

Scaling from lab to prototype - the role of the supply chain



Power Electronics & Energy Storage event
27 juni 2023 | 1931 Congrescentrum 's-Hertogenbosch

ENERGY STORAGE

A graphic element on the right side of the slide. It consists of a horizontal line that transitions into a series of green lines that fan out to the right, ending in several small green plus signs. The text "ENERGY STORAGE" is positioned above this graphic.

A net zero energy system needs both green electrons & molecules



We need deep electrification to minimize losses



Batteries needed for deep electrification




We need green H₂ for the applications we cannot electrify



Affordable Green H₂ is needed to sustain welfare


Battolyser® is the only EU compliant electrolyser technology

Embedded in policy

Renewable Energy Directive

Limiting policy requirement:
 Hourly temporal correlation required for producing *renewable hydrogen* and claim EU subsidies/credits.



First proposal: Q1 2023

Net Zero Industry Act

Limiting policy requirement:
 At least 40% of all hydrogen consumed in EU need to be produced by electrolysers manufactured in the EU





First proposal: Q1 2023


Critical Raw Materials Act

Limiting policy requirement:
 Max. 65% of strategic raw materials across electrolyser value chain sourced from one non-EU nation


AEL, PEM, SOEC


 Hourly temporal correlation requires flexibility that AEL & SOEC technologies cannot meet


 Limited EU manufacturing capacities except for AEL, no existing NL manufacturing capacity

 PEM and SOEC need PFAS-based materials & Iridium, Platinum and Yttria (highly China dependent); some AEL use critical raw materials (e.g. Roderium and Class 1 Ni)

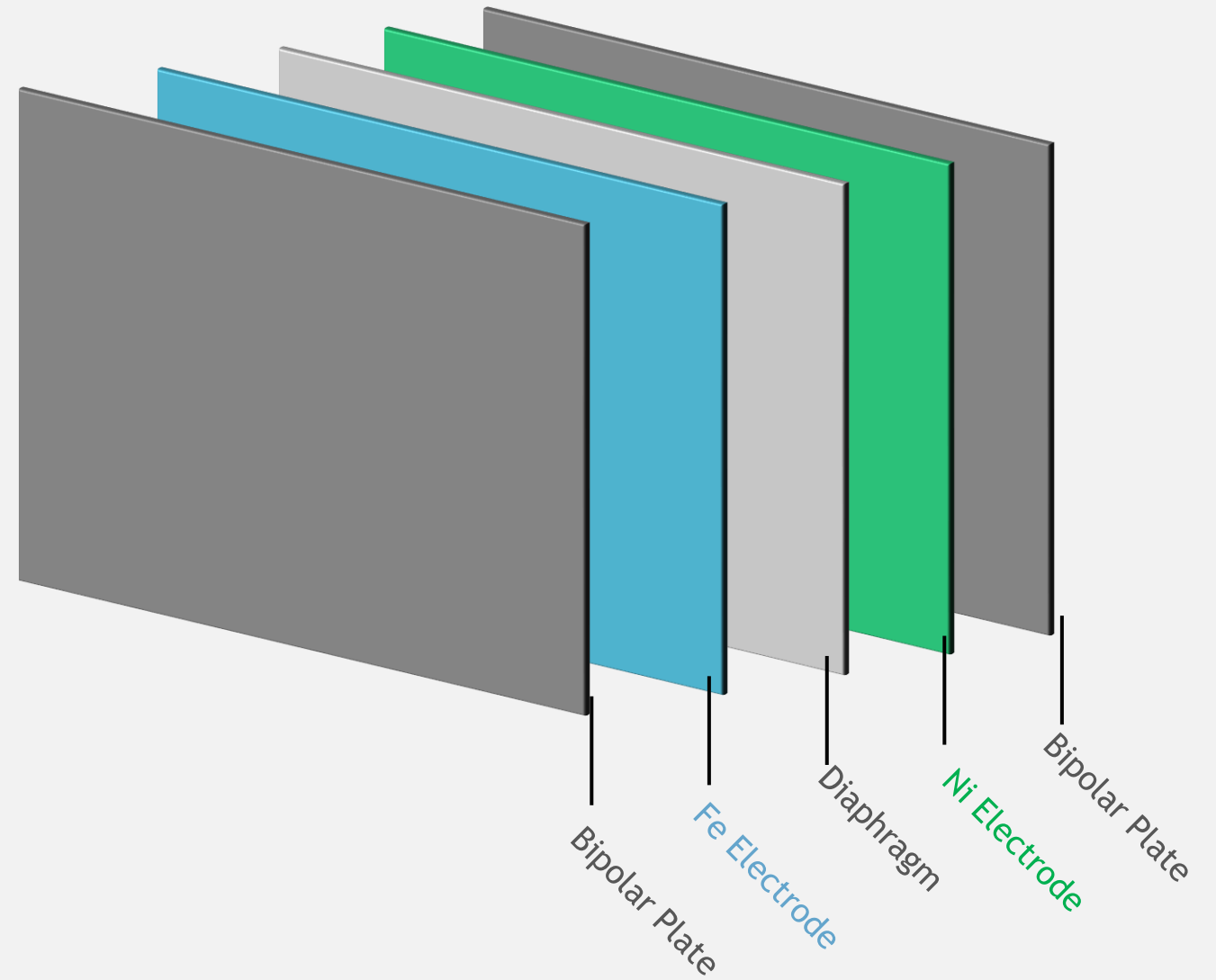
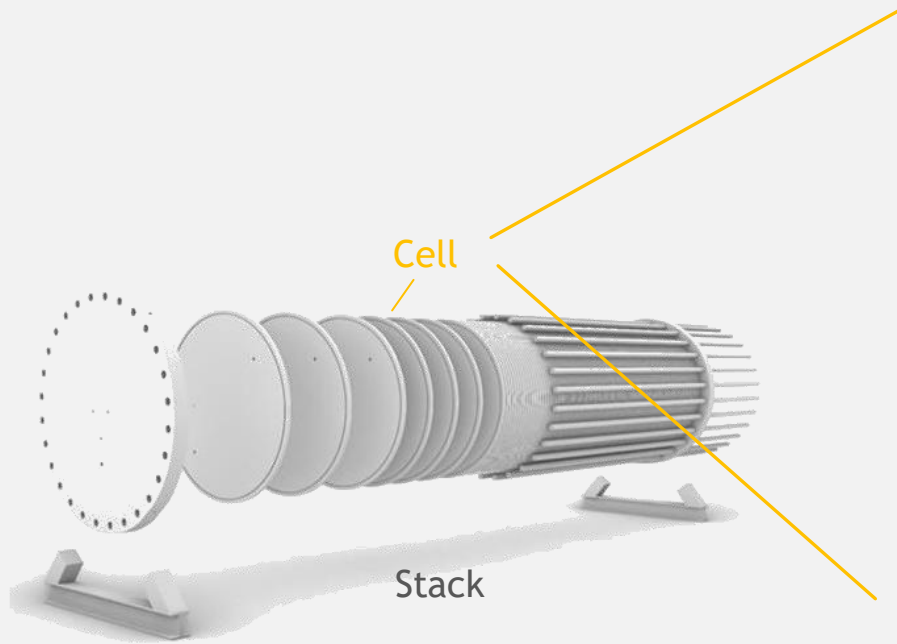


 Ability to start/stop each hour to produce fully green H2, and even sell power when prices are high

 First manufacturing capacity in NL

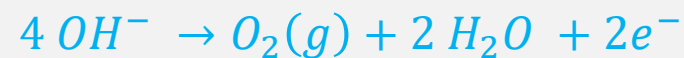
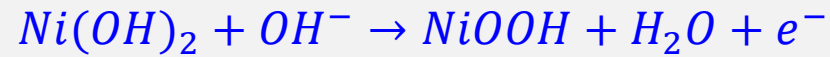
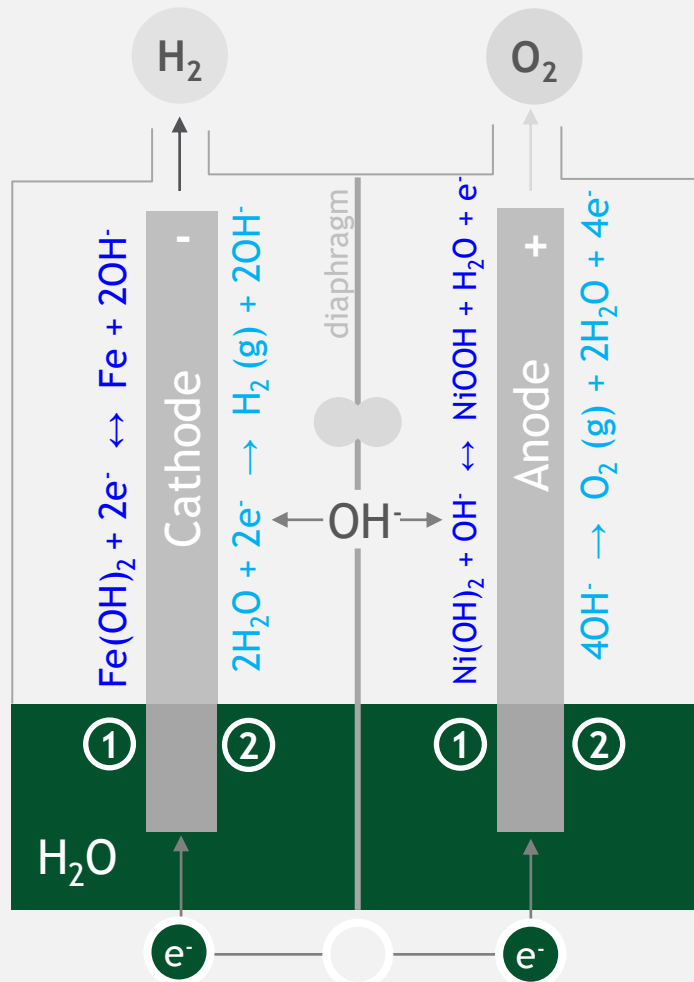
 No critical raw materials, no PFAS

The science...



The science

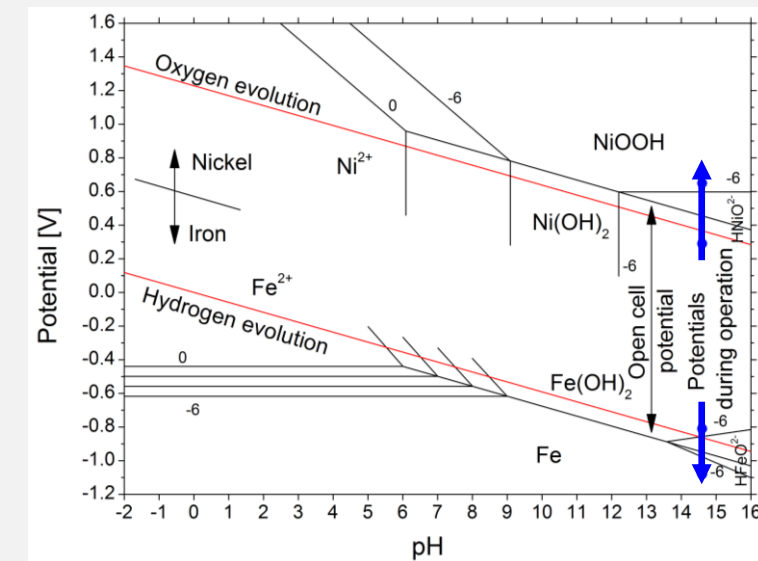
Charging (storing energy in the form of electrons)



Oxidation of Ni phase, reduction of Fe phase → cell potential window wide enough to include both HER and OER

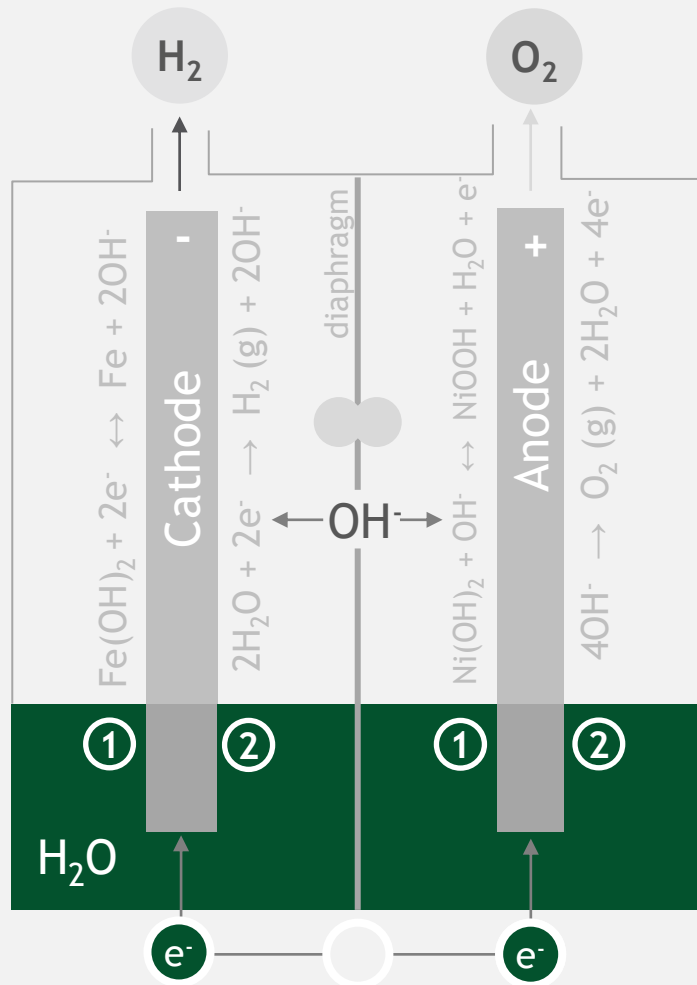
Hydrogen Evolution Reaction (HER)

Oxygen Evolution Reaction (OER)



Source: Battolyser Systems analysis, Battolyser Systems data

The science



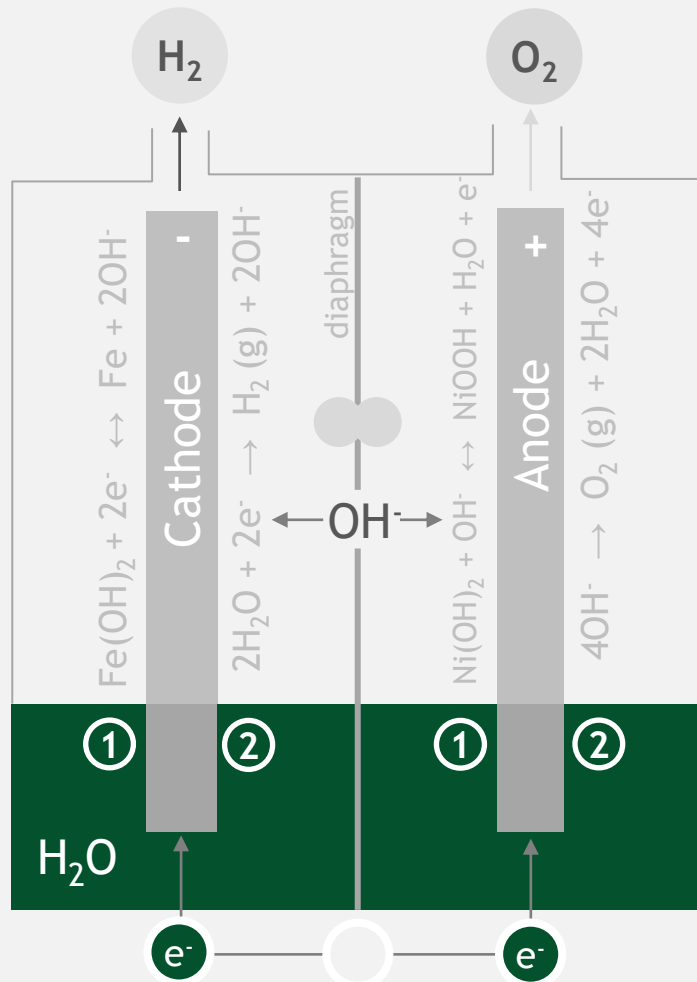
How does it work?

- 1 In a first electrochemical reaction, the electrodes are charged and store electrons
- 2 When overcharged, hydrogen and oxygen are formed in a subsequent reaction

Cheap renewable energy stored in electrons and molecules!

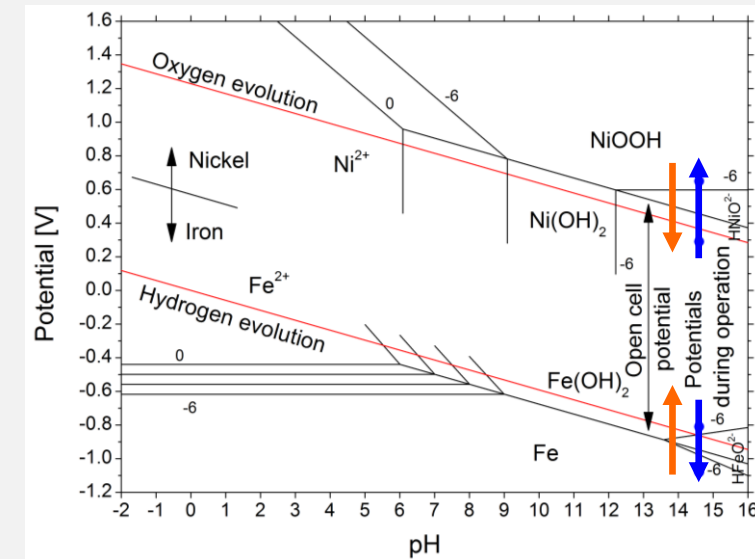
The science

Discharging (when electricity price is high)



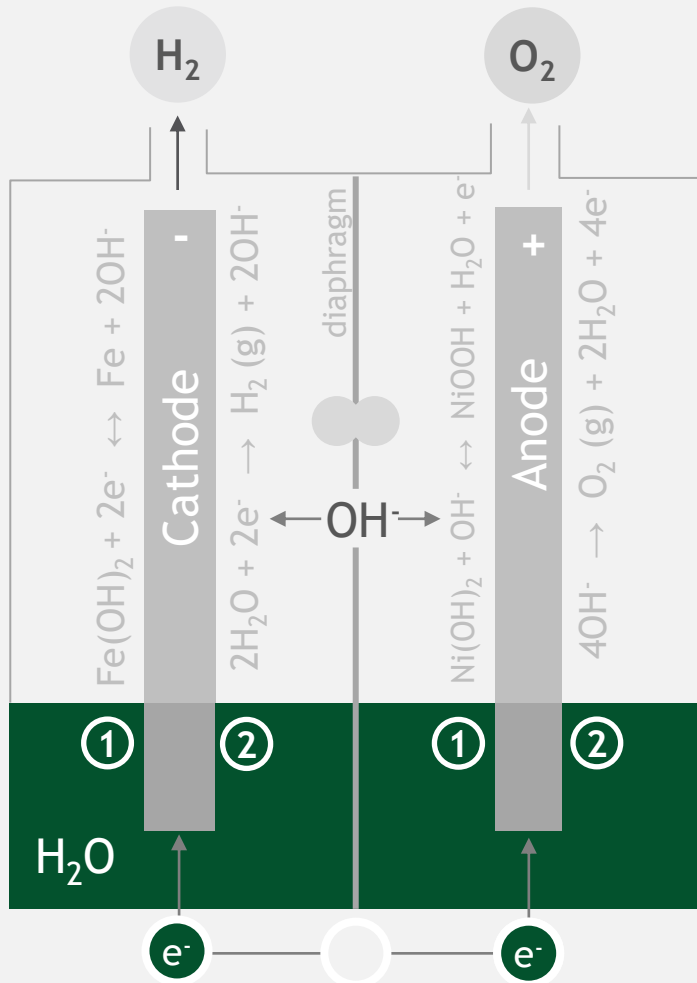
Battery function assists in ‘cleaning up’ the system when not producing hydrogen - essential for intermittency

Change in potential also allows recombination reactions to happen



Source: Battolyser Systems analysis, Battolyser Systems data

Battolyser is the next generation electrolyser..



How does it work?

- 1** In a first electrochemical reaction, the electrodes are charged and store electrons
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Advantages of the technology

	Flexible	Battolyser can instantly switch back and forth between charging and discharging (no crossover)
	Efficient	Stack is 80-90% energy efficient thereby using less electricity
	Sustainable	Technology is using only abundant active materials - i.e., Nickel (Class 2) and Iron - largely abundant
	Robust	Battery allows deep discharging and no risk of overcharging (electrolysis) with little-to-no degradation allowing a long lifetime
	Versatile	System can arbitrage between power and hydrogen markets

Next steps



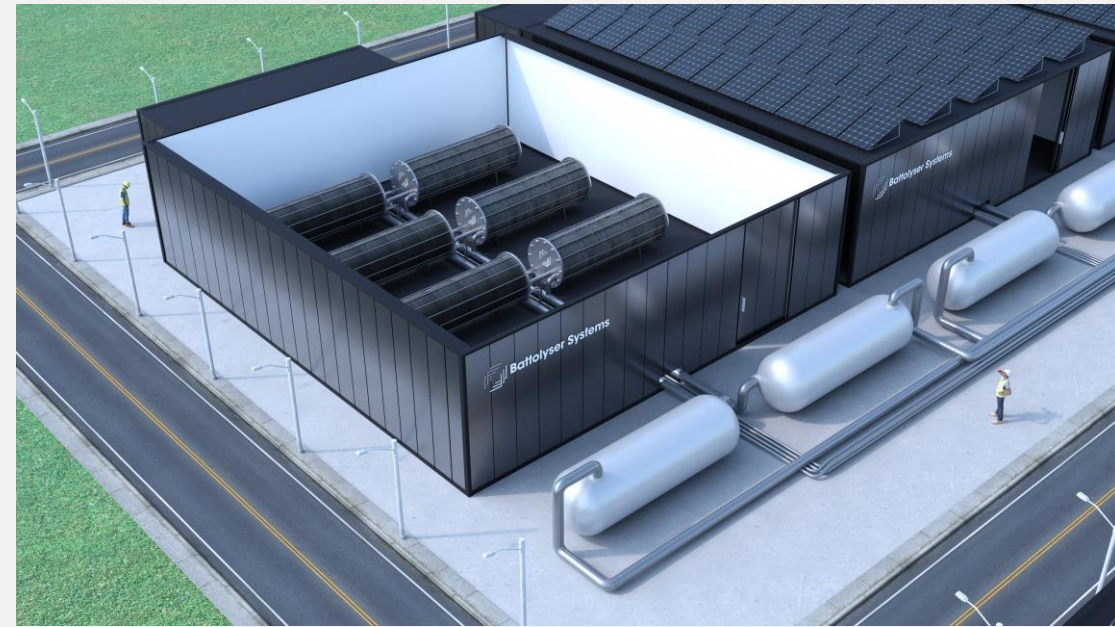
BL250 - ready 2024

- Prototype unit
- 1 MW system (250 kW/stack)
- Skid based
- Stack and system design in house
- Stack assembly in house
- Components and system manufacturing with partners

Next steps

Automated assembly

- Currently manual stacking process
- With partners developed into automated line



BL1000 - 2025

- Commercial unit
- 1 MW/stack)
- Stick based
- Stack design and assembly in house
- System design and integration: EPC
- **Components and system manufacturing with partners**

Questions?



Battolysers Systems

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