The promises of electrolysis

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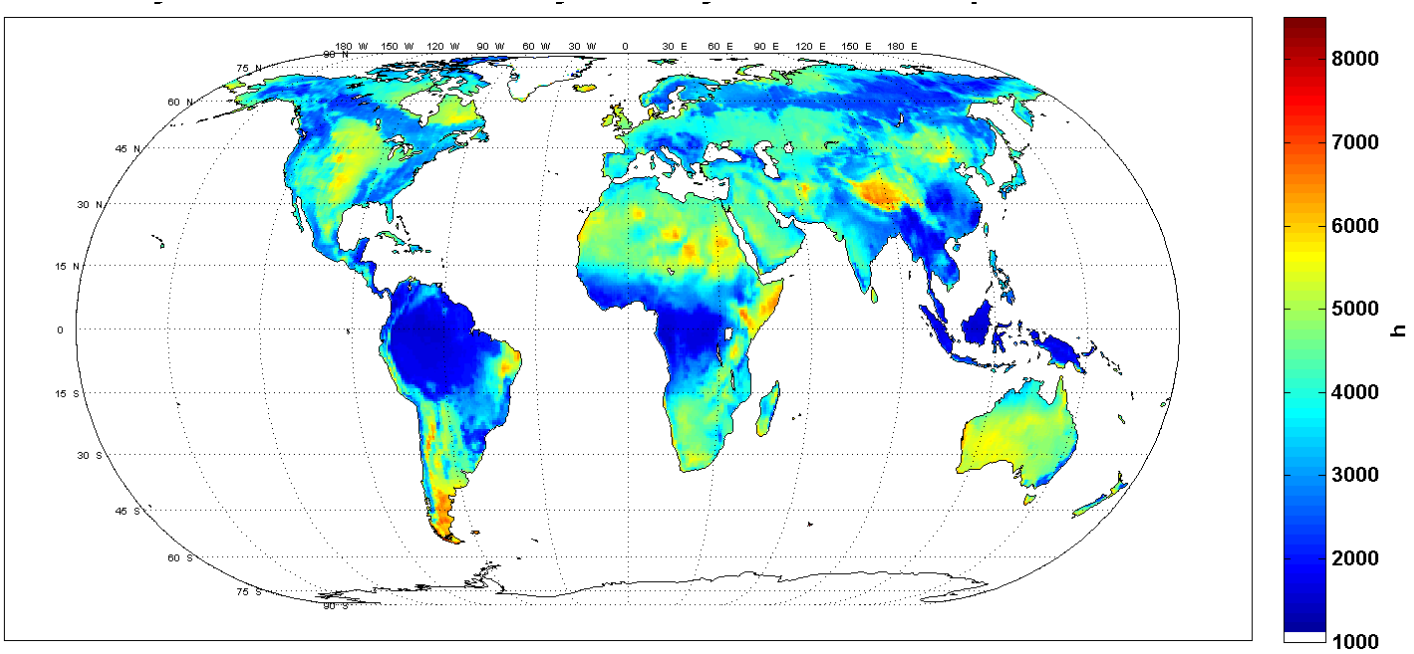
IEA

The emergence of low-cost renewable power is a game-changer

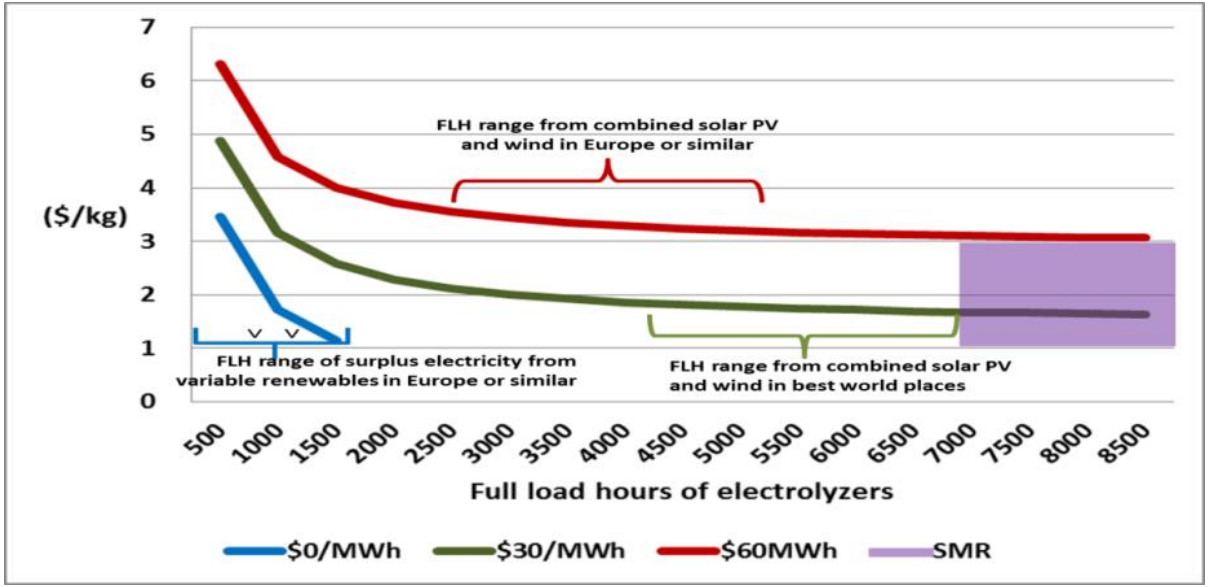
Hybrid solar and wind full load hours adjusted for overlap



Capacity factors of combined wind and power exceeds 50% in vast areas, often remote from large consumption centers, potentially delivering huge amounts of power at less than $30/MWh

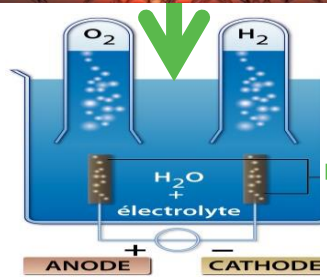
Producing renewable-based hydrogen becomes competitive

Cost of hydrogen from electrolysers at USD 450/kW Capex



With large amounts of cheap electricity from solar and wind, electrolysis of water can compete with steam methane reforming depending on gas prices

Ammonia precursor of fertilisers: a low-hanging fruit



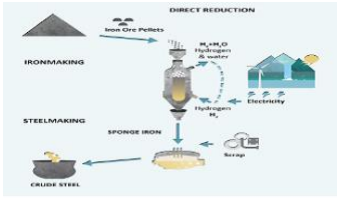
H_2

N_2

NH_3

Precursor fertilizers industry

Process agent steel industry

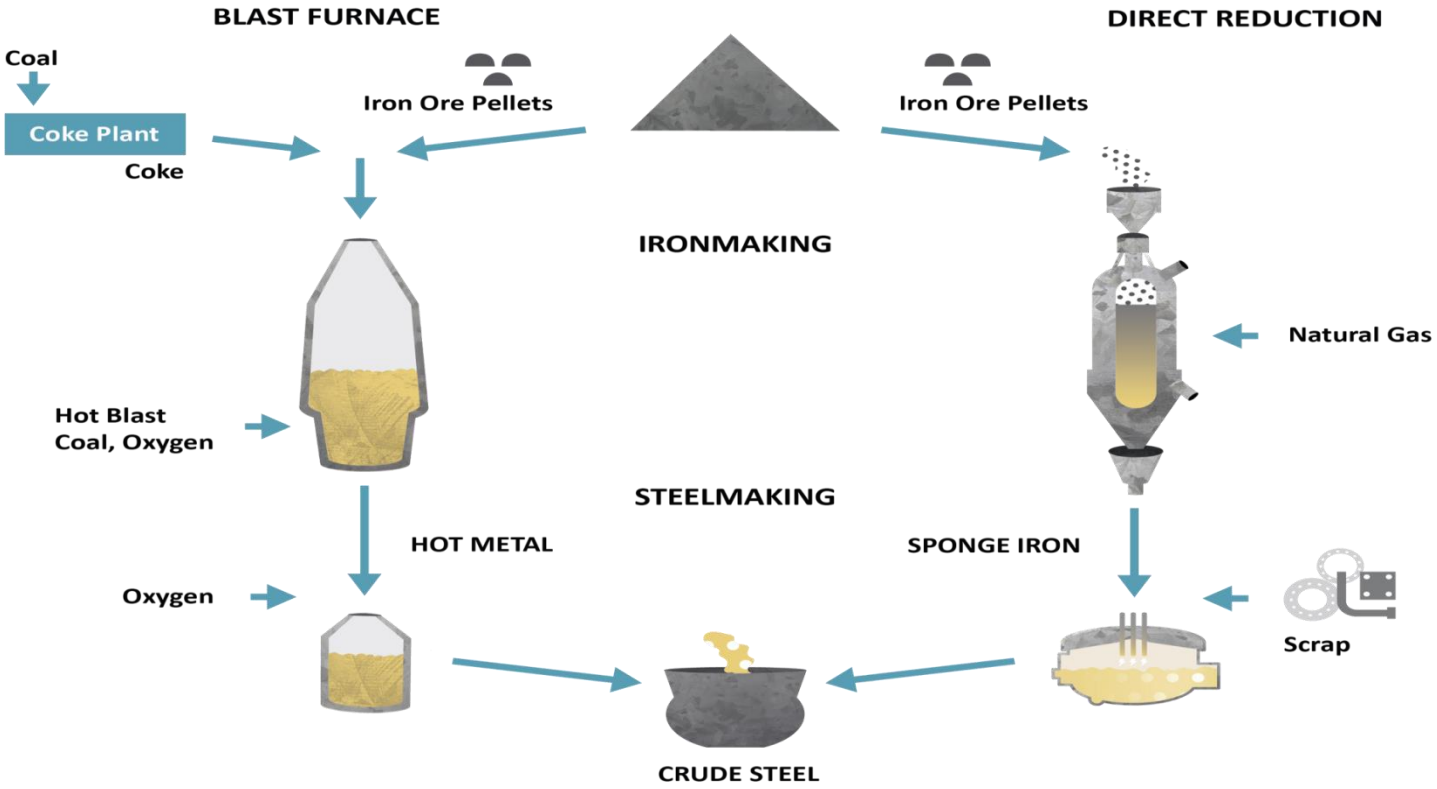


Fuel

Current and forthcoming industrial uses will initially dominate the market for green hydrogen;

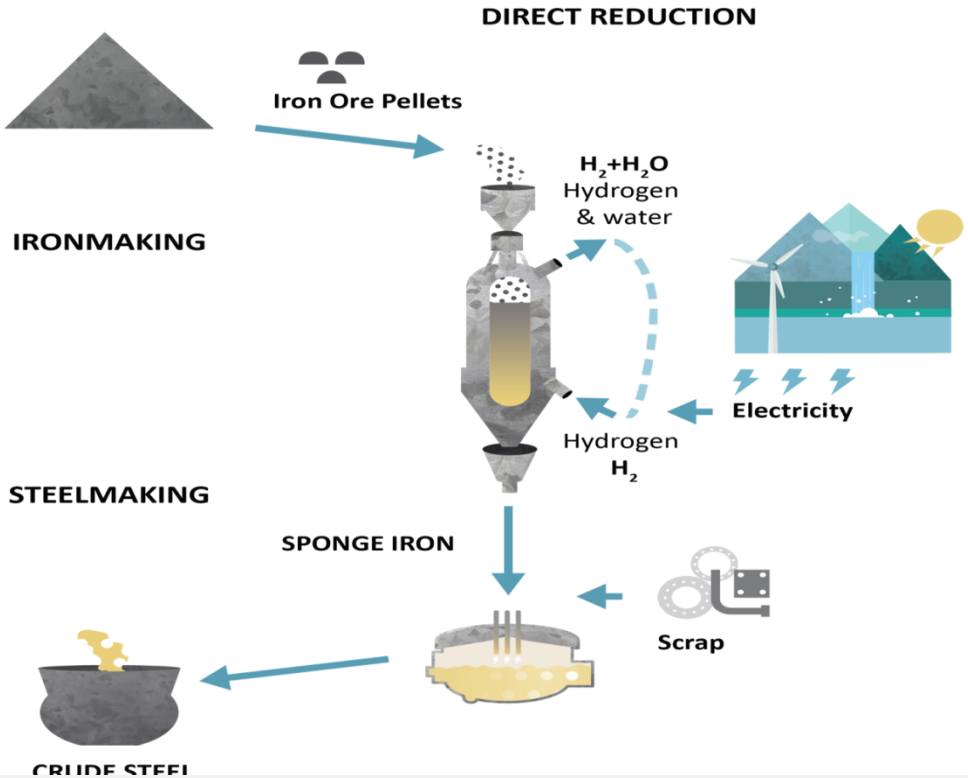
How to make green steel with renewable hydrogen

Before



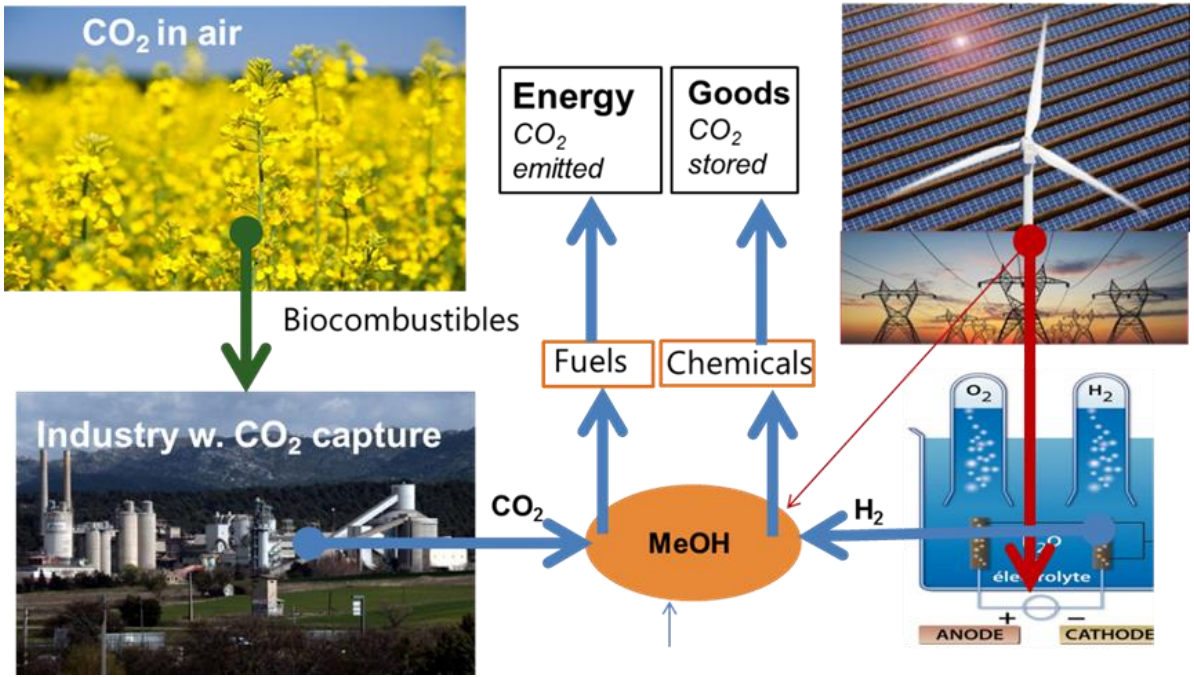
How to make green steel with renewable hydrogen

After



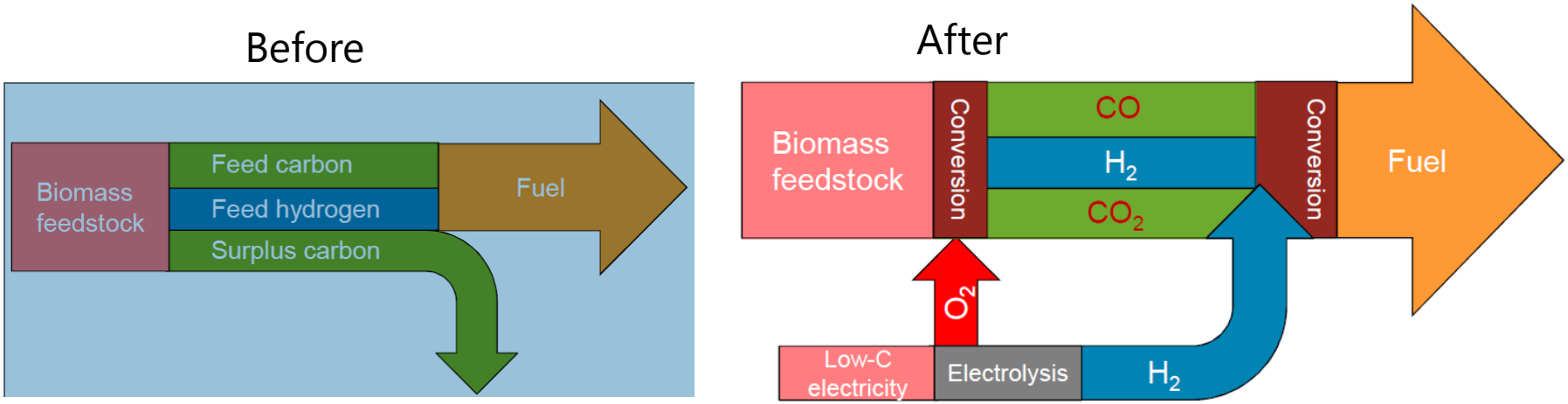
The Swedish iron and steel making industry works with Vattenfall to reduce iron ore with renewable-based hydrogen and drastically reduce process and energy-related CO_2 emissions

Renewable hydrogen can be combined with recycled CO_2



Manufacturing methanol and other hydrocarbons from renewables-based water electrolysis and recycled CO_2 would strongly reduce life-cycle CO_2 emissions and could drive negative emissions

Multiplying the use of constrained biomass feedstock

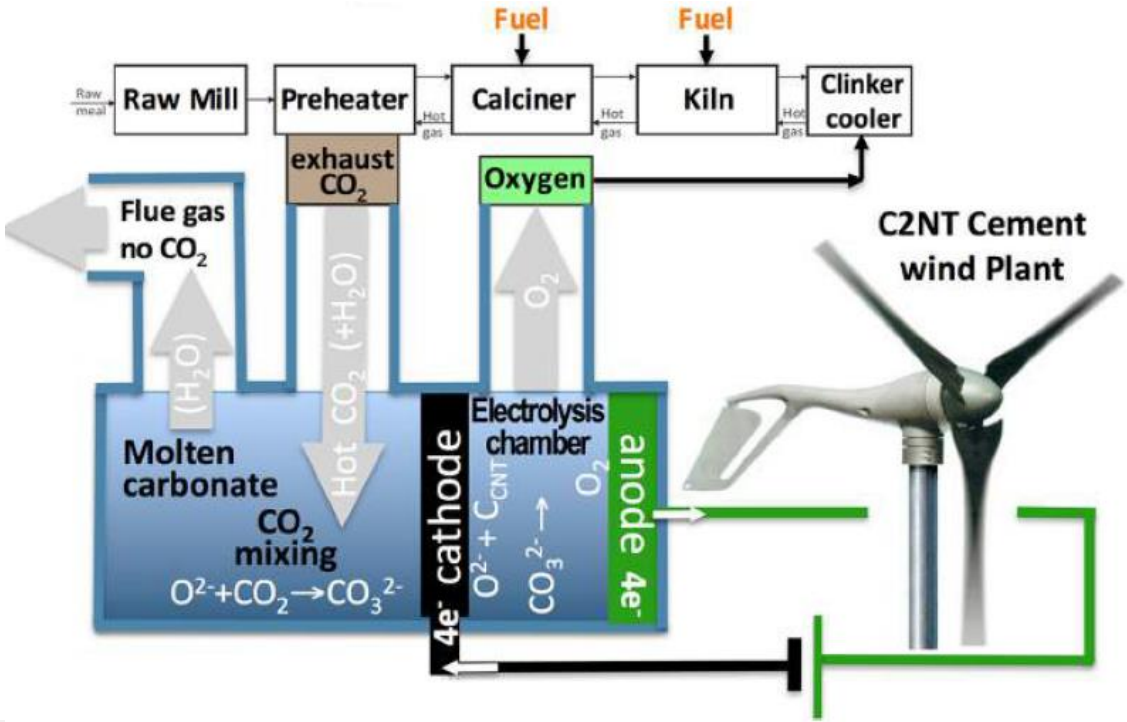


Source: Hannula, VTT, 2016

Using hydrogen and oxygen from renewable-base water electrolysis can convert CO_2 into fuel and thus increase two- to three-fold the climate-change mitigation potential of biomass

Electrolysis might allow for CO_2-free cement manufacturing

Concept scheme of co-production of cement and carbon nanotubes

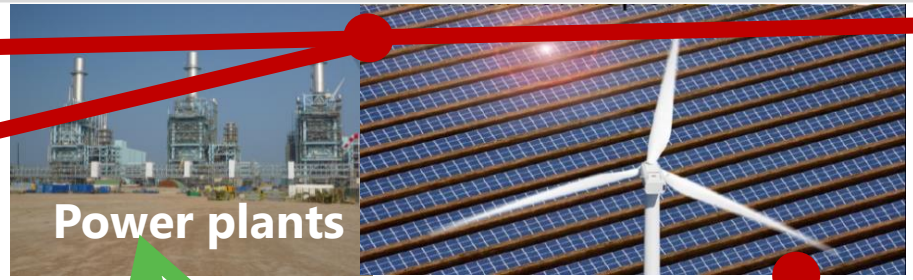


Source: Stuart Licht, Journal of CO2 utilization, 2017

Still at lab-scale, molten carbonate electrolysis run on solar and wind could be coupled with an oxyfuel cement factory and produce high-value carbon nanotubes instead of CO_2

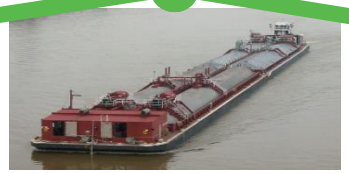
In sum, renewable power can replace fossil fuels in many uses

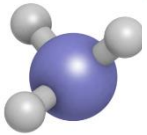
Buildings
Heating
Cooking
Lighting

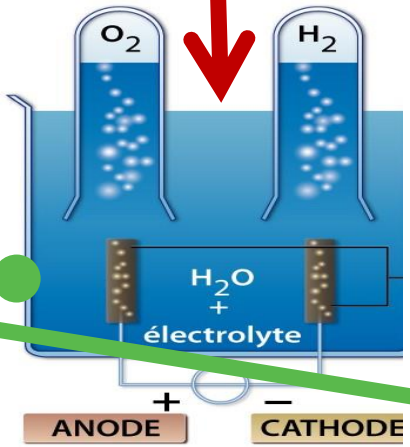


Industry
Steam
Force
Electrolysis

Transports
EVs
H-rich fuels







Feedstock, process agents, fuel

Beyond current uses, renewable electricity can replace fossil fuels in direct uses in buildings, industry and transports, directly or through electrochemistry/electrolysis