

POTENTIAL FOR POWER-TO-HEAT APPLICATIONS IN GERMANY AND ITS IMPACT ON NATURAL GAS DEMAND

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Overview

Germany, Europe's largest market for natural gas, has ambitious aims to reduce the primary energy consumption and increase the share of renewable energy sources¹. The country's natural gas consumption accounts for almost 20 percent of the EU 28 consumption and follows the European decreasing trend for over a decade (Eurostat 2016). In Germany, natural gas is the major energy carrier for heating and more than half of the natural gas consumption is used for this purpose (AGEB 2016). With an increasing share of volatile renewable energy sources (RES), electrical heating may partly replace natural gas heating and therefore would have an impact on natural gas consumption. This study aims to assess the potential of power-to-heat applications² in Germany and its impact on natural gas consumption.

In recent years, power-to-heat applications have become important suppliers of negative balancing control in Germany. Currently, a research project evaluates the potential for power-to-heat as an option to use electricity from curtailments of photovoltaic and wind stations to solve grid congestions (EnSys 2015). Furthermore, the use of electricity in the heating sector will increase in a future power system with a significant negative residual load. Today, power-to-heat applications are not profitable. Even if the electricity comes at negative prices, the taxes and levies on the electricity price make power-to-heat not competitive to natural gas heating. As outlined in the white paper for a new electricity market design by the Federal Ministry for Economic Affairs and Energy, intersectoral technologies will play a key role in the future energy system (BMWi 2015). Therefore, we can expect a change in the supporting scheme of power-to-heat in the near future.

Several pipeline projects (e.g. Nabucco-West, South-Stream, TANAP) aim to increase the natural gas delivery from the Caspian region into the EU and reduce the dependency on Russian natural gas (bpb 2013). A switch to electric heating (prospectively power-to-gas) may have an impact on Germany's demand for natural gas and therefore may pose a risk to the new pipeline projects and Caspian economies.

Methods

This study estimates the potential for power-to-heat applications in Germany based on a) available historic data and prognoses for ancillary services and volatile RES curtailments and b) studies for the long-term development of electricity prices and the residual load under different policy regimes for the use of power-to-heat. Thereby we assume conservatively that the respective amounts of electricity can be fully converted into heat and replace only natural gas in the heating sector.

Results

The evaluation results in a timeline of the potential decrease in Germany's natural gas consumption forced by a higher share of electrical heating. First findings show that in the upcoming years, the natural gas demand will decrease maximally by 0.5 percent³ due to the use of power-to-heat for ancillary services. With a likely policy change on the use of electricity from curtailments of volatile RES, electricity can replace already today two percent of the natural gas consumption – with a rising trend. In 2030, the reduction could climb up to 30 TWh (five percent of 2014's consumption). This number is mainly depending on the must run capacities, the deployment of renewables and the policy regime for power-to-heat in Germany. For 2050, studies even assume up to 250 TWh of electrical heating (IWES 2016) which represents 20% of the natural gas consumption in 2014.

¹ Germany aims to reduce the non-renewable primary energy consumption in the building sector by 80% between 2008 and 2050 by improving the efficiency of buildings and by decarbonising the primary energy consumption.

² By *power-to-heat* the author means *electrical heating* and not *heat pumps*.

³ Based on Germany's 2014 natural gas consumption. With the expected increase in efficiency, the overall share would be even higher.

Conclusions

Under the current circumstances, the findings suggest a low impact of electrical heating on Germany's natural gas consumption until 2020, mainly caused by electrical heating for ancillary services. The impact for the following decades will be significant. However, with an earlier change in the policy regime allowing the use of curtailed electricity, the reduction of natural gas consumption can appear earlier. Electrical heating and the risk of a change in the support scheme have a considerable influence on investment decisions for pipeline projects.

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