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Hydrogen

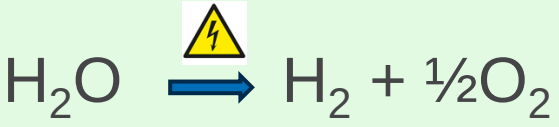
The most abundant element in the universe…

3rd most abundant on Earth

”No” natural hydrogen

H_2 needs to be produced, currently almost exclusivly from fossil fuels.

-> Electrolysis



$$H_2O \rightarrow H_2 + \tfrac{1}{2}O_2$$

Green hydrogen

Targets Elektrolysis:

EU: 100 GW (2030)

Sweden: 5 GW (2030) 15 GW(2045)

Finland: 12 GW (2030)

Denmark: ~5 GW (2030)

2030:

4 years, 11 month, 8 days, 8 hours

Forsmark Nuclear Plant:

(3 reactors) ~3.2 GW

Olkiluoto Nuclear Plant:

(3 reactors) ~3 GW

Vattenfall/TVO

Sweden: 5500 Windturbines

Installed Power 16.2 GW

Avg. Power 3.9 GW

Energimyndigheten 2023

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Electrolysis techniques

	Alkaline Water Electrolysis (AWE)	Proton Exchange Membrane Water Electrolysis (PEMWE)	Solid Oxide Electrolysis (SOEC)
Maturity			
Efficiency			
Responsiveness			

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Based on C. Bernuy Lopez (H2 Green Steel)

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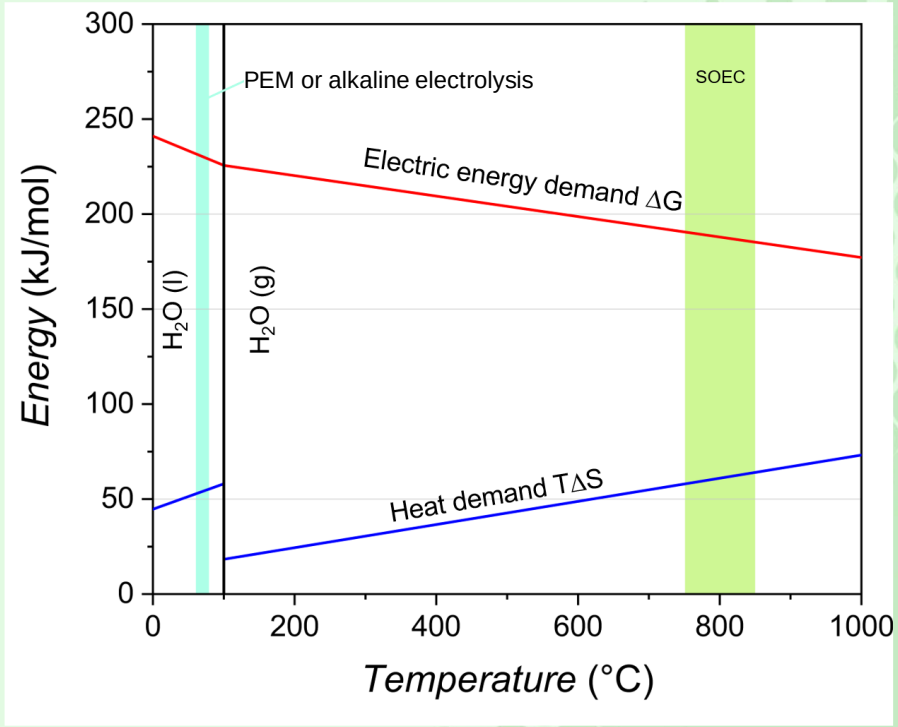
Proton exchange membrane Electrolysis (PEMWE) has unmatched flexbility and thus most suitable to accomodate load balancing.

Solid Oxide Electrolysis (SOEC) needs ~20% less electricty*.

*when heat/steam is available



After: Laguna et al.

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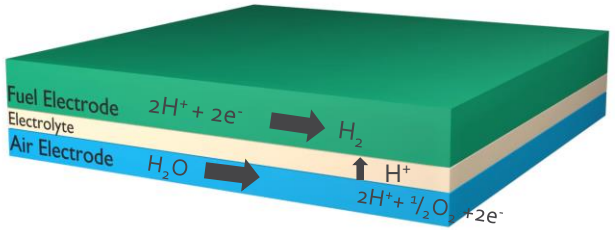
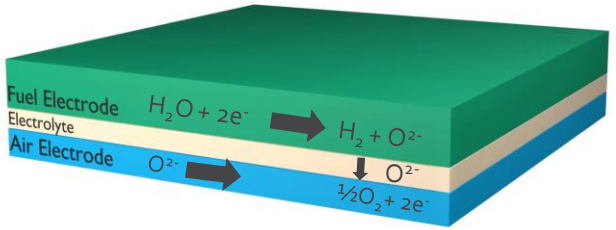
Interconnects/Bipolar plates



PEMWE

T ~ 80°C



SOEC

T = 600-900°C

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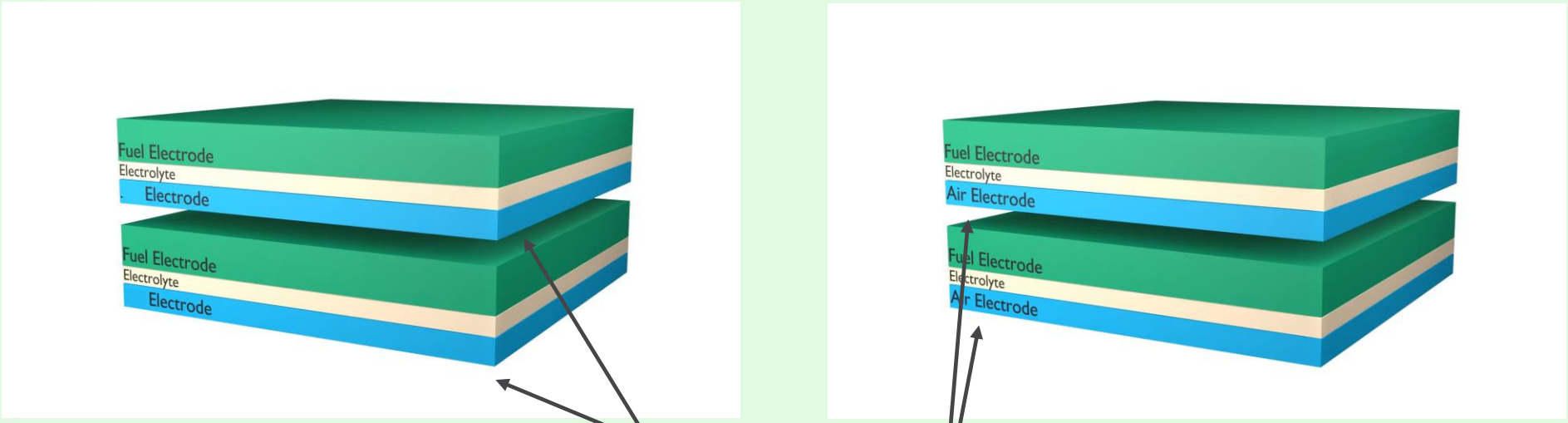
Interconnects/Bipolar plates



PEMWE

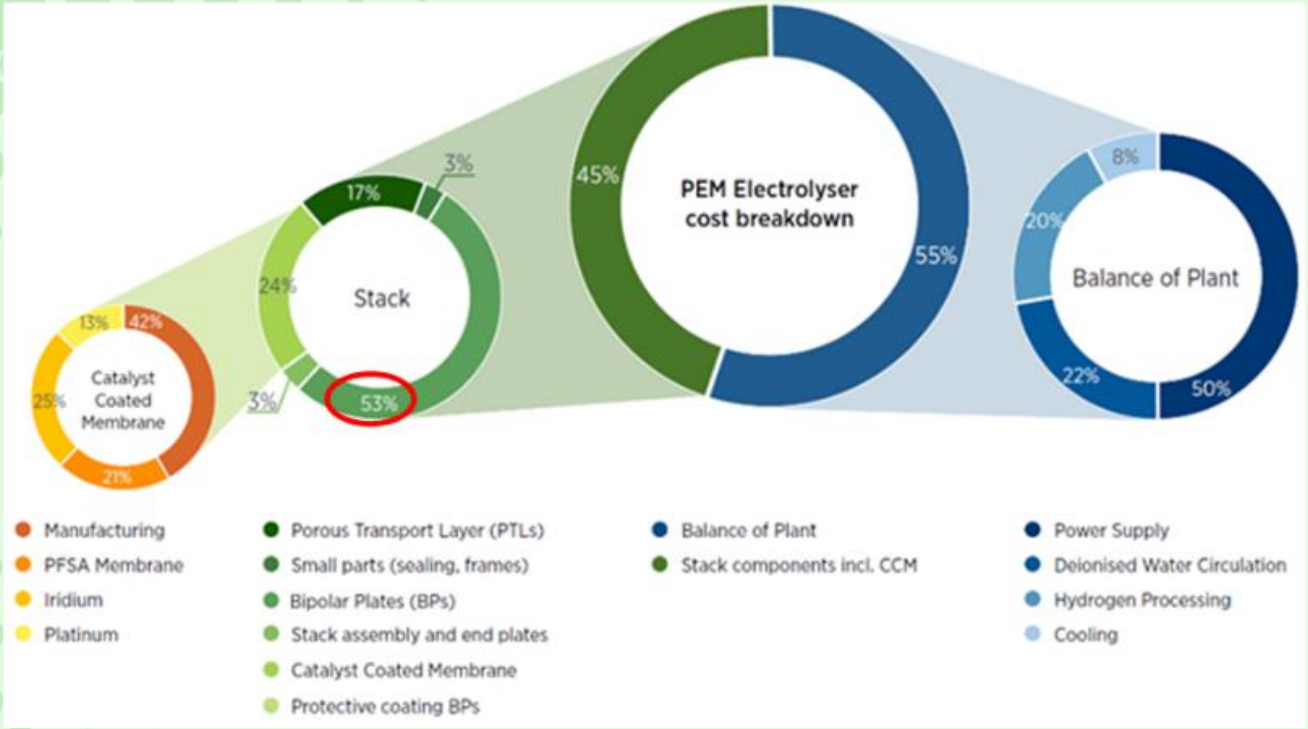
T ~ 80°C

Bipolar plate

Interconnect

SOEC

T = 600-900°C



Cost breakdown of a 1 MW PEM electrolyser system based on IRENA analysis.

Replace Pt coated Ti with stainless steel bipolar plates

Develop protective coatings for SOEC interconnects

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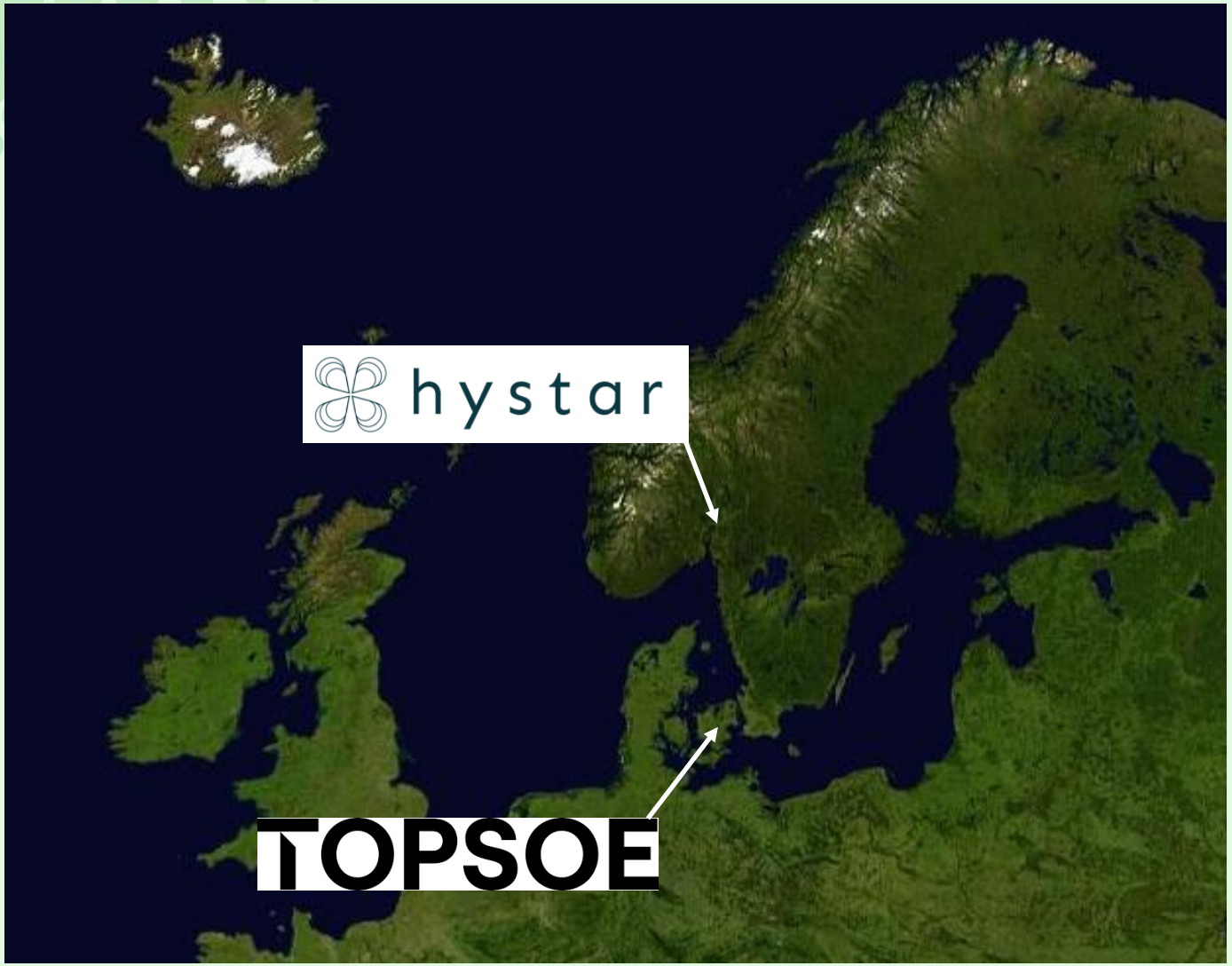

Largest SOEC factory in the world, Herning DK

-> Tobias Holt, tomorrow ~9:10

July 2025, Stockholm:
The largest conference on SOC technology in the world

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