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**

\[ 2 \text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2 \]

water $\rightarrow$ hydrogen gas + oxygen gas

**Chlor-alkali electrolyser**

\[ 2 \text{NaCl} + 2 \text{H}_2\text{O} \rightarrow 2 \text{NaOH} + \text{H}_2 + \text{Cl}_2 \]

kitchen salt + water $\rightarrow$ caustic soda + chlorine gas + hydrogen gas

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

- 1kg of hydrogen required 60kWh of electricity
- 9kg water $\rightarrow$ 1kg hydrogen + 8kg oxygen

Process needs 60kWh/all products or 60kWh/kg H₂

(Oxygen is not used)

**How does hydrogen score in terms of carbon neutrality?**

- **Electricity based on 50% renewable energy (0g CO₂/kWh) + 50% average EU-27 electricity mix (in 2019, 275g CO₂/kWh)**
  - 60kWh/kg H₂
  - 8.8kg CO₂ emission/kg hydrogen
  - 1.3kWh/kg H₂
  - 0.2kg CO₂ emission/kg hydrogen

- **Electricity based on 100% renewable energy (0g CO₂/kWh)**
  - 60kWh/kg H₂
  - 0kg CO₂ emission/kg hydrogen
  - 1.3kWh/kg H₂
  - 0kg CO₂ emission/kg hydrogen

- **Electricity based on 98% renewable energy + 2% average EU electricity mix**
  - 60kWh/kg H₂
  - 0.35kg CO₂ emission/kg hydrogen
  - 1.3kWh/kg H₂
  - 0.35kg CO₂ emission/kg hydrogen

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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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