elcogen Affordable green hydrogen

SOC products: technology, applications and innovation

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Key facts about Elcogen

150+ people and growing fast!

20+ years in business

20+ nationalities fostering global diversity

160+ customers in 30 countries

15% PhDs driving innovation

170M raised since 2022 (euros)

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Scaling to meet the demand

- **ELCO I** factory is under construction in Estonia
- Ramp-up in 2026
- SOEC production capacity for
  - 360 MW/a in cells and
  - 200 MW/a in stacks
- 75% cost reduction
- Total closed area ca 14 000 m^2

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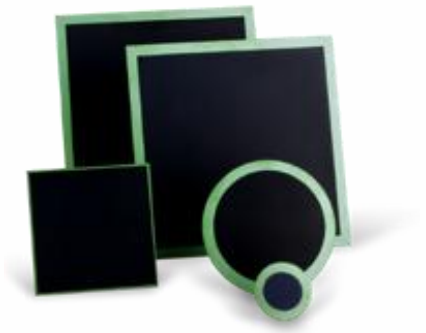
Elcogen product offering



elcoCell

- Fuel electrode supported cells (600-800C)
- Reversible operation
- Different sizes and shapes

elcoStack

- Operates in SOFC and SOEC mode
- Designed for mass manufacturing
- Ideal building block for large systems

elcoModule

- Stack module for bundling multiple elcoStack E3000 (1,2,4)
- Easy integration to systems
- Scaling from kW to MW sizes

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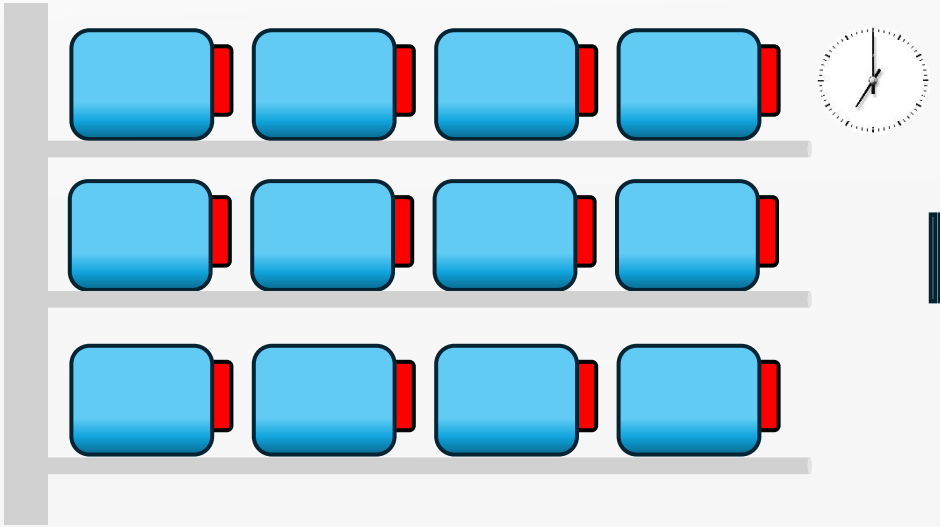
Transition to Industrial scale

- Batch to continuous slurry and Ink/Paste processing

Batch process



Continuous process

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Industrialization at ELCO I elcoCell

- Tape-caster
  - ✓ Single layer doctor blade (thickness control)
  - ✓ 2x width, 3x faster casting

- Printing
  - ✓ Automatic self-loading screen printer
  - ✓ 1.5-1.8 X faster printing
  - ✓ Roll to roll
  - ✓ Inline drying and curing

- Thermal treatments
  - ✓ Tunnel furnace
  - ✓ Continuous operation
  - ✓ Optimized thermal profile

AMPS project highlights

- ✓ Cell manufacturing: 100% waste recycling with 15% raw material saving.
- ✓ Production line with fully automated of raw material handling, dosing and material tracking for nickel oxide (anode substrate).
- ✓ Cell and Stack quality control using automatic machine vision system.
- ✓ Development of concept for automated handling and heat treatment of cells using tunnel furnaces

- ➢ Automated high-speed interconnector (IC) plate production including high volume coating process.
- ➢ Fast non-destructive testing of IC welding has been developed for quality control (Inline detection of critical defects of SOC)
- ➢ Development of concept for automated stacks assembly using SCARA-robots. (Pick & Place concept).

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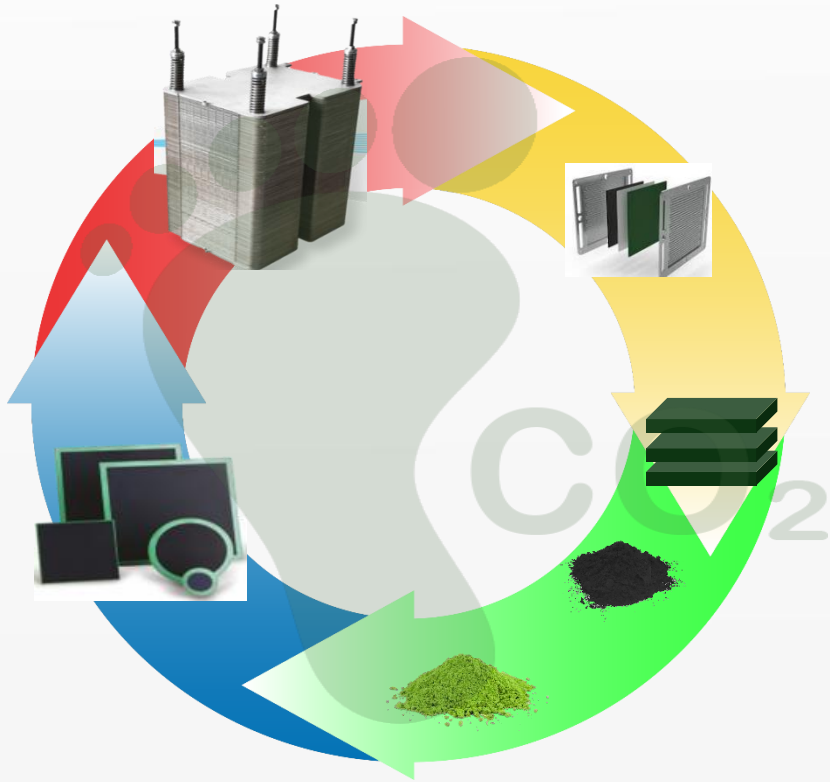
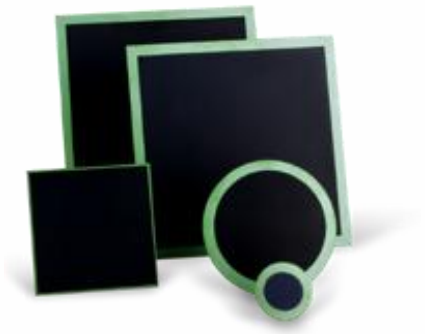
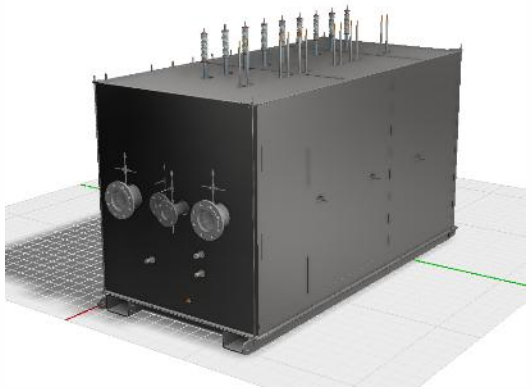
Innovation at ELCO I

- Green path: Water based slurry
- Circularity : Recycle of EOL and waste
- Optimize process : Co-casting, Co-sintering (reduced time and enhanced yield)
- Advance technology : ALD/ PVD based barrier layer for high performance and 10X more durable SOCs



Elcogen product development





elcoCell

- Optimized for manufacturing
- Maintaining performance and lifetime

elcoStack

- Optimized for cost
- Optimized for manufacturing
- Maintaining performance and lifetime

elcoModule

- Increasing output
- Enabling MW installations

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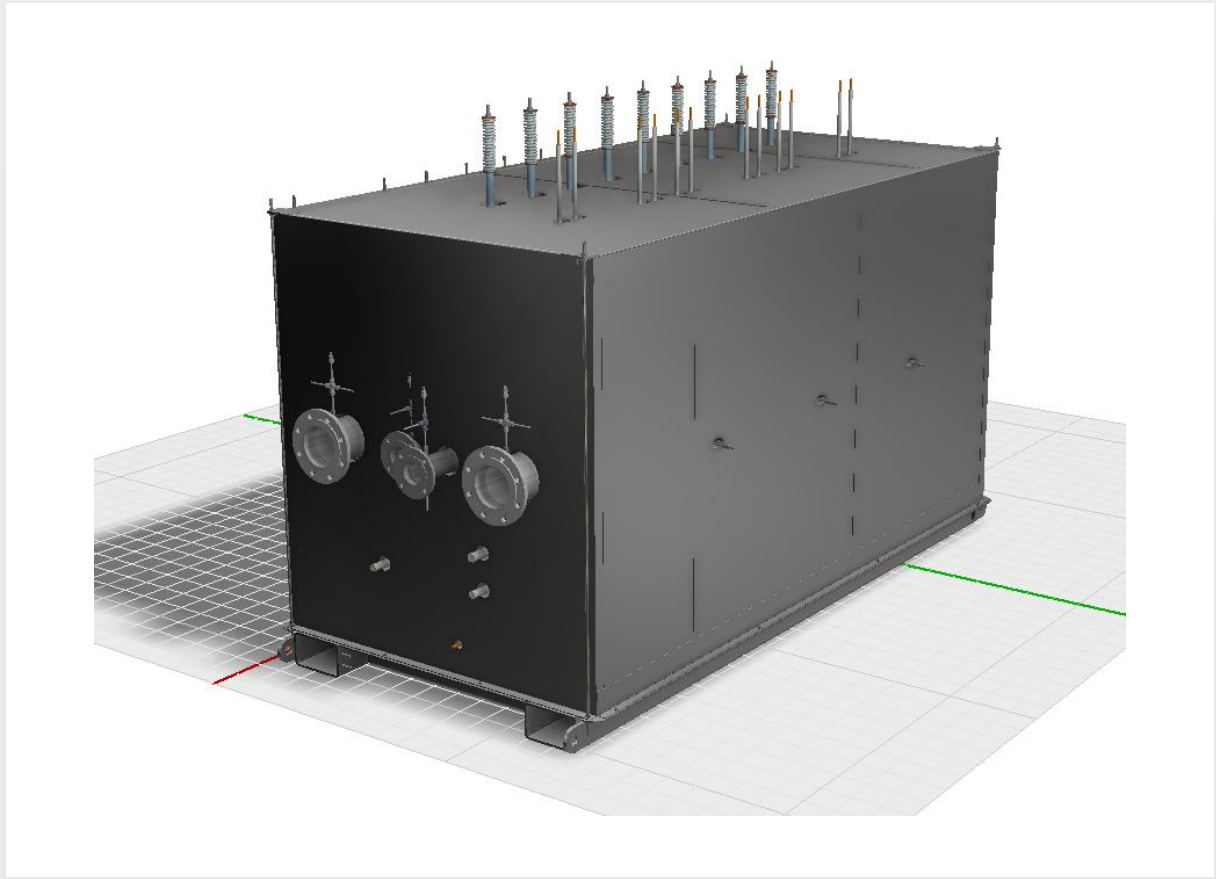
Stack module development

- Large stack module development is done together with AVL
- Targeted output

  4.9 kg(H_2)/h – **electrolysis**

  54 kW_e – **fuel cell**

- Module with **18 × E3000** stacks
- Project is in procurement phase, validation in electrolysis mode planned for 2025



elcogen AVL IPCEI HYDROGEN

Solid oxide technology advantages

Reversibility

The ability to generate power from fuel, as well as fuel from power in one single integrated system.

Efficiency

SOFCs and SOECs run at high temperatures with an efficiency greater than 80%, reducing running costs and material use.

Fuel flexibility

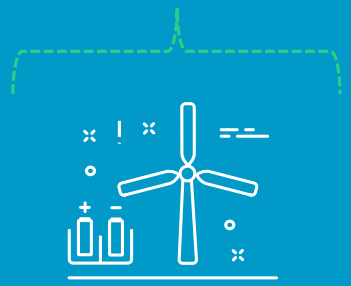
Allows for fuel flexibility compared to PEM/ Alkaline solutions.

Current – Short term

Commercial and industrial power and CHP

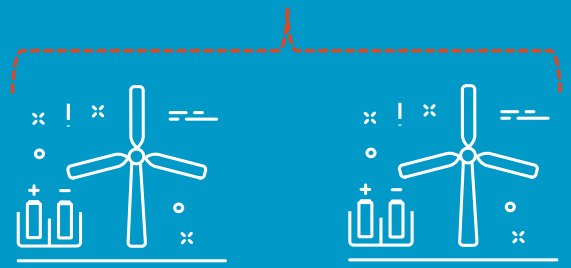
Off-grid and residential

Short – Mid term



Electrolysis for green hydrogen

Mid – long term



CO_2 and co-electrolysis for Power-to-X

Reversible SOC for energy storage

Longer term

Long-range transportation (LNG, H_2, MeOH, NH_3)

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