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# Hydrogen, alternative gases and decarbonising cities

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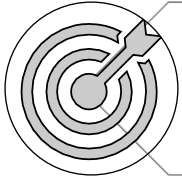


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# What is E3G?



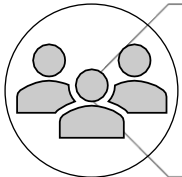
**What:** [E3G](#) is an independent climate change think tank.



**Mission:** To accelerate the transition to a climate safe world.



**Where:** London, Brussels, Berlin, Dublin and Washington D.C. and staff in seven other countries worldwide.



**How:** We deliver outcomes through coalitions with partners in government, politics, NGOs, science & media.



**Funding:** Primarily from philanthropic foundations.

# Hydrogen and net-zero emissions

## Facts:

- **Biomethane** still emits CO<sub>2</sub> at combustion stage and potential methane through production and transportation. It is thus only net-zero if the production method leads to additional capturing of CO<sub>2</sub> or avoidance of waste.
- **Hydrogen** does not emit CO<sub>2</sub> at the point of combustion, but there may still be (significant) lifecycle emissions incl from:
  - Fossil gas production and transportation through methane leakage (for so called blue or turquoise hydrogen)
  - The limitations of the carbon capture method (the maximum achieved is so far 95%)
  - The electricity used to produce electrolysis hydrogen.
- **As a result, sustainable gases are a scarce premium product and likely to be expensive.** Between 1/10<sup>th</sup> and ¼ of current fossil gas use by 2050 at EU level. ([ICCT](#))

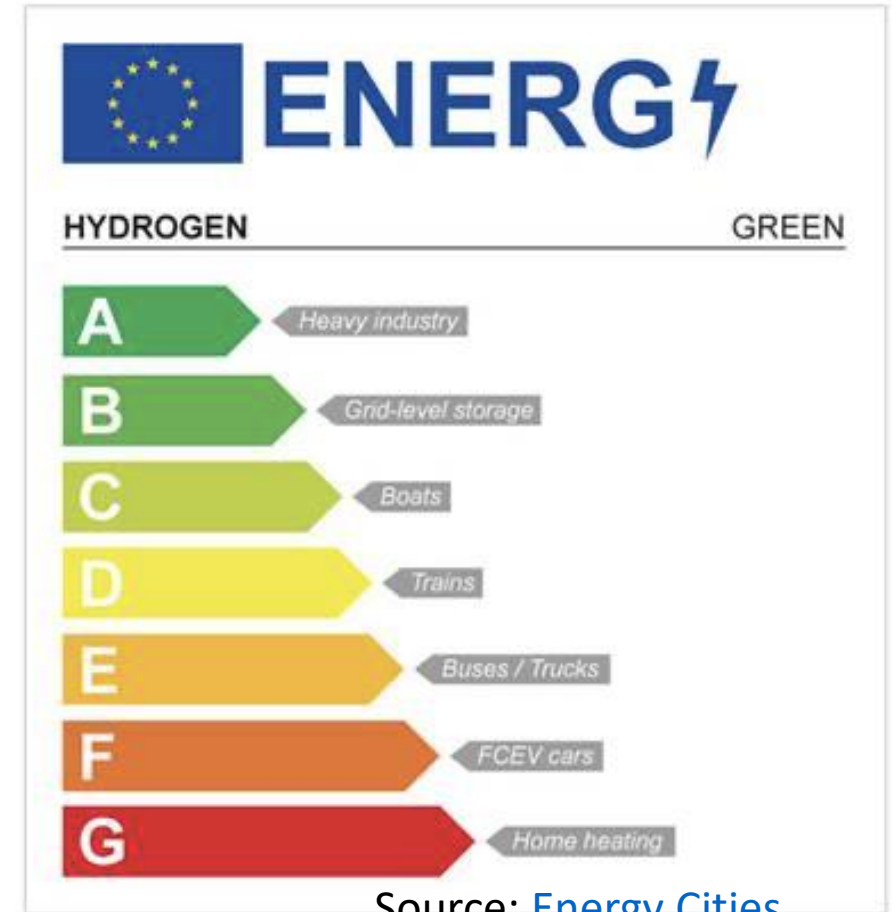
## Policy context:

- EU hydrogen strategy prioritises renewable hydrogen in the long term.
- EU sustainable finance taxonomy (draft) sets levels for hydrogen manufacturing that only allow for renewable (or nuclear) hydrogen.
- At EU level, targets require a >60% reduction in GHG emissions in the building sector until 2030. It is unlikely hydrogen can make a significant contribution until then.

1. **Emissions:** Does the 'emissions scope' used in your planning allow to reflect up- & midstream emissions (i.e. include scope 3 emissions)?
2. **Lock-in risk:** Does the city strategy allow for switching to 100% renewable hydrogen in the end? Where would it come from? What would happen if it didn't develop at scale?
3. **Adding value:** For what purposes would hydrogen be of highest added value in your city?

# Hydrogen and the energy system

- In terms of overall system efficiency, **there is only a few end use sectors where it makes sense to deploy hydrogen and where demand is likely to emerge**, notably where currently no alternatives are available. E.g. 40% of current gas use in industry is for heat  $>100^{\circ}\text{C}$  and can be replaced with heat pumps which can in many cases be more energy-efficient than hydrogen ([Agora Energiewende](#))
- The suitability of existing gas infrastructure for hydrogen use needs to be examined carefully.
  - Destinations may be different to current gas use (e.g. instead to replace grey hydrogen and coal) and demand volumes may be lower than for gas.
  - Refurbishment of networks, compressors and end use appliances would be required (only 10% blending safe on average) and costs are only poorly understood.
  - As a result, hydrogen infrastructure and networks may be much more localised around industrial clusters or be thought as a function of the electricity infrastructure.
- **“Blue hydrogen” as a transitional strategy requires significant investments (in CCS) that may not be justified if only used for a limited amount of time.** Given the entanglement with fossil companies, this also bears a higher risk of lock-in and non-delivery which would need to be governed carefully.



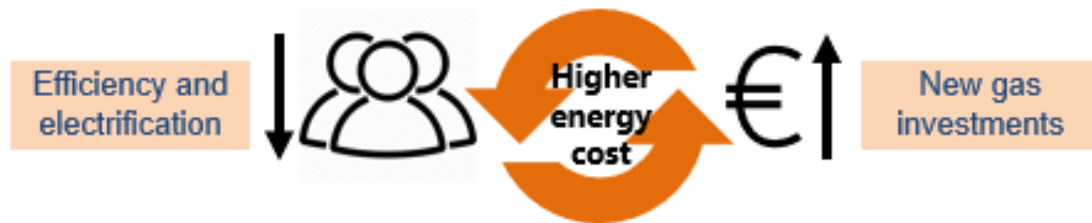
1. **Adding value 2:** How to design an energy system (network, markets and investments) where hydrogen gets steered towards where it adds most value? What are the barriers to that?
2. **Managing risk:** What happens if we don't do that?



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# Hydrogen and the citizen

- **Affordability:** It is important that all consumers have the option to come off the gas/hydrogen grid, instead of being penalised for not being able to do so in the long run.



- **Health:** NOx impacts of hydrogen in homes & flammability risk could be potentially higher, impacts still need to be better understood ([UK BEIS study](#))
- **Jobs:** hydrogen production can create jobs, with the bulk of that being in the electricity production ([EC study](#)), yet efficiency creates around 3x as many jobs per € invested ([IEA green recovery](#)).

1. **Fairness:** How to provide a regulatory and fiscal framework so that coming off the gas grid is at least as accessible as switching to hydrogen?
2. **Social and economic effect:** How does hydrogen fit with the overall local economic and social vision? How does it contribute to skills profiles, local supply chains and industries, if at all? What local value add?



# Choosing your pathway: what role for hydrogen? Critical factors

- Making fast progress: Is your plan dependent on short term delivery of alternative gases?
- Managing risk: How dependent is your plan on
  - Projected cost reductions of H2 or delivery of CCS
  - Supply of renewable hydrogen outside your control?
  - Demand from sectors where other solutions are available?
  - Decisions about infrastructure outside your control?
- Ensuring fairness: What would a green gas/hydrogen pathway mean for consumer costs and benefits?



# Discussion questions

1. **Emissions:** Does the 'emissions scope' used in your planning allow to reflect up- & midstream emissions (i.e. include scope 3 emissions)?
2. **Lock-in risk:** Does the city strategy allow for switching to 100% renewable hydrogen in the end? Where would it come from? What would happen if it didn't develop at scale?
3. **Adding value:** For what purposes would hydrogen be of highest added value in your city?
4. **Adding value 2:** How to design an energy system (network, markets and investments) where hydrogen gets steered towards where it adds most value? What are the barriers to that? What governance or institutions do we need?
5. **Managing risk:** What happens if we don't target the use of hydrogen?
6. **Fairness:** How to provide a regulatory and fiscal framework so that coming off the gas grid is at least as accessible as switching to hydrogen?
7. **Social and economic effect:** How does hydrogen fit with the overall local economic and social vision? How does it contribute to skills profiles, local supply chains and industries, if at all? What local value add?



# Relevant material on hydrogen

## Markets/broader context:

- E3G, Feedback on [Gas networks – revision of rules on market access](#)
- E3G, [Hydrogen Strategy – harnessing momentum for a new regulatory approach](#)

## Costs & comparisons:

- Carbon Brief, [In-depth Q&A: Does the world need hydrogen to solve climate change?](#)
- Michael Liebreich, [Separating Hydrogen Hype from Hope](#)
- ICCT, [Hydrogen for heating? Decarbonisation options for households in the European Union in 2050](#)
- [E3G, Renewable and decarbonised gases – options for a zero-emissions society](#)

## Infrastructure:

- Agora, [No-regret hydrogen infrastructure for Europe](#)
- Artelys, [What energy infrastructure to support 1.5°C scenarios?](#)





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## 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. In 2018, for the third year running, E3G was ranked the fifth most globally influential environmental think tank.

More information is available at [www.e3g.org](http://www.e3g.org)