E3G HYDROGEN FACTSHEET: **SUPPLY**

E3G

Key political questions

1. **How can renewable energy capacity be sufficiently scaled up to enable the production of hydrogen from renewable energy-powered electrolysis?** If hydrogen is to become a viable decarbonisation option, renewable energy capacity needs to be dramatically scaled up.
2. **How can the EU hydrogen strategy ensure global competitiveness?** EU policies can accelerate innovation and bring down prices by accelerating renewable energy deployment and incentivising the scale-up of electrolysers, a global market that EU companies are well-placed to benefit from.
3. **If there is a transition from 'blue' to 'green' hydrogen, how will it be governed?** This includes key questions such as when the shift will happen, how it will be driven, and whether and to what extent investments in interim blue hydrogen infrastructure are worth it. If a transition is to be effective, vested interests arising from investments in 'blue' hydrogen infrastructure will need to be managed.

Key facts affecting the political choice

Technical

- **Significant demand for hydrogen already exists today, with a large climate footprint:** 99% of hydrogen produced globally in 2019 was produced from coal or natural gas, with **less than 1%** of the latter being combined with carbon capture and storage (CCS). Existing hydrogen production produces emissions equivalent to the CO2 emissions of the **United Kingdom and Indonesia combined**. This has implications on the existing market incentives for hydrogen production and highlights the challenge of decarbonising production and achieving the required supply.
- **Renewable energy deployment is a prerequisite:** The extent of renewable hydrogen deployment depends on a massive expansion of renewable energy capacity. For the 40GW installed electrolysis capacity planned in the EU by 2030 to be powered by renewables, **80-120 GW** of additional solar and wind generation capacity are needed (**triple** the Europe-wide renewables capacity expansion in 2019). To achieve climate neutrality by 2050, the EU already needs to accelerate renewable energy deployment: the IEA estimates **50 GW of renewable energy capacity additions every year**.
- **Electrolysis hydrogen is not always 'green':** Hydrogen produced by electrolysis (a process that uses electricity to split water into hydrogen and oxygen) is only as 'green' as the electricity powering its production. This means that any strategy for sustainable hydrogen must include significant commitments for the development of renewable electricity generation.
- **Blue hydrogen is not climate neutral:** Blue hydrogen is produced using natural gas and CCS. This production route is not climate neutral, as CCS technology is not proven at scale and is expected to reach at best **85-95% efficiency**. In addition, natural gas extraction and transportation produces **methane leakage between 0.5-4.1%** depending on the country of origin and application. Methane has a global warming potential over **80 times greater** than CO2 over a 20-year time frame. The average emissions of blue hydrogen therefore still amount to between **143-218 g CO2e/kWh**.
- **Blue does not necessarily enable green:** 'Blue' and 'green' hydrogen are produced using different technologies and inputs. As a result, the extent to which blue hydrogen production infrastructure such as steam methane reforming and CCS capacity can enable the deployment of hydrogen from renewable energy-powered electrolysis is limited.

Economic or political

- **Hydrogen from renewables may soon undercut 'blue' hydrogen:** Although there is uncertainty on future costs, it is possible that hydrogen from electrolysis powered by renewable energy will become more economically viable than 'blue' hydrogen **as soon as 2030**. This possibility has to be weighed against the costs of investing in blue hydrogen in the short-term and the time it would take before the first blue hydrogen facilities (including associated CCS) could go online.
- **Hydrogen from renewable energy presents an innovation opportunity:** With major global economies developing hydrogen strategies and committing to climate neutrality, the hydrogen electrolyser market is widely **expected to expand** in the coming years. EU companies are well-placed to gain competitiveness benefits from electrolyser market growth, due to a leading position along the whole value chain.
- **Meeting the high expectations for large-scale hydrogen imports will be challenging:** Many EU countries plan to rely on potentially large amounts of imported hydrogen. While hydrogen imports are likely in the future, they are **anything but simple to realise**. There are both technical and economic constraints on the efficiency and competitiveness of hydrogen imports. These include the need for very low temperatures or conversion processes for shipping hydrogen, which result in energy losses and **high prices**, the need to build and upgrade pipelines which have a limited geographical scope, and limitations in export countries (*see below*).
- **Renewable hydrogen production capacity in the EU neighbourhood hinges on unprecedented renewables deployment:** The current EU hydrogen strategy envisages substantial renewable hydrogen imports to decarbonize the European economy. This will be challenging: the installation of 40GW of electrolysers in the Eastern and Southern Neighbourhood by 2030 would require 77 GW of renewable energy capacity, a figure **far above the currently installed 22 GW in Ukraine and North Africa**. As a result, catering for export capacity alone would require **tripling renewable energy capacity** in these countries over the next ten years – disregarding any domestic decarbonization efforts.
- **Vested interests will be difficult to manage:** If blue hydrogen is pursued as a "bridge technology", strong economic interests are likely to delay its phase out, as the operators of the associated infrastructure will have a direct interest in keeping their assets in operation.

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