SolydEra

High efficiency SOEC solutions

presented by Bernard Turi
Italian Hydrogen Expo
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We stack it.

Mission statement

SolydEra aims to become the world’s premier **solid oxide stack and stack module** supplier for high temperature electrolysis and power generation applications, providing **standardized stacks and sub-systems** into both markets and contributing as a core technology provider to industrial decarbonization solutions. The company’s USP consists of stack efficiency, reversibility, and flexibility along with decades of core system knowhow.

From startup to scale-up to industrialization

2000
HTCeramix founded

2006
SOFCpower founded, Acquisition HTceramix

2015
Acquisition Ceramic Fuel Cells

2016
Development Agreement for Hydrogen Refueling Stations

2020
Start of stack industrial plant in Pergine (ITA)

2022
New name and company strategy for the H2 economy

2024
Launch of G8X, the largest solid oxide stack on market

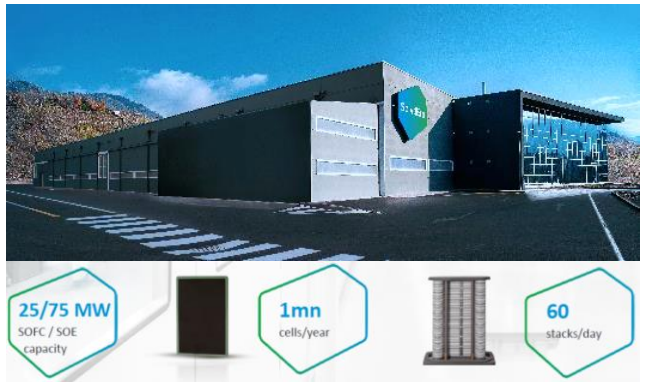
Research and Innovation Centers

Mezzolombardo (TN)
ITALY

Yverdon-les-Bains
SWITZERLAND

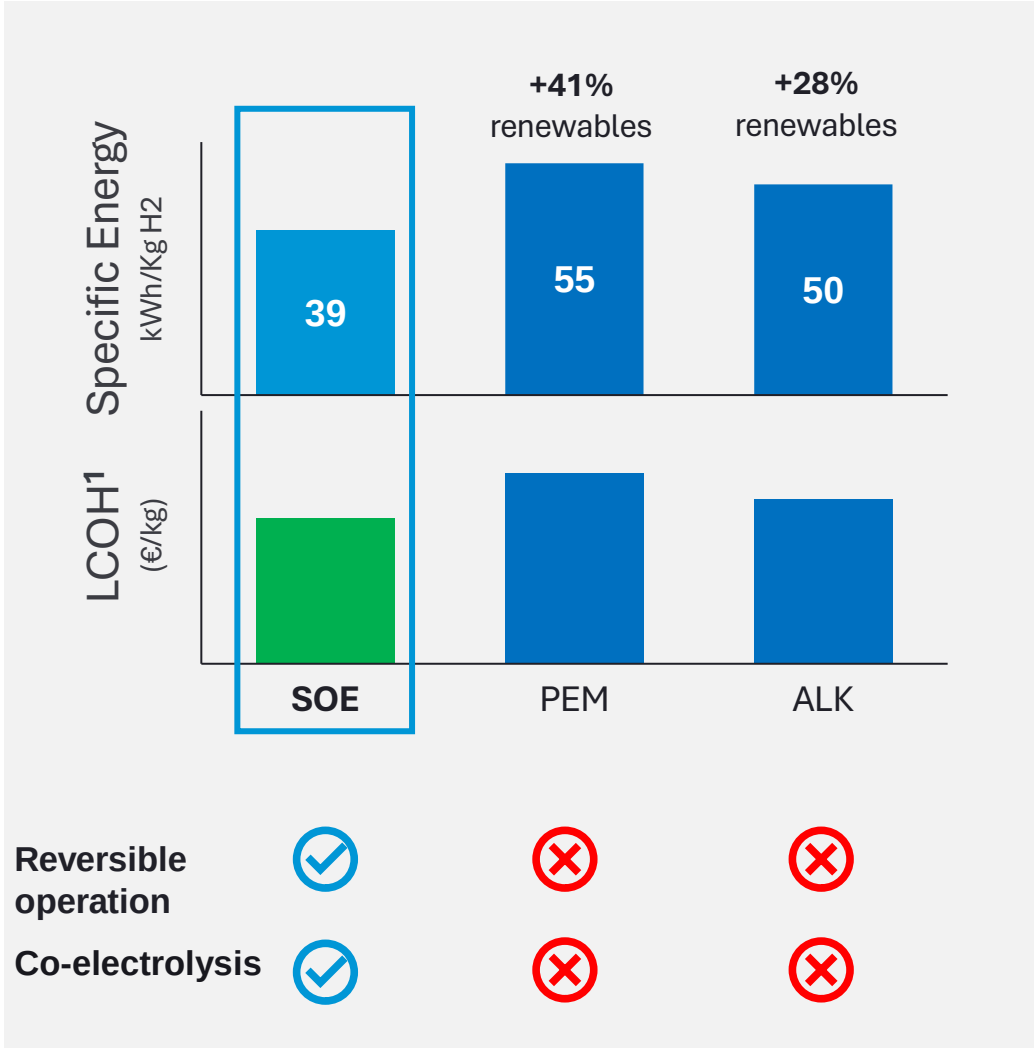
Melbourne
AUSTRALIA

Head Quarters and 75MW Industrial plant



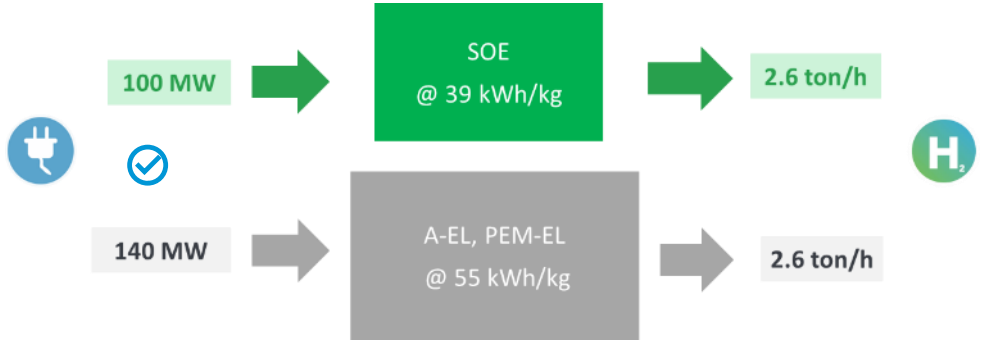
Pergine Valsugana (TN)
ITALY

Competitive advantage in green hydrogen and derivatives



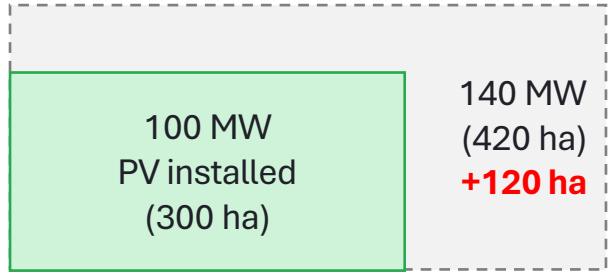
Not only Opex savings..

- **>30% larger electrolyzer installed capacity** required with ALK/PEM electrolyzer for the same H_2 production



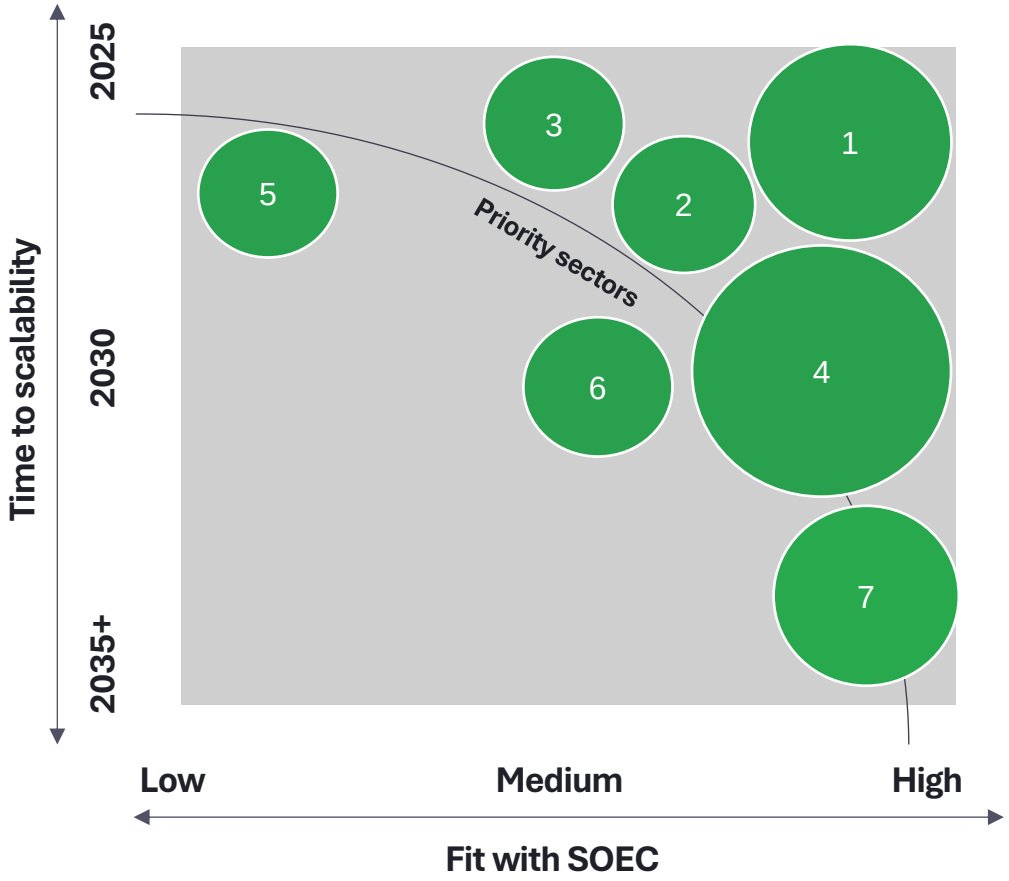
- **>30% more CapEx and land** required for RES (*eg* PV)

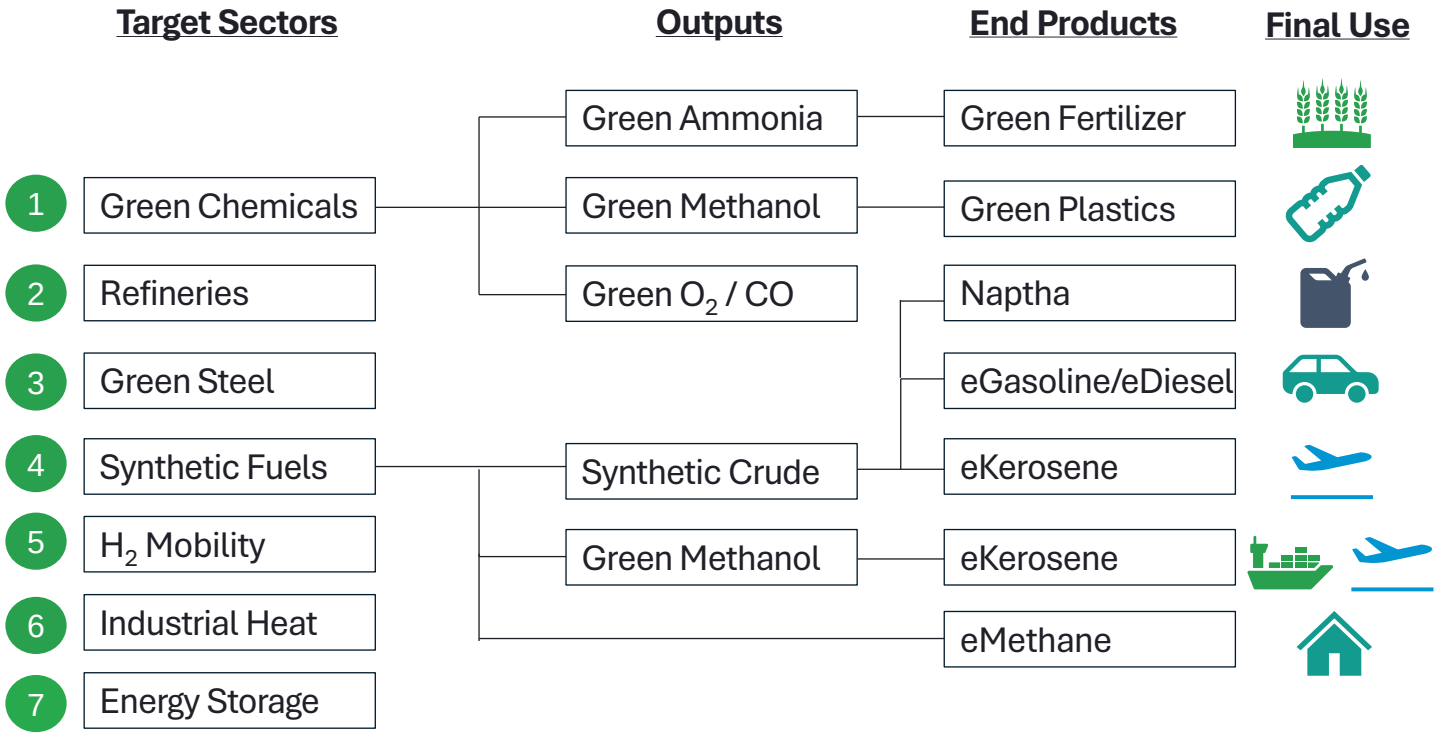
Land use



- **Significant savings on battery storage** with rSOC system

Target applications for SOEC





Efficiency, reversibility, & flexibility position SOEC ahead

High conversion efficiency
Up to **90%** both in steam electrolysis and cogeneration mode from gas; similar efficiencies with co-electrolysis

Long-term advantage in Green H_2 production

Low cost based on **proprietary design** and use of materials & processes from well-developed industries

No use of noble metals or other rare materials, therefore **no risk for shortage nor limitation for capacity ramp up**

Long-term advantage in Storage / P2P

Reversible operation using the same stack makes it ideal for large scale off-grid production & storage projects

No polluting emissions
(NOx, SOx, VOC)
CO_2 reduction between 50%-100%

Strategic advantage in Green Fuels production

Feedstock flexibility
Steam, CO_2, biogas, off-gas, and co-electrolysis abilities offers strategic advantage over other technologies

Proven **fuel cell operation with 70M+ hours** in the field

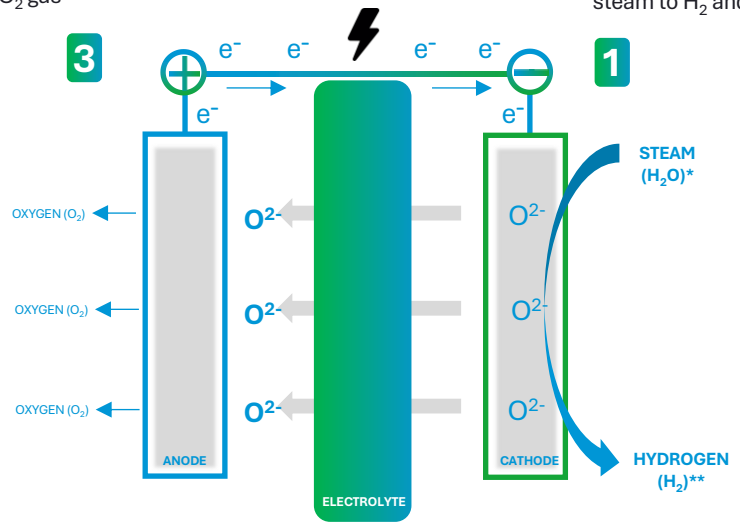
Proprietary core technology (**11 patent families**)

Reversible technology for Power AND Hydrogen(+) production

Producing Hydrogen (& Syngas) in SOE Mode

At anode, O^{2-} ions are oxidized to pure O_2 gas

Cathode voltage reduces steam to H_2 and O^{2-} ions



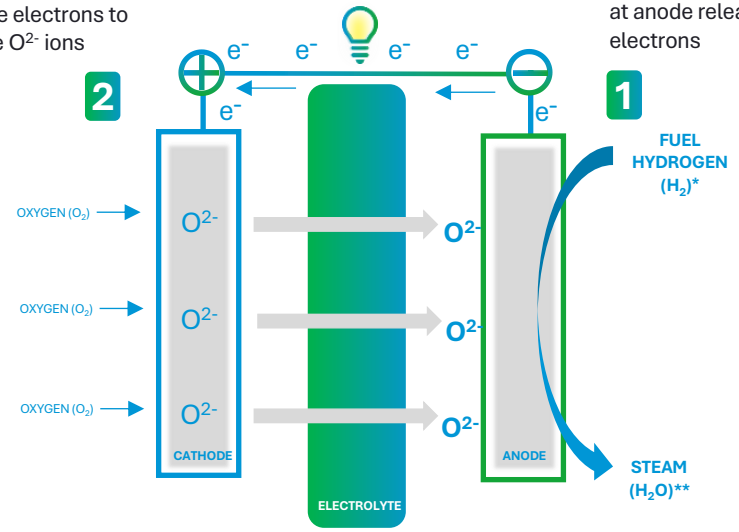
Cathode-produced O^{2-} ions passing through the electrolyte

*H_2O/CO_2 mixture can be also used;
**In case of H_2O/CO_2 input, syngas is produced

Producing power & heat in SOFC Mode

Oxygen molecules take electrons to give O^{2-} ions

Hydrogen oxidation at anode releases electrons



O^{2-} ions pass through the electrolyte, react with hydrogen ions (H^+), through an exothermic reaction, steam and heat

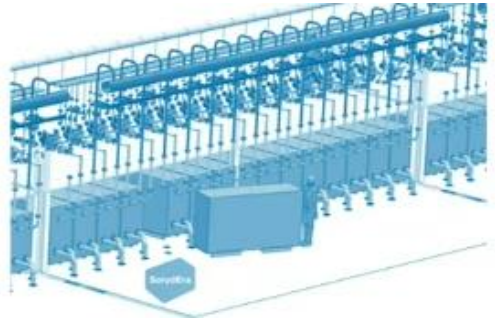
*At system level, wide range of fuels can be used (NG, biomethane, H2NG blends, Ammonia, H2, biogas);
**Also CO_2 in case of hydrocarbon fuels, or N2 in case of Ammonia

G8X (30 kW) – the world‘s largest solid oxide stack

Number of cells	100 repeating elements, 400 cells
Size (w-h-d)	306mm – 379mm – 424mm (excluding compression system)
Weigth	130kg
Fuels	Hydrogen, methane, biogas, LPG, ammonia, syngas
Electrolysis	Steam, CO_2, Co-electroylsis
Features	Reversible Operation Electrolysis: >95% el. efficiency Power: >60% el. efficiency Low degradation (0.2% per 1000 hrs)

G8X Stack

EMX Module



Multi-MW Array

SolydEra's electrolyser module solution: EMX (150kW)

5 x 30 kW

150 kW

The **EMX** is a stand alone subsystem

The scope of supply is:

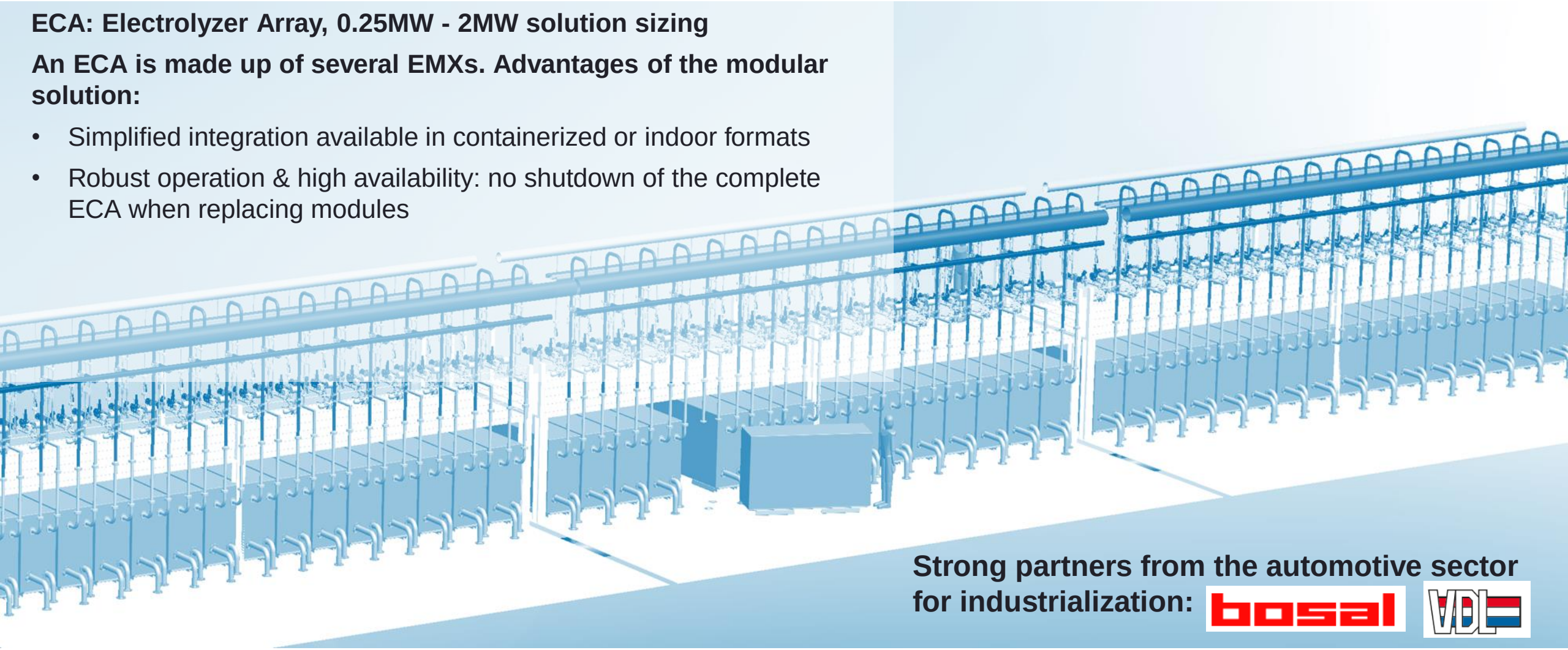
- Five G8X stacks (150 kW)
- One hot BoP for easy thermal integration
- Safety functions
- Flow control
- Defined hard- and software interface
- One housing for easy integration and maintenance
- Rectifier

SolydEra Electrolyser Plant Solution: ECA

ECA: Electrolyzer Array, 0.25MW - 2MW solution sizing

An ECA is made up of several EMXs. Advantages of the modular solution:

- Simplified integration available in containerized or indoor formats
- Robust operation & high availability: no shutdown of the complete ECA when replacing modules



Strong partners from the automotive sector for industrialization: bosal VDL

Summarizing SolydEra's position in the SOEC value chain

Stack | Module | Array | System

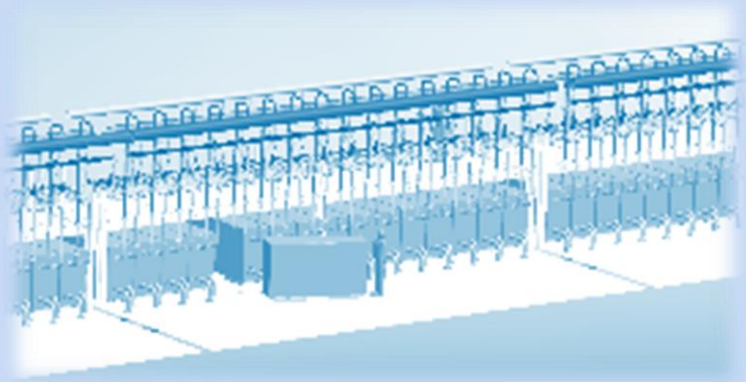
G8X Stack
30kW Stack

EMX Module
150kW Stack Module

HotModule
Instrumentation
PLC/SPLC
Flow control
Recirculation Module

ECA Array
2MW Electrolyzer Array

PLC/SPLC Master
Power Electronic
Gas headers
Optional
Array recirculation
Array condensers
Array Ventilation

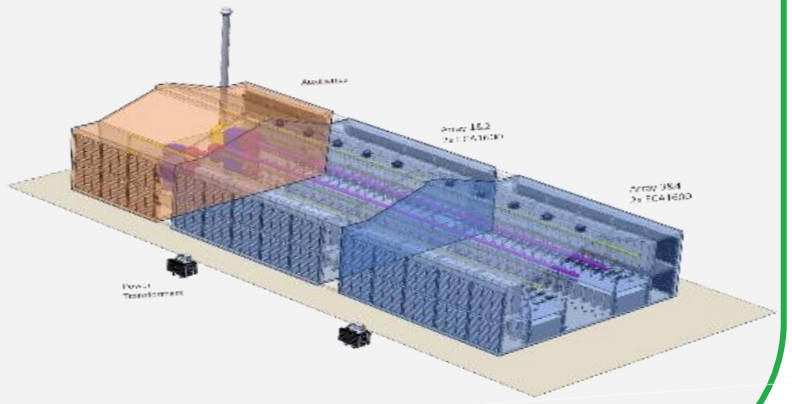


SolydEra

Electrolyzer
EPC & Balance of Plant

Building/Container
Auxiliary systems
Water preparation
Steam supply/purification
Auxiliary gases
Gas farms

Room Ventilation
Downstream processing
Condensation
Compression
Recirculation systems



Integrator / Customer

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Thank you!