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Green or Blue Hydrogen : (much) more than a matter of colors !

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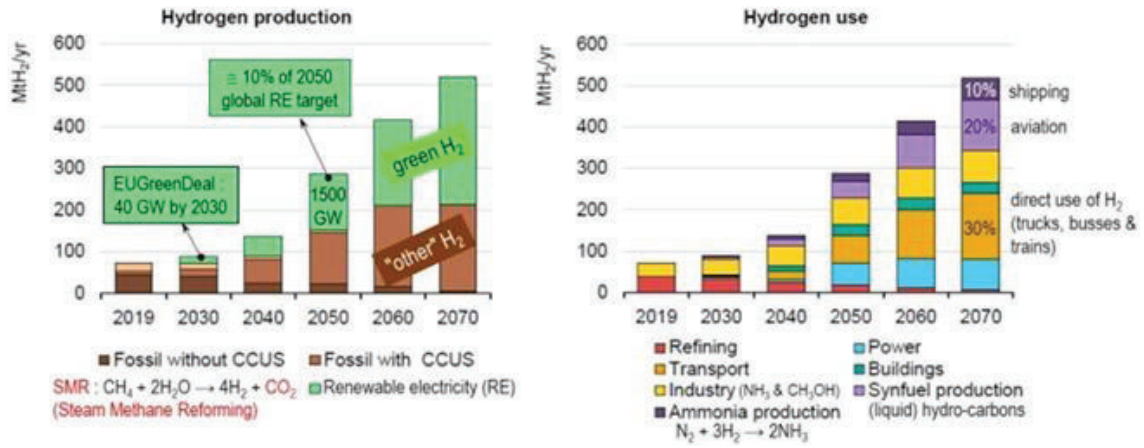
Hydrogen demand is expected to increase significantly over the coming decades. According to a recent study from the International Energy Agency (IEA) [1], a 4-5 fold increase up to 300 Mt/yr is projected for reaching climate neutrality by 2050 (cfr. Figure below). By then, the major use will shift from industry to transport, with 30% being dedicated to direct use in fuel-cell driven trucks, busses and trains, 20% to liquid hydro-carbon production as a synthetic fuel for aviation, and 10% to the production of ammonia as a shipping fuel. From 2050 onwards, a small fraction of hydrogen gas will be used in buildings and in the power sector as well.
On the production side, to satisfy this increasing H_2 demand, a massive deployment of green H_2 will be needed. By 2050, it will require a renewable electricity (RE) capacity of about 1500 GW for dedicated use in water electrolysers, representing about 10% of the total installed RE power capacity worldwide. As it is hard to imagine that more than 10% of this capacity will be dedicated for green H_2 production [2], other production routes will be needed as well as an additional source of low-carbon H_2. The majority of H_2 production today is assured by Steam Methane Reforming (SMR), a very CO_2-intensive chemical production route also called grey H_2. The initial fossil-based grey H_2 becomes blue when such SMR installations are equipped for active CO_2 capture, utilisation and/or storage (CCUS). From the Figure below, green and "other" low-carbon H_2 are expected to contribute in more or less equal parts from 2050 onwards to assure the global low-carbon H_2 production capacity. In other words, we will need both green and other low-carbon H_2 to satisfy the projected growing H_2 demand over the coming decades. If not, we may not to be able to use H_2 for some applications [3].
As a result, in order for H_2 to hold its promises towards contributing to the energy transition, critical, well-thought and strategic upfront choices will have to be made. In this paper, we will discuss and motivate a selection of applications for which either green or "other" H_2 would preferably be used, taking into account the specificities of both green and blue H_2 production.



References:
[1] International Energy Agency (IEA), Energy Technology Perspectives 2020, p. 110
[2] FCH JU, Hydrogen Roadmap Europe, a sustainable pathway for the European Energy Transition, 2019, p.23
[3] J. Proost, 2020 International Journal for Hydrogen Energy 45:17067