




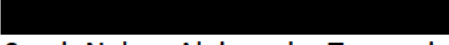


Minutes of the meeting with representatives from Hydrogen4EU Friday 28 May 2021 (online meeting/WebEx).

Participants:

- , Deloitte 
 IOGP,  IOGP, 
 Cambre Associates,
- Sarah Nelen, Aleksandra Tomczak & Carlijn Torenbeek (Cabinet Timmermans), Carla Benauges & Stefaan Vergote (DG CLIMA), MARQUEZ URIARTE Tatiana (CAB-SIMSON)

1/ Presentation of the study (Sébastien Douguet)

Hydrogen 4EU is a study carried by CINTEF and IFPEN under the directorship of Deloitte against the backdrop of reaching net-zero emissions by 2050 and the -55% by 2030.

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.

The study assessed the role of the Hydrogen in the EU, using 3 complementary models, a dedicated technology learning model, MIRET (classic energy model) and one for energy trade, HyPE. The HyPE model developed by Deloitte is used to explicitly assess potential of imports from neighbouring regions.

The Hydrogen 4EU study explores two main pathways – the technology diversification (TD) pathway and renewable push pathway (RP) - which shows the implications of a deliberate focus on renewables.

In both pathways, hydrogen supply rises sharply (TD: multiples by 3.5 in 30 years, RP: quadruples) and there is a clear dwindling role of coal and oil (48% in 2016 to 3% share in final gross energy consumption by 2050). The share of natural gas increases in the TD pathway with a peak in 2040. The gross final energy consumption falls by 10% thanks to energy efficiency improvements with electricity having a share of 42-43% (compared to 26% in 2016).

By 2050, hydrogen represents 21% of final energy consumption and e-fuels 3% (similar results for both pathways), hydrogen becomes the second largest contributor to final consumption by 2050, natural gas representing only 3% of final energy consumption.

Demand for hydrogen ramps up substantially over the 2030s and 2040s and exceeds 100 million tons (Mt) by 2050 in both pathways. More than half the demand comes from the transport sector reaching 55MtH₂ in 2050 (60% of maritime demand, 30% of aviation and 15 million trucks & buses). Industrial hydrogen demand, primarily for energy, reaches some 45 Mt by 2050 (18 MtH₂ in iron and steel and 6 MtH₂ in chemicals as energy (excludes feedstock)). Only minor quantities used in buildings.

Export of hydrogen ramps up to reach 10% (RP) and 15% (TD) of total H2 in Europe by 2050. Access to existing cross border infrastructures is a big advantage (e.g. Algeria and Russia) but we also see hydrogen from new players such as Morocco and Tunisia.

The development of **CO2 storage** in the Technology Diversification pathway broadly follows a linear trajectory, reflecting continuous ramp up of drilling and increase in annual injection capacities. **CO2 injection reaches the maximum limit of 1,000 MtCO2/year in 2040 and 1,400 MtCO2/year in 2050.** In some applications, the cost of full decarbonisation stays greater than compensating emission with CO2 removal. In the Renewable Push pathway, CCS is lower (1,170 MtCO2/year) but still significant.

In terms of investments, trillions of euros are needed in both scenarios to finance the hydrogen value chain – **They estimate the Renewable Push pathway to need 1 trillion euros by mid 2030s (total 5.5 trillion euros) compared to 3.1 trillion in the Technology diversification pathway. In total costs, the possibility of wider range of technologies in the TD pathways saves 1 trillion euros.**

In terms of political recommendations, there are five main guidelines in the study:

- internalizing CO2 emissions and changing the economics in favour of clean technologies
- Accounting for CO2 content of energy use
- Fostering innovation and R&D and bringing new technologies to commercial viability
- Enabling low-cost financing and bankability of investment in low-carbon and renewable solutions
- Ensure system integration and coordinate supply and demand uptake

In a Q&A issues related to the different models (eg which hydrogen technologies) were discussed as well as the respective share of hydrogen in transport/energy/buildings, the reasons linked to the difference in total investment between both pathways

██████████ also informed that Deloitte would organise an event at the beginning of July to go more into depth on this study.