

E3G HYDROGEN FACTSHEET: BUILDING HEAT



Key political questions

1. **What are the best options for quickly cutting emissions from residential heat?** To get on track for meeting EU climate objectives, emissions from the residential building sector in the EU **must decline by over 60% until 2030** (relative to 2015). This means that decarbonization options that are deployable at scale over the coming years are urgently needed. However, sustainable hydrogen will not be available at scale before the 2030s, while other options such as efficiency measures, electric heat pumps and district heating are already available. For example, 1.6 million heat pumps were installed across Europe in 2020 alone, with double digit growth **expected** for this year.
2. **How will heat decarbonization pathways affect the future of the gas grid?** Residential heat demand currently accounts for **over one third** of the natural gas use supplied through Europe's extensive gas grid, and is an especially important demand source for regional and local distribution grids. These pipelines would only have a future if large parts of heat supply were provided through hydrogen products, although extensive and expensive retrofits would be necessary. If more efficient and affordable options such as electric heat generation and district heat networks are widely used, the operators of gas distribution grids may need to radically adjust their business models. Significant efficiency gains in the buildings stock will be necessary in any decarbonisation scenario.
3. **Should households pay for the development of hydrogen infrastructure?** If hydrogen is used for decentralized heating, parts of the financial burden for converting and building hydrogen infrastructure will fall on individual households and small scale consumers. However, they will most likely not be the main beneficiaries of hydrogen, as its main positive impact will be in large-scale demand centers, especially around industrial users, in line with the strategic approach of developing "hydrogen valleys". Hydrogen-powered heat generation will also overall be more expensive for consumers than heat pumps.

Key facts affecting the political choice

Technical

- **Electric heat pumps are significantly more efficient than hydrogen heating.** Thanks to their ability to draw on ambient heat, **heat pumps can generate around six times more heat energy out of one unit of renewable electricity** compared to hydrogen heating appliances using 'green' hydrogen. Furthermore, heat pumps are also capable of cooling houses, something that gas-powered appliances are generally not capable of. As climate change causes heat waves to happen more frequently and intensely, this ability is likely to become increasingly **important**.
- **Today's gas transport and heating infrastructure is not ready for hydrogen.** Existing gas transport infrastructure is not capable of transporting significant amounts of hydrogen and **blending small amounts of hydrogen into the grid would not contribute to a significant lowering of emissions**. Furthermore, the heating infrastructure currently deployed in households and elsewhere is **not capable** of operating on hydrogen, including boilers, household pipes and metering equipment. Therefore, retrofits of the gas grid and appliances would be necessary for hydrogen to be used for decentralised heat generation, which would in any case only be a viable option if hydrogen is available in the necessary amounts.

	<ul style="list-style-type: none"> • It is unlikely that renewable hydrogen will be available in the amounts required to decarbonise heating within the necessary timescale. To achieve the EU’s planned new 2030 climate target, emissions from the residential building sector must decline by over 60% by 2030 (relative to 2015). This means that strong action for heat decarbonization is necessary over the coming years, while hydrogen (both ‘green’ and possibly ‘blue’) is unlikely to be available at scale before the 2030s. Even then, it will be more urgently needed in other sectors where there are no alternatives to its use. • The use of hydrogen to decarbonize district heat networks where there are no alternatives could become part of transition pathways in the mid-term. In light of the limited availability of sustainable hydrogen and the efficiency losses associated with hydrogen production, other renewable district heat options such as the use of industrial or commercial waste heat, ambient and geothermal heat combined with heat pumps and low temperature heat grids, as well as solar thermal energy and sustainably sourced biomass, are preferable for operating district heat networks to the largest possible extent. But it is likely that there will be some instances in which those solutions cannot be utilized, for instance expansive high temperature district heat grids. In these cases, the use of hydrogen for centralized heat generation, ideally combined with power generation, can make a contribution to decarbonizing district heat networks. However, it must be noted that the potential use of hydrogen for centralized heat provision does not alter considerations regarding the decentralized use of hydrogen for heating that is usually the focus of political debates.
Economic and political	<ul style="list-style-type: none"> • Using electric heat pumps is more affordable for households than using hydrogen for heat generation. Heat pumps are a powerful competitor to hydrogen heating and can provide household heat at significantly lower prices than hydrogen. A 2021 study found that hydrogen-only heat generation is more than twice as expensive for households than using heat pumps, even though the affordability of the required upfront investments for heat pumps as well as the relatively high costs of electricity compared to gas are still issues. • Treating hydrogen as an option for decentralised heat undermines strategic deployment of green hydrogen where it adds the most value in the economy. Deploying hydrogen in a way that is targeted on high value “demand pillars” such as industrial end use makes an efficient development of infrastructure, a concise allocation of costs and targeting of support measures possible. If, on the other hand, the use of hydrogen is allowed for the decentralised heating sector, many private consumers and individual households would be part of the equation. This is why consumer protection associations have argued for a focus on industrial hydrogen use. Both European associations for national energy regulators (ACER and CEER) equally argued that users of the current gas network should not cross-subsidise the hydrogen network.

*This factsheet is part of an **E3G series of factsheets on hydrogen and the gas transition**. It has been written by Felix Heilmann and Eleonora Moro. For questions and feedback on this factsheet, please contact felix.heilmann@e3g.org.*

About E3G

E3G is an independent climate change think tank accelerating the transition to a climate safe world. E3G builds cross-sectoral coalitions to achieve carefully defined outcomes, chosen for their capacity to leverage change. E3G works closely with like-minded partners in government, politics, business, civil society, science, the media, public interest foundations and elsewhere. E3G is making the necessary possible. More information is available at www.e3g.org

Copyright

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 2.0 License. © E3G 2021