



## Key political questions

- 1. How to ensure that hydrogen is used where it can make the biggest positive impact?** The majority of scenarios show that sustainable hydrogen will only be available in limited quantities. They also underline that it is an important decarbonisation option in processes for which electrification and other solutions such as material and energy efficiency improvements are not available, but an inefficient option for all other processes. There will hence be a trade-off between using pure hydrogen in centralized demand areas, such as industrial clusters, and blending hydrogen widely into the gas grid, where it will also do little to lower emissions from natural gas use.
- 2. What does the future of hydrogen mean for the future of the European gas grid?** Europe has an extensive gas grid, and advocacy efforts for blending hydrogen into the grid are often motivated by the argument that the grid should be kept in operation. Blending hydrogen into the existing grid would also give natural gas grid operators a strong direct stake in the development of hydrogen. However, tomorrow's hydrogen grid will fulfil a very different function than today's gas grid and will look different, both with regards to the specific end users supplied and its overall scope. Furthermore, blending does not enable a smoother transition to a 100% hydrogen grid: costly retrofits to the existing grid would be necessary in any case once the relatively low levels of hydrogen that the existing gas grid can carry have been reached.
- 3. Who should pay for the development of hydrogen infrastructure?** If hydrogen is blended into the existing natural gas grid, the financial burden for converting and building hydrogen infrastructure is likely to fall on all current gas consumers due to their connection to the current grid. However, not all current gas consumers will benefit from the availability of hydrogen in the future – a mismatch between benefits and costs poses a legitimacy risk to the transition.

## Key facts affecting the political choice

### Technical

- **European gas networks can only integrate very low amounts of hydrogen into the existing infrastructure.** If higher amounts of hydrogen are mixed into the existing gas grid, damages to the infrastructure are very likely due to a phenomenon known as **'hydrogen embrittlement'**. Furthermore, **leakages from the existing gas grid are a widespread problem** that so far remains untackled. In most European countries, blending hydrogen into the existing natural gas supply without costly infrastructure retrofits (including for end use appliances) will therefore only be possible to a **very limited extent** of often less than 10%. Retrofitting midstream infrastructure and end use appliances simultaneously, potentially multiple times to eventually get to 100% hydrogen, is a complex undertaking that would require centralised planning and intervention.
- **Hydrogen has a three times lower energy density than natural gas, meaning that blending only makes a very small contribution to lowering emissions.** For instance, **a 5% blending by volume of hydrogen would only displace 1.6% of natural gas demand.**
- **Blending hydrogen into the natural gas grid undermines gas quality standards.** Many industrial end users of natural gas rely on a high and constant gas quality for their processes. A blending of hydrogen into the existing gas grid would therefore pose a risk to their operations, as highlighted by the **European Chemical Industry Council.**

- **Blending runs counter to an efficient allocation of scarce hydrogen resources.** Most governmental hydrogen strategies, including the **EU hydrogen strategy**, emphasise the importance of targeting the use of hydrogen in specific processes for which there are no climate neutral alternatives. This is sensible due to the limited availability of renewable hydrogen and the availability of more efficient alternatives elsewhere. Blending hydrogen widely into the existing gas grid would deviate from a strategic allocation of a scarce resource and would hence drive up the costs of hydrogen for where it is urgently needed, such as for building up a competitive, zero-emissions industry.
- **Blending would increase consumer prices for today's natural gas users.** The energy content of natural gas is more than three times **higher** than the energy content of hydrogen. This does not only limit the emission reductions achieved through blending (*see above*) but also means that significantly larger volumes of hydrogen must be purchased by consumers relative to the replaced natural gas demand to keep energy supply constant. At the same time, hydrogen will remain more expensive than natural gas in the years to come, with **Bloomberg New Energy Finance** expecting renewable hydrogen prices to undercut blue hydrogen prices while still being at least twice as high as natural gas prices in 2030. Therefore, blending hydrogen would drive up consumer prices for gas.
- **Blending endangers the effective and just allocation of the costs of developing hydrogen infrastructure.** Developing hydrogen infrastructure will be costly. Consumer protection organisations have stressed that **today's gas consumers, especially households, are unlikely to be tomorrow's hydrogen consumers**, and should therefore not have to pay for the development of the hydrogen infrastructure. If hydrogen use is focused on demand centres, such as industrial facilities, costs can be clearly allocated to beneficiaries. This becomes practically impossible if hydrogen is blended into the existing grid, reaching a very fragmented set of existing consumers.
- **Blending hydrogen into existing gas networks is likely not an efficient infrastructure design.** Studies suggest that planning hydrogen networks together with renewable energy production offers the potential to reduce the amount of hydrogen infrastructure needed by **up to 60%**, thereby reducing costs. Generalized blending would not contribute to the strategic development of an infrastructure in line with this.

*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](mailto:felix.heilmann@e3g.org).*

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