HYDROGEN FROM CHLOR-ALKALI PRODUCTION: AS GREEN AS GREEN CAN BE

euro chlor 17.
A sector group of Cefic

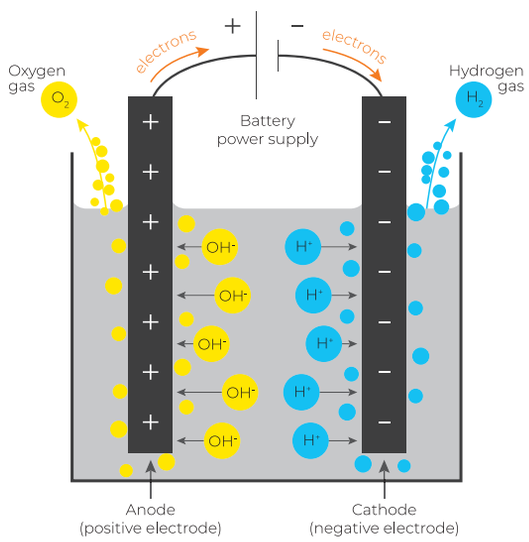
Electrolysis makes use of electricity to split molecules

Hydrogen is considered as green when climate neutral electricity is used during electrolysis.
When using climate neutral electricity within chlor-alkali production, green hydrogen is produced as a by-product.
The climate neutrality of the electricity used determines the carbon footprint of the hydrogen.

Water electrolyser

$2\ H_2O \rightarrow 2H_2 + O_2$

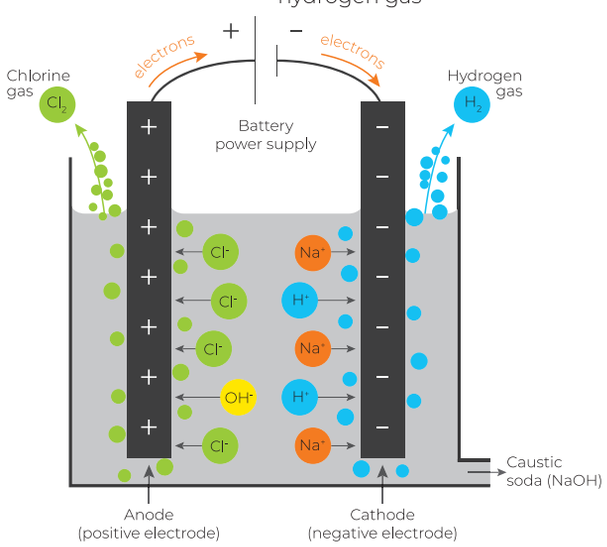
water → hydrogen gas + oxygen gas



Chlor-alkali electrolyser

$2\ NaCl + 2\ H_2O \rightarrow 2\ NaOH + H_2 + Cl_2$

kitchen salt + water → caustic soda + chlorine gas + hydrogen gas



How much electricity is needed to produce 1kg of hydrogen?

1kg of hydrogen required 60kWh of electricity

9kg water → 1kg hydrogen + 8kg oxygen

Process needs 60kWh/all products or 60kWh/kg H_2
(Oxygen is not used)

1kg of hydrogen required 1.3kWh of electricity

58.5kg salt + 18kg water → 1kg hydrogen + 35.5kg chlorine + 40kg caustic soda

Process needs 97kWh/all products or 1.3kWh/kg H_2

How does hydrogen score in terms of carbon neutrality?

Electricity based on 50% renewable energy (0g CO_2/kWh) + 50% average EU-27 electricity mix (in 2019, 275g CO_2/kWh)

60kWh/kg H_2
8.8kg CO_2 emission/kg hydrogen

1.3kWh/kg H_2
0.2kg CO_2 emission/kg hydrogen

Electricity based on 100% renewable energy (0g CO_2/kWh)

60kWh/kg H_2
0kg CO_2 emission/kg hydrogen

1.3kWh/kg H_2
0kg CO_2 emission/kg hydrogen

Electricity based on 98% renewable energy + 2% average EU electricity mix

60kWh/kg H_2
0.35kg CO_2 emission/kg hydrogen

Electricity based on 100% average EU electricity mix

1.3kWh/kg H_2
0.35kg CO_2 emission/kg hydrogen

Hydrogen is obtained as a by-product in chlor-alkali production, the starting point of many value chains (in health protection, construction, green energy devices, digital devices, etc.)

Hydrogen from chlor-alkali electrolysis scores even better in being carbon neutral than water electrolysis, so certainly deserves to be classified as green.

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