months of war, 6% of natural gas is still imported from Russia [2]. However, rising energy prices and the fear of gas shortages in winter stimulate the discussion whether Europe can manage without any natural gas imports from Russia. How such a European energy system could look like and whether it can function using alternative technologies and trade shall be examined in this paper.

Methodische Vorgangsweise

The Global Energy System Model (GENeSYS-MOD) is used to represent the future European energy system for this paper. GENeSYS-MOD is a linear, cost-optimizing, techno-economic energy system model, publicly available with code and data. The sectors electricity, heat, transport and their interdependencies are considered to model a sector-coupled energy system towards deep decarbonization. Figure 1 shows a stylized illustration of the model's structure.

The European model version 3.1, developed in the H2020 project openENTRANCE [3] serves as the basis for this study. With the help of international partners, comprehensive country-level data was collected within the project, serving as a baseline. Additionally, this study improves the modeling of international gas infrastructure within Europe. Improvements to the representation of hydrogen technologies strengthen the model's possibility to substitute Russian natural gas. These changes include e.g., retrofitting of natural gas pipelines to also carry hydrogen. This could be especially important considering renewable hydrogen as a viable short- to medium-term alternative.

In order to investigate an independence from Russian natural gas, imports from Russia into Europe are stopped completely. Based on the given data and model formulations, the model then decides what the cost-optimal energy system looks like and what alternatives to invest in.

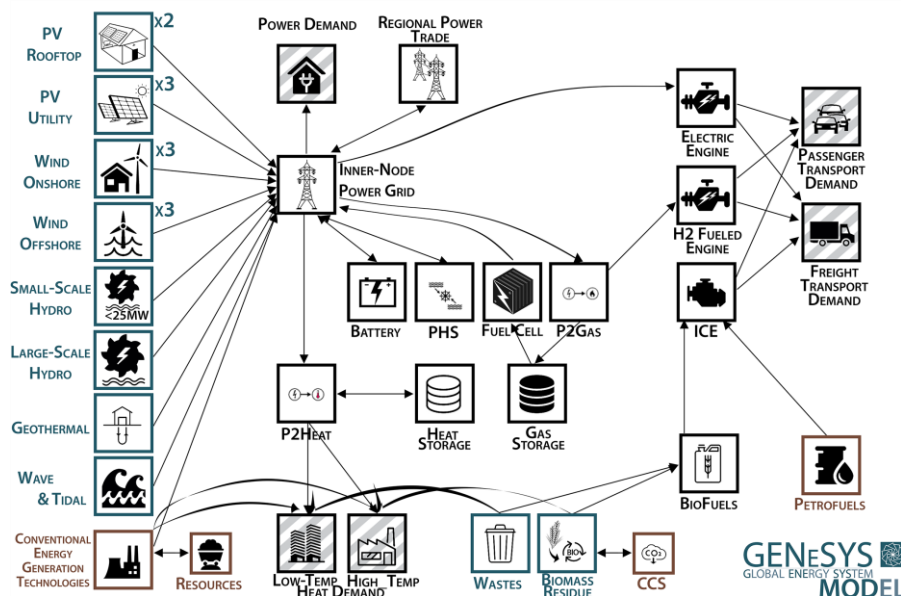


Figure 1: Stylized illustration of GENeSYS-MOD's structure

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Ergebnisse und Schlussfolgerungen

This paper intends to display possibilities of a European energy system without natural gas imports from Russia. Overall, it will show in which time period the model invests in which alternatives to identify the cost-optimal energy system until 2050. LNG imports from Turkey and outside Europe will play an important role, especially in view of the scarce natural gas resources within the continent. Especially in the heating sector, natural gas is difficult to replace in the short term. Therefore, it is assumed that the import of LNG will be the first alternative, before switching to other technologies such as heat pumps. In the electricity sector, natural gas can be more easily substituted. Although coal-fired power generation would potentially need to increase in the short term, the transformation towards 100% renewables could be accelerated, especially in the long run. In addition to alternative technologies, trade within Europe is another important factor that can contribute to the phase-out of Russian natural gas. Since especially Eastern European countries have only limited access to LNG, trade through continental measures is necessary. It is assumed that this will further lead to an increased trade across Europe in order to ensure an optimal energy system.

Literatur

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