

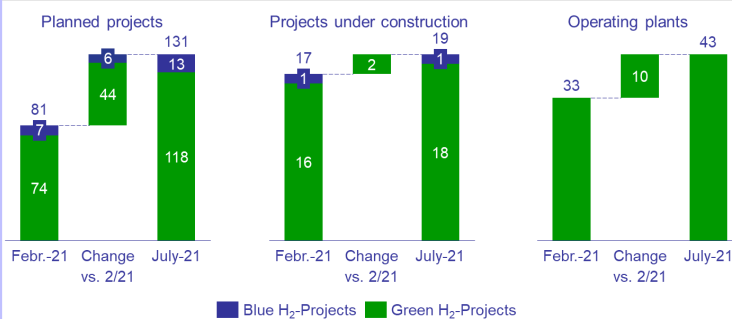
H₂ MARKET RADAR

27.07.2021

KEY FACTS

- The dynamic development of hydrogen projects in Northwest Europe continues unabatedly. Since the publication of the previous issue, another 10 projects with a H₂ production capacity of 16 MWh/h have started operations.
- The future role of hydrogen in the heating market has been a topic of various studies published in recent months. According to the assumptions made and scenarios considered, a demand of between 180 und 238 TWh could result.
- Based on its own commissioned work, Team Consult concludes that there could be a demand potential of around 250 TWh, assuming that by 2050 around 9 million residential buildings could depend on hydrogen, because for these buildings alternative options such as a conversion to electric heat pumps would require prohibitive technical efforts and investments.

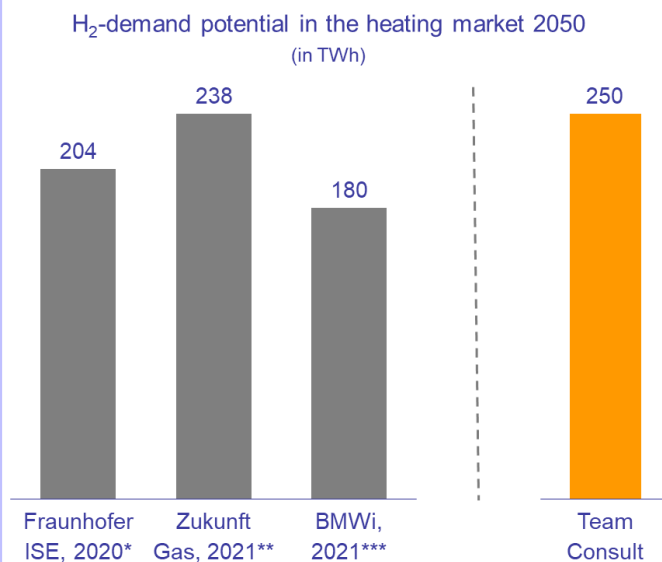
Development of H₂ projects in Northwest Europe (B, D, DK, N, NL, UK)



- There are currently over 190 projects in Northwest Europe for the production of green or blue H₂. 22% of these projects are already operational with a further 10% under construction.
- Since February the number of planned projects increased by 50 projects, with projects for green H₂ continuing to show a strong dynamic.
- Germany has a leading position with regard to operational and planned „green“ projects.

Source: Research/Analysis Team Consult

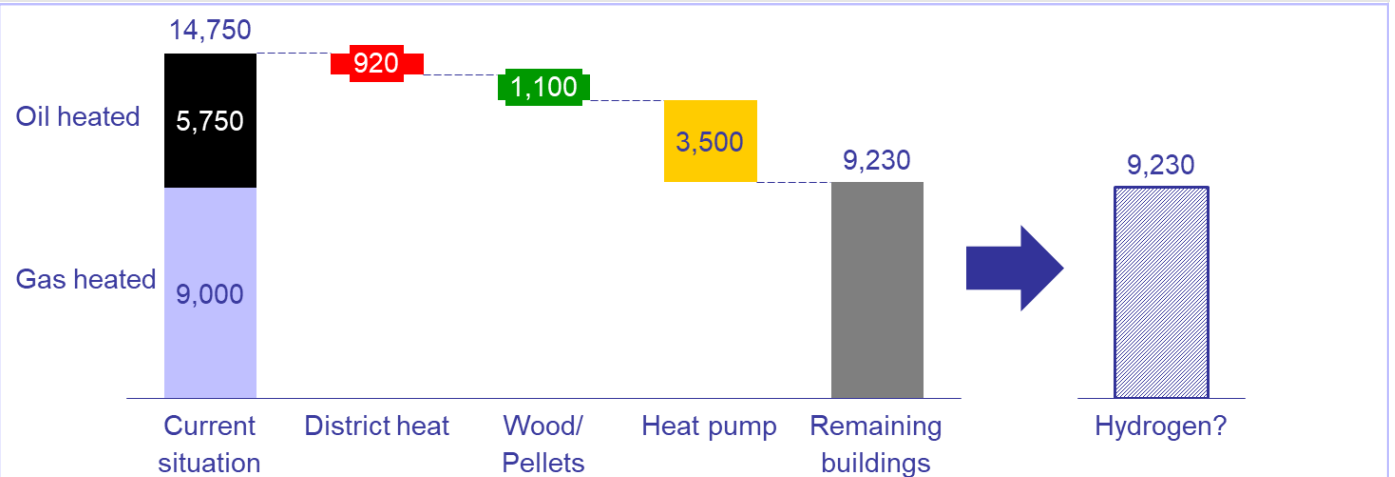
Hydrogen in the heating market



* „Wege zu einem klimaneutralen Energiesystem“, Szenario „Beharrung“; ** Nymoen, „Klimaneutral Wohnen“; *** Fraunhofer ISI, „Langfristszenarien“, Szenario TN-H₂

- Assuming that Germany achieves its climate targets by 2050, various studies have recently examined the possibilities of using hydrogen to decarbonise the industry, transport, heat and power generation sectors.
- The results depend strongly on the assumptions made and the scenarios examined. While some scenarios see no role for hydrogen in the heating market, other scenarios show a hydrogen demand between 180 and 238 TWh.
- Based on its own commissioned work, Team Consult concludes that there could be a potential demand for hydrogen of around 250 TWh in this sector in 2050.
- This potential is based on the stock of older, unrefurbished residential buildings which today are supplied with gas. In these buildings, a complete energy-efficient retrofit and conversion to alternative heating systems (e.g. electric heat pump) is associated with comparatively high investment costs (see next page for further details).

Existing oil/gas heated residential buildings: Conversion of heating technology until 2050

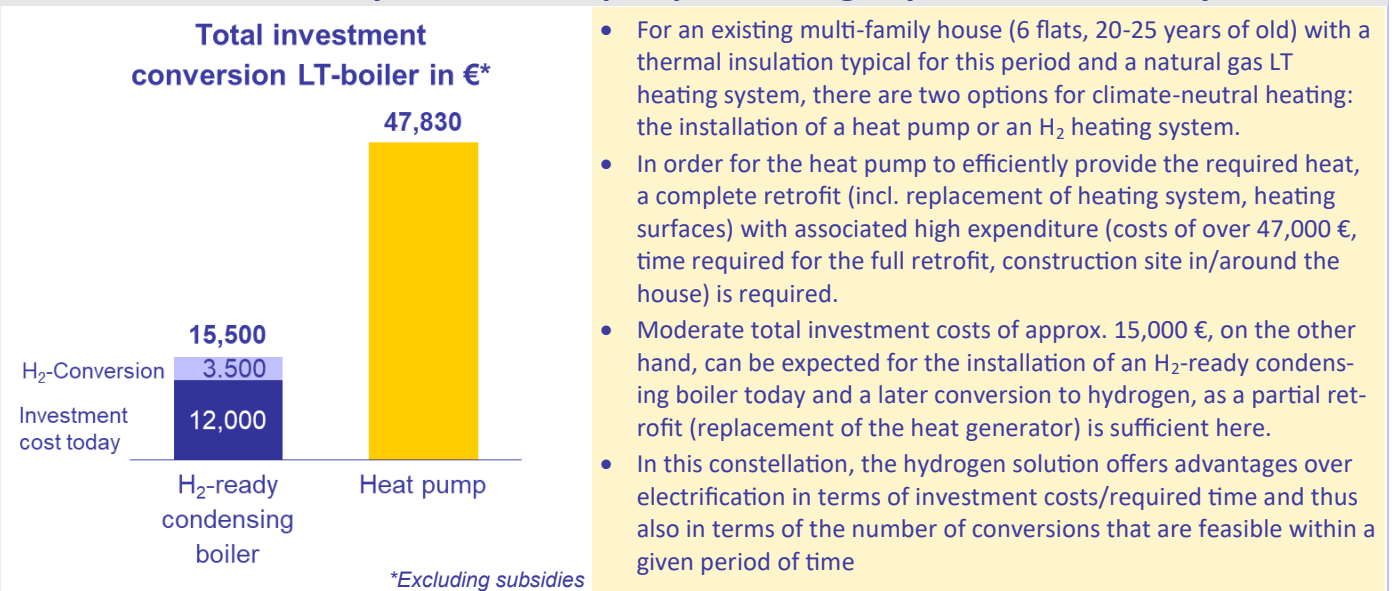


Source: Team Consult Analysis

Unit of measurement: 1.000 Buildings

- Just under 15 million residential buildings are heated by oil and gas. The most obvious conversions are district heating (approx. 900,000) in urban areas with district heating supply, heat pumps (mainly 1- or 2-family houses without gas/district heating connection in rural areas, mostly renovated; 3.5 million in total) and wooden pellets (approx. 1.1 million).
- Approx. 9.2 million residential buildings remain in the gas supplied area for which an alternative decarbonisation solution must be found; hydrogen presents an obvious choice due to the low time and financial conversion efforts required.
- The conversion of 3.5 million existing buildings to heat pumps is already ambitious (approx. 110,000 p.a. on average up to 2050 and thus approx. twice as high as the current rate of expansion in the existing stock).
- A full electrification of the remaining 9.2 million residential units would translate into more than 300,000 additional conversions per year. This is unrealistic in a stock that is often characterised by:
 - Old buildings with small heating surfaces and high system temperatures
 - Dense settlement structures with limited ambient heat sources
 - A social structure, in which many do not have the funds required for a complete renovation and new heating system

Investment cost H₂-system vs. heat pump in existing city based multi family houses



Source: Team Consult analysis based on "bdew - Heizkostenvergleich 2021", "H21, Leeds City Gate Report"

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