

German Vision of Hydrogen Chains

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(with comments from Uli Büniger, Philipp Seydel and Martin Wietschel)

The German HyWays stakeholders have developed a national vision of the deployment of hydrogen energy for the next decades. This national vision takes into account: a wide variety of relevant H₂ sources from fossil to renewable feedstocks, as well as the different scales of production from onsite to centralised production. In this vision CO₂-reducing or CO₂-free sources should play an important role especially in a long-term view.

The most promising application sector for hydrogen is seen in transport with a focus on cars and regional vehicle fleets using hydrogen in fuel cells, and in the transition phase also in internal combustion engines. For stationary applications the potential to use hydrogen is also envisioned, but to a lower extent. The key drivers for a hydrogen economy – energy supply security and international competitiveness – put less pressure on industry and politics than the transport sector. In the transition phase to a wider use of hydrogen energy starting after 2010, industrial by-product hydrogen can significantly contribute. Additionally hydrogen will be produced by on-site steam methane reforming (SMR) and electrolysis. Demand centres in densely populated areas will arise and for hydrogen transport liquid or compressed hydrogen trucks will play a relevant role.

After 2020 the growth in hydrogen demand is expected to broaden the range of options for local and central hydrogen production. Another H₂ supply option with growing importance is electrolysis from renewables and grid mix electricity. Depending on the hydrogen penetration rate and the feasibility of CCS (economy, security) natural gas (NG) and coal can contribute to secure higher amounts of GHG emission free hydrogen (centralized). For hydrogen transportation pipelines will play a relevant role at this stage. But also on-site steam methane reforming (SMR) and electrolysis production will be important, especially for the supply in rural areas with warranted demand profiles.

After 2030, hydrogen already plays a major role in supplying vehicles and a remarkable role for stationary applications. Provided, CCS is already established at industrial scale, central hydrogen production schemes based on fossil fuels could dominate in Germany either from SMR, or coal gasification - depending on long-term price developments of the energy carriers. Although the end-use competition for the merits of renewable resources between different sectors (transport, electricity, heat) will grow, the share of renewable hydrogen will increase. Main renewable H₂ supply chains are wind (on- and off-shore) via grid electricity and central or de-central electrolysis as well de-central biomass gasification. New renewable resources (geothermal) might fit the growing hydrogen demand with the help of new storage systems. The import of hydrogen (e.g. from Norway via a European pipeline network) may become another option. The transport of hydrogen will be by pipeline or liquid hydrogen truck depending on the hydrogen demand and location of the end use.