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FACTSHEET

H₂-INFRASTRUCTURE PLANNING IN GERMANY

Germany is in the process of designing the future hydrogen pipeline networks for the expected market ramp-up. The current state of planning exemplifies opportunities and challenges of this transformation, most of which are universally applicable for countries in the transformation phase.

Role of gas and gas infrastructure in meeting Germany's energy and raw materials needs

The natural gas infrastructure and corresponding regulatory processes play a crucial role in the switch to hydrogen, as this infrastructure will partly be repurposed during the energy transition.

Currently, natural gas plays a vital role in meeting the demand for energy and raw materials in German society. In total, natural gas accounts for roughly 27 % (corresponding to 850 TWh/83 BCM) of final energy consumption, which is mainly covered by imports. Natural gas imports are realized via pipelines from various countries. Due to a stop of natural gas imports from Russia in 2022, several LNG import terminals were added in order to diversify supply.

German gas infrastructure consists of around 40.000 km of high-pressure transmission pipelines and distribution networks with approx. 500.000 km in total length. The uninterrupted supply is secured with underground gas storages with 250 TWh (24 BCM) of storage volume.

The different networks are managed by sixteen individual Transmission System Operators (TSO) in Germany. Planning and development of the gas transmission network is coordinated in a national network development plan. The plan is binding with a ten-year planning horizon and is updated on a two-year rolling basis. Preparing the plan includes the following phases:

1. Scenario framework – accumulation of assumptions on developments in gas production like supply, consumption and planned investments in network and storage facilities as well as possible supply interruptions
2. Network Development Plan (NDP) – based on the scenario framework; TSOs model the network expansion requirements
3. Implementation Report on the NDP – documents the achieved progress in implementing the latest NDP and (if applicable) main reasons for delays

Both the scenario framework and the NDP require approval from the German Federal Network Agency (Bundesnetzagentur) which reviews and publishes the implementation report on the NDP. Furthermore, as part of the internal energy market of the European Union (EU), gas transmission infrastructure must be included in the European-wide Ten-Year Network Development Plan (TYNDP). The TYNDP is a non-binding plan; however, it must be consistent with the national NDPs.

Gas market and infrastructure on a transformation path

Under the current regulation of the German Technical and Scientific Association for Gas and Water, blending of hydrogen in the natural gas pipelines is allowed for up to 10 vol. % with a possible extension to 20 vol. %. Yet, blending only plays a subordinate role in the German debate, with the primary focus being on dedicated hydrogen pipeline network.

Current hydrogen pipeline infrastructure in Germany is limited to several private networks for the chemical industry but preparation for the development of a cross regional and cross border hydrogen network is advancing. Several risks and uncertainties need to be addressed in this process. First, there is uncertainty about the speed and scale of the future hydrogen market development; and secondly, regulatory rules are still to be completed.

In 2020, as part of the Gas NDP 2020/2030 process, the German TSOs presented the first voluntary modeling of the hydrogen network. The so-called “hydrogen core network” is supposed to connect the industrial demand centers in the West of Germany with the hydrogen production sites in northern Germany. The length of this network is planned to be 1.200 km in 2030, consisting of 90 % converted methane pipelines and about 10 % newly built pipelines.

Studies show that investment costs for a new pure hydrogen pipeline are 110–150 % of those for a new natural gas pipeline with a similar diameter, while investment costs for a repurposed pipeline are 10–35 % of those for a new hydrogen pipeline with similar diameter.

The next step in incentivizing the development of hydrogen networks was initiated through the framework of Important Projects of Common European Interest (IP-CEIs). Within the project group “storage, transportation and distribution of hydrogen”, 15 German projects were selected with a total length of up to 1.800 km of hydrogen pipelines – both newly built and converted from existing natural gas pipelines; as well as hydrogen storage capacities of 130 million Nm³ (~400 GWh). The IPCEI status will allow state subsidies and foster rapid development of the infrastructure. The infrastructure is planned to be operational by 2028.

Following the publication of the planned network of IPCEI-projects, the TSOs updated the voluntary modelling of the hydrogen network and published it as a part of the Gas NPD 2022/2032. The network length increased to 8.500 km, with 5.900 km of converted methane pipelines and 2.900 newly built pipelines. The TSOs estimated the costs of this network at 8.1 to 10.2 billion EUR.

However, there is still no binding hydrogen network development plan. Therefore, in May 2023 the German Government has mandated the Association of the German gas TSOs to submit a plan for the realization of a hydrogen core network by 2032. The core hydrogen network will connect relevant regions on the supply and demand side and is expected to be around 10.000 km long. The plan for its development is to be examined and approved by the German Federal Network Agency.

In the next step, the German government plans to prepare and propose rules for a regular planning process for hydrogen network development through an integrated gas and hydrogen network development plan.

Due to high investment costs and an initially low numbers of connected users, as well as smaller hydrogen quantities, financing through network tariffs would result in prohibitively high transport costs. To ensure rapid and efficient network development and a fair distribution of costs and risks, the German government is currently developing financial support measures.

Integration of the German national grid in the European Hydrogen Network

EU gas rules to facilitate the market entry of renewable and low-carbon gases will be amended and published in a so-called hydrogen and decarbonised gas markets package, which is expected to be adopted by the end of 2023. It will enable the development of a pan-European Hydrogen Network to connect renewable and low-carbon hydrogen production sites with demand centers. Germany is expected to meet its hydrogen demand with a significant share of imports. To this end, there are six supply corridors being considered by the European Clean Hydrogen Alliance:

1. South Central H₂ corridor
2. Iberian H₂ corridor
3. North Sea H₂ corridor
4. Nordic Baltic H₂ corridor
5. Eastern H₂ corridor
6. South-eastern H₂ corridor





German pre-selected IPCEI-Projects 2021 © BMWi¹

1 https://www.bmwk.de/Redaktion/DE/Downloads/I/ipcei-standorte.pdf?__blob=publicationFile&v=4 (August 2023)

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