Hydrogen4EU

CHARTING PATHWAYS TO ENABLE NET ZERO

The Hydrogen for Europe study is the result of a holistic, joint industry research project charting potential pathways for hydrogen to contribute to the EU's goal of net zero GHG emissions, based on actual European targets and open modelling frameworks. The study supports the realisation of EU targets for 2030 and 2050 by assessing which mix of hydrogen production technologies can enable the EU to meet its goals in the most effective way – and what supportive framework is needed to enable this. The project is funded by a group of 17 partners from the industry and carried out by three science partners. Research relies on existing literature, but also discussions with numerous experts and a wide range of hydrogen industry stakeholders to enhance data quality.

ABOUT HYDROGEN4EU

Hydrogen4EU is a cross-sectoral and multi-disciplinary research project aiming to support the understanding of the potential contribution of low-carbon and renewable hydrogen in reaching the European energy transition goals. Based on modelling prepared by the project's Research partners, IFP Énergies Nouvelles (research), SINTEF (research) and Deloitte (project management), the partnership aims to chart pathways exploring the role of hydrogen in a decarbonised European energy system. The research was funded by 17 partners: BP, ConocoPhillips, Concawe, ENI, Equinor, Ervia, ExxonMobil, Gassco, Hydrogen Europe, IOGP, Norwegian Oil & Gas Association, OMV, Shell, Snam, Total, Wintershall Dea, Zukunft Gas.

WHAT WE FOUND

- Hydrogen plays a key role in unlocking renewable energy integration.
- European hydrogen production and use can grow dramatically, with both low-carbon and renewable hydrogen necessary to enable fast, lower risk and more cost-effective delivery of net zero. A mix of hydrogen types will be needed regardless of the policy path chosen.
- Ambitious decarbonisation targets raise European hydrogen demand up to three times higher than the EU's Hydrogen Strategy objectives for 2030.
- Allowing low-carbon hydrogen to contribute at its full potential along with renewable hydrogen could save Europe over 1 trillion EUR through 2050.
- The uptake of both renewable and low-carbon hydrogen requires the simultaneous development across the value chain, with policy support required to spur the investments needed to unlock hydrogen's full potential.

TWO POLICY PATHWAYS

The Technology Diversification Pathway

is based on already-approved targets and assumes no obstacles to the deployment of different technologies, as well as perfect market foresight on investment decisions. This pathway considers an array of decarbonisation technologies, deployed as needed, which enables a more competitive and efficient zero carbon energy system.

The Renewable Push Pathway

prioritises the deployment of renewable energy with targets exceeding current policy goals for renewables' share of gross final energy consumption by 2050. This pathway sees an increased role for hydrogen in helping to absorb, store, and transport the additional energy resulting from higher renewables generation.

Results for each pathway are generated using three models considering system lifecycle (MIRET-EU), costs and investments (Integrate Europe) as well as external competition (Hydrogen Pathway Exploration).

WHAT IS NEEDED

- The current regulatory and policy framework still lack sufficient incentives to stimulate hydrogen's upscaling and allow all decarbonised options to compete commercially.
- Early investments are needed to enable the hydrogen value chain to grow to the necessary scale to unlock its full contribution to net zero.

QUICK FACTS

- **Driven by policy, demand for hydrogen could exceed 100 million tons (Mt) of H2 by 2050.**
- **More than half of total gross final energy consumption will be supplied by non-electrified technologies in 2050, such as low-carbon hydrogen and biomass.**
- **The transport sector accounts for more than half of hydrogen demand, exceeding 100 Mto of H2 in 2050, followed by industry – particularly the steel and chemical industries.**
- **The development of renewable hydrogen requires more than 1,800 GW of dedicated solar and wind capacities and more than 1,600 GW of electrolysers to be installed by 2050, implying a difference of more than 2 trillion in capital spending.**
- **Natural gas is an element of continuity, including in the Renewable Push pathway where it provides flexibility as a complement to renewables. It offers greatest benefits when coupled with CCS.**
- **The development of the hydrogen value chain relies on a dedicated energy infrastructure that includes transport and distribution of hydrogen, storage and refuelling options, and connects supply and demand.**
- **Nearly 15% of the hydrogen needed in the transition to net-zero emissions could be imported from outside Europe.**
- **Low-carbon hydrogen can provide sufficiently large volumes of hydrogen early in the transition to support the development of infrastructure that enables deployment of both low-carbon and renewable hydrogen.**