Hydrogen Role on the Decarbonization Transition Route

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1. Introduction

Awareness of climate change impacts and the need for deep decarbonization has increased greatly in recent years. In 2018 the EU published its vision for the future of energy in Europe 'A Clean Planet for All' which aims at creating a "prosperous, modern, competitive and climate neutral economy by 2050." A set of pathways has been developed and assessed that rely heavily on renewable energy and energy efficiency, with a role for natural gas and hydrogen.

The need to accelerate clean energy transitions is underscored by recent data: CO_2 emissions rose for a second year in a row in 2018 to reach a record high.

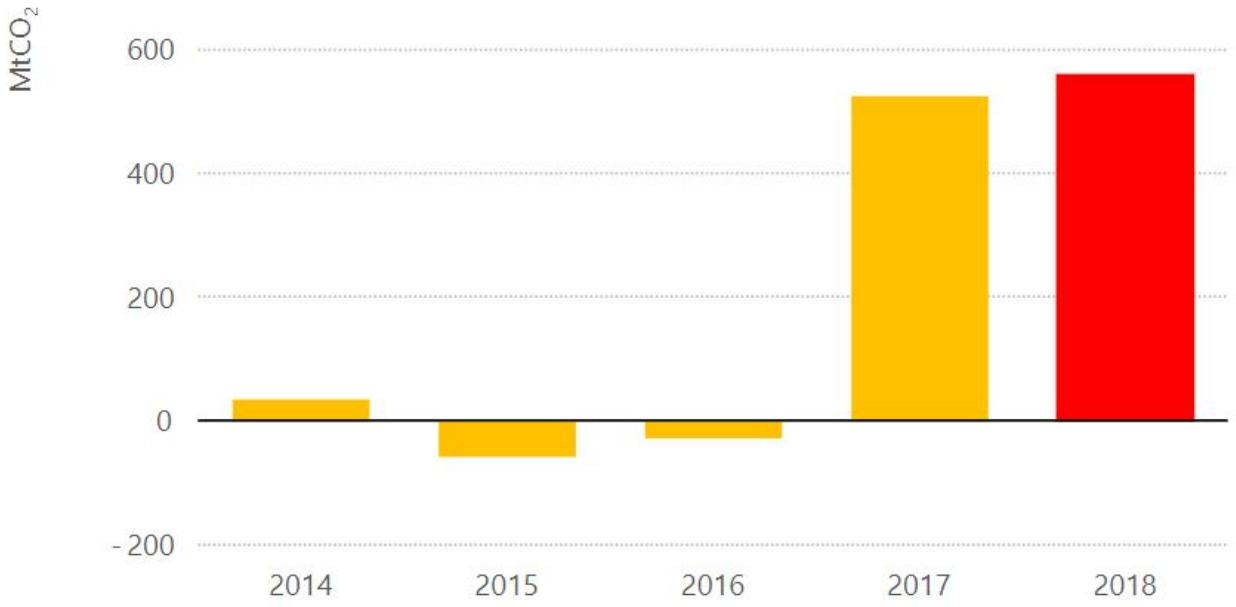

Figure 1 Annual change in global energy-related CO_2 emissions, 2014-2018[1]

In response to this growing awareness and the urgency of decarbonization, policy makers have taken action and in 2015 agreed to what is known as the Paris agreement. This has set the target to limit the expected global average temperature increase to significantly less than 2°C, with the ambition to keep to the limit to less than 1.5°C. In order to achieve such necessary and ambitious targets, the European economy, and in particular the energy sector, needs to significantly reduce CO_2 emissions to a fraction of current levels (e.g. -80%, -95%) with a growing consensus that net zero emissions will be required. Many changes will be required in how we work, travel, heat our homes and how we obtain the energy necessary to carry out all these activities, as shown in Figure 2.

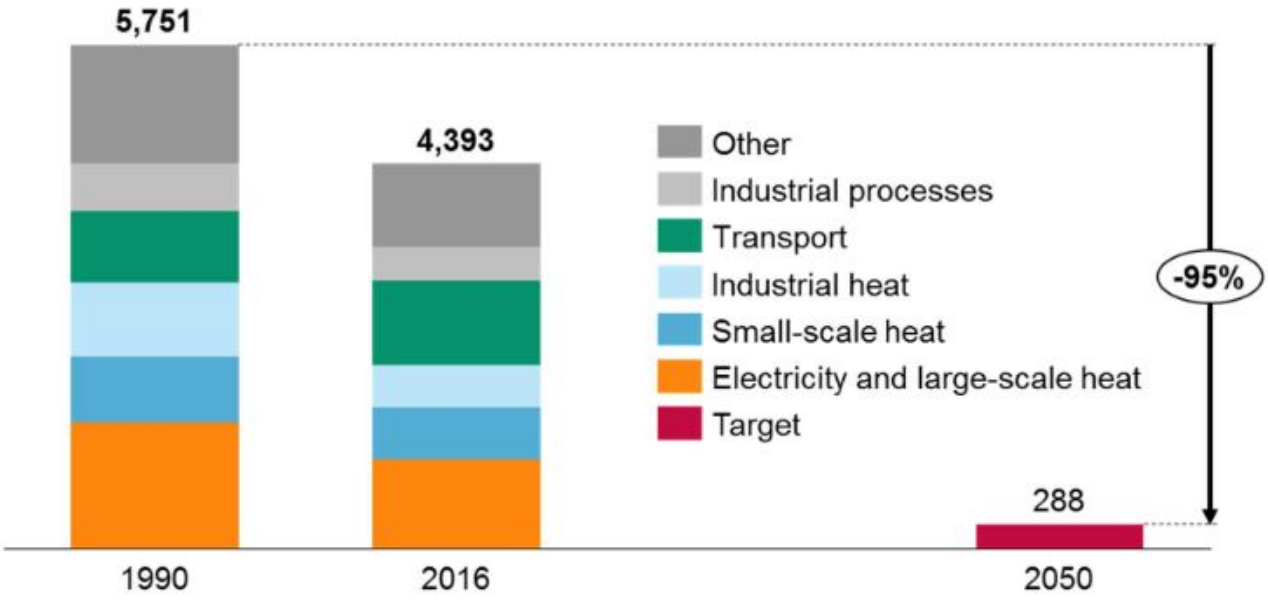

Figure 2 The scale of Europe's decarbonisation challenge – emissions by sector (MtCO2e)[2]

Hydrogen can help overcome many difficult energy challenges:

- Integrate more renewables, including by enhancing storage options & tapping their full potential
- Decarbonize hard-to-abate sectors – steel, chemicals, trucks, ships & planes
- Enhance energy security by diversifying the fuel mix & providing flexibility to balance grids

Either if there are challenges:

- costs need to fall;
- infrastructure needs to be developed;
- cleaner hydrogen is needed;
- regulatory barriers persist.[3]

A key feature of hydrogen is its ability to act as both a source of clean energy (for a variety of uses), and an energy carrier for storage. Hydrogen can be transported through existing pipelines, mixed with natural gas, and through dedicated pipelines in the future. It offers an energy storage solution that costs ten times less than batteries.

Hydrogen is already widely used for industrial purposes across the steel, petrochemical and food sectors, but it is now also being used in mobility. In the future, it could also replace natural gas to heat residential and commercial buildings. Hydrogen can also be transformed into clean electricity by injecting it into fuel cells.

The most interesting thing about hydrogen, is that it does not generate carbon dioxide emissions or other climate-changing gases, nor does it produce emissions that are harmful for humans and the environment. For this reason, it will play a key role in ensuring that European and global decarbonisation objectives are achieved by 2050.[4]

Low-carbon hydrogen from fossil fuels is produced at commercial scale today, with more plants planned. It is an opportunity to reduce emissions from refining and industry.

Figure 3 Hydrogen production with CO_2 capture is coming online[5].

[1] IEA 2019

[2] Source: 2016 National Inventory Submissions (Common Reporting Format) for EU, Norway and Switzerland Note: Transport here refers to ground-based transport. Aviation and waterborne transport are counted towards the ‘Other’ segment

[3] IEA, 2019

[4] https://www.snam.it/en/hydrogen_challenge/hydrogen_energy_transition/

[5] Keith Scott, Chapter 1: Introduction to Electrolysis, Electrolysers and Hydrogen Production, in Electrochemical Methods for Hydrogen Production, 2019, pp. 1-27 DOI: 10.1039/9781788016049-00001 eISBN: 978-1-78801-604-9