
elestor
electricity storage at an
unrivalled cost level

Launching a technology

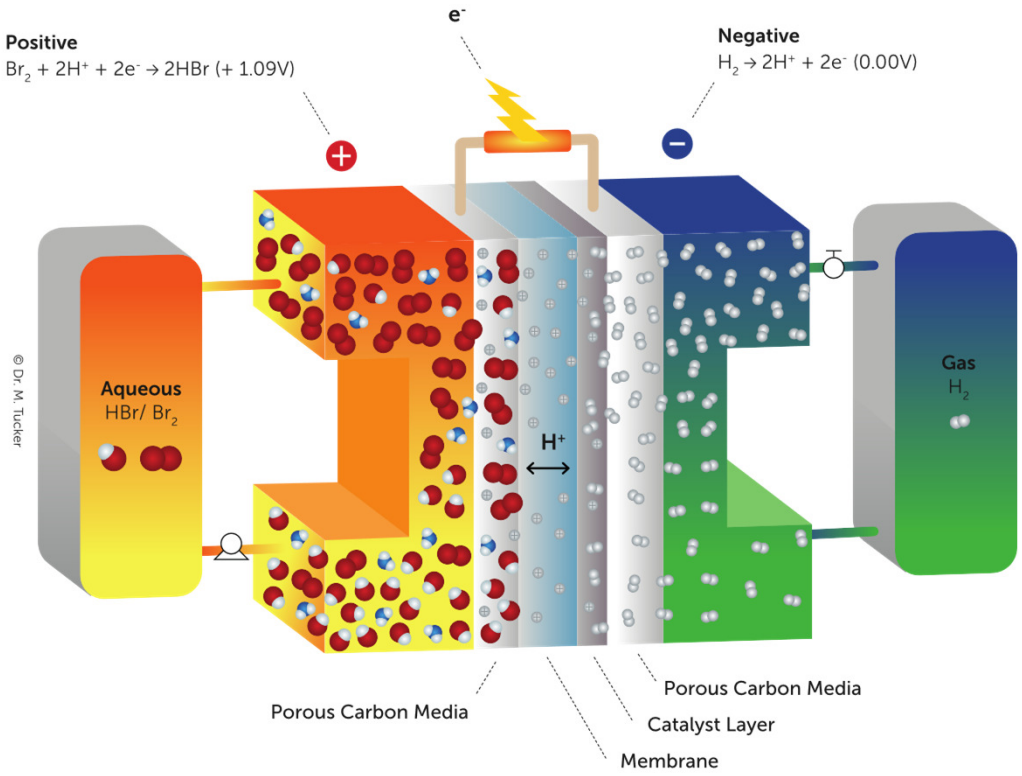
- For large scale, stationary electricity storage
- Applications:
  - Combined with large PV and Wind
  - Substitute for peaking power plants
  - Connection with hydrogen
- Fully modular, up to GW/GWh range
- Based on:
  - Flow battery technology
  - Active materials: Hydrogen & Bromine
- Patented worldwide

ELESTOR'S MISSION:

Targeting the lowest possible storage costs per MWh

elestor

Technology: Combined Electrolyser and Fuel Cell



discharge: fuel cell

$$H_2 + Br_2 \rightleftharpoons 2HBr + \text{Electrical energy}$$

charge: electrolyser

Power and Capacity are not coupled

- Membrane surface area → Power [MW]
- Active material volumes → Capacity [MWh]

Virtually every thinkable combination is possible

100% reversible chemical reaction

- Chemicals are used, not consumed
- No refill during lifetime necessary
- Negligible loss of capacity during lifetime

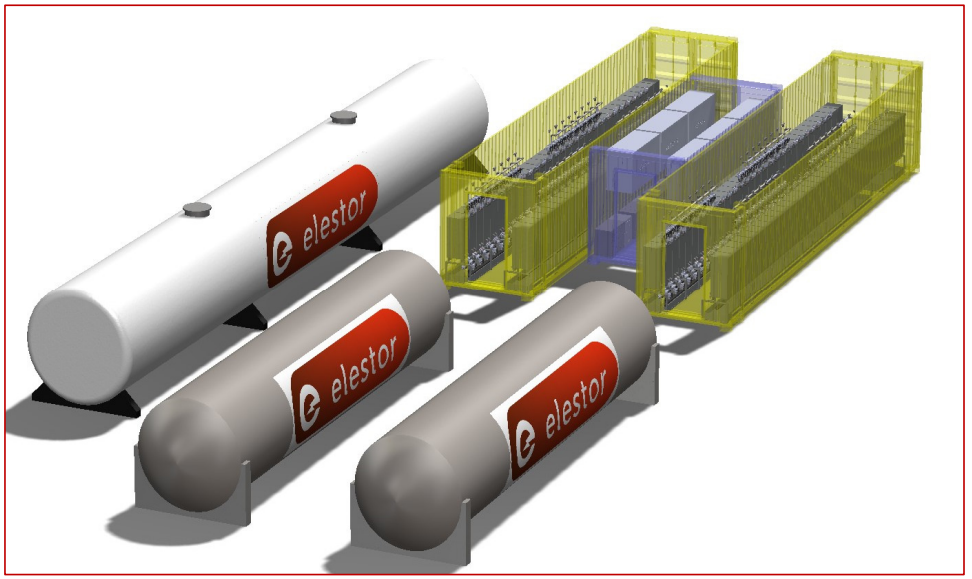
FACT:

Reduces the LCoS to
< € 50 / MWh

elestor

100% selfcontained: Nothing goes in or out… except electricity !

50kW/250kWh HBr Flow Battery system

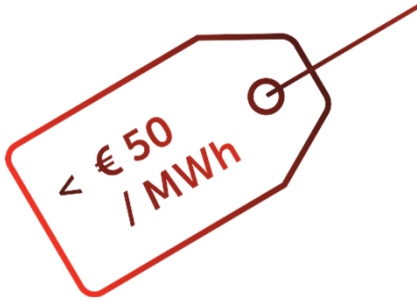


1 MW/10MWh HBr Flow Battery system
(artist impression)

Triple cost reduction strategy

1. The Flow Battery concept

- Power (kW) and Capacity (MWh) not coupled
- Long lifetime, 10,000 cycles
- No fundamental degradation
- Lifetime not related to ‘Depth of Discharge’
- No self-discharge
- Upgradable, servicable
- Ultra short reaction times
- High power density



2. The choice for hydrogen & bromine

- Abundant, global available > low cost
- Can be fully recycled, ‘cradle-2-cradle’
- Safety assured

ICL Industrial Products
Where needs take us

3. Elestor’s patented system design

- Simplified and robust
- Easy to manufacture, in very large quantities

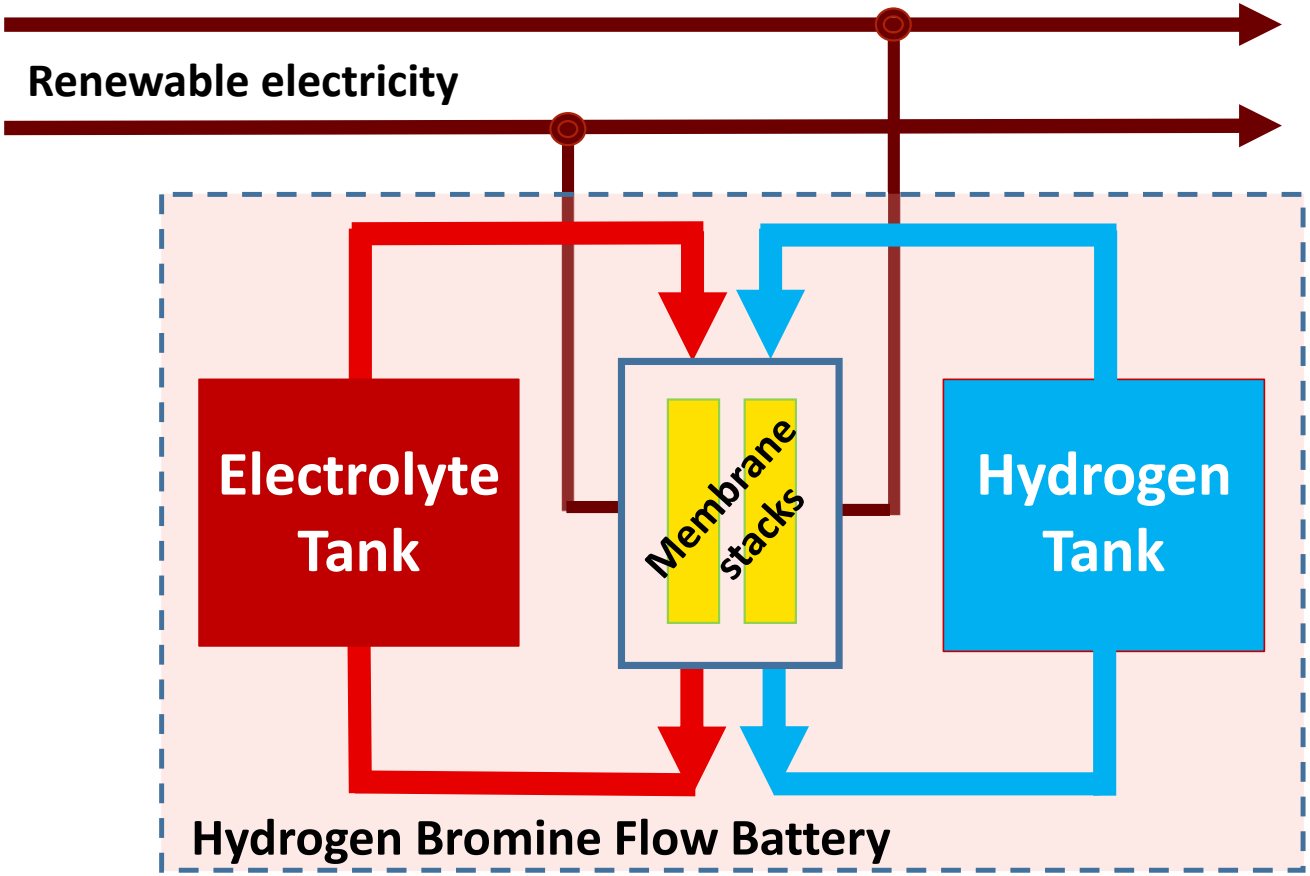
elestor

The Hydrogen Bromine Flow Battery connects

Electricity Storage

Hydrogen Infrastructures

elestor

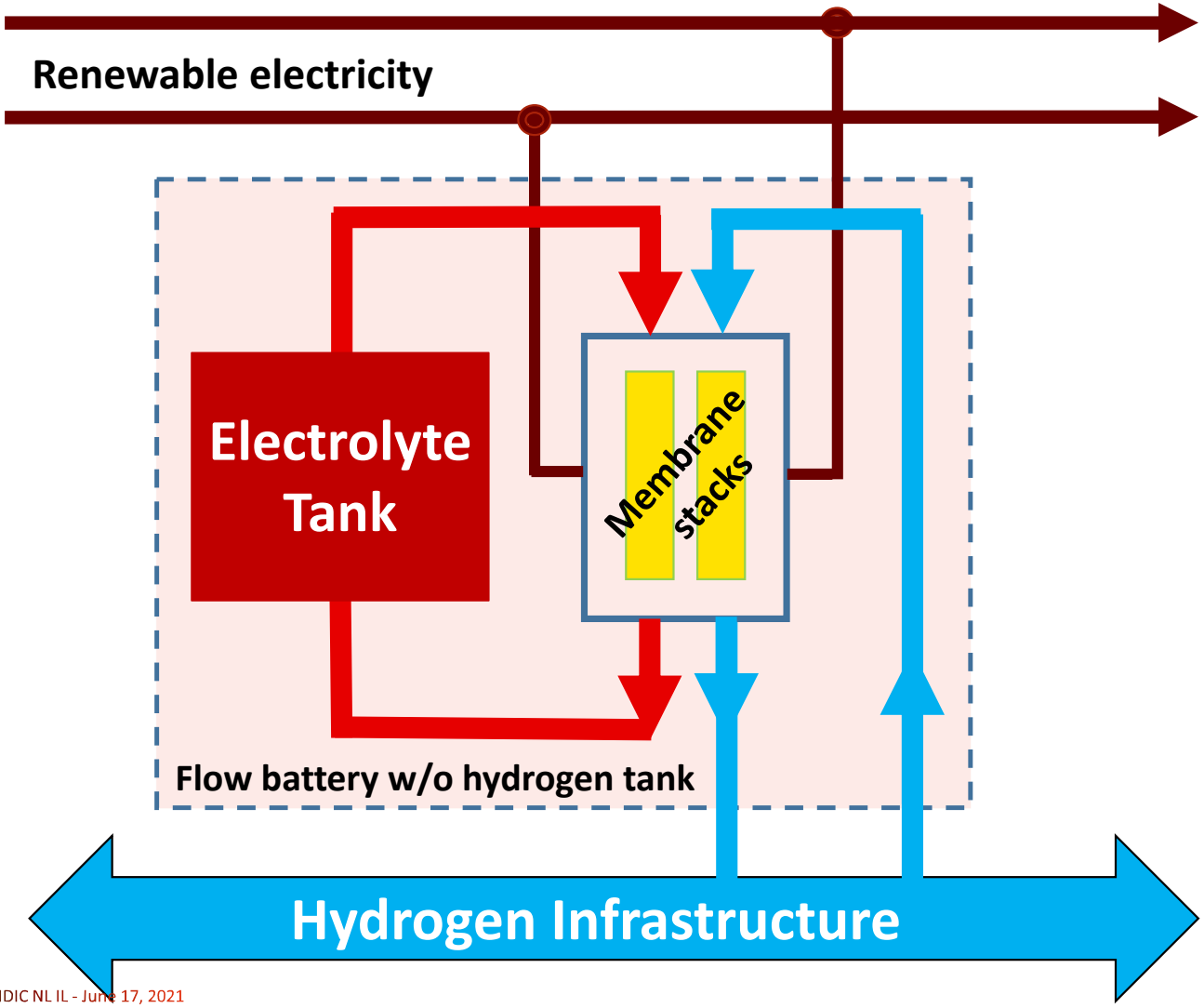


✓ **Electricity storage** based on Hydrogen Bromine Flow Battery technology

✓ **Consists of**
- Electrolyte tank
- Hydrogen tank
- Membrane stacks

✓ **Enables** electricity storage at very low cost (LCoS)

elestor



✓ **Connects**
electricity storage with hydrogen infrastructures

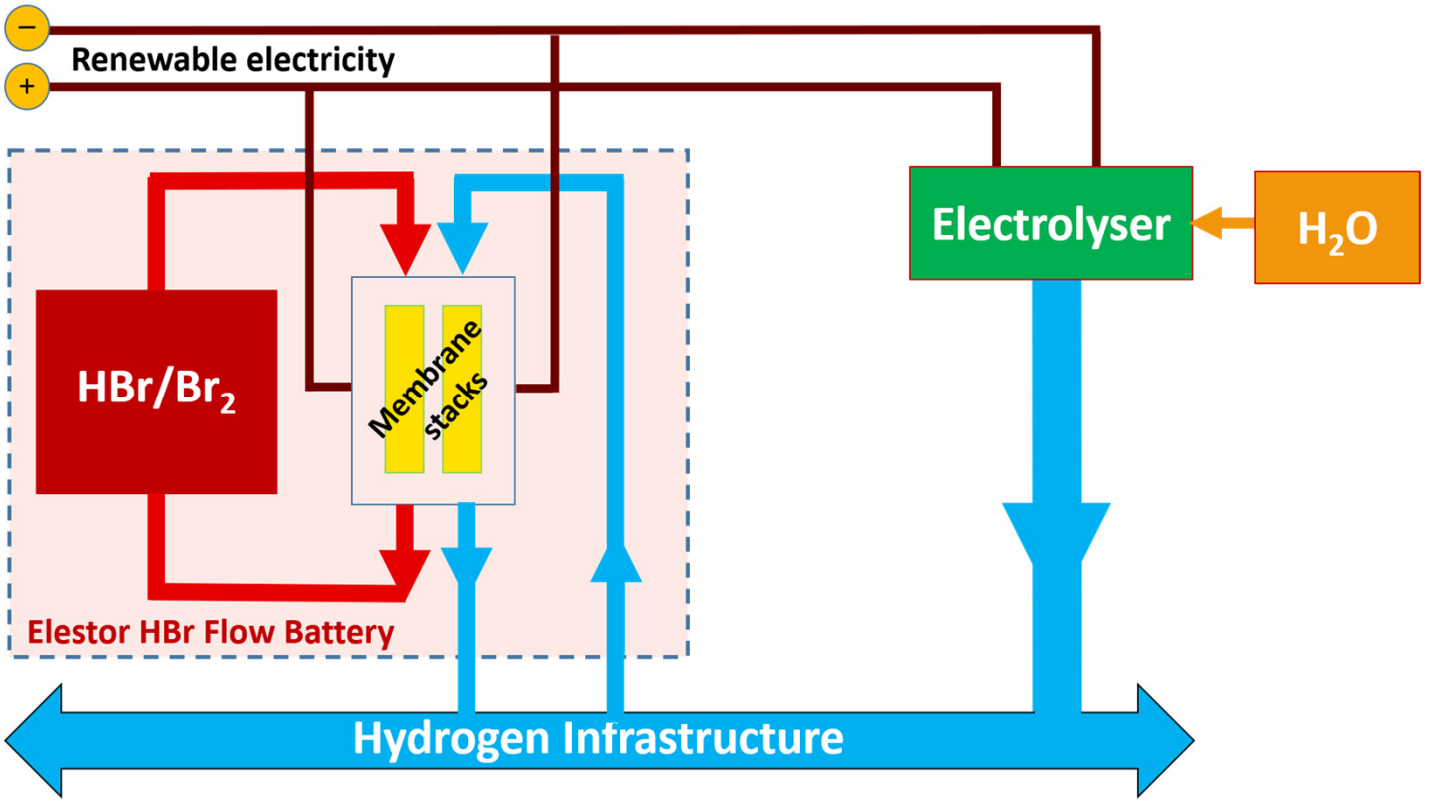
✓ **Hydrogen infrastructure**
serves as 'hydrogen tank' (with zero effect on infrastructure)

✓ **Reduces**
1) Battery capex
2) Storage costs
3) System size

✓ **Introduces**
new optimization options

elestor

Integration with electrolysers



- ✓ **Integrates**
  electricity storage & hydrogen production
- ✓ **Maximizes**
  electrolyser utilization
- ✓ **Reduces**
  - Capex flow battery
  - Hydrogen costs
- ✓ **Reduces**
  storage costs per kWh (LCoS) *further*

elestor

About Elestor

Management

Guido Dalessi (59)
CEO

- Graduated in Physics
- Demonstrated history in developing companies from startup to established global players
- Former CEO of Singulus Mastering BV, subsidiary of Singulus Technologies AG, Germany
- Early investor in Elestor BV

Wiebrand Kout (44)
Founder & CTO

- High level of expertise of 3 hydrogen electrochemical systems:
  - PEM Fuel cells
  - Electrochemical hydrogen compressors
  - HBr flow batteries
- Head of Mechanical Design at Nedstack
- COO and Lead Designer at HyET

Hylke van Bennekom (38)
COO

- Industrial Business Administration
- Background in PV and semicon
- Experience in high volume manufacturing of advanced technologies
- Broad international experience in strategic sourcing, establising production locations in Europe & Asia
- Joined per April 12, 2021 (MBI)

Team

The Team

- International team (26 FTEs) of Scientists & Engineers, combined with broad Business Development experience
- 1 PhD candidate graduated in 2020 at Technical University Eindhoven, Dept of Membrane Materials and Processes (MMP), Prof. Dr. Kitty Nijmeijer.
- A second PhD candidate to promote in 2022
- 8 different nationalities
- Member of the European 'FlowCamp' consortium, led by Fraunhofer Institute, Germany
- Deep tech know-how on: Catalysts, Electrodes, Membranes, Electrolytes, Cell stacks, Control & power electronics, System architecture, Compliancy
- > 100,000 R&D hours since June 2014

elestor

Elestor was granted several (inter)national awards

2015 **Challenge Cup for Best Pitch** InnoEnergy Benelux

2016 **Jan Terlouw Ambition Award 2016** Kiemt Congress

Audience Award 2016 Kiemt Congress

Sustainable Energy Startup Award SWECO

2017 **Best Technical Development within Energy Storage** IDTechEx Europe
(juried by Fraunhofer Institute, Technical University Berlin, Toyota Motors Europe)

2019 **Pearl of the Region** The Economic Board

2020 **Best Poster Award** German Society for Membrane Technology

Verbund X-Accelerator Austria, 1 of 6 winners out of 300+ participants

2021 **Innovation 2020 Audience Award** Chamber of Commerce

elestor

Commercial projects

- Royal Vopak is the world's leading independent tank storage company on sea port terminals
    - Agreement signed in April 2021
    - From 500kW/3MWh to industrial scale
    - Part of Vopak's "New Energy strategy"
- A 2nd agreement with a European corporate (name embargoed) for integration with electrolysers
- Installation in Norway (EU funded "GIFT" project)
- Discussing various projects in the Netherlands, Singapore, Indonesia and Australia


Bloomberg

aos with real time updates on the news affecting the global economy. **Enable Notifications.**

Business

World's Top Oil Storer Turns to Large-Scale Batteries

By Eddie Spence
9 juni 2021 06:00 CEST *Updated on 9 juni 2021 17:16 CEST*

LIVE ON BLOOMBERG

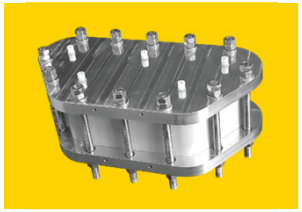
▶ Vopak partners with Elestor to develop battery for storage

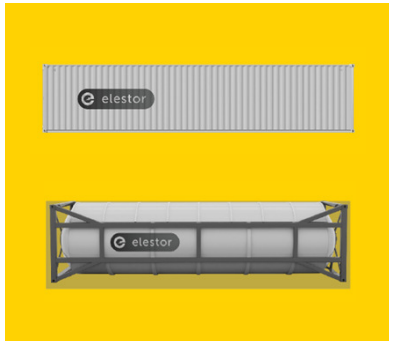
https://www.bloomberg.com/news/articles/2021-06-09/world-s-biggest-oil-storer-turns-to-batteries-for-greener-future

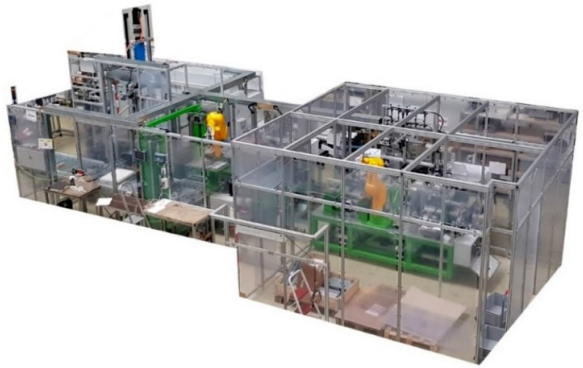
elestor

Roadmap

2020-21	Deploy 4 pre-production storage systems at scale - In-house production of stacks - Outsource system assembly
2021-22	Commercial deliveries - Automated stack production - Max outsource system assembly
2022-24	Construct and operate pilot plant for large scale automated stack production
2024-	Construction first ‘Giga-factory’ equivalent for stack production







elestor

elestor

"We will make electricity so cheap
that only the rich will burn candles"

- Thomas A. Edison

"We will make hydrogen so cheap
that only the rich will burn oil"

- Elestor BV