

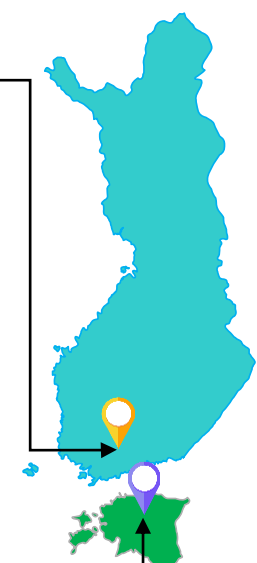


Scaling fuel cell production to meet defense and critical energy needs

Ivan Vakulko, R&D Manager

Tartu Hydrogen Days 2025
October 9-10

Key facts about Elcogen



150+

people and
growing fast!

20+

years in business

15%

PhDs driving
innovation

20+

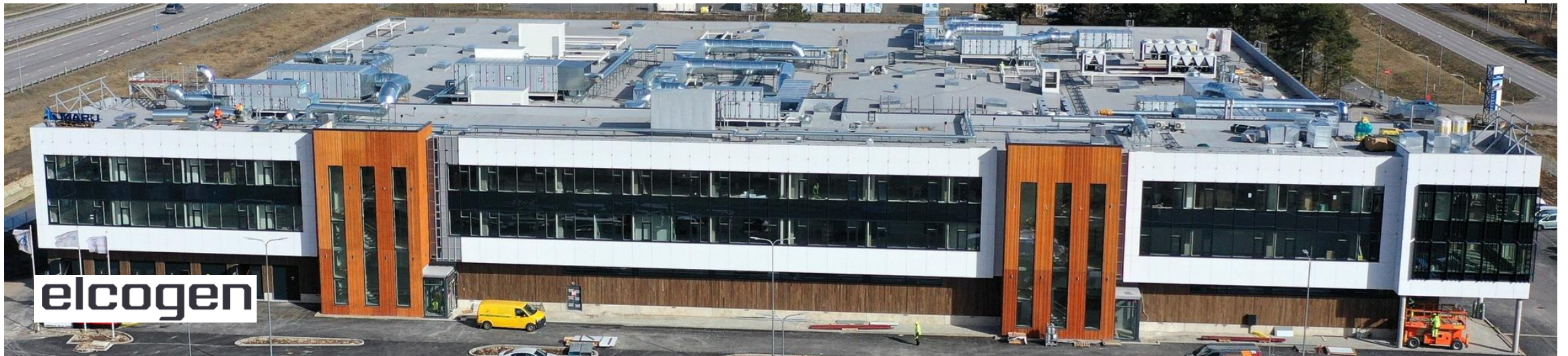
nationalities fostering
global diversity

160+

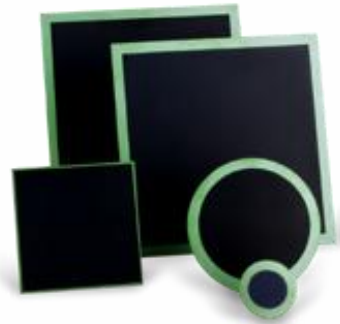
customers in
30 countries

170M

raised since 2022 (euros)



Elcogen product offering



elcoCell

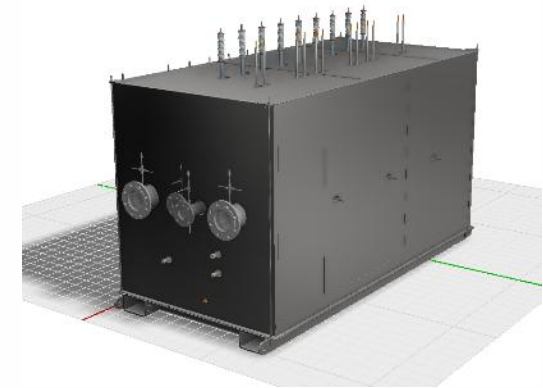
- Fuel electrode supported structure
- Reversible operation
- Different sizes and shapes
- Optimized for manufacturing
- Maintaining performance and lifetime

elcogen



elcoStack

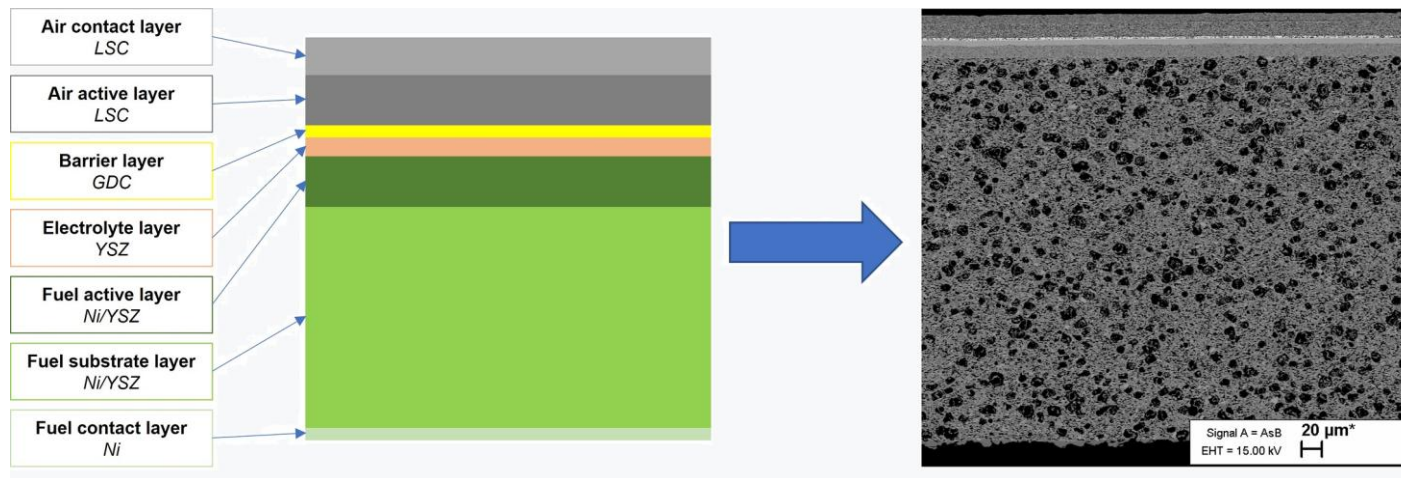
- Operates in SOFC and SOEC mode
- Designed for mass manufacturing
- Building block for large systems
- Optimized for cost
- Maintaining performance and lifetime



elcoModule

- Increasing output
- Stack module for bundling multiple elcoStack E3000
- Easy integration to systems
- Scaling from kW to MW sizes
- Enabling MW installations

ElcoCell®: Microstructure

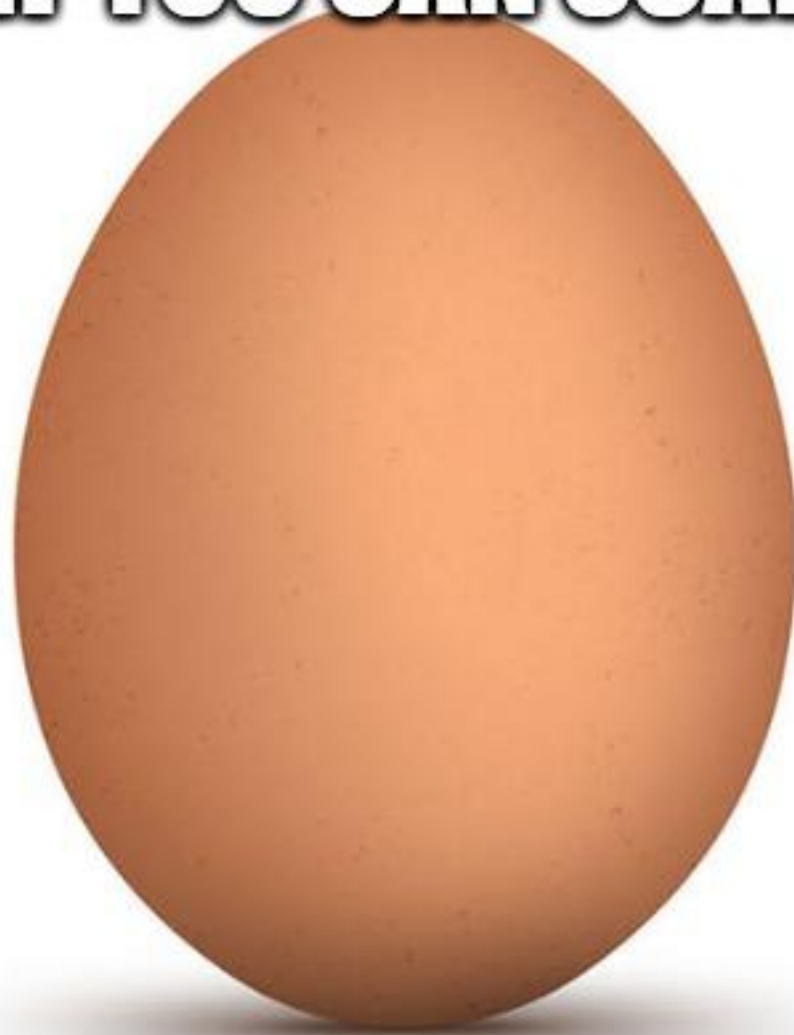


- Planar, ceramic, anode-supported cells operating at **580-800 °C**
- **Two product families:** 300-C and 400-B
- **Different shapes:** from button and rectangular cells to custom-designed non-symmetrical configurations
- **Different sizes** available: from 1 to above 200 cm² of active surface area per cell
- **Different thickness** of cells: from 300 to 530 µm
- **Flexible manufacturing** for customised products, to fit different stack technology requirements
- **Easily scalable production** of cells, only well-known mature manufacturing methods
- **2 patent families** together with cell manufacturing **trade secrets** and **know-how**

How to scale

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CUSTOMER: I AM BUYING IF YOU CAN SCALE!



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LET'S DO IT!



SEPTEMBER 17, 2025

Elcogen launches new high-volume solid oxide fuel cell factory in Europe to meet global demand for clean energy solutions

Elcogen expansion

Current setup



- **elcoCell®** development and manufacturing in Estonia
- **elcoStack®** development and manufacturing in Finland
- Capacity increased to ~3 MW/Yr. from 2023

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Capacity expansion to 30/90 MW/a SOFC



ELCO-1

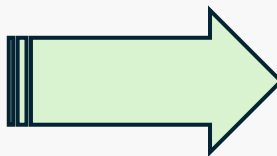
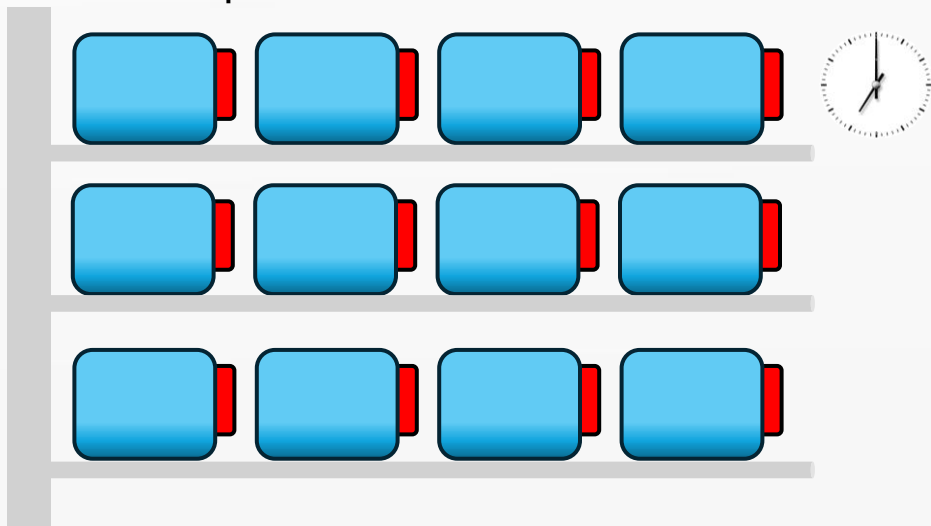
- Elcogen capacity expansion to 30 MW / 90 MW
 - ~ 1.2M to 3.6M **elcoCell®**
 - ~ 7000 to 17.000 **elcoStack®**

Transition to Industrial scale

elcoCell

- Batch to continuous slurry and Ink/Paste processing

Batch process



Continuous process



- Scaling without adapting processes:
 - Production floor requirements
 - Stability of process

Industrialization at ELCO-1 **elcoCell**

- Tape-caster

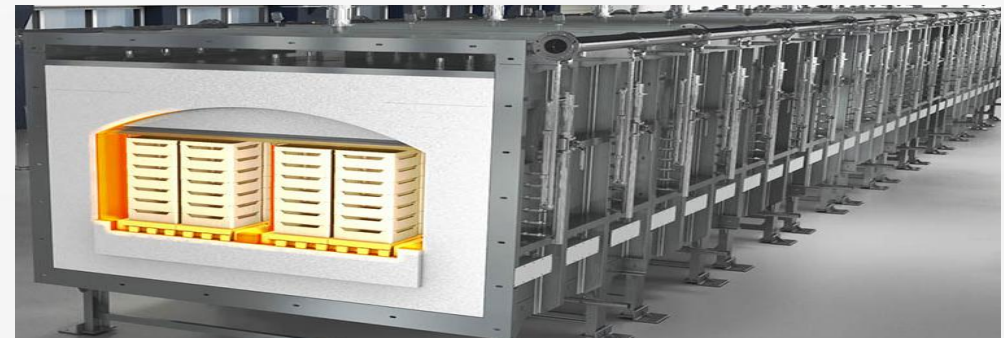
- ✓ Single layer doctor blade
- ✓ 2x width, 3x faster casting
- ✓ Roll to roll
- ✓ Co-casting with embedded doctor blade and Slot die

- Printing

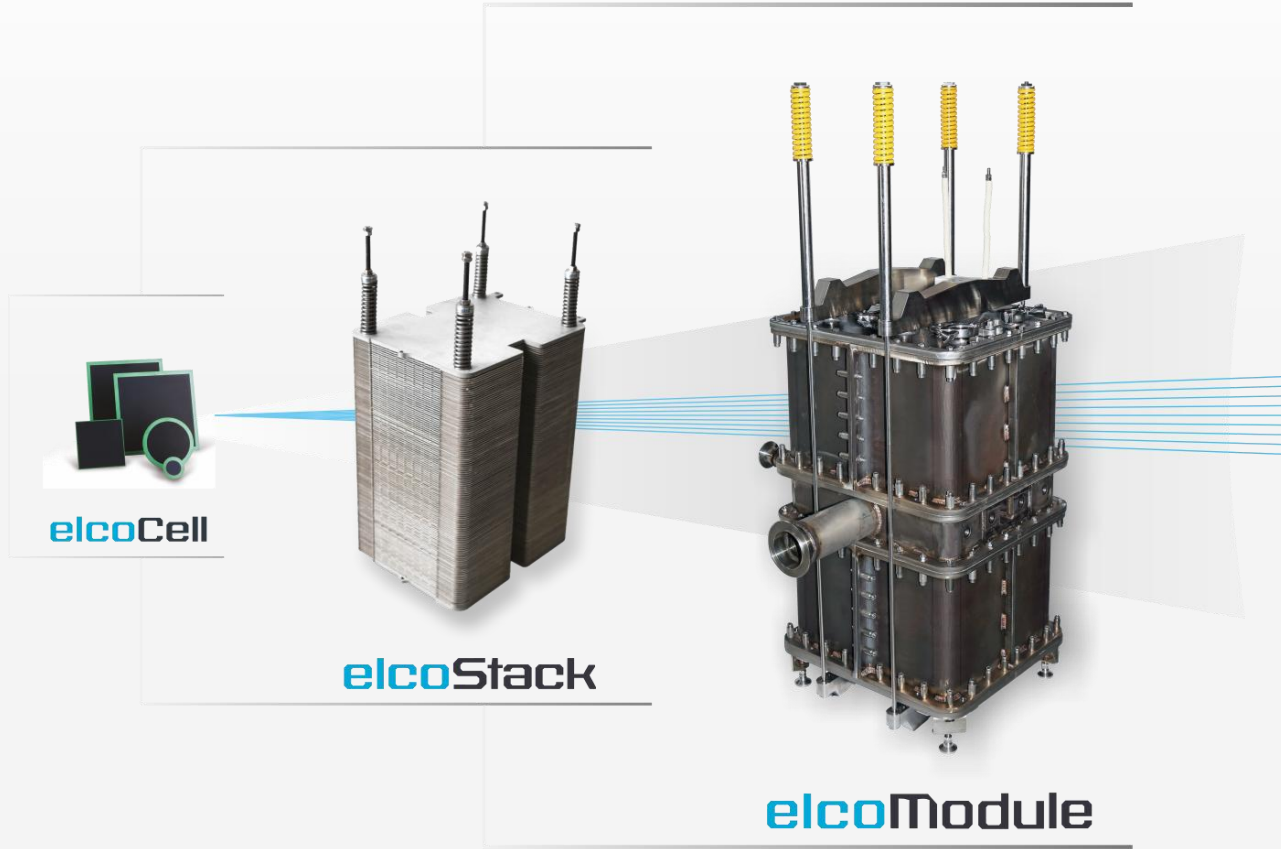
- ✓ Automatic self-loading screen printer
- ✓ 1.5-1.8 X faster printing
- ✓ Roll to roll
- ✓ Online drying and curing

- Thermal treatments

- ✓ Tunnel furnace
- ✓ Continuous (batch) operation
- ✓ Optimized thermal profile



Core product to the end-users



Elcogen offers core components for integration to solid oxide fuel cell and electrolyser systems

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System integrators use our core components in their client-specific applications

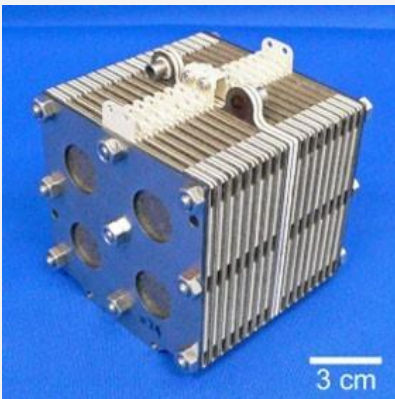


Elcogen's products end-users.

Use cases

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FIRST SOFC POWERED FLYING DRONE – JAPAN



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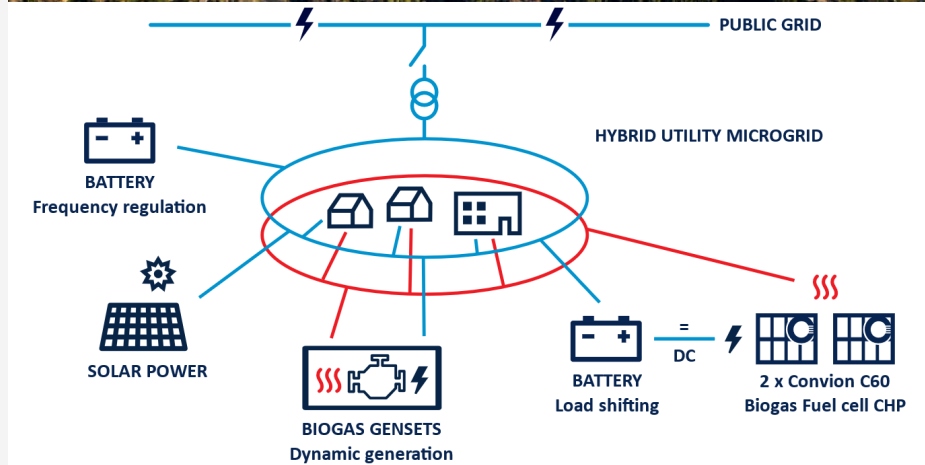
Overview

- Japanese companies and research institutes have developed and demonstrated world's first solid oxide fuel cell drone. The drone can fly for a longer time than ever by generating power in the air. The drone uses Elcogen's solid oxide cells.
- Developed SOFC system uses liquefied petroleum gas (LPG) and light weight SOFC stack (weight per output is reduced by 60% compared to the conventional one) enabling power generation in the air.

Why it's interesting

- The drone can fly and work for a longer time than ever with higher output and lighter weight fuel cells
- Developed LPG internal reforming solid oxide fuel cell technology for drones with large power load fluctuations
- Expected to be utilized in areas such as logistics, infrastructure inspection, disaster response, etc. even in areas before hydrogen infrastructure development

POWER GENERATION FROM BIOGAS – FINLAND



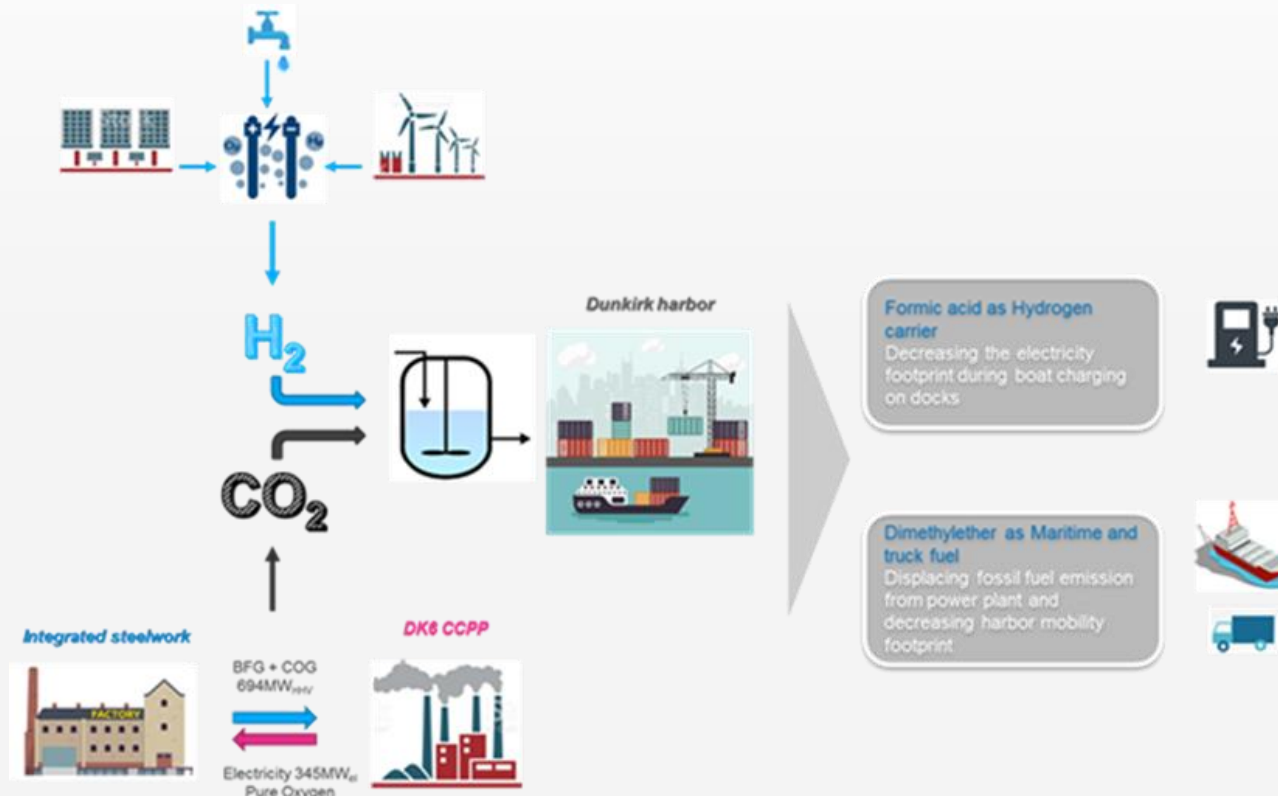
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Biogas Fuel Cell System

Elcogen has teamed up with fuel cell system developer Convion to power two combined heat and power (CHP) systems with a total electrical output of 116kW. Convion's fuel cell systems use Elcogen's next generation of solid oxide fuel cell (SOFC) and stack technology.

- Reliable and dependable power generation
- Non-existing emissions of NO_x, SO_x, PM, VOC or noise
- 60% electrical efficiency
- By waste heat recovery 80% of total efficiency
- Able to produce high voltage DC power with direct integration to energy storage systems. Also avoiding intermediary steps of conversion and enable load shifting functionality.

VALORISATION OF CO₂ EMISSIONS – FRANCE



Production of synthetic fuel through electrolysis

- Development of energy-efficient, economical and environmentally viable CO₂ conversion technologies
- CO₂ in the blast furnace gas is combined with green hydrogen generated by electrolysis
- Concept to be demonstrated at Dunkirk between DK6 combined cycle power plant, Arcelor Mittal steel factory and the harbour
- C2FUEL unique circular approach could contribute to mitigate up to 2,4 Mt CO₂ per year

Conclusion

What to take home?

- We are ready
- We are very open to collaboration
- We are still looking for talented people to join us in various functions

Thank you!

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 **elcogen** Affordable green hydrogen

Are You interested?



Find out more from elcogen.com



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