Chapter 1 – Executive Summary

It is widely recognised that hydrogen has the potential to decarbonise a number of different industries and play a key role in the energy transition. Decarbonised hydrogen can be produced from application of CCS on established natural gas to hydrogen production units ("clean"/"low GHG emissions[1]" hydrogen) or electrolysis using renewable energy sources ("green" hydrogen). This report addresses the role of clean hydrogen and provides recommendations to promote the role of clean hydrogen.

Clean Hydrogen production currently has lower costs than green hydrogen (3-4 €/kg ex-works @30-40 bar) and could be an accelerator of the Hydrogen Economy as it can bring now the hydrogen cost that could be brought by the renewable route in around 25 years.

Hydrogen production equipped with CCS in industrial clusters, where several large users for hydrogen can co-exist, could also trigger the initiation of a CO2 transport and storage network.

There are multiple country roadmaps and studies that discuss the ability of hydrogen to decarbonise for different industries. Current and future uses for decarbonised hydrogen range from mobility and synthetic fuels production to power generation and fuel switching for domestic or industrial heating. One IEA study predicts a potential hydrogen demand of up to 300 million tonnes per annum for 2050[2], up from the 65 million tonnes consumed per annum currently (2% of primary energy) and a US study estimates up to 10% of primary energy could come from hydrogen by 2050. A study for Japan shows an increase up to 40% of primary energy from hydrogen with significant volumes of hydrogen for mobility, power generation and heating.

The UK H21 Project assesses the feasibility to decarbonise the city of Leeds through end use fuel switching and replacing natural gas used for domestic heating/use with hydrogen. The results show a peak hydrogen demand of 6.4 TWh (0.2 MTPA H2) per annum and a decarbonisation potential of approximately 1 MTPA CO2 using predominantly centralised hydrogen production from natural gas with CCS.

Technologies are available for clean H2 production with CO2 capture from natural gas and there are multiple projects already capturing CO2 from hydrogen production. Today the limiting factors are the availability of CO2 transport and storage infrastructure, demand for hydrogen as clean fuel and the required substantial hydrogen infrastructure and adaptations at points of use.

Recommendations

- Identify policies and stable support mechanisms that could promote the production of clean hydrogen for example EU RFD to create economically viable clean hydrogen projects.
- Encourage collaboration along the clean hydrogen value chain to promote new projects.
- Identify local clusters where synergies could be established between hydrogen production, hydrogen consumption and CCS.
    - First targets are intensive industrial areas like the industrial clusters of Antwerp, Rotterdam and Teesside, especially where H2 or CO2 networks exists;
- Investigate the role clean hydrogen could play in decarbonizing the EU power sector including assessment of ability to balance intermittent renewable energy with hydrogen combustion in gas turbine combined cycles.
- Maximize cross cutting opportunities with other world initiatives around low-carbon hydrogen initiatives (Japan/KHI, China/Shenhua NICE) and other EU hydrogen initiatives.
- Develop LCA for clean hydrogen value chains to assess the CO2 abatement potential.
- Support RD&I for emerging clean hydrogen production technologies with a potential to significantly reduce energy consumption and/or cost.
- As soon as possible initiate the establishment of CO2 transport and storage infrastructure, recognizing that production of clean hydrogen can be one of the early suppliers of CO2 for geological storage or other uses (e.g. EOR).

[1] http://www.certifhy.eu/images/project/reports/Certifhy_Deliverable_D2_4_green_hydrogen_definition_final.pdf

[2] https://ec.europa.eu/research/energy/pdf/weto-h2_en.pdf – H2 Case